INDIAN GEOPHYSICAL UNION

Diamond Jubilee Annual Convention

on

Advances in Geosciences with Special Reference to Coastal Hazards

22-24 November 2023

Organised by

Indian Geophysical Uinion (IGU)

and

Department of Marine Geology and Geophysics
School of Marine Sciences

Cochin University of Science and Technology (CUSAT)
Kochi

Ministry of Earth Sciences
Government of India

User-customised Service Products

Search And Rescue Aided Tool (SARAT) helps in finding out the most probable Search Area for missing persons/objects at Sea. Users will be able to select 60 types of missing objects such as person in water, life raft, fishing boat, aviation, surf boat, sailboat etc.

Forecast along ship routes provides daily Ocean State Forecast updates along with meteorological data and warnings, on waypoints, for standard routes like Chennai-Port Blair and Kolkata-Port Blair.

Inland Vessel Limits

Our demarcation of Inland Vessel Limits for various coastal states and island territories of India greatly benefits the coastal shipping/ inland navigation sectors.

Ocean Observations

To understand the oceanic processes several instruments such as floats, buoys, gliders, etc are deployed as round-the-clock watchers of the ocean and provide real /near real time data for operational and forecast services.

Climate Services

El Niño-Southern Oscillation (ENSO) is an atmosphere-ocean phenomenon of the tropical Pacific. In the positive phase, also known as El Niño, the eastern Pacific warms, and the western Pacific cools. During El Niño, the Indian Ocean becomes warmer than normal and causes prolonged marine heat waves. It can also weaken the Indian summer monsoon.

Indian Ocean Dipole (IOD) is an El Niño like oceanic phenomenon in the Tropical Indian Ocean. During its positive phase, the eastern Indian Ocean cools and the western Arabian Sea warms.

INCOIS provides global and regional climate outlooks on its portal by regularly updating prevailing El Niño & La Niña (the two phases of ENSO) and IOD conditions.

Information, Communication & Technology Services

State-of-the-art facilities including high performance computing and communications facilities are adopted to provide round-the-clock services to the nation.

Ocean Data & Information Services

Heterogeneous data from various in-situ and satellite platforms as well as numerical modeling are made available at the fingertips of the researchers, students, and industry.

International Training Centre for Operational Oceanography (ITCOOcean)

A Category-II Training Centre, recognised by IOC-UNESCO, provides advanced training in operational oceanography that would help the trainees in translating the results and findings in ocean science to real-time use by end users.

ABSTRACTS

DIAMOND JUBILEE ANNUAL CONVENTION

on

"Advances in Geosciences with Special Reference to Coastal Hazards"

November 22-24,2023

Venue:

Department of Marine Geology and Geophysics
School of Marine Sciences
Cochin University of Science and Technology (CUSAT), Kochi

Sponsored by

Ministry of Earth Sciences (MoES), New Delhi
Oil India Limited (OIL), Delhi
Oil and Natural Gas Corporation (ONGC), New Delhi
National Institute of Ocean Technology (NIOT), Chennai
CSIR-National Geophysical Research Institute (CSIR-NGRI), Hyderabad
National Centre for Polar and Ocean Research (NCPOR), Goa
Indian National Centre for Ocean Information Services (INCOIS), Hyderabad
National Centre for Earth Science Studies(NCESS), *Thiruvananthapuram*
CSIR- National Institute of Oceanography (CSIR-NIO), Goa
Indian Institute of Geomagnetism (IIG), Mumbai
National Remote Sensing Centre (NRSC), Hyderabad
Indian Institute of Tropical Meteorology (IITM), Pune
Wadia Institute of Himalayan Geology (WIHG), Dehradun
Centre for Marine Living Resources and Ecology, MoES, Kochi
Punjab National Bank, Kochi

INDIAN GEOPHYSICAL UNION
CSIR-NGRI CAMPUS, HYDERABAD

November 2023

Price: Rs. 1500/-

For Copies
Write to:
Hon. Secretary
Indian Geophysical Union
CSIR-NGRI Campus, Uppal Road
Hyderabad - 500 007
India

Draft by
Dr. Abhey Ram Bansal. Hon. Secretary, IGU
Dr. ASSSRS Prasad, Organizing Sect, IGU
Mr. Mohammed Rafique, Treasurer, IGU

SPONSORS

सत्यमेव जयते
Ministry Of Earth Sciences
Government of India

ऑयल इंडिया
OIL INDIA

ओएनजीसी
ongc

राष्ट्रीय भूभौतिकीय अनुसंधान संस्थान
NGRI (CSIR) INDIA

NATIONAL CENTRE FOR EARTH SCIENCE STUDIES

NATIONAL INSTITUTE OF OCEAN TECHNOLOGY
NIOT
CHENNAI

राष्ट्रीय ध्रुवीय एवं समुद्री अनुसंधान केन्द्र
NCPOR
NATIONAL CENTRE FOR POLAR AND OCEAN RESEARCH

सी एस आई आर - राष्ट्रीय समुद्र विज्ञान संस्थान
CSIR - National Institute of Oceanography

इंकोइस
INCOIS

भारतीय उष्णदेशीय मौसम विज्ञान संस्थान पुणे
INDIAN INSTITUTE OF TROPICAL METEOROLOGY PUNE

भारतीय भूचुम्बकत्व संस्थान
IIG
Indian Institute of Geomagnetism

वाडिया हिमालय भू-विज्ञान संस्थान
1968
WIHG

pnb

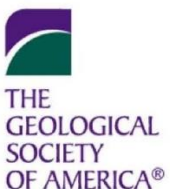
Aimil Ltd.
Instrumentation & Technologies

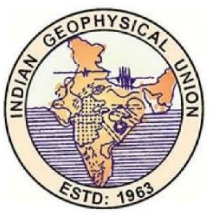
इसरो isro
nrsc

Reg.34/2012
MRK GEOMATICS
SURVEYING AND MAPING SERVICES
An ISO 9001:2015 Certified

Complete
Instrumentation Solutions

IGU'S PRESENCE ON GLOBAL SCENARIO





INDIAN GEOPHYSICAL UNION

NGRI Campus, Uppal Road, Hyderabad – 500 007

Dear Esteemed Colleagues and Participants,

It is with great pleasure that I welcome you to the IGU-Diamond Jubilee Annual Convention. Our Union has a long and proud history of fostering scientific research, collaboration, and the exchange of knowledge. This conference is a testament to our commitment to advancing the frontiers of science and technology. It is a platform for us to share our discoveries, discuss emerging trends, and inspire one another in our collective pursuit of knowledge.

The theme of this year's conference, Advances in Geosciences with Special Reference to Coastal Hazards", reflects our dedication to addressing some of the most pressing challenges and opportunities in our field. I am confident that the presentations, discussions, and interactions that take place during this event will contribute significantly to the advancement of our discipline.

I would like to express my heartfelt gratitude to the organizers, sponsors, and, most importantly, to each of you who have contributed to the success of this conference. Your dedication and enthusiasm for scientific exploration are truly inspiring.

I encourage you all to engage fully in the conference, make new connections, and explore new avenues of research. I am certain that the knowledge and experiences you gain here will not only benefit your individual endeavors but also contribute to the greater scientific community.

I look forward to the exchange of ideas and the collaborative efforts that will undoubtedly emerge from this gathering. Together, we can make a positive impact on our world through the power of science.

Thank you for being a part of the Indian Geophysical Union and for your commitment to the pursuit of knowledge.

Wishing you a successful and enriching conference.

Sincerely,

Shailesh Nayak
President, Indian Geophysical Union (IGU)

Office: Secretary | **Phone :** 040-27012332; 040-27012734 | **Grams :** Geophysics | **Fax :** 040-27171564 | **E.mail :** igu123@gmail.com

Cochin University of Science and Technology

Cochin University P. O., Kochi - 682 022, India

(Re-accredited by NAAC with 'A+' Grade)

Dr. P. G. SANKARAN
Vice-Chancellor (i/c)

Phone : +91-484-2577619 (O)
+91-9847348528 (M)
E-mail : rector@cusat.ac.in
pgsankaran@cusat.ac.in

MESSAGE FROM THE VICE-CHANCELLOR

Dear Esteemed Members of the Indian Geophysical Union,

It is with great pleasure and honour that I extend my warmest greetings to each one of you on the occasion of the Diamond Jubilee Annual Convention organized by the Indian Geophysical Union (IGU), in association with our Department of Marine Geology and Geophysics, School of Marine Science, Cochin University of Science and Technology CUSAT).

This significant milestone marks sixty years of dedicated efforts, scientific exploration, and collaborative endeavours in the field of Geosciences. The IGU has been at the forefront of fostering research, innovation, and excellence, contributing significantly to our understanding of the Earth's processes.

Our School of Marine Sciences has played a pivotal role in advancing knowledge in Earth-sciences and related fields, making instrumental contributions to both academia and industry. The collaboration between the Indian Geophysical Union and our department underscores our commitment to pushing the boundaries of scientific inquiry and promoting interdisciplinary approaches to address the complex challenges in Geology and Geophysics.

As we gather to celebrate the Diamond Jubilee, let us reflect on the achievements and breakthroughs that have shaped the landscape of Geosciences in India. This convention provides a unique platform for scientists, researchers, academicians, students and industry professionals to exchange ideas, share their latest findings, and nurture collaborations that will pave the way for future advancements in Geosciences.

In a world facing unprecedented environmental challenges, the role of Geoscience in understanding and mitigating these challenges is more critical than ever. The theme of this year's convention "*Advances in Geosciences with Special Reference to Coastal Hazards*" is undoubtedly apt as we explore innovations in Geology and Geophysics for sustainable development. I am confident that the deliberations during this convention will contribute to the development of innovative solutions that align with the principles of sustainability.

I encourage all participants to actively engage in the various sessions, workshops, and discussions that have been carefully curated to provide a comprehensive overview of the latest trends and developments in Earth-sciences. Let this convention be a platform for encouraging new collaborations, cultivating young talents, and inspiring a new generation of Geoscientists to continue pushing the boundaries of knowledge.

On behalf of Cochin University of Science and Technology, I extend my heartfelt congratulations to the Indian Geophysical Union on reaching this remarkable milestone. May this convention be a resounding success, and may the upcoming years bring even greater achievements and advancements in the field of Geosciences.

Wishing you all a fruitful and inspiring Diamond Jubilee Annual Convention.

Prof.(Dr.)P.G.SANKARAN

Kochi-22
14.11.2023

PREFACE

The Indian Geophysical Union (IGU) started in 1963 with the blessings of the-then luminaries like Prof K.R. Ramanathan, Prof. S. Bhagavantham, Prof. M.S. Krishnan and Dr. S. Balakrishna. In the past, the union has provided a platform for the dissemination of knowledge, sharing thoughts/views, interaction between young scientists/researchers and experienced geoscientists, understanding societal problems and finding feasible solutions, and discussion on current topics and recent phenomena, which are required for sustainable development of society, and continues to serve the Earth Scientific Community of India.

Many geoscientists supported enormously for sustaining IGU and its progress. We salute them for their contribution and encouragement. The motive of IGU is to encourage young researchers to improve their research capabilities and widen their knowledge globally. IGU requests the senior scientists to guide the young researchers, using their vast experience.

IGU is planned to provide a proper forum for presenting the latest works in various disciplines in earth sciences. IGU has taken up the initiative to jointly organize its diamond Jubilee annual convention at CUSAT, Kochi, November 22-24, 2023. The disciplines cover Solid Earth, Marine Geosciences, Coastal Processes and Hazards and Atmospheric, Planetary and Space Sciences. This year's special theme is *"*Advances in Geosciences with Special Reference to Coastal Hazards". This three-day convention covers plenary and invited talks, and there will be sessions covering different disciplines of Earth Sciences during the IGU Diamond Jubilee convention.

Besides the award lectures and invited talks, more than 200 papers will be presented during the three-day convention. More than 300 delegates are expected to participate in the convention, which would help improve interaction between eminent scientists, young researchers and students. On behalf of IGU, we request the delegates to send full papers of their presentations for publishing in the Journal of IGU after a proper reviewing process.

The IGU congratulates all the medal winners viz., IGU- Dr. Harinarain Life time achievement award, IGU-Prof. K.R. Ramanathan Memorial Lecture, IGU-Decennial Award, IGU-Krishnan Medal, IGU-Anni Talwani Memorial Prize, IGU-Anni Talwani Memorial Award for Young Women Researchers and IGU-Prof. Jagdeo Singh and Dr. S. Balakrishna Memorial grant for student's participation in the annual convention. IGU-Prof. D. Lal Best Paper award selected from the papers published in The Journal of Indian Geophysical Union during 2022-2023.

We place on record our Thanks to the Local Organizing Committee and Prof. P. G. Sankaran, Vice-Chancellor (LOC- Chairman, CUSAT), Prof. Mohamed Hatha, Director, School of

Marine Sciences, CUSAT, Dr. Joji VS, HoD, Department of Marine Geology and Geophysics, Dr. P. S. Sunil (Convener-LOC) for their committed involvement and help in organizing the Diamond Jubilee Annual convention. It ensures uninterrupted conduction of various technical sessions and better presence of delegates during the Award and invited talks.

The Executive Committee of IGU is indebted to Prof. Shailesh Nayak, President of IGU, Prof. Harsh Gupta, Prof. V.P. Dimri the past Presidents, Dr V. M. Tiwari, Dr. Kalachand Sain, Dr. Sunil K. Singh, Dr. O. P. Mishra the Vice- Presidents of IGU, Dr. O. P. Pandey, Chief Editor, JIGU for their unequivocal support and guidance. IGU is indebted to all the Fellows and Members of IGU and executive committee members for their continued support. We also thank the chairpersons for technical sessions for accepting to conduct various sessions, as per the technical schedule. Special thanks to Mr. Rafique Mohammad Attar, Treasurer of IGU, for his continuous support in executing various works related to the convention. Finally, we thank IGU office personnel for their ongoing support to complete multiple tasks before and during the three-day convention.

Abhey Ram Bansal
Prasad ASSSRS

CONTENTS

ORAL PRESENTATIONS

COASTAL PROCESSES AND HAZARDS

SOLID EARTH GEOSCIENCES

11. ISOSTATIC COMPENSATION MECHANISM OVER THE ARABIAN AND EAST SOMALI BASINS

    Shravan Kumar, KND Prasad, Uma Shankar

12. EVIDENCE OF PRECAMBRIAN ARAVALLI-DELHI MOBILE BELT TECTONIC TREND BIFURCATION FROM ADVANCED DIMENSIONALITY ANALYSIS OF MAGNETOTELLURIC DATA

    K. K. Abdul Azeez

13. HIGH-RESOLUTION 3D MOHO STRUCTURE ESTIMATION IN SOUTHERN INDIA AND SURROUNDING REGIONS: INSIGHTS FROM GRAVITY DISTURBANCES AND SEISMIC CONSTRAINTS

    Arka Roy, J. K. Tomson

14. LITHOSPHERIC STRUCTURE BENEATH WESTERN TIBET: INSIGHT FROM JOINT INVERSION OF RAYLEIGH WAVE GROUP VELOCITY DISPERSION WITH INTERPOLATED RECEIVER FUNCTIONS

    Ritima Das, Gokul Kumar Saha, Utpal Saikia

15. DEEP CRUSTAL ELECTRICAL RESISTIVITY STRUCTURE OF THE CENTRAL GANGA BASIN COVERING THE TRANSVERSE FAIZABAD RIDGE

    M. Demudu Babu, A. Manglik, M. Suresh and G. Pavankumar

16. GEOELECTRIC STRUCTURE ESTIMATED FROM MAGNETOTELLURIC (MT) AND RESISTIVITY DATA IN INDIA

    D.C. Naskar, O.P. Mishra

17. METASOMATISM OF THE LITHOSPHERIC MANTLE BENEATH THE BUNDELKHAND CRATON: RESULTS FROM INTEGRATION OF ELECTRICAL CONDUCTIVITY AND SEISMIC VELOCITY MODELS

18. G. Pavankumar and A. Manglik

19. AN UPPER MANTLE LOW RESISTIVITY ZONE BENEATH THE KONKAN PLAINS REVEALED BY MAGNETOTELLURIC IMAGING
    N.N. Chakravarthi, G. Pavankumar, A. Manglik

20. SEISMIC LATERAL VELOCITY VARIATIONS IN NORTHEAST INDIA USING AMBIENT NOISE TOMOGRAPHY

    Dhiraj Kumar Singh, Mohit Agrawal, O. P. Mishra and M.K. Sen

21. 3-DIMENSIONAL VELOCITY STRUCTURE BENEATH THE ANDAMAN-NICOBAR ISLANDS

    P. Mahesh, C. Sribin, P. Dewangan, V. Yatheesh, S. Gupta

22. GEODYNAMICAL INSTABILITY AND RIFTING OF THE DHARWAR CRATON (SOUTH INDIAN SHIELD)

    O. P. Pandey

23. SHEAR WAVE VELOCITY STRUCTURE BENEATH THE INDIAN OCEAN GEOID LOW (IOGL) REGION

    Amit Kumar, Sanjay S. Negi, Lachit S. Ningthoujam, Dhananjai K. Pandey

24. INVESTIGATING THE IMPLICATION OF SHEAR ZONES IN THE SOUTHERN GRANULITE TERRANE: A STUDY USING GRAVITY AND MAGNETIC DATA

    Harikrishnan P R and S. Lasitha

25. RE-EXAMINATION OF MARINE MAGNETIC ANOMALIES IN THE BAY OF BENGAL TO TRACE THE MAJOR PLATE REORGANISATION OF THE MIDDLE CRETACEOUS PERIOD

    Maria Ana Desa, Jensen Jacob, Saif Ali Khan, Brandis Carlier

26. COMPLEX CRUST-MANTLE SEISMIC STRUCTURE BELOW ALAMPUR-KONIKI-GANAPESWARAM PROFILE, NORTH CUDDAPAH BASIN (INDIA): REGIONAL GEODYNAMICS AND EAST ANTARCTICA CORRELATION

    K. Chandrakala

27. ABUNDANCES OF RADIOELEMENTS AND RADIOGENIC HEAT PRODUCTION FOR THE GRANITOIDS OF THE SINGHBHUM CRATON, EASTERN INDIA AND ITS THERMAL AND GEODYNAMIC IMPLICATIONS

    Labani Ray, Sukanta Dey, Nishu Chopra

28. INTRAPLATE STRESS PATTERNS IN THE INDIAN PLATE: A STRESS SIMULATION PERSPECTIVE

    Akhil Mishra, Radheshyam Yadav, Virendra Mani Tiwari

29. ACOUSTIC WAVE EQUATION MODELING WITH DISPERSION RELATION USING STAGGEREDG GRID FINITE DIFFRENCE METHOD

    Vanga Mounika and Maheswar Ojha

30. GEOCHEMISTRY OF MARINE SEDIMENTS FROM LESSER ANTILLES ARC: IMPLICATIONS ON ACTIVE GEODYNAMIC SETTING AND DEPOSITIONAL ENVIRONMENT

    K.S.V. Subramanyam, S.S. Sawant, A. Keshav Krishna and IODP Expedition 340 Scientists

31. STRUCTURAL INTERPRETATION AND CRUSTAL MODELLING USING GRAVITY AND MAGNETIC METHODS IN PARTS OF SAKOLI AND SAUSAR BELTS OF MADHYA PRADESH & MAHARASHTRA, CENTRAL INDIA

    Kant, R. Kumar, U. Shankar, C.B. Tiwari, S.R. Baswani, R. Gorle, A. Kumar, S.K. Bharati and P.K. Jain

32. LITHOSPHERE STRUCTURE ACROSS THE PRECAMBRIAN TERRAINS OF THE NORTHWEST INDIAN SHIELD BASED ON MULTI-SCALE POTENTIAL FIELD MODELLING AND ITS GEODYNAMIC IMPLICATIONS

    Sumanta Kumar Sathapathy, Munukutla Radhakrishna, Tapas Kumar Biswal, and Giri Yellalacheruvu

33. SEISMIC ACTIVITY IN ARUNACHAL PRADESH: PROBING THE MECHANISMS OF EARTHQUAKE OCCURRENCE AND TREMOR TRIGGERING

    Abhey Ram Bansal, Tony Saini and N. Purnachandra Rao

34. ANALYSIS OF ULF GEOMAGNETIC SIGNAL USING FRACTAL DIMENSION AND POLARIZATION RATION IN SEARCH OF POSSIBLE EM SIGNATURES ASSOCIATED WITH EARTHQUAKES OCCURRED IN SUBDUCTION ZONE OF ANDAMAN-NICOBAR REGION

    Rahul Prajapati and Kusumita Arora

35. ROLE OF GEOPHYSICS FOR SEEPAGE ISSUES AT DAM SITES –A REVIEW

    K.Satish Kumar

49. INDIAN OCEAN DIFFUSE ZONE DEFORMATION AND SEISMIC SOURCE CHARACTERISTICS

    Anil Earnest

50. SPATIAL ANALYSIS AND PREDICTIVE MODELING OF NATURAL SEISMIC ACTIVITY: A SMOOTHED SEISMICITY APPROACH

    S Lasitha and Aswini S

51. MAPPING OF IN-CROP COAL SEAM'S POSITION THROUGH MULTICHANNEL ANALYSIS OF SURFACE WAVES (MASW) STUDIES AT GODAVARIKHANI COAL MINE, RAMAGUNDEM, TELANGANA

    K. Swapna Sri*, K. Satish Kumar, P. Pavan Kishore, M. Shri Hari Rao, D. Mysaiah and Nimisha Vedanti

52. CRUSTAL STRUCTURE DEFORMATION ALONG THE ANDAMAN FOREARC AND THEIR ROLE ON SEISMICITY DISTRIBUTION- AN INTEGRATED STUDY

    Nisha Nair, Nikhil Sabulal, Sanjay S. Negi, Dhananjai K. Pandey, Thena, T, Singh, N. L.

53. LITHOSPHERIC ANOMALY MODEL OVER THE INDIAN-SUBCONTINENT AND ADJOINING OCEAN – BASIC CORRECTIONS AND MODELING OF THE SATELLITE DATA

    Monica Rawat and S. P. Anand

54. GROUNDWATER POTENTIAL ZONATION MAPPING OF THE TAWA RIVER BASIN, MADHYA PRADESH, INDIA

    Sushil Kumar, Dinesh Kumar, Kamal, B. S. Chaudhary

55. DELINEATION OF CRUSTAL STRUCTURE BELOW THE VINDHYAN BASIN, CENTRAL INDIA THROUGH THE INTEGRATED GEOPHYSICAL STUDIES.

    Choppalli Visweswara Rao, Sumanta Kumar Sathapathy, and Munukutla Radhakrishna

56. GROUNDWATER CHEMISTRY, SALINIZATION AND STABLE ISOTOPE STUDIES OF COASTAL AQUIFERS IN EASTERN PARTS OF ODISHA

    Atulya Kumar Mohanty, Bharat Moharana, B. Kiran Kumar, Devender Kumar, G. Sravya Sai and K. Rama Mohan

57. BENEFITS OF PETROPHYSICAL UNCERTAINTY ANALYSIS IN DETERMINISTIC METHOD USING SINGLE WORKFLOW – A CASE STUDY

    Anish Krishnapillai, Vivek Ramalingam

58. MAPPING OF RESERVOIR PROPERTIES BY INTEGRATION OF SEISMIC ATTRIBUTES AND SEISMIC INVERSION IN ARTIFICIAL NEURAL NETWORK: A MACHINE LEARNING APPROACH

    Nitin Verma, S.P. Maurya, G.Hema, Ajay P. Singh, Ravi Kant

59. NEW INSIGHT AND CONCEPTUALIZATION OF AQUIFER SYSTEM IN SEMI-ARID REGION OF HARYANA, NORTHWESTERN INDIA: IMPLICATIONS FROM HIGH RESOLUTION ELECTRICAL RESISTIVITY TOMOGRAPHY

    Dewashish Kumar, Savita Singh, Shailesh Batnagar and Amal Joy

60. DETERMINING THE DOMINANT EFFECT OF LITHOLOGY AND GROUNDWATER SALINITY ON AEM RESISTIVITY

    K. Bhima Raju, Penukula Akhil, Joy Chodhury, and Subash Chandra

61. INTERPRETATION OF SUBSURFACE GEOLOGICAL STRUCTURES AND IDENTIFICATION OF FEASIBLE MINERALIZATION POTENTIAL ZONE IN MAHAKOSHAL GROUP OF ROCKS USING GRAVITY AND MAGNETIC METHODS

    Ashish Kumar, Kunal K. Singh, Mehdi Hasan, Parashar Mishra, Gaurav Baruah, S. P. Chaubey and Uma Shankar

62. OPTIMIZATION OF MODEL INITIATION FOR AEM INVERSION IN ALLUVIUM-COVERED HARDROCK

    Penukula Akhil, Subash Chandra and Ved P. Maurya

63. HYDRO-GEOPHYSICAL CHARACTERIZATION OF AQUIFER SYSTEMS AND MAR AROUND OSSUDU LAKE, PONDICHERRY

    Sahebrao Sonkamble, Erugu Nagaiah, Subash Chandra

64. ELECTRICAL RESISTIVITY CHARACTERISTICS OF BEDROCK FRACTURE SYSTEM IN CRYSTALLINE HARDROCK

    Joy Choudhury and Subash Chandra

65. APPLICATION OF ELECTRICAL METHODS IN MAPPING GRAPHITIC CONDUCTORS AS AN AID TO URANIUM MINERALIZATION ALONG THE SHEAR ZONE IN GEGAL-RAMNER AREA, AJMER DISTRICT, RAJASTHAN.

    Prakash Mukherjee, Bibhu Prasad Das, Subhash Ram, Srinivasulu, A. Markandeyulu, S.K.Sharma, K.Chakrabarti, B.Sarvanan

66. GROUNDWATER FLOW MODEL OF A TYPICAL HARD ROCK GRANITIC TERRAIN- A CASE STUDY FROM SE PART OF YADADRI BHUVANAGIRI DISTRICT, TELANGANA, INDIA.

    K.Navitha, B.Madhusudan Rao

MARINE GEOSCIENCES

67. ATMOSPHERIC METHANE FLUXES FROM TROPICAL URBANISED MANGROVES AND THEIR ROLE IN ATMOSPHERIC WARMING

    Regina Hershey N. and S. Bijoy Nandan

68. A SYNTHESIS OF CARBON BURIAL IN THE NORTH-EAST INDIAN OCEAN DURING THE LATE CENOZOIC ERA

    Rajeev Saraswat, Rinu Fathima, Mohd Salman, Thejasino Suokhrie, S.M. Saalim

69. STRESS DISTRIBUTION IN THE SUMATRA-ANDAMAN REGION BEFORE AND AFTER 2004 MEGA THRUST EARTHQUAKE

    Aswin, A. S. Panicker, Mahesh, P., Dewangan, P

70. TINY TROUBLE IN TASTY DELICACIES: SOME PRELIMINARY INSIGHTS ON MICROPLASTICS IN SEAFOOD FROM UDUPI, KARNATAKA

    Anjali Tamrakar and Anish Kumar Warrier

71. ANALYZING AMPLITUDE VARIATIONS WITHIN SEISMIC CHIMNEY STRUCTURES TO GAIN INSIGHTS INTO GAS HYDRATE AND FREE GAS DISTRIBUTION: A CASE STUDY OF THE MANNAR BASIN

    C.K. Mishra, P. Dewangan, G. Sriram

72. PREDICTION OF ACOUSTIC IMPEDANCE AND POROSITY USING HYBRID OPTIMIZATION OF SIMULATED ANNEALING BASED SEISMIC INVERSION TECHNIQUES

    S.P. Maurya , Ravi Kant, Nitin Verma, Raghav Singh, K.H. Singh, Ajay P. Singh, Prabodh K. Kushwaha, M.K. Srivastava, G. Hema, Harsha Raghuvanshi And Richa

73. ARRAY OF CARBONATE MOUNDS INDICATE FAULT INDUCED FLUID ESCAPE FEATURES ALONG THE SHELF-EDGE OF THE NORTHERN KONKAN BASIN

    Mahale Vasudev, Pawan Dewangan

74. MACHINE LEARNING REGRESSION MODEL FOR SHEAR WAVE VELOCITY PREDICTION IN GAS HYDRATE BEARING SEDIMENTARY FORMATION OF KRISHAN GODAVARI BASIN.

    Pradeep Kumar Yadav, Uma Shankar

75. OFFSHORE SAND RESOURCES OF KERALA - AN ALTERNATIVE TO SAND CRISIS.

    C.V.Gopalan, N.M.Shareef, A.C.Dinesh, C.Jayaprakash, S.V.Hegde, N.Maran & K.K.Bhat

76. LATE CRETACEOUS AND CENOZOIC PALEOCEANOGRAPHY FROM LACCADIVE POLYMETALLIC CRUSTS, CHAGOS-LACCADIVE RIDGE, ARABIAN SEA, INDIA

    Saju Varghese, Basab Mukhopadhayay, C.V. Gopalan

77. TEXTURAL AND GEOCHEMICAL CHARACTERISATION OF PALK BAY SEABED SEDIMENTS: AN APPRAISAL ON PROVENANCE

    Anjaneyulu Katari, G. Nagendran and K. Priya

78. TRACE METAL VARIABILITY AND ECOSYSTEM RISK ASSESSMENT IN THE SEDIMENTS OF MANGROVES OF KERALA

    S Sreelekshmi and S Bijoy Nandan

79. UNRAVELLING THE SEASONAL MICROPLASTIC TRENDS IN THE TROPICAL MANGROVE WATERS OF SOUTH-WESTERN INDIA

    Gokul Valsan, Anish Kumar Warrier, S. Anusree, Anjali Tamrakar, Nelson Rangel-Buitrago

80. A PRELIMINARY STUDY ON THE VERTICAL DISTRIBUTION OF MICROPLASTICS IN THE WATER COLUMN OF THE NETHRAVATHI ESTUARY, KARNATAKA

    Vishnu Unnikrishnan, Anusree[1], Gokul Valsan, Manu Martin Paul, Anish Kumar Warrier

ATMOSPHERIC, PLANETARY AND SPACE SCIENCES

81. DIURNAL VARIABILITY AND TREND OF SUMMER MONSOON RAINFALL DURING PAST 22 YEARS OVER WEST COAST OF INDIA

    P. Ancy, C. A. Babu and H. Varikoden

82. GPR INVESTIGATIONS FOR UNCOVERING FOSSIL-BEARING STRATA IN QUATERNARY SEDIMENTS, CUDDAPAH BASIN, INDIA

    Sakram Gugulothu, Shanthosh S, Anil Kumar Devara, Vrushab Mahesh, Prabhin Sukumaran[4] and Anand Kumar Pandey

83. STUDY OF VERTICAL DISTRIBUTION OF OZONE USING OZONESONDE

    Anurag S.S., Aswini Thampi S.L. and Prince P.R.

84. VARIABILITY IN THE EQUATORIAL ELECTROJET DUE TO THE SOLAR MIGRATING TIDES

Divyanshu Dwivedi, N. Phani Chandrasekhar and Kusumita Arora

85. EVIDENCE FOR THE ROLE OF LOWER ATMOSPHERIC LARGE-SCALE WAVE PERTURBATIONS ON THE LONGITUDINAL BAND-LIKE APPEARANCE OF EQUATORIAL IONIZATION ANOMALY

Aswathy R.P and Anandu V

86. COMPARATIVE ANALYSIS OF EQUATORIAL COUNTER ELECTROJETS SIGNATURES: SWARM SATELLITE VS. GROUND OBSERVATIONS IN THE INDIAN SECTOR

Archana R.K and Kusumita Arora

87. ESTIMATION OF JOULE HEATING DURING INTENSE SUBSTORMS OF SOLAR CYCLE 24

Devi R Nair and Prince P.R

88. ANALYSIS OF JANUARY 15,2022 TONGA ERUPTION TRIGGERED IONOSPHERIC DISTURBANCE BASED ON GPS AND SWARM MISSION DATA

Aswini Thampi S.L., Sreebala P.S. and Prince P.R.

89. VHF RADAR OBSERVATIONS OF TROPOSPHERE-IONOSPHERE COUPLING DYNAMICS OVER A NEAR- EQUATORIAL STATION, COCHIN

Rakesh V., Sreekumar H., Abhilash S., Manoj M. G. and Binu Paul

90. CO-SEISMIC IONOSPHERIC PERTURBATIONS ASSOCIATED WITH THE 06 FEBRUARY 2023 TURKEY EARTHQUAKES

Sunil A. S., P. S. Sunil, M. S. Rose, K. M. Sreejith, and Mahesh N Shrivastava

91. ON THE CORRESPONDENCE BETWEEN SOLAR RADIATION, SOLAR FLARE LOCATION, AND IONOSPHERIC RESPONSE

Sreeraj M.S and Sumod S.G

92. PALEO-SEISMOLOGY OF THE MOON AND MARS

P. Senthil Kumar

93. ABNORMAL WEATHER (HEAT WAVE) CONDITIONS IN PENINSULAR INDIA AFTER 2015 NEPAL SEISMIC EVENTS

A.Akilan, K. K. Abdul Azeez, Gunda Goutham Krishna Teja , and H.V.S. Satyanarayana

94. FLOOD SUSCEPTIBILITY MAPPING IN KARWAR TALUK, UTTARA KANNADA DISTRICT OF KARNATAKA, USING INTEGRATED REMOTE SENSING AND GIS APPROACH

Ananda Krishnan, S. G. Dhanil Dev, S. Arjun, V. Deepchand, P. K. Krishnaprasad

95. INTEGRATING BAND RATIONING, AHP AND GIS APPROACH FOR IDENTIFICATION OF GROUND WATER POTENTIAL ZONES OF MAHI RIVER BASIN (MRB), INDIA.

Shanthosh S, Sakram Gugulothu, Pradeep Kumar Badapalli and Nilesh Kumar

96. CHARACTERIZATION OF SNOW HYDROLOGICAL PROCESSES OVER THE NORTHERN HEMISPHERE: DO WE KNOW ENOUGH?

Dheeraj Kumar Singh, Subhadeep Halder

97. ASSESSING THE STREAMFLOW TREND AND VARIABILITY AND ITS RELATIONSHIP WITH THE BOUNDARY LAYER WATER CYCLE PROCESSES AND MULTISCALE CLIMATE OSCIILATIONS-A STUDY OVER KRISHNA RIVER BASIN

    Sumana Sarkar and Ramesh K.V.

98. LONGTERM SEASONAL CHARACTERISTICS OF PRTICULATE MATTER USING CMIP6 MODELS UNDER DIFFERENT SSP SCENARIOS OVER INDIAN REGION

    Pritam Das Mahapatra, Abhilash S

99. FUTURE CHANGES IN THE POTENTIAL INTENSITY OF TROPICAL CYCLONES OVER THE ARABIAN SEA IN RESPONSE TO THE THERMAL STRUCTURE OF THE ATMOSPHERE AND THE OCEAN IN CMIP6 MODELS

    Abhiram Nirmal C. S. And Abhilash S.

YOUNG RESEARCHER PROGRAM

100. SEISMIC IMAGING OF THE MESOZOIC KACHCHH RIFT BASIN (KRB), NW INDIA, DERIVED FROM DEEP SEISMIC REFLECTION PROFILING

    K. Laxminarayana, Biswajit Mandal, V. Vijaya Rao, P. Karuppannan, Sumer Chopra, M. Ravi Kumar, Prakash Kumar

101. AGE CONSTRAINTS AND MAGNETIC FABRICS OF EARTHQUAKE INDUCED LIQUEFACTION FEATURES IN THE MEIZOSEISMAL AREA OF 1943 EARTHQUAKE, NE INDIA: CURRENT UNDERSTANDING AND FUTURE DIRECTIONS

    Md.Mujahed Baba, B.V. Lakshmi, V.M. Rokade, K. Deenadayalan, S.N.Patil and Priyeshu Srivastava

102. CRUSTAL STRUCTURE BENEATH THE WESTERN DHARWAR CRATON SEGMENT OF WESTERN GHATS: INSIGHTS FROM AMBIENT NOISE TOMOGRAPHY

    Sribin C, Padma Rao B, Sunil Rohilla

103. ALONG-STRIKE VARIATION IN EXHUMATION RATES AND SEISMICITY PATTERN OF THE GARHWAL-KUMAON REGION OF NW HIMALAYA

    Amit Sagwal, Paramjeet Singh, Manisha Sandhu, R.C. Patel

104. HORIZONTAL PLUME CHANNEL AND THE EVOLUTION OF YOUNG DIVERGENT TRIPLE JUNCTIONS: INSIGHTS FROM 3-D GRAVITY INTERPRETATION OF THE AFAR REGION

    K. S. Sreenidhi, M. Radhakrishna, Peter G. Betts, Robin Armit

105. SLOPE INSTABILITIES IN THE KRISHNA GODAVARI AND THE CAUVERY BASINS DUE TO GAS HYDRATE DISSOCIATION

    Palle Jyothsna and Nittala Satyavani

POSTERS

SOLID EARTH GEOSCIENCES

P1. CSIR-INTEGRATED SKILL INITIATIVE TRAINING PROGRAMME AT CSIR-NGRI, HYDERABAD

    G Swaroopa Abhay Ram Bansal, T Hemasundar Rao

P2. RADIOMETRIC SURVEYS FOR MINERAL EXPLORATION: A COMPREHENSIVE OVERVIEW

Alle Shivakumar, Udayalaxmi

P3. OPENING OF THE LACCADIVE BASIN AND THE EVOLUTION OF THE WESTERN CONTINENTAL MARGIN OF INDIA (WCMI) SOUTH OF TELLICHERRY ARCH

M. G. Gilbert, M. Radhakrishna and P. Unnikrishnan

P4. A REVIEW ON AEROMAGNETIC ANOMALIES ALONG THE KRISHNA RIVER TRANSECT FOR DIAMOND BEARING KIMBERLITES/ LAMPROITES, CUDDAPHA BASIN

D.Seshu and K.Satish Kumar

P5. REASSESSMENT OF GEOPHYSICAL STRUCTURE AND TECTONIC EVOLUTION OF THE COMORIN RIDGE IN THE CENTRAL INDIAN OCEAN.

Vishnu R Murali, Ratheesh Kumar

P6. EXPLORING STRUCTURAL DEFORMATION EVOLUTION IN THE CENTRAL INDIAN OCEAN USING MULTI-CHANNEL SEISMIC REFLECTION DATA

Rahul Yadav, Dhananjai K Pandey, Lachit Singh Ningthoujam, Sanjay Singh Negi

P7. CRUSTAL STRUCTURES OF DECCAN SYNECLISE, CENTRAL INDIA DERIVED FROM THREE-DIMENSIONAL MAGNETOTELLURIC INVESTIGATION

Anita Devi, Prasanta K.Patro , K. K. Abdul Azeez

P8. NATURE OF LITHOSPHERE-ASTHENOSPHERE BOUNDARY BENEATH THE INDIAN OCEAN

S. Silpa, B. Padma Rao, S. Maurya

P9. ESTIMATION OF CURIE DEPTH AND HEAT FLOW FOR CENTRAL PART OF EASTERN GHATS MOBILE BELT: INSIGHT INTO NON-VOLCANIC GEOTHERMAL SYSTEMS

Ananya P. Mukherjee and Animesh Mandal

P10. MINERAL MAGNETIC TRACING OF SEDIMENT PROVENANCE OF THE HIRPUR FORMATION, KAREWA GROUP, KASHMIR VALLEY

Shirish Verma, Binita Phartiyal, Prasanta Kumar Das and Rakesh Chandra

P11. PRIMARY INDICATION OF TWO LAYER UPPER MANTLE SEISMIC ANISOTROPY BENEATH THE IOGL REGION: INSIGHTS FROM SHEAR WAVE SPLITTING ANALYSIS

Sribin C, Lachit S. Ningthoujam, Sanjay S. Negi, Amit Kumar

P12. GEOMAGNETIC SECULAR VARIATIONS AND JERKS IN THE INDIAN SECTOR: A COMPREHENSIVE STUDY

Manjula Lingala, and Archana R.K

P13. HETEROGENEOUS LITHOSPHERIC STRUCTURE OF THE CENTRAL GANGA BASIN BETWEEN THE BUNDELKHAND CRATON AND THE SHARDA DEEP BY MAGNETOTELLURICS

M.Suresh*, A. Manglik, S. Thiagarajan

P14. CRUSTAL STRUCTURE OF COMORIN RIDGE DEPICTS POSSIBLE PLUME-RIDGE INTERACTIONS

Lachit S. Ningthoujam, Dhananjai K. Pandey, Nisha Nair, Rahul Yadav, Sanjay S. Negi, Amit Kumar, Khogenkumar Shoraisham

P15. SURFACE WAVE TOMOGRAPHY FOR CENTRAL HIMALAYAS AND TIBETAN PLATEAU

Chandranil Das

P16. EXPLORING THE GENESIS AND STRUCTURE OF ALCOCK AND SEWELL RISES BY INVERSION OF GRAVITY ANOMALIES

Brandis Carlier, Jensen Jacob, Maria Ana Desa, Saif Ali Khan

P17. SHALLOW SUBSURFACE TEMPERATURE DISTRIBUTION IN THE LADAKH REGION FROM BOREHOLE DATA: IMPLICATIONS FOR GEOTHERMAL PROSPECTS

Ayan Dutta, Labani Ray, Nagaraju Podugu, Sandeep Kumar Prajapati, Amar

P18. THERMAL CONDUCTIVITY, RADIOELEMENT DISTRIBUTION AND GEOCHEMISTRY OF THE GRANITOIDS AND GNEISSES ACROSS THE SON-NARMADA LINEAMENT AND ITS GEODYNAMIC IMPLICATIONS IN CENTRAL INDIAN TECTONIC ZONE

Nishu Chopra, S.P. Singh, Labani Ray, Ayan Dutta, Sandeep Kumar Prajapati

P19. GEOTHERMAL EXPLORATION OF WEST COAST, INDIA FROM GEOLOGICAL, GEOCHEMICAL AND GEOPHYSICAL INVESTIGATIONS: A REVIEW

Amar Prakashrao Dudhate, Labani Ray, Nishu Chopra, Nagaraju Podugu

P20. HIGH HEAT FLOW IN GODAVARI GONDWANA BASIN, INDIA: IMPLICATIONS FOR GEOTHERMAL PROSPECTS

Sandeep Kumar Prajapati, Labani Ray, Vishal Vasantrao Sakhare, Nishu Chopra, Bishnu Prasad Biswal, S. Eswara Rao

P21. CORRELATING b-VALUES AND GRAVITY ANOMALY ALONG INDO-BURMAN AND ANDAMAN- SUMANTRA-JAVA SUBDUCTION ZONE

Harsha K Haridas, Jensen Jacob Mahesh Perugu, Dibakar Ghosal, Sunil P S, Barndis Dominic Carlier, Saif Ali Khan

P22. PHYSICS-GUIDED UNSUPERVISED DEEP LEARNING APPROACH FOR THE INVERSION OF RECEIVER FUNCTIONS IN DIPPING AND ANISOTROPIC MEDIA

Bijayananda Dalai, Prakash Kumar and Mrinal K. Sen

P23. DECIPHERING THE SOUTHERN INDIAN SHIELD REGION: INSIGHTS FROM THE 3-D MAGNETOTELLURIC INVERSION

Kusham, Pradeep Naick B, Pratap A, Naganjaneyulu K

P24. MAPPING OF THE CRUSTAL ELECTRICAL CONDUCTIVE STRUCTURE BENEATH THE DECCAN VOLCANIC PROVINCE AND THE WESTERN DHARWAR CRATON, INDIA

Naganjaneyulu K, Kusham, Pradeep Naick B, Pratap A

P25. A COMBINED METHOD FOR THE DENOISING OF GNSS COORDINATE TIMESERIES USING SINGULAR SPECTRUM ANALYSIS AND CEEMDAN.

P.V.M.V. Prasada Raju, P.N.S. Roy

P26. UNRAVELING MARS' MAGNETIC MYSTERIES: INSIGHTS FROM CRUSTAL MAGNETIZATION AND SPHERICAL HARMONIC COEFFICIENT ANALYSIS

Debopam Ghosh and Swarandeep sahoo

P27. PETROGRAPHIC AND FLUID INCUSION STUDIES IN HIGH GRADE METAMORPHIC ROCKS OF COORG AND MERCARA SUTURE ZONE, SOUTHERN GRANULITE TERRAIN, SOUTH INDIA

Rajkumar P.B, Amaldev T, and Rahul Raj R

P28. INTER-SEISMIC, CO-SEISMIC AND POST-SEISMIC DEFORMATION OF THE 2015 MW 7.8 NEPAL (GORKHA) EARTHQUAKE

Rajesh Sathiyaseelan and John P. Pappachen

P29. FAULT CHARACTERIZATION USING CENTROID MOMENT TENSOR (CMT) SOLUTIONS OF EARTHQUAKES IN NATIONAL CAPITAL TERRITORY (DELHI) REGION

Urvashi Tyagi, Naina Gupta, Rimpy, Charu Kamra, Manisha Sandhu and R.B.S. Yadav

P30. PETROGRAPHY AND MINERAL CHEMISTRY OF MAFIC INTRUSIVE ROCKS FROM THE SIROHI DOMAIN, ARAVALLI CRATON, WESTERN INDIA: INSIGHTS INTO MANTLE-CRUST INTERACTIONS TECTONIC EVOLUTION.

Mahimaa Dash, N. V. Chalapathi Rao.

P31. PROCESSING OF 2-D ONSHORE SEISMIC DATA OF SOUTHERN ALBERTA REGION, CANADA

Rohit Chauhan, Abhishek, Ishika Aggarwal, Manisha Sandhu

P32. STRESS-STRAIN PARTITIONING OF INDIA-EURASIA COLLISION ZONE USING FPS AND GPS DATA

R. Abhirami, P.S. Sunil A Sooraj

P33. DEEP LITHOSPHERIC STRUCTURES BENEATH PRANHITA-GODAVARI VIS-À-VIS SON-MAHANADI RIFT BASINS OF INDIA THROUGH THE ANALYSIS OF GRAVITY DATA

Swarnapriya Chowdari and Bijendra Singh

P34. EVIDENCE FOR PALEO-CONTINENTAL MARGIN AND FOLDING OF RELIC FRAGMENT OF THE BAY OF BENGAL, NORTHEAST INDIAN SUBCONTINENT

R. Abhimanyu, K.S Krishna, M. Ismaiel

P35. THE IMPORTANCE OF ACCURATE PHASE LABELING IN SEISMIC ARRIVAL TIME DATASETS: IMPLICATIONS FOR SEISMIC TOMOGRAPHY

Pratul Ranjan, Konstantinos I. Konstantinou, Prakash Kumar

P36. DISTRIBUTION OF POWER SPECTRAL DENSITY FUNCTIONS USING SURFACE AND BOREHOLE SEISMIC RECORDS OF KOYNA, WESTERN INDIA

K. Mallika, D. Shashidhar, R. Rajesh and N. Purnachandra Rao

P37. SEGMENTED NATURE OF THE INDIAN PLATE BENEATH THE HIMALAYA ARC: RESULTS FROM ANALYSIS OF NORMALIZED RIVER CHANNEL STEEPNESS INDEX

K. Raj Sunil, G. Pavankumar, Ajay Manglik

P38. SOURCE PARAMETER ESTIMATION OF 21ST JULY 2023 JAIPUR EARTHQUAKE

Delna Joy K, Ambikapathy Ammani, Gera Sasi Kiran, Sindu Kumari, Shikha Vasisht, Priya Singh, O.P.Mishra

P39. STUDY ON THE VARIATION OF SOIL TEMPERATURE AND SOIL MOISTURE OF SANDY SOIL AT THUMBA

Sree Lekshmi R, Nizy Mathew

P40. ANALYSIS ON THE EFFECT OF THE PRE-SEISMIC ACTIVITY ON IONOSPHERE-THERMOSPHERE DYNAMICS FOR THE M 8.8 EARTHQUAKE IN CHILE

Parvathy.S, Aswathy R.P

P41. ANALYZING SPATIO-TEMPORAL B-VALUE VARIATION IN THE HIMALAYAN REGION FOR ENHANCED HAZARD ANALYSIS

Ashisan Dhodray and S. Lasitha

P42. ASSESSING THE REACTIVATION POTENTIAL OF LANDSLIDE PLANES IN THE DARJEELING SIKKIM HIMALAYA BY FRACTURE-INDUCED ELECTROMAGNETIC RADIATION (FEMR) TECHNIQUE

Saima Azam, Dip Das and Jyotirmoy Mallik

P43. SEISMIC APPROACH FOR LANDSLIDES IDENTIFICATION IN EASTERN HIMALAYAN REGION, INDIA, USING BROADBAND DATA

R P Singh, N Purnachandra Rao , Himangshu Paul, R Rekapalli, Venkatesh Vempati

P44. A DEEP LEARNING APPROACH TO SEISMIC EVENT CLASSIFICATION IN THE GUJARAT REGION, INDIA: PERFORMANCE AND CHALLENGES

D. Pragnath, G. Srijayanthi, Santosh Kumar, Sumer Chopra

P45. SEISMICITY PATTERN OF ANDAMAN-SUMATRA REGION – STUDY OF SEISMIC QUIESCENCE AND BVALUE AS POSSIBLE PRECURSORS

Varsha M

P46. ADVANCEMENT IN PROCESSING AND JOINT NATURE-INSPIRED INVERSION OF MAGNETOTELLURIC AND SEISMOLOGICAL DATA VIA SEISPY OVER HIMALAYAN REGION

Kuldeep Sarkar, Angad Yadav and Upendra K Singh

P47. A COMPREHENSIVE INVESTIGATION OF CRUSTAL DEFORMATION INDUCED BY KOYNA-WARNA RESERVOIRS USING GEODETIC OBSERVATIONS AND MACHINE LEARNING TECHNIQUES

A.Sooraj, P.S. Sunil, A.S Sunil, and R. Abhirami

P48. INSAR BASED SUBSIDENCE MONITORING IN URBAN CENTERS OF KOLKATA, INDIA: CONSTRAINS FROM DWINDLING GROUNDWATER RESOURCES

Praveen Kumar Kannojiya and Ashwani Raju

P49. SEISMIC ATTENUATION BENEATH THE CENTRAL HIMALAYA CONSTRAINED BY FUNDAMENTAL MODE OF RAYLEIGH WAVE FROM THE HI-CLIMB DATA SET.

Utpal Saikia and Davin Mathews David

P50. TOTAL ELECTRON CONTENT (TEC) FOR SEISMOIONOSPHERIC PHENOMENON

Monika Thakur, Saima Siddiqui, Neetu Paliwal and S. Choudhary

P51. MACHINE LEARNING APPROACH FOR ANALYSIS OF IONOSPHERE PARAMETERS FOR EARTHQUAKE PRECURSORS

Saima Siddiqui, Monika Thakur, Neetu Paliwal, S. Choudhary

P52. LANDSLIDE OCCURRENCES AND THE PRECIPITATION PATTERN IN THE KASHMIR HIMALAYA

Bilquis shah, Umar Farooq Malik

P53. NEW ARCHAEOINTENSITY DATA FROM THE 16TH CENTURY CE IN THE HISTORICAL TOWN OF SINDKHED RAJA, MAHARASHTRA

Rajapandy P., Pradnya Ramesh Mohite, K. Deenadayalan, B.V. Lakshmi, Priyeshu Srivastava

P54. MINERAL MAGNETIC AND GEOCHEMICAL PROPERTIES OF HOLOCENE SEDIMENTS FROM DUDHNAI RIVER, ASSAM, NE INDIA

K. N. Vishnu, Mujahed Baba, B.V. Lakshmi, K. Deenadayalan, Priyeshu Srivastava

P55. ISOTOPIC FINGERPRINTING OF POST LAST GLACIAL MAXIMUM SEDIMENTATION IN THE WESTERN GREAT RANN OF KACHCHH, WESTERN INDIA.

Ayushi Bhatnagar, Anil D. Shukla, Mamata Ngangom and M.G. Thakkar

P56. IMPLICATIONS OF SOURCE ROCK CHARACTERISTICS AND MICROSTRUCTURAL REACTIVITY FOR HYDROCARBON GENERATION FROM EARLY PERMIAN COALS

Akhandal Sahoo, Santanu Ghosh, Tushar Adsul, Atul Kumar Varma, Nimisha Vedanti

P57. CHEMICAL WEATHERING AND ASSOCIATED CO2 CONSUMPTION RATES OF KARAMANA RIVER DRAINING SOUTHERN GRANULITE TERRAIN, INDIA.

B. Upendra, M. Ciba, S. Rahul, V. Arun, K. Anoop Krishnan

P58. PETROGRAPHY AND MINERAL CHEMISTRY OF LAMPROPHYRE DYKES FROM THE NONGCHRAM FAULT, SHILLONG PLATEAU, NORTHEAST INDIA

*R.B.Ananth , N.V.Chalapathi Rao

P59. HYDROGEOLOGICAL AND HYDROCHEMICAL CHARACTERISTICS OF KARST AQUIFER SYSTEM IN THE MANIMUTHAR SUBBASIN, TAMIL NADU

M Mathiazhagan, Y Srinivas, T Mercy, M Muthu, P Athi Narayanan, P Kousika & S Rakesh

P60. GEOELECTRICAL INVESTIGATION OF GROUNDWATER IN PARTS OF TUTICORIN DISTRICT, TAMILNADU, INDIA

S. Arunbose, , P.Boopathy Raja, C. Sivanadhini, R. Roja and Y.Srinivas

P61. ASSESSMENT OF STRATIGRAPHIC CORRELATION THROUGH CHAOTIC BEHAVIOUR OF GEOPHYSICAL LOGS: A CASE STUDY FROM AMGURI OIL FIELD, UPPER ASSAM BASIN

Kurakula Kalyani, Bappa Mukherjee, Kalachand Sain

P62. ADVANCED DATA-DRIVEN ALGORITHMS FOR RESERVOIR ROCK PROPERTY ESTIMATION

Shib Sankar Ganguli and Prakash Kumar

P63. SEISMIC IMAGING ALONG THE NARAYANPUR - NANDURBAR PROFILE, DECCAN SYNECLISE, WESTERN INDIA: PRELIMINARY RESULTS

K. Renuka, Laxmidhar Behera, Biswajit Mandal, Prakash Kumar

P64. SEISMIC IMAGING OF COAL SEAMS IN DURGAPUR, RANIGANJ BASIN

Arkajit, Ajay Malkoti and Nimisha Vedanti

P65. REVIEW ON GLOBAL CO2 STORAGE PROJECTS IN BASALT AND AN ANALOGY FOR DVP, INDIA.

Gadela Dharma Sai Goud and Nimisha Vedanti

P66. CURRENT SCENARIO AND TECHNICAL CHALLENGES OF CO_2 SEQUESTRATION IN GLOBAL MAJOR COAL SEAMS AND ECBMR: A REVIEW

Omkar Kumar Gupta, Sakshi, Manika Rawal and Nimisha Vedanti

P67. IDENTIFICATION OF PALAEOCHANNEL USING GEOPHYSICAL METHOD IN KURUKSHETRA DISTRICT, HARYANA, INDIA

Harsh Kumar, Vikas Kumar, Sushil Kumar, B. S. Chaudhary

P68. DISTRIBUTION AND POLLUTION POTENTIAL OF DISSOLVED TOXIC METALS IN SUBTERRANEAN ESTUARIES OF KERALA COAST

N.K. Vishnudattan, S. Bijoy Nandan, E.H. Aravind, D.S. Suresh Babu

P69. GROUNDWATER VULNERABILITY IN VICINITY OF LANDFILL SITE THROUGH GIS AND DRASTIC APPROACH IN DELHI, NCR REGION

Rishu Pandey, Tanvi Arora

P70. ASSESSMENT OF CONTAMINATION LEVEL OF RADON (^{222}RN) IN GROUNDWATER AROUND TULSHISHYAM GEOTHERMAL AREA AND SAVARKUNDLA FAULT IN SAURASHTRA, GUJARAT, INDIA

Bala Chandar P, Sushanta Kumar Sahoo, and Madhusudhanarao Katlamudi

P71. STATISTICAL ANALYSIS AND IRRIGATION WATER QUALITY ASSESSMENT OF SELECTED RIVERS OF WESTERN GHATS, SOUTH INDIA

Raveena Nandilath, Anish A U

P72. SUBSURFACE MODELING AND IMAGING USING SEISMIC REFRACTION AND WIDE-ANGLE REFLECTION DATA IN DECCAN SYNCLISE PROVINCE

Pratiksha Tiwari, Biswajit Mandal, ASSSRS. Prasad, Prakash Kumar

P73. ASSESSING FLUORIDE CONTAMINATION AND HUMAN HEALTH RISKS IN THE PULLAMAPATTI WATERSHED, NORTHERN TAMIL NADU, SOUTH INDIA

Divya A S, Joji V S, and Reshma Susan Jacob

P74. ASSESSING GROUNDWATER QUALITY IN THE PONDICHERRY REGION OF THE UNION TERRITORY OF PONDICHERRY: A GIS-BASED STUDY ON HYDROCHEMICAL CHARACTERISTICS OF PHREATIC AND DEEPER AQUIFERS

Reshma Susan Jacob, Joji V S, and Divya A S

P75. PORE PRESSURE PREDICTION USING DECISION TREE REGRESSION ANALYSIS OF WELL U1517A LOCATED AT LANDSLIDE COMPLEX OF SITES IODP 372

Goutami Das, and Saumen Maiti

P76. PRELIMINARY STUDIES ON UM AND HE BASED HYBRID DEEP LEARNING MODELS FOR SEISMIC IMAGE ENHANCEMENT

Thandan Babu Naik R, Polaiah B, Vamsi Krishna G, Pradeep Naick B, and Satyanarayana H.V.S

P77. SMART HYDROLOGY: ENHANCING GEOPHYSICAL STUDIES WITH IOT-DRIVEN WATER LEVEL AND QUALITY MONITORING

Pradeep Naick B, Sateesh Chandrapuri, G Vasudevan, Thandan Babu Naik, H.V.S. Satyanarayana and Team

P78. ELECTRICAL RESISTIVITY IMAGING OF A CRITICAL ZONE IN THE PRANMATI BASIN, UTTARAKHAND HIMALAYA FOR BEDROCK STRUCTURE AND REGOLITH THICKNESS

Akashdeep Barman, G. Pavankumar, M. Demudu Babu and Ajay Manglik

P79. ENHANCING CO_2 MONITORING ACCURACY IN THE SLEIPNER AREA WITH SEISMIC ATTRIBUTE TECHNIQUES

G. Hema, S.P. Maurya, Nitin Verma, Ravi Kant, Ajay P. Singh

P80. APPLICATION OF SEISMIC INVERSION BASED ON MAXIMUM LIKELIHOOD METHODS TO MONITOR CO_2 PLUME IN SLEIPNER GAS FIELD, NORWAY

Ajay Pratap Singh, S.P. Maurya, Ravi Kant, Nitin Verma, Raghav Singh, K.H. Singh, Prabodh K. Kushwaha, M.K. Srivastava, G. Hema[1], Harsha Raghuvanshi and Richa

P81. UNVEILING THE POTENTIAL OF GEOPHYSICAL METHODS FOR CONTAMINANT STUDIES IN URBAN AREAS: A REVIEW

Sohelkhan Pathan, Tanvi Arora

P82. GEOELECTRIC INVESTIGATION USING DZP TO DELINEATE GROUNDWATER POTENTIAL ZONE AND AQUIFER PROTECTIVE CAPACITY: A CASE STUDY IN SEMI-ARID NIGER, AFRICA

Ronak Dahiya, Sohelkhan Pathan, Rishu Pandey, Rehmat Khan and Tanvi Arora

P83. ELECTRICAL RESISTIVITY IMAGING OF A CRITICAL ZONE IN THE PRANMATI BASIN, UTTARAKHANDHIMALAYA FOR BEDROCK STRUCTURE AND REGOLITH THICKNESS

Akashdeep Barman*, G. Pavankumar, M. Demudu Babu and Ajay Manglik

P84. TWO DIMENSIONAL DEEP LEARNING BASED INITIAL MODEL FOR FAST MAGNETOTELLURIC INVERSION

Koustav Ghosal and Arun Singh

P85. SUBSURFACE CHARACTERIZATION OF ROCK GULLY EXPOSURE USING MAGNETO-TELLURIC SCANNING FOR ANCHORING THE TOWER IN KOLLAM, KERALA

Kiran C.J., Jishma R. Jayan, Anand S.P. and Biju Longhinos

P86. AMT STUDIES IN RAJAPUR GEOTHERMAL ZONE, WESTERN MAHARASHTRA

Vasu Deshmukh, P V Vijaya Kumar, P B V Subba Rao and A K Singh

P87. TELL-A-TALE STORY OF HOLOCENE COASTAL SEDIMENTARY RECORD OF GUJARAT, WESTERN INDIA

Utkarsh Pandey and S. P. Prizomwala

P88. SPATIO-TEMPORAL VARIATION IN EXHUMATION RATES OF THE HIMACHAL HIMALAYA OF THE NW-INDIA: INSIGHTS FROM LOW-TEMPERATURE THERMOCHRONOLOGY

Sarthak Ranjan Giri, Paramjeet Singh, Sushil Kumar, Manisha Sandhu

P89. GENERATION OF SONIC LOG IN THE KG BASIN FROM THE NEIGHBOUR WELL LOGS USING CONVOLUTIONAL NEURAL NETWORKS

D. Haritha, and N. Satyavani

P90. A PSEUDO 3D FOLD FROM 2D SEISMIC TRACES: A CASE STUDY ON SURIN-MASTGARH ANTICLINE

Madhab Biswas and Kalachand Sain

P91. HIGH HEAT FLOW IN GODAVARI GONDWANA BASIN, INDIA: IMPLICATIONS FOR GEOTHERMAL PROSPECTS

Sandeep Kumar Prajapati, Labani Ray, Vishal Vasantrao Sakhare, Nishu Chopra, Bishnu Prasad Biswal, S. Eswara Rao

P92. SHEAR WAVE VELOCITY STRUCTURE FOR THE INDO-GANGETIC PLAIN, FROM INVERSION OF AMBIENT VIBRATION SINGLE-STATION AND ARRAY MEASUREMENTS

Uma Shankar

P93. HYDRO-GEOCHEMICAL EVOLUTION CHARACTERIZING THE CRYSTALLINE HARD ROCKS AQUIFERS OF NAGAVALI RIVER BASIN, SOUTHERN INDIA

Enatula Appalanaidu and Sahebrao Sonkamble

P94. NEW MAGNITUDE SCALING RELATIONS FOR EARTHQUAKE EARLY WARNING SYSTEM IN THE KUMAON HIMALAYA USING OBSERVED-SIMULATED EARTHQUAKE DATASETS

Sandeep, Suraj Kumar Pal, P. Kumar, A. Joshi

P95. NONLINEAR DYNAMICS AND PREDICTABILITY OF GROUNDWATER LEVEL IN VISAKHAPATNAM DISTRICT, ANDHRA PRADESH, INDIA USING BAYESIAN NEURAL NETWORKS

Gathala Vinod Mathews, Rekapalli Rajesh, N. Purnachandra Rao and Shaik Kareemunisa Begum.

COASTAL PROCESS AND HAZARDS

P96. IDENTIFICATION OF SITES AND MAPPING OF FRESH WATER MANGROVES ALONG KUWANA AND BISUHI RIVER, GONDA FOREST DIVISION IN UTTAR PRADESH USING GEOSPATIAL TECHNIQUES

P. Kunwar, Kaneez Zaman

P97. COASTAL RETREAT- A COMPARATIVE ANALYSIS OF BAKKHALI AND MOUSUNI, INDIAN SUNDERBANS

Shreya Das, Srirupa Saha, Tanushree Bose, Kamalika Mondal, Kanailal Das, and Karabi Das

P98. THE INDIAN COASTAL AREA AND NATURAL DISASTERS THAT ARE AFFECTING IT

B. Satya Madhuri, N. Veera Lakshmi and P.S.H.S.N. Dattatreya

P99. INTEGRATING SIDE SCAN SONAR DATA FOR ASSESSING ENVIRONMENTAL IMPACTS OF ESTUARINE SAND MINING

K.M. Dubey*, G. Sriram, S.G. Sivalanka, P. Dewangan

P100. AN INTEGRATED METHODOLOGY FOR EFFECTIVE MANAGEMENT OF A MULTIFARIOUS COAST

Sai Ganesh Veeravalli, Mridula G M, Subburaj S, Satya Kiran Raju Alluri, Ramanathan V

P101. UNPRECEDENTED FLOODING IN KOCHI: PROBING THE INFLUENCE OF TIDES

Amal George K, P.S. Sunil

P102. COASTAL VULNERABILITY ASSESSMENT IN A HIGHLY URBANIZED COAST OF KERALA USING BAYESIAN BELIEF NETWORK AND GIS

A. L Achu, Girish Gopinath, Sanju Eldhose, Mohamed Fasil CT

P103. "UNVEILING THE BIO-OPTICAL SIGNATURE: ALGAL BLOOM DYNAMICS IN CHILIKA, ASIA'S LARGEST BRACKISH WATER LAGOON"

Sambit Singh, Susmita Raulo, Tamoghna Acharyya, Anu Gopinath

P104. SHORELINE CHANGES ALONG SOUTH-WEST COAST OF INDIA: INFERENCES FROM GEOLOGICAL, GEOMORPHOLOGICAL, GEOPHYSICAL AND REMOTE SENSING STUDIES

Mamatha P.K., A. Anil Kumar, K.S. Jayappa, K.G. Mohan, Subhradeep Das, L.C. Anupama, Shaniba V

MARINE GEOSCIENCES

P105. METHANE GAS FLARES IN THE FOREARC BASIN OF THE ANDAMAN – NICOBAR SEA

Ankush, P. Dewangan, G. Sriram

P106. RESERVOIR CHARACTERIZATION USING HYBRID OF PARTICLE SWARM OPTIMIZATION- A CASE STUDY FROM THE BLACKFOOT FIELD, CANADA

Ravi Kant, S.P. Maurya, Nitin Verma, Raghav Singh, K.H. Singh, Ajay P. Singh, Prabodh K. Kushwaha, M.K. Srivastava[1], G. Hema, Harsha Raghuvanshi and Richa

P107. GAUSSIAN PROCESS REGRESSION AIDED GAS HYDRATE SATURATION PROXY FROM GEOPHYSICAL LOGS: A CASE STUDY FROM KG BASIN, INDIA

Suman Konar, Bappa Mukherjee, Kalachand Sain

P108. ESTIMATION OF GAS HYDRATE SATURATION IN NGHP-02 WELLS BY USING ELECTRICAL RESISTIVITY METHODS AND ROCK PHYSICS MODELLING

Sneha devi, Pradeep Kumar Yadav, Uma Shankar

P109. SEISMIC INTERFEROMETRY OF OCEAN BOTTOM SEISMIC DATA TO INCREASE SUBSURFACE ILLUMINATION

Sanjay Mandal and Maheswar Ojha

P110. MULTIMINERAL PETROPHYSICAL ANALYSIS WITH MACHINE LEARNING TECHNIQUE OF AN OFFSHORE CLASTIC RESERVOIR

Shahnawaz Salim, Partha Pratim Mandal

P111. INSIGHTS OF KG-OFFSHORE BASIN THROUGH SEISMIC REFLECTION AND OTHER GEOPHYSICAL DATA

Satendra Singh, Kalachand Sain, Maheswar Ojha and Prakash Kumar

P112. PRINCIPLE INVESTIGATIONS AND OBSERVATIONS OF HIGH LATITUDE SEDIMENT DEPOSITS AT EIRIK DRIFT DURING IODP EXPEDITION 395

Thena Thulasi, Halima Ibrahim, Claire Jasper, Saran Lee, Sevasti Modestou, Suzanne O'Connell, Leah Levay, Anne Briais, Ross Parnell-Turner and the Expedition 395 Shipboard Party

P113. BOTTOM WATER OXYGEN RESPONSE OF THE SOUTHERN BAY OF BENGAL: BASED ON BENTHIC FORAMINIFERAL MORPHOTYPES AND MICROHABITAT

Kavya Aravind and N R Nisha

ATMOSPHERIC, PLANETARY AND SPACE SCIENCES

P114. WAVE TRAITS FROM THE JANUARY 15, 2022 HUNGA-TONGA VOLCANIC ERUPTION OVER INDIAN AND POLAR REGIONS

M. S. Rose, P. S. Sunil, A. Sooraj, A. S. Sunil, Priyesh Kunnummal, K. Amal George, K. K. Ajith, Dhanya Thomas, V. K. Mini

P115. EVIDENCE OF TWO-STEP NONLINEAR INTERACTIONS IN THE PRESENCE OF ZONALLY SYMMETRIC WAVES DURING MAJOR SUDDEN STRATOSPHERIC WARMINGS

G. Mitra, A. Guharay1, J. F. Conte, and J. L. Chau

P116. ON THE RESPONSE OF EQUATORIAL PLASMA TO NOCTURNAL PROMPT PENETRATION ELECTRIC FIELDS: A CASE STUDY

Meenu Krishnan, Ajesh A, T.K. Pant

P117. A CASE STUDY OF FLUCTUATIONS IN GROUNDWATER LEVEL THROUGH REMOTE SENSING IN KURUKSHETRA DISTRICT, HARYANA

Aashu Mehra*, Shreya Mondal, Hemant Yadav, Akash Deep, B S Chaudhary

P118. CLIMATOLOGICAL ANALYSIS OF LIGHTNING ACTIVITY OVER KERALA AND ITS ASSOCIATION WITH DYNAMICAL AND THERMODYNAMICAL VARIABLES.

Nandhulal K., Hamza Varikoden, Vishnu R.

P119. COMPOSITIONAL AND MORPHOLOGICAL CHARACTERISTICS OF AITKEN CRATER, FARSIDE OF THE MOON: IMPLICATIONS FOR VOLCANIC AND TECTONIC ACTIVITIES

B. B. Deepak and A.V. Satyakumar

ANNI TALWANI MEMORIAL GRANT FOR YOUNG WOMEN RESEARCHERS

1. ROLE OF REGIONAL GEOLOGY IN HOT-SPRINGS OF THE EASTERN GHAT, INDIA

   Susmita Goswami, Abhishek. Kumar. Rai
2. FLUID-INDUCED METASOMATISM IN NEO-TETHYAN SUB-ARC MANTLE: INFERENCES FROM MANTLE SECTION FROM NAGA HILLS OPHIOLITE
   Anisha Verencar, Abhishek Saha
3. TAPHONOMIC INSIGHTS INTO SHALLOW-MARINE SHELL BEDS: EVIDENCE FROM THE OLIGOCENE (CHATTIAN) CORAL LIMESTONE MEMBER, KUTCH BASIN,
   Gujarat Kanchan Prasad, Sudipta Dasgupta, Abhishek Natarajan

4. IMAGING OF GONDWANA SEDIMENTS HIDDEN BELOW THE DECCAN BASALTS IN SOUTH REWA BASIN OF CENTRAL INDIA USING RAY TRACE INVERSION OF SEISMIC DATA

   Sudeshna Moharana and Laxmidhar Behera

5. APPLICATION OF SEISMIC REFRACTION TOMOGRAPHY FOR IDENTIFICATION OF SHALLOW COAL SEAMS IN MAHANADI BASIN COALFIELD

   Muthulakshmi V, Dhanam K and Nimisha Vedanti

IGU AWARDS/MEDAL/PRIZE-2023

IGU- Decennail Award
BLUE ECONOMY: CHALLENGES AND OPPORTUNITIES
M.Ravichandran

IGU-KRISHNAN MEDAL
THE MANTLE CAULDRON BENEATH THE INDIAN OCEAN
Abhishek Saha and Arghya Hazra

IGU- DR. J. G. NEGI YOUNG SCIENTIST AWARD
CRUSTAL EVOLUTION IN THE WESTERN CENTRAL INDIAN SHIELD THROUGH PRECAMBRIAN TTG- GRANITOIDS AND THE MAGMATIC ROCKS OF THE WESTERN HIMALAYA, LADAKH REGION.
Hiredya Chauhan

ORAL

COASTAL PROCESSES AND HAZARDS

COASTAL EROSION STUDIES ALONG THE PARTS OF KERALA COAST AND THE ROLE OF MUD BANK

S Santhosh Kumar[1&4 *], R Mani Murali[1&4], K N Reshma[2] and P J Vidya[3]
1-CSIR-National Institute of Oceanography, Goa;
2-National Centre for Coastal Research, Chennai, Tamil Nadu;
3-National Centre for Polar and Ocean Research, Goa;
4-Department of Marine Science, Bharathidasan University, Tiruchirappalli, Tamil Nadu.
*Presenting author: ssantosh@nio.org

ABSTRACT

The formation of mud bank along the Kerala coast, especially at Alleppey region is a unique phenomenon that persistently occurs every year during the southwest monsoon. The presence of fluid mud in the near bottom helps in dampening large waves during the rough monsoon weather that protects the coastline from monsoonal erosion. The region remains calm throughout the event and helps the fishermen to access the shore at ease. This study was carried out to delineate the periphery of the mud bank using in-situ observations and satellite data. The mapping of the mud bank region through remote sensing techniques was attempted for 2007 and 2015-2020. This mapping revealed the geo-spatial variations of the mud bank. It was observed at Vandanam which is 3 km south of its original location Punnapra from 2017 onwards. The reason for the shifting of the mud bank was due to a remotely originated swell from the southern Indian Ocean, which hit the Alleppey coast resulting in huge erosion. Thus, the role of mud bank in regulating the parts of the Kerala coast during the monsoon has been studied.

COASTAL RETREAT- A COMPARATIVE ANALYSIS OF BAKKHALI AND MOUSUNI, INDIAN SUNDERBANS

Shreya Das[1*], Srirupa Saha[1*], Tanushree Bose[1], Kamalika Mondal[1], Kanailal Das[1] and Karabi Das[2]
[1]Estuarine and Coastal Studies Foundation, West Bengal, India.
[2]Department of Geography Dr Kanailal Bhattacharyya College, Howrah, West Bengal, India.
*Equal contribution authors
*Presenting authors: dasshreyaa123@gmail.com ; srirupasaha15102000@gmail.com

ABSTRACT

Coastal erosion refers to displacement of lands along the coasts by the continuous process of erosion and accretion changing the physiography. Coastal islands of Indian Sundarbans have faced severe cyclonic effects of Bulbul (2019), Amphan (2020) and Yaas (2021) triggering embankment breaching and salt water intrusion hampering livelihoods. A comparative study was done between Mousuni and Bakkhali, part of Indian Sundarbans facing Bay of Bengal in the Southern part of Ganges delta. Mousuni island faced a land reduction of about 3.82km^2 along western bank (1979 -2011; Das,2022) whereas coastal stretch of about 2km from Bakkhali in the east to Fraserganj in the west was eroded (Das,2022). The objective of the study was to assess the suitability of embankments to combat the vulnerability regarding coastal erosion in Mousuni and Bakkhali. To observe the beach morphology both quantitative and qualitative approaches were undertaken. Quantitative methods such as

measuring various parts of embankments with observations of embankment design (mainly permanent concrete embankment and temporary geojute) were undertaken. A beach profile was done to observe the effects of coastal erosion on beach with the help of dumpy level. A comparison from two field surveys (7th May, 7th October) at Mousuni shows striking effects of coastal erosion at Baliara demolishing the geojute embankments and resorts. The coastal configuration of Bakkhali shows an interesting erosion and accretionary behavior at two adjacent sections unlike Mousuni. High concrete embankments are demanded by the local residents in case of the islands. Qualitative methods such as questionnaire survey was done to understand the people's perception regarding the sustenance of embankment. Armored concrete embankment protected by vegetative wall is required to cope up with the coastal retreat of these two islands.

LAND SUBSIDENCE AND FLOOD INUNDATION RISK ASSESSMENT FOR A TROPICAL ESTUARINE ISLAND THROUGH INSAR ANALYSIS AND HYDRODYNAMIC MODELLING: THE CASE OF MUNROE ISLAND, SOUTHWEST INDIA

K. M. Sreejith[1, *], Ratheesh Ramakrishnan, Arpan Shastri, Ritesh Agrawal[1], M. K. Rafeeque[2], A. Krishnakumar[2], and L. Sheela Nair[2]

[1] Geosciences Division, Space Applications Centre, Indian Space Research Organisation, Ahmadabad, India.
[2]National Centre for Earth Science Studies, Thiruvananthapuram, India
* Corresponding author: sreejith81@sac.isro.gov.in

ABSTRACT

Coastal and estuarine land subsidence owing to natural or anthropogenic reasons is a global phenomenon that need to be systematically studied in view of the alarming sea-level rise scenario. In this work, we report decadal scale land subsidence at Munroe, Island: an ecologically fragile, densely populated estuarine island system in the Ashtamudi Estuary, south west India. InSAR analysis suggests that about 30% of the island is undergoing land subsidence at an alarming rate of -25 mm/yr during 2007-2011 which increased up to -40 mm/yr during 2015-2022. The land subsidence at Munroe Island could be attributed both natural and anthropogenic factors including the inherent compaction of sediments, changes in farming practices and expansion of aquaculture activities. The observed rates of subsidence exceeds the average local sea level rise by an order of magnitude. Hydrodynamic modelling is carried out using Telemac modelling system to simulate the probable future flooding scenario. The model domain is created by integrating high-resolution lake bathymetry data with the expected future land subsidence from InSAR estimated subsidence rate. By taking into account of the sea level rise, the projected flood map of Munroe Island after 50 years suggest a large area of coastal land adjacent to the lake and creek to be permanently flooded. The result shows around 50 ha of low-lying inland region, adjacent to the creeks are subjected to inundation during the high tide condition. The approach presented in this work has broader implications in understanding the future flood risk vulnerability for coastal and estuarine regimes in view of the rapid increase in sea-level and vertical land motions.

SATELLITE-DERIVED BATHYMETRY (SDB) ANALYSIS ALONG THE RAMESHWARAM COAST WITH LANDSAT 8 DATA

Komal Rani[a*], Pawan Dewangan[a], Sriram Gullapali[a], Chaitanya Raj[b]
[a]CSIR- National Institute of Oceanography, Dona Paula, Goa- 403 004
[b]Indian Institute of Science Education and Research, Bhopal- 462 066
Email Id: komalrani@nio.org

ABSTRACT

Obtaining bathymetric data is a critical component of various activities near the shoreline and hydrological research, including applications in coastal engineering, sedimentary analysis, and hydrographic surveys. While traditional bathymetry measurement methods like single-beam and multibeam echosounders can offer high accuracy and spatial resolution, they come with certain limitations when conducting surveys in shallow coastal regions. Remote sensing imagery offers an efficient, cost-effective, and expansive means of acquiring bathymetric measurements. Recently, optical satellite imagery has gained prominence as an alternative approach to conventional bathymetric survey methods in order to tackle this challenge. This shift is primarily driven by the accessibility of advanced satellite data from sensors, such as, Landsat 8 and Sentinel-2 that provide cost-effective data with enhanced spatial and temporal resolutions. In the present study, Landsat-8 data was processed (atmospheric corrections) to obtain Satellite-derived Bathymetry (SDB) using Log transformed band ratio (LBR) model. The evaluation was conducted along the coastline of Rameshwaram in the state of Tamil Nadu, India. The bathymetric data obtained from Landsat 8 data was assessed using Echo Sounder data. The findings indicated that the linear algorithm effectively obtains bathymetric data for depths ranging from 0-20 meters. By utilizing readily accessible satellite imagery, this research has the potential to enhance our comprehension of coastal processes and advance the effective management of coastal resources.

COASTAL PROCESSES AND DYNAMICS OF SANDBARS AT MANDOVI ESTUARY IN THE CENTRAL WEST COAST OF INDIA

Puneet Kumar Mishra[1,2*], Mani Murali R[1,2,3], Santhosh Kumar S[1,3]
[1]CSIR-National Institute of Oceanography, Dona Paula, Goa – 403004, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India
[3]Department of Marine Science, Bharathidasan University, Tiruchirapalli- 620024, Tamil Nadu, India
[*]Presenting author: pkatayayan@protonmail.com, pkmishra@nio.org

ABSTRACT

Sandbars, often found in coastal regions, play a crucial role in protecting vulnerable areas from the forces of nature. They play an important role in shaping local and regional coastlines by responding to a variety of stimuli such as tides, river flow, sediment availability, wave energy, and so on. This study focuses on Aguada and Reis Magos sandbars, two prominent sandbars located at the Mandovi estuary in Goa, India. Employing a comprehensive approach with in-situ observations (beach profiling and bathymetry) and remote sensing methods (freely available optical and microwave images combined with Google Earth imagery), we studied the evolution cycle of these sandbars and associated coastal processes. It is found that during the intense wave conditions of the southwest monsoon (June to September), these sandbars undergo a temporary phase of dispersion, subsequently obstructing

maritime traffic by forming a unified shallow bar and blocking the navigation channel. However, following the attenuation of monsoon waves in October to November, the sandbar and adjacent beach initiate a gradual replenishment process, aimed at compensating for the sediment loss incurred during the monsoon season. Understanding the dynamic nature of sandbars and their pivotal role within coastal environments remains imperative. This knowledge underpins decisions on land use, infrastructure, and securing the coastal ecosystem's natural beauty and functions.

SUBMARINE GROUNDWATER DISCHARGE: GEOPHYSICAL TRACKING OF PATHWAYS

Subash Chandra*, N. Srinivasa Rao and V.M Tiwari
CSIR-National Geophysical Research Institute, Hyderabad-500007
*Corresponding author, email: schandra75@ngri.res.in

ABSTRACT

Submarine groundwater discharge (SGD) and the release of nutrients to the sea are important hydrogeological processes in land-sea exchange influencing the coastal environment. One of the most important factors controlling SGD is structural pathways that connect the land to sea facilitating the terrestrial groundwater flows down-gradient and ultimately discharges into the sea.

The DC electrical resistivity is a well-established method for the delineation of aquifer and structure. However, it often suffers a number of field constraints to provide adequate information on groundwater pathways. We present the potential of heliborne geophysical mapping for the application of SGD through an example from the Cuddalore coast, Tamil Nadu. The dense AEM data acquired over about 400 sq.km coverage at the sea coast provided a high-resolution 3D map of a multi-layered aquifer system including paleochannel and subsurface structural pathways hydro-geologically connected with the sea.

TEXTURAL ANALYSIS OF COASTAL SEDIMENTS FROM SINDHUDURG DISTRICT, ALONG WEST COAST OF MAHARASHTRA, INDIA

Sumit S. Sonar, Prafull B. Kamble and Milind A. Herlekar,
Department of Geology, Savitribai Phule Pune University, Pune-411007, Maharashtra, India
Corresponding author: milindaherlekar@gmail.com

ABSTRACT

The study investigates textural characteristics of sediment at beaches from Vijaydurg Creek to Devgarh creek, Maharashtra, along west coast of India. The seasonal variations in the textural parameters of 164 sediment samples with different environment setup of foreshore, backshore, raised beach and beach dune were carried out. During Pre-monsoon season, the sediments are dominantly fine sand to medium sand, well sorted to poorly sorted, strongly fine skewed to coarse skewed, platykurtic very leptokurtic. During post monsoon season, fine sand to coarse sand, moderately well sorted to poorly sorted, strongly fine skewed to strongly coarse skewed, mesokurtic to very leptokurtic. During post-monsoon seasons, Vijaydurg, Kolwadi, Phanse and Padavanewadi beaches reveal the presence of well-sorted to moderately well-sorted sediments resulting from very high wave

energy conditions. During pre and post-monsoon, the foreshore zone sediments has majority of negatively skewed samples indicating consistent beach erosion at Vijaydurg, Kolwadi, Girye, Kothar and Phansewadi. Majority of samples belong to beach environment and few samples signify riverine/Aeolian environment, whereas Linear Discriminant Function (LDF) indicates dominance of shallow marine environment and Aeolian/ shallow agaited of deposition for both the seasons. The CM plot shows that sediment samples fall predominantly in the tractive current and beach environment of deposition. The tractive current diagram of the post-monsoon season shows that samples fall in mixtures of rolled grains and suspension indicating high energy condition, while few samples of fall in suspension and graded suspension no rolling.

TOWARDS RESILIENT COASTAL SAND DUNES: AN INTEGRATED PERSPECTIVE ON VULNERABILITY AND PROTECTION MEASURES

Dipanjan Das Majumdar[1]*; Barendra Purkait[2]; Ashis Kumar Paul[3]
Netaji Satabarshiki Mahavidyalaya, Ashoknagar, North 24 Parganas, West Bengal, India;
University of Calcutta, Kolkata, West Bengal, India; Vidyasagar University, Kolkata, West Bengal, India*Corresponding Author: dipddm@gmail.com

ABSTRACT

The coastal dune vulnerability assessment takes fundamental relevance for assessing conservation status and identifying important shoreline disturbance events. This study examines the effectiveness of the Dune Vulnerability Checklist (DVC) in the coastal region of Odisha, which is located along the Bay of Bengal. The main goals include classifying shoreline segments according to their degree of vulnerability, examining system reactions to environmental disturbances, and developing effective dune conservation management measures. The coastal dune vulnerability index (DVI) methodology is comprised of three pivotal phases: firstly, the segmentation of the studied shoreline; secondly, the establishment of parameters for the DVC; and thirdly, the execution of field surveys and cartographic mapping. Shoreline segmentation was meticulously undertaken using the linear referencing tool integrated into a Geographic Information System (GIS) environment. Out of the comprehensive 124-kilometer study area, a total of 111 dynamic shoreline segments were discerned and subsequently linked with the DVC. The proposed checklist includes one protective measure index and 71 vulnerability factors that are logically divided into four vulnerability indices, including dune morphology, marine effect, seaward surface features, and human influence. Each index is given a rating between 0 and 1, with 1 denoting increased vulnerability. The total of these four vulnerability indices results in the comprehensive DVI, and the DVI-to-Protection Measure (PM) ratio makes it easier to categorize segments as "in equilibrium systems," which indicate dune stability, or "out of equilibrium systems," which call for maintenance or protection. Results underscore that a substantial 35 kilometers of shoreline remains classified as stable, maintaining equilibrium, while a contiguous 23.195 shoreline necessitates diligent maintenance and seasonal monitoring to safeguard inherent resilience against degradation factors. Furthermore, a 52.67-kilometer dune segment exhibits tangible signs of degradation, warranting comprehensive protection measures underpinned by stringent legislative actions at the governmental level.

Keywords: Coastal dune; Shoreline segment; DVC; DVI; Odisha

COASTAL VULNERABILITY ASSESSMENT USING GEOSPATIAL TECHNOLOGIES ALONG THE COASTAL STRETCH OF PONNANI KOLE WETLANDS

***Sreechitra S, Samreena Mohmmed, Arunkumar K S**
Department of PG Studies & Research in Geology MES Ponnani College, South Ponnani P.O, Malappuram-679586, Kerala, India
*Presenter:sreechitrageo@gmail.com

ABSTRACT

Due to the increase in population rate, settlement near the coastal zone, and urbanisation, the coastal area has become a vulnerable zone. Global warming is an alarming issue in our society, and one of the major impacts of global warming is sea level rise. The study of the coastal vulnerability index (CVI) reveals that the vulnerability is also due to sea level change. Many projects around the globe are now being carried out to monitor and understand the sea level changes caused by global warming. Here, GIS tools and satellite data are used for the research on shoreline change in the Ponnani coastal stretch, which is about 12.6 km long. The shoreline changes were studied using the vector overlay methodology from 1993 to 2023. On Earth, dynamic changes such as erosion are permanent. Hence, studies related to changes in shorelines are given prime importance. In this study, the coastal vulnerability index was classified using the DSAS tool. The Coastal Vulnerability Index (CVI) was calculated using shoreline change, slope, geomorphology, wave height and tide range to find the coastal vulnerable zone. In this paper the linear regression rate (LRR) model was used to predict the shoreline changes. This CVI was classified into low-, moderate-, and high zones by calculating its percentage. It was found that the erosion took place the highest in the Southern part of the coast and most of the accretion was carried in the north of the study area. In this paper, the study suggests that major erosive regions are to be managed and assessed by us to maintain the risks attached and some suggestions are made to manage the risk.

Keywords: DSAS, Shoreline changes, Coastal vulnerability index, Remote sensing and GIS, Coastal risk assessment.

HIGH PREVALENCE OF MULTIDRUG RESISTANT PATHOGENS AT COASTAL BELTS OF COCHIN, KERALA: A PUBLIC HEALTH CONCERN ASSOCIATED WITH COASTAL FLOODING AND INUNDATIONS

Jesmi Yousuf* and Mohamed Hatha A.A
Department of Marine Biology, Microbiology and Biochemistry, Cochin University of Science and Technology, Cochin-682016, Kerala, India
Presenting author: jesmimujeeb@gmail.com

ABSTRACT

Coastal belts of Cochin, Kerala, are frequently affected by natural hazards, making them vulnerable to the spread of multidrug resistant pathogens (MDRPs). Coastal flooding and merging of water bodies provides an ideal habitat for horizontal gene transfers among bacterial pathogens and non-pathogens. It helps them acquire capabilities such as antibiotic resistance and virulence properties. This study evaluated the risk assessment of bacterial pathogens from domestic water sources at these coastal belts focusing on their multidrug resistance. A total of 100 bacterial strains were isolated from the

study area using selective and chromogenic media, and then identified using molecular methods. The risk assessment is carried out in terms of antibiotic susceptibility, biofilm production capability, prevalence of antibiotic resistance genes (ARGs) and virulence genes in the strains. The most common MDR waterborne pathogens were Escherichia coli and Vibrio species. We also identified opportunistic pathogens from the genera Enterobacter, Klebsiella, Pseudomonas, Proteus, Citrobacter, Aeromonas, and Acinetobacter. All strains were resistant to at least two antibiotics, and the prevalence of drugs resistance was among the strains ranged from 3% to 62%. Resistance to macrolids, colistin and beta-lactam antibiotics was significantly higher than resistance to other tested antibiotics ($P>0.05$). Total 81% of MRDPs had a high multiple antibiotic resistance index. Escherichia coli had the highest MAR index (0.72) and Klebsiella species were the main biofilm producers. Antibiotic resistance and virulence genes were also detected in a significant proportion of the isolates. These genes are associated with the production of toxins and other factors that can cause various diseases. In conclusion, coastal flooding and inundation can lead to high prevalence of MDRPs, which poses a major risk to public health in coastal communities. This study highlights the need for improved water quality monitoring and management in coastal areas that are frequently affected by natural hazards such as flooding and inundation.

SOLID EARTH GEOSCIENCES

ISOSTATIC COMPENSATION MECHANISM OVER THE ARABIAN AND EAST SOMALI BASINS

Shravan Kumar[1*], KND Prasad[2], Uma Shankar[1]
[1]Department of Geophysics, Institute of Science, Banaras Hindu University, Varanasi-221005, India.
[2]CSIR- National Geophysical Research Institute, Hyderabad- 500006, India
*Presenting author: sk.bhu89@gmail.com

Several rift and drift activity have changed the Arabian and East Somali basins into a complex tectonic region. In view of this, flexural rigidity (D) of the basins is aimed to be estimated for its lithospheric strength in the present study. The effective elastic thickness (T_e) of the lithosphere reflects the long-term flexural strength and provides a proxy for mechanical strength that can be used to constrain lithospheric rheology and understand how surface deformation relates to deep Earth processes. Like this, load ratio (F) represents how magmatic loads are emplaced over the region. Here, we map T_e and F variations over the western Indian Ocean comprising the Arabian Basin and East Somali Basin from joint inversion of admittance and coherence between free-air gravity anomaly and bathymetry data. With the help of open source PlateFlex software, it has been calculated using a continuous wavelet transform, taking both surface and subsurface loads into account. This study shows the highest T_e (> 35 km) with low F value over the regions coinciding Indus Fan sediment accumulations. Sediment accumulations in this region provides large topographical surface load that results in high T_e indicative of strong lithosphere. Laxmi Ridge exhibits variable T_e (5-25 km) with its E-W segment as >25 km and NW-SE segment as 5-18 km. F value over the Laxmi Ridge estimated as 0.6-0.8 which indicates high subsurface loading. Laccadive Ridge shows T_e as 5-9 km with F as ~0.3. With low T_e values over the aseismic Laxmi and Laccadive ridges, these ridges are interpreted as Airy-type compensated feature. Low T_e value (~5 km) with F (0.3-0.5) observed around the Carlsberg Ridge are obtained as upwelling of hot magma at the spreading centre may manifest as subsurface loading. Seamounts in Arabian Basin due to its small wavelengths show T_e~5 km with F value as 0.2 which represent a case of uncompensated feature. Like this, seamount chain in East Somali Basin shows variable T_e as 5-10 km with F as 0.2 which exhibits this is locally compensated with deep flexure.

EVIDENCE OF PRECAMBRIAN ARAVALLI-DELHI MOBILE BELT TECTONIC TREND BIFURCATION FROM ADVANCED DIMENSIONALITY ANALYSIS OF MAGNETOTELLURIC DATA

K. K. Abdul Azeez*
CSIR-National Geophysical Research Institute, Hyderabad, India.
Email: azeez@ngri.res.in/azeez.kk@gmail.com

The Aravalli-Delhi Mobile Belt (ADMB), comprising the Precambrian Aravalli Fold Belt and the Delhi Fold Belt systems, is a prominent tectonic feature within the Indian continental lithosphere. It is believed that the main NE–SW Aravalli trend continues across the Cambay rift basin into the Saurashtra peninsula, while the Delhi trend makes a westward turn to overlap with the Kutch rift basin. An eastward deflection of the Aravalli trend to join the roughly east-west Satpura Fold Belt is also speculated. In this study, magnetotelluric (MT) data covering central-western India are evaluated to understand the dimensionality and directionality of subsurface electrical resistivity structures using an advanced Complex Apparent Resistivity Tensor (CART) and the popular Phase Tensor (PT)

approaches. The study yielded clear information on the subsurface structural trends beneath the surface volcanic and sedimentary covers in the region. Interestingly, the directionality results showed the bifurcation of the NE-SW oriented ADMB trend into the adjacent Kutch, Saurashtra, and Central Indian Tectonic Zone (CITZ) domains. The study presents an obvious westward and eastward deflection of the ADMB trend.

HIGH-RESOLUTION 3D MOHO STRUCTURE ESTIMATION IN SOUTHERN INDIA AND SURROUNDING REGIONS: INSIGHTS FROM GRAVITY DISTURBANCES AND SEISMIC CONSTRAINTS

Arka Roy[1,2], J. K. Tomson[1]
[1]National Centre for Earth Science Studies, Akkulam, Trivandrum, Kerala, India.
[2]Cochin University of Science and Technology, Kochi, Kerala, India.

A comprehensive analysis of the high-resolution 3D Moho structure beneath the southern Indian subcontinent and its neighboring regions has been undertaken through the utilization of observed gravity disturbances. This investigation employs the globally recognized gravity model, EIGEN6C4, with a spatial resolution of 0.1 degrees. To deduce the intricate Moho undulations beneath the Indian peninsula, an extended Bott inversion algorithm is employed in conjunction with a forward model based on spherical prisms. Rigorous testing of the inversion algorithm against synthetic models characterized by predefined density contrasts and mean Moho depths has been conducted to evaluate its reliability. Furthermore, the robustness of the inversion algorithm has been assessed under the influence of noise-integrated gravity data. In order to attain a precise and unique Moho estimation, discrete control points have been strategically employed as constraints. These control points are instrumental in the estimation of two crucial hyperparameters, namely, density contrast and reference depth, which play a pivotal role in the accurate determination of Moho depth. The optimized Moho values obtained through this approach exhibit a remarkable level of accuracy when compared to synthetic models. The observed gravity disturbances encapsulate the cumulative effects of all density irregularities as well as the influence of Moho undulations. Employing a combination of diverse global datasets and seismic tomography models, the actual contribution of gravity effects solely attributed to pure Moho undulations has been meticulously extracted from the observed gravity disturbances. Through the utilization of receiver function-driven control points constrained by seismic data, the inverse Moho depth for the southern region of India and its adjacent oceanic areas reveals an intricate Moho structure. This structure is characterized by substantial lateral variations, offering insights into the orientation of distinct crustal blocks, particularly in the context of regional geodynamic processes. Within the study area, the average crustal thickness is determined to be approximately 35.35 kilometers, corroborating previously reported Moho depth values. Notably, the southern portion of the Archaean Western Dharwar Craton exhibits the maximum crustal thickness, measuring 53.04 kilometers. Beneath the southern sector of the Salem block and extending to the Achankovil Shear Zone, a Moho depth ranging from 44 to 47 kilometers is observed, suggesting the potential continuity of the Archaean crust across the Palghat-Cauvery Shear Zone System, recognized as a significant tectonic boundary. Conversely, a region of notably reduced crustal thickness, approximately 36 kilometers, is identified along the boundary between Nagercoil and the southern part of the Madurai block, which corresponds to the location of the Achankovil Shear Zone. The

lowest crustal thickness values are concentrated along the eastern perimeter of the Cuddapah basin, coinciding with the Proterozoic Krishna basin within the Eastern Ghats Mobile belt.

LITHOSPHERIC STRUCTURE BENEATH WESTERN TIBET: INSIGHT FROM JOINT INVERSION OF RAYLEIGH WAVE GROUP VELOCITY DISPERSION WITH INTERPOLATED RECEIVER FUNCTIONS

Ritima Das[1*], Gokul Kumar Saha[2], Utpal Saikia[3]
Department of Earth Sciences, Pondicherry University, Puducherry – 605014, India
CSIR Fourth Paradigm Institute, Bangalore 560037
. Department of Earth and Climate Science, Indian Institute of Science Education & Research-Tirupati-517507, India

We study the 3-D shear wave velocity variation in the crust and upper mantle structure of the western Tibet using joint inversion of Rayleigh wave group velocity dispersion and interpolated receiver function. The lateral sampling of the receiver function and the surface wave dispersion is equalized by the interpolation scheme. The difficulties arise in receiver function due to back azimuthal variation is suppressed by this new method of spatial interpolation. We have jointly inverted these interpolated receiver functions with the Rayleigh wave group velocity dispersions obtained from the earthquake and ambient noise tomography in order to map the tectonic structure of the western Tibet. The study reveals the remarkable variation of the seismic characteristics in the crust and shallow upper mantle of western Tibet. The Moho depth is mapped ~74 km in the northern part of the plateau, whereas it is ~69 km in the southern part. A thick mid-crustal slow velocity zone from ~8 km up to ~40 km has been observed which might be due to the existence of the partial melt. A significant finding of the study is the lower crustal velocity variation in the south and north of the Lhasa block. We interpret this as the Indian crust has been underthrusted beneath the Tibetan plateau and the northern limit of the Indian lithosphere is extended up to the south of the Lhasa block.

DEEP CRUSTAL ELECTRICAL RESISTIVITY STRUCTURE OF THE CENTRAL GANGA BASIN COVERING THE TRANSVERSE FAIZABAD RIDGE

M. Demudu Babu*, A. Manglik, M. Suresh and G. Pavankumar
CSIR-National Geophysical Research Institute (NGRI), Uppal road, Habsiguda, Hyderabad 500 007
Email: mdemudubabutechgeo7@gmail.com

Geophysical studies including deep exploratory drillings in the Ganga Basin, mainly carried out for hydrocarbon exploration, have revealed the presence of transverse ridges, depressions, and faults beneath the alluvial cover of the basin. These studies were mainly focused on the intra-basinal structures and at some places could not delineate the basement, especially in the basin depressions. The Faizabad Ridge (FR) is considered as a NNE extension of the Bundelkhand craton beneath the alluvial cover of the central Ganga Basin. Its exact extension up to the Himalayan front is not known. Here, we present the results of a magnetotelluric (MT) study along a 350-km-long profile covering the ridge to delineate its extent beneath the sediments towards the Himalayan front. We acquired broadband MT data at 31 sites with inter-station spacing of 8 to 10 km. A two-dimensional (2-D) geoelectric model of the crust and sub-crustal lithosphere has been obtained by using the distortion corrected impedance tensors in the period band of 0.001-1000 s. The geoelectric model suggests that

the Faizabad Ridge does not continue to the Himalayan foothills along the profile and it is constituted of at least three resistive crustal blocks rather than a single unit. Moderate conductivity zones bounding these blocks broadly coincide with the locations of major rivers implying that these rivers follow the geological trend of the buried conductive zones. The post-collision sedimentary succession above the Ridge forms a smooth layer that thickens northward and attains a thickness of about 6 km at the Himalayan foothills. The results also suggest the presence of a near-vertical weak zone of moderate resistivity in the vicinity of the Yamuna River that coincides with the contact between the buried Faizabad Ridge and the rocks of the Vindhyan Supergroup.

GEOELECTRIC STRUCTURE ESTIMATED FROM MAGNETOTELLURIC (MT) AND RESISTIVITY DATA IN INDIA

D.C. Naskar[1], O.P. Mishra[1]
[1]National Centre for Seismology (NCS), Ministry of Earth Sciences (MoES), Gov. of India, Lodhi Road, New Delhi-110003.
E-mail: drdcnaskar@gmail.com

With the advent of sophistication in magnetotellurics (MT) and audiofrequency magnetotellurics (AMT) the use of DC dipole has gone down considerably because of a larger logistic support one needs in man power and field surveys. A DC dipole survey will prove to be a better tool where the study area has a high cultural noise. CSAMT (Controlled Source Audiofrequency Magnetotellurics) remains a contender for DC dipoles. In a rugged terrain, DC dipoles may get preference over CSAMT on field logistics. With the advent of high precision GPS (Global Positioning System) and a large network of cell phones, a DC dipole survey has become considerably easier and the accuracy in the computation of apparent resistivity has increased. The principal objectives of the present investigations are the delineation of both the shallow and deep geological structures and the dispositions of the different rock units in the areas especially at depth and demarcate the zones of rifting/faulting. With view of these MT and resistivity surveys are carried out by Geological Survey of India (GSI) in regular field work program over Narmada-Son lineament (NSL) in Central India; Bakreswar geothermal region in Birbhum district, West Bengal; over foothill of Sikkim-Darjeeling Himalaya in West Bengal; and over Sagar Island in South 24 Parganas, West Bengal. 2D MT inversion in Bakreswar geothermal region shows that the entire lower crust consists of an anomalous structure of conductive layers with a relatively low resistivity embedded in the high resistivity background. Results of resistivity survey indicate the presence of subsurface conductive bodies due to structural breaks like shear zones/geothermal region. The MT results across NSL show mantle conductivity at Moho depth north of Narmada South Fault (NSF) suggesting an upwarp in the Moho that is also corroborated by the deep resistivity results where basement has come up to a level of 61 m at the Narmada River. Therefore, it is prejudiced that NSL is a faulted zone and Narmada River flows right over the fault. DC resistivity survey (sounding and traversing) shows that the study area is full of major and minor faults. Since the NSL is a high heat flow area (85 ± 2.2 mW/m^2) and this fractured plate is continuous, moving upwards to collide with the Tibetan plate, accumulation of stress and strain in the mid-plate may cause earthquakes in the future. MT and resistivity results in Sikkim-Darjeeling Himalaya indicate that the basement depth varies from 2917-4450 m, indicating huge relief. Due to the high conductivity of the overlying sediments, basement depth could be ascertained

only at a few resistivity sounding locations. Three basement faults have been mapped over the transect. A notable feature is observed between Siliguri and Sevoke (ES-14), where a resistivity value of 1100 Ohm-m near the surface persists with depth. However, after 40 m of depth, this resistivity value suddenly falls. This is attributed to the presence of Siwaliks at depth. The Siwalik floor is quite undulatory in this part of the frontal foredeep region of the Himalayas. The intervening zone between km stones 452 and 493 shows a highly resistive bed lying unconformably over a conductive horizon. This may be a basement slice thrusted over the Siwaliks. At least three prominent deep-seated faults and a gravity saddle between Chopra and Sonapur have been interpreted from the geophysical investigation. These structures may prove to be of significance with regard to oil exploration in this area. MT and resistivity method were carried out over 100 km transect over Sagar Islands to delineate the fresh water/saline water contamination zones and also to map the high resistive formation in the area. Inversion results for all 38 vertical electrical sounding points reveals the presence of four to five layers in the region. The first layer is interpreted as alluvial clayey soil. The second and third layers represent moist/wet soil and clay saturated with saline water zones. Both these layers are composed of clay with silt and sand lenses. The fourth layer is impermeable clay saturated with brackish water. The most important layer is the lowermost, which is interpreted to be a sandy, fresh water zone. The fresh water zone is at a depth of 109.8-265.9 m. The fresh water zone has high resistivity values (10.1-36.9 Ohm-m) while the overlying saline and brackish layers have low values (0.4-1.5 Ohm-m, and 2.9-7.8 Ohm-m) respectively. MT data successfully delineates the fresh waterbearing horizon with thickness varying from 455-885 m followed by a high resistive formation which is inferred as bedrock. The boundary of fresh water and saline water is separated by a fault in between stations Gopalnagar and Surjyanagar which goes up to longest period for the MT signals is also delineated. These locations appear appropriate for additional study, including test drilling, and follow-on simulation for an economic feasibility study. In general, this survey area appears highly promising for exploitation. Henceforth it is concluded that the resistivity method and electromagnetic methods are two very important and useful techniques in geophysical exploration.

METASOMATISM OF THE LITHOSPHERIC MANTLE BENEATH THE BUNDELKHAND CRATON: RESULTS FROM INTEGRATION OF ELECTRICAL CONDUCTIVITY AND SEISMIC VELOCITY MODELS

G. Pavankumar* and A. Manglik
CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad – 500007, India
Email: pavan.ngri@gmail.com

Geophysical investigations of a craton provide information on its geodynamic evolution and also aid in understanding the chemical, physical and thermal states of the lithosphere and mantle rejuvenation. Metasomatism is a complex and diverse process in which bulk composition and phase assemblages of mantle peridotite are modified due to its interaction with melt or fluids. These processes include modification of oceanic lithosphere, fluid flow, alteration of subducted oceanic and continental crust, volatile storage in the subcontinental lithospheric mantle (SCLM), etc. The Bundelkhand Craton (BKC) is one of the Archaean nuclei in the north central part of the Indian shield which has a lesser exposed areal extent compared to other cratons. Here, we present the results of a magnetotelluric study carried out in the BKC along a 300 km long profile that also covers the adjoining Ganga

foreland basin. The study has provided an electrical image of the Precambrian crust along with the presence of an electrical Moho (e-Moho) at a depth of 40-42 km. The geoelectric model shows significantly moderate resistivity values (200 – 500 Ωm) for the upper SCLM compared to upper mantle structure of other major Indian and global cratons. A comparison of the shear wave velocities and average SCLM resistivities of the BKC with the other Indian cratons and various global cratons has suggested that the shear wave velocities for the BKC are not only lower than the Indian cratons but also lower than some of the global cratons. The study relates the moderately conductive upper subcontinental lithosphere mantle with a metasomatized upper mantle. We infer that the water concentration in the mantle mineral phases of the sub-continental lithospheric mantle of the BKC has resulted in metasomatic lithospheric rejuvenation. The conclusions drawn from the present study are supported by the schematic models suggested for the BKC from recent geochemical analyses of mantle derived rock samples.

AN UPPER MANTLE LOW RESISTIVITY ZONE BENEATH THE KONKAN PLAINS REVEALED BY MAGNETOTELLURIC IMAGING

N.N. Chakravarthi*, G. Pavankumar, A. Manglik
CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad – 500007, India
Academy of Scientific & Innovative Research (AcSIR), Ghaziabad 201002, India
Email: nalluru.ngri21j@acsir.res.in

The western continental margin of India is constituted of significant geomorphological features namely the Western Ghats (WG) and the Konkan plains. The 1600 km long WG extends from Satpura range in north to Kanyakumari in south covering diverse lithological formations. The northern part of the WG adjoining the Deccan plateau has been experiencing seismic activity and it is inferred that the plateau is tectonically active. Recent geological and geophysical studies affirmed that the traps together with the sub-basaltic terrain have been undergoing structural deformation along pre-existing linear tectonic zones. Here, we present the results of a magnetotelluric study carried out along a 100 km long E-W profile traversing major tectonics features between the Konkan plains and the Deccan plateau. Two-dimensional modelling of distortion corrected impedance tensors reveals high resistivity crustal blocks down to 35-40 km, dissected by faults/fractures. These crustal blocks are underlain by a moderately conductive mantle lithosphere which is also characterized as a low seismic velocity and low density layer. The model in conjunction with earlier results from the Palghar swarm region suggests southward continuation of major conductivity anomalies from that region. The model yields some westward dipping conductive and resistive zones coinciding with the exhumed topography highs. The persistent elevated topography of the WG could be explained by a buoyant, low velocity/low resistivity upper mantle coupled with reactivation of deep crustal features during the Quaternary period.

SEISMIC LATERAL VELOCITY VARIATIONS IN NORTHEAST INDIA USING AMBIENT NOISE TOMOGRAPHY

Dhiraj Kumar Singh[1], Mohit Agrawal*[1], O. P. Mishra[2] and M.K. Sen[3]
1 Indian Institute of Technology (Indian School of Mines), Dhanbad
2 National Centre for Seismology, Delhi
3 The University of Texas at Austin
*Corresponding author: mohit@iitism.ac.in

Northeastern India is a tectonic mosaic resulting from the collision of the Indian plate with the Eurasian plate in the north and subduction of the Indian plate beneath the Burmese plate to the east. To unresolve the tectonic mysteries associated with this region, we cross-correlated continuous ambient noise data, for the period between 2015 and 2020, for twenty three seismic stations which resulted in 253 Green's functions. The Rayleigh wave group velocities at the nodes are inverted for the shear wave velocities at periods from 6s to 25s. At period 6s, we observe velocity variation from 2.49 km/s to 2.58 km/s demarcating Shillong Massif, Brahmaputra River Valley and Bengal Basin. Our tomography results show a boundary between the crystalline structure of the Shillong plateau (SP) and the Brahmaputra valley where the shear wave velocity are varying distinctly, margin of low velocity sediment deposition or presence of Dauki Fault on the southern side of the SP at 10s. The increase of velocity gradient from west to east identifies the greater basement depth in the western BB than the eastern part. Further, we observe high velocity in the region of SP which supports the crumbled crust hypothesis in the region. At 15s-25s, we observe the low velocity layer orienting in the NE-SW direction, in the upper crust on the eastern side of the Bengal Basin, which may be a subsurface fault generated due to eastward propagation of Indo-Burma subduction effect. We conclude on satisfying the identification of previous features and presence of azimuthal velocity variation in crust beneath the Shillong plateau.

3-DIMENSIONAL VELOCITY STRUCTURE BENEATH THE ANDAMAN-NICOBAR ISLANDS

P. Mahesh[1,*], C. Sribin[1,2], P. Dewangan[1], V. Yatheesh[1], S. Gupta[3]
[1]CSIR-National Institute of Oceanography, Goa -403004, India
[2] National Centre for Polar and Ocean Research, MoES, Goa 403804, India
[3]CSIR-National Geophysical Research Institute, Hyderabad - 500007, India
*Correspondingauthor: pmahesh@nio.org

The Andaman-Nicobar (A-N) region is one of the seismically active subduction zones of the world with a complex tectonic setting. To understand the subduction process, seismotectonics, and associated seismic hazard, it is crucial to image the geometry of the subducting Indian plate (SIP). We determined 3-D velocity structure beneath the A-N Islands by inverting 2819 P- and 2171 S- phases from 410 earthquakes located with a network of nine Ocean bottom seismometers (OBS), and six seismic stations from the ISLANDS experiment. For the first time using OBS data in the A-N region, the produced tomographic images show high- V_P and V_P/V_S anomalies, which indicate a colder and thicker subducting Indian plate beneath the A-N subduction region. Low V_P and V_P/V_S in the upper crust indicate signature of accreted and basin sediments above the SIP. Low- V_P in the fore-arc mantle wedge indicates mantle serpentinization due to ample fluids from slab dehydration. Under the

Andaman Backarc Spreading Center (ABSC), a low velocity anomaly at a depth of 60 to 100 km indicate signature of the mantle upwelling. We noticed low V_P anomalies in the crust and mantle wedge beneath the active volcanic Barren Island, which indicates arc magmas produced by corner flow in the mantle wedge and slab dehydration.

GEODYNAMICAL INSTABILITY AND RIFTING OF THE DHARWAR CRATON (SOUTH INDIAN SHIELD)

O. P. Pandey
CSIR-National Geophysical Research Institute, Hyderabad-500007 (India)
Email: om_pandey@rediffmail.com

Unlike other global Precambrian terrains, Indian shield is unique in many ways. It is highly deformed, decratonised, and possibly have the shallowest Lithosphere-Asthenosphere boundary (on an average ~100 km) as per our latest estimates. Deep cratonic roots, so prevalent in other Archean cratons, are almost absent from many geotectonic segments and as such, many of them now correspond quite closely to the mobile belts. Singhbum craton, which is also considered one of the oldest, may be the finest example. Our recent palynological and other geoscientific studies, provide unequivocal evidence of the reactivation and rifting of the intra-cratonic inner parts of the Dharwar craton (south Indian shield) during earliest Permian Gondwana Period. We postulate that the in-land rifting during the Gondwana assembly period, may have been a prelude to the breakup of India from Antarctica, with final separation between the two blocks, taking place much later during the Early Cretaceous. This phenomenon apparently led to severe lithospheric mantle destruction, thinning of the Indian lithosphere, rise of isotherms and the total alteration and restructuring of the crust/mantle underneath. These findings would not support the prevalent idea of cratonic stability of the ancient shield terrains, hitherto believed.

SHEAR WAVE VELOCITY STRUCTURE BENEATH THE INDIAN OCEAN GEOID LOW (IOGL) REGION

Amit Kumar*, Sanjay S. Negi, Lachit S. Ningthoujam, Dhananjai K. Pandey
National Centre for Polar and Ocean Research, Ministry of Earth Sciences, Government of India,
Headland Sada, Vasco-da-Gama, Goa 403 804, India
*Email: amitkumar@ncpor.res.in

Indian Ocean Geoid Low (IOGL) is an enigmatic anomaly that occurred in the Central Indian Ocean Basin (CIOB) and is poorly understood. Several hypotheses have been proposed by researchers that explain the source of large geoid anomaly is linked with the upper, mid and lower mantle, but reasonable explanations still remain elusive. It needs a detailed understanding and appropriate depth estimates that could be assigned to this feature.

In order to investigate the deep subsurface velocity structure beneath the IOGL region, earthquakes are used with focal depth ≤ 100 km, magnitude ≥5.2 Mw, and epicentre location distance at regional to teleseismic ranges. Using the OBSs pairs (E-W), we estimated the inter-station Rayleigh wave phase velocity variations within the period range of 15-197 s. Estimated dispersion curves are inverted

and 1-D velocity-depth sections are constructed down to c.a.380 km or less along with N-S and E-W profiles. Our result demarcates the regional Moho depths varying from c.a.11.6 ± 0.8 km to c.a.19.8 ± 1.2 km along the OBS array from south to north, respectively. A thickened oceanic crust (c.a.9-10 km) is attributed to magmatic underplating in the lower crust near the aseismic Comorin ridge. The lithospheric thickness ranges between c.a.47.6 ± 2.9 km and c.a.75.1 ± 3.6 km along a south-north profile. We observed a c.a.20–23 km thick lithosphere-asthenosphere boundary (LAB). The depth interval between c.a.87 km and c.a. 280 km is characterized by a distinct low-velocity zone (LVZ). A thick LVZ appears to be associated with a thin lithosphere, which implies a hot thermal regime in the upper mantle. We envisage a possible connection of this hot thermal regime with the African LLSVP (large low shear velocity province) and/or a vertically deep mantle upwelling directly beneath the IOGL region.

INVESTIGATING THE IMPLICATION OF SHEAR ZONES IN THE SOUTHERN GRANULITE TERRANE: A STUDY USING GRAVITY AND MAGNETIC DATA

Harikrishnan P R and S. Lasitha
Department of Earth Sciences, Pondicherry University
hari2555794@gmail.com

The Southern Granulite Terrain (SGT) and its surroundings offer crucial insights into eastern Gondwana's tectonic history. A comprehensive geophysical study has unveiled complex crustal structure of the region. Ground magnetic investigations along the Salem Attur Shear Zone (SASZ) have revealed hidden subsurface structures. A broader regional study utilizing high-resolution ground gravity and magnetic observations exposes structural differences, especially at the boundaries of structural provinces. Importantly, gravity and magnetic anomalies distinctly characterize the Moyar Bhavani Salem Attur Shear Zone (MBSASZ) and the Palghat Cauvery Shear Zone (PCSZ). A crustal model, incorporating gravity and magnetic data, suggests a four-layered crust with a thickness of 36-41 kilometres beneath the SGT. Offshore structures demonstrate a clear connection between onshore and offshore features. The offshore basin floor is relatively flat but is intermittently disrupted by east-west stretching shear zones, as confirmed by seismic profiles. Sedimentary units overlying basement rocks have undergone structural deformation, including faulting, folding, and uplift. Present tectonics involve compressional deformation, with rift-related normal faults and later compressive thrust faults and folds. The Palghat Cauvery Shear System (PCSS) plays a key role in accommodating stress from the northward Indian plate's movement against the Asian plate. PCSS is currently reactivating evidenced by recent earthquakes and marked by a narrow continental shelf, distinctive magnetic and gravity anomalies, and deformed structures. The geophysical crustal model identifies deep crustal-scale faults associated with the marine extension of PCSS, possibly extending into the Continent Ocean Transition Zone (COTZ). In summary, this comprehensive study enhances our understanding of eastern Gondwana's tectonic history by shedding light on the complex geological and tectonic processes shaping the Southern Granulite Terrain and its vicinity.

RE-EXAMINATION OF MARINE MAGNETIC ANOMALIES IN THE BAY OF BENGAL TO TRACE THE MAJOR PLATE REORGANISATION OF THE MIDDLE CRETACEOUS PERIOD

Maria Ana Desa[1, 2], Jensen Jacob[1, 2], *Saif Ali Khan[1, 2], Brandis Carlier[1]
[1]CSIR-National Institute of Oceanography, Dona Paula, Goa 403 004
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India

The breakup of India from Antarctica in the Early Cretaceous and subsequent seafloor spreading in the NW-SE direction initiated the formation of the Bay of Bengal. The arrival of the Kerguelen mantle plume beneath Eastern India around 120 Ma triggered a major reorganisation of the plate boundaries in the Middle Cretaceous causing the spreading center to align E-W by Late Cretaceous time. The tectonics involved in this ~40° change in spreading direction is unknown till date and difficult to fathom as it occurred in the Middle Cretaceous period. In the present study, we have generated a revised magnetic isochron map of the Bay of Bengal and used the modulus of its analytic signal to understand the dynamics/tectonics between the two plates during this Cretaceous Long normal polarity period. Mesozoic magnetic anomalies M12n to M0, and Middle Cretaceous incursion Q2 (108 Ma) are identified in the western basin of the Bay of Bengal, while Q2 and Q1 (92 Ma), and Late Cretaceous isochron A34 are inferred in its eastern basin. Gravity grid reconstructions demonstrate asymmetrical crustal accretion in the conjugate corridors of the two plates. Fan shaped spreading with higher rates towards east occurred facilitating the clockwise rotation of the spreading center. A southward ridge jump due to plume-ridge interaction also belongs to the major reorganisation between the Indian and Antarctica plates. The presence of the volcanic basement within the extra crust suggests on-axis mode of formation for the Ninetyeast Ridge during the Middle Cretaceous period.

COMPLEX CRUST-MANTLE SEISMIC STRUCTURE BELOW ALAMPUR-KONIKI-GANAPESWARAM PROFILE, NORTH CUDDAPAH BASIN (INDIA): REGIONAL GEODYNAMICS AND EAST ANTARCTICA CORRELATION

K. Chandrakala
CSIR-National Geophysical Research Institute, Hyderabad-500 007

The origin and evolutionary nature of the Proterozoic Cuddapah basin and adjoining geotectonic terrains like Nellore Schist Belt, Eastern Ghats Belt and Nizampatnam Bay and their relationship with east Antarctica, remained a subject of considerable debate for several decades. In view of this, we reprocessed the Deep Seismic Sounding data acquired along 325 km long Alampur-Koniki-Ganapeswaram profile to decipher the deep crustal seismic structure below these regions. During Paleo-Mesoproterozoic period, this zone underwent prolonged sedimentation, magmatism, oceanic subduction, multiple accretion and continent-continent collision. Our studies based on the first arrival refraction and wide angle reflection travel times data, reveals presence of a thin veneer of alluvium (2.00- 2.90 km/s), underlain by Gondwana (4.00 km/s) and thick Proterozoic sediments (5.00 - 5.50 km/s) in East Coast Sedimentary Basin, located east of the Eastern Ghats Belt. Similarly, in the

Cuddapah basin, upper and lower Proterozoic sediments characterised respectively by velocities 5.05 - 5.20 km/s and 5.50 - 5.70 km/s with a combined thickness of 2.8 km in Kurnool basin and 1.9 km in the Nallamalai basin, has also been delineated. These sediments rest directly over the crystalline basement (5.90- 6.05 Km/s), underlain further by a mafic mid-crustal layer (6.20 to 6.30 km/s) located at variable depths of 5 to 15 km. Massive exhumation of this layer close to the surface appears to have resulted in the form of a prominent hidden ridge structure below Darsi and Addanki regions of Nellore Schist and Eastern Ghats Belts. This ridge structure, which is 50 km wide, paralleling the east coast and bounded by two major faults, can be ascribed to India-East Antarctic collision after the cessation of prolonged subduction during Meso-Proterozoic period. Consequently, up-dipping of the upper crustal layers can clearly be seen east of the delineated hidden ridge structure. Presence of unprecedently thick (up to 20 km) high velocity (7.0-7.4 km/s) differentiated magma layer above the Moho, has also been delineated which would indicate strong crust-mantle thermal perturbation and massive subcrustal erosion. Moho is delineated at a depth of 38 km below Nallamalai fold belt and 45 km below Nellore Schist Belt. An unusual 5-10 km thick metasomatized LVZ, characterized by velocity 7.0 km/s, is also mapped in the upper part of the lithospheric mantle.

ABUNDANCES OF RADIOELEMENTS AND RADIOGENIC HEAT PRODUCTION FOR THE GRANITOIDS OF THE SINGHBHUM CRATON, EASTERN INDIA AND ITS THERMAL AND GEODYNAMIC IMPLICATIONS

Labani Ray[1,2,*], Sukanta Dey[3], Nishu Chopra[1]
[1]CSIR-National Geophysical Research Institute, Hyderabad - 500007, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad - 201002, India
[3]Department of Earth Sciences, Indian Institute of Science Education and Research Kolkata, ohanpur, Nadia - 741246, India
*Presenting author : labani.ngri@gmail.com

The spatial distribution of long-lived radioelements Th, U and K within the Earth's upper crust is a critical factor in both lithospheric thermal modeling and the comprehension of the geodynamic processes. The Singhbhum Craton, which is one of the oldest cratons (3.53 Ga) of the Indian shield and where granitoids are exposed in about 20000 square km area, has not been studied yet in terms of radioelement abundances and heat production (A). For the first time, a systematic analysis of Th, U, K and A of the granitoids from the Singhbhum Craton is made, using a laboratory gamma-ray spectrometric setup. We conducted an analysis on 204 samples, including Paleoarchaean gneiss, three phases of Paleoarchaean Singhbhum Granite, and early Neoarchaean granitoid. In the Paleoarchaean Singhbhum Granite, Th, U, K, and A are slightly lower (10.8 ppm, 1.4 ppm, 2.4%, and 1.3 μWm^{-3}), compared to the Paleoarchaean gneiss (9.6 ppm, 1.7 ppm, 1.8%, and 1.3 μWm^{-3}). In contrast, the early Neoarchaean granitoid exhibited significantly higher values (31.1 ppm, 4.2 ppm, 3.9%, and 3.6 μWm^{-3}). The surface heat production in this craton is notably low (1.36 μWm^{-3}), making it one of the lowest among cratons worldwide. Moreover, it exhibits the lowest average crustal heat production (0.42 μWm^{-3}), which contributes minimally to observed surface heat flow. In the studied granitoids, heat production is primarily driven by Th, followed by U and K. The spatial distribution of Th/U and K/U ratios mirrors the radioelement trends, suggesting systematic depletion of Th and U compared to K. This study indicates that coeval granitoids, despite their spatial separation, originate from distinct magma sources within the heterogeneous crust. The lower radioelement abundances in the

Paleoarchaean granitoids result from partial melting of mafic sources, while higher radioelement abundances in the early Neoarchaean granitoids stem from partial melting of felsic sources.

INTRAPLATE STRESS PATTERNS IN THE INDIAN PLATE: A STRESS SIMULATION PERSPECTIVE

Akhil Mishra, Radheshyam Yadav, Virendra Mani Tiwari
CSIR-National Geophysical Research Institute, Hyderabad, India 500007.
Corresponding Email: amishra@ngri.res.in

The Indian Plate, encompassing oceanic and continental lithosphere, is characterized by a complex tectonic setting with various plate boundaries, including divergent, convergent, and transform boundaries. However, the scarcity of in-situ stress data within the Indian Plate necessitates numerical simulation to understand regional stress patterns, particularly the maximum horizontal compressive stress (SHmax). In this study, an attempt is made to explore the influence of rigidity, lithospheric thickness, and boundary forces on intraplate stress distribution. Rigidity is determined from the Effective Elastic Plate Thickness (T_e), calculated through joint inversion using gravity and topography data.

Four simulation scenarios are presented which arises from different combination of variations in lithospheric thickness, T_e and boundary force conditions. Comparing these scenarios with in-situ measurements and the analysis of the simulated models indicates that the magnitude of S_{Hmax} is predominantly influenced by boundary forces and T_e, scaled by lithospheric thickness. The orientations of S_{Hmax} are primarily governed by the tectonic forces applied and the rigidity (T_e). There is a notable correlation between the spatial distribution of earthquakes and von Mises stress, with regions prone to earthquakes showing higher von Mises stress levels. Beyond the influence of boundary forces, it is evident that T_e stands out as one of the most significant factors governing the distribution of the stress field. Incorporating depth-dependent rheology and density in simulation may further improve result quality and predict stress states more accurately.

ACOUSTIC WAVE EQUATION MODELING WITH DISPERSION RELATION USING STAGGEREDG GRID FINITE DIFFRENCE METHOD

Vanga Mounika[1, *] and Maheswar Ojha[1,2]
[1]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India.
[2]CSIR-National Geophysical Research Institute, Uppal, Hyderabad-500007, India.
[*]Corresponding author email: vangamounika97@gmail.com

The primary objective of simulation of seismic wave is to increase accuracy, and to reduce the numerical dispersion and computation time. Among various numerical methods, the staggered grid finite difference method is one of the most useful method for the seismic waveform modelling, inversion and subsurface imaging. We use an optimization method based Genetic algorithm to derive finite difference coefficients, which incorporates the effect of grid spacing, sampling time and the order of approximation. Using this optimization technique, we get greater accuracy with lower order of approximations, which reduces the computation time with better stability. When compared to a

conventional, joint time-space and Taylor series expansion method, our method shows good and promising results in terms of dispersion, computation time and stability.

Keywords: Modeling, Wave equation, Numerical Dispersion, Staggered-grid Finite Difference Method.

GEOCHEMISTRY OF MARINE SEDIMENTS FROM LESSER ANTILLES ARC: IMPLICATIONS ON ACTIVE GEODYNAMIC SETTING AND DEPOSITIONAL ENVIRONMENT

K.S.V. Subramanyam*, S.S. Sawant, A. Keshav Krishna and IODP Expedition 340 Scientists[1]
CSIR-National Geophysical Research Institute, Hyderabad
[1]Integrated Ocean Drilling Program Expedition 340 ‘’lesser Antilles Volcanism and Landslides
Presenting author: ksvsubramanyam@yahoo.com

ABSTRACT

The marine sediment samples of U1398 B holes drilled to west of Martinique Volcanic Island, Lesser Antilles Arc are subsampled and collected from various cores spanning from top depths 1.67 m to bottom most at 170.55 m CSF (core depth below sea floor; CSF). The objective for this site was to characterize the sedimentation processes in the Grenada back-arc Basin during IODP Expedition 340. The sediments are characterised as shales based on the binary relationship between SiO_2 Vs. Al_2O_3 and these horizons are characterised for major, minor, trace, rare earth elements and total carbon to decipher their mode of origin, provenance and implications on paleo-environment.

The studied shales show variation in major oxide contents; SiO_2 (52–60 wt.%), CaO (6–11wt.%), Fe_2O_{3T} (4–10 wt%), MgO (1–3 wt%) with very low K_2O, TiO_2 and P_2O_5 contents. These shales show normal range of SO_3 (0.05-0.17 wt.%). CIA Vs. ICV, Mafic-felsic-RW modelling and CIA Vs. Al/Na ratio indicate unweathered/fresh igneous rock trend to weakly weathered nature for these samples. La/Sc and Co/Th relationship indicate that these shales are derived from basalts to andesites source rocks. Post Archean Australian Shale normalised rare earth element (REE) distribution patterns indicate relative heavy REE enrichment over depleted Light REE with a significant -Eu positive anomaly (Eu/Eu*=0.9-1.1) with consistent Y/Ho ratios 23-28. The -La and -Ce anomalies are absent in these samples. Their Y/Ho ratios are very consistent Overall REE distribution patterns indicate that these shales show depletion characteristics compared to UCC, PAAS, MUQ, NASC, EUS and Chondrite. Down the hole geophysical, geochemical variations in porosity, bulk density, P-wave velocity, temperature gradient, thermal conductivity, alkalinity, concentrations of ammonium, calcium, magnesium, total carbon, sulphate and chloride ion are discussed.

Further, in this paper an attempt has been made to compare the other intricate geochemical attributes of the studied shales originated in a known tectonic setting i.e., a Phanerozoic arc back arc basin with similar lithologies of Archean and Proterozoic sedimentary sequences.

Key words: Lesser Antilles Arc, Arc-Back-Arc, Shale geochemistry

STRUCTURAL INTERPRETATION AND CRUSTAL MODELLING USING GRAVITY AND MAGNETIC METHODS IN PARTS OF SAKOLI AND SAUSAR BELTS OF MADHYA PRADESH & MAHARASHTRA, CENTRAL INDIA

A. Kant[1, 2]*, R. Kumar[1], U. Shankar [2], C.B. Tiwari[3], S.R. Baswani[4], R. Gorle[5], A. Kumar[6], S.K. Bharati[3] and P.K. Jain[6]

[1]Geological Survey of India, Central Region, Nagpur, India
[2]Department of Geophysics, BHU, Varanasi, India
[3]Geological Survey of India, Northern Region, Lucknow, India
[4]Geological Survey of India, Southern Region, SU: AP, Hyderabad, India
[5]Geological Survey of India, M & CSD, Visakhapatnam, India
[6]Geological Survey of India, Western Region, Jaipur, India
*Corresponding Author: abhay.kant@gsi.gov.in

ABSTRACT

This study emphasizes on characterizing crustal structures (faults and tectonic contacts) using ground gravity and magnetic methods in the Sakoli and Sausar Belts of central India. Geologically, the study area comprises the oldest Tirodi Gneissic Complex/ Amgaon Gneissic Complex of Archaean, Sakoli and Sausar Group of Paleoproterozoic, Lameta Group of Upper Cretaceous, Deccan Trap Supergroup of Upper Cretaceous- Paleocene and Laterite of Cenozoic.

The general trend of gravity and magnetic anomalies is in approximately NE-SW direction which is in good agreement with the NE-SW alignment of geological formations. Notably, high gravity (H1) values ranging from -35.5 to -22.0 mGal are observed in the southeastern region near Lakhni and Chandrapur villages. These anomalies may be attributed to the presence of phyllite and andalusite mica schist within the Sakoli formation and associated basement upliftment.

Magnetic anomalies in the study area vary in between -914 and 1373 nT. The magnetic anomaly map reveals prominant anomalous zones within Sakoli group of rocks located in the southern part of the study area. Additionally, the gravity gradient (F10-F10´) displays trends in the WNW to ESE and WSW to ENE directions, particularly near Hivra, north of Chorbahuli, and south of Piparwani in the northern part of the study area. These gradients are likely the result of cumulative inferred lineaments within the Mansar formation. Inferred faults, boundaries, and tectonic contacts (F1-F1´) between the Amgaon Gneissic Complex and Sakoli Formation and contacts (F4-F4´) in the southeastern part of the study area are evident in THDR and TDR maps.

Euler depth solutions indicate depths of less than 1 km, 1 to 2 km, 2 to 3 km, and beyond 3 km, with a majority of solutions occurring at the contact between two litho-units at depths ranging from less than 1 to 2 km. The SPI map generated from magnetic data indicates shallower causative sources in the south-central and central-eastern sectors, while the central-western area exhibits deeper sources, with depths ranging from 100 meters to 4300 meters. Furthermore, P-depth solutions and forward model along the NNW-SSE profile A-B suggest that causative sources are located at depths of approximately under 5000 meters.

LITHOSPHERE STRUCTURE ACROSS THE PRECAMBRIAN TERRAINS OF THE NORTHWEST INDIAN SHIELD BASED ON MULTI-SCALE POTENTIAL FIELD MODELLING AND ITS GEODYNAMIC IMPLICATIONS

Sumanta Kumar Sathapathy, Munukutla Radhakrishna, Tapas Kumar Biswal, and Giri Yellalacheruvu

Department of Earth Sciences, Indian Institute of Technology Bombay, Mumbai, 400076 India
sumantasatpathy1992@gmail.com

ABSTRACT

The Precambrian terrains of the Northwest Indian shield (NWIS) comprises of the Bundelkhand, Marwar and Dharwar cratons with intervening mobile belts such as the Aravalli Delhi fold belts (ADFB) and the Central Indian tectonic zone (CITZ). The region is also characterized by the presence of Proterozoic/phanerozoic rift basins such as the Vindhyan (VB), Cambay rift (CR) and Kutch rift (KR) with significant area covered by the Cretaceous flood basalts of the Deccan Volcanic Province (DVP). In this study, we present the results of a seismically constrained multi-scale geopotential field interpretation along two long corridors that cut across the major Precambrian terrains of the NWIS. The lithosphere architecture across these terrains in correlation with the structural geological and geochronological data allowed us to generate the robust geodynamic models of evolution. The joint interpretation of gravity and magnetic anomalies in the NWIS region reveal that the ADFB and CITZ are bounded by deep crustal faults having denser crustal rocks, shallow Moho below DVP and CR with the presence of thick underplated layer at the base of the lower crust below most of the NWIS region indicating a strong magmatic imprint. The distinct crustal structure and the deeper LAB below the ADFB and CITZ reveal the signatures of Proterozoic amalgamation. Further, these characteristics are used to build the geodynamic models for the lithosphere evolution in the NWIS region

SEISMIC ACTIVITY IN ARUNACHAL PRADESH: PROBING THE MECHANISMS OF EARTHQUAKE OCCURRENCE AND TREMOR TRIGGERING

Abhey Ram Bansal 1,2 , Tony Saini 1,2 and N. Purnachandra Rao 1,2

1 CSIR- National Geophysical Research Institute, Uppal Road, Hyderabad -500007, India
2 Academy of Scientific and Innovative Research (AcSIR), Ghaziabad- 201002, India
Email: abhey.bansal@gmail.com

Dynamic earthquake triggering has emerged as a significant field of study in Seismology, providing important insights into the interrelated nature of seismic events. The phenomena of dynamic triggering describe how seismic waves from one earthquake can cause the occurrence of subsequent earthquakes farther away. Arunachal Pradesh is located in the eastern Himalayan seismic region which is highly sensitive to earthquakes. The Assam-Tibet earthquake of 1950 (Mw 8.7) had a long-lasting effect on Arunachal Pradesh, and is one of the most noteworthy events in the history of the area. In this study we explored the effect of dynamic triggering on events in the Arunachal Pradesh region. We analyzed 34 large teleseismic events since 2010 and found triggering effect during six events, which is 17 % percent of the analyzed events. The triggering in the region occurred in the form of local earthquakes and tremors. The dynamic stress as low as 1 kPa was found capable of triggering. We found both instantaneous and delayed triggering in our study. We infer that the

possible reason of triggering could be Coulomb failure criteria and fluid movements. The Back Azimuth (BAZ) and the direction of incoming waves with respect to the fault do not seem to play any important role in triggering. The region has a high degree of sensitivity to stress, such that even tiny stresses have the potential to induce seismic activity in the form of earthquakes and tremors.

ANALYSIS OF ULF GEOMAGNETIC SIGNAL USING FRACTAL DIMENSION AND POLARIZATION RATION IN SEARCH OF POSSIBLE EM SIGNATURES ASSOCIATED WITH EARTHQUAKES OCCURRED IN SUBDUCTION ZONE OF ANDAMAN-NICOBAR REGION

***Rahul Prajapati and Kusumita Arora**
Geomagnetism group, CSIR-National Geophysical Research Institute, Hyderabad-500007, India.
Correspondence: rahulphy007@gmail.com

The ULF geomagnetic data recorded in an active seismic zone of Andaman-Nicobar region can be useful to study the EM signatures emitted from lithospheric deformation in focal zone of earthquakes. Identification of such EM signatures from local sources in geomagnetic signal is often very tedious job, because geomagnetic signal is composed of global fields from magnetosphere and atmosphere. In this regard, we have use polarization ratio and fractal dimension techniques to study the EM signatures possibly associated with earthquakes ($M \geq 4.5$) occurred in subduction zone of Andaman-Nicobar region. The polarization ratio estimated from the ratio of spectral density of vertical to horizontal components in ULF frequency range 0.001 to 0.1 Hz. The temporal variation in polarization ratio shows significant increment prior to two weeks of the occurrences of earthquakes. Similarly, the time series of geomantic signal also examined through fractal dimension using spectral and Higuchi method. The fractal dimension from Higuchi method shows more reliable and consistence variations than spectral method. Thus, the close inspection in temporal variations in fractal dimension from Higuchi method shows the significant increment in fractal dimension 3 to 31 days prior to the occurrences of earthquakes. The analysed temporal variation of polarization ratio and fractal dimension also correlated with planetary index Kp and Dst to reduce the ambiguity of EM signatures with any global effects. Thus the gradual increase occurred in polarization ratio and fractal dimension prior to earthquakes can be considered as precursory signatures.

ROLE OF GEOPHYSICS FOR SEEPAGE ISSUES AT DAM SITES –A REVIEW

K.Satish Kumar
CSIR- National Geophysical Research Institute (CSIR), Uppal Road, Hyderabad
Email: satish_marine777@ngri.res.in

Seepage is a slow escape of a liquid through a porous material (or) fracture, this phenomenon often arises in earth dams caused due to influence of several internal and external sources. The effects of seepage in dams pose problems like piping, internal erosion, saturation, and blowout, which will destroy the dam structure. Selective non-invasive geophysical technique like Microgravity, Ground Penetrating Radar (GPR), Electrical Resistivity Tomography (ERT), Multichannel Analysis of Surface Waves (MASW), Seismic Refraction Tomography (SRT), Self Potential (SP), well logging provides clues delineate to hidden seepage paths in the dam sites. The present study emphasises a

brief review of applying selective geophysical techniques on seepage issues in dam sites. This study provides information to dam engineers for the adoption of selective geophysical techniques to address the seepage issues at dam sites.

THE PERFORMANCE OF EARTHQUAKE EARLY WARNING SYSTEM AND SHAKE MAPS FOR UTTARAKHAND HIMALAYAS, INDIA

Himanshu Mittal*[1], O. P. Mishra[1], Sandeep[2], Atul Saini[1], Rajiv Kumar[1], Ambikapathy Ammani[1]

[1] National Center for Seismology, Ministry of Earth Sciences, New Delhi-110003
[2] Department of Geophysics, Banaras Hindu University, Varanasi- 221005
Corresponding Author: Himanshu Mittal, himanshumitt10@gmail.com

The primary objective of this study is to assess the operational effectiveness of India's earthquake early warning (EEW) system through the utilization of earthquake data recorded in Taiwan with reference to using station locations of EEW network of the north-west Himalayas established by Indian Institute of Technology, Roorkee where the recorded waveforms from Taiwan are analyzed to evaluate the performance of India's EEW system that ensured a meaningful correlation in terms of station distances.

The selected grid of Taiwanese instruments has been transformed to correspond to Indian coordinates. Subsequently, recorded waveforms have been processed through the Earthworm software, utilizing the tankplayer module. The evaluation of the EEW system's effectiveness revolves around two key metrics: the time taken by the system to issue a warning subsequent to confirming a destructive earthquake event, and the lead time – the interval between warning issuance and the arrival of the destructive earthquake at a specific location. This lead time naturally varies from a few seconds to several tens of seconds at different locations, contingent upon the distance from the epicenter.

Our findings indicate that the EEW system performs well across various aspects, including earthquake detection, identification of P-waves, determination of earthquake magnitude, and localization of events. These evaluations rely on established regression techniques. Notably, we observe longer lead times in flatter regions, which pose a significant challenge for the application of the EEW system.

Additionally, we attempted to integrate shake maps into our assessment of the EEW performance using newly adopted algorithms. We created shake maps for earthquakes recorded by India's Strong Ground Motion Network, including the well-documented April 4, 2011 Indo Nepal earthquake, which had its source mechanism determined through waveform inversion techniques. By comparing our calculated fault plane solution with those of other researchers, we confirm a thrust mechanism, consistent with the consensus within the field and the seismic trends in the Uttarakhand Himalayas.

The assimilated shake maps offer valuable insights into the rupture process of the earthquakes studied. Moreover, the computed focal mechanism points to a nodal plane oriented in the NW-SE direction, which aligns with the shaking map for the April 4, 2011 Indo-Nepal earthquake.

In conclusion, we find that to ensure robust and consistent information in shake maps for the region, a dense network is essential. This information can be crucial for designing and implementing an effective EEW system in the north-west Himalayan region.

DOUBLE SINGLE-FORCE SOURCE MODEL TO STUDY THE SOURCE MECHANISM OF LANDSLIDE EVENTS: A SYNTHETIC APPROACH

D. Shashidhar*[1], Simone Cesca[2], Angela Carrillo Ponce[2], P. Athul[1] and N. Purnachandra Rao[1]
[1]CSIR-National Geophysical Research Institute (CSIR-NGRI), Uppal Road, Hyderabad, India
[2]GFZ German Research Centre for Geosciences (GFZ), Helmholtz Centre, Potsdam, Germany
*shashidhar@ngri.res.in, shashi.geo@gmail.com

Seismic signal analysis can provide valuable information to understand rockslide/landslide dynamics in the absence of direct observation. Established methods of moment tensor inversion, which is typically used for resolving the earthquake source mechanism from seismic waveform data, may also assist with rapid rockslide/landslide parameter estimation. This is crucial for mitigating secondary hazards. Landslides begin with the detachment of a mass and end with its impact at lower altitude. Although their time evolution can be complex and extended in time, these two source components often characterize the low frequency seismic radiation at local to regional distances. Therefore, to model the seismic signals produced by these two processes, we consider a double single-force source model, where the first force oriented upward the slope is used to model the landslide detachment and a later force in opposite direction is used to model the following impact. We applied this source model to compute the seismic signals generated by a set of 1,000 synthetic landslides in the Uttarakhand region, India. Our synthetic landslides have random slope geometry (dip and azimuth) and source locations; the corresponding synthetic seismograms are estimated for the dense seismic network operated by CSIR-NGRI at Uttarakhand Himalaya, India. Further, these synthetic data are inverted using a probabilistic moment tensor inversion approach by applying a low frequency band (0.04 – 0.10 Hz) on the three component synthetic waveforms to derive moment tensors for landslide events. The results show that moment tensors are predominantly characterized by CLVD and isotropic components, which are atypical for tectonic earthquakes. Therefore, moment tensor inversion could be used to process regional seismic recordings and identify potential landslide events. This study brings a new approach to understand the source dynamics of landslide events.

Key words: Landslide, source mechanism, fault plane, synthetic seismogram, single-force

GEOMORPHOLOGICAL AND GEOTECHNICAL CHARACTERISTICS OF 2021 LANDSLIDES AND FLOOD IN KERALA

Thatikonda Suresh Kumar, Sravan K Kotluri, V Nandakumar
National Centre for Earth Science Studies, Akkulam, Trivandrum, Kerala, India
Corresponding Address/Email: sureshkumarncess@gmail.com

Landslides and floods, both natural hazards, are closely linked, particularly during persistent rainfall. The Western Ghats have been a hotspot for such events, resulting in significant casualties. Factors such as heavy rainfall, geological vulnerabilities, and human activities contribute to landslide occurrences in this region. Kerala, situated in the southern part of the Western Ghats and a monsoon

gateway, has been prone to continuous natural disasters since 2018. In October 2021, Kokkayar and Kootickal in Kerala experienced intense rainfall, leading to fatal landslides and floods that claimed approximately 30 lives and caused extensive infrastructure damage. Our analysis, including geomorphic and geotechnical assessments, identified excessive rainfall (>200mm) as the primary trigger for these disasters. Furthermore, activities like rubber plantation and quarry mining exacerbated the landslide risk. Additionally, the flood vulnerability of Kokkayar and Kootickal, located in foothill areas, played a significant role in the flooding. In our Geotechnical study, we conducted a post-event analysis to assess the combined impact of these factors on slope instability. Despite cohesion and friction angles within specific ranges, disturbed slopes failed due to high moisture content and silt-clay content before the landslides. Our findings emphasize the importance of understanding these factors to mitigate landslide risks in areas with clay-rich soils and weathered bedrock.

UNCERTAINTY QUANTIFICATION OF GRAVITY INVERSION

Mahak Singh Chauhan*

*CSIR – National Geophysical Research Institute

Email: mahak.singh@ngri.res.in

A critical issue in the potential field inversion is the non–uniqueness, which need to be dealt with utmost care. Non-uniqueness, particularly in the gravity and magnetic inversion, can be caused by the various ambiguities in the source region. An inherent ambiguity comes from the mathematical foundation of potential theory via the Green's third identity. Besides that, there are also other ambiguities of different origins which can be distinguished based on their characteristics. For instances, algebraic and error ambiguities can occur due to the discretization of the source and instrumental errors respectively. Discretization of a continuous field also produces the sampling ambiguity. Therefore, in the presence of all these ambiguities, modelling of potential fields required to incorporate some a-priori information into the inversion algorithm. There are various ways to use the available information into the inversion, for instances, providing the reference model or the information of the density. Most of the classical inversion approaches incorporate a-prior information into the error function and searches for a model w.r.t the minimum error often called best-fit model. Such model may not be the best representation of the true source. Therefore, inversion based on the probabilistic approaches are more suitable for mapping the model space and estimating the uncertainties that occurs due to the presence of different ambiguities. In this work, I will use the Bayesian inversion based on the Monte Carlo Markov Chain (MCMC) algorithm for sampling the posterior density functions (pdfs) of the model parameters. The samples are drawn from the bounded uniform distribution and a Metropolis-Hasting sampler is used to calculate the pdfs. The results obtained from Bayesian inversion are more realistic in terms of the total representation of the model space. I will the show the results of estimating the various complex sources using synthetic and real case examples.

SIGNATURES OF NATURAL HAZARDS IN THE PALEO-COASTAL SEQUENCES OF CENTRAL INDIA: AN EXAMPLE FROM THE VINDHYAN BASIN

B. P. Singh* and Preeti Mittal
Department of Geology, Banaras Hindu University, Varanasi-221005
*Presenting author email: drbpsingh1960@gmail.com

Signatures of the seismic and volcanic hazards are common in modern sequences as well as in rock records. Particularly, the soft-sediment deformational structures (SSD) can be considered as produced by seismic as well as non-seismic processes. The seismic-induced SSD structures show large lateral continuity and absence of continental slope-related depositional environments. Most of these structures are formed as a result of liquefaction and fluidization processes. The SSD structures are found in Semri as well as Kaimur groups of the Vindhyan Supergroup in the Son valley. We present here the possible causes of the development of the SSD structures in the Semri Group of the Vindhyan Supergroup. In the Semri Group, the SSD structures are commonly present in the Kajrahat Limestone, Chopan Porcellanite and Rohtas Limestone formations, and the Glauconitic Sandstone Member. The SSD structures include, slump folds, kink bands, chevron folds, convolute beddings, contorted cross-beds, flame structures, pinch-and-swell structures, breccias, sagging structures, water-escape structures, and dykes of varying dimensions. The SSD structures of the Kajarahat Limestone Formation show large lateral extent. Moreover, the Kajarahat Limestone was possibly deposited in the lagoonal and tidal depositional environments not on the continental slope. These lead to suggest that the SSD structures formed as a result of the seismic activities in them. The SSD structures of the Chopan Porcellanite Formation associated with rhyolite and volcanic tuff might have originated as a result of volcanic activities or seismicity. Their occurrence in the Glauconitic Sandstone Member (Kheinjua Formation) adjacent to the Son Lineament might be related to tectonics-induced seismicity. The convolute bedding with large lateral extent in the Rohtas Limestone Formation looks related to seismicity in the light of its deposition along the shelf. Thus, the upper Palaeo-Mesoproterozoic Semri Group, Vindhyan Supergroup represents varieties of the SSD structures formed mostly by seismic processes. These imply that the Central India was unstable and was a place for tectonically controlled seismic events during the upper Palaeo-Mesoproterozoic (1,700–1,600 Ma).

A NOVEL JOINT MODELLING STRATEGY FOR SITE CHARACTERIZATION AND ITS APPLICATION TO DHANBAD CITY (INDIA)

Mohit Agrawal[1], Ravindra K. Gupta[1] and Jay Pulliam[2]
[1]Department of Applied Geophysics, Indian Institute of Technology (ISM), Dhanbad, India
[2]Department of Geosciences, Baylor University, Waco, TX, USA
*Email: mohit@iitism.ac.in

We develop a novel joint modelling technique to decipher seismic shear wave velocities for site characterization using Horizontal-to-Vertical Spectral Ratios (HVSR) and Rayleigh wave phase velocity dispersion curves. The joint modelling technique utilizes the complementary sensitivities of these disparate datasets to constrain the model search space sufficiently using the global nonlinear optimization technique of Very Fast Simulated Annealing (VFSA). The uncertainties are statistically quantified with estimates of marginal Posterior Probability Distributions (PPDs) and Parameter

Correlation Matrices (PCMs). To validate its viability, we conducted a synthetic test to demonstrate the effectiveness of the modelling scheme and applied it to field data recorded in Dhanbad city. Our results reveal that the engineering bedrock depth varies between ~9.5 m, in the northwestern, and ~42 m, in the southwestern parts of the city. The Vs30 value is largest in Dhanbad's southern border (~562 m/s) and in south-central neighbourhoods (~351 m/s). The obtained shear wave velocity profiles match well with borehole lithology data. The site characteristics obtained from this study will complement future earthquake risk mitigation efforts to facilitate infrastructure that can withstand the dynamic load of the earthquakes.

Keywords: Vs30, Site Characteristics, Joint Modelling, PPDs and PCM

GEODETIC EVIDENCE FOR CASCADING LANDSLIDE MOTION TRIGGERED BY EXTREME RAIN EVENTS AT JOSHIMATH, NW HIMALAYA

K. M. Sreejith[1, *], M.C.M. Jasir[1, 2], P. S. Sunil[3], M. S. Rose[3], Ajish P. Saji[4], R. Agrawal[1], M. T. Bushair[5], K. Vijay Kumar[4] and N. M. Desai[1]

[1] Space Applications Centre, Indian Space Research Organisation, Ahmadabad, India.
[2]Department of Geophysics, Andhra University, Visakhapatnam, India.
[3]Department of Marine Geology and Geophysics, Cochin University of Science and Technology, Kochi, India.
[4]Indian Institute of Geomagnetism, Department of Science and Technology, Mumbai, India.
[5]India Meteorological Department, Ministry of Earth Sciences, New Delhi, India.
* Corresponding author: sreejith81@gmail.com

Slope instability due to tectonic, hydrological and anthropogenic activities cause severe landslides in Himalaya. Joshimath, a densely populated Himalayan town witnessed a catastrophic landslide event during December 2022 and January 2023 causing damages to ~700 buildings. We use InSAR, GPS and rainfall measurements to probe the kinematics of the Joshimath landslide. We separate the seasonal and transient deformation using singular spectrum analysis. While the low amplitude annual landslide motions are modulated by seasonal precipitation, transient motions are triggered by extreme rain events. Our analysis revealed episodes of cascading motions triggered by extreme rain events resulting an overall increase in landslide velocity from -22 mm/yr during 2004-2010 to -325 mm/yr during 2022-2023. We estimate the landslide depth (~30 m) and hydraulic diffusivity (~3×10^{-5} m^2/s) using a 1-D pore-water pressure diffusion model. Our study reveals the importance of systematic monitoring of ground deformation and weather parameters at Himalaya for landslide hazard mitigation.

SEISMIC HAZARD ANALYSIS OF THE EASTERN SHILLONG PLATEAU-MIKIR HILLS PLATEAU THROUGH LG ATTENUATION MODELING AND SPECTRAL ANALYSIS APPROACH

K V R H Prasad and Bijit Kumar Choudhury
E-mail: nati.neist21j@acsir.res.in

Northeastern Region (NER) of India is well known for its vulnerability to earthquake hazards. The Shillong Plateau-Mikir Hills Plateau (SP-MHP) tectonic domain plays a pivotal role as a seismic source in the NER of India. This study focuses on the seismic hazard analysis in the Eastern Shillong

Plateau and Mikir Hills Plateau of NER of India through the examination of attenuation of Lg waves and the Lg spectra by adopting the Reverse Two Station Method (RTSM) approach, which has been applied for the first time in the context of NER of India. In this study, a database comprising of 14 regional seismic events from in and around NER of India, yielding 50 Lg source-receiver paths have been employed. The Lg attenuation model devised for the study region is expressed as:

$$Q_{Lg} = 141 \pm 18f^{\,0.151 \pm 0.0052}$$

The notably low Q_o value (141) and low η(0.151) underscores the fact that this study region is akin to some tectonically active and seismically hazardous regions of the world. The high degree of Lg attenuation in the SP-MHP region and the low power of frequency-dependence suggest that Lg attenuation is not strictly governed by frequency. But, given the fact that the degree of Lg attenuation is very high, the role of other multiple mechanisms contributing to Lg attenuation in the region has been envisaged. It has been observed that Lg arrives with an average predominant frequency of around 6 Hz, which could be detrimental from a seismic hazard point of view as it coincides with the natural frequency range of most common civil engineering structures (1-10 Hz). Thus, this Lg attenuation model could be of much use for safe and resilient civil engineering practices for effective seismic hazard mitigation and management in the study region.

Keywords: Attenuation, Crustal Quality Factor, Hazard, Lg, Scattering, Tectonic.

EVIDENCE OF PORE-FLUID ACCUMULATION AND MIGRATION ACROSS THE ANDAMAN NICOBAR SUBDUCTION TRENCH

G. Sriram [1*], P. Dewangan[1] and B.K. Nandi[2]
[1]CSIR-National Institute of Oceanography, Dona Paula, Goa 403004, India
[2] Geological Survey of India, Mangalore, Karnataka, 575 001, India
[*]Corresponding author: sriram@nio.org

Prior to the subduction begins, there is significant fluid release, but sediment accumulation in the subduction trench impedes heat transfer, creating a thick trench wedge. These sediment layers, where the decollement develops, undergo extensive diagenetic dehydration even prior to subduction. The transformation of smectite-illite minerals in these sediments generates fluids, explaining polarity reversals on pre-decollement reflectors. These processes are crucial in the seismic cycle of subduction zones, reducing stress and mitigating major earthquakes. In our study, we utilized 990-line km high-resolution 2D multi-channel seismic data, perpendicular to the subduction trench, from the Geological Survey of India focusing on extracting seismic prestack amplitude data from the pre-decollement layer and fault plane reflections rooted in the decollement to the seafloor within the proto and frontal thrust regions of the subduction trench. This investigation aimed to elucidate amplitude variations with offset, shedding light on fluid/gas accumulation within the decollement and the active migration of fluids through subduction trench fault lines. Seismic analysis of the decollement revealed both class III and class IV AVO behavior, with intercepts ranging from -0.01 to -0.06 and gradients from -0.5 to 1. Class III predominated near the frontal thrust. Fault plane reflections from the decollement in the proto-thrust and frontal thrust regions displayed typical class III AVO signatures, with intercepts varying from -0.0001 to -0.01 and gradients from -0.001 to -0.8. The class III AVO signature near the

trench indicates the presence of fluids/gases. A noteworthy observation was the heightened AVO gradient as the fault neared the seafloor within the frontal thrust fault core, suggesting temperature influences on mantle fluids traversing faults, leading to their transition into a gaseous state near the seafloor. In summary, our comprehensive analysis of seismic signatures linked to pre-decollement and fault plane reflections provides vital insights into subduction dynamics, their role in slow-slip earthquakes, and their impact on seafloor morphology. This understanding enhances our knowledge of tectonic interactions and improves seismic hazard assessment in subduction zones.

INTEGRATED GEOLOGICAL AND GEOPHYSICAL INVESTIGATIONS AROUND NUCLEAR POWER PLANT SITES IN INDIA

H.V.S. Satyanarayana
Instrumentation and Engineering Geophysics group,
CSIR- National Geophysical Research Institute, Hyderabad, India
*Corresponding Author: hvsatya@ngri.res.in

Under the initiative of the Government of India's programme of attaining self-reliance in energy sector, the Nuclear Power Corporation of India Limited (NPCIL), has accelerated its programme of enhancing the nuclear power generation by establishing new Nuclear Power Plants (NPP) in India. The most crucial aspect of establishing the NPPs is the suitability of the site for setting up of a new Nuclear Power Plant. This aspect can be effectively handled by carrying out the site-specific studies that can address the issue of seismic hazard, design basis ground motion analysis etc, which in turn provide crucial inputs for the design parameters of the plant.

CSIR- National Geophysical Research Institute (NGRI) is carrying out the site-specific, integrated Geological and Geophysical studies as per the Atomic Energy Regulatory Board (AERB) guidelines, at the behest of NPCIL, in their upcoming NPPs. This exercise will help in assessing the suitability of the location for setting up a new NPP. As part of this endeavour, Integrated Geological and seismotectonic studies are being conducted at various NPP sites. Digital Broadband Seismographs are deployed in the radius of 50km from the plant sites so as to monitor the seismic activity if any. Also, CSIR-NGRI is conducting the active seismic surveys within the radius of 5km and 50km from the plant site to delineate the shallow basement and lineaments, if any in the plant sites. The details of the site-specific studies with an emphasis on micro seismic monitoring around NPP sites will be presented here.

Key Words: NPP sites, site specific studies, AERB, micro seismic monitoring

CHARACTERISTIC FEATURES OF TWO RECENT TREMORS (M > 4.0) OF 2020 OCCURRED IN THE SOUTHWESTERN PART OF DELHI NCR AND GROUND CHARACTERIZATION

Shikha Vashisth, Ajeet P. Pandey*, O.P. Mishra
National Center for Seismology, Ministry of Earth Sciences, New Delhi – 110003
*ajeet.moes@gmail.com

On 03 July 2020, a strong tremor M 4.7 occurred in the Alwar region (close to Delhi) at a depth of ~ 35 km which was followed by another tremor M 4.2 that occurred on 17 December 2020 in the Rewari region at a depth of ~ 25 km. The later event was located ~ 21 km away roughly to the north of the first tremor in a similar tectonic regime near the northernmost part of the NE-SW trending Aravalli Mountain range. Typically, both the tremors occurred in an interval of a short span of ~ 5 months and their epicentres were located in the southwestern part of Delhi NCR (National Capital Region). Analysis of the NCS earthquake catalog indicates the source region to be seismically not very active for significant earthquakes. In the last two decades, about 130 small-magnitude earthquakes have occurred in the region; out of these only four events are of M ≥ 4.0 having a maximum magnitude of M 4.7 associated with the July 2020 tremor. A characteristic pattern in the spatial distribution of M ≥ 4.0 events is observed, wherein these events are aligned in the NNE-SSW direction in a stretch of ~ 100 km. The M 4.4 event of August 2003 was located in the SSW part of the stretch; however, the subsequent events (M ≥ 4.0) occurred to the NNE of the respective previous event. The July 2020 tremor (M 4.7) is located ~ 25 km SW of Bhiwandi, Rajasthan; ~ 60 km SSW of Gurugram, Haryana, and ~ 80 km SSW of New Delhi. However, the epicentre of the December 2020 event (M 4.2) is located ~ 46 km SW of Gurugram, Haryana. The focal mechanisms of both events indicate normal faulting with a slight strike-slip component. The stress drops in the source region for both events are found to be 166 bars and 138 bars, respectively. As both the events are closely spaced, unidirectional with respect to the Delhi region and also have a similar faulting nature, it provides a unique opportunity to investigate the ground motion variability in and around the Delhi region and characterize the ground shakings to understand the hazard. In the present study, we discuss site characteristics based on various analyses of the ground motion (broadband and strong motion) data recorded at different seismic stations corresponding to both the tremors and the results were compared with the site-specific acceleration response computed based on soil dynamics for the Delhi region for potential earthquakes. The h/v spectral analysis performed at 26 broadband seismic stations, located at a distance range of ~ 18 - 350 km from the epicentre, clearly indicates a fairly flat response for the rock/hard site in the frequency range 0.50 - 10.0 Hz characterizing site class A to C. However, a prominent amplification observed at lower predominant frequencies (< 0.5 Hz) typically characterizes the soil sites with site class D to F. The strong ground shaking parameters like peak ground acceleration (PGA), peak ground velocity (PGV), peak ground displacement (PGD), and response spectra were computed at each recording site using strong motion data. The maximum PGA obtained for the July 2020 (M 4.7) tremor is found to be ~ 24.8 Gal at the KUDL seismic station, which is approximately 25 km away from the epicentre. However, the maximum PGA for the December 2020 (M 4.2) event is found to be typically low (~ 8.0 Gal) at the same site, which is ~ 18 km away from the respective epicentre. Nevertheless, these outcomes corroborate well with the findings of an earlier study carried out in the NCT of Delhi. The site-to-reference approach, based on the ratio of the

response spectra of the soft soil site to the rock/hard site, was also employed on the ground motion data to characterize the site amplification in the region, which will be discussed in the paper.

Key Words: Ground motion, Site characterization, Ground shaking, PGA, Spectral analysis.

STRATIGRAPHIC AND STRUCTURAL EVIDENCE OF TRANSPRESSIONAL QUATERNARY FAULT REACTIVATION ALONG THE SE KOREAN PENINSULA

Sambit Prasanajit Naik, Kiwoong Park, Francois Hategekimana, Hyeon Cho Shin, Young-Seog Kim
Major of Environmental Geosciences, Pukyong National University, Nam-gu, Yongso-ro, 45, Busan-48513, Republic of Korea
Email: sambitnaik@gmail.com

Understanding the nature, extent, and distribution of seismogenic structures, including their seismogenic potential to cause damaging earthquakes in low-strain seismic settings, is of paramount socio-economic importance. To understand the controlling factors of earthquakes in intraplate regions in low-strain regions like the Korean Peninsula, the analysis of historical and paleoearthquakes is necessary. With the current level of knowledge, the seismic pattern of the intraplate region, especially along the Korean peninsula, is more heterogeneous as derived from the historical seismic records, instrumentally detected seismic patterns, or from the paleoseismological analysis. Systematic paleoseismological studies may contribute new evidence for fault activity, and hence they are an important contribution to the understanding of the seismic and structural evolution of faults. To an extent, most of the paleoseismic investigations are concentrated along SE Korea and mostly along the Yangsan or Ulsan faults. Less attention has been given to other faults located along the SE Korean Peninsula. In this present study, under the ongoing Korean Active Fault Mapping Project, we have identified a ~5.5 km fault trace along the Ulsan-Dongnae Fault system for which the detailed paleoseismic investigations and evolution history were studied in detail. The fault presents a clear example of fault reactivation under the present compressional tectonics with a paleoearthquake during the late Pleistocene (~121±6 ka). The fault is capable of generating an earthquake of magnitude similar to the 2016 Gyeongju earthquake (Mw 5.8). This study will help in understanding the ongoing tectonic process and the Quaternary activities of fault systems along the SE Korean peninsula as well as for the local scale seismic hazard analysis of the area.

COSEISMIC AND POSTSEISMIC DEFORMATION ASSOCIATED WITH THE 2019 MIRPUR EARTHQUAKE USING INSAR MEASUREMENTS AND MODELLING

M.C.M. Jasir[1, 2]; Sreejith K.M.[1]; Ritesh Agrawal[1]; S.K. Begum[2]
[1]Space Applications Centre, ISRO, Ahmedabad;
[2]Department of Geophysics, Andhra University, Visakhapatnam
Email: jasirmckbl@gmail.com

An earthquake occurred near the Mirpur city of the Kashmir Himalaya on 2019 September 24 caused widespread damage including 34 deaths. We used Interferometric Synthetic Aperture Radar (InSAR) data to estimate coseismic and postseismic surface displacement associated with the event and

inverted the near-field InSAR measurements to find the co and postseismic slip distribution pattern on the Main Himalayan Thrust (MHT).

Bayesian inversion of Coseismic InSAR data suggests that the earthquake ruptured a shallow, near-horizontal up-dip portion of the décollement of MHT. The distributed slip model predicts a compact rupture terminating the up-dip end at the base of the Main Frontal Thrust (MFT) with higher slip around the hypocentre, equivalent to a moment magnitude of M_w = 6. Himalayan earthquakes typically originate at the down-dip portion of the MHT and propagate southward, a shallow up-dip rupture of the MHT by a moderate magnitude earthquake is unusual. We propose that the low effective friction may result from high pore-fluidic pressures or weak materials lubricating the fault surface, allowing the near-horizontal rupture.

We used Time-series InSAR analysis to find postseismic deformation of the earthquake and the inversion of InSAR data revealed 0.06 m postseismic slip towards south of the coseismic rupture. The 2019 Mirpur earthquake released less than 10% of the accumulated strain energy since the 1555 Kashmir earthquake, and the afterslip released 20% of the main shock. These findings compel a revisit of the seismic hazard assessment of the northwestern Himalaya.

INDIAN OCEAN DIFFUSE ZONE DEFORMATION AND SEISMIC SOURCE CHARACTERISTICS

Anil Earnest
CSIR Fourth Paradigm Institute, Wind Tunnel Road, Bangalore – 560 037,
Email: earnest@csir4pi.in

This study, in particular, looks at the seismogenic characteristics at the Indian Ocean Diffuse Zone region in the northern Indian Ocean. The Indian plate diffuse zone, the worlds most actively deforming oceanic lithosphere has hosted many large earthquakes including the largest instrumentally recorded strike-slip event, the 2012 April (Mw 8.6) earthquake (Hill et al., 2015). Several studies noted that these fracture zones have a great influence on the subduction processes and the related seismicity (Andrade and Rajendran, 2014; Aderhold and Abercrombie, 2016). The Indian ocean lithosphere also shows the characteristic variations in the seismic source depths. The 2012 earthquakes, which occurred within the Wharton Basin, beyond the 600^0C isotherm, showed a more complex rupture process, over depths beyond the limits of brittle failure (Lay, 2019; Duputel et al., 2012a; Hill et al., 2015). This point towards the presence of seismic activities at or beyond the brittle-ductile transition zones, which is believed to be governed by the shift of velocity weakening to strengthening transition zone to higher depths at regions where strain rates are higher with rapid deformation (e.g., Hill et al., 2015; Molnar, 2020) or by the thermal runaway feedback system, where the thermal weakening causes such deeper source origin earthquakes (e.g., Hill et al., 2015; McGuire and Beroza, 2012). Our mode of investigation involved the usage of the tele-seismic kinematic finite-fault simulations with supportive stress-inversion models. Our results on the Northern Wharton diffuse basin models favour faulting on ~ESE-WNW oriented active shear structures. This study confirms that the centroid depths at this region lie within the 600^0C isotherm, but occasionally the seismic slip can extend up to ~750^0C isotherm, indicating brittle nature at the upper mantle. A depth-wise variation in stress field with shallow oblique-normal faulting and deeper oblique-reverse,

indicating plate bending or slip-partitioning effects having direct control on the Northern Wharton tectonics.

SPATIAL ANALYSIS AND PREDICTIVE MODELING OF NATURAL SEISMIC ACTIVITY: A SMOOTHED SEISMICITY APPROACH

S Lasitha and Aswini S
Dept. of Earth Sciences, Pondicherry University, Pondicherry, India-605014
Email: lasitha_s@yahoo.com

The integration of smoothed seismicity analysis with fault comparison significantly enhances our understanding of seismic hazards. It not only pinpoints regions with increased seismic activity but also elucidates fault behavior, offering invaluable insights for seismic risk assessment, land-use planning, and the development of effective earthquake mitigation strategies. Kerala and Pondicherry, both located in the southern part of Peninsular India, are generally considered tectonically stable due to minimal tectonic strain. Despite this stability, the high population density and extensive infrastructure in these regions render them susceptible to even minor seismic events. Consequently, there is a pressing need for comprehensive mapping of earthquake-prone areas and an assessment of future seismic activity. Seismic activity within a source zone is characterized by the Gutenberg-Richter (G-R) recurrence relation. A higher b-value suggests a higher occurrence rate of smaller earthquakes, as seen in Pondicherry. Conversely, a lower b-value, as observed in Kerala, indicates a larger proportion of larger earthquakes. As the a-value decreases, the expected number of earthquakes exceeding the threshold annually decreases. Consequently, the southern-central region of Kerala is expected to have fewer earthquakes with a magnitude of five or above compared to Pondicherry. This distinction becomes evident when examining Smoothed seismicity models. The significant difference in maximum smoothed rate values between Kerala (0.22) and Pondicherry (0.7) strongly suggests a higher likelihood of seismic activity offshore near Pondicherry and on land in south-central part of Kerala. Examination of smoothed seismicity data alongside the region's lineaments reveals faults and lineaments intersecting zones with elevated seismic probability. The heightened smoothed seismicity near faults and lineaments signifies a strong association with increased seismic activity. This concentration of elevated seismicity rates indicates a higher level of seismic hazard, posing risks to human populations, infrastructure, and nearby vulnerable assets.

MAPPING OF IN-CROP COAL SEAM'S POSITION THROUGH MULTICHANNEL ANALYSIS OF SURFACE WAVES (MASW) STUDIES AT GODAVARIKHANI COAL MINE, RAMAGUNDEM, TELANGANA

K. Swapna Sri*, K. Satish Kumar, P. Pavan Kishore, M. Shri Hari Rao, D. Mysaiah and Nimisha Vedanti
CSIR-National Geophysical Research Institute, Hyderabad.
*Corresponding author: swapna979@ngri.res.in

In-crop coal seams are known to be a former outcrop overlain by younger formations. Delineation of these in-crop coal seams positions is one of the challenging tasks for mining engineers to adopt

suitable methods in the proposed coal mine areas at the initial stage of exploitation. A number of explanatory boreholes at different intervals may provide clues to the position of the in-crop coal seams. However, it may not predict precisely in highly heterogenic complexity of the near-surface layers and is also a time-consuming, laborious and costly affair. The Multichannel Analysis of Surface Waves (MASW) technique was executed to understand the In-crop coal seam's position in a non-destructive approach. Subsurface strata were mapped up to a depth of 25 m in terms of shear wave velocity along the 140m. It is observed from the present study, that the MASW technique successfully mapped the saturated and unsaturated sandstone and shale formations and the position of the in-crop coal seams along the profile. The obtained results were in good agreement with the experimental borehole strata. This study fingerprints the application of the MASW study for precise demarcation of the In-Crop coal seam's position in the Indian coal environment for economical mining prospects.

CRUSTAL STRUCTURE DEFORMATION ALONG THE ANDAMAN FOREARC AND THEIR ROLE ON SEISMICITY DISTRIBUTION- AN INTEGRATED STUDY

Nisha Nair[1*], Nikhil Sabulal[2], Sanjay S. Negi[1], Dhananjai K. Pandey[3], Thena, T.[1], Singh, N. L.[1]
1-National Centre for Polar and Ocean Research, Goa
2-Cochin University of Science and Technology, Kochi
3- Jawaharlal Nehru University, New Delhi
* Email: nishanair@ncpor.res.in

The Andaman Forearc Basin (AFB), an intra-oceanic geological feature, formed as a result of the collision of the Indian and Eurasian plates in the Late Oligocene-Early Miocene. The earlier studies have reported ~3-5km thick sedimentary cover in the forearc basin that has accumulated over millions of years. In the present study, we made an attempt to map the different sediment sequences and the subsurface structural elements that took place during the evolution of the Andaman forearc region. The seismic interpretation of E-W trending 2D multichannel seismic reflection profiles across the Andaman forearc region revealed ~3.0s TWT thick deposition of sediments from Neogene to Recent hosting heavily folded to faulted deformational structures and sag-filled basins. The interpretation also mapped the lateral extent of the major fault systems across the Andaman forearc region which helped to delineate the structural characteristics as well as the subsurface deformations that took place during the evolution of the margin. The initial interpretations were correlated to the nearby drilled well log data sets and compared with the recent published literature with similar study. Each seismic sequences interpreted shows the characteristics of sediment deposition. This seismo-lithological interpretation will provide important insights to understand the evolutionary process of the sediment basin in the forearc region. In this study, we also identified the involvement of deeper tectonics by analysing earthquake data sets and the results will be presented here.

LITHOSPHERIC ANOMALY MODEL OVER THE INDIAN-SUBCONTINENT AND ADJOINING OCEAN – BASIC CORRECTIONS AND MODELING OF THE SATELLITE DATA

***Monica Rawat and S. P. Anand**
Indian Institute of Geomagnetism, Navi Mumbai, 410218
*Email: monicarawat10@gmail.com

Magnetic vector field measurements have been carried out from space over the past 50 years for which different satellite missions has been launched, with one of its aim of modeling the lithospheric magnetic field. As the lithospheric field is one of the weakest sources masked by the main field and external field, makes it very difficult to isolate from the large background fields originating from the internal and external sources. Therefore careful correction and better treatment of background noise is required to obtain accurate lithospheric model. The recent Swarm satellite mission data for a period from 2014-2020 has been used in the present work to model the lithosphere field over Indian-subcontinent and adjoining oceans. The field originating from the external sources is minimized by selecting the quiet day night time passes. After such selection, the external field component (if any) present in the data and the contribution from the main field is removed using the CHAOS model to obtain the residual lithospheric data. To remove the noise signatures in the residual data, various procedure such as manually removing incomplete & cross cutting satellite passes, elimination of spikes and other spurious noises by using filters etc. has been undertaken. The corrected residual data of the observed lithospheric field is inverted using damped least inversion technique where Legendre polynomial of harmonics terms are expanded from order 6-50 to generate the lithospheric magnetic anomaly map of India and adjoining areas. The regional lithosphere model has a great significance in studying the different tectonic provinces over Indian-subcontinent and surrounding oceans. The various steps in the processing of the satellite data to generate the lithospheric anomaly model and the magnetic signature of various tectonic provinces will be discussed.

Groundwater Potential Zonation Mapping of the Tawa River Basin, Madhya Pradesh, India

Sushil Kumar1, Dinesh Kumar2, Kamal1, B. S. Chaudhary1
1Department of Geophysics, Kurukshetra University, Kurukshetra
2Govt. M. G. M. Postgraduate College, Itarsi, Madhya Pradesh
Email ID: sushil_gp24@kuk.ac.in

Groundwater is one of the most important and vital natural resources which is stored in the subsurface geological formations in the critical zone of the earth's crust. It serves as a source of water for domestic, industrial and agricultural uses and other developmental initiatives. In the present study, Remote Sensing and GIS techniques with Analytical Hierarchy Process (AHP) were used for delineating the groundwater potential zones in TAWA river basin, Madhya Pradesh. A total of twelve thematic layers Geology, Geomorphology, LULC, Soil, Rainfall, Lineament Density, Drainage Density, Slope gradient, TPI, TWI, NDVI and Curvature were used in this study to delineate the groundwater potential zones. According to the final output map, the study area could be classified into five distinct groundwater potential zones such as very high, high, moderate, low and poor. Very high and high groundwater potential zones are predominantly located in lower catchments as well as

the middle reaches of the river basin. Low and very low groundwater potential zones are situated in the migmatite complex formation of the river basin. Moderate groundwater potential zone spreads over the catchment area and covers 29% of the study area. High and low groundwater potential zones cover an area of 29.29% and 21.79% respectively. Very high and very low groundwater potential zones in the study area are 10.79% and 9.19% respectively. The delineated groundwater potential zones map was validated using the groundwater level information of the study area. The groundwater potential zone map of the present study provides insights for decision-makers for proper planning and management of groundwater for urban and agricultural purposes. Since most part of the study area is covered by agricultural land, this study will help to improve the irrigation facility and develop the agricultural productivity of the area.

DELINEATION OF CRUSTAL STRUCTURE BELOW THE VINDHYAN BASIN, CENTRAL INDIA THROUGH THE INTEGRATED GEOPHYSICAL STUDIES.

Choppalli Visweswara Rao, Sumanta Kumar Sathapathy, and Munukutla Radhakrishna
Department of Earth Sciences, Indian Institute of Technology Bombay, Mumbai, 400076 India
Email: choppallirao@gmail.com

ABSTRACT

The Vindhyan Basin is one of the largest Proterozoic basin in India and is bounded by the Narmada-Son lineament (NSL) / fault zone in the south Great boundary fault (GBF) in the west and north-west and Bundelkhand craton in the north. The Vindhyan Supergroup consists of about 5000 m thick pile of sedimentary formations pertaining to the Proterozoic period in the basin. The evolutionary history of the Vindhyan Supergroup gives an insight about the mineral- hydrocarbon deposits. However, limited attempts have been made to reconstruct the evolution history of the Vindhyan basin and is not properly understood in that aspect. In this study, an attempt is made to address the basin evolution by understanding the crustal structure modelling and tectonics by studying the integrated geophysical data. To delineate the sediment structure in the study area, correlation of twenty-three 2-D seismic reflection profiles with the available well data has been carried out covering the Son valley area of the Vindhyan basin. The integrated interpretation of the gravity and aeromagnetic magnetic data along with the available seismic data has been carried out to understand the distribution of Vindhyan sediments and delineate major structural trends and cross trends within the Vindhyan basin. From the integrated analysis of the potential anomaly maps, the high anomaly trends in the gravity anomaly (~-32 mGal), Residual gravity anomaly (~10 mGal) and magnetic tilt angle maps reveals the SW-NE Singoli-Rajgarh-Banda ridge and Sardpur-Dewas-Sehore-Sagar (SDSS) ridge along with NW-SE Damoh-Jabera cross trend. A high first vertical derivative gravity anomaly trend observed in the south of Bundelkhand massif can be correlated well with the extension of Singoli-Rajgarh-Banda ridge towards NE as Ratlam-Panna ridge. The 2-D constrained integrated crustal modelling using Deep Seismic Sounding (DSS) profiles and Receiver Function (RF) data revealed that i) the western Vindhyan basin is tectonically active and more disturbed whereas eastern part is less disturbed, that ii) the central crustal upwarping in the basin iii) Basin tilt and rifting sequences in the western part of the study from the seismic profiles, iv) a deeper mid and upper crustal signature is observed below the Bundelkhand craton suggesting deep cratonic scenario. It is also understood that the Narmada-Son lineament has played a major role in the southern part of the basin which is resulted in the crustal

upwarping leading to horst-graben scenario. Hence, it is inferred that the Vindhyan basin is affected by the post tectonic activity of Narmada-Son Lineament during the Proterozoic period.

GROUNDWATER CHEMISTRY, SALINIZATION AND STABLE ISOTOPE STUDIES OF COASTAL AQUIFERS IN EASTERN PARTS OF ODISHA

Atulya Kumar Mohanty*, Bharat Moharana, B. Kiran Kumar, Devender Kumar, G. Sravya Sai and K. Rama Mohan

CSIR- National Geophysical Research Institute, Uppal Road, Hyderabad, 500 007, Telangana

* E-mail: atulyakmohanty@gmail.com

Ground waters are the major sources of fresh waters and used for the drinking water and domestic uses in many parts of the world. Ground waters are the major sources of fresh waters in coastal areas. The impact of seawater intrusion leads to the depletion of groundwater storage in quantity and quality with increasing in ion concentrations. The present study describes about the groundwater chemistry, hydrogeochemical characteristics, and analyses of salinization processes in the coastal areas of eastern parts Odisha. Groundwater chemistry show, the water composition are generally near neutral to slightly alkaline nature in pH, and the total dissolved solids (TDS) concentrations varies from 200 to 3000 mg/l. The oxygen isotope ($\delta^{18}O$) values are found between (-5.5‰ to – 2.90‰), which indicates groundwater compositions were influenced by the seawater mixing, evaporation and recharge process. The principal hydrochemical water types in the coastal aquifer indicates, water chemistry changes from fresh water to the saline water mixing zones from inland areas to coastlines. Saturation index shows, groundwater samples were saturated to near equilibrium conditions with dolomite, gypsum, halite and under-saturated with calcite, aragonite and anhydrite. The groundwater samples were distinctly enriched and deviates in stable isotope values as compared to the seawater origin. The high values of $\delta^{18}O$ observed in groundwater samples, with a relatively low chloride ions and TDS contents, indicates recharging of groundwater. The evaporation processes influenced with the dissolution of carbonate phase minerals (gypsum, anhydrite) and halites were observed in the groundwater. The coastal aquifers are subject to the continuous influence of seawater mixing, dissolution of minerals, rock-water interaction, and ion exchange processes are major factors, which controls the groundwater chemistry. For the sustainable management and the protection of coastal groundwater resources, should be practiced conservatively during the water scarcity time and during the summer seasons and drought periods.

BENEFITS OF PETROPHYSICAL UNCERTAINTY ANALYSIS IN DETERMINISTIC METHOD USING SINGLE WORKFLOW – A CASE STUDY

Anish Krishnapillai[1], Vivek Ramalingam[2]
1Department of Petroleum Engineering, School of Energy Technology, Pandit Deendayal Energy University, Gandhinagar, Gujarat, 382426, India
Email Id: anish.pphd20@spt.pdpu.ac.in

Production and development of any hydrocarbon reservoir depends on the hydrocarbon in place of that particular field. If we look at the in-place calculation formula, three important parameters like net-gross, porosity and water saturation are the results of petrophysical analysis from well log data. There are generally two kind of petrophysical interpretation which is deterministic and probabilistic approach. In any petrophysical interpretation there is uncertainty on the results due to the parameters used in the equations or even the equation itself. It is often the case where the parameters or the equations used by the interpreter are, based on his experience and knowledge of the reservoir available during the interpretation. This will finally lead to an interpretation with a single value for hydrocarbon in place. However, during the project economic viability study, we need to consider the possible upside and downside of the interpretation. To do this Monte Carlo technique are used to quantify the uncertainties and its impact on the result. Monte Carlo processing involves running a calculation, or a series of calculations, many times, while randomly varying each measurement and parameter within a given statistical distribution, to reflect the analyst's uncertainty in those variables. From this process many results are obtained, showing the range and distribution of possible answers given the uncertainty described.

In most commonly used deterministic approach of petrophysical interpretation, Petrophysicist calculate the formation properties like shale volume, porosity, and saturation in a series of steps. It is possible to run each step in the process many times using different parameters. Monte Carlo uncertainty can be run in two ways while doing the uncertainty analysis for deterministic approach, it is important to understand the difference between both and which one provide better results. In the first approach, it is possible to run each step in the process many times using different parameters. The output from each step will be either a mathematical distribution which closely matches the results or a set of three curves showing most likely, high, and low values for each result. These outputs are then used as an input for subsequent steps in the process. For example, shale volume could be run through a Monte Carlo process, then three versions of the shale volume curve could be used as input for the porosity calculations. In second approach it is possible to run complete deterministic analysis in one step starting from shale volume to saturation in single step and this step can repeated with varying parameters in the range defined and can generate a distribution of output curves.

Another important challenge in uncertainty analysis of well data is whether to run uncertainty analysis for each depth increment or to run for the complete interval. Uncertainty analysis play a crucial role in reserve estimation for visualizing the project economic scenarios. Based on above discussed workflow/ approaches for understanding and addressing the uncertainties, this case study shows single workflow of Monte Carlo provides better estimation on petrophysical results while using deterministic method.

MAPPING OF RESERVOIR PROPERTIES BY INTEGRATION OF SEISMIC ATTRIBUTES AND SEISMIC INVERSION IN ARTIFICIAL NEURAL NETWORK: A MACHINE LEARNING APPROACH

Nitin Verma[1]*, S.P. Maurya[1], G. Hema[1], Ajay P. Singh, Ravi Kant[1]
1Department of Geophysics, Institute of Sciences, Banaras Hindu University, Varanasi-221005, India
Email ID: nvnitin@bhu.ac.in

In the current study, integration of seismic attributes, and seismic inversion in artificial neural networks is performed to predict various petrophysical parameters of the subsurface. This is a machine learning approach that uses a particularly multilayer feedforward neural network (MLFNN) for its implementation. For the analysis, 3D seismic and well-log data from the Blackfoot field, Canada is used. Seismic attributes are the parts of seismic data that are derived directly or indirectly through measurement, computation, and other techniques. These attributes highlight specific geological features or properties of the subsurface. On the other hand, seismic inversion is a process that aims to transform seismic data (reflection amplitudes) into a quantitative representation of subsurface properties, such as acoustic impedance. Machine learning is a subset of Artificial intelligence (AI), which uses an algorithm or computer program to learn about different patterns in data, and then takes that algorithm to improve the accuracy and efficiency of seismic inversion to understand reservoir properties. The present study uses seismic attributes and seismic inversion as input in machine learning and petrophysical parameters are predicted as output. In this analysis, first, seismic attributes are analyzed including amplitude envelope, instantaneous phase, instantaneous frequency, acoustic impedance, etc. After attribute analysis, the training and validation with well-logs for the real field have been performed and finally, porosity volume is generated. Initially, the single seismic trace is used to predict porosity near to well log location which shows a very strong correlation with well log porosity followed by entire seismic volume inversion. The cross-plots between predicted porosities and actual porosities indicate very excellent prediction results. The porosity varies from 5-22% of the region with an anomalous zone present at 1045-1065ms. The analysis of seismic attributes and seismic inverted impedance also shows an anomaly at 1045-1065ms two-way travel time. This anomalous zone is classified as a sand channel (reservoir zone) with probable hydrocarbon. This study provides evidence that subsurface parameters like acoustic impedance or porosity may be promptly and affordably determined using seismic inversion based on machine learning techniques.

NEW INSIGHT AND CONCEPTUALIZATION OF AQUIFER SYSTEM IN SEMI-ARID REGION OF HARYANA, NORTHWESTERN INDIA: IMPLICATIONS FROM HIGH RESOLUTION ELECTRICAL RESISTIVITY TOMOGRAPHY

Dewashish Kumar[1]*, Savita Singh[2], Shailesh Batnagar[2] and Amal Joy[1]
1 CSIR-National Geophysical Research Institute, Hyderabad -500007
2 CGWB North Western Region, Chandigarh
*Corresponding author: dewashishkumar@ngri.res.in

Groundwater is vital for existence of living beings on this planet. Role of the groundwater in large volume of thick alluvium aquifer especially in northwestern India, is critical in terms of groundwater

exploration, prospects, and its availability within the aquifer system. Nevertheless, the near surface water in this semi-arid region was highly exploited in the past and the mankind is regressly shifting towards the deeper groundwater resources. This is an alarming call for the judicious management of groundwater resources for its sustenance. Depth to water table ranges from 18 to 76 m bgl in the alluvium region of six district's developmental blocks in Kurukshetra and Yamunanagar of Haryana state. The wide range of depth to water table variation indicates strong bearing of structural controls and hence necessitates to understand the subsurface geological and hydrogeological settings on a regional scale for cost-effective exploitable groundwater resources and its sustainable management plan. The main thrust is to understand the structural setting of alluvial sand and its implication to the groundwater occurrences in the semi-arid region of northwestern India. The present work presents high resolution electrical tomography study carried out in the alluvial plains lying between different hydrogeological units in parts of Ghaggar and Yamuna basin covering Kurukshetra and Yamunanagar area. The detailed interpretation of resistivity models considering the hydrogeological and geological scenario deciphered buried channel sand (dry sand signature), unsaturated sand, distorted sand structure, clay dominated sand zones, compact sand, recharge conduit source and thick dry sand layer(s). Interestingly, the interpreted resistivity models of Galedwa, Urnai and Pratapgarh clearly revealed highly distorted sand structure(s) and upwelling thick sand indicating presence of neo-tectonic activity. Considering above, hydrogeological interpretation and inferred characteristic zones, subsurface lithology was classified into six distinct classes i.e., clay, sandy-clay, sand with gravel, saturated sand with clay, thick sand and unsaturated sand. The characteristics resistivity of these layers/formations are 1 – 8 Ω.m, 19 – 146 Ω.m, 70 – 164 Ω.m, 3 – 90 Ω.m, 50 – 1500 Ω.m and 30 – 345 Ω.m respectively. Further, the above analyzed depth wise sectional lithologies were interpolated in order to conceptualize the aquifer system in the form of three-dimensional strip-logs, fence and solid models for better regional hydrogeological understanding, development and management of the groundwater resources in the study area.

Keywords: Electrical tomography, Groundwater, Kurukshetra and Yamunanagar, NW India

DETERMINING THE DOMINANT EFFECT OF LITHOLOGY AND GROUNDWATER SALINITY ON AEM RESISTIVITY

K. Bhima Raju[1,2], Penukula Akhil[1,2], Joy Chodhury[1], and Subash Chandra[1,2]
[1]CSIR National Geophysical Research Institute, Uppal Road, Hyderabad-500007, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad- 201002, India
*Corresponding author: bheemusonys@gmail.com

Airborne electromagnetic method has been extensively used for the past few decades for hydrogeological investigations across the globe as well as in India. AEM offers rapid measurements of resistivity over large areas with high data density and high resolution. The AEM resistivity measurement is the cumulative response of the physics and chemistry of the formation. In general, formation is composed of varying compositions with space with varying degrees of porosity, moisture

percentage, and chemical quality of fluid present. For hydro-geophysicists, it becomes of utmost importance to characterize the dominance of the influencing parameter on resistivity for its realistic translation into the hydrogeological model.

A demonstrative study has been carried out on AEM data acquired from the Surat area with about 300 sq.km coverage on the Arabian sea coast, where excessive groundwater pumping is causing seawater intrusion into coastal aquifers. Besides the AEM data, 54 water samples collected from boreholes and dug wells were monitored for in-situ electrical conductivity. Systematic histogram analysis of resistivity with depth has revealed the predominance effect of sand, clay, and saline water on measured AEM resistivity. AEM resistivity is found very well corroboration with groundwater electrical conductivity. The relationship has established a breaking point beyond. The groundwater quality is found with linear relations with AEM conductivity. However, for groundwater, EC exceeding the breaking point (3000 μS/cm), the AEM conductivity is found increasing exponentially. The study revealed that resistivity falling below 3-ohm m is mostly an indication of seawater intrusion. This information has been validated with borehole data and finally used for demarcating lithological predominance i.e. sand, clay, and zones affected by seawater intrusion.

INTERPRETATION OF SUBSURFACE GEOLOGICAL STRUCTURES AND IDENTIFICATION OF FEASIBLE MINERALIZATION POTENTIAL ZONE IN MAHAKOSHAL GROUP OF ROCKS USING GRAVITY AND MAGNETIC METHODS

Ashish Kumar[1*], Kunal K. Singh[1], Mehdi Hasan[1#], Parashar Mishra[1], Gaurav Baruah[2], S. P. Chaubey[1] and Uma Shankar[3]

[1]Geological Survey of India, NR, Lucknow, Uttar Pradesh-226024
[1#]Retired officer from Geological Survey of India, NR, Uttar Pradesh-226024
[2]Geological Survey of India, NER, Shillong, Meghalaya-793006
[3]Department of Geophysics, BHU, Varanasi, Uttar Pradesh-221005
*Corresponding author: ashish.kumar3@gsi.gov.in

The detailed gravity and magnetic survey were carried out in parts of Sonbhadra district of Uttar Pradesh and Sidhi district of Madhya Pradesh. The objective of the survey was to delineate subsurface geological structure and identification of shear zone controlled mineralization. Geologically the study area is mainly occupied by rocks of Mahakoshal and Semri Groups of Palaeo-Proterozoic to Meso-Proterozoic age. The Mahakoshal Group of rocks exposed in the entire southern and central parts is classified into Agori, Parsoi, and Dudhmania formations. A total variation of 25.31mGal has been observed in the Bouguer anomaly with minimum value of -46.86 mGal in the south of Benadah and to maximum value of -21.55mGal in the northeast of Belgadi. The general trend of the contour appears in the south-western part of the area is north-south and in the central, north-western, and eastern part of the study area is the east-west direction. The high gravity anomaly observed in the northwest portion of the study area near and surrounding Belgadi and Hasra and south of Parsoi is due to the high-density body associated with the mafic rock of Agori formation. A significant gravity low has been observed south of Obra Dam railway station due to a graben-type structure surrounded by contacts/lineaments/faults. The magnetic anomaly variation of 3110 nT from -1305 nT near Hasra to 1805 nT in the southwest corner near Dhanbahwa. High magnetic anomaly values observed in the

south-western part of the study area which follow a NW-SE trend may be possibly due to magnetic material present in the rocks at shallow depths over Agori Formation. A significant bipolar magnetic anomaly patch is observed from Belgadi to Phaphrakund showing the presence of the magnetic body. The acquired gravity and magnetic data were also interpreted using different techniques of interpretation i.e. regional-residual separation, horizontal derivative, analytic signal, radially averaged power spectrum, Euler's depth solutions, and 2D modeling. Residual gravity is high in the southwestern part of the area due to high-density material at shallow subsurface depth level. Some contacts/lineaments/faults were observed west of Parsoi, near Phaphrakund and Arangi, west of Obra dam railway station, and west of Ninga nearly N-S direction are very well corroborated with the horizontal gradient, Euler's depth solutions and analytical signal. The analysis of radially averaged power spectrums of gravity data has shown five (5) interfaces at average depths of 3.91 km, 1.15 km, 0.48 km, 0.23 km, and 0.11 km, and four (4) interfaces for magnetic data at 2.27 km, 0.46 km, 0.29 km and 0.15 km which emphasized the structural disturbance in the subsurface. A 2D geological model of gravity anomaly represents the subsurface geological fabric. The gravity high observed near Hasra associated with the low magnetic anomaly can be correlated with the presence of sulfide mineralization for further detailed study.

Key words: Gravity; Magnetic; Interpretation; Mahakoshal Group; radially averaged power spectrum; sulphide mineralization.

OPTIMIZATION OF MODEL INITIATION FOR AEM INVERSION IN ALLUVIUM-COVERED HARDROCK

Penukula Akhil[1,2], Subash Chandra[1,2] and Ved P. Maurya[1,2]
[1]CSIR National Geophysical research Institute, Uppal Road, Hyderabad-500007, India
[2]Academy of scientific and Innovative Research (AcSIR), Ghaziabad-201002, India
[*]Corresponding author: akhilpenukula123@gmail.com

The airborne transient electromagnetics (AEM) method is increasingly employed for various hydrogeophysical investigations globally. CSIR-NGRI has been actively involved in the AEM survey for aquifer mapping and management in diverse hydrogeological settings in India since 2013. The AEM data provide resistivity with depth after detailed processing. As the AEM survey covers a large area consisting of thousands of 1D data, we run inversion of data in batches. In general, the larger area suffers from a high degree of lithological variation in compositions, alteration, and structural discontinuity and hence expected a wide range of resistivity. In such case, taking the initial model for running batch inversion become very crucial and decides the quality of the inversion result.

The present paper describes the result of taking various sets of initial models for homogeneous half-space and its optimization for a more realistic inversion result. The AEM data acquired under the AQUIM pilot project in alluvial covered hard rock area in the Dausa district, Rajasthan are used for the above exercise. We have used laterally constrained inversion for smooth models and a few layer models. The paper also discusses the generation of artifacts as a result of inappropriate initial model input. The inversion results with multiple sets of initial uniform half-space models are compared with borehole resistivity and attempted to establish an approach for optimization of the initial input model for inversion that yields consistent and realistic inversion results.

HYDRO-GEOPHYSICAL CHARACTERIZATION OF AQUIFER SYSTEMS AND MAR AROUND OSSUDU LAKE, PONDICHERRY

Sahebrao Sonkamble*, Erugu Nagaiah, Subash Chandra
CSIR-National Geophysical Research Institute, Hyderabad 500007 India
*Corresponding author: sahebrao@gmail.com

Ossudu lake fed by the Gingee River through the canal is an artificial freshwater body (6.83 km^2) built by the French to serve as a drinking water source to Pondicherry city. Over the years, the lake has evolved into a wetland beset by coastal plains underlain by alluvium clay, limestone, and sandstone formations. These diverse geological settings traversed by lineaments govern the aquifers of varying lithology, and managed aquifer recharge (MAR) phenomenon around Ossudu lake. We perform electrical resistivity tomography (ERT) coupled with hydrogeological survey such as water level, and pH & EC to generate the improved hydrogeological models. In results, the alluvium clay formations showed a three-layer models where top clayey formations act as aquiclude followed by sandy clay as potential aquifer. In limestone formation, the weathered mantle serves potential aquifer zone below clay/shale layer. The Cuddalore sandstone showed semi weathered dry zone followed by highly saturated weathered limestone. Groundwater with elevated EC (3660 µS/cm) in limestone formations shows the enrichment of fertilizer and poor recharge from the lake as confirmed from the lower order resistivity range 5-10 Ω-m. Further, despite dense settlements and open dumping practices in the south and eastern part of the lake, the moderate EC values 764-1373 µS/cm signifies the dominancy of MAR from the lake. Overall the study concludes that the complex aquifer systems with diverse geological formations are continuously recharged by the Ossudu lake and needs to be scientifically managed to achieve the sustainability.

ELECTRICAL RESISTIVITY CHARACTERISTICS OF BEDROCK FRACTURE SYSTEM IN CRYSTALLINE HARDROCK

Joy Choudhury* and Subash Chandra
CSIR - National Geophysical Research Institute, Uppal Road, Hyderabad-500007
Corresponding author: joy8099@gmail.com

Hard rock terrain is hydrogeologically complex and are associated with varied weathered zone thickness and fracture network connectivity. The growing water demand has resulted in depletion of the groundwater from weathered zone and presently the underlying fractures acts as principle aquifers. In such terrains, systematic characterization and precise knowledge of fracture system controlling the groundwater hydrodynamics provides vital input for aquifer delineation and management. The fracture behaviour depends on many parameters like the structural features, lithological characteristics, geometry, density etc. and their connectivity at the local or regional scale controls the storage and overall flow. In general, dense pattern of fractures can be seen in fine grained rocks and usually are limited in length, whereas bigger fractures develop in coarse grained rocks which runs over tens to hundreds of meters long. The sporadic distribution of fractures increases the hydrogeological complexity by many folds and requires scientific intervention for exploration.

The advanced geophysical technique, Electrical resistivity tomography (ERT) which measures the subsurface resistivity distributions and the lateral heterogeneity effect through multiple electrode

arrangement was carried out in Tumkur district, Karnataka to investigate the lithological variability and the associated fractured zones. The study presents 2D subsurface setup of the granitic terrain that helped to identify the fractured zones which are potential groundwater aquifers. The results were validated with the borehole lithologs and video camera logging.

Keywords: Electrical resistivity tomography, Fracture zone, Groundwater, Hard rock.

APPLICATION OF ELECTRICAL METHODS IN MAPPING GRAPHITIC CONDUCTORS AS AN AID TO URANIUM MINERALIZATION ALONG THE SHEAR ZONE IN GEGAL-RAMNER AREA, AJMER DISTRICT, RAJASTHAN.

Prakash Mukherjee[*1], Bibhu Prasad Das[1], Subhash Ram[1], Srinivasulu[2], A. Markandeyulu[2], S.K.Sharma[1], K.Chakrabarti[2], B.Sarvanan[2]

Atomic Minerals Directorate for Exploration and Research, Department of Atomic Energy
Government of India, Jaipur[1], Hyderabad[2]
*Email: prakashmukherjee.amd@gov.in

Geophysical methods have been indispensably applied for uranium mineralization concealed under thick soil. Although direct detection of concealed uranium mineralization by the geophysical methods is not possible, however indirectly these methods can be utilized for detecting subsurface geological features associated with uranium mineralization. The graphitic conductors as well as sulphide rich zones along the structural discontinuities such as faults, shear zones, lithological contacts in Gegal-Ramner area, Ajmer district, Rajasthan is one of such favourable targets for uranium mineralization. In the study area electrical methods like Induced Polarisation (IP), Resistivity and Self potential (SP) methods are utilised to map the graphitic conductors along an inferred shear zone demarcated by geological survey favourable for uranium mineralization. Resistivity and IP data was acquired using Wenner-Schlumberger array which deciphered a high conductive zone trending in $N20^0E$-$S20^0W$ along the inferred shear zone. High chargeability values of the order of 3-4 times the background values of 10 mV/V associated with low apparent resistivity values of the order of 6-7 times lower than the background values of 460 Ω-m were recorded over a width of 250-300 m over a strike length of 7 km. Self-Potential (SP) data was also acquired across the high chargeability and low resistivity zone by total field SP method by keeping a potential electrode fixed at barren ground with station spacing 25 m. The SP response of the order of -110 mV over the inferred shear zone corroborates IP results. Inversion of the IP, Resistivity is carried out and depth to the top of the causative body is estimated as 35 m. SP data was specifically inverted assuming a dipping thin sheet model, using Grey wolf optimization technique and it corroborates IP, Resistivity inversion results. Electrical methods adopted in the soil covered area have successfully brought out the conductive shear zone with the possible presence of uranium mineralization.

GROUNDWATER FLOW MODEL OF A TYPICAL HARD ROCK GRANITIC TERRAIN- A CASE STUDY FROM SE PART OF YADADRI BHUVANAGIRI DISTRICT, TELANGANA, INDIA.

K.Navitha*, B.Madhusudan Rao.
Centre of Exploration Geophysics, Osmania University, Hyderabad.
Corresponding mail id: navithakorepu@gmail.com

A finite difference groundwater model is developed using visual MODFLOW Flex 6.1 for the study area which is a hard granitic terrain in the South East part of Yadadri Bhuvanagiri district, Telangana, India. The area is covering about an area of about 1098 sq-km. comprises of five mandals namely B.Pochampalli, Choutuppal, Valigonda, Atmakur_M, and Mothkur. Due to the increasing population there is an increase in demand of groundwater for agriculture, industrial and domestic purposes resulting in increase of groundwater abstraction. Over exploitation of groundwater resources leads to excessive with drawls reflects serious imbalance of groundwater draft and recharge situation in future. Based on geological, hydrogeological, and geophysical data that were acquired used to construct the conceptual model of the study area to understand the present and future groundwater scenario. The results of the 3D groundwater flow model for three layers is obtained under steady state and transient conditions are compared with the field data. The validation is done by using observed groundwater levels from post monsoon 2010-2014 period and the groundwater flow model was validated with data for the period 2015-2017. For this study purpose 13 wells were selected in the study area and it was observed that the water table values of the validated model were matching with the calculated values. From the predicted model,it is suggested that artificial recharge is to be done in order to increase the groundwater resources in certain mandals such as Mothkur and Athmakur. The groundwater budget was computed from the groundwater flow model for the entire study area using zone budget and model output also provides velocity vectors with direction flow. This model will help future groundwater yield, for planning and protection regarding the groundwater management in the study area.

MARINE GEOSCIENCES

ATMOSPHERIC METHANE FLUXES FROM TROPICAL URBANISED MANGROVES AND THEIR ROLE IN ATMOSPHERIC WARMING

Regina Hershey N. and S. Bijoy Nandan

Dept. of Marine Biology, Microbiology, and Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Cochin 682 016, India

E-mail: mail2reginahershey@gmail.com

Increasing attention is being directed towards the imperative to more precisely regulate the release of atmospheric methane (CH_4) from urbanized tropical mangroves. This focus is driven by the heightened global warming impact of CH_4 and the increasing human-driven activities in these areas. Here we document that urbanized Cochin mangrove stands contribute atmospheric CH_4 within the range of 32 to 289 µmol m^{-2} d^{-1}, with greater fluxes occurring during the pre-monsoon season. The study identified the key factors influencing CH_4 dynamics in various human-impacted mangrove ecosystems. The study also reveals that the primary source of organic matter for CH_4 production is of mangrove origin, followed by contributions from marine algae. This research highlights the potentially substantial yet often overlooked role of urbanized tropical mangroves in the global CH_4 budget.

A SYNTHESIS OF CARBON BURIAL IN THE NORTH-EAST INDIAN OCEAN DURING THE LATE CENOZOIC ERA

Rajeev Saraswat[1]*, Rinu Fathima[1,2], Mohd Salman[1,2], Thejasino Suokhrie[1], S.M. Saalim[1,3]

1 Micropaleontology Laboratory, National Institute of Oceanography, Goa, India
2 School of Earth, Ocean and Atmospheric Sciences, Goa University, Goa, India
3 Department of Geology, Patna University, Bihar, India
* Correspondence: rsaraswat@nio.org

The atmospheric carbon dioxide concentration is an important climatic parameter, as any change in it has far reaching implications on global temperature. The oceans act as a major sink for the atmospheric carbon dioxide. The biologically mediated carbon sequestration in the form of both inorganic ($CaCO_3$) and organic carbon (C_{org}) and its subsequent burial, is the major process for carbon dioxide removal from the atmosphere. A proper understanding of carbon distribution at present as well as under different boundary conditions in the past can help to assess the fate of carbon dioxide in the future. Here, we synthesize the surface and subsurface distribution of carbon (both the $CaCO_3$ and C_{org}) in the fresh-water influx dominated north-east Indian Ocean during the Late Cenozoic. The factors affecting the spatio-temporal variation in carbon burial in this climatically sensitive region have also been discussed. The entire continental shelf and slope region has <10% $CaCO_3$. A significant $CaCO_3$ abundance is in the deeper central north-east Indian Ocean, away from the mouth of major river systems. The low C_{org} on the continental shelf is attributed to the well-oxygenated coarse-grained sediments as compared to the fine-grained sediments on the slope. The highest C_{org} is in front of the Godavari River outfall region. The lowest C_{org} is in the well oxygenated deeper central north-eastern Indian Ocean. The total carbon was highest in the deeper central and equatorial north-eastern Indian Ocean. The highest C_{org}/N ratio is on the shelf in front of the major river systems. The spatial heterogeneity is also evident in the carbon burial since the glaciation. A distinct divergence is, however, observed in both the $CaCO_3$ and C_{org} burial in the upper and lower slope of the north-east Indian Ocean. The $CaCO_3$ content of the sediments decreased in the deep sea and increased on the

shelf, during the last glacial maximum. The C_{org} burial pattern since LGM was opposite with values higher than recent, throughout since LGM. The highest C_{org} content was during the LGM. The basin-wide lowest $CaCO_3$ as well as C_{org} content was during the Greenlandian and Northgrippian. We report a strong influence of grain size, sealevel, proximity to the fresh water influx, terrigenous dilution, dissolved oxygen, water masses and productivity on carbon accumulation in the north-east Indian Ocean.

STRESS DISTRIBUTION IN THE SUMATRA-ANDAMAN REGION BEFORE AND AFTER 2004 MEGA THRUST EARTHQUAKE

Aswin, A. S. Panicker[1], Mahesh, P[2,*]., Dewangan, P[2].
1 Cochin University of Science and Technology, Kochi, Kerala- 682022
2 CSIR-National Institute of Oceanography, Goa -403004, India
*Corresponding author: P. Mahesh (pmahesh@nio.org)
Presentation preferred: aswinanisin01@gmail.com

The 26th December 2004 Sumatra-Andaman mega thrust earthquake (Mw 9.1) caused significant alterations to the in-situ stress. Specifically, the co-seismic stress rotation of the pressure axis, also known as the σ1 axis, led to an increase in the number of seismic events in different segments of the Sumatra and Andaman region. These changes may have long-term implications for the seismic hazard in the region. We try to understand the stress orientation of different segments of the Sumatra and Andaman region using iterative stress inversion of focal mechanisms solutions compiled from Global Centroid Moment Tensor (CMT) catalog and International Seismological Centre (ISC) bulletin from 1976 to 2023. To infer the stress rotation caused by 2004 Sumatra-Andaman earthquake, the stress inversion was performed prior and after major earthquake. The normal faulting has been activated extensively in the Andaman sea and the region east of the Nicobar Islands after the 2004 earthquake. We observed significant changes in the maximum principle stress orientation before and after the 2004 event, along the segments containing the Andaman Islands, Andaman back-arc spreading center and Sumatra coast.

TINY TROUBLE IN TASTY DELICACIES: SOME PRELIMINARY INSIGHTS ON MICROPLASTICS IN SEAFOOD FROM UDUPI, KARNATAKA

Anjali Tamrakar* and Anish Kumar Warrier
Department of Civil Engineering, Manipal Institute of Technology,
Manipal Academy of Higher Education, Manipal, India.
*Corresponding author: anjali2.mitmpl2022@learner.manipal.edu

The presence of microplastics (MPs) in seafood has emerged as a growing concern for its safety. These tiny pieces of plastic, ranging in size from 1µm to 5mm, can enter humans through seafood consumption. In this study, we have investigated the presence of microplastics within the gastrointestinal tract (GIT), gills, and tissue of three commercially significant species: Sardinella longiceps (Indian Oil Sardine; n = 9), Mugil cephalus (Flathead Grey Mullet; n = 3), and Tenualosa ilisha (Ilisha; n = 3). These specimens were procured from the fish market in Udupi, Karnataka, India.

A total of 823 microplastic particles were extracted from the sampled specimens. The most microplastics were found in Tenualosa ilisha, with an average of 25.88 (±43.27) MPs per individual. This was followed by Mugil cephalus, with an average of 21.66 (±31.96) MPs per individual, and Sardinella longiceps, with an average of 4.87 (±17.45) MPs per individual. In all three species, fibrous microplastics were dominant (99.51%), followed by fragments (0.4%) and films (0.1%). Approximately 86 % of the MPs belonged to the size range of 1-5 mm. The colour of the MPs were blue (49.81%), transparent (23.45%), black (9.35%) and red (10.57%). This is the first study which provides baseline data on the presence of MPs in various anatomical compartments such as the gills, gut, and tissue of commercially important species from Karnataka, India. It is estimated that around 2341-8893 microplastic particles are consumed per person per year in Karnataka. It must also be taken into consideration that these depend on factors such as the species consumed and the quantity. The results of this investigation raise concerns regarding the annual dietary intake of microplastic particles by individuals who consume the flesh of the fish. Further research must focus on the impacts of MPs on human beings after their consumption.

ANALYZING AMPLITUDE VARIATIONS WITHIN SEISMIC CHIMNEY STRUCTURES TO GAIN INSIGHTS INTO GAS HYDRATE AND FREE GAS DISTRIBUTION: A CASE STUDY OF THE MANNAR BASIN

C.K. Mishra*, P. Dewangan, G. Sriram
CSIR-National Institute of Oceanography
Corresponding author: cmishra8891@gmail.com

This study's primary objective is to investigate the presence and spatial distribution of gas hydrates and free gas within the Mannar basin, employing a comprehensive analysis that incorporates Amplitude-Versus-Offset (AVO) analysis and attribute analysis. Bottom Simulating Reflectors (BSRs) are particularly interesting within this basin, which are often linked with chimney-like structures. These BSRs serve as indicators of gas movement from deeper reservoirs to shallower subsurface layers, occasionally reaching the seafloor and creating cold seep environments. AVO analysis plays a pivotal role in this research by aiding in the differentiation between gas hydrate and free gas deposits, with a primary reliance on BSR identification. Amplitude data from various horizons were systematically extracted using Common Image Gathers (CIGs). Shuey's approximation is considered to fit the extracted amplitude data to accurately determine crucial AVO parameters, specifically intercept and gradient values. The results of this analysis unveil distinct AVO patterns at various locations within the Mannar basin. Within the chimney structures, we observed Class IV AVO behavior, characterized by a decline in negative amplitudes as offset increases, which indicates the presence of gas hydrates. In the immediate vicinity of these chimneys, we noted Class III AVO characteristics, characterized by an increase in negative amplitudes with offset, providing evidence of free gas presence. Within the chimneys, a negative intercept and a positive gradient distinctly indicate the presence of gas hydrates. In areas with high amplitude reflections extending beyond the primary chimneys, a pronounced negative intercept value (< -0.2) coupled with a highly negative gradient (< -1.5) confirmed the presence of free gas. Furthermore, horizons between the seafloor and the BSR displayed Class IV AVO behavior, indicating the presence of gas hydrates. In summary, the present study provides valuable insights into the distribution of gas hydrates and free gas within the Mannar

basin, leveraging advanced seismic data and AVO analysis. It also underscores the significant role played by chimney-like structures in facilitating gas migration and highlights the effectiveness of AVO attributes in distinguishing between gas hydrate and free gas signatures.

PREDICTION OF ACOUSTIC IMPEDANCE AND POROSITY USING HYBRID OPTIMIZATION OF SIMULATED ANNEALING BASED SEISMIC INVERSION TECHNIQUES

S.P. Maurya[1#] , Ravi Kant[1], Nitin Verma[1], Raghav Singh[1], K.H. Singh[2], Ajay P. Singh[1], Prabodh K. Kushwaha[1], M.K. Srivastava[1], G. Hema[1] , Harsha Raghuvanshi[1] And Richa[1]

[1]Department of Geophysics, Institute of Science, Banaras Hindu University, Varanasi-221005, India

[2]Department of Earth Sciences, Indian Institute of Technology, Bombay, Mumbai-400076, India

[#]Email ID: mauryasatya@bhu.ac.in

The present research introduces a novel approach that combines the strengths of simulated annealing (SA) and the quasi-Newton method (QNM) to predict impedance and porosity in inter-well region. The SA is meant to find potentially global optimum solutions given unlimited time and computational resources while QNM is a local optimization technique that have tendency to optimize local solution if the initial model is not much accurate. To mitigate these limitations and capitalize on their advantages, this study integrates SA and QNM into a single methodology. The idea is to give specific iteration for SA followed by QNM optimization using initial model estimated by former method. The developed technique underwent testing, starting with synthetic data, and then with real data from the Blackfoot field in Canada. The results demonstrate that the inverted impedance closely matches the modelled impedance under the hybrid optimization approach, both for synthetic and real data. Moreover, statistical metrics indicate that the hybrid optimization approach yields excellent results within a reasonable computational time. Specifically, correlation coefficients for the synthetic, real impedance, and real porosity cases are 0.99, 0.84, and 0.75, respectively, while RMS errors are 0.11, 0.26, and 0.36. Furthermore, impedance and porosity volume in inter-well region is predicted which shows very high resolution subsurface information. The impedance varies from 6000m/s*g/cc to 12000m/s*g/cc whereas porosity varies from 5% to 20% of the region. The analysis of the inverted impedance and porosity sections also reveals a distinct anomaly characterized by low impedance (ranging from 6000 to 9000 m/s*g/cc) and high porosity (ϕ>12%) within a two-way travel time window of 1045ms to 1060ms. This anomaly is interpreted as a probable sand channel.

ARRAY OF CARBONATE MOUNDS INDICATE FAULT INDUCED FLUID ESCAPE FEATURES ALONG THE SHELF-EDGE OF THE NORTHERN KONKAN BASIN

Mahale Vasudev[1,2,*], Pawan Dewangan[1,2]

[1]CSIR-National Institute of Oceanography
Dona Paula, Goa-403004, India

[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India

*****corresponding author: vmahale@nio.org

High resolution parametric sonar surveys and multibeam backscatter imagery along the shelf edge of northern Konkan basin located off-Goa coast, has revealed existence of numerous seafloor carbonate

mounds. These features demonstrate a strong backscatter intensity variation as compared to the surrounding region and are very prominent in the backscatter intensity map. Majority of these carbonate mounds are located along the shelf edge. Moreover, the parametric sonar records indicates presence of buried carbonate mounds, that have been draped with newer sediments. This instigated conducting geophysical sparker survey given to it's greater depth penetration capability, over few of these features. Interestingly, this exercise revealed that the mounds have been present over a multiple geologic time scale and were buried during the evolution of the western continental margins. Further, indicating their linkage to faults of deeper horizons. Our findings suggest that these seafloor mounds are of great significance and warrant further investigation to understand their origin.

MACHINE LEARNING REGRESSION MODEL FOR SHEAR WAVE VELOCITY PREDICTION IN GAS HYDRATE BEARING SEDIMENTARY FORMATION OF KRISHAN GODAVARI BASIN.

Pradeep Kumar Yadav, Uma Shankar
Banaras Hindu University, Department of Geophysics, Varanasi- 2210005
pradeepk.yadav10@bhu.ac.in

Shear wave velocity (V_S), being independent of rock-saturating fluid, is an important acoustic wave parameter in various fields of geophysics, rock physics, and geomechanics. The V_S data are generally recorded from the core data in the laboratory or by using Dipolar Sonic Image (DSI) while well-log. It can be useful in lithology identification, pore fluid identification, and ambiguity reduction in seismic interpretations when studied along with P-wave velocity. Its transverse wave nature makes it further applicable in anisotropy identifications. Despite being a valuable variable, the V_S is available in scarcity due to its time taking and costly acquisition process. Further, technical difficulties and unfavorable geological conditions make its acquisition challenging.

Researchers have diligently sought to estimate V_S (shear wave velocity) data, which is of great significance. Historically, they have relied on empirical equations and rock physical models based on different parameters. These equations were originally tailored for consolidated formations with 15% to 40% porosity, primarily filled with fluids. In Area B of KG basin, the geological conditions are distinct. The sediments house gas hydrates (solid material), and they lack consolidation due to their youthful nature. Porosity spans a wide range, from 40% to 90%, with gas hydrates as solid fillers instead of typical fluids. Consequently, estimating VS data in this context poses unique challenges compared to conventional formations where traditional empirical equations were formulated. This study employed Machine Learning Regression (MLR) to predict V_S in unconsolidated sedimentary formations containing gas hydrates in Area B within the Krishna Godavari basin.

OFFSHORE SAND RESOURCES OF KERALA - AN ALTERNATIVE TO SAND CRISIS.

C.V. Gopalan[1], N.M. Shareef[1], A.C. Dinesh[2], C. Jayaprakash[2], S.V. Hegde[3], N. Maran[3] & K.K. Bhat[4]

1.Directors, Geological Survey of India, Mangalore.
2.Directors (Retired), Geological Survey of India, Mangalore & Kochi.
3. Deputy Director Generals (Retired), Geological Survey of India, Mangalore
4.Deputy Director General (Retired), Geological Survey of India, Vizag.
Email- c.gopalan@gsi.gov.in

The Marine and Coastal Surveys Division of GSI has surveyed the Territorial Waters off Kerala since 1985 (Cruises-153, SD-160, SD-207, SD-209, SD-214, SD-224, SD-233, SD-239, SD-254 etc) and a sizable amount of construction grade sand resources were reported from many areas off Ponnani, Chavakkad, Kochi, Aleppey and Kollam at a water depth varies from 22 m to 45m The sand recovered are of good quality and grade where sand percentages vary from 80 to 96. The clay content in the sediment varies from 4% to 20%. The sand includes fine, medium and coarse grains. The silica sand is mixed with clay and carbonaceous matters/peat. The vibro-core samples collected onboard vessel Samudra Shaudhikama were having core lengths varied from 0.5m to 4.0m. The sand resources in these offshore areas up to 4m below seabed were estimated by Arc-GIS software with a resource of 2000 Million Tonnes. Many palaeo-channels and paleo-strandlines were detected during the analysis indicating a marine transgression probably during last LGM (18K Yrs). Sands are of riverine origin which are angular and modified to rounded to sub-rounded by marine activities. Sand can be extracted and be used for construction purposes after removing excess salt content (below 0.075%) by repeated washing. The sand can provide an alternative source to meet the construction material crisis faced by the state Kerala which is needed to meet ongoing construction activities.

The source of these sand bodies is traced to hinterlands of Western Ghats consisting of Charnockites, Khondalites, Gneisses and Migmatites. The sand also contains heavy minerals in traces like ilmenite, monazites, rutile, zircon, garnet, sillimanites etc.

LATE CRETACEOUS AND CENOZOIC PALEOCEANOGRAPHY FROM LACCADIVE POLYMETALLIC CRUSTS, CHAGOS-LACCADIVE RIDGE, ARABIAN SEA, INDIA

Saju Varghese*, Basab Mukhopadhayay, C.V. Gopalan
Geological Survey of India
*Corresponding Author: saju.varghese@gsi.gov.in

Oceanic hydrogenetic ferromanganese (Fe-Mn) crusts are condensed records of seawater evolution through time that can be used for paleoceanographic reconstruction. Here, we present the results of a high-resolution, stratigraphic, textural and geochemical investigation of a core sample, obtained from a Fe-Mn crust pavement, located on the summit of Laccadive Ridge, Arabian Sea. Using cobalt chronometry method, the cumulative growth time of the Fe-Mn crust was determined to be 35 Ma. CLR Fe-Mn crusts grew on phosphorite substrate rock (phosphorite cemented volcanoclastic sediments) indicating explosive volcanic activity till lower Eocene. Following the eruption of the volcanoes in lower Eocene, the CLR subsides, and phosphorite develops as a result of intense upwelling. As the depth of CLR ridge gradually increased until it reached its present level during the late Eocene which trigerred the genesis of CLR Fe-Mn crusts from 35 Ma onwards. CLR Fe-Mn

crusts formed when the North Indian deep-water layer mixed with oxygen-depleted waters from the Arabian Sea, Persian Gulf, and Red Sea. The different layers developed in response to fluctuation in dissolved oxygen during periods of intensified suboxic bottom waters and monsoon maxima associated with past climatic events in the Arabian Sea.

TEXTURAL AND GEOCHEMICAL CHARACTERISATION OF PALK BAY SEABED SEDIMENTS: AN APPRAISAL ON PROVENANCE

Anjaneyulu Katari, G. Nagendran and K. Priya
Marine & Coastal Survey Division, Geological Survey of India, Mangladevi Road, Pandeshwar, Mangalore-575001
e-mail: Anjaneyulu.katari@gsi.gov.in

In the present study, textural and geochemical studies of seabed sediments collected during cruises ST-228, ST-235, ST-236 and ST-237 in the Palk Bay were attempted to constrain its provenance. The sea bottom in the study area is floored by carbonate-rich sand in the near-shore zone (upto 6m) and sandy silt and clayey silt in the relatively deeper zone (upto 13m). Studies of the placer minerals reveal that the ilmenite, sillimanite, garnet and pyroxenes are the dominant mineral constituents. According to SiO_2 versus Al_2O_3/TiO_2 plot, Ce versus La/Yb, Hf versus La/Th plots, the sediments occupy the felsic domain. Comparatively, light REEs (LREEs) contribute to REE content than heavy REEs (HREEs). The LREE/HREE ratios of sediment samples are high, which indicate that the source rocks are felsic. Normalized REE patterns also reveal LREE enrichment with a Eu negative anomaly in most of the studied sediments, which again points towards its felsic source. By analysing the major oxides, trace elements and REEs, we conclude that the sediments are originated from granulitic provenance comprising of felsic rock like khondalite, charnockite and granite gneisses and transported through the Vellar, Koluvan, Pambar, Kottakarai and Uppar Rivers, and finally deposited as continental shelf sediments by current action, forming sand banks and submerged shoals in the Palk Bay.

TRACE METAL VARIABILITY AND ECOSYSTEM RISK ASSESSMENT IN THE SEDIMENTS OF MANGROVES OF KERALA

S Sreelekshmi and S Bijoy Nandan
Department of Marine Biology, Microbiology and Biochemistry, Cochin University of Science and Technology
Correspondence: sreelekshmis1987@cusat.ac.in

The study investigated trace metal accumulation in the sediments of three major mangrove ecosystems of Kerala state, Munroe Island, Ayiramthengu and Vypin and the ecological risks they pose, as these systems are heavily impacted by anthropogenic interventions. The findings of the study revealed that the mean trace metal concentrations recorded were in the following order: Cr>Zn>Cu>Mn> Pb>Ni>Cd>Ag. The metal concentrations recorded were above the ERL standard, indicating little impact on the ecosystems. Cu and Cr concentrations at Munroe Island and Ni in Vypin, however, exceeded the ERM, indicating a detrimental risk to biota in the sediments. Principal component analysis and higher geo-accumulation index indicated the contribution of trace metals

from industries, agricultural run- off and urban waste disposal. The ecological risk index suggested that cadmium poses a very high risk to the mangrove ecosystem at Vypin. The bioconcentration and translocation factors of various trace metals for different mangrove species revealed that Avicennia marina could be a promising candidate species for the bioremediation of trace metals in the coastal settings of Kerala state.

UNRAVELLING THE SEASONAL MICROPLASTIC TRENDS IN THE TROPICAL MANGROVE WATERS OF SOUTH-WESTERN INDIA

Gokul Valsan[a*], Anish Kumar Warrier[a], S. Anusree[c], Anjali Tamrakar[a], Nelson Rangel-Buitrago[c]

[a]Centre for Climate Studies, Department of Civil Engineering, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal, India.
[b]Department of Sciences, Manipal Institute of Technology, Manipal 576104, Karnataka, India.
[c]Programa de Física, Facultad de Ciencias Básicas, Universidad del Atlántico, Atlántico, Colombia
Presenting author email: gokul.valsan1@learner.manipal.edu

Mangroves constitute a critical ecosystem, serving as a protective interface between terrestrial and marine environments. This distinctive habitat hosts a diverse array of plant and animal species. The vulnerability of this delicate ecosystem is significantly exacerbated by human activities that disturb its natural equilibrium through the introduction of various pollutants. Microplastics ranging in size from 1µm to 5mm have emerged as a prominent and extensively documented contaminant of concern. Yet there exists a notable scarcity of research pertaining to the extent of microplastic contamination within mangrove blue carbon ecosystems, particularly in the Indian context.

In this study, we present the preliminary results on the seasonal fluctuations in microplastic concentrations, specifically within the size range of 0.1mm to 5mm, in tropical mangroves located in Kota, South-Western India. The findings reveal an average concentration (±SD) of 1.42 ± 0.92, 0.62 ± 0.38 and 0.19 ± 0.08 microplastics per litre during the post-monsoon (December 2021), pre-monsoon (April 2022), and monsoon seasons (September 2021), respectively. Fibrous microplastics were the most prevalent category detected in all the samples, and microplastics smaller than 1mm in size dominated the samples. Fourier Transformed Infrared Spectroscopy with Attenuated Total Reflectance identified the presence of various polymers, including polypropylene (PP), polyethylene terephthalate (PET), high-density polyethylene (HDPE), low-density polyethylene (LDPE), polystyrene (PS), and polyvinyl chloride (PVC), in the collected samples. The sources of microplastic contamination in this region are attributed to tourism, industrial activities, marine product import and export, prawn farming, and residential areas. This study contributes essential insights into comprehending the seasonal dynamics of microplastic pollution within the Kota mangrove blue carbon ecosystem.

A PRELIMINARY STUDY ON THE VERTICAL DISTRIBUTION OF MICROPLASTICS IN THE WATER COLUMN OF THE NETHRAVATHI ESTUARY, KARNATAKA

Vishnu Unnikrishnan[1]*, Anusree[1], Gokul Valsan[1], Manu Martin Paul[1], Anish Kumar Warrier[1,2]

[1] Department of Civil Engineering, Manipal Institute of Technology, Manipal Academy of Higher Education, Manipal 576104, Karnataka, India

[2] Centre for Climate Studies, Manipal Academy of Higher Education, Manipal – 576104, Karnataka., India

***** Correspondence: vishnu.u@manipal.edu

Microplastics (MPs) are a new class of emerging pollutants that has become a cause of concern for the society. It is ubiquitous and has been reported from different environmental matrices within India. However, there is sparse knowledge on the processes controlling the vertical distribution of microplastics in the estuarine environments of India. In this study, we present the preliminary results of the work conducted to identify the distribution of microplastics in the water column and bottom sediments of Netravati-Gurupura Estuary, situated on the south west coast of India. Microplastics (MPs) was observed in all the water and sediment collected from the Netravati-Gurupura estuary with an average abundance of 815.48 (±381.51) particles/m^3 and 222.47 (±161.74) particles/kg respectively. Modified NOAA laboratory methods were used for the separation of microplastics from the sample. In case of water samples 0.1mm -0.3 mm microplastics were high in number with an average abundance of 63.09 % (±7.93%) compared to 0.3 mm- 1mm (32.94%) and 1 mm-5 mm (3.96 %) sizes. Microscopic identification of MPs in water samples showed fibres were more predominant with 92.25 % (±7.75%) with film (3.01 %), fragment (3.83 %), pellets (0.7 %) and foam (0.19 %) constituting the remaining percentage. In terms of colour of microplastics, Transparent (35.44 %), Black (31.6%) and Blue (23.73%) were found high in number in the water column. In the case of sediment samples, MPs with 0.1mm -0.3 mm microplastics were high in number with an average abundance of 67.7 % (±7.77%) compared to 0.3 mm- 1mm (28.19%) and 1 mm-5 mm (4.11 %) sizes. Microscopic identification of MPs in sediment samples showed fibres were more predominant with 95.52 % (±7.85%) with film (1.75 %), fragment (2.2 %), pellets (0.47 %) and foam (0.05 %) constituting the remaining percentage. In terms of colour of microplastic Transparent (37.1 %), Blue (34.4%) were predominant in bottom sediments. The increased amount of small sized MPs is a result of the longer residence time of large-sized plastics in the water column allowing it to disintegrate into tiny MPs. More studies are in progress to determine the polymer composition of the MPs that will help us in determining their origin.

ATMOSPHERIC, PLANETARY AND SPACE SCIENCES

DIURNAL VARIABILITY AND TREND OF SUMMER MONSOON RAINFALL DURING PAST 22 YEARS OVER WEST COAST OF INDIA

P. Ancy[1], C. A. Babu[1] and H. Varikoden[2]
[1] Department of Atmospheric Sciences, Cochin University of Science and Technology, Kochi
[2] Indian Institute of Tropical Meteorology, Pashan, Pune - 411 008, India.
Presenting Author's Name: Ancy P.
E-Mail: ancyp.cca@gmail.com

West coast of India receives good amount of monsoon rainfall due to the orographic lifting associated with Western Ghats and moisture transport from the Arabian Sea. However, the rainfall amount is not uniform throughout the entire West coast. Here, diurnal variation in rainfall amount, frequency, intensity as well as contribution during summer monsoon period was studied using TRMM 3 hourly precipitation data. Since the rainfall pattern behaves differently, the analysis was carried out in Southern, Central and Northern sub regions separately. As the West coast of India poses uneven terrain features, these sub regions are further divided into coastal (0 to 20 m), midland (>20 to 75 m) and highland (>75 m) regions based on elevation. Rainfall amount is the total rainfall per total observational hours, rainfall intensity is the total rainfall per total precipitating hours, rainfall frequency is the ratio of number of rainfall events at each hour to total number of events in percentage and the rainfall contribution is the ratio of total rainfall at each hour to the total rainfall in percentage. In general, bimodal variation with late afternoon and early morning peaks are found over coastal and midland regions in rainfall frequency, amount and contribution. However, highland regions exhibit unimodal variation with a single late afternoon peak. Rainfall intensity exhibits a different pattern compared to other parameters over South and Central midland regions with a unimodal variation. Rainfall intensity increases from South to North. Among the subsections, maximum rainfall intensity is found over midland and minimum is over highland regions. Over coastal and midland regions, rainfall frequency and contribution during evening hour is decreasing and during morning hour it is increasing. The diurnal pattern of rainfall over the west coast shows a remarkable spatial variation due to change in topography and moisture transport.

GPR INVESTIGATIONS FOR UNCOVERING FOSSIL-BEARING STRATA IN QUATERNARY SEDIMENTS, CUDDAPAH BASIN, INDIA

Sakram Gugulothu[1,2*], Shanthosh S[1, 2], Anil Kumar Devara[3], Vrushab Mahesh[3], Prabhin Sukumaran[4] and Anand Kumar Pandey[1,2]
[1]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad 500007, Telangana, India.
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India
[3]Department of Archaeology and Ancient History, The Maharaja Sayajirao University of Baroda, Vadodara – 390 002, Gujarat, India
[4]Dr. K. C. Patel Research and Development Centre, Charotar University of Science and Technology, in Anand, 390 002 Gujarat, India
*Corresponding author: sakram@ngri.res.in

The Quaternary strata developed due to the erosional-depositional cycle in the Kadapa basin region are rich in fossil-bearing horizons. However, their discoveries are often chance findings, despite their tremendous potential in understanding paleoecology, evolution trajectories, and past adaptive skills and subsistence in the paleoenvironments. Geophysical methods, such as Ground Penetrating Radar

(GPR) with a wide range of utility in geological investigations work on the principle of electrical permittivity and dielectric contrast of the buried materials as a proxy to locate the shallow subsurface features. The present study hypothesized that the fossil-bearing strata in Quaternary sediment would provide a distinguishable signature due to the difference in physical properties of the fossil-bearing soil layers from the ones devoid of fossils. The GPR study has been conducted in the Manneru River Basin near Prakasam in the Cuddapah Basin, Andhra Pradesh, where rich well-preserved fossils have been recorded in the recent past. A series GPR grid survey was conducted in three localities covering a cumulative profile in a 423 sq. meter area. The acquired data has been further analyzed for 2D and 3D visualization using Radan 7 software. The current paper discusses potential fossil-bearing zones identified from the survey. The zones identified include worn and semi-weathered particle zones, weak zones, and cavity zones up to 5m below the topsoil. The data acquired here provides a basis for future investigation and excavation, with the potential to reveal the rich paleontological history buried under the surface.

STUDY OF VERTICAL DISTRIBUTION OF OZONE USING OZONESONDE

Anurag S.S., Aswini Thampi S.L. and Prince P.R.
Department of Physics, University College, University of Kerala, Thiruvananthapuram-695034, Kerala, India
anuragsajeev1999@gmail.com , aswinithampislppd@gmail.com and princerprasad@gmail.com

The atmosphere is essential for supporting life on Earth, providing the necessary gases for respiration and regulating the planet's temperature. The ozone layer within the atmosphere acts as a crucial protective barrier, shielding the Earth from harmful UV radiation and preventing potential health risks and ecological imbalances. The distribution of the ozone layer over the southern and northern hemispheres during winter and summer seasons is primarily influenced by the Earth's tilt and the resulting variations in sunlight exposure. The distribution of the ozone layer between January 2022 and August 2022 at three stations located at various latitudes has been observed and the distribution over the southern and northern hemispheres has also been analysed using various NOAA ozonesonde data. It was discovered that the northern hemisphere's ozone layer is more concentrated in the summer than it is in the winter. However, in the southern hemisphere, the summertime ozone concentration is much lower than the wintertime ozone concentration.

VARIABILITY IN THE EQUATORIAL ELECTROJET DUE TO THE SOLAR MIGRATING TIDES

Divyanshu Dwivedi*, N. Phani Chandrasekhar and Kusumita Arora
Geomagnetic Observatories, CSIR-National Geophysical Research Institute, India
Email: ddwivedi@ngri.res.in

Earth’s lower atmosphere generates daily ionospheric variation during geomagnetic quiet times. Atmospheric waves such as solar and lunar tides, planetary waves, and gravity waves likely cause ionospheric currents that cause daily variations in the geomagnetic field. Among these atmospheric waves, solar migrating tides have significant amplitudes. The vertically propagated migrating diurnal and semidiurnal solar tides affect the Equatorial electrojet (EEJ), and the counter electrojet (CEJ)

associated with the variability in the solar radio flux. However existing studies indicate no significant correlation between tidal effects on geomagnetic data and solar activity.

In this study, we determine the daily characteristics of EEJ and CEJ signatures from equatorial observatory (ETT) in Indian sector over two decades (1980-2002). The EEJ is influenced by diurnal tidal (DW1), semi-diurnal (SW2), ter-diurnal (TW3) and quarta-diurnal (QW4) amplitudes by 46.7%, 28.5%., 17.1%, and 7.5% respectively. These tidal amplitudes are found to be maximum in equinox in comparison to solstices and follow the solar cycle patterns. The instances of strong, moderate and weak Pearson correlation are observed between solar radio flux (F10.7) and the four tidal amplitudes during different phases of solar cycles (21-23) highlighting that the characteristics of each solar cycle are unlike each other. The discrepancy between the ground observatories and the EEJM-2.0 model may provide constraints on the role of other atmospheric processes on the EEJ.

EVIDENCE FOR THE ROLE OF LOWER ATMOSPHERIC LARGE-SCALE WAVE PERTURBATIONS ON THE LONGITUDINAL BAND-LIKE APPEARANCE OF EQUATORIAL IONIZATION ANOMALY

Aswathy R P and Anandu V
Department of Physics, University of Kerala, Thiruvananthapuram, India
Aswathyrp872@gmail.com

The Ionospheric Connection Explorer (ICON) observations of the F- region plasma density reveal the band-like manifestation of the Equatorial Ionization Anomaly (EIA) in the global context, for the vernal equinox season of 2020. Two bands of intense EIA are present at (180^0E-280^0E) and (310^0E-120^0E) longitude sectors. Spectral analysis of F-region zonal neutral wind establishes the presence of large-scale wave structure which is not co-located with the EIA band pattern. Thermosphere Ionosphere Mesosphere Energy and Dynamics (TIMED) satellite observations of the zonal neutral wind at the southern conjugate E-region where the equatorial F-regions are magnetically linked, reveal the presence of two intense wave bands, which are exactly co-located with the crests and troughs of the global band pattern of EIA. Modern Retrospective Analysis for Research and Applications Version 2 **(**MERRA-2) derived temperature at 0.3 hPa exhibits two enhancements corresponds to the longitudes where the intense EIA bands are observed. These observations provide the evidence for the first time, that the lower atmospheric waves reach up to E-region and the subsequent coupling via the magnetic field lines causes the observed band-like global pattern of EIA.

COMPARATIVE ANALYSIS OF EQUATORIAL COUNTER ELECTROJETS SIGNATURES: SWARM SATELLITE VS. GROUND OBSERVATIONS IN THE INDIAN SECTOR

Archana R.K and Kusumita Arora
CSIR-National Geophysical Research Institute, Hyderabad, India
Corresponding author: archanamgp.ngri@gmail.com

Using geomagnetic H component data from Swarm A and C satellites, signatures of Equatorial electrojets (EEJ) have been identified in the Indian sector for 2014 and 2015. A recent study based on ground observations from the Indian sector reported a significant difference in the amplitudes of EEJ

and occurrence pattern of Counter Electrojets (CEJs) at Tirunelveli (TIR) while deriving Equatorial electrojet (EEJ) using Solar quiet time current variations (Sq) from the northern and southern hemispheres, Hyderabad (HYB) and Gan (GAN) respectively. This study compares the amplitudes of CEJs identified in the Swarm A-C satellites using the CHOAS-7 model, with the amplitudes of the CEJs derived using the TIR-HYB pair and TIR-GAN pairs. The EEJ and CEJ derived from Swarm are obtained by considering Sq from both hemispheres, thus minimizing bias towards the Sq of one hemisphere. The observations from the study reveal that the CEJs derived using TIR-GAN correlate better with the observations from Swarm than those from the TIR-HYB pair. The results indicate that the southern Sq current may contribute more to the EEJ in the Indian sector than the northern Sq current system

ESTIMATION OF JOULE HEATING DURING INTENSE SUBSTORMS OF SOLAR CYCLE 24

Devi R Nair* and Prince P.R
Department of Physics, University College,
University of Kerala, Thiruvananthapuram-695034, Kerala, India
Email: deviarnair@yahoo.com

Eleven intense geomagnetic substorms (AL<-2000nT) of solar cycle 24 has been selected for substorm energetics study. The solar wind energy coupled to the magnetosphere during these events was estimated as the time integral of epsilon parameter from SuperMag magnetometer. These ranged from 2%-14% of the solar wind energy input. For substorms with coupling efficiency greater than 100%, the majority of the energy dissipation was through joule heating (JH) process. Contribution of energy input to the magnetospheric joule heating during unloading process has been estimated using different auroral indices as well as from Open Geospace General Circulation Model (OpenGGCM). JH estimated using former method was about 14% to 97% of solar energy coupled to magnetosphere while 14% to 61% was obtained from OpenGGCM model. 2% to 13% of SW energy coupled to MI system got dissipated as local JH (using auroral local index, IL) while total local to global JH ratio ranged between 4% to 57% (4% to 41% when AE index was replaced with SME index).

ANALYSIS OF JANUARY 15,2022 TONGA ERUPTION TRIGGERED IONOSPHERIC DISTURBANCE BASED ON GPS AND SWARM MISSION DATA

***Aswini Thampi S.L., Sreebala P.S. and Prince P.R.**
Department of Physics, University college, University of Kerala, Thiruvananthapuram-695034, Kerala, India
* aswinithampislppd@gmail.com, pssreebala@gmail.com & princerprasad@gmail.com

A massive eruption of Hunga Tonga–Hunga Ha'apai volcano on 15 January 2022 left its footprint as various perturbations in the atmosphere and ionosphere. Equatorial plasma bubbles are a phenomenon of plasma density depletion with small- scale density irregularities, normally observed in the equatorial ionosphere. This phenomenon, which impacts satellite-based communications, after the largest-on-record January15,2022 eruption of the Tonga volcano. Present study focuses on the investigation of ionospheric TEC perturbations and plasma density variations triggered by Tonga volcanic eruption in selected locations. We analysed ionospheric disturbance following

volcanic eruptions using global positioning system (GPS) and Swarm satellite mission observations to demonstrate that an air pressure wave triggered by the Tonga volcanic eruption could cause the emergence of an equatorial plasma bubble. The total electron content (TEC) measurements obtained from dual frequency GPS receivers are one of the most important methods of investigating the earth's ionosphere. The intensity of the volcanic eruption and the background ionospheric conditions determine the magnitude of ionospheric responses. Ionospheric TEC variations are due to the formation of acoustic shockwave and atmospheric lamb waves. The most remarkable observation result shows a sudden increase of electron density] of the ionosphere several ten minutes to hours before the arrival of the air pressure wave in the lower atmosphere. After the ionospheric perturbations, plasma density depletion appeared in the equatorial and low-latitude ionosphere. This study applied GPS observation data and SWARM mission data to monitor ionospheric disturbances caused by the volcanic eruption in 2022, demonstrating the sensitivity of the ionosphere to volcanic eruptions.

VHF RADAR OBSERVATIONS OF TROPOSPHERE-IONOSPHERE COUPLING DYNAMICS OVER A NEAR- EQUATORIAL STATION, COCHIN

Rakesh V.*, Sreekumar H., Abhilash S., Manoj M. G. and Binu Paul

*Advanced Centre for atmospheric Radar Research (ACARR),
Cochin University of Science and Technology (CUSAT), Cochin-22
*rakesh.acarr@cusat.ac.in

The troposphere is the lowest layer of Earth's atmosphere, extending from the Earth's surface up to an average altitude of about 8-15 kilometers, where weather occurs, and it contains most of the Earth's atmospheric mass. The ionosphere is a region of Earth's upper atmosphere that contains charged particles, or ions ranges from 80 km and extends upward into space. The ionosphere is important for various radio wave propagation, communication, and navigation systems because it can refract and reflect radio waves. The coupling between the troposphere and ionosphere refers to the interaction and interplay between these two atmospheric layers. Tides in the troposphere can create atmospheric waves that propagate upward into the ionosphere. These waves can affect the density and behaviour of charged particles in the ionosphere. Gravity waves generated in the troposphere due to factors like weather disturbances can propagate into the ionosphere. These waves can lead to irregularities in the ionosphere. These interactions can affect radio wave propagation, GPS signals, and other communication and navigation systems. When the troposphere and ionosphere are coupled, it can lead to signal disruptions or enhanced signal propagation, depending on the specific conditions. Understanding the coupling between the troposphere and ionosphere is important for various applications, including space weather forecasting, radio communication, and navigation systems. Researchers and scientists study this interaction to better predict and mitigate the effects of space weather on Earth's technology and infrastructure.

This paper explores the operational capabilities of a VHF radar system operating at 205MHz, installed at the Advanced Centre for Atmospheric Radar Research (ACARR), Cochin University of Science and Technology (CUSAT) in the Cochin coastal region(10.04N, 76.33E). Originally designed for monitoring 3D wind components within the troposphere and lower stratosphere, with a vertical range from 315m to 20km, this radar has demonstrated versatility beyond its primary purpose. It can detect

signals originating from the ionosphere due to space weather events. At a later stage, the radar signals were also recognized as originating from tropospheric events, encompassing a wide range of natural phenomena, including volcanic eruptions, thunderstorms, and seismic activities like earthquakes. Our research aims to comprehensively analyze the influence of tropospheric events on the ionosphere, using the specific VHF radar installation at CUSAT as a reference. This analysis yields valuable insights into the impact of various tropospheric events on the ionosphere, deepening our understanding of atmospheric layer coupling. It underscores the radar's multifaceted role in monitoring both space and terrestrial weather events, emphasizing its broader scientific and practical significance.

CO-SEISMIC IONOSPHERIC PERTURBATIONS ASSOCIATED WITH THE 06 FEBRUARY 2023TURKEY EARTHQUAKES

Sunil A. S.[1], P. S. Sunil[1], M. S. Rose[1], K. M. Sreejith[2], and Mahesh N Shrivastava[3]
[1]Department of Marine Geology and Geophysics, School of Marine Sciences, CUSAT, India
[2]Geosciences Division, Space Applications Center (ISRO), Ahmedabad, India
[3]Department of Geological Sciences, Universidad Católica del Norte, Antofagasta, Chile
Email: sunnil.as@gmail.com

Co-seismic Ionospheric Perturbations (CIP) are ionospheric electron density disturbances caused by mechanical waves generated during large magnitude earthquakes. This study investigates the CIP and ground deformations associated with the two consecutive earthquakes of magnitude Mw 7.8 and Mw 7.5 that occurred in Turkey on 06 February 2023. The crustal deformation is estimated from GPS and InSAR data, and the ionospheric disturbances are detected from GPS Total Electron Content (TEC) measurements. The results show that the earthquakes caused significant ionospheric electron density perturbations, with the amplitudes being notably higher for the Mw 7.5 event, despite its lower magnitude. Moreover, the ionospheric signals show directional asymmetry and are more pronounced towards the south of the epicenter. The study also examines the effects of geomagnetic field and background ionization on the evolution of CIP. To quantify the influence of geomagnetic field, a metric called the "geomagnetic coupling factor" is introduced. This reveals a higher coupling factor towards the south of the epicenter, indicating a greater likelihood of CIP evolving in that direction. However, the crucial role in determining the amplitude of CIP is played by the ambient electron density of the ionosphere, which tends to increase with higher ionization levels. It is found that the ambient ionization was significantly lower during the first earthquake, potentially explaining the lower amplitudes of CIP in that event. The study demonstrates the potential of multi-faceted analysis of ground and ionospheric observations for better understanding of earthquake processes and impacts.

ON THE CORRESPONDENCE BETWEEN SOLAR RADIATION, SOLAR FLARE LOCATION, AND IONOSPHERIC RESPONSE

Sreeraj M S and Sumod S G
Space Science Group, Department of Physics, Sacred Heart College, Thevara, Kochi – 682013
Corresponding email: sumod.sg@shcollege.ac.in

This study investigates the spatio-temporal variability of flare-induced ionospheric Total Electron Content (TEC) for the entire Solar Cycle 24. A total of 49 X-class solar flares that occurred during the

period are analyzed. In order to characterize the flare radiations in detail, SOHO measured EUV in the wavelength range 26-34 nm along with X-ray in the region 0.1-0.8 nm are considered. The TEC data from the International GNSS Service (IGS) network has been utilized to address the global ionospheric changes associated with these flares.

Initial analysis shows significant EUV and X-ray enhancements at flare peaks. However, the correlation between radiation enhancements (ΔEUV and ΔX-ray) shows a non-linear trend, with a correlation coefficient of only 0.6. Nevertheless, this correlation strengthens to 0.87 when the product of ΔX-ray and the cosine of central meridian distance (CMD) are considered. This revealed the impact of solar flare location on EUV flux compared to X-ray flux. The relation between solar radiation and ionospheric TEC enhancements (ΔTEC) has also been explored. The correlation between ΔTEC and ΔX-ray is weak with a coefficient of 0.45 but strengthens to 0.93 when considering ΔX-ray×cos(CMD). A strong correlation of 0.85 is observed between ΔTEC and ΔEUV. This reveals that ΔX-ray×cos(CMD), rather than ΔX-ray alone, better represents ionospheric TEC enhancements, emphasizing the dependence of ΔTEC on the solar flare's central meridian distance. The study is critical, particularly in view of space weather predictions and in improving the accuracy of communication-navigation systems such as GPS.

PALEO-SEISMOLOGY OF THE MOON AND MARS

P. Senthil Kumar*
CSIR-National Geophysical Research Institute, Hyderabad – 500007
*E-mail: senthil@ngri.res.in

Apart from Earth, Mars and Moon are only planetary bodies where quakes were recorded by the seismometers placed on the planetary surfaces. These quakes provided important insights into the ongoing seismo-tectonic processes, encompassing the last 60 years. However, the seismic activities that occurred in the past few million years have been gleaned from the geological records. In this presentation, I provide a review of work carried out by our research group on this topic. On the Moon, our study of Schrodinger, Lorentz and Orientale basins revealed recent tectonic activities in the form of young thrust faults, namely, lobate scarps. Similarly, the south polar region of the Moon developed hundreds of young lobate scarps. These faults were formed in the last 10-100 million years. The paleo-moonquakes along these faults produced significant seismic ground motion that triggered formation of co-seismic landslides and boulder avalanches. The seismic ground motion originating from these faults are potential hazard to the future human and robotic missions. Global contraction along with the Earth-Moon tidal forces contributed to recent tectonics and seismicity on the Moon. On the other hand, on Mars, seismicity is largely concentrated in and around 4 billion years old Tharsis and Elysium volcanic provinces. Our mapping of young faults (both normal and thrust faults) and thousands of co-seismic boulder avalanches and landslides in the vicinity of these faults suggested paleo-seismic activities contributed by both tectonics and magmatism. Active mantle plumes beneath Tharsis and Elysium volcanoes are the major drivers of geodynamics in Mars.

ABNORMAL WEATHER (HEAT WAVE) CONDITIONS IN PENINSULAR INDIA AFTER 2015 NEPAL SEISMIC EVENTS

A. Akilan 1 *, K. K. Abdul Azeez 1, Gunda Goutham Krishna Teja 2 , and H.V.S. Satyanarayana1

1CSIR-National Geophysical Research Institute, Hyderabad- 500 007, India
2 Indian Institute of Remote Sensing, I.S.R.O., Dehradun -248001, India.
*corresponding author: akilan@ngri.res.in

The southern Indian region experienced unusual heatwave conditions a couple of weeks after the 2015 Nepal earthquake (M7.8) sequence. Here, we analyse a possible linkage between these natural phenomena using atmospheric parameters observed over Hyderabad in South India and Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) modelling studies. Our HYSPLIT models showed atmospheric mass and air movement towards the Eastern coast of India, the Bay of Bengal. A previous HYSPLIT study has shown air mass movement from the Bay of Bengal region to the Nepal region, where a significant increase in atmospheric precipitation and rainfall happened immediately after the 2015 earthquake occurrence. Combining the above observations, we infer that the low pressure generated at the epicentral region attracted the air masses from the surrounding region, i.e., from the Bay of Bengal and Southern India. As a consequence, cloud-free conditions developed that are favourable for higher levels of solar radiation penetration into the South Indian granulite terranes. Granitic rocks can absorb and retain excessive solar heat received for extended periods. It can dissipate the heat slowly into the atmosphere at relatively colder conditions at night. This process may result in the heat wave conditions experienced in the Southern states as an aftermath of the 2015 Nepal earthquake.

FLOOD SUSCEPTIBILITY MAPPING IN KARWAR TALUK, UTTARA KANNADA DISTRICT OF KARNATAKA, USING INTEGRATED REMOTE SENSING AND GIS APPROACH

Ananda Krishnan[1], S. G. Dhanil Dev[1*], S. Arjun[2], V. Deepchand[1], P. K. Krishnaprasad[1]

[1]Department of Geology, University of Kerala, Thiruvananthapuram-695581
[2]Seismotectonic Department, National Institute of Rock Mechanics, Bangalore 560070, India
[*]Correspondence email: dhanildev@keralauniversity.ac.in

Floods are a recurrent major disaster in Uttara Kannada, primarily due to the exceptionally high annual precipitation in the region. Using remote sensing data and GIS techniques, this study aims to create flood susceptibility maps for selected subbasins of the Kali River in Karwar taluk, Uttara Kannada district. Karwar and Kadra have been identified as one of the districts in Uttara Kannada most susceptible to flooding. The purpose of these flood risk maps is to increase public awareness. As inputs, various factors, including elevation, slope, distance from the river, precipitation, flow accumulation, stream density, soil types, water ratio index, land use/land cover, topographic wetness index, and stream power index, have been selected. The final maps of flood susceptibility are divided into five zones ranging from extremely low to extremely high. The prevalence of flooding in the study area can be attributed to increased siltation, human-induced reduction in stream width, changes in land cover and land-use patterns, gentle slopes, elevated soil moisture levels, reduced stream capacity, and insufficient soil infiltration capabilities. The accuracy of the prepared maps was evaluated using

the receiver operating characteristic (ROC) curve method. The area under the ROC curve (AUC) values of 0.82 for the AHP method are regarded as acceptable and excellent. This verifies the predictive capability of the maps generated. Approximately 14.87 percent of the study area comprises the highly susceptible zone. This map provides urban planners and policymakers with valuable insights, enabling them to devise strategies to mitigate the impact of future flood hazards and minimise damages.

INTEGRATING BAND RATIONING, AHP AND GIS APPROACH FOR IDENTIFICATION OF GROUND WATER POTENTIAL ZONES OF MAHI RIVER BASIN (MRB), INDIA.

Shanthosh S[1, 2]*, Sakram Gugulothu[1,2], Pradeep Kumar Badapalli[3], and Nilesh Kumar Jaiswara[1]

[1]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad, 500007, Telangana, India.
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India.
[3]Department of Geology, Yogi Vemana University, Kadapa, Andhra Pradesh, 516005, India.

Complex interaction of environmental, topographical, and variable aquifer behavior affects the availability of groundwater in semi-arid and dry areas, where delineation of Groundwater Potential Zones (GWPZs) of utmost importance. We integrate a novel combination of RS, AHP, and GIS techniques to delineate GWPZs in the Mahi River Basin, offering a robust approach compared to existing methodologies in similar semi-arid settings. The results are validated through a comparative analysis with existing case studies in similar semi-arid settings, showcasing its distinctiveness in groundwater potential assessment. We combined Remote Sensing (RS), and the Analytical Hierarchy Process (AHP) in geographic information system (GIS) to identify and assess GWPZs in the Mahi River Basin on Western India. The thematic layers on Geology, Geomorphology, Lineament Density, Slope, Drainage Density, Land Use and Land Cover (LULC), and Satellite-based Vegetative and Water Indices such as the Normalized Difference Water Index (NDWI), Normalized Difference Vegetation Index (NDVI), Top Soil Grain Size Index (TGSI), and Soil Adjusted Vegetation Index (SAVI) are created in raster format. With the use of raster computations, the combined area was divided into five groundwater potential zones, such as Very Good (4.23%), Good (17.21%), Moderate (31.45%), Poor (32.85%), and Very Poor (14.28%). The observed variations in GWPZs shed light on the region's complex hydrogeological characteristics and have significant implications for groundwater resource management and conservation initiatives in semi-arid areas. By emphasizing the variations observed and their implications. This study serves as a valuable decision-support tool for sustainable groundwater resource management in the Mahi River Basin and can be replicated elsewhere for similar settings.

CHARACTERIZATION OF SNOW HYDROLOGICAL PROCESSES OVER THE NORTHERN HEMISPHERE: DO WE KNOW ENOUGH?

Dheeraj Kumar Singh, Subhadeep Halder
Department of Geophysics, Institute of Science, Banaras Hindu University, Varanasi 221005, UP
E-mail: dheerajsingh26042021@gmail.com;subhadeeph@bhu.ac.in

The inverse relationship between the Eurasian snow in winter and spring and the subsequent Indian Summer Monsoon Rainfall (ISMR) is well documented. Primarily, studies have focused on the role of

snow-albedo feedback in ISMR variability. Until recently, the importance of delayed hydrological processes due to snowmelt and the resulting snow-atmosphere feedback was not much appreciated.

Due to the rising global temperature of earth in the recent few decades, early and rapid melting of the snow packs may have played a crucial role in changing the mechanisms and feedbacks affecting the variability of the ISMR. One of the crucial drawbacks in understanding snow-atmosphere feedbacks and their effect on the ISMR or global climate per se, has been the lack of long-term in-situ snow cover, depth or water equivalent data having a global coverage or continuity. This issue is glaring as far as the Himalayan region is concerned. To understand the representation of snow-hydrological processes in atmospheric and land surface model based reanalyses over Eurasia and the Himalayan region and quantify the accuracy a comparative study against various available remote sensing based observations is presented in this study. Major differences are noted in various available datasets over these regions when compared to remotely sensed observations. An attempt is also made to investigate snow-atmosphere feedback processes and their role in the ISMR variability. This endeavour shall help identify important snow hydrological processes over these regions and propose measures that are needed to better understand the hydrological processes and glacier dynamics. The first author thankfully acknowledges the support given the UGC, Government of India in the form of research fellowship. The second author gratefully acknowledges the financial support and research infrastructure provided as part of the Seed Grant of the Institute of Eminence scheme of the Banaras Hindu University.

ASSESSING THE STREAMFLOW TREND AND VARIABILITY AND ITS RELATIONSHIP WITH THE BOUNDARY LAYER WATER CYCLE PROCESSES AND MULTISCALE CLIMATE OSCIILATIONS-A STUDY OVER KRISHNA RIVER BASIN

Sumana Sarkar and Ramesh K.V.
CSIR Fourth Paradigm Institute, Wind Tunnel Road, Bangalore-560037, India
Corresponding Author: kvram55@gmail.com
Presenting Author: sarksumana@gmail.com

Combined impacts of Climate, Land-use/Land-cover (LULC) and human induced changes have excerbated the changes in the distribution of water resources and their availability across space and time. Hence, understanding of the behaviour of hydrological regimes and hydrological processes occurring within a river basin that ultimately affects the streamflow variability, is of crucial importance for sustainable water resources management. The present study aims to detect and analyse the existing trend, in the Krishna River Basin (KRB), based on streamflow observations of 14 gauging stations for the period of 1966-2017. The trend detection and quantification have been done using Mann-Kendall (MK-test), modified MK (MMK-test) and Sen's slope estimator at different timescales (Annual, monthly, seasonal, decadal). The results indicate the presence of statistically significant (95% confidence level) downward trends all over the gauging stations located near upstream and downstream. The detection of the change-point in the stream flow time series is done using Pettitt's test.

Besides, the streamflow trends and their relationships with the boundary layer water cycle processes like rainfall, evapotranspiration and various global climate indices like ENSO precipitation index (ENSO_PI), Indian Ocean Dipole (IOD), Pacific decadal oscillation (PDO), East central Tropical

Pacific SST (Nino3.4), North Atlantic Oscillation (NAO) etc. are not thoroughly explored in KRB. A power spectrum density analysis has been employed to unravel the association amongst the streamflow variability, rainfall, evapotranspiration and the various global climate indices. The findings will help to identify the potential climate drivers behind the streamflow trends and will help to assess the future streamflow variability with the help of hydrological and data driven models (Machine learning techniques, AI driven models etc.).

LONGTERM SEASONAL CHARACTERISTICS OF PRTICULATE MATTER USING CMIP6 MODELS UNDER DIFFERENT SSP SCENARIOS OVER INDIAN REGION

Pritam Das Mahapatra*, Abhilash S
Department of Atmospheric Sciences, School of Marine Sciences
Cochin University of Science and Technology Lakeside Campus, Kochi-682016, Kerala, India
Email: inspdm@gmail.com

The presence of particulate matter (PM) in the atmosphere poses significant risks to human health and the environment. India, with its diverse geography, population density, and industrial activities, faces unique challenges in understanding and managing PM pollution. In this work surface particulate matter (PM2.5 and PM10) concentration distribution alaysed for annual as well as seasonal scale over Indian region for 1980 to 2021 period using Modern-Era Retrospective analysis for Research and Applications, Version 2(MERRA-2) reanalysis.

The study utilizes a multi-model ensemble from Couple Model Intercomparison Project Phase 6 (CMIP6), encompassing state-of-the-art global climate models, to simulate PM concentrations over India. Through a systematic evaluation against ground-based measurements from multiple CPCB staions across India, the accuracy and reliability of CMIP6 models in capturing PM distribution patterns across different regions of India are assessed. In next phase of the work future projection using different Socio-economic pathways (SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5) also studied to understand particulate matter concentration both in terms of magnitude and seasonal scale, which will play crucial role in air quality as well as human health conditions up to 2100.

Furthermore, the study explores the drivers and underlying mechanisms of PM formation and transport within the Indian subcontinent. It investigates the impact of various factors such as anthropogenic emissions, natural sources, meteorological conditions, and regional topography on the spatial and temporal variability of PM concentrations. The analysis also highlights the role of local emissions versus long-range transport in contributing to PM pollution in different parts of India.

The findings of this study have significant implications for air quality management, public health, and policy formulation in India. The integration of CMIP6 models and observations provides a comprehensive framework to assess the current state of PM pollution, identify hotspots, and evaluate the effectiveness of mitigation strategies

FUTURE CHANGES IN THE POTENTIAL INTENSITY OF TROPICAL CYCLONES OVER THE ARABIAN SEA IN RESPONSE TO THE THERMAL STRUCTURE OF THE ATMOSPHERE AND THE OCEAN IN CMIP6 MODELS

Abhiram Nirmal C. S.[1] And Abhilash S.[1, 2]

[1] Advanced Centre for Atmospheric Radar Research, CUSAT, Cochin abhiramcsn@gmail.com
[2]Dept. Of Atmospheric Sciences, CUSAT, Cochin
Email: abhimets@gmail.com

It is well established that the intensity of Severe Cyclonic Storms over the Arabian Sea has increased in recent decades in response to the changes in the thermal structure of the atmosphere as well as Ocean. Due to rapid urbanisation of the coastal cities, more and more people are getting exposed to these changes. Life and livelihood of indigenous people living along India's vast coastal regions are more vulnerable to these changes. It is imperative to understand how tropical cyclone activity is affected by the changing climate so that policy-makers are able to develop appropriate strategies for mitigation. CMIP6 dataset offers a unique opportunity in assessing the projected tropical-cyclone activity in the Arabian Sea by analysing various dynamical and thermodynamic factors to understand the projected variability in the thermal structure of atmosphere and Ocean in contributing to the changes in the cyclogenesis over Arabian Sea. Different variants of genesis potential index and storm identification and tracking schemes will be applied on historical simulations and then compared with re-analysis and actual storms track to identify the best models. Then the ensemble mean prepared using the best participating models will be examined to detect the future changes in comparison to the historical reference period.

YOUNG RESEARCHER PROGRAM

SEISMIC IMAGING OF THE MESOZOIC KACHCHH RIFT BASIN (KRB), NW INDIA, DERIVED FROM DEEP SEISMIC REFLECTION PROFILING

K. Laxminarayana[1,2*], Biswajit Mandal[1,2], V. Vijaya Rao[1], P. Karuppannan[1], Sumer Chopra[3], M. Ravi Kumar[1,2], Prakash Kumar[1,2]

[1] CSIR- National Geophysical Research Institute, Uppal Road, Hyderabad-500007, India.
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad- 201002, India.
[3]Institute of Seismological Research, Gandhinagar-382009, India.
*corresponding author: laxmingeo109@gmail.com

Deep seismic reflection profiling was conducted for the first time across the Kachchh Basin to gain insights into its subsurface structure, seismicity, and tectonic history of the region. The study employed a state-of-the-art seismic data acquisition system and comprehensive data processing techniques. The image reveals large variations in the thickness of sediments from 150 m to 6.5 km and crustal thickness from 45 km to 35 km from north to south, with a Moho up warp of 4 km beneath the Kachchh Mainland fault. Further, the seismic image illuminates a 15 km thick sub-horizontal lower crustal reflection fabric and crustal-scale domal-type structure extending from the surface to the Moho. We interpret the earlier one as magmatic underplating and the latter as the Kachchh Mainland uplift. We find the basin exhibits an unusually thick crust of 45 km, contrary to many rift basins, due to its interaction with the Reunion plume. We interpret the Reunion mantle plume activity, manifested as Deccan volcanics, in terms of magmatic underplating, crustal thickening, and uplift in the region. We identified a previously unknown fault system and complex network of faults within the basin, shedding light on the active tectonics and seismicity of the region. High-resolution seismic profile provided detailed images of subsurface structures, including fault geometries and sedimentary layers, allowing for a better understanding of basin evolution.

Keywords: Crustal reflection fabric, Domal-type structure, Uplift, Rift Basin, Magmatic underplating, Mantle plume.

AGE CONSTRAINTS AND MAGNETIC FABRICS OF EARTHQUAKE INDUCED LIQUEFACTION FEATURES IN THE MEIZOSEISMAL AREA OF 1943 EARTHQUAKE, NE INDIA: CURRENT UNDERSTANDING AND FUTURE DIRECTIONS

Md.Mujahed Baba[1,2], B.V. Lakshmi[1], V.M. Rokade[2], K. Deenadayalan[1], S.N. Patil [2] , Priyeshu Srivastava[1]

1. Indian Institute of Geomagnetism, Navi Mumbai
2. School of Environmental and Earth Sciences, Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon, Maharashtra
Corresponding author: mujahedgg2048@gmail.com

Paleoseismic field studies unveil insights into seismic hazard and past earthquake activity preserved in the form of liquefaction features in the meizoseismal zone of the 1943 Hojai Earthquake (Mw 7.3). The excavated trenches revealed compelling secondary evidence of substantial liquefaction occurring at a depth of approximately 2-3 meters below the surface like sand dykes and sills with variation of color, grain size and indurations of sediments varied at the sites. The age constraints from paleoseismic investigations carried out in the meizoseismal area of 1943 Hojai and 1869 Cachhar

earthquakes, suggest four-time intervals of their formations i.e. (i) between 105±0.35 and 60±30 yr BP (ii) between 116±0.35 and 30±30 yr BP, (iii) between 135±30 and 140±30 yr BP and (iv) between 1860±30 and 4330±30 yr BP. These new ages of liquefaction features correspond to the occurrence timings of causative seismic events which are in addition to the known historical earthquakes and thus enhance our understanding of the paleoseismic history of this region.

Using the anisotropy of magnetic susceptibility (AMS) magnetic fabrics, we aim to categorize the liquefaction features and interpret their emplacement mechanisms. The surrounding and horizontal bedded layers above the liquefaction features exhibit a typical oblate sedimentary fabric and the fabrics of the liquefaction feature are greatly influenced by current conditions. Based on the AMS fabrics, they are classified into two types: Type-I, resulting in subvertical k3 and subhorizontal k1-k2 axes and Type-II resulting in streaked k2-k3 on the dike plane and horizontally clustered k1 axes. The AMS fabrics of each type can be a significant indicator for flow direction. Based on abundant AMS fabrics formed by high-energy current, coexistence of paleoseismic structures, and tectonic setting of the basin, earthquake-induced liquefaction is the most plausible trigger for the formation.

CRUSTAL STRUCTURE BENEATH THE WESTERN DHARWAR CRATON SEGMENT OF WESTERN GHATS: INSIGHTS FROM AMBIENT NOISE TOMOGRAPHY

Sribin C[1,2,3,*], Padma Rao B[1], Sunil Rohilla[4]
[1]MoES-National Centre for Earth Science Studies, Govt. of India, Trivandrum, Kerala, India
[2]Cochin University of Science and Technology, Kerala
[3]MoES-National Centre for Polar and Ocean Research, Govt. of India, Vasco-da-Gama, Goa, India
[4]MoES- Borehole Geophysics Research Laboratory, Karad, Maharashtra, India
*Email id: sribinc200@gmail.com

The Western Ghats (WG) constitute a collage of three major tectonic blocks, namely the Deccan Volcanic Province (DVP), Western Dharwar Craton (WDC) and Southern Granulite Terrain (SGT), from north to south. Among these, the WDC region comprises the oldest basement rocks, including greenstone belts and calc-alkaline plutons (~3.0 to 3.4Ga). The crustal structure of the DVP and SGT segments of the WG has been studied by various research studies. However, the knowledge on crustal structure beneath the WDC segment is limited due to the scarcity of seismic stations. Therefore, in this study, we utilized continuous waveform data from a newly established network of stations by NCESS along with the other available stations and deciphered the shallow crustal structure beneath the WDC segment of the WG using 2D ambient noise tomography. The results reveal a continuous upper layer with varying thickness, characterized by a high shear-wave velocity of ~3.6km/s. Additionally, a thick middle layer is observed with velocities reaching up to ~3.9km/s and a lower layer with velocities ≥4.2km/s. Interestingly, variations in the thickness of the upper layer, ranging from 5km to 20km are observed beneath the study region. This layer thickness exhibits variations in relation to changes in topography and this dependency decreases for deeper layers. In the upper layer, high shear-wave velocity perturbations (~10%) are observed beneath low-elevation regions. These may represent TTG-type gneiss, which is a significant rock type in the WDC region, along with greenstone belts and late calc-alkaline to potassic plutons. These findings suggest that the uneven topography of the WG highlights the possibility of long-term erosion, which has exposed deeper and higher-density rocks, resulting in higher shear-wave velocities at shallow depths. Further, this research

will be expanded to investigate the influence of the upper crustal layer and its correlation with the evolution of the WG.

ALONG-STRIKE VARIATION IN EXHUMATION RATES AND SEISMICITY PATTERN OF THE GARHWAL-KUMAON REGION OF NW HIMALAYA

Amit Sagwal*[1], Paramjeet Singh[2], Manisha Sandhu[1,] R.C. Patel[1,3]
[1]Department of Geophysics, Kurukshetra University, Kurukshetra 136119 (India),
[2]Wadia Institute of Himalayan Geology, Dehradun 248001 (India),
[3]Department of Geology, Banaras Hindu University, Varanasi 221005 (India)
*Email:amitsinghpb30@gmail.com

About 50-55 Ma ago, the continental collision between the Indian and Tibetan plates formed the Himalayan Mountain belts. Despite the similar geological and tectonic setting, distinct pattern of Fission Track ages, exhumation rates and seismicity variability exist in NW- Himalaya. The AFT ages from HHC of Kumaon region ranges between 1.0±0.1 Ma and 2.8±0.3 Ma along the Darma valley, between 1.4±0.2 Ma and 2.4±0.3 Ma along Kaliganga valley and between 0.3±0.2 Ma and 2.9±0.6 Ma along Goriganga and fall in range between 0.3±0.1Ma and 4.2±0.5 Ma along the Pindar valley with a mean ER of 2mma^{-1} except Goriganga section (4mma^{-1}) where a sudden increase in ER observed during 0.4 Ma. In LHS of Kumaon, AFT ages reported from MT/MCT to BT lies between 0.3±0.1 to 0.9±0.2 Ma which is younger than the ages across VT (0.3±0.1 to 4.2±0.7 Ma). Discontinuous age trend across VT, MT/MCT and BT indicates rapid exhumation and reactivation of duplex within LHMS. Within Almora Klippe AFT data ranges from 6.6±0.6 to 13.2±0.9 Ma with young ages proximity to NAT and older ages from SAT. Whereas in Garhwal section, AFT ages range between 0.9±0.3 to 3.6±0.5 Ma along Dhauliganga valley and 1.53±0.42 to 2.41±0.52 Ma in Gangotri region with an increase in FT ages from MCT to STDS indicating a consistence exhumation trends since Pliocene.

The 1-D thermal modelling quantify that initially both Garhwal and Kumaon regions were uplifting at almost the same rate during the late Miocene. Later on, the Kumaon region uplift as a single block with rapid exhumation (~4mma^{-1}) whereas the Garhwal region underwent slow exhumation (~1.5 mma^{-1}). Additionally, the seismicity data plot (>1) suggests that the Kumaon region has almost uniform distribution of seismicity from MCT/MT to STDS whereas in the Garhwal region seismicity is concentrated within MCT/MT zone. These observations suggest a two-segment structure within the Garhwal-Kumaon Himalaya, (i.e. possibly due to structural discontinuity or an active transverse lineament) caused by different seismicity, exhumation and geometry of the MHT. Further, we also suggest this active transverse lineament might be a northern extension of the Moradabad transverse fault.

HORIZONTAL PLUME CHANNEL AND THE EVOLUTION OF YOUNG DIVERGENT TRIPLE JUNCTIONS: INSIGHTS FROM 3-D GRAVITY INTERPRETATION OF THE AFAR REGION

K. S. Sreenidhi[1,2,3*], M. Radhakrishna[2], Peter G. Betts[3], Robin Armit[3]
[1] IITB-Monash Research Academy, Indian Institute of Technology Bombay, Mumbai 400076, India
[2] Department of Earth Sciences, Indian Institute of Technology Bombay, Mumbai 400076, India
[3] School of Earth, Atmosphere and Environment, Monash University, Victoria 3800, Australia
***** Presenting author: nidhisree94@gmail.com

The Afar region, a distinctive triple junction of divergent tectonic boundaries—the Red Sea, Main Ethiopian Rift, and Gulf of Aden—provides an ideal setting to investigate melt channeling and plume-assisted rifting in a mechanically stressed environment, owing to its proximity to the Afar mantle plume. To unravel the connection between crustal geometry and the region's geodynamics, we conducted a detailed 3-D gravity interpretation study. Crustal gravity anomalies were calculated after incorporating corrections for an improved sediment thickness grid and upper mantle density structure, derived from shear wave tomography data. The 3-D inversion of this gravity grid, with constraints from independent seismic and seismological data, resulted in a high-resolution crustal thickness map. This map offers a more precise representation of the crustal architecture of the region compared to sparse seismic data and the lower-resolution CRUST1.0 model. The crustal gravity anomalies facilitate cross-domain comparisons, and the crustal thickness grid both confirms and expands upon prior crustal thickness estimates. The Afar region exhibits a thinner crust (20-26 km) compared to neighboring continental areas. The Main Ethiopian Rift displays varying crustal thickness, with the central segment having thicker crust (38-40 km) than the northern and southern portions (30-35 km). Along the Gulf of Aden, the crust thins from the west (~17 km) to the east (~5 km), signifying a transition from seafloor spreading to continental rifting. Notably, the southern Red Sea shows an asymmetric crustal thickness pattern, with a thicker crust (~17 km) on the eastern flank compared to the western flank (~11 km). This asymmetry is attributed to differential crustal accretion influenced by a sub-lithospheric channel associated with the Afar mantle plume. We propose a conceptual model to clarify the connection between the plume channel, differential crustal accretion, and other asymmetric features observed around the southern Red Sea.

SLOPE INSTABILITIES IN THE KRISHNA GODAVARI AND THE CAUVERY BASINS DUE TO GAS HYDRATE DISSOCIATION

Palle Jyothsna[1,2,*] and Nittala Satyavani[1,2]
[1]CSIR-National Geophysical Research Institute, Marine Seismic Group, Hyderabad, Telangana, India.
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India.
[*]Corresponding author: jyo.sarika@gmail.com

The role of the gas hydrate dissociation on submarine slope failures is studied using the seismic and sea surface temperature (SST) data in two gas hydrate provinces of the East Indian Margin, namely the Krishna-Godavari (KG) and Cauvery basins. Compared to the KG basin, the sedimentation rate in the Cauvery basin is lower. The 3D seismic data of the KG and Cauvery basin has shown Bottom Simulating Reflectors (BSR) occurrences at ~160 meters below seafloor (mbsf) and ~110 mbsf, respectively. Historical data reveals a 3°C

increase in SST in the Bay of Bengal post-Last Glacial Maximum. The modeling of the base of the hydrate stability zone at ~1000m water depth has shown that the BSR is shifted by ~80m shallower in the KG and ~60 m in the Cauvery basin post-LGM. The difference in the BSR shifts in these basins can be attributed to factors such as lithology, high sea bottom temperature, low geothermal gradients, and lower sedimentation rates in the Cauvery basin compared to the KG. The slope angle in both study areas is less than 2 degrees; however, we have identified a large slump of ~21km in the KG due to the gas hydrate dissociation and fluid migration. Slumping is not observed in the Cauvery region, possibly due to lower sedimentation rates and lithology. Another reason might be the extent of seismic data available for the study, which is less ~20 sq. km in the Cauvery region. However, significant mass transport deposits (MTD) and mud diapirs were observed, which might have been formed due to the hydrate dissociation beneath the BSR. Hydrate dissociation due to increased bottom water temperatures is also recorded in the carbon isotopes of benthic (Miliolida) foraminifera in the Indian margin. The first ever detected gas flares in the multibeam echo sounder data of the Cauvery basin supports our argument that the gas hydrate dissociation is actively occurring in the East Indian margin.

POSTERS

SOLID EARTH GEOSCIENCES

CSIR-INTEGRATED SKILL INITIATIVE TRAINING PROGRAMME AT CSIR-NGRI, HYDERABAD

G Swaroopa* Abhay Ram Bansal, T Hemasundar Rao
CSIR-National Geophysical Research Institute, Hyderabad, Telangana.
email: g.swaroopa14@gmail.com

We present a comprehensive study on a CSIR Integrated skill development training program implemented at the National Geophysical Research Institute (NGRI), Hyderabad, India. The aim of the program is to provide hands-on training on geophysical techniques for different applications for postgraduate students, Researchers, academicians, Faculty, scientists, officers, and other employees (Industry) for different universities, R&D organizations, etc. Through skill development programs more than 4000 participants have been trained across the country. This paper provides a detailed case study of 10 different training programs organized on different geophysical techniques and their application to solving real-time problems, pre and post-training feedback, and their improvement. The statistical analysis has been done and future initiatives have been discussed.

RADIOMETRIC SURVEYS FOR MINERAL EXPLORATION: A COMPREHENSIVE OVERVIEW

Alle Shivakumar*, Udayalaxmi Garu
CEG Osmania University, Hyderabad
Email: alleshivakumarvillain@gmail.com

Radiometric surveys on the ground surface are primarily 'passive,' measuring natural radioactivity. However, some 'active' methods are in use on the ground surface and in boreholes. The term 'radiometric techniques' is generally considered to refer to measurements of natural radiation. The passive methods are by far the most widely used radiometric techniques, in particular the use of gamma ray scintillometers and gamma ray spectrometers. The radiometric surveys detect and map natural radioactive emanations (γ ray) from rocks and soils. The gamma radiation takes place from the natural decay of elements like U, Th and K. The radiometric method is capable of detecting these elements at the surface of the ground. The common radioactive minerals are uraninite (238 U), monazite, thorianite (232 Th), rubidium (87 Rb) in granite-pegmatite, feldspar (40 K), muscovite, sylvite in acid igneous rocks and radiocarbon (14 C). The technique of measurement of natural radiation in the earth's surface is called "Radiometric method" (also known as Gamma ray spectrometry). This is a process in which the unstable atom becomes stable in the process of its nucleus. Energy is released in the form of radiation, viz., alpha, beta, and gamma rays. Radioactive uranium and thorium minerals occur naturally in earth materials. Since they are radioactive, their presence or any anomalous concentration can be detected by radiometric surveys. In the exploration geophysical methods Radiometric method plays vital role in distinguish of minerals by their properties corresponding presence of elements. For an instance of radioactive minerals their characteristics can be identified by radiometric scintillators, Geiger counters etc... which couldn't possible by other geophysical methods. Near-subsurface lithology in borehole logging using radioactive minerals as a source in it. There also be constraints in radiometric survey of near-surface and airborne for exploration of minerals based on the properties, origin few are not detectable but

their presence can be estimated and gives an idea to perform which method is suitable for exploration. Often in exploration zone of minerals for every method geophysical method has their own its perspective merits and demerits which are more reliable to think and stepping us to reach for more evaluation, modification, rectification and execution in perfect manner. In this same manner radiometric survey still at processing zone to get every detail about minerals which can be possible to succeed in future as our earth scientist's prediction.

OPENING OF THE LACCADIVE BASIN AND THE EVOLUTION OF THE WESTERN CONTINENTAL MARGIN OF INDIA (WCMI) SOUTH OF TELLICHERRY ARCH

M. G. Gilbert*, M. Radhakrishna* and P. Unnikrishnan*
*Indian Institute of Technology Bombay, Department of Earth Sciences, Mumbai, India
Email: georgegilbertm@gmail.com

Earlier investigations of the Western Continental Margin of India (WCMI) has brought to light its double breakup history, with the first breakup between India and Madagascar in the Late Cretaceous and the second breakup between India and Seychelles in the Early Paleocene time. Later, the Reunion plume has emplaced volcanics all over the margin while the Indian Plate moved over it. This masked most of the rift-drift related features along WCMI as a result of which the nature of the crust underlying the offshore basins and the Laccadive Ridge are still debated. Laccadive Basin falls along the Southern WCMI and is bounded by the Laccadive Ridge on the west and the continental slope of WCMI towards its east. Integrated analysis of seismic, gravity and sediment thickness data reveal that the Laccadive Basin and the part of the Laccadive Ridge south of the Tellicherry Arch has a different evolutionary history as compared to the northern part of WCMI. The analysis of sediment deposition patterns in the Laccadive Basin region implies a post-breakup extension between the Laccadive Ridge and the West coast of India. We further propose that the anti-clockwise rotation of India and the passage of the Reunion plume have facilitated the opening of the Laccadive Basin.

A REVIEW ON AEROMAGNETIC ANOMALIES ALONG THE KRISHNA RIVER TRANSECT FOR DIAMOND BEARING KIMBERLITES/ LAMPROITES, CUDDAPHA BASIN

D.Seshu* and K. Satish Kumar
CSIR-National Geophysical Research Institute, Hyderabad
*Corresponding author: seshugeo@ngri.res.in,seshu.geo@gmail.com

The Cuddapah basin, India is known to be one of the repositories of diamond-bearing Kimberlites and Lamproites which were originated at sub-mantle depths. These are transported through alkaline suite of rocks, Kimberlites/Lamproites and available in river gravels, alluvium and conglomerates. Kohinoor, Orloff and Pitt were the famous diamonds originated from the gravels of the Krishna river basin in the Cuddapah basin. Geological, geomorphological, geochemical, petrological and varieties of geophysical studies were executed in this basin to understand the emplacement of diamond-bearing rocks and reported diamond bearing Kimberlites/ Lamproites. However, researchers still felt there is a possibility of new prospective zones in this basin. In this regard, the present study focuses on the understanding of existing aeromagnetic anomalies along the periphery of the Krishan river basin, which is associated with known Kimberlite pipes. The following are discussed in the present study

viz. i) The relation among the aeromagnetic anomalies, geological formations and associated structural features. (ii) Integration of geochemical results at identified pipe locations with the aeromagnetic anomalies and (iii) Identifying a new structural regime might be favourable for new potential zones. The present approach will meet the success in understanding the known and virgin prospective zones in terms of aeromagnetic anomalies.

REASSESSMENT OF GEOPHYSICAL STRUCTURE AND TECTONIC EVOLUTION OF THE COMORIN RIDGE IN THE CENTRAL INDIAN OCEAN.

Vishnu R Murali*, Ratheesh Kumar
Marine Geophysics Student, Department of Marine Geology and Geophysics, CUSAT
*Presenting Author: devdas7iq@gmail.com

Comorin Ridge is an aseismic ridge situated in the Central Indian Ocean, off the southern margin of India and South-west of Sri Lanka. It is one of the least studied ridge systems in the Indian Ocean, but recent studies started exploring the relevance of the ridge by considering its key position in the Indian Ocean to understand the breakup of eastern Gondwanaland Limited data and lack of detailed studies contributed contrasting views by previous studies for the crustal structure, nature of the lithosphere, and mode of origin of the Comorin Ridge. Therefore, a reassessment of the previous works as well as improved recovery of lithospheric parameters using advanced data and techniques are necessary for a better interpretation of the structure and evolution of the Ridge, which is what addressed in this study. The Te (Elastic Thickness) result shows a relatively large Te (~30 km) in the northernmost segment of the Comorin Ridge, whereas its central and southern segments show anomalously low Te (~2 km). Significant high-to-low Te variations are observed in the normal oceanic regimes surrounding the Ridge. The Te variations show a first order correlation with the Moho depth undulation along the ridge such that the high-Te segment in the north are underlain by thicker crust (~ 18 km) and the low-Te segments towards the southern part of the ridge are characterized by progressive thinning of the crust (<14 km). 2D potential field models derived in this study are consistent with the magmatic underplating model in a recently published study that inferred to be the result of Marion hotspot magmatism during the India-Madagascar separation. Considering the wide-spread magmatic records of the hotspot plume, we support the idea that the emplacements of Marion hotspot plumes through a leaky transform fault could have led to the formation of the Ridge.

EXPLORING STRUCTURAL DEFORMATION EVOLUTION IN THE CENTRAL INDIAN OCEAN USING MULTI-CHANNEL SEISMIC REFLECTION DATA

Rahul Yadav 1,2 *, Dhananjai K Pandey, Lachit Singh Ningthoujam, Sanjay Singh Negi
1 Geosciences Division, National Centre for Polar and Ocean Research, MoES, Goa 403 804, India
2 School of Earth, Ocean and Atmospheric Sciences (SEOAS), Goa University, Goa 403 206, India
*Email: rahulyadav@ncpor.res.in

The central Indian Ocean has long fascinated researchers due to its intricate intra-plate deformations, a topic that continues to provoke discussion and debate. Despite numerous research endeavors to unravel this phenomenon, a consensus on its structural characteristics and spatiotemporal origins still needs to be discovered. Initial geophysical investigations and deep-sea drilling suggested extensive crustal deformation commenced during the late Miocene. However, recent considerations propose an

earlier initiation of deformation, dating back approximately 15.4-13.9 million years ago, attributed to the concurrent dynamics of the India- Eurasia convergence. Another hypothesis posits that temporal variations in the rotational motion of the India-Somalia-Capricorn plates may have played a pivotal role in the extensive crustal deformations. Our study leveraged new deep-penetrating multi-channel seismic reflection data from the central Indian Ocean. Our primary objectives were to characterize the style and extent of structural deformations and investigate potential mechanisms underlying their occurrence. Employing seismic-stratigraphic interpretation and cumulative fault-throw analyses of the recently acquired regional seismic profiles, we contribute valuable insights into the evolution of intra-plate deformations. Our findings confirm extensive faulting in the early Miocene period across the Central Indian Deformation Zone (CIDZ). We reevaluate the structural deformations and infer that approximately 40% of the faults were activated around or before the early Miocene, with the most significant displacement occurring at a regional unconformity dating back to 17-18 million years ago. This extent of deformation significantly surpasses previous estimates. Furthermore, we identify distinct categories of deformation within these faults, adding nuance to our understanding. Our study provides compelling evidence supporting the onset of deformation well before the late Miocene based on the new subsurface imagery we obtained. These images offer improved constraints on the region's prominent stratigraphic and structural variations. By integrating our seismic data with other geological and geophysical datasets, we have made substantial progress in enhancing our comprehension of the complex deformations in the central Indian Ocean

CRUSTAL STRUCTURES OF DECCAN SYNECLISE, CENTRAL INDIA DERIVED FROM THREE-DIMENSIONAL MAGNETOTELLURIC INVESTIGATION

Anita Devi *[a], Prasanta K. Patro [a], K. K. Abdul Azeez [a]
[a] CSIR-National Geophysical Research Institute, Hyderabad, India.
*Corresponding author: anitadevi@ngri.res.in/anita5808@gmail.com

A large number of seismic and magnetotelluric (MT) surveys were done in past to understand the tectonic structure of the Narmada-Son Lineament (NSL) zone. The region is highly disturbed and bounded by several, known and unknown faults namely, Barwani Sukta, Gavligarh fault, Kaddam Fault, Narmada South fault, Purna fault, and Tapti fault, both shallow and deep seated. Broadband MT data were acquired at 273 stations in different phases in a gridded fashion to image the Narmada Lineament Zone. Two-dimensional studies of few of these sites are published earlier. We performed a 3D inversion of the data to derive the 3D resistivity model of the region. The derived 3D resistivity model delineates several major crustal conductors, fault boundaries and the resistive basement. The deep-seated conductors (~10 Ωm) corresponds to the underplating of mafic magmatic and/or fluid intrusions during the Cretaceous-Tertiary Deccan volcanism and is controlled by the deep-seated faults. Shallow depth localized faults also seem to have facilitated further upward movement of these underplated material and fluids release during this process. The resistive structure (>1000 Ωm) corresponds to the basement. The study shows a basement uplift between the Narmada and Tapti rivers. Delineation of neotectonic activity along known fault zones and tectonic lineaments within the central region is necessary to understand the nature and behaviour of faulting in the core region of the Indian Peninsular Shield.

NATURE OF LITHOSPHERE-ASTHENOSPHERE BOUNDARY BENEATH THE INDIAN OCEAN

S. Silpa[1,2], B. Padma Rao[1], S. Maurya[3]
[1]MoES-National Centre for Earth Science Studies, Thiruvananthapuram, India,
[2]Dept. of Marine Geology and Geophysics, Cochin University of Science and Technology, Cochin, India,
[3]Dept. of Earth Sciences, Indian Institute of Technology, Mumbai, India

Email: silpasundaran16@gmail.com

The Lithosphere-Asthenosphere Boundary (LAB) separates the rigid lithosphere from the ductile asthenosphere. This boundary is seismically defined as a discontinuity with a negative velocity contrast within the Earth's interior. In this study, we aim to determine the depth of the LAB beneath the Indian Ocean using the high-resolution shear wave velocity model, which is derived from the inversion of 19,300 dispersion curves. The depth to the LAB within the study region is calculated based on a drop in shear wave velocity (>-1.3%) and considering a maximum gradient ($-\partial V_{sv}/\partial z$) above the low-velocity zone. Results reveal a thin lithosphere at major mid-oceanic ridges (~25km), with the lithosphere gradually thickening as the distance from the ridges increases. In the subduction zone along the Java-Sumatra, the lithospheric thickness increases significantly, reaching up to ~150 km. The observed average thickness of the lithosphere in the central Indian Ocean is ~80-90 km, consistent with global ocean lithosphere thickness. Notably, we observe a thinning of the lithosphere in the Indo-Australian diffusion plate boundary (IADPB) along the southwest to northeast direction, where it indicates ~50-70 km. This thinning could be attributed to active tectonic processes and the emergence of a young oceanic plate. These findings align with seafloor age data, which indicates that this region features younger ages (~35-40Ma) compared to its surroundings. Additionally, there is an increased occurrence of earthquakes in this region. The focal mechanics of earthquakes suggest that the nascent diffusion plate boundary is a complex zone characterized by various fault mechanisms. There is a dominance of thrust faulting on the northeastern side and normal faulting on the southwestern side, with the pole of rotation situated at the centre. The results from our study along with other observations, strongly indicate the presence of active tectonics and a clear demarcation of the plate boundary in the IADPB region.

ESTIMATION OF CURIE DEPTH AND HEAT FLOW FOR CENTRAL PART OF EASTERN GHATS MOBILE BELT: INSIGHT INTO NON-VOLCANIC GEOTHERMAL SYSTEMS

Ananya P. Mukherjee* and Animesh Mandal
Affiliation: Department of Earth Sciences, Indian Institute of Technology, Kanpur
*Corresponding author: ananyam@iitk.ac.in

The Eastern Ghats Mobile Belt (EGMB) is a Proterozoic-aged orogenic belt, running along the east coast of India. The dominance of granulite facies rocks, namely, charnockites, khondalites, and migmatites, along with the presence of several major shear zones cross-cutting the EGMB point to the complex accretionary history of EGMB. Sporadically located non-volcanic geothermal systems within EGMB pose a possible correlation between their genesis and the prevalent crustal configuration. This study focuses on three hot-springs, Atri, Tarabalo, and Taptapani, in the central part of EGMB, by utilizing the Earth Magnetic Anomaly Grid (EMAG2) to understand the structure

and thermal nature of the crust of the study area. The spectral method is applied to the magnetic data to calculate the Curie point depth (CPD) by considering 36 blocks of 300 × 300 km extent with 50% overlap. The average CPD values range from 19.5 to 32.1 km, while surface heat flow values vary from 66.5 to 109 mWm^{-2}. The hot-springs are localized in the region of low heat flow, bordered by regions with high heat flow. This indicates that the possible heat source for thermal water is situated near the hot-springs, instead of being directly underneath their locations. The shear zones around the geothermal systems aid in transferring thermally heated fluids from the high-heat flow regions. The calculated average radiogenic heat production (RHP) of the major rock types lying within the study area is 3 μWm^{-3} and the average surface heat flow contributed by the radiogenic crust is 70.2 mWm^{-2}. The surface heat flow derived from both the RHP and CPD values prompts us to consider the role of both radioactive decay and transfer of thermal waters from crustal depths through the network of shear zones for the formation of the hot-springs lying in the study area.

MINERAL MAGNETIC TRACING OF SEDIMENT PROVENANCE OF THE HIRPUR FORMATION, KAREWA GROUP, KASHMIR VALLEY

Shirish Verma[1,2], Binita Phartiyal[1,2], Prasanta Kumar Das[1] and Rakesh Chandra[3]
[1]Birbal Sahni Institute of Palaeosciences, 53-University Road, Lucknow-226007, India
[2]Academy of Scientific and Innovative Research, Ghaziabad, U.P - 201002, India
[3]Department of Geology, Ladakh University, Leh-194101, Ladakh, India

The oval-shaped intermountain Karewa Basin of Kashmir Valley is surrounded by the Himalayan ranges towards the north-eastern side and the Pir Panjal range towards the south-western side covering an area of approximately 5000 sq km. The emergence of the Pir Panjal orogeny impounded the ancient drainage and formed a vast lake known as the Karewa lake. Covering the entire Quaternary period, the sedimentation in the Karewa lake basin started as early as 4 Ma. Various ages of Plio-Pleistocene, middle Pleistocene & late Pleistocene have been assigned to different sections of the lake basin. The continuous uplifting of the Pir Panjal during the Pleistocene caused the shrinking & shifting of the lake towards the Himalayan side and later the tectonic activities exposed these sediments in different parts of the valley. Lithologically, the Karewa is divided into lower and upper. The studied two sections (i.e. Dubjan & Rembiara) are of the Hirpur Formation, which is a part of the Lower Karewa group which is overlain by the Nagaum Formation (Upper Karewa). The aeolian loessic deposit overlies these formations. The section is exposed along the left bank of the Rembiara River, near Heerpora village in Shopian district. It consists of different facies-grey to bluish grey clay, light grey sand clay, purple laminated compact clay, lignite & lignitic clay, coarse to medium grain sand & thick conglomerate bed. To understand the provenance & the transport mechanism, we performed mineral magnetism analysis on these sediments. The low field magnetic susceptibility (χ_{lf}) implies the effectiveness of the erosional processes and the increasing concentration of detrital input from the catchment and shows values ranging from 12.34 to 171.5 × 10^{-8} m^3 kg^{-1} for Dubjan & 9.91 to 187 × 10^{-8} m^3 kg^{-1} for Rembiara. The concentration of the magnetic minerals, grain size and mineralogy was worked out with the interparametric ratios (χ_{lf}, $\chi_{fd\%}$,ARM, SIRM, S-Ratio, Soft, Hard, ARM/SIRM, SIRM/χ_{lf}, χ_{ARM}/χ_{lf}). Hence, the results suggest that the concentration is highly variable for both sections, the contribution of both the PSD- SD & MD grain sizes are there in the remanence, mixed magnetic mineralogy i.e. presence of both ferrimagnetic & antiferrimagnetic minerals suggesting diverse sources of sediments in the Karewa lake basin.

PRIMARY INDICATION OF TWO LAYER UPPER MANTLE SEISMIC ANISOTROPY BENEATH THE IOGL REGION: INSIGHTS FROM SHEAR WAVE SPLITTING ANALYSIS

Sribin C[1,*], Lachit S. Ningthoujam[1] , Sanjay S. Negi[1], Amit Kumar[1]
[1]National Centre for Polar and Ocean Research, Ministry of Earth Sciences, Government of India, Headland Sada, Vasco-da-Gama, Goa 403 804, India
*Email id: sribinc200@gmail.com

Indian Ocean Geoid Low (IOGL) is the world's largest geoid low with a significant negative anomaly of -106 m (Sreejithet al., 2013). Some studies suggested that Tethyan subducted slab graveyards above the Core Mantle Boundary (CMB) could be responsible for the IOGL. In contrast, the density anomalies inferred from seismic tomography explain the presence of low-density anomalies at ~300–900 km depth, which is interpreted as the causative factor for IOGL (Ghosh and Pal,2022). The African LLSVP moving towards the NE is facilitated by the movement of the Indian plate along the same direction that might cause such anomalies in the upper mantle below IOGL.It is crucial to examine their anisotropic properties in order to comprehend the mantle flow and related deformations in this area. New insights into the mantle dynamics of a region can be gained by comprehending the underlying causes of seismic anisotropy in that area. Hence, using SK(K)S splitting to examine upper mantle anisotropy, we offer the first shear wave splitting result from the IOGL region in this study. and 43 splitting measurements were acquired after analyzing 2520 waveforms recorded in 15 Ocean bottom seismometers placed by NCPOR in various locations of the Indian Ocean. In accordance with the results, the fast axis polarization directions (φ) primarily lie in the NNW-SSE direction, with delay times ranging from 1.2 s to 3.8 s. This orientation is parallel to the Indian subcontinent's absolute plate motion, which indicates that shear at the lithosphere's base is the main process causing anisotropy along the studied area. Additionally, supplementary ENE-WSW oriented φ directions are seen with delay times ranging from 1.8 to 3.2 seconds. This is an interesting finding that might be influenced by the NE-moving African LLSVP. For an accurate understanding of this, more observations from surrounding sites are necessary. It is the study's intended future focus.

GEOMAGNETIC SECULAR VARIATIONS AND JERKS IN THE INDIAN SECTOR: A COMPREHENSIVE STUDY

Manjula Lingala[1,2], and Archana R.K[1]
1. Geomagnetic Observatories, CSIR-National Geophysical Research Institute, Hyderabad, India
2. Department of Geophysics, Osmania University, Hyderabad, India
Corresponding Author: manjulal.1118@ngri.res.in

A detailed study of geomagnetic long-term changes carried out to show how the geomagnetic field has been changing in the last few decades in the Indian region and investigated the spatio-temporal pattern of occurrence of geomagnetic jerks. Using all day annua mean and monthly mean data from 1955-2021 from six geomagnetic observatories the main field variations of H, D, and Z components has been studied and observations reveals that the secular trend of H component shows a steady decrease at mid latitude region, a decrease followed by flat trend at low latitudes, and a decrease followed by a steep increase in the equatorial belt. For the D component, the mid latitude shows an increase throughout this duration, a decrease followed by an increase in the low latitude western area and a steady decrease elsewhere on the sub-continent. The broad pattern of the Z component is the

same at all locations, showing an increase throughout. Notably, the study identifies jerks in 2008, 2011, 2014, 2019/2020 and the observed jerks follow a consistent pattern irrespective of the observatory's location within the Indian sector. The 2014 and 2019 global jerks are observed at all latitudes in the X, Y, Z components; only at the equatorial latitude station TIR, the trends are insufficiently defined in the H component. The 2017 jerk is observed only in X-component of low latitude region but is more pronounced in the Z component in peninsular region of India. After 2019 jerk again identified a jerk in 2021 is noticeable in the central low latitude part of the Indian sector only in the Y component. Furthermore, geomagnetic secular variations and jerks during the last decades have been studied using Swarm satellite data and the CHAOS-7 model, and the results have been compared with ground observations in the Indian sector.

HETEROGENEOUS LITHOSPHERIC STRUCTURE OF THE CENTRAL GANGA BASIN BETWEEN THE BUNDELKHAND CRATON AND THE SHARDA DEEP BY MAGNETOTELLURICS

M.Suresh*, A. Manglik, S. Thiagarajan
CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad – 500007, India
Email: surleela@gmail.com

The geology and tectonic structure of the Indian plate in the Ganga Basin is concealed by alluvial sediments. Geophysical surveys for hydrocarbons have revealed the presence of transverse basement ridges and Cenozoic stratigraphy in the basin but basement depth and the nature of the underlying crust and mantle lithosphere in the northern part of the basin are largely unknown. We have carried out a magnetotelluric study (MT) along a 300 km long profile between the Bundelkhand craton and the Sharda Deep to delineate the basement and the lithospheric structure. From this study, we have noted a significant lateral heterogeneity in the subsurface structure that includes a super-thick sedimentary basin with multi-stage sediment deposition in the Sharda Deep and a highly heterogeneous lithospheric structure of the Indian plate north of the Bundelkhand craton. Our model results suggest the presence of fluids and upper mantle conductors feeding to the crustal conductors. This study is the first one to report the heterogeneity of the Indian continental lithosphere beneath the Ganga Basin at a regional scale. Further analysis is required to determine the genesis of the upper mantle conductors.

CRUSTAL STRUCTURE OF COMORIN RIDGE DEPICTS POSSIBLE PLUME-RIDGE INTERACTIONS

Lachit S. Ningthoujam[1*], Dhananjai K. Pandey[2], Nisha Nair[1], Rahul Yadav[1], Sanjay S. Negi[1], Amit Kumar[1], Khogenkumar Shoraisham[3]
[1]National Centre for Polar and Ocean Research, MoES, Go, Indi
[2]Jawaharlal Nehru University, Delhi, India
[2]CSIR-National Institute of Oceanography, Goa, India
*Corresponding email: lachit@ncpor.res.in

Several enigmatic tectonic elements (e.g. Comorin ridge) in the Central Indian Ocean Basin (CIOB) play a crucial role to understand its genesis and evolution which is largely related to the early-mid Cretaceous Antarctica-India rifting and dispersal followed by the late Cretaceous India-Madagascar

break-up. The northward voyage of the Indian plate and adjoining margins was accompanied with frequent interactions between concurrent mantle plumes and spreading centres. Despite its strong geodynamic significance, a detailed understanding of the CIOB and its adjoining regions has remained elusive due to the lack of deep penetrating high-quality seismic refraction and reflection data. An in-depth understanding of the crustal processes that shaped up this region would require velocity and structural information of the crust and upper mantle through deep penetrating seismic observations. In the study ~420-km long wide-angle reflection and refraction seismic profile in the CIOB south off Sri Lanka is utilized to improve our understanding about the geodynamic evolution in the region. Two dimensional seismic travel-time tomographic inversions demonstrate the presence of an anomalously thick crust (~14 km) underneath the Comorin ridge, which gradually thins out in the east towards the centre of the geoidal low. It is observed that the crust to the east of this point appears to be a normal oceanic type. We attribute the lateral diversity in the crustal type to possible magmatic underplating beneath the Comorin ridge. It is interpreted that the concurrent plume-ridge interaction during the late Cretaceous India-Madagascar break-up may have caused this crustal underplating. These findings have significant implications towards better understanding of plume-ridge interaction processes along various passive margins as well as precise reconstruction of India-Madagascar dispersal.

SURFACE WAVE TOMOGRAPHY FOR CENTRAL HIMALAYAS AND TIBETAN PLATEAU

Chandranil Das
IIT ISM, Dhanbad
Email: 21mc0024@agp.iitism.ac.in

We present a high-resolution 3-D lithospheric model for the central Himalayas and Tibetan plateau using the surface tomography method obtained from the dispersion of the fundamental mode of surface waves. We used data from 74 permanent stations (from IRIS) collected for around 6000 Rayleigh waves and almost 2000 love waves. We employ the surface wave tomography method to get 2D image dispersion curves for 5s to 60s periods of surface waves in the target area. Then, using 2D tomographic images for various wavelengths that emerged from the 1D dispersion curve study, dispersion curves are inverted for 3D velocity distribution.

EXPLORING THE GENESIS AND STRUCTURE OF ALCOCK AND SEWELL RISES BY INVERSION OF GRAVITY ANOMALIES

Brandis Carlier[1] , Jensen Jacob[1, 2] , Maria Ana Desa[1, 2], Saif Ali Khan[1, 2]
[1]CSIR-National Institute of Oceanography, Dona Paula, Goa 403 004
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India

The Andaman Sea, located in the north-eastern Indian Ocean and to the east of the Andaman Islands, is a region of active backarc spreading. It owes its existence to oblique subduction of the Indo-Australian plate under the Southeast Asian plate. Present on either side of this spreading centre, are the Alcock and Sewell Rises to the north and south, respectively. The analysis of the bathymetric signature of these rises exhibit northeast-southwest parallel trends similar to the spreading axis

suggesting their conjunction prior to the opening of the Andaman Basin. To enhance the comprehension of the anatomy of these rises, their origin and how they are possibly related to each other, volcanic gravimetry parameters like orientation, shape, volume, length, depth and mass of subsurface structures can play a crucial role. The inversion of gravity data can help in discerning these source parameters and thereby offer possible insight into the nature of magmatic emplacement, the density contrasts of the lithospheric structure right up to the mantle and the quantification of the volcanic source. In this study, we use satellite gravity data to carry out a preliminary study to derive vital results and make meaningful interpretations. Using gravity inversion, we aim to understand the lithospheric structure of the Alcock and Sewell Rises by modelling the subsurface and basement relief to explicate the genesis of these rises, the relationship between them, their extents, their association with the subduction zone and the part they played in the early opening of the Andaman Sea.

SHALLOW SUBSURFACE TEMPERATURE DISTRIBUTION IN THE LADAKH REGION FROM BOREHOLE DATA: IMPLICATIONS FOR GEOTHERMAL PROSPECTS

Ayan Dutta[1,2,*], Labani Ray[1,2], Nagaraju Podugu[1], Sandeep Kumar Prajapati[1,2], Amar Prakashrao Dudhate[1], Nishu Chopra[1], S. Eswara Rao[1,2]

[1]CSIR-National Geophysical Research Institute, Hyderabad 500007, India

[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India

* Presenting author: ayandutta378@gmail.com

Continental collision is a fundamental geodynamic phenomenon that helps in the accretion and growth of supercontinents. The Himalayas are one prominent example of such continental accretion, result of continental collision between Indian and Eurasian plates. Ladakh Himalayas are situated in the North-Western part of the Himalayas, characterized by its cold desert environment. It can be subdivided into five geo-tectonic units from north to south: Karakoram Block, Shyok Suture Zone, Ladakh Batholith, Indus Suture Zone, and Tethys Himalayas. Throughout Ladakh, numerous hot springs have been encountered. Previous studies revealed three geothermally prospective regions (Puga, Chumathang, and Panamik), where hot spring temperatures reach up to 84 ^{o}C.

To accurately assess the geothermal potential of the reservoirs, it is imperative to understand subsurface temperature distribution on a regional scale. In the present study, temperature logging has been carried out in 32 boreholes of opportunity ranging in the depth from 30-144 m and distributed in three regions: (i) west of Leh-around Khalsi, (ii) in and around Leh, (iii) north of Leh-Shyok-Nubra valley.

Two boreholes, located near Changlung and Panamik hot springs in the Shyok-Nubra valley, exhibit comparatively high temperatures (up to 75 ^{o}C). Interestingly, in a borehole, situated 400 m away from Panamik hot spring, the recorded temperature is normal, indicating that higher temperature is not evenly distributed in that area. The subsurface temperature distribution appears to be within normal range for the region away from hot springs.

The temperature-depth data of the present study, in combination with previous data from Puga and Chumathang, strongly indicate that in regions with geothermal manifestations, high temperatures are spatially confined, rather than being evenly distributed across the entire area. This strongly suggests

for an adequate characterization of the deeper thermal regime leading to better reservoir models and understanding of sustainability of the heat source in Ladakh.

THERMAL CONDUCTIVITY, RADIOELEMENT DISTRIBUTION AND GEOCHEMISTRY OF THE GRANITOIDS AND GNEISSES ACROSS THE SON-NARMADA LINEAMENT AND ITS GEODYNAMIC IMPLICATIONS IN CENTRAL INDIAN TECTONIC ZONE

Nishu Chopra[1*], S.P. Singh[2], Labani Ray[1,3], Ayan Dutta[1,3], Sandeep Kumar Prajapati[1,3]
[1]CSIR-National Geophysical Research Institute, Hyderabad-500007, India
[2] Bundelkhand University, Jhansi, Uttar Pradesh-284128, India
[3]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India
*Presenting author: nishuchopra@ngri.res.in, nishuchopra31@gmail.com

The Central Indian Tectonic Zone (CITZ) is a prominent ENE-WSW tectonic feature covering 1600 x 200 km^2 that divides the Indian subcontinent into northern and southern blocks. CITZ comprises of three major supracrustal belts: Mahakoshal, Betul and Sausar, and is intersected by numerous lineaments, including Son-Narmada North Fault (SNNF), Son-Narmada South Fault (SNSF), Central Indian Suture/Shear (CIS), etc. The northern part of CITZ records Paleoproterozoic (ca.1.8 Ga) events, while the southern part records late Paleoproterozoic-early Mesoproterozoic (ca.1.6-1.5 Ga) events. The most recent collision occurred during the late Mesoproterozoic to early Neoproterozoic (ca.1.04-0.93 Ga), which resulted in the amalgamation of the two blocks. Despite its significance in terms of geological evolution and potential region for geothermal resources, it is devoid of thermal data.

First-time thermal conductivity and heat production are measured in the laboratory on various rock types, including alkali granite, ultrapotassic granite, granitic/migmatite/dioritic gneiss/TTG gneisses, collected from the Mahakoshal and Betul belts, specifically from Harda, Betul, Jabalpur, Umaria, Majhauli, Sidhi, Bargawan-Singrauli areas. To characterize the rocks, physical (density, porosity), geochemical and petrographic studies are performed.

The results indicate that the alkali and ultrapotassic granites exhibit the highest average thermal conductivity between SNNF and SNSF, intermediate in the north of SNNF and lowest in the south of SNSF. In contrast, gneisses have lower thermal conductivity (2.1-3.3 $Wm^{-1}K^{-1}$) compared to granitic rocks (3.0-3.9 $Wm^{-1}K^{-1}$). Thermal conductivity shows a positive correlation with SiO_2 and quartz, whereas a negative correlation with alkali feldspar and density. Average heat production from west to east increases for alkali granite (2.3-5.8 □□Wm^{-3}) while decreases for granite and ultrapotassic granite (1.8-1.2 □Wm^{-3}, 8.6-6.6□□Wm^{-3}, respectively). Gneisses exhibit comparatively lower heat production values compared to the granitic rocks. The distinct thermal and physical properties indicate that the granites were emplaced in multiple events, both temporarily and spatially.

GEOTHERMAL EXPLORATION OF WEST COAST, INDIA FROM GEOLOGICAL, GEOCHEMICAL AND GEOPHYSICAL INVESTIGATIONS: A REVIEW

Amar Prakashrao Dudhate[1,*], Labani Ray[1,2], Nishu Chopra[1], Nagaraju Podugu[1]
[1]CSIR-National Geophysical Research Institute, Hyderabad 500007, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India
* Presenting author: amar.dudhate@gmail.com

Geothermal energy has attracted considerable interest in recent years as an alternative energy resource. On the western coast of the Indian subcontinent, about sixty hot springs are situated at eighteen localities along a linear 350 km stretch referred as the West Coast Geothermal Province (WCGP), which is divided into Northern, Central and Southern sectors.

The temperature of hot springs in WCGP ranges from 33−70 ºC and the reservoir temperatures range from 62−170 ºC by Silica, Quartz and Na/K geothermometry. Hot spring waters are mostly of alkali chloride, indicating deep geothermal reservoir. Isotope studies suggest that the hot and cold water falls along normal meteoric line, indicating surface water recharge in the WCGP. Further, in Northern sector, saline springs with elevated calcium imply basalt-seawater interaction at high-temperatures, in Central sector, springs with high fluoride suggest basement xenoliths in basalt flows, while in South sector, high barium indicates circulation within radiogenic granites. The consistent composition of major ions in thermal waters signifies a well-established geothermal system.

Geophysical investigations were carried out to identify faults and conductive zones in the WCGP. In Tural-Rajawadi, Southern sector faults acting as geothermal conduits are at very shallow depth (<50−150 m) as revealed from magnetic study, but appear to extend deeper (50−500 m) as revealed from gravity study. Conductive features at shallow depths (<35 m) are also observed by different electrical methods. Audio-frequency Magnetotelluric study delineated intrusive bodies at 500−1000 m depths acting as heat sources. Similar shallow conductive features are observed in Aravali, Southern sector and Unhavare (Khed), Central sector. In Sativali-Koknere, Northern sector, a conductive zone at around 2 km depth is suggested by Magnetotelluric investigations. Thus, above regions hold geothermal potential. However, detailed studies on deep thermal regimes and rock thermo-physical properties are essential for reservoir simulations and geothermal resource development in the WCGP.

HIGH HEAT FLOW IN GODAVARI GONDWANA BASIN, INDIA: IMPLICATIONS FOR GEOTHERMAL PROSPECTS

Sandeep Kumar Prajapati[a,*], Labani Ray[a], Vishal Vasantrao Sakhare[b], Nishu Chopra[a], Bishnu Prasad Biswal[b], S. Eswara Rao[a]
[a] CSIR-National Geophysical Research Institute, Hyderabad-500007, India
[b] Geological Survey of India, Nagpur-440006, India
* Presenting author: prajapatisandeep133@gmail.com

The Pranhita-Godavari basin, one of the biggest Gondwana basins in India, formed due to the occurrence of extensional tectonic activities and crustal weakness between Dharwar and Bastar Cratons. The sediment of the Godavari basin lies over the gneiss and granulite basement rocks.

The study area, Manuguru, part of the Manuguru–Cherla coal belt, is situated on the southeastern margin of the Godavari basin. Geological Survey of India drilled eight deep boreholes, each ~1000 m

deep, where temperature measurements were done. The highest recorded temperature was 83 ^{o}C. Among these boreholes, only two yielded undisturbed geothermal gradients, which were used to determine the heat flow of the region. The borehole formations consist of sandstone, shale and quartzite, with minor banding of siltstone, conglomerate, and coal.

The thermal conductivity of 60 core samples was determined in the laboratory using a steady-state method. The average thermal conductivity varies, with the lowest values for shale (1.95 $Wm^{-1}K^{-1}$) and siltstone (2.34 $Wm^{-1}K^{-1}$); intermediate for sandstone (3.03 $Wm^{-1}K^{-1}$); and highest for quartzite (4.56 $Wm^{-1}K^{-1}$). Heat flow values, determined using the Bullard technique, exhibit similar ranges as observed earlier from southwestern (Parsa: 84.2 mWm^{-2}) and southern (Chintalapudi and Aswaraopeta: 92.1 and 104.3 mWm^{-2}, respectively) part of the basin. In contrast, Bellampalli, the central portion of the Godavari basin and Mailaram, bordering the Gondwana sediments, exhibit low heat flow values of 44.4 and 46.1 mWm^{-2}, respectively.

The high heat flow value in the southeastern, southern, and southwestern parts of the Godavari basin could be due to the existence of a subsurface geothermal reservoir. The high heat flow in Manuguru region is due to upflow of subsurface geothermal hot water along the multiple normal faults. Geological, geochemical, and geophysical results, along with thermal data of the present study, are used to access the temperature distribution of the reservoir.

CORRELATING b-VALUES AND GRAVITY ANOMALY ALONG INDO-BURMAN AND ANDAMAN- SUMANTRA-JAVA SUBDUCTION ZONE

Harsha K Haridas[1], Jensen Jacob[2], Mahesh Perugu[2], Dibakar Ghosal[3], Sunil P S[1], Barndis Dominic Carlier[2], Saif Ali Khan[4]

[1]Department of Marine Geology and Geophysics, Cochin University of Science and Technology, Kochi, India
[2]Geological Oceanography Department, National Institute of Oceanography, Dona Paula, Goa
[3]Indian Institute of Technology Kanpur, Kanpur-208016, U.P., India
[4]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India

The tectonic boundary of the Indian Plate, stretching from the Indo-Burman Region to the Sumatra-Java Trench, is one of the most seismically active regions globally. The Sagaing fault and Sumatra-Java Subduction zone contribute to this high seismicity. The frequent earthquakes are continuously altering the stress orientation within this region. The Gutenberg-Ritcher equation gives the relationship between the cumulative number of earthquakes and their magnitude. The scaling parameter, b (b value), in the relationship gives insight into the region's stress accumulation. In this study, the b value has been utilised to investigate the region's stress distribution. The earthquake data between the period of 2004 and 2021 from the ISC earthquake catalogue with a magnitude ranging from 1 to 9 is used. All seismic magnitudes are converted into a common magnitude scale, mb (body-wave magnitude), to incorporate all the events. For the present analysis, we divided the study area into four regions and calculated the b value for each. It is observed that the b values from the four regions are high, indicating low-stress accumulation. Additional comprehension analysis is performed to correlate the b-values with the spatial density variation of the region using Bouguer gravity anomaly map. High positive bouguer anomalies is observed along the subduction zone compared to the Indo-Burman plate Boundary, which reciprocates the higher b values estimated for these regions.

Further, to investigate the relationship between b-values and the density contrast with depth, a mantle bouguer inversion coupled with receiver function analysis will be performed.

PHYSICS-GUIDED UNSUPERVISED DEEP LEARNING APPROACH FOR THE INVERSION OF RECEIVER FUNCTIONS IN DIPPING AND ANISOTROPIC MEDIA

Bijayananda Dalai[1,2], Prakash Kumar[1,2] and Mrinal K. Sen[3]
[1]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad 500007, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad 201002, India
[3]The University of Texas at Austin, Austin, TX 78758-4445, USA
Email: bijayanandadalai@gmail.com

Understanding the Earth's subsurface structure is critical for delineating the composition and tectonic evolution of the lithosphere. Receiver functions (RF) have become a favourable technique for probing this structure, particularly useful for estimating variations in shear wave velocity. In the analysis of receiver functions, deterministic physical methods such as inversions are frequently employed to refine these estimations to image the subsurface geological structure. Despite their utility, the presence of dipping and anisotropic geological structures very often complicates and can even hinder the inversion process. To address these complexities, this study introduces a Physics-guided unsupervised deep learning approach for the inversion of receiver functions. This framework leverages the strengths of unsupervised deep learning empowered with implicit neural representation to predict Earth model parameters without the need for labeled data. Following this, predicted parameters are integrated into the forward modeling process to simulate the receiver functions. Then the loss function serves as the guiding metric for the training of the approach in subsequent iterations. Inversion results suggest that this physics-guided unsupervised deep learning approach is effective in inversion tasks, particularly when dealing with intricate geological settings like dipping and anisotropic media. With its application aimed at understanding subsurface structures, we believe that this approach holds potential to broaden the capabilities of subsurface exploration.

DECIPHERING THE SOUTHERN INDIAN SHIELD REGION: INSIGHTS FROM THE 3-D MAGNETOTELLURIC INVERSION

Kusham[1], Pradeep Naick B[1], Pratap A[2], Naganjaneyulu K[1]
[1]CSIR-National Geophysical Research Institute, Hyderabad, India
[2]Absolute Imaging International India Limited, Noida, India
Corresponding author: kusumsandhu33@gmail.com

The Southern Indian Shield Region (SISR) is predominantly characterized by stable continental conditions. It is considered a cratonic region, which means it consists of an ancient, stable continental crust that has not experienced significant tectonic activity for millions of years. To examine the lithospheric resistivity structure beneath the Southern Indian Shield Region, 32 stations of magnetotelluric data were used. This survey included the Deccan Volcanic Province (DVP), the Western Dharwar Craton (WDC), and the Southern Granulite Terrain (SGT). It covered an approximate 800 km NW-SE trending profile with approximately 25 km site spacing. The range of time series records included in the data set was from 0.01 to 3,000 seconds. Phase tensor and WALDIM dimensionality analysis were carried out to evaluate the dimensionality of the data. Data

analysis shows the three-dimensional (3-D) nature of the sub-surface structures. 3-D magnetotelluric inversion with diagonal (Zxx, Zyy) and off-diagonal (Zxy, Zyx) components were used in our investigation. It stares into the unexplored sub-surface, investigates the tectonic evolution of the area, identifies the polarity of subduction, and maps anomalous features. The conductive features found in the crust were associated with the deep-seated faults and shear/suture zones in the area. Subduction and plume-derived models, in turn, supported the present study resistivity model. According to our research, there is a southward subduction polarity between the western Dharwar craton and southern granulite terrain, with the Palghat-Cauvery Suture Zone (PCSZ) serving as a prominent collisional zone. Furthermore, the conductivity properties of the crustal and lithospheric mantle coincided with the Moho depth and the lithosphere-asthenosphere boundary. The resistivity structure revealed beneath the geologically complex Southern Indian Shield Region sheds light on significant tectonic aspects of the region.

MAPPING OF THE CRUSTAL ELECTRICAL CONDUCTIVE STRUCTURE BENEATH THE DECCAN VOLCANIC PROVINCE AND THE WESTERN DHARWAR CRATON, INDIA

[1] Naganjaneyulu K, [1] Kusham, [1] Pradeep Naick B, [2] Pratap A
[1] CSIR-National Geophysical Research Institute, Hyderabad, India
[2] Absolute Imaging International India Limited, Noida, India
Corresponding author: kasturi.naganjaneyulu@gmail.com

The magnetotelluric method is used to map the electrical conductivity structure of the subsurface beneath the Deccan Volcanic Province and the western Dharwar craton. The study was carried out along a 150 km long NW-SE trending traverse from Belgaum (in the north-western region - in the Deccan Volcanic Province) to Haveri (in the south-western region - in the western Dharwar craton). Data at 19 magnetotelluric stations with a station spacing of 10-15 km are used. The two-dimensional (2-D) inversion for apparent resistivity and phase is performed using a non-linear conjugate gradient technique. Weerachai and ModEM code were used to do three-dimensional (3-D) inversion using data from the diagonal and off-diagonal components. In the 2-D model, many conductive features are mapped. According to this study, the upper crust is extremely resistive (>10,000 ohm-m) along the entire profile. It implies that the tonalite-trondhjemite-granodiorite (TTG) crust is present. A boundary or rift-related feature is thought to be represented by the conductor traced on the northwest portion of the profile, which lies beneath the contact zone of the Deccan Volcanic Province and the western Dharwar craton. This conductive feature might be thought of as a further westward extension of the Kaladgi basin. The mid-crust exhibits a highly resistive character on the center and southeast sides. The robustness of the conductive features acquired in the 2-D model is confirmed by the sensitivity studies. Two-dimensional and three-dimensional magnetotelluric inversion results are compared. Despite the overall stable nature of the study region, there are areas of localized tectonic activity, especially in the northern part of the profile. This area is characterized by a rift zone, where the Earth's crust is undergoing extension. In summary, Within the stable continental region, the localized rift zone provides geological diversity and contributes to the geodynamics of the region.

A COMBINED METHOD FOR THE DENOISING OF GNSS COORDINATE TIMESERIES USING SINGULAR SPECTRUM ANALYSIS AND CEEMDAN.

P.V.M.V. Prasada Raju, P.N.S. Roy
Department of Geology and Geophysics, IIT Kharagpur, Kharagpur, India, 721302.
Email: prasadrajupvmv@kgpian.iitkgp.ac.in

A GNSS time series is a continuous record of 3D displacements over a wide time scales, aiding the study of geophysical processes involving crustal deformation. It is a combination of modelled components (e.g., annual, and semi-annual variations, sudden jumps, post-seismic relaxation) and unmodeled components referred to as noise. Singular Spectrum Analysis (SSA) is a widely used data-driven method in time series analysis and signal processing. One of the disadvantages of SSA is that there are no exact criteria for selecting the reconstruction order parameters for denoising. In this study, we present a combined method utilizing the signal features obtained from signal decomposition using CEEMDAN, an existing variant of Empirical Mode Decomposition. These features help us to set a threshold for selecting the reconstruction components for SSA. The method was tested on noisy synthetic data, recovering 99.96% of the original signal. Subsequently, we applied this combined approach to real-world GNSS time series sourced from the Nevada Geodetic Laboratory website significantly improved denoising parameters (RMSE, Signal-to-Noise ratio, and correlation coefficient) compared to individual methods that relied on manual selection of parameters. The denoised data is expected to enhance the accuracy of calculations in Earth processes modelling.

UNRAVELING MARS' MAGNETIC MYSTERIES: INSIGHTS FROM CRUSTAL MAGNETIZATION AND SPHERICAL HARMONIC COEFFICIENT ANALYSIS

Debopam Ghosh* & Swarandeep sahoo
Department of Applied Geophysics, Indian Institute of Technology Indian School of Mines Dhanbad.
*Email Id: 21mc0031@agp.iitism.ac.in, ghoshd00012@gmail.com.

The absence of magnetization in Martian impact basins, such as Hellas, Argyre, and Isidis (~3.9 billion years old) suggests the absence of a current active dynamo on Mars. However, evidence from residual crustal magnetization strongly implies that Mars once possessed an active dynamo responsible for magnetizing its crustal rocks. The hemispheric dichotomy of Mars, both in terms of topography and residual crustal magnetism, remains an intriguing feature that lacks a definitive explanation. Notably, the southern hemisphere exhibits dominant crustal magnetization. The prominent southern hemisphere magnetic field feature can be a result of the internal origin of magnetic field by an ancient dynamo active approximately 4.3 billion years ago would have magnetized the crustal rocks and the observed magnetic field distribution today is a remnant of that. Until recently, studies of the Martian dynamo have majorly relied on the mantle heterogeneity model, influencing fixed heat flux pattern at the Core Mantle boundary (CMB). However, the INSIGHT Lander mission in 2018 - through the seismological and earthquake data from the seismometer- SEIS predicted that, Mars lacks an inner core. In our ongoing study we've incorporated this new information into our model for ancient Martian dynamo. In our investigation, we have employed available spherical harmonic coefficients to reconstruct the crustal magnetic field of Mars, encompassing Br, Btheta, Bphi, and Bintensity across the Martian surface. These spherical harmonic coefficients for the Martian crustal field have been derived from the inversion of magnetic field data

collected by satellites such as MGS and MAVEN, extending up to n=134. The complexity of crustal magnetic field of Mars, marked by numerous small-scale features, likely accounts for this disparity. Our analysis of these SH-coefficients includes spherical harmonics analysis, power spectral analysis, separating the crustal magnetic field from noise contributions, assessing upward and downward continuity of the crustal field of Mars. These can be used to compare the simulated magnetic field-distribution with the observed crustal field in further studies. To minimize the influence of rock types with varying susceptibilities on the distribution of magnetic field components over the Martian surface, we primarily consider the intensity distribution, represented as Bintensity=(Br2+ Btheta2+ Bphi2)1/2 i.e. focusing solely on magnitude instead of individual component of magnetic field vectors. Furthermore, our research investigates the influence of meteorite impacts (impact craters) on the temporal modification of the Martian crustal magnetic field after the extinction of the Martian dynamo. This analysis enhances our ability of verification and analysis of simulation results of Martian dynamo with observed crustal magnetism data in our future studies.

PETROGRAPHIC AND FLUID INCUSION STUDIES IN HIGH GRADE METAMORPHIC ROCKS OF COORG AND MERCARA SUTURE ZONE, SOUTHERN GRANULITE TERRAIN, SOUTH INDIA

***Rajkumar P B1, Amaldev T1, and Rahul Raj R2**
1 Department of Marine Geology and Geophysics, School of Marine Sciences, CUSAT, India
2 Christ college (autonomous), Irinjalakuda, India
E mail: *rajkumarpbalan@gmail.com

The Southern granulite terrain (SGT) is one of the classical granulite terrain in the world which is famous for mosaic of distinct high grade metamorphic blocks and is situated in the southern tip of peninsular India below the Archean Dharwar craton. The Southern granulite terrain is regionally categorized into several distinct tectonic blocks dissected by crustal scale shear/suture zones. When progressing from the northern region to southern region of SGT, these blocks are designated as: Coorg Block, Nilgiri Block, Salem Block, Madras Block, Madurai Block, Trivandrum Block (referred to as the Kerala Khondalite belt), and Nagercoil Block. Among this, the Coorg block is one of the oldest crustal blocks and is renowned for its Mesoarchean magmatic rocks. The present study relies on field investigation, petrography and fluid inclusion analyses of high grade metamorphic rocks collected from different localities in and around Coorg block and Mercara suture zone. Field investigation and petrographic studies reveals the high pressure and medium grade temperature of metamorphism along the Mercara suture zone and Coorg block. Furthermore, microthermometric studies reveals presence of primary, secondary and pseudosecondary type inclusions which is identified as CO2 type fluid having moderate to high density, indirectly indicating the dry nature and peak grade of metamorphism occur along the Coorg and Mercara suture zone

INTER-SEISMIC, CO-SEISMIC AND POST-SEISMIC DEFORMATION OF THE 2015 MW 7.8 NEPAL (GORKHA) EARTHQUAKE

Rajesh Sathiyaseelan[1*] and John P. Pappachen[2]
Wadia Institute of Himalayan Geology, 33 GMS Road, Dehradun*
satraj@wihg.res.in

The 25th April 2015 Nepal earthquake of Mw 7.8 was the recent and significant Himalayan earthquake that struck near Gorkha, approximately 80 km northwest of Kathmandu at a depth of ~ 15 km. It is the largest earthquake that occurred on the Main Himalayan Thrust (MHT) since the great 1934 Bilhar-Nepal earthquake of Mw 8.2. In this work, we have investigated the inter-seismic, co-seismic and the post-seismic deformations associated with the 2015 Mw 7.8 Nepal (Gorkha) earthquake using continuous GPS observations.

GPS data from 72 stations from IGS (International GNSS Service), and Nepal GPS Array (NEGAR) for a span of 11 years from 2010 to 2020 were used in this study. The data were processed using the GAMIT/GLOBK software in IGB14 reference frame and estimated the co-seismic offsets, inter-seismic and post-seismic velocities and the surface strain rates. The estimated inter-seismic velocities show an orientation towards the northeast as that of the movement of the Indian Plate, which decreases from 49.81 ± 0.10 mm/a in the south of Himalayan Frontal Thrust (HFT) to 41.06 ± 0.02 mm/a in the Higher Himalaya. Stations in the Higher and the Lesser Himalaya show relatively larger velocities and oriented towards south in the Indian reference frame. However stations at the Sub- and the Frontal Himalaya show relatively lower velocities of 1.41 ± 0.10 mm/a and 0.66 ± 0.08 mm/a respectively, which indicate strong inter-seismic coupling of MHT and its locking towards the Frontal Himalaya. In the MCT zone the inter-seismic second invariant strain-rate shows a clear pattern of high strain-rate of ~100 nstrain/a; in fact, the Mw 7.8 event occurred in this high strain-rate zone with the co-seismic rupture propagated towards the southeast.

The estimated co-seismic displacements associated with this earthquake show an abrupt change and large offsets in the near field (<150 km, like CHLM and KKN4). These near field stations situated at the north of the Main central thrust (MCT) show crustal subsidence whereas the southern block got uplifted with Physiographic Transition (PT2) marks the border between these blocks. The post-seismic velocity vectors show that most of the deformation is occurring towards SE of the Mw 7.8 Nepal (Gorkha) event. Inter-comparison of pre- and post-seismic offset phases reveal that the relaxation process of the crust was quite rapid and almost got completed within five years after the Gorkha event. This indicates that, the stress adjustments were mainly bounded within the shallow crustal layer and the much anticipated involvement of the upper mantle through viscoelastic relaxation is not evident. The comparison of the inter-seismic and post-seismic deformation suggest that the seismogenic zone is gradually reverting to the pre-earthquake status and entering into the inter-seismic stress accumulation phase and preparing for yet an another significant Himalayan earthquake.

FAULT CHARACTERIZATION USING CENTROID MOMENT TENSOR (CMT) SOLUTIONS OF EARTHQUAKES IN NATIONAL CAPITAL TERRITORY (DELHI) REGION

Urvashi Tyagi*[1], Naina Gupta[1], Rimpy[1], Charu Kamra [2], Manisha Sandhu[1] and R.B.S. Yadav[1]
[1] Department of Geophysics, Kurukshetra University, Kurukshetra
[2] Institute of Seismological Research, ISR, Gandhinagar
Email-urvashityagi4699@gmail.com

The National Capital Territory (NCT), Delhi, capital of India, is not only the administrative hub but also becomes important due to its location in the vicinity of the Himalayas, the most active seismically region. The region falls in Zone IV (second highest seismic hazard) in the seismic zoning map of India, which makes it more prone to the occurrences of the earthquakes of magnitude 7.0 in future. The fault characterization is highly important to understand the source genesis of earthquakes in this region. For this purpose, we used the waveform of small earthquakes with magnitude ranging from Mw 3.6 to 4.4 recorded by the seismic network of the National Center for Seismology (NCS), New Delhi.

We performed moment tensor inversion of some selected events using the ISOLA software. Moment tensors are important because they completely describe sudden relative displacement at a fault surface, sudden volume collapse due to phase transition or sudden volume increase due to explosions. Centroid Moment Tensor (CMT) solution is a solution of earthquake estimation extracted by 3 components waveform inversion. CMT solution includes 9 components of moment tensor (3 of which are symmetric), latitude, longitude, centroid depth and it also provide the information about the type of fault. A local velocity model is used to find the moment tensor. This research provides valuable insights into the seismic characteristics of the NCT, offering a better understanding of the region's tectonic activity.

PETROGRAPHY AND MINERAL CHEMISTRY OF MAFIC INTRUSIVE ROCKS FROM THE SIROHI DOMAIN, ARAVALLI CRATON, WESTERN INDIA: INSIGHTS INTO MANTLE-CRUST INTERACTIONS TECTONIC EVOLUTION.

Mahimaa Dash*, N. V. Chalapathi Rao.
EPMA Laboratory, Department of Geology, Centre of Advanced Study, Banaras Hindu University, Varanasi – 221005, U.P., India
*presenting author: mahimaadash@bhu.ac.in, nvcrao@bhu.ac.in.

Neoproterozoic mafic magmatism is rare in the geological history of the Aravalli Cratons. However, some N-S, NE-SW, E-W, ENE-WSW, and NW-SE trending mafic dykes are present around Ishra, Andor and Sirohi areas, and these dykes intrude the Erinpura Granite (Neoproterozoic). Andor and Ishra dykes are doleritic and Sirohi dykes are doleritic, dioritic in nature. These are well-developed system of post malani basic rocks in the south-western part of Rajasthan. The present paper highlights field, petrographic and mineral-chemical studies of these dykes. Despite extensive hydrothermal alterations, relicts of the primary textures are, to some extent, well preserved in the doleritic and dioritic samples, which provide essential insights into the mineralogy and nature of the original intrusives. According to studies of component mineralogical properties, these dykes are related to a common parent magma. The chemical properties of the component pyroxene grains show that they

are in between Diopside-Hedenbergite solid solution or, in rare cases, pigeonite field. Amphiboles are well differentiated as 'calcic' type. The chemistry of additional accessory mineral phases such as opaque oxides, sphene, and chlorite has been presented. The use of suitable thermobarometric procedures (involving pyroxene and amphibole) generates temperatures ranging from 800 degree C to 1000 degree C at pressures ranging from 3 to 6 kb. Based on existing field, petrographic, and mineral-chemical data, it has been proposed that the cooling of the parent invading magma began at a shallow to intermediate depth. The petrology and mineral chemistry of these dykes hold the potential to elucidate their role in the craton's geological history, including mantle-crust interactions, magmatic processes, and potential contribution to mineral resources of Aravalli craton.

PROCESSING OF 2-D ONSHORE SEISMIC DATA OF SOUTHERN ALBERTA REGION, CANADA

Rohit Chauhan*, Abhishek, Ishika Aggarwal, Manisha Sandhu
Department of Geophysics, Kurukshetra University, 136119
Presenting Email: rohit.chauhan199959@gmail.com

The seismic exploration of subsurface structures plays a pivotal role in understanding the geological features and potential hydrocarbon[1] reservoirs[2]. This study delineates the seismic processing steps undertaken to analyse 2-D seismic data acquired in the **Southern Alberta region, Canada**. The objective is to showcase a comprehensive workflow that facilitates a detailed investigation of the subsurface, aiding in prospecting and resource assessment. The 2-D land seismic data has been taken from an open-source platform.

The seismic processing begins with data acquisition, where geophones[3] are deployed to record the reflected seismic waves[4] generated by controlled sources[5]. The subsequent stages involve data pre-processing, including data quality control, noise reduction, and static corrections to enhance the quality and accuracy of the dataset.

Following pre-processing, data is migrated to create an accurate subsurface image, mitigating imaging challenges and correcting for velocity variations. This step involves applying various migration algorithms to accurately position subsurface reflectors. Subsequently, velocity analysis[6] is performed to determine the appropriate velocity model for depth migration[7].

After migration, the processed seismic data undergoes structural interpretation to identify subsurface features and potential reservoirs. This involves identifying faults, folds, and other geological structures critical for resource assessment and reservoir characterization.

The integrated seismic processing workflow highlights the iterative and intricate nature of seismic data analysis, emphasizing the critical role it plays in revealing subsurface structures and optimizing hydrocarbon exploration strategies in this area.

STRESS-STRAIN PARTITIONING OF INDIA-EURASIA COLLISION ZONE USING FPS AND GPS DATA

***R. Abhirami, P.S. Sunil A Sooraj**
Department of Marine Geology and Geophysics, School of Marine Sciences
Cochin University of Science and Technology, Kochi-682016, Kerala
*Presenting author's: abhiramiratnakar@gmail.com

The Neotectonics of the India-Eurasia Collision Zone is complicated due to India's northward convergence, which results in crustal shortening across the Himalayas and crustal thickening of Tibetan terranes, followed by the reactivation of various structural characteristics exhibited by significant earthquakes throughout the collision zone. The current work looks at the spatial distribution of the present-day stress field and stress orientations in the Himalayan-Tibetan orogen using earthquake fault plane solutions (FPS) by incorporating two approaches of stress inversion. One is by carefully assessing the seismicity, tectonics, and faulting style of the region, we divided the research area into thirty-four seismotectonic subzones, along with the trends of key active structures, to carry out the stress inversion for evaluating the regional stress field. While the other is dividing the whole area into grids to carry out formal stress inversion.The result is corroborated with the GPS derived strain data. Our findings suggest that compressive stress dominates in Himalayan subvolumes with low plunging N-S orientation, accompanied by a minor component of higher plunging E-W extension, which provides information about lithospheric plate convergence and slab negative buoyancy; whereas Tibetan seismotectonic subvolumes have low plunging E-W extension with a minor higher plunging N-S compression, displaying the signatures of wrench tectonics towards Eastern Tibet. The maximum compressive stress (SHmax) determined in this work is linked to second and third-order stresses and can be attributable to the Himalayan-Tibetan orogen's crust-mantle mechanical interaction.

DEEP LITHOSPHERIC STRUCTURES BENEATH PRANHITA-GODAVARI VIS-À-VIS SON-MAHANADI RIFT BASINS OF INDIA THROUGH THE ANALYSIS OF GRAVITY DATA

***Swarnapriya Chowdari and Bijendra Singh**
CSIR-NGRI (National geophysical Research Institute), Hyderabad-50007, India
Email: * swarnapriya.ngri@gmail.com

The NW-SE trending Son-Mahanadi and Pranahita-Godavari rift basins depict significant gravity lows within the basin boundary which are caused by the low-density Gondwana sediments. The adjoining gravity highs suggest high-density rocks along shoulders, which is typical of extensional tectonics related to continental rift basins. However, long wavelength regional Bouguer gravity anomaly maps over these basins shows contrasting gravity signatures. It depicts a feeble gravity high over the Pranhita-Godavari basin whereas the Son-Mahanadi basin is associated with a large wavelength regional gravity low. Yet another contrasting signature is the presence of regional topographic upwarp over the Son-Mahanadi basin whereas such feature is missing over the Pranhita-Godavari basin. An inverse correlation between regional topography and gravity is a typical signature of the presence of anamolous low density due to upwarp of the asthenosphere (thinning of lithosphere) produced by the impact of mantle plume on the continental lithosphere.

2½D gravity modeling of the 1000 km long profile from Dharwar to Singbhum cratons across Pranhita-Godavari and Son-Mahanadi basin disclose contrasting density distributions. Regional gravity low associated with the Son-Mahanadi basin is caused by asthenospheric up warp and associated thinning of the lithosphere and high over the Pranhita-Godavari rift basin is due to mafic magma underplating at the crust-mantle interface. It suggests that the lithosphere-asthenosphere boundary (LAB) below the Pranhita-Godavari basin has a normal thickness of about 160 km that reduces to 90 km beneath the Son-Mahanadi basin. Therefore, this study clearly suggests that the Gondwana rift basins of India evolved in a passive rift environment while the Son-Mahanadi rift witnessed post-rift tectonic event due to the impact of the Deccan plume resulting in contrasting lithospheric structures. The presence of mafic dykes of Deccan origin supports the above conjecture.

EVIDENCE FOR PALEO-CONTINENTAL MARGIN AND FOLDING OF RELIC FRAGMENT OF THE BAY OF BENGAL, NORTHEAST INDIAN SUBCONTINENT

R. Abhimanyu[1], K.S Krishna[2], M. Ismaiel[3]

1.Department of Marine Geology and Geophysics, School of Marine Sciences, Cochin University of Science and Technology, Kochi, India
2.School of Sciences, GITAM University, Visakhapatnam, India
3.Earth Science Department, Khalifa University, Abu Dhabi, UAE
*Email: abhimanyurajan004@gmail.com

The processes of continental breakup, reassembling of landmasses, and huge deltaic sediment depositions contribute to reconfiguring the Earth's surface. Here, we show a classic example of contiguous structures of paleo-continental margin on the eastern Indian Shield and an ancient fragment of the oceanic lithosphere beneath Bangladesh. In the present work, we collated gravity data from Bangladesh and adjoined parts of the Indian shield and the northern Bay of Bengal to decipher rocks' nature and long-term behavior. The gravity map illustrates N-S oriented alternate bands of ~150 km wide positive and negative anomalies in the Bangladesh region, besides showing signatures of prominent geomorphic features such as the Shillong Plateau, Sylhet Trough, Burmese Arc, etc. The crustal models reveal the presence of paleo-continental margin segments on the eastern edge of the Singhbhum craton and south of the Shillong Plateau, ~150 km wide folded oceanic crust beneath Bangladesh, and a low slab dip of the subducting Indian plate beneath the Burma platelet. The inferred continental margin evolved after the breakup occurred between the Rajmahal-Sylhet Line and continental fragments (Elan Bank and southern parts of the Kerguelen Plateau) at about 120 Ma. Subsequently, the sediments carried by two great Himalayan river systems were excessively deposited on the margin and over an older fragment of the oceanic lithosphere, resulting in the progradation of the Bengal delta towards the ocean. The oceanic crust beneath Bangladesh was folded with approximately 150 km wavelength as the compressive stress regime is locally operative due to the eastward moment of the Indian plate and westward propagation of the Indo-Burman Wedge.

THE IMPORTANCE OF ACCURATE PHASE LABELING IN SEISMIC ARRIVAL TIME DATASETS: IMPLICATIONS FOR SEISMIC TOMOGRAPHY

Pratul Ranjan[1], Konstantinos I. Konstantinou[2], Prakash Kumar[1]

[1] CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad-500001, Telangana
[2] Department of Earth Sciences, National Central University, Taoyuan, Taiwan-320
corresponding email: pratulranjan@ngri.res.in

The seismological community heavily relies on the correct identification of seismic phases by the local analysts at data-centers around the world for a variety of applications. For studies on a global scale, the body wave or surface wave phases arrive several seconds apart and they can easily be identified. However at local to regional scale, arrival times of many pairs of phases have a sub-second difference, which leads to often misidentification of these phases. One such phase-pair is the Pg-Pn phase, where the former is a P-wave refracted in the crust and the latter is a P-wave refracted in the upper mantle close to the Moho. Depending on the depth of the earthquakes and epicentral distances, Pn phase can arrive earlier than the Pg phase and may get misinterpreted as the latter. Using a dataset from the National Observatory of Athens (in Greece), where P phases are not sub-classified, we perform 1D velocity model optimization for the Greece region. The optimized 1D model shows very fast P-wave velocities for the crust, which does not match the smaller scale 1D models in the region. Furthermore, using this model for tomography, we obtain positive P-wave anomalies all across Greece. By modeling the ray paths through the crust-upper mantle using the ak135 1D model, we are able to identify the Pn phases and conclude that a significant proportion of the NOA dataset is contaminated by "P" labeling used for both the Pg and Pn phases. We also model the earthquake location errors and the arrival time residuals produced as a consequence of this erroneous phase labeling. This finding raises concerns about the applicability of such large datasets for seismological applications and highlights the need for appropriate quality control before making them public.

DISTRIBUTION OF POWER SPECTRAL DENSITY FUNCTIONS USING SURFACE AND BOREHOLE SEISMIC RECORDS OF KOYNA, WESTERN INDIA

K. Mallika*, D. Shashidhar, R. Rajesh and N. Purnachandra Rao
CSIR-National Geophysical Research Institute, Hyderabad
mallika.nerella@gmail.com

The Koyna region experienced an earthquake of M~6.3 on 10 December 1967 which is considered as world's largest reservoir-triggered earthquake so far. Seismicity continued to occur soon after the impoundment of the Koyna reservoir in 1962. In the present study, we have analysed the seismic noise at borehole and surface seismic stations. The cultural noise, the noise from the actions of human beings at or near the surface of the Earth, propagates mainly as high-frequency surface waves (>1-10Hz). This high-frequency noise attenuates within a few kilometers in distance and depth. For this reason, cultural noise generally is significantly reduced in boreholes. We have computed the probability density function (PDF) to estimate the distribution of seismic power spectral density (PSD) from broadband surface seismic data and short-period borehole data of Koyna-Warna seismic networks. The PSD-PDFs allowed us to estimate and evaluate the overall station quality and a baseline level of crustal noise at each site. Further, we analyzed the impact of water level changes in

the reservoirs on the amplitudes of ambient noise in the range of 0.01 Hz to 5 Hz. Our results indicate high noise levels at the secondary micro-seismic level (~5Sec) to the north of the seismicity zone, which is close to the Koyna Dam, compared to all other directions. An increase in the randomness over frequencies 0.01Hz to 3Hz was observed just before the monsoon i.e., during the month of June, evidenced by reduced power spectral probabilities. The results also indicate a reduction in the noise power during the post-monsoon season, which may be associated with increased loading of the Koyna reservoir. The results suggest the modulation of noise levels by the changing reservoir water levels, particularly during pre and post-monsoon seasons in the Koyna-Warna region.

SEGMENTED NATURE OF THE INDIAN PLATE BENEATH THE HIMALAYA ARC: RESULTS FROM ANALYSIS OF NORMALIZED RIVER CHANNEL STEEPNESS INDEX

K. Raj Sunil*, G. Pavankumar, Ajay Manglik
CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad – 500 007
E-mail: krsunil17@gmail.com

The pre-existing transverse tectonic structures of the Indian plate in the Ganga foreland basin are considered to be segmenting the Indian plate underthrusting the Himalaya. These segmentations imply changes in mechanical properties of adjoining blocks which should manifest in the form of spatial variations in topography build-up. In the present study, we have analysed a geomorphic index, normalized channel steepness (k_{sn}), along the Himalayan arc to test whether there is any correlation between the k_{sn} and these segmentation boundaries. Our results bring out spatial variability in the k_{sn} along the arc. Based on these results, the arc can be segmented into five blocks, similar to the ones delineated based on correlation between the width of the Ganga foreland basin and the disposition of major Himalayan thrusts from the foothills. The offsets in the pockets of the k_{sn} concentration from the arc-parallel distribution are linked to the transverse tectonic fabric of the Indian plate in the Ganga-Brahmaputra plains. The k_{sn} offset at the boundary between the Kashmir-Himachal and Uttarakhand blocks is linked to the Delhi-Haridwar Ridge (DHR). Offset in the western Nepal block is bounded between the Great Boundary Fault (GBF) and inferred extension of the Faizabad Ridge (FR). For the Sikkim-Bhutan sector, the pockets of the k_{sn} get aligned in the NW-SE strike direction of the Dhubri–Chungthang Fault (DCF). In terms of mechanical strength, we attribute low k_{sn} to strong Indian lithosphere in the Kashmir-Himachal sector and weak lithosphere in the eastern-central Nepal sector. This is supported by the results on the northernmost limit of the Indian mantle lithosphere (IML). The mechanically strong IML in the western Himalaya sector traverses much to the north compared to weak IML in the central Himalaya.

SOURCE PARAMETER ESTIMATION OF 21ST JULY 2023 JAIPUR EARTHQUAKE

Delna Joy K*, Ambikapathy Ammani, Gera Sasi Kiran, Sindu Kumari, Shikha Vasisht, Priya Singh, O.P. Mishra
National Center for Seismology, Ministry of Earth Sciences
*del.kachappilly@gmail.com

On the 21st of July 2023 (04:09:38 IST), an earthquake of magnitude Ml,4.3 struck Jaipur region of Rajasthan. The earthquake's epicenter was located at coordinates 26.883^0N and 75.774^0E, with a

depth of 34 km below the Earth's surface. The Jaipur region, situated in the state of Rajasthan, is known for its geological complexities. It is characterized by the presence of multiple fault lines, several of which display evidence of movement during the Holocene epoch. From a seismic perspective, the region falls within Zone–II, classified as one of the seismically less vulnerable areas. However, it is worth noting that the Jaipur region has experienced recurrent low to moderate-magnitude earthquakes over time.

In our current study, we used the waveform data acquired from eight seismological observatories operated by the National Center for Seismology (NCS), Ministry of Earth Sciences (MoES), strategically located in the regions of Rajasthan, Madhya Pradesh, and Uttar Pradesh. Our primary objectives were twofold: first, to pinpoint the earthquake's precise location and second to estimate the Source Parameters including the Fault Plane Solution (FPS) of the earthquake. For the estimation of the Fault Plane Solution (FPS) and the epicenter location, we employed the local crustal velocity model provided by Mitra et al. (2011). Data from five Seismic Stations namely Jodhpur (JODH); Ajmer (AJM); Udayapur (UDPR); Gwalior (GWAL) and Jhansi (JHNI) were used to estimate the FPS using ISOLA software.

The analysis of the FPS yielded insightful results, indicating that the earthquake in question is associated with a normal fault mechanism, with an additional strike-slip component. To further refine our understanding of the seismic event, we determined source parameters through the SEISAN software and custom code development. The earthquake had a source radius of 681m approx. and stress drop of around 0.85 MPa has been estimated for the Jaipur earthquake. These parameters were calculated both in the time domain, derived from precise measurements of seismic phase arrival times, and in the frequency domain, derived from the spectral characteristics of the seismic waves. This multifaceted approach allowed us to comprehensively characterize the earthquake and its associated fault plane dynamics.

STUDY ON THE VARIATION OF SOIL TEMPERATURE AND SOIL MOISTURE OF SANDY SOIL AT THUMBA

Sree Lekshmi R[1], Nizy Mathew[2]

[1]Department of Physics, University of Kerala, Thiruvananthapuram-695581
[2]Space Physics Laboratory, Vikram Sarabhai Space Centre, Indian Space Research Organisation, Thiruvananthapuram-695022
Email: sree19992018@gmail.com

Soil temperature and soil moisture are two important factors that influence soil properties and control the hydrological and biological processes in the soil. They play a significant role in regional climate change mechanisms. The study aims to analyze the variation of soil temperature and soil moisture of sandy soil at Thumba (8°N and 76°E), VSSC, Thiruvananthapuram for different depths during the North-East monsoon period in 2022 based on the in situ data measured using the CS655 Soil Moisture and Temperature Sensor that works on the dielectric technique. The obtained measurements were recorded by data logger CR300 in a data card. The probe placement positions were 5 cm, 15 cm, 30 cm, and 50 cm, respectively. Measurements were obtained every 15 minutes. Collocated tipping bucket rain gauge measurements are also available for this period.

Observations revealed that the soil temperature varies as a harmonic function of time. This variation is more pronounced in the surface layers than in the interior. Soil temperature is largely affected by solar radiation. During wet days, soil temperature decreases due to rainfall and cloud cover. Soil moisture is controlled by precipitation events. Since this study was done in sandy soil, it has less ability to retain water, and therefore inner layers showed increased volumetric water content than the top layers. The study is based on ground measurements using soil moisture and temperature sensor which provides insight into the regional scale variation of soil temperature and soil moisture.

ANALYSIS ON THE EFFECT OF THE PRE-SEISMIC ACTIVITY ON IONOSPHERE-THERMOSPHERE DYNAMICS FOR THE M 8.8 EARTHQUAKE IN CHILE

Parvathy.S, Aswathy R.P
Department of Physics, University of Kerala, Thiruvananthapuram, India
Email: santhiniprathap@gmail.com

Earthquake, natural, unexpected, and sudden phenomena, causes massive harm to human life, material properties, the eco system environment, and regional structural alterations. Hence, developing earthquake prediction techniques at both short and long-timescales is critical for reducing massive losses. In the present study, an attempt has been made to analyze thermospheric and ionospheric perturbations caused by the major earthquake having magnitude 8.8, which occurred on 27 th February 2010 in Chile (36.122^{o} S, 72.898^{o} W), using TIMED and C/NOFS satellite observations. Thermospheric neutral density rises two weeks before the earthquake (increment ~ 3.045 x 10^{11} cm^{-3}), before which the trend was declining. In the two weeks preceding the earthquake catastrophe, however, an 6.37 K decrement in neutral kinetic temperature in the thermosphere is detected. The response of ionospheric parameters is quite different. The ion density decreases sharply one week prior to the event (decrement is 3.5 x 10^{4} cm^{-3}) and increases in the 4 to 1 pre-earthquake week (increment is 2.08 x 10^{5} cm^{-3}). The zonal electric field shows a sharp decrement one week prior (0.0042mV/m (decrement). It shows increment in trend 3 to 1 weeks prior to the occurrence of earthquake. In accordance with that, sharp changes in plasma velocity components and plasma temperatures are also observed in the specified time bin. This could be due the wave-induced variabilities in the ionosphere-thermosphere system. Analysis of the zonal and meridional wind in two distinctly separated altitudes in thermosphere reveals the upward amplitude enhancement trend which is indicative of the presence of atmospheric waves in conjunction with the earthquake event.

ANALYZING SPATIO-TEMPORAL B-VALUE VARIATION IN THE HIMALAYAN REGION FOR ENHANCED HAZARD ANALYSIS

Ashisan Dhodray and S. Lasitha
Department of Earth Sciences, Pondicherry University, Puducherry-605014
ashisandhodray@pondiuni.ac.in

Spatio-temporal b-value mapping is a valuable tool for understanding earthquake frequency and magnitude distribution in the Himalayan region. Earthquake data from 1964 to 2020, totaling 3,233 events from the International Seismological Center Catalog, was used to estimate recurrence rates and magnitudes. The comprehensive dataset processing was initiated with ZMAP software, enabling the

construction of a frequency-magnitude distribution, and a 3.6 mb Magnitude Completeness threshold was established through meticulous analysis, signifying dataset harmonization. Additional data refinement involved declustering, revealing 79 distinct earthquake clusters within the dataset, totaling 655 events from the original 3,233. Using Ztools' robust analysis, we thoroughly studied seismic event trends, estimating the b-value for our entire study area. Subsequently, we harnessed this b-value data to create a meticulous mapping grid, demarcated into 0.5°×0.5° sections, spanning the entirety of our research domain. Our b-value mapping revealed vital insights. Specifically, the b-values across the entire study area ranged from 0.6 to 1.5, with a narrow standard deviation of ±0.0425. As for the clustered seismic events, their geographic distribution was confined to the latitude range of 27°-29°N and longitude range of 84°-86°E. In this specific region, b-values oscillated between 0.88±0.07 and 0.93±0.08. It's worth noting a subtle uptick in b-value following the significant seismic event of April 25, 2015, which displayed a lower b-value of 0.6, indicative of stress release. Conversely, the northwestern segment of our study area, spanning from 87°-89°E longitude and 25°-28°N latitude, exhibited a b-value range of 0.65-0.67 ±0.04. This declining b-value suggests a buildup of stress in this region, raising concerns about the potential for a major earthquake in the near future. Our study confirmed the inverse correlation between b-value and crustal stress, consistent with previous research. Interplate earthquakes primarily occurring in this region also intensify seismic activity in the upper crust.

ASSESSING THE REACTIVATION POTENTIAL OF LANDSLIDE PLANES IN THE DARJEELING SIKKIM HIMALAYA BY FRACTURE-INDUCED ELECTROMAGNETIC RADIATION (FEMR) TECHNIQUE

Saima Azam[1], Dip Das[2] and Jyotirmoy Mallik[2]
[1] CSIR-National Geophysical Research Institute (CSIR NGRI), Hyderabad 500007, India
[2] Department of Earth and Environmental Sciences, IISER Bhopal 462066, India
Email: saima66@ngri.res.in

The entire Himalayan belt experiences tremendous upheaval in the form of landslides[1] where weak-slip planes get reactivated time and again causing immense devastation to property, lives and economy. Fuelled by the onset of monsoons, the remotely located Darjeeling Sikkim Himalaya region becomes more vulnerable to landslides thus rendering total cut-off from the rest of India. The Eastern Himalayas[2] exhibit landslides that are recurrent in nature and guided generally by the tensile rupture coupled with a shear sliding mechanism (TRSS). Since fracture generation involves the emission of electromagnetic waves, the Fracture-Induced Electromagnetic Radiation (FEMR)[3] technique has been explored for a possible landslide Early Warning System (EWS)[4]. To address this issue, geophysicists have explored the Fracture Induced Electromagnetic Radiation (FEMR) technique as a potential Early Warning System (EWS) for landslides which can be an excellent proxy to avoid future catastrophic scenarios in a cost-effective and quick manner. To test the FEMR technique's efficacy, high-resolution FEMR linear profiles were acquired using the portable device ANGEL-M, and to further complement the results of FEMR, numerical slope failure analysis was also carried out. It was noticed that the lithology-dependent critical FEMR amplitude with sandstone slopes is showing the least critical value for slope failure and gneissic slopes which depict the maximum value in a Mohr-Coulomb space. Additionally, the FEMR critical value is correlated linearly with the compressive uniaxial strength of the rocks as FEMR generation involves bond breaking. The conclusive results

explain that the very high range of FEMR amplitude is correlated to deep while very low FEMR amplitude corresponds to no failure. Yet, the moderate FEMR amplitudes belong to shallow-intermediate landslides. The study was carried out in postmonsoon season and the introduction of water into the system during monsoon can alter these threshold values. The study recommends that the pre and post-monsoon surveys can help to understand the FEMR behavior of slopes, as water involvement during the monsoons may change the threshold values. Hence this technique has the potential to act as an excellent EWS if coupled with other forecasting techniques like rainfall-threshold measurements. Keywords: Landslides, Himalayas, Fracture Induced Electromagnetic Radiation (FEMR), Early Warning System (EWS).

SEISMIC APPROACH FOR LANDSLIDES IDENTIFICATION IN EASTERN HIMALAYAN REGION, INDIA, USING BROADBAND DATA

R P Singh[1*,2], N Purnachandra Rao[1,2] , Himangshu Paul[1,2], R Rekapalli[1] , Venkatesh Vempati[1]
1 CSIR- National Geophysical Reseach Institute, Hyderabad-500007, India
2Academy of Scientific and Innovation research (AcSIR), Ghaziabad-201002, India
*Corresponding Author: raviprakash47010@gmail.com

Geohazards, particularly landslides, are among the most damaging natural hazards in mountainous regions. The primary cause of landslides is gravity acting on slopes. Long revisit times of satellites and climatic conditions limit the temporal and spatial resolution for monitoring the landslides. Seismic networks help to record such events remotely with high temporal resolution and the analysis of seismic waveforms. A broadband sensor has a high dynamic range and high temporal resolution, which have been successfully used to detect and characterize landslides in recent studies. In the present study, it is attempted to precisely identify landslides, for the first time in India. However, it is challenging to analyse the waveforms of landslides compared to earthquake waveforms as the small landslide signals are weak and do not produce sharp onsets. We utilize the seismic data from a network of four nearby stations in the state of Arunachal Pradesh to identify the landslides and relate them to the Uttarakhand rockslide on February 7, 2021, for reference. The seismic signature in the time and frequency domains and spectral characteristics help identify the landslide in continuous data.To identify the landslide, we employ the conventional earthquake analysis software 'SEISAN' application and 'eseis' programe, focusing on signal duration, shape, arrival times, size in the time domain, and various frequency domain analyses such as DFT, STFT, PSD and particle motion of landslides in the frequency domain. We successfully identified 15 landslides whose coda magnitude (Mc) ranged in size from 1.1-3.5. This study suggests that adopting the long-term analysis of background noise levels for real-time seismological landslide waveforms will enhance the detection of landslides

A DEEP LEARNING APPROACH TO SEISMIC EVENT CLASSIFICATION IN THE GUJARAT REGION, INDIA: PERFORMANCE AND CHALLENGES

D. Pragnath *, G. Srijayanthi, Santosh Kumar, Sumer Chopra

1 Institute of Seismological Research, Gandhinagar, Gujarat, India
Email: pragnathd@gmail.com

In anticipation to substitute the existing manual and semi-automated methods for classifying three categories of seismic events (quarry blasts, earthquakes, and noise), we developed three convolutional neural network (CNN) models. The three CNN models extract relevant features from seismograms (waveform), spectrograms (spectrum), and a combination of the two respectively. The CNNs were trained on a dataset of labeled seismograms recorded at a single station SUR from GSNet during 2007-2022. A total of 3414 samples were extracted from the three categories, with a uniform data length of 180 s, considering factors such as coda length, which varies with magnitude and epicentral distance. 15% of the data from each category was split for testing, and the remaining data was augmented and given for training. The waveform model, spectrum model, and combined model achieved accuracies of 95%, 93%, and 93%, respectively. The reliability of these models was ascertained by promising accuracies of >90% and 100% obtained for large and small datasets from testing with SCEDC data and records from the Palitana region (Gujarat) respectively. The results of this study demonstrate the potential of deep learning-based approaches for the effective classification of seismic events. These models have important implications for the safety and environmental management of quarry operations, as well as for seismic monitoring in earthquake-prone regions.

SEISMICITY PATTERN OF ANDAMAN-SUMATRA REGION – STUDY OF SEISMIC QUIESCENCE AND BVALUE AS POSSIBLE PRECURSORS

Varsha M
Department of Earth Sciences, Pondicherry University
Email: varshamuralikv@gmail.com

Objectives: a) To analyze the long-term seismicity and understand the potential of seismic quiescence study to use it as a reliable seismic precursor b) To estimate b-value and understand the variation in b-value as earthquake precursor in seismically active region. Methods: The present study analyses the seismicity pattern from the Andaman-Sumatra region for a period of 1964 to 2020. The area has been divided into 7 epicentral blocks. Earthquakes preceding and succeeding a major earthquake with different seismic phases of quiescence and pattern of seismicity have been studied carefully. All quiescence periods are characterized by high b values and period of major shocks has a low b value. Main shock events for each epicentral block with different phases of quiescence (Q1, Q2 and Q3) and active seismicity have been identified and analyzed. Findings: The study suggests that there is generally approximately 6-12 years of gap between major earthquakes. But combined analysis of blocks 5 and blocks 6 reveals that the area was comparatively quiet for a long period of around 28 years before the megathrust earthquakes of 2004, suggesting that long term quiescence leads to great earthquakes. Magmatic pulsations can result in earthquake swarms in volcanically active areas such as Off -Nicobar region. Our analysis shows that the northern segments are comparatively quiet since the megathrust earthquake which can lead to a major earthquake in the near future. Based on the mapping of co-seismic ruptures of the Eastern boundary thrust of Andaman over the last 2000 years

scientists suggest an increase in slip deficit which can lead to a large magnitude earthquake in the Andaman- Nicobar region. A thorough analysis of long-term seismicity and seismic quiescence can be used as an earthquake precursor, though with limitations. The latest post seismic quiescence period Q2 after the greater events of 2004 and 2005, may yield an impending event of 6.5 Mw or even greater. The study suggests that a proper study of the longterm seismicity and seismic quiescence can be used an effective earthquake precursor. All quiescence periods are characterized by high b values and period of major shocks has a low b value. Such studies can help in preparing a mitigation plan of seismic hazard.

ADVANCEMENT IN PROCESSING AND JOINT NATURE-INSPIRED INVERSION OF MAGNETOTELLURIC AND SEISMOLOGICAL DATA VIA SEISPY OVER HIMALAYAN REGION

Kuldeep Sarkar, Angad Yadav and Upendra K Singh
Department of Applied Geophysics, IIT (ISM) Dhanbad, Jharkhand, India
Email id: kuldeepsarkar39@gmail.com; upendra@iitism.ac.in

The utilization of inversion techniques in geophysical data analysis is indispensable for characterizing Earth's diverse structures. However, conventional methods, reliant on initial guess models, often face the risk of becoming trapped in local minima. In response to this, recent research has shifted its focus towards global optimization techniques that operate without dependency on these initial guesses or can adapt to rudimentary subsurface information. However, such approaches encounter challenges when searching for comprehensive solutions across the entire parameter space or achieving convergence. Consequently, this study introduces an innovative hybrid algorithm that possesses the ability to navigate both issues, offering a means to evaluate global solutions. The proposed method is employed for the joint inversion of Magnetotelluric (MT) and Receiver Function (RF), datasets. MT and RF data are pivotal in elucidating the Earth's deeper subsurface features. Precise modeling is particularly crucial for these datasets due to inherent data ambiguity, which can potentially yield inaccurate models. Therefore, this study advocates for the application of a hybrid global optimization technique in the joint inversion of MT and RF data, encompassing various geological models and the generation of 1000 model variants. Subsequently, Probability Density Function coupled with a 68% confidence interval is applied to the inverted models to select the model with the highest probability, thereby reducing mean model uncertainty. The study employs case examples from a range of geological terrains, including a simple sediment-lithosphere-asthenosphere model and the model of Kaapvaal Craton in South Africa, demonstrating the practicality of the proposed algorithm. Finally applied to stations over Himalayan Region, India. The results emphasize the superior performance of the hybrid algorithm compared to other optimization techniques, enabling the derivation of more accurate subsurface models without the need for prior knowledge.

A COMPREHENSIVE INVESTIGATION OF CRUSTAL DEFORMATION INDUCED BY KOYNA-WARNA RESERVOIRS USING GEODETIC OBSERVATIONS AND MACHINE LEARNING TECHNIQUES

A. Sooraj *, P.S. Sunil, A. S Sunil, and R. Abhirami
Department of Marine Geology and Geophysics, School of Marine Sciences,
Cochin University of Science and Technology, Kochi-682016, Kerala, India
*E-mail: soorajbabu935@gmail.com

Over the past two decades, the quantity and quality of satellite-geodetic measurements for tectonic deformation have significantly advanced, enhancing our capacity to monitor active tectonic processes. These studies establish direct connections between earthquakes and their underlying fault systems, enabling us to compute the potential impact of resulting changes in crustal stress on future seismic hazards. In this investigation, we assess GPS-derived velocity data obtained through campaign measurements conducted between the Koyna and Warna reservoirs to delineate the strain rate distribution in the Koyna-Warna region. The velocity patterns reveal a pronounced northward trend in the eastern section of the existing fault systems situated between the Koyna and Warna reservoirs, while the western portion of the fault system exhibits a NNW orientation in the velocity vectors. Employing the K-means clustering technique in conjunction with the Elbow method, we identify two discrete earthquake clusters within the area. The cluster proximate to the Koyna reservoir is designated as the Koyna Seismic Zone (KSZ), characterized by a left-lateral strike-slip motion, whereas the cluster near the Warna reservoir is referred to as the Warna Seismic Zone (WSZ), displaying a normal dip-slip motion. The multiscale components of the strain rate tensor reveal a deformation pattern dominated by extensional stress across the fault system, with the shear strain map indicating a prominent shear strain regime at the central region of the fault system. The 2nd Invariant total strain rate and the distribution of principal strain rates across the region align with the extensional deformation pattern, correlating well with the occurrence of earthquakes associated with normal stress. The observed tectonic deformation, localized strain, and seismic activity collectively imply a heightened likelihood of a reservoir-induced significant earthquake within the fault system spanning from the Koyna to Warna reservoir systems.

INSAR BASED SUBSIDENCE MONITORING IN URBAN CENTERS OF KOLKATA, INDIA: CONSTRAINS FROM DWINDLING GROUNDWATER RESOURCES

Praveen Kumar Kannojiya*, and Ashwani Raju
Department of Geology, Institute of Science, Banaras Hindu University, Varanasi
Email: praveenk@bhu.ac.in

Subsidence is a critical and emerging geo-hazard prominent in metropolitan hubs and coastal areas due to exponential unscientific extraction of groundwater and climate change. The Lower Ganga plains (LGP) has dynamic geomorphology stating with alluvial deposits from Ganga to coastal geomorphology and host prolific aquifer system. The advancement of microwave remote sensing in subsidence monitoring at global and regional scale has been quite efficacious. In order to monitor the rate and evolutionary pattern of emerging land subsidence, this study explores the multi-temporal analysis of 192 Sentinel 1A SAR scenes acquired between February 2017 and August 2023. The dataset were processed using Persistent Scatterer Interferometry (PSI), an advanced time series synthetic aperture radar technique (InSAR). The subsidence rates measured at potential hotspots. The

potential area under extreme subsidence are classified into 13 blocks (block 1- block 13). The results shows the range of rate of subsidence (mm/yr) for the 13 blocks to be Block 1 (-6.7 to -19.8), Block 2 (-7.5 to -17.2) Block 3 (-6.8 to 17.2), Block 4 (-8.6 to -21.7) Block 5 (-8.0 to -18.0) Block 6 (-7.3 to -17.6) Block 7 (-6.9 to -15) Block 8 (-6.2 to -20.3), Block 9 (-6.1 to -15.5), Block 10 (-6.2 to -34.7), Block 11 (-6.3 to -21.6), Block 12 (-6.0 to -22.9) and Block 13 (-5.4 to -18.1). Results depicts that the unconfined aquifer is under significant stress and is experiencing a progressive loss of storage capacity over time, according to the discovered displacement trends, which also considerably match the city's ongoing decline in groundwater levels.

SEISMIC ATTENUATION BENEATH THE CENTRAL HIMALAYA CONSTRAINED BY FUNDAMENTAL MODE OF RAYLEIGH WAVE FROM THE HI-CLIMB DATA SET.

Utpal Saikia* & Davin Mathews David
[1]Earth and Climate Science department, Indian Institute of Science Education and Research, Tirupati. A P,
Corresponding Mail: utpal@labs.iisertirupati.ac.in

Surface wave attenuation in the Himalayan region has been a subject of extensive research due to its relevance in understanding the seismic properties and the structure of the Earth's crust and upper most mantle structure of this tectonically active region. Usually seismic velocity is frequently used to image the crust and upper mantle structure, seismic attenuation offers an important complementary observation. This study presents an analysis of Rayleigh wave attenuation in the Himalayan range, utilizing data collected from the High-Climb network during its operation from 2002 to 2005. A total of 82 seismic events, with a magnitude range of 4.5 to 7.0 and epicentral distances between 200 to 1000 kms, were used. We determine the attenuation coefficient for periods between 15 and 40 s. By employing inverse analysis and grid-search techniques, the attenuation coefficient of Rayleigh waves in this region was estimated. The findings revealed that the attenuation coefficient ranged from 0.5 to 1.0 x 10^{-3} km^{-1}, providing valuable insights into the propagation of surface waves in the Himalayan tectonic environment. Surface wave attenuation analysis is of paramount importance for seismic hazard assessment and earthquake risk mitigation in the Himalayas. Our results are consistent with the global model of surface wave attenuation coefficients. In the future, enhancing the dataset and estimating the quality factor (Qμ) in one dimension would yield increased value and contribute to a more insightful interpretation of the findings.

MACHINE LEARNING APPROACH FOR ANALYSIS OF IONOSPHERE PARAMETERS FOR EARTHQUAKE PRECURSORS

Saima Siddiqui[1], Monika Thakur[2], Neetu Paliwal[3], S. Choudhary[4]
Department of Physics, Rabindranath Tagore University, Raisen (M.P)
Saimasiddiqui187@gmail.com, thakur.moni21@gmail.com, neetu.paliwal@aisectuniversity.ac.in, csuryansh@gmail.com

The wide range of atmospheric, ionospheric, and magnetospheric abnormalities believed to be associated to earthquakes demonstrates the need of both ground-based ionospheric parameter measurements and satellite-based data for examining earthquake precursors. Researchers evaluated a

possible spatial and temporal correlation between earthquakes and ionospheric disturbances using a basic spatial correlation analysis and a coupled temporal technique. The processing of data gathered for seismic hazard monitoring by equipment in the coal mines region using the seismic induction method. Data are derived from two long walls at a coal mine in Poland. Seismic hazards, which regularly occur in many underground mines, are a unique form of this type of threat. Seismic hazard is similar to an earthquake in that it is the toughest natural hazard to forecast and detect. The statistical approaches are insufficient to anticipate seismic danger due to the complexity of seismic processes and the large disparity between the number of low-energy seismic events and the number of high-energy phenomena (e.g. > 104J). Therefore, it is crucial to look for new prospects for improved hazard prediction, including through the use of machine learning techniques. A summary of the seismic activity inside a change in the rock mass is contained in the electron density data. Any seismic shock with energy higher than 104 J was reported if decision attribute had value 1. The challenge of predicting dangers is based on the correlation between the energy of observed tremors, seismo-acoustic activity, and the potential for rock-burst occurrence. Therefore, such hazard forecasting is unrelated to precise rock-burst prediction. The phrase "machine learning" is used to refer generally to computer data analysis, which uses data to draw conclusions and forecasts. Broadly speaking, it encompasses data analytics, data mining, computational statistics, and a significant amount of data science. Seismic waves datasets are used to assess the efficacy of the proposed machine learning-based EQ-PD approach using ionospheric real-time data. Validation and test sets made up of unique EQ precursor detection signals that are begun and stopped, the frequency of occurrence, and their FFT seismic wave analysis.

Keywords: Ionospheric, seismic hazard, precursor, machine learning, acoustic

LANDSLIDE OCCURRENCES AND THE PRECIPITATION PATTERN IN THE KASHMIR HIMALAYA

Bilquis shah[1*], Umar Farooq Malik[2]

[1]Department of Geography and Disaster Management, University of Kashmir, Srinagar 190006, Jammu and Kashmir, India

[2] Department of Studies in Geography, University of Mysore, Karnataka, India.

*corresponding author: shahbilquisgeo@gmail.com

Precipitation regimes in terms of magnitude, intensity, and frequency have a direct and immediate impact on the occurrence of landslides. Kashmir Himalaya is a hotspot of landslide activity; however, not much research has been carried out on the interplay of precipitation and landslides, despite precipitation being a key factor for landslide occurrence in the area. The current study constructed the landslide history (1990-2020) of Kashmir Himalaya (Kashmir valley and NH-44) and established a correlation of past landslide events with extreme precipitation indices. Analysis of the rainfall pattern was carried out by deriving a suite of indices pertaining to the triggering mechanism of landslides. The relationship between the indices and landslide occurrences was evaluated using Pearson's correlation coefficient and their temporal tendencies were assessed using Man Kendall's Tau test and Sen's Slope Estimator. The results show that there is a moderate to strong annual concentrated precipitation distribution, depicting the seasonality in both precipitation and landslide distribution patterns. The behavior of the extreme climate events and enhance the future landslide activity in the region. The recognizable evidence describing the interaction of extreme precipitation events and the

landslide activity in this study is expected to be useful for developing a reliable rainfall-indices-based landslide early warning system and for minimizing the impact of landslides in the region.

NEW ARCHAEOINTENSITY DATA FROM THE 16TH CENTURY CE IN THE HISTORICAL TOWN OF SINDKHED RAJA, MAHARASHTRA

Rajapandy P., Pradnya Ramesh Mohite, K. Deenadayalan, B.V. Lakshmi, Priyeshu Srivastava
Indian Institute of Geomagnetism (IIG), New Panvel, Navi Mumbai, India
Correspondence Author: rajapandy24051997@gmail.com

Paleomagnetic analysis of archaeological materials is crucial for understanding the past geomagnetic field behaviour. It enables us to know the past variations of the geomagnetic field through the study of the remanent magnetization acquired by the archaeological materials when heated at high temperatures. In the present work, Archaeological artefacts from Shivaji Sindkhed Raja (SSR) site at Buldhana district of Maharashtra, were collected for rock magnetic and archaeomagnetic investigation. It is a famous monument (1573 AD) in India since it was the birthplace of Jijabai, the mother of Chhatrapati Shivaji Maharaj. The detailed rock magnetic studies offer critical information about the magnetic -concentration, -grain size, -composition and thermal stability of the archaeological artefacts. The Koenigsberger ratio (Q-ratio) is a direct measure of the ratio of remanent magnetization to induced magnetization. All Q-ratio values are greater than one, which indicates a stable thermoremanent origin of natural remanent magnetization for all artefacts.

Isothermal remanent magnetization acquisition curves confirmed the presence of dominant ferrimagnetic (magnetite) minerals in all samples, except two samples that exhibit a mixture of ferri and antiferro, and S-ratio values also confirmed this magnetic composition. The magnetic susceptibility curve as a function of temperature (χ-T curves) ensures that there is no major alteration in the sample during the heating and cooling cycles. It shows Curie temperatures in the range of 580°C, suggesting the presence of thermally stable magnetite. From the rock-magnetic results, suitable artefacts were identified for the archaeointensity measurement i.e., Thellier-Thellier experiment and the mean archaeointensity (B_{anc}) value for the Sindkhed Raja is 39.95±3.2 μT. The new archaeointensity result agrees with the paleosecular variation curve of the Indian sector from the global model SHA.DIF.14k. Hence, the present study will add one more archaeointensity data point in the 16th century CE, which will contribute to improving the archaeomagnetic dating for India.

MINERAL MAGNETIC AND GEOCHEMICAL PROPERTIES OF HOLOCENE SEDIMENTS FROM DUDHNAI RIVER, ASSAM, NE INDIA

K. N. Vishnu[1,2,3], Mujahed Baba[2], B.V. Lakshmi*[,2], K. Deenadayalan[2], Priyeshu Srivastava[2]

[1] Indian National Centre for Ocean Information Services, Hyderabad
[2] Indian Institute of Geomagnetism, Navi Mumbai
[3] Department of Marine Geology and Geophysics, Cochin University of Science and Technology, Kochi
*Corresponding Author: lakshmi.bv@iigm.res.in

Sediment samples collected from two sections [Siluk (SL); Udaipur (UP)] along Dudhnai River in Assam, NE India, were analyzed to understand rock magnetic and geochemical characteristics that

reflect local environmental induced changes. Rainfall and climate play a major role in chemical weathering processes, which cause chemical weathering and increase the intensity of major chemical reactions. Usually, in warm (cold) and humid (dry) climates, the rate of weathering is high (low) because of chemical reactions. In this study, the magnetic properties and chemical intensity of alteration were analyzed with respect to the depth and compared between the two profiles. The present study reached the following conclusions: The magnetic mineral concentration parameters are higher in the SL profile than in the UP profile. In the studied profiles, mineral magnetic (χ_{lf}, χ_{ARM}, SIRM, χ_{ARM}/χ_{lf}, SIRM/χ_{lf}, χ_{ARM}/χ_{fd}, S-ratio, and soft IRM) and other non-magnetic measurements indicate variations are controlled by the concentration of magnetite and maghemite. The rock magnetic results indicate that low-coercivity magnetite and maghemite are the main magnetic minerals within the sediments of the two profiles. Both the chemical intensity of alteration (CIA) values of the SL and UP profiles are significantly higher than that of the UCC (47.92) and approach the moderate chemical weathering intensity. The variations encountered in rock magnetic and geochemical data of the studied sediments reveal their deposition in warm and moist environments.

ISOTOPIC FINGERPRINTING OF POST LAST GLACIAL MAXIMUM SEDIMENTATION IN THE WESTERN GREAT RANN OF KACHCHH, WESTERN INDIA.

Ayushi Bhatnagar[1*], Anil D. Shukla[2], Mamata Ngangom[1] and M.G. Thakkar[3]

[1]School of Earth Sciences, Banasthali Vidyapith, Banasthali, Rajasthan, 304022
[3]Geosciences Division, Physical Research Laboratory, Ahmedabad, 380009
[2]Department of Earth and Environmental Science, KSKV Kachchh University, Kachchh, Bhuj, 70001
Presenting author: *ayushibhatnagar231929@gmail.com ,anilds@prl.res.in

The relict mud flat of Great Rann of Kachchh (GRK) which barely above the sea level is a rich repository of the complex land-sea interaction during the late Quaternary period. Limited studies carried out in the recent past indicate that both continental and marine process led to the sedimentation and eventual filling up of the western GRK. The inferences drawn in earlier studies based largely on the geomorphological, sedimentological and limited geochemical data that too was limited to the upper few meters going back to the last 5 ka. In the present study we carried out detailed geochemical and isotopic studies supported by radiocarbon chronology on a 45 m long sediment core raised from the Allah Bund scarp in the vicinity of the virtually defunct Nara River (the only river draining into the western GRK). The objective is to reconstruct the past pattern and causes of temporal changes in sedimentation pattern during the post Last Glacial Maximum (LGM) rising sea level in the western GRK. We observed that during periods of weakened monsoonal activity, the sediment was routed through the Nara River contributed by the westerly dominated and glacial fed Indus River, whereas the monsoon dominated Himalaya Rivers were the dominant source of the sediment supply during periods of frequent floods. In this paper we will provide the complex dynamics of Himalayan River system along with role of the sea level in the post LGM sedimentation in the western GRK.

IMPLICATIONS OF SOURCE ROCK CHARACTERISTICS AND MICROSTRUCTURAL REACTIVITY FOR HYDROCARBON GENERATION FROM EARLY PERMIAN COALS

Akhandal Sahoo[1*], Santanu Ghosh[2,3], Tushar Adsul[2], Atul Kumar Varma[2] Nimisha Vedanti[1]

[1]: Shallow Seismic Group, CSIR-National Geophysical Research Institute, Hyderabad-500007, India
[2]: Department of Applied Geology, Indian Institute of Technology (ISM), Dhanbad-826004, India
[3]: Department of Geology, Mizoram University, Aizawl-796004, Mizoram, India
Corresponding Author: asahoo@ngri.res.in, dipakalok@gmail.com

Source rock characteristics, depositional environment, thermal maturity, and hydrocarbon generation potential of thirty coal samples collected from the Ib Valley Basin, Odisha, India, are evaluated by optical, microstructural, and geochemical attributes. These Early Permian coal samples are dominated by the vitrinite macerals (38.89–74.68 vol.%), especially telovitrinites, derived from the ligno-cellulosic terrestrial floral tissues. The range of the hydrogen index (HI) values (115.85 – 268.23 mg HC/g TOC) may further suggest the presence of terrestrial type III and admixed type II/III kerogen in the samples, which is also complimented by the semiquantitative parameters calculated from the Fourier transform infrared (FTIR) spectroscopy. Although, the petrographic ratios suggest an ombrotrophic depositional environment, the mineral matter content (12.80–44.91 vol.%) may imply fast drowning or periodic flooding of peatland and/or a mesotrophic environment. Further, the micrtolithotype distributions may point toward organic matter deposition in a forest moor environment. Besides, the mean random vitrinite reflectance (0.33–0.52 %), production index (0.004–0.033), and T_{max} (416 – 428 °C) parameters indicate thermally immature to early mature kerogen. The TOC content (37.70–80.87 wt%), genetic potential, and the HI values reveal that the coals are excellent source rocks to generate gas and mixed oil and gas upon attaining threshold thermal maturity. The aliphatic CH stretching and high A-factor observed from the FTIR, as well as, D_4 and D_5 bands in the Raman spectra reflect highly reactive aliphatic CH groups within the macerals, which are prone to generate hydrocarbons. Interestingly, the telovitrinite macerals and the vitrite microlithotype are found to dominantly influence the hydrocarbon generation from the organic matter. The carbopyrite grains are further observed to enhance the reactivity of the macerals to augment hydrocarbon generation from the kerogen, which is a novel finding from this study.

CHEMICAL WEATHERING AND ASSOCIATED CO2 CONSUMPTION RATES OF KARAMANA RIVER DRAINING SOUTHERN GRANULITE TERRAIN, INDIA.

B. Upendra[1,2], M. Ciba[1], S. Rahul[1], V. Arun[1], K. Anoop Krishnan[1*]

[1]National Centre for Earth Science Studies (NCESS), Thiruvananthapuram-695011, India.
[2]Department of Applied Chemistry, Cochin University of Science and Technology (CUSAT), Kochi-682022, India.
*****Corresponding author: upendra.ncess@gmail.com

The dissolved solute chemistry of a river is the resultant of several hydrogeochemical processes, which link the geosphere-hydrosphere-atmospheric systems within the basin. The main goal of this study is to discerning the dissolved solute sources, controlling mechanisms of a small tropical west-flowing coastal mountainous river, the Karamana river basin (KRB), flowing through the Southern Granulite Terrain (SGT), India. A total of 39 water samples are collected for three different seasons

covering the full hydrological cycle followed by standard physio-chemical analysis and the hydrochemical data that produced is within the reproducible limits. Additionally, a chemical mass balance (CMB) model is used for source-wise solute load quantification, along with estimates of Silicate weathering rates and CO2 consumption rates. The geochemical data of rock, soil, and weathered profile specific to the KRB are employed to procure the objectives along with the hydrochemical data. The CMB model confirms that the silicate weathering (52.80%) is the dominant process controlling the dissolved load chemistry followed by the anthropogenic (38.35%) and atmospheric input (8.84%) at the outlet. The estimated SWR and CCR for KRB at the outlet region are 53.58 t km^{-2} yr^{-1} and 16×10^6 mole km^{-2} yr^{-1} respectively, signifying the intense chemical weathering of silicate rocks in the region. This is further confirmed by the Arrhenius plot (SWR versus 1/T) which reveals that activation energy (AE) for silicate weathering to occur in KRB is only 24.7 kJ mol^{-1}. The SWR of KRB are comparable with other west-flowing Western Ghats (WGs) rivers, but are higher than the east-flowing WGs, Peninsular and Himalayan rivers. This must be attributed to lower silicate weathering activation energy of KRB due to the granulite terrain of steep slopes combined with tropical humid climate (high rainfall and high temperatures) and topographical undulation in the region.

PETROGRAPHY AND MINERAL CHEMISTRY OF LAMPROPHYRE DYKES FROM THE NONGCHRAM FAULT, SHILLONG PLATEAU, NORTHEAST INDIA

***R.B.Ananth , N.V.Chalapathi Rao**
Department of Geology, Banaras Hindu University, Varanasi-221005, India
Email: *ananthrb1318@gmail.com

Petrography of the lamprophyre dykes from Nongchram fault, Shillong Plateau, Northeast India, are presented. The Shillong Plateau, also known as the Assam-Meghalayan Plateau, played an important part in the Precambrian history of the Indian Shield as it experienced detachment from the Peninsular Shield during the Miocene. It is an uplifted horst-like structure, which is bordered and crosscut by fault systems such as the E-W Dauki Fault in the south, the E-W Brahmaputra Fault System in the north, the N-S Jamuna Fault in the west and the NW-SE Kopili Fracture (Rift) Zone in the east. Lamprophyre dykes intrude in porphyritic granite and granite gneiss, are spatially associated with the N-S trending deep-seated Nongchram fault and well exposed around the Rongjeng -Swangkre- region. These dykes are genetically associated with ijolites, tinguaites and carbonatites. Field investigation shows lamprophyres have meso-melanocratic nature. Lamprophyres contain crustal rock fragments, as well as mantle-derived ultramafic nodules and aggregated megacrysts. Petrography shows typical porphyric–panidomorphic lamprophyric texture. They contain spherical to sub-spherical ocelli with macrophenocrysts of zoned amphibole having size of 0.719mm. Phenocrysts mainly consists of phlogopite, amphibole, clinopyroxene, and opaques with fine grained feldspar ground mass. Megacrysts of amphibole consists of having inclusions of different pyroxenes. Lamprophyres reveal the crystallization of following phases: clinopyroxene, amphibole, phlogopite, opaques , calcite and zeolites in that order.Zoning in amphibole denotes changes in the chemical composition of the magma during crystallization. Presence of secondary minerals like zeolite and calcite reveals secondary alteration. The mineralogy parameters of these lamprophyres coupled with the common presence of ocelli and megacryts of mafic minerals and their genetic association with sodic alkaline rocks and carbonatite classify them as alkaline lamprophyres.

HYDROGEOLOGICAL AND HYDROCHEMICAL CHARACTERISTICS OF KARST AQUIFER SYSTEM IN THE MANIMUTHAR SUBBASIN, TAMIL NADU

M Mathiazhagan, Y Srinivas, T Mercy, M Muthu, P Athi Narayanan, P Kousika & S Rakesh
Centre for Geotechnolgoy, Manonmaniam Sundaranar University, Tirunveli – 12, Tamil Nadu

The dissolution and karstification of carbonate rocks is the cause of the very diverse and anisotropic nature of karst aquifers. Therefore, through regional and temporal variations in groundwater's physico-chemical characteristics, hydrogeochemical evolution and potential water-rock interaction are examined. The study area is located at the tail end of the Manimuthuar Subbasin. There are 25 water samples collected from both drilled and dug wells. Titration, flame photometer, and digital spectrophotometer were used to analyse the groundwater quality. Major ions (Ca^{2+}, Mg^{2+}, and HCO_3^-) in water are primarily produced by the dissolution of carbonate minerals. Agriculture increases the concentration of ions that contribute to pollution (such as sulphates, chlorides, potassium etc.). In terms of several processes, such as dilution and water-rock interactions, etc., the variability of water chemistry was discussed. The limestone aquifer has a clear seasonal hydrochemical change, according to the study. The groundwater in karst regions is typically of the Ca^{2+}, Mg^{2+}, and HCO_3^- type. Analysing the different types of recharge in the area also benefited from hydrogeochemical signature.

GEOELECTRICAL INVESTIGATION OF GROUNDWATER IN PARTS OF TUTICORIN DISTRICT, TAMILNADU, INDIA

S. Arunbose, P. Boopathy Raja, C. Sivanadhini, R. Roja and Y. Srinivas
Centre for Geotechnology, Manonmaniam Sundaranar University, Tirunelveli-627012, Tamil Nadu

Geoelectrical method is widely used technique for the identification of groundwater potential zones. In this study thirty vertical electrical sounding (VES) data were acquired across the study area for the purpose of evaluating the hydrological condition. The Schlumberger electrode array was adopted for data acquisition using the WDDS-2 resistivity meter. The acquired field data were interpreted by using IPI2Win software. The interpreted result showed three to five geoelectrical layers present in the study area. The study revealed the first layer is topsoil followed by highly weathered gneiss, fresh charnockite and biottite gneiss. The topsoil layer is characterized by the resistivity range of 0.3 Ωm to 1083 Ωm with a thickness of 0.46 m to 3.5m. The aquifer resistivity and aquifer thickness of the study area ranged from 70.3Ωm to 0.5Ωm and 2m to 40m respectively. In the study area 23.3% found to have excellent groundwater potential zone with aquifer thickness greater than 30m whereas 20% of the study area identified as moderate groundwater potential zone with aquifer thickness of 10m to 20m and the area of 26.7% fall under poor groundwater potential zone with the aquifer thickness lies between 5m to 10m. The remaining portion of the study area have identified as very poor groundwater potential zone with the aquifer thickness of less than 5m. The comparison between aquifer resistivity and thickness map revealed the western and central parts of the study area have suitable for drinking and other domestic purposes. The coastal region near the study area is contaminated due to sea water intrusion and anthropogenic activities. The present study provides the practical importance as it guides the local people to select suitable areas for groundwater extraction.

ASSESSMENT OF STRATIGRAPHIC CORRELATION THROUGH CHAOTIC BEHAVIOUR OF GEOPHYSICAL LOGS: A CASE STUDY FROM AMGURI OIL FIELD, UPPER ASSAM BASIN

Kurakula Kalyani[1, 2, *] Bappa Mukherjee[1], Kalachand Sain[1, 2]

[1]Seismic Interpretation Laboratory, Wadia Institute of Himalayan Geology, Dehradun-248001
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, Uttar Pradesh- 201 002
[*]Corresponding author: kalyaniau23@gmail.com

We propose an approach for the appraisal of stratigraphic correlation based on the fractal analysis of geophysical logs. Fractal analysis can elucidate the self-similar and hierarchical structure of geological formations, making it a viable technique for subsurface characterisation. We use multifractal detrended fluctuation analysis to determine the self-similarity and long-range dependability of geophysical logs from the Amguri oil field of the Upper Assam basin. The fractal properties of the logs associated with each well's various stratigraphic units are then used to establish a fractal-based stratigraphic signature. We observe that a particular log response associated with a specific stratigraphic unit offers a distinctive fractal behaviour, which helps in characterising the vertical and lateral extension of a distinct stratigraphic unit. In addition, we also observe that the presence of hydrocarbons in the formation imparts weak multifractality. Thus, one can precisely correlate the lateral extension of a specific stratigraphic unit and able to discriminate vertical succession. The fractal-based stratigraphic correlation is a trustworthy and precise approach for characterising the spatial distribution of subsurface formations. Our findings help advance stratigraphic correlation and provide a fresh look at fractal analysis for subsurface characterisation. This approach can improve reservoir characterisation, optimise well location, and boost hydrocarbon exploration and production operations.

ADVANCED DATA-DRIVEN ALGORITHMS FOR RESERVOIR ROCK PROPERTY ESTIMATION

Shib Sankar Ganguli and Prakash Kumar

CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad-500007, India
Email: shibg@ngri.res.in

Lately, there has been a growing interest in the frequent use of data-driven (machine learning) algorithms for reservoir characterization studies. The application of these advanced data-driven approaches is becoming increasingly crucial in optimizing production and effectively addressing complex reservoir challenges. In the current study, we tried to demonstrate the utilization of advanced data-driven algorithms for the estimation of permeability, an important property of reservoir rock. We will examine a selection of case examples from various reservoir types to conduct a thorough analysis of algorithm performance and their ability to predict petrophysical attributes based on well-log variables. A parametric sensitivity analysis is also conducted to obtain the most influential predictor variable important for building an efficient predictive model. The present work aims to highlight the existing gaps in petrophysical reservoir characterization and the potential application of data-driven algorithms for estimating reservoir rock properties with much accuracy.

SEISMIC IMAGING ALONG THE NARAYANPUR - NANDURBAR PROFILE, DECCAN SYNECLISE, WESTERN INDIA: PRELIMINARY RESULTS

K. Renuka*, Laxmidhar Behera, Biswajit Mandal, Prakash Kumar

CSIR- National Geophysical Research Institute, Uppal Road, Hyderabad-500007
* E-mail: renu.kolluru@gmail.com

66 Ma old Deccan Large Igneous Province, covering almost half a million sq. km both onshore and offshore across western and central India, constitutes one of the largest flood basaltic eruptions on the surface of the Earth, which is made up of a large number of basaltic flows. The crustal seismic structure of this region is not well understood. In the present study, we made an attempt to reprocess the 2-D seismic refraction and wide-angle reflection data, acquired along 45 km long Narayanpur – Nandurbar profile, located in the Narmada-Tapti region of Deccan syneclise. The earlier study was limited to only basement depths. Our initial study suggests the presence of two basaltic trap layers, the first layer having a P-wave velocity of 4.95-5.10 km/s and thickness of 0.15 km, while the second layer is characterized by a higher P-wave velocity of 5.3-5.5 Km/s with a thickness of about 1.60 km. It is followed by low-velocity Mesozoic sediments (V_p of 4.20 km/s) that overlie granitic-gneissic basement, associated with a velocity of 5.95-6.10 km/s and found at a depth of about 3.0 km. Below this region, the mid-crustal layer has upwarped considerably and lies at 5.0 to 7.0 km depth. This layer is characterized by a 6.3 – 6.4 km/s velocity along the profile.

SEISMIC IMAGING OF COAL SEAMS IN DURGAPUR, RANIGANJ BASIN

Arkajit*, Ajay Malkoti and Nimisha Vedanti
CSIR-NGRI, Hyderabad
Email: arkajit-c@ngri.res.in, tijakra@gmail.com

Raniganj basin was the first coal-producing region in India that was explored using traditional drilling techniques without much detailed knowledge of the prospective zone apart from existing geological reports. Drilling is quite expensive and doesn't provide lateral continuity of the subsurface. On the other hand, the seismic method provides very good subsurface information with lateral continuity. Further, the seismic method has recently gained more acceptance in the coal industry due to its better imaging capability of the subsurface. CSIR-NGRI has conducted a seismic survey in the Raniganj basin near Durgapur, West Bengal. The study was conducted to image coal layers that are found in Raniganj and Barakar formations. To image these formations, we laid out eleven 2D seismic lines covering a total length of 26 km. A vibroseis source was used with frequencies ranging from 10 - 80Hz, and three-component receivers were used to record the data. This 3C-2D data was acquired in a nonconventional way, and to process this data, we have developed a specialized workflow to improve the signal-to-noise ratio. Coal seams have relatively low seismic velocities, due to which they have distinct acoustic impedance and are seen in seismograms as distinct events. The final migrated images reveal prominent sedimentary layers within a time range of about 640 ms to 1200 ms in all the lines and with a dip along the N-S direction obtained from the final sections of all the lines together. By converting existing well logs into a time domain, we can verify our results, and the shallowest layer might represent the Raniganj coal seams and the deepest one, Barakar. The study will be useful for determining coal reserves in the area and future research.

REVIEW ON GLOBAL CO2 STORAGE PROJECTS IN BASALT AND AN ANALOGY FOR DVP, INDIA.

Gadela Dharma Sai Goud[1] and Nimisha Vedanti[1]

[1]CSIR-National Geophysical Research Institute, Hyderabad-500007, India.
Presenting author: dharmag@ngri.res.in

The Deccan Volcanic Province (DVP) consists of Basalt, Mesozoic sediments and granitic/ metamorphic basement rock, extend from the mid-central region to the western part of India. Inspired by the Carb-fix and the Wallula geological carbon sequestration projects, many sites in DVP are being studied for permanent sequestration of CO2 in India. The basaltic provinces have the potential for giga-tons storage of CO2. The process of CO2 sequestration in the Basalt mainly depends on the reservoir rock's physical and chemical properties and is categorized under the reactive mechanism. Many Physio-chemical processes are involved and thus depend upon various factors. Therefore, this study reviews the similarities and differences in the ongoing CO2 sequestration projects and the associated technical challenges in Basalts. Based on the review, an analogy for DVP will be presented. We also discuss the seismic and petrophysical properties of vesicular basalt samples recovered from the Killari Borehole KLR-1. Further, the cost factor of the permanent geological sequestration project will also be discussed.

CURRENT SCENARIO AND TECHNICAL CHALLENGES OF CO_2 SEQUESTRATION IN GLOBAL MAJOR COAL SEAMS AND ECBMR: A REVIEW

Omkar Kumar Gupta[1], Sakshi[2], Manika Rawal[3] and Nimisha Vedanti[1]

[1]CSIR-National Geophysical Research Institute, Hyderabad-500007, India
[2]Hindustan Oil Exploration Company Limited, Chennai-600018, India
[3] Indian Institute of Technology, Kharagpur-721302, India
Presenting author: ogupta@ngri.res.in

Studies have shown that Carbon dioxide (CO_2) is one of the main greenhouse gases that causes global warming due to the Green House Effect. Therefore, the scientific community has taken Carbon Capture Utilization and Storage (CCUS) studies very seriously. In the same connection, studies on storing CO_2 in deep, un-mineable coal seams to enhance coal bed methane (ECBM) recovery have attracted much attention due to its mechanism and the availability of large reserves of coal deposits worldwide. CO_2-ECBM methodology has been conducted globally in many coal mines worldwide for three decades, but it is not a very popular option for sequestration due to associated complexities. This paper discusses the principles of geological sequestration of CO_2 in coal seams and the influencing factors and presents an overview of the global status of major CO_2-ECBMR projects initiated in the past three decades. The status report clearly shows that we have upgraded technology in the last three decades to recover CBM from the deep, un-mineable coal seams by virtue of injecting CO_2. However, there are still many technical challenges in ECBM projects, such as CO_2 storage capacity evaluation in deep un-mineable coal formations, efficient site characterization, injectivity loss with CO_2 injection etc. Researchers have recommended practices like hydraulic fracturing, using a gas mixture of CO_2 and Nitrogen as injection fluids etc., for enhanced CBM recovery. However, a detailed integrated feasibility study is required for the geological storage of CO_2 in coal seams.

IDENTIFICATION OF PALAEOCHANNEL USING GEOPHYSICAL METHOD IN KURUKSHETRA DISTRICT, HARYANA, INDIA

Harsh Kumar, Vikas Kumar*, Sushil Kumar, B. S. Chaudhary**
Department of Geophysics, Kurukshetra University Kurukshetra-36119.
Email id: harshsainibargat@gmail.com

A palaeochannel is an ancient, now-inactive river or stream channel that has been flown in the past and now filled with sediment and buried over the time. These buried channels often serve as underground reservoirs or aquifers, holding significant quantity of groundwater. In context of decreasing subsurface aquifer reserves, it's leading to execute geoscientific, site-specific analyses to delineate new zones for advanced groundwater exploration. Groundwater exploration studies were carried both along and across the presumed palaeochannel within Kurukshetra district. Electrical Resistivity Tomography (ERT) surveys were carried out in and around the Garhi Roran and Indbari villages of Kurukshetra district of Haryana. The presence of high resistivity third layer gives clue about the presence of high resistive sand and gravel, indicates the presence of palaeochannel. Therefore, Vertical Electrical Sounding (VES) surveys were conducted in the study area at eight villages for further investigation. The paleo-path of high resistivity was delineated from 15 to 50 m depth and the width of the palaeochannel was interpreted as about 10-12 km. Interpretation based on Dar-Zarrouk (D-Z) parameters also confirm the presence of the palaeochannel within the specified study locale.

DISTRIBUTION AND POLLUTION POTENTIAL OF DISSOLVED TOXIC METALS IN SUBTERRANEAN ESTUARIES OF KERALA COAST

N.K. Vishnudattan[1*], S. Bijoy Nandan[1], E.H. Aravind[1], D.S. Suresh Babu[2]
[1] Department of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science & Technology, Fine Arts Avenue, Cochin 682016, Kerala, India.
[2]National Centre for Earth Science Studies, Akkulam, Thiruvananthapuram 695031, Kerala, India.
Presenting author E-mail ID: vishnuhd007@gmail.com

Submarine groundwater discharge (SGD) is the movement of fresh or recirculated groundwater from land into the sea through permeable aquifers along continental margins. Subterranean estuaries (STEs) are formed along coastal aquifers when fresh groundwater and saline sea water mix. In addition to surface water discharge and atmospheric deposition, SGD has the potential to be an important source of heavy metals into coastal ecosystems. Even though, the global fresh SGD flux has been estimated to be only ~1 % of riverine discharge, the SGD flux of metals to coastal system is highly significant. Here we quantified the spatial and temporal distribution of dissolved toxic metals (As, Pb, Cd, Cr) and estimated its SGD flux and pollution potential along 15 subterranean estuaries of Kerala during three contrasting seasons between 2019 and 2021. Average concentration of toxic metals in the coastal groundwater during all three seasons displayed a similar trend of As > Pb > Cr > Cd. At Kodikkal beach, the average Cd concentration during all seasons was four-fold higher (1.3 µg/L) than other study sites. Pb and As exceeded the highest permissible limit for drinking water prescribed by Bureau of Indian Standards (BIS 2012) and World Health Organisation (WHO 2017) in Kodikkal beach. As and Pb were the major contributors among toxic metal fluxes and the estimated SGD derived toxic metal fluxes ranged from 0.002 to 0.74 (10^{-2} mol/m/day). As was the only metal

that exceeded the pollution threshold (Single Factor Contamination Index > 1) while Cr showed the least pollution. The maximum SFCI values indicated higher pollution for As at the Kodikkal beach (1.05) and Puthenthope beach (1) closely followed by Aattupuram beach (0.97). The ecological risk index (ERI) also suggests that Aattupuram beach (ERI = 6.9) and Punnakkachal beach (ERI = 5.3) are of moderate ecological risk.

GROUNDWATER VULNERABILITY IN VICINITY OF LANDFILL SITE THROUGH GIS AND DRASTIC APPROACH IN DELHI, NCR REGION

Rishu Pandey[1*], Tanvi Arora[1, 2]

[1]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad 500 007, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 201002, India
Corresponding Author: *rishu29pandey@gmail.com

In a research initiative centered on the Ghazipur municipal dumping site in the Delhi NCR region, India, a comprehensive assessment of groundwater vulnerability to contamination was conducted. Employing the DRASTIC model within the framework of a Geographic Information System (GIS), the study aimed to pinpoint areas at substantial risk of groundwater pollution. The DRASTIC model, encompassing seven critical hydro geological parameters influencing groundwater quality, was utilized. Arc Map 10.6, software developed by ESRI GIS, was instrumental in creating a groundwater vulnerability map. This map was meticulously crafted by overlaying the seven layers, thus enabling a holistic understanding of the potential contamination risks in the area. To validate the accuracy of the vulnerability map, rigorous chemical and BOD analyses were carried out on samples procured from wells located in close proximity to the dumping site. These analyses aimed to identify areas with heightened pollution risks, ensuring the reliability of the vulnerability assessments.

The resulting vulnerability map effectively categorized the study area into three distinct classes, each representing varying levels of vulnerability. These classes were designated as moderately vulnerable, highly vulnerable, and very highly vulnerable, offering a clear and intuitive representation of the groundwater contamination risks present in the region. Significantly, the research findings underscored that the north-east and south-west regions of the Ghazipur Landfill dumping site exhibited an alarming vulnerability to groundwater contamination. This heightened susceptibility was attributed to the gently sloping terrains in the eastern area, which facilitated the percolation of contaminants into the groundwater, accentuating the risk factor significantly.

In essence, this study not only utilized advanced GIS techniques and the DRASTIC model but also rigorously validated its results through extensive chemical and bacteriological analyses. By highlighting specific vulnerable zones, especially around the eastern and southeastern regions, the research provided crucial insights that can inform targeted environmental management strategies to safeguard the groundwater resources in the Delhi NCR region.

ASSESSMENT OF CONTAMINATION LEVEL OF RADON (^{222}RN) IN GROUNDWATER AROUND TULSHISHYAM GEOTHERMAL AREA AND SAVARKUNDLA FAULT IN SAURASHTRA, GUJARAT, INDIA

Bala Chandar P[1, 2], Sushanta Kumar Sahoo[1], and Madhusudhanarao Katlamudi[1*]

Institute of Seismological Research, Gandhinagar, Gujarat, India
Earth Science Department, Gujarat University, Ahmedabad, Gujarat, India
*Corresponding author: madhuspl@yahoo.com; Orchid ID: 0000-0001-9216-9927

Radon concentration in water was estimated to determine the level of radon (^{222}Rn) pollution in drinking water of Amreli district in Saurashtra region of Gujarat. As part of the study, water samples from 94 sites spread over an area of around 3,000 km^2 in the Saurashtra region were analysed. The RAD7 device from Durridge Instruments (https://durridge.com) was used to measure the radon concentration. During the investigation, the water sample was collected using a radon tight regent bottle of 250 ml capacity. The radon concentration range was 0.1 to 13.6 Bq/L with an average value of 4.52 Bq/L. The radon concentration at three points (P9, P29 and P35) exceeds the limit recommended by the World Health Organization (WHO) (i.e. 11.1 Bq/L). Among these three points, P9 and P29 are located near the Tulshishyam geothermal area, while P35 is located near the Savarkundla fault. The geothermal fluid in the Tulshishyam geothermal region acts as a suitable carrier for the upward movement of radon and groundwater contamination. Additionally, ongoing seismic activity near Savarkundla fault can trigger the migration of radon to the Earth's surface. Besides radon, other physicochemical parameters like pH and TDS are also measured at the same time. The analysis reveals a non-significant correlation between radon and physicochemical parameters (pH and TDS). The information on the depth of the tube wells from which the water samples are collected is also obtained and it is observed that the depth range during the survey is limited to 105 to 750 feet with an average value of 359 feet. A strong correlation (R2=0.92) was observed between radon concentration and depth. The health risk associated with exposure to radon in water is also examined by estimating the annual effective dose rate. Based on the different values of water consumption and indoor occupancy of the residents of the study area, six different cases are considered to calculate the effective annual dose rate and it is observed that among these six cases, in two cases, the effective annual dose rate exceeds more than 100 µSv/year (value recommended by the WHO).

STATISTICAL ANALYSIS AND IRRIGATION WATER QUALITY ASSESSMENT OF SELECTED RIVERS OF WESTERN GHATS, SOUTH INDIA

Raveena Nandilath*, Anish A U
Department of Civil Engineering, Government Engineering College, Thrissur, Kerala-680 009.
* Email: raveenanandilath@gmail.com.

Kerala is endowed with 44 rivers originating from the Western Ghats. In the present study, pre- and post-monsoon hydro-physicochemical data (3 physical parameters and 6 chemical parameters) of Bharathapuzha (BTRB), Thoothapuzha (TRB), Meenachil (MRB), Pambar (PRB) and Periyar (RPLB) obtained from the published Scopus indexed journals, were compiled and analysed. Correlation Matrix and Anova were conducted to interpret the relation between the physical and chemical parameters. Comparison of analytical data generally shows that the values of parameters

exhibit a slight decreasing trend from the pre-monsoon to the post-monsoon period. The analysis proves that there is spatial variation in the physical properties and chemistry of the surface water samples. The surface water is slightly alkaline in BTRB and acidic in RPLB. Comparatively, high values of parameters were reported from BTRB. From Pearson's correlation analysis, it is observed that a strong correlation exists between EC and TDS, Mg^{2+} and Ca^{2+}, Na^{+} and Mg^{2+}, Cl^{-} and Na^{+}, Na^{+} and HCO^{3-}, Cl^{-} and HCO^{3-} during the pre- and post-monsoon seasons. The hydrochemical data is evaluated for their suitability for irrigation purposes by estimating the potassium retention, permeability index, and Sodium Absorption Ratio (SAR). The estimated values suggest that water in these rivers are suitable for irrigation.

SUBSURFACE MODELING AND IMAGING USING SEISMIC REFRACTION AND WIDE-ANGLE REFLECTION DATA IN DECCAN SYNCLISE PROVINCE

Pratiksha Tiwari*, Biswajit Mandal, ASSSRS. Prasad, Prakash Kumar

CSIR- NGRI, Uppal Road, Hyderabad- 500 007
Email: pratikshatiwari112@gmail.com

To generate a 2-D refined velocity model and reanalyze the crustal evolution due to tectonic activity with geological age along with the Jhagadia-Rajpipla (SW-NE) profile in the Deccan syncline western part of central India, forward and inverse modeling of seismic first arrival and wide-angle reflection travel time data method was used. The surface of the study region is mostly made up of alluvium. After inversion and interpretation of the data, 6 layered 2D velocity model including the basement was acquired. The top 3 layers have velocities of 1.7–2.1 km/sec, 2.5–2.6 km/sec, and 3.0-3.3 km/s and indicate Recent alluvium, Oligocene, and Quaternary sediments with a thickness variation of 50–600 m, 900–1250 m, and 400-2300 m respectively sediments respectively. LVZ and HVZ layers' thickness and velocities have been obtained from the travel time skip phenomena and loss of amplitude. The velocity and depth of the basement were found to be 6–6.05 km/sec lying at a depth of 5.4 km, approximately near Jhagadia, and shallows to about 1.8 km near Rajpipla. The second layer merges with the first at around 15km before shot point 3. During this study, we noticed a phase in SP1 and SP2 (observed seismograms). It may be corresponding to the Oligocene formation with a velocity of 2.5-2.6 km/sec. The Trap layer (velocity 4.6–5.2 km/sec) thickness varies from 300 to 1200 m and the low-velocity Mesozoic sediment thickness ranges from about 500 m to 1500 m along with the profile. Travel-time skip and amplitude decay of the first arrival refraction together with the wide-angle reflection data from the top and bottom of LVZ have been used to derive the thickness of the low-velocity zone. The basement (6–6.05 km/sec velocity) lies at a depth of 5 km approximately near Jhagadia and shallows to about 1.8 km near Rajpipla. The thick low-velocity Mesozoic sediments present below the relatively thin Deccan Traps near SP 2 along the profile is an important zone for further hydrocarbon exploration work in the Narmada–Tapti region of the western part of the Deccan syneclise. The precise velocity model obtained from modeling will be used in Pre-Stack Depth Migration for imaging the subsurface because it allows us to estimate subsurface variables like rock composition, porosity, and fluid saturation with better certainty, which is crucial for hydrocarbon exploration and reservoir characterization.

ASSESSING FLUORIDE CONTAMINATION AND HUMAN HEALTH RISKS IN THE PULLAMAPATTI WATERSHED, NORTHERN TAMIL NADU, SOUTH INDIA

***Divya A S Joji V S, and Reshma Susan Jacob**

Department of Marine Geology and Geophysics, School of Marine Sciences, CUSAT, India
Email: divyageology123@gmail.com

Groundwater quality is essential for ecosystem survival and human well-being. Present study focuses on assessing fluoride contamination in Pullamapatti watershed in Northern Tamil Nadu, South India. A total of 70 ground water samples, representing the entire watershed were collected during premonsoon period. With reference to BIS and WHO standards, all the collected samples were analysed for various cations and anions such as F- , Ca2+, Mg2+, Cl- , HCO3 - , Na+ , and K+ etc. It is found that 27 samples of Pullamapatti watershed noted for fluoride contamination. High fluoride concentrations were observed in areas at Dharmapuri, Karimangalam, Manicknoor, Mittanahalli, Timmanapuram, Nallampalli, Bandarahalli, and Kongarapatti. Moreover, Gibbs plots were used to understand geochemical evolution of groundwater. The study reveals that rock-water interaction is the major contributor for fluoride contamination in this area. The health risk assessment demonstrated that non-carcinogenic health risks from fluoride exposure through drinking water exceeded acceptable levels for infants, children, and adults in the Pullamapatti watershed (HQ > 1). This implies a potential adverse health impact on the population, particularly among these vulnerable age groups, due to their consumption of fluoride-contaminated groundwater. The health risk assessment highlights the importance of addressing this issue to protect the health of the local population, especially infants, children, and adults at higher risk of non-carcinogenic health problems due to their exposure to fluoride-contaminated groundwater.

ASSESSING GROUNDWATER QUALITY IN THE PONDICHERRY REGION OF THE UNION TERRITORY OF PONDICHERRY: A GIS-BASED STUDY ON HYDROCHEMICAL CHARACTERISTICS OF PHREATIC AND DEEPER AQUIFERS

Reshma Susan Jacob, Joji V S, and Divya A S
Department of Marine Geology and Geophysics, School of Marine Sciences, CUSAT, India
Email: reshmasusan2014@gmail.com

Groundwater, accounting for 0.6% of the world's freshwater resources, plays a vital role as a primary source of drinking water, sustaining life on Earth. Approximately 1.5 billion people rely directly or indirectly on groundwater for drinking, withdrawing a substantial volume each year, constituting 20% of worldwide groundwater use. However, the pressures of rapid industrialization, urbanization, and a growing population strain the environment. Over recent decades, extensive usage of groundwater for domestic, agricultural, and industrial purposes has led to alterations in its chemical composition. Furthermore, natural factors such as ion-exchange, redox potential, residence time, geological conditions, and rock types contribute to the presence of various contaminants in water bodies. Groundwater quality assessment in Pondicherry's coastal aquifers is the central focus of this study, aided by Geographic Information Systems (GIS) to visualize the regional distribution of groundwater quality. The study entails the analysis of 63 groundwater samples, encompassing various physico-chemical parameters, including Total Dissolved Solids (TDS), Electrical Conductivity (EC), Chloride (Cl), Calcium (Ca), Bicarbonate (HCO3), and Sulfate (SO4). The findings reveal wide variations and

substantial standard deviations in these parameters, indicative of anthropogenic contamination and seawater intrusion in the coastal aquifers. However, most of the groundwater in the area is generally safe for potable and domestic purposes. In terms of irrigation suitability, 95.3% of the groundwater samples, based on Sodium Adsorption Ratio (SAR) values, are suitable for irrigation across different soil types with a low risk of exchangeable sodium. Nonetheless, the Wilcox Plot classification categorizes most samples as permissible-doubtful for irrigation, necessitating careful considerations. The USSL classification suggests that most samples have high to very high salinity with minimal sodium risks. Effective drainage planning is vital to address this issue and ensure sustainable irrigation practices. The permeability index (PI) values classify most groundwater samples as class I, making them suitable for irrigation. The study underscores the importance of regular groundwater monitoring to mitigate potential environmental risks. This comprehensive assessment provides valuable insights into groundwater quality and its implications for various uses of coastal aquifers in the Pondicherry region.

PORE PRESSURE PREDICTION USING DECISION TREE REGRESSION ANALYSIS OF WELL U1517A LOCATED AT LANDSLIDE COMPLEX OF SITES IODP 372

***Goutami Das, and Saumen Maiti**

Machine Learning and Geocomputing Laboratory, Department of Applied Geophysics, IIT(ISM), Dhanbad-826004, Jharkhand (INDIA)

* Corresponding Author: goutami.20dr0048@agp.iitism.ac.in, saumen@iitism.ac.in

Knowledge of the pore pressure (PP) of wells is among the most critical concerns in the design of a safe drilling operation and is used to optimize the casing seat selection for well design. Accurate PP prediction plays a remarkable role in the analysis of geomechanical properties of reservoirs, hydrocarbon field development, and risk management by preventing specific drilling problems such as wellbore instability, mud kicks, and mud loss. Predicting the trend of pore pressure in complex geological regions poses a significant challenge, especially in oceanic slope settings with relatively high sedimentation rates, where Pp can be influenced by a multitude of complex geological processes. To address these challenges, a variety of analytical and intelligent techniques have been developed for estimating pore pressure (PP) from conventionally available petrophysical logs. The empirical method for predicting pore pressure (Pp) consists of two main stages: data pre-processing and model establishment. Eaton's method was applied to calculate Pp for well U1517A, situated within the Tuaheni Landslide complex of the Hikurangi Subduction Zone, New Zealand of IODP Expedition 372A. Sonic travel time, bulk density, gamma ray, caliper, temperature, neutron porosity, and neutron porosity are extracted from well-log data. These seven parameters are used for the theoretical framework construction. The analysis of the normal compaction trend (NCT) curve is employed to assess the best fit for low-permeability zone data. Statistical analysis involves histogram analysis and the calculation of Pearson's correlation coefficients using the Pp data series to determine potential input combinations for the development of machine learning-based predictive models. The dataset is first prepared and split into two sections: Training and Testing. The Pp data and well log data from borehole U1517A are pre-processed to scale within the range of [-1, +1]. A Decision Tree Regression (DTR) algorithm is constructed to assess its performance in predicting Pp and identifying overpressure zones within the Hikurangi Tuaheni Zone of IODP Expedition 372. The uncertainty analysis is performed to evaluate the model's efficiency. Present results show that the DTR algorithm

has the potential to predict the Pp from well log and the method used here can be explored further in combination with deep learning models in the other complex landslides area of world oceans to facilitate the creation of more efficient approaches for predicting pore pressure and optimizing reservoirs.

PRELIMINARY STUDIES ON UM AND HE BASED HYBRID DEEP LEARNING MODELS FOR SEISMIC IMAGE ENHANCEMENT

Thandan Babu Naik R1*, Polaiah B2, Vamsi Krishna G1, Pradeep Naick B1, and Satyanarayana H.V.S1

1. CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad, India
2. Institute of Aeronautical Engineering, Hyderabad, India
*Corresponding author: thandan@ngri.res.in

Seismic images have crucial role to play in delineation of various geological features, such as reflectors corresponding to various formations. The seismic images are constructed using the seismic data acquired in field and is accompanied by the noise. Noise limits the visualization of geological features and come in variety of forms like mono response noise, random noise, erratic noise, multiples, ground rolls etc. The minimization of noise to improve the quality of seismic image is carried out at various data processing stages, such as pre and post processing, and during processing. The removal of the noise through conventional and nonconventional processes does not completely eliminate it and leaves scope for further improvements. The present work illustrates the preliminary studies on UM and HE based hybrid deep learning based models for seismic image enhancements by noise minimization. Deep learning (DL) is a sub set of methods in artificial intelligence (AI). It simulates the natural behavior of human brain. It is a neural network based with three or more layers, designed to aim at producing accurate insightful information. In general DL requires a large number of high-quality training image samples to yield better performance. But relatively low contrast of input seismic images is used to assess the effect of image enhancement on performance of DL technique. The initial low contrast seismic images are improved with enhancement algorithms such as Unsharp Masking (UM) for reducing blurriness, High-Frequency Emphasis (HE) filtering for sharpening edges of reflectors. These enhanced image samples were then fed to the Convolutional Neural Network's (CNN) ResNet models for transfer learning. This Hybrid UM-HF based deep learning seismic image enhancement produced the image with 70% rise in contrast against conventionally generated image. The geological visual features are also pronounced around the reflector regions with enhanced edges and boundaries.

SMART HYDROLOGY: ENHANCING GEOPHYSICAL STUDIES WITH IOT-DRIVEN WATER LEVEL AND QUALITY MONITORING

Pradeep Naick B, Sateesh Chandrapuri, G Vasudevan, Thandan Babu Naik, H.V.S. Satyanarayana

CSIR-National Geophysical Research Institute, Hyderabad, India
Presenting author: kholapradeep@gmail.com

In the realm of geophysical studies, the utilization of advanced technologies is pivotal for accurate data collection and analysis. This abstract presents an innovative IoT-based Water Level and Quality

Monitoring System, designed to enhance geophysical studies. The system integrates sensors for measuring water level, pH, conductivity, and temperature, providing comprehensive insights into water quality parameters.

This study showcases the significance of employing Internet of Things (IoT) technology in geophysical research. The implemented sensors offer a holistic view of water resources, enabling a deeper understanding of their quality and quantity. The water level sensor accurately measures water depths, while the pH sensor evaluates the acidity or alkalinity levels. Concurrently, the conductivity sensor gauges the water's salinity and the temperature sensor monitors thermal variations. Utilizing Raspberry Pi 4 single board computer as the core controller and a 24-bit Analog-to-Digital Converter, the system ensures precise and real-time data acquisition. The Raspberry Pi system was meticulously programmed using Python, an open-source platform, enabling seamless coding and configuration. Utilizing the power of IoT technology, the system effortlessly transmitted real-time data to the cloud, enabling remote monitoring and analysis, thereby enhancing the system's flexibility and accessibility.

The system's real-time monitoring capabilities revolutionize decision-making in water management. By providing continuous data streams, it facilitates proactive measures in response to fluctuations in water quality. By bridging the gap between data acquisition and actionable insights, this system contributes significantly to the conservation and management of water resources. Utilizing machine learning technology enhances our data comprehension, leading to more effective water resource management strategies.

ELECTRICAL RESISTIVITY IMAGING OF A CRITICAL ZONE IN THE PRANMATI BASIN, UTTARAKHAND HIMALAYA FOR BEDROCK STRUCTURE AND REGOLITH THICKNESS

Akashdeep Barman*, G. Pavankumar, M. Demudu Babu and Ajay Manglik

CSIR-National Geophysical Research Institute, Hyderabad – 500007
*Email: akashdeep1996geophysics@gmail.com

The active Himalayan mountains exhibit steep slopes and dissected topography dominated by overall compressive tectonic forces having coarse-textured thin soil layer with low water-retaining capability and are highly prone to erosion. Soil erosion is primarily driven by factors such as heavy rainfall, deforestation, landslides, agricultural activities on slopes and ongoing tectonic processes. These activities not only impact downstream ecosystems but also affects the critical zone (CZ), the interface where atmosphere, geosphere and biosphere are interacting. In this study, an Electrical Resistivity Tomography (ERT) study has been conducted in the Pranmati critical zone of the Alaknanda basin, the Lesser Himalaya, to comprehend the erosion pattern, sediment transport and depositional processes by characterizing the underlying bedrock and associated regolith. A total of six ERT profiles has been laid in the catchment at two locations: one at a flat grassland, while the other in a cultivated field situated on a steep hill slope (> 25°). The study area is a part of the Baijnath klippe consisting quartz-biotite gneisses with layers of quartz mica-schist enclosed by thrust faults. The 2-D electrical resistivity sections in the downslope grassland show a thick regolith (> 10 m) and a sharp resistivity contrast along the SW-NE transects suggesting an increment in the dip of the bedrock towards SE direction, oblique to the NE facing surface topography. The resistivity sections in the

crop field site, yield a very thin layer of regolith (< 2 m) indicating significant soil erosion. From the study, we propose that water-rock interaction facilitated by shallow-level subsurface water circulation acts as a potential source for the weathering of the bedrock and the thick regolith. These observations align with the existing hypotheses proposed for the evolution and development of deep critical zones and hypothesize that the bedrock architecture and water channel paths within the CZ together control the regolith thickness.

ENHANCING CO_2 MONITORING ACCURACY IN THE SLEIPNER AREA WITH SEISMIC ATTRIBUTE TECHNIQUES

G. Hema[1]*, S.P. Maurya[1], Nitin Verma[1], Ravi Kant[1], Ajay P. Singh[1]
[1]Department of Geophysics, Banaras Hindu University, Varanasi, India-221005
Email: gopalhema96@gmail.com

Monitoring CO_2 in the subsurface is a crucial aspect of long-term storage in any carbon capture and storage (CCS) project. This process involves the continuous measurement and tracking of carbon dioxide (CO_2) concentrations and evaluating its behaviour within geological formations and storage sites situated beneath the Earth's surface. The key objectives of CO_2 monitoring in the subsurface include ensuring that injected CO_2 is securely contained, detecting any potential leaks or breaches early on to prevent environmental and safety hazards, and understanding how CO_2 interacts with subsurface conditions such as pressure and temperature. Additionally, this monitoring helps to characterize the geological reservoirs, optimize storage strategies, and ensure long-term stability. long-term safety of geologic carbon storage sites. This monitoring can be done using a variety of geophysical methods. The seismic method is commonly used to monitor CO_2 migration in geologic carbon storage sites for the long-term safety of CO_2 emissions. In the present study, we will monitor the CO_2 plume using seismic attributes analysis of time-lapse seismic data of the Sleipner gas field, North Sea. 3D seismic data were obtained in 1994 before the injection began, and subsequently in 1999, 2001, 2002, 2004, 2006, 2008, and 2010. The seismic data shows a series of bright, sub-horizontal reflections of the CO_2 plume that increase over time, with a noticeable pushdown in velocity underneath. The seismic attribute analysis involves extracting and examining different attributes or characteristics from seismic data generated by sending acoustic waves into the Earth's subsurface and recording their reflections. These attributes include amplitude, frequency, phase, envelope second derivative, etc. One way to identify geological features like faults and changes in rock properties is through amplitude attributes which can help determine the intensity of seismic reflections. Another important attribute is frequency, which can reveal variations in seismic data's frequency content and facilitate the recognition of lithological changes and reservoir properties. Lastly, phase attributes examine phase shifts in seismic data which is crucial for identifying structural features such as anticlines and synclines. The analysis of seismic attributes provides many advantages, such as the monitoring of subsurface CO_2 levels. The analysis reveals evidence that seismic attributes can distinguish and monitor the CO_2 plume zone with enhanced resolution better than the seismic amplitude itself.

APPLICATION OF SEISMIC INVERSION BASED ON MAXIMUM LIKELIHOOD METHODS TO MONITOR CO_2 PLUME IN SLEIPNER GAS FIELD, NORWAY

Ajay Pratap Singh[*], S.P. Maurya[1], Ravi Kant[1], Nitin Verma[1], Raghav Singh[1], K.H. Singh[2], Prabodh K. Kushwaha[1], M.K. Srivastava[1], G. Hema[1], Harsha Raghuvanshi[1]And Richa[1]

[1]Department of Geophysics, Institute of Science, Banaras Hindu University, Varanasi-221005, India
[2]Department of Earth Sciences, Indian Institute of Technology, Bombay, Mumbai-400076, India
[*]Email ID: ajaygeop21@bhu.ac.in

Global warming is one of the most important environmental issues of our day. Several international organizations have been established to address these concerns. One of the best methods to maintain atmospheric CO_2 concentrations is the capturing and storing of CO_2 in geological formations. Remote monitoring is crucial for tracking the movement of the CO_2 plume and spotting potential leaks both during and after injection. Although general monitoring for the boundaries of the plume and verification of stored amounts are also required, leak detection is probably the greatest concern. There are numerous efficient remote CO_2 monitoring methods with different advantages and disadvantages. Monitoring in the context of geological carbon storage involves employing various techniques, one of which is seismic imaging. Seismic imaging is a non-invasive geophysical method used to create detailed images of subsurface geological structures and detect any potential changes related to the storage of CO_2. This study focuses on the monitoring of a CO_2 plume using seismic inversion based on the Maximum Likelihood sparse spike Inversion (MLSSI) methods. The research utilizes 4D seismic data obtained from the Sleipner Gas Field in Norway, a prominent site for CO_2 storage. The objective is to accurately detect and monitor the spatial distribution and evolution of the injected CO_2 within the subsurface reservoir. Additionally, the study evaluates the consistency between seismic data acquired at different phases, specifically comparing baseline and monitoring data using the Normalized Root Mean Square attribute. This comparison helps assess the reliability and repeatability of the acquired seismic data. This alignment facilitates the inversion process, allowing for a more accurate analysis of CO_2 distribution. Through calibration, the Normalized root mean square (NRMS) improved from the original NRMS value of 0.753 to 0.539 with a phase shift, shaping filter, and Time variant shift. This signifies notable enhancement, implying reasonable repeatability. The results of the seismic data inversion are showcasing the impedance values ranging from 1200 to 1500 (m/s*g/cc). A notable discrepancy in impedance is evident between the baseline and monitoring data. The appearance of a lower impedance value in the monitoring data is a key observation, suggesting that this variation likely corresponds to the CO_2 storage within the Utsira sandstone formation. This finding is crucial for confirming and monitoring the efficacy of CO_2 storage within the targeted reservoir.

UNVEILING THE POTENTIAL OF GEOPHYSICAL METHODS FOR CONTAMINANT STUDIES IN URBAN AREAS: A REVIEW

Sohelkhan Pathan[1*], Tanvi Arora[1,2]

[1]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad 500 007, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India.
Corresponding Author: sohel.geophysics@gmail.com

Worldwide, groundwater contamination is a huge issue that puts human health at risk and can result in fatal diseases. Groundwater contamination is majorly caused by municipal solid waste (in urban environment) along with industrial and agricultural discharges. About 2.01 billion tons of municipal solid waste is generated globally each year in which most of the waste is disposed of in landfills. Countries in Asia and Pacific regions account for 43% of the global waste generation in which India and China accounts for 27.45% of global waste generation. Most of the landfills operated Southeast Asian countries are non-sanitary Landfills. This leads to the percolation of leachate in the unsaturated zone thereby affecting the aquifer beneath.

Conventional hydrogeological and geochemical methods are primary indicators and detect high levels of critical parameters near landfills, indicating groundwater contamination from leachate. However, predicting the depth and movement of leachate remains highly uncertain based on these findings. Geophysical methods are non-invasive, non-destructive, cost-effective and can deliver a holistic perspective of subsurface conditions. The integrated use of geophysical methods such as electrical, electromagnetics, shallow seismic and infrared thermography emerged as an important tool for evaluation and characterization of landfill sites due to the conductive nature of most contaminants. Soupios et al. (2007) employed various techniques, including ERT, VLF, electromagnetic, seismic refraction, and ambient noise measurements, for comprehensive landfill characterization and delineation. Naudet et al. (2004) effectively mapped landfill leachates by combining the Self-Potential method with ERT. Tsourlos et al. (2014) successfully detected landfill leaks using ERT and identified leaking fracture zones. Ntarlagiannis et al. (2016) demonstrated ERT and IP's usefulness for temporal leachate monitoring in an olive oil mill waste site. In this work, preliminary results of Ghazipur landfill site, India are used to describe the evidence of contaminant in the unsaturated zone of Delhi, NCR region.

GEOELECTRIC INVESTIGATION USING DZP TO DELINEATE GROUNDWATER POTENTIAL ZONE AND AQUIFER PROTECTIVE CAPACITY: A CASE STUDY IN SEMI-ARID NIGER, AFRICA

Ronak Dahiya[1*], Sohelkhan Pathan[2], Rishu Pandey[2], Rehmat Khan[3] and Tanvi Arora[2,3]

[1]Department of Geophysics, Kurukshetra University, Kurukshetra, India
[2]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad 500 007, India
[3]Academy of Scientific and Industrial Research, Ghaziabad, India
Presenting author *mail2ronakdahiya@gmail.com

Water availability in the semi-arid region is intensely difficult to understand. Where there are no surface water resources, Groundwater is a crucial resource for a variety of applications including domestic, agricultural, and industrial. Semi-arid country Niger, face water scarcity due to infrequent rainfall and high rates of evaporation. By analyzing current data and carrying out field research the purpose of this research is to identify groundwater potential zones and assess aquifer protection

capacity to attention on the Sustainable Development Goals of UN with an awareness on African countries. For this work, 166 profiles of Vertical Electrical Sounding (VES) using the Schlumberger array technique were in the investigation in the regions of Tillaberi, Niamey, Dosso, Tahoua, and Maradi. Dar-Zarrouk parameter was conducted using two parameters of geoelectric inversion i.e., resistivity and layer thickness. Thematic maps were prepared for Longitudinal Conductance (S), Transverse Resistance (T), and Electrical Anisotropy (λ) for the study area. A transverse resistance map which classified the groundwater potential zone of the study area into low, moderate, and good was obtained. The Transverse resistance value ranges from $126.79\Omega m^2$ to $80101.66\Omega m^2$. Based on this value north-west part of the study area reflects a good groundwater potential zone as can be seen from the high resistance values. Longitudinal conductance value ranges from 0.02 Siemens to 9.6 Siemens. Based on this value south-west part of the study area reflects a very good protective capacity rating as can be seen from the high conductance value and Anisotropic coefficient value ranges from 1 to 3.17. Geophysical data is further correlated with lithological variations within the region. By examining various lithological and drilled logs, it is possible to create a map of the aquifer with resistivity variations ranging from 2m∼6m across the entire site. This process delineates the aquifer zones for recharge and sustainable management.

ELECTRICAL RESISTIVITY IMAGING OF A CRITICAL ZONE IN THE PRANMATI BASIN, UTTARAKHANDHIMALAYA FOR BEDROCK STRUCTURE AND REGOLITH THICKNESS

Akashdeep Barman*, G. Pavankumar, M. Demudu Babu and Ajay Manglik
CSIR-National Geophysical Research Institute, Hyderabad – 500007
*Email: akashdeep1996geophysics@gmail.com

Tectonically active Himalayan Mountain belt exhibits steep slopes and dissected topography dominated by overall compressive tectonic forces. These mountain slopes have coarse-texturedthin soil cover with low water-retaining capability and are highly prone to erosion. Soil erosion is primarily driven by factors such as heavy rainfall, deforestation, landslides, agricultural activities on slopes and ongoing tectonic processes. These activities not only impact downstream ecosystems but also affect the critical zone, the interface where atmosphere, geosphere and biosphere are interacting. We have carried out an Electrical Resistivity Tomography (ERT) study in the Pranmati critical zone of the Alaknanda basin, Lesser Himalaya, to comprehend the erosion pattern, sediment transport and depositional processes by characterizing the underlying bedrock and associated regolith. Six ERT profiles have been laidin the catchment at two locations: one at a flat grassland while the other in a cultivated field situated on a steep hill slope (> 25□). The study area is a part of the Baijnath klippe consisting of quartz-biotite gneisses with layers of quartz mica-schist enclosed by thrust faults. The 2-D electrical resistivity sections in the downslope grassland show a thick regolith (> 10 m) and a sharp resistivity contrast along the SW-NE transects suggesting an increment in the dip of the bedrock towards SE direction, oblique to the NE facing surface topography. The resistivity sections in the crop field site yield a very thin layer of regolith (< 2 m) indicating significant soil erosion. From the study, we propose that water-rock interaction facilitated by shallow-level subsurface water circulation acts as a potential source for weathering of the bedrock and the thick regolith. These observations affirm the existing hypotheses proposed for the evolution and development of deep critical zones and

hypothesize that the bedrock architecture and water channel paths within the critical zone together control the regolith thickness.

TWO DIMENSIONAL DEEP LEARNING BASED INITIAL MODEL FOR FAST MAGNETOTELLURIC INVERSION

Koustav Ghosal*[1] and Arun Singh[1]

[1]Department of Applied Geophysics, IIT(ISM) Dhanbad
*Email: koustav.20dr0066@agp.iitism.ac.in

For the interpretation of acquired 2D magnetotelluric data, in- version is the most important tool through which the sub-surface conductivity model is obtained. The conventional gradient-based optimisation techniques is prone to fall into local minima thus the initial or starting model model plays a very crucial role. A good initial model not only overcomes the local minima but also accelerate the inversion process by reducing the number of iteration. Tra- ditionally, half space or layered earth models, estimated from the 1D inversion of the magnetotelluric data are used as the initial guess model. More complex initial models maybe constructed using the aprior information. Alternatively the deep learning algorithms can be used to estimate the model. In this study, we have used end-to-end deep neural network training to estimate the initial resistivity model from the resistivity and phase data. The proposed network is based on UNet architecture. A total of 36000 resistivity models were generated using the concept of Gaussian random field (GRF) and the forward responses for TE and TM- modes were computed using a finite-difference based solver. The GRF based resistivity models helps to attain a good generalization on out-of-distribution samples and this allows our proposed method to be used for field data with pre-trained weights. The numerical experiments of synthetic data set shows that predicted model using the network is in close approximation with the true model and the further refinement can be achieved using conventional gradient-based methods.

SUBSURFACE CHARACTERIZATION OF ROCK GULLY EXPOSURE USING MAGNETO-TELLURIC SCANNING FOR ANCHORING THE TOWER IN KOLLAM, KERALA

Kiran C, J. [1], Jishma R. Jayan[2], Anand S. P. [3] and Biju Longhinos[2]
1Government Engineering College Barton Hill
2 College of Engineering Trivandrum, Trivandrum
3 Indian Institute of Geomagnetism, Mumbai
Corresponding author - jishmarjlakshmi@gmail.com

The "geological anomalies/surprises'' are becoming the evident causative factors for the failures of engineering /civilian constructions and the surface environment because of the lack of proper knowledge about the nearer subsurface. Characteristics of the shallow subsurface is one of the major determinative factors which decides the technology, the design, and the execution of any engineering construction to maintain the existing equilibrium of the subsurface. Environmental geophysics is a new approach of geophysics which deals with the physical properties of the earth's shallow subsurface (upto500m geologically) using non-invasive geophysical instruments and has got wider

range of application which includes the construction application in civil engineering. The use of magneto-telluric investigation method for characterizing the nearer subsurface is getting more attention for its quick, cheap, and ergonomic results. The study was conducted for the detailed analysis of the subsurface to anchor the tower structure and it concerns about the strata characterization of the terrain having garnet biotite gneissic rock gullies exposure, by magneto-telluric scanning up to 300m in Kollam, Kerala. The detailed scanning at the proposed site with 6 transects was conducted and followed by the geological study. The resulting 2D and 3D profiles gave insight to the extent of the rock intactness and fracture zones up to the 300m depth. The details of this work will be presented.

AMT STUDIES IN RAJANPUR GEOTHERMAL ZONE, WESTERN MAHARASHTRA

Vasu Deshmukh[1], P V Vijaya Kumar[2], P B V Subba Rao[1] and A K Singh[1]

1-Indian Institute of Geomagnetism, Panvel, Navi Mumbai, India
2-National Geophysical Research Institute, Hyderabad, India
Email: vasu.deshmukh@iigm.res.in

Geothermal energy is heat energy from the earth. Assets of the geothermal zone are a reservoir of hot water below the earth's surface. This hot water has different applications like electricity generation, heating and cooling, etc. Many hot springs exist along the western coast of India, extending from Kokener in Maharashtra state in the north to Irde in Karnataka state in the south, and are related to deep-seated fault/lineament categories.

The Rajapur hot spring is located in southernmost Konkan on the west coast of India and emerges through Deccan volcanics. A 3D Audio Magnetotelluric (AMT) survey was conducted across this geothermal zone to understand the possible source/reservoir for the hot spring. 2D and 3D results denote high conductivity anomaly at a depth range of 0.1-0.4 km, associated with fault/fracture zone carrying hot water. A high resistive basement related to the Precambrian gneisses and granite is observed at a shallow depth. The basement is likely the source of the heating of the meteoric water, as granite produces heat through the radioactive decay of its constituent elements. Thus, hot water is being gushed up to the surface through faults and fracture zones, resulting in hot spring formation. The primary reservoir appears to be located south of Rajapur hot spring.

TELL-A-TALE STORY OF HOLOCENE COASTAL SEDIMENTARY RECORD OF GUJARAT, WESTERN INDIA

Utkarsh Pandey* and S. P. Prizomwala
Tectonic Climate and Extreme Events group, Institute of seismological Research, Gandhinagar, India 382007
Email: pandey.utkarsh1607@gmail.com

The shoreline of Gujarat, western coast of India facing the northern Arabian Sea has remained exposed to tsunamis in past from distant to regional sources (Makran Subduction Zone) and processes and yet has so far remained 'Terra-Incognita'. The western coast of India owing to its varied geomorphology (rocky coastline to sandy beaches / mudflats) has archived tsunami/extreme event

traces in the form of boulder blocks to sand sheets deposited far inland from the present day shoreline. The sedimentary record illustrates character, dynamics and micro-processes active during and after a tsunami or extreme wave event along the coastline. The tale of how past processes dominated the Gujarat shoreline and their character have been probed using various proxies. Changes in grainsize, landward extent, contrasting provenance of sand layers, changes in biodiversity index are some of the distinguishing criteria. The extreme wave event, tsunami deposits in particular, were distinguished using suite of geochemical, micropalaeontological and sedimentological tools, while comparing with known geological record and characteristics of historical storms in the Arabian sea region.

SPATIO-TEMPORAL VARIATION IN EXHUMATION RATES OF THE HIMACHAL HIMALAYA OF THE NW-INDIA: INSIGHTS FROM LOW-TEMPERATURE THERMOCHRONOLOGY

Sarthak Ranjan Giri*[1], Paramjeet Singh[2], Sushil Kumar[1], Manisha Sandhu[1]

[1]Department of Geophysics, Kurukshetra University, Kurukshetra 136119 (India),

[2]Wadia Institute of Himalayan Geology, Dehradun 248001 (India),

*Email:sarthak.ranjan96@gmail.com

The intracontinental collision between the Indian and the Eurasian plates took place ~55 Ma ago and resulted in the Himalayan mountain belt formation. We have integrated 1-D thermal modeling to study the exhumation rate and obtain new transient exhumation rates. The available AFT ages in the Chenab-Bhot Nala Valley range from 1.01±0.15 Ma to 3.23±0.45 Ma within the window, whereas they range from 2.13±0.14 Ma to 11.0±0.30 Ma in the HHC zone. Similarly, the ZFT ages range between 6.17±0.57 and 12.26±0.67 Ma. The obtained transient exhumation rates (ER) suggest that from 18.4 Ma to 8.6 Ma, the ER was ~ 0.41 mm/yr. Similarly, from 8.6 Ma to 5 Ma it has been increased and reached to ~0.84 mm/yr. Moreover, the exhumation rate from 2.3 Ma to the present has been raised to ~1.3 mm/yr. So, the increase of exhumation around 8.6 Ma indicates the rapid upliftment and erosion.

In the Sutlej valley, the available AFT age ranges between 0.6±0.2 to 3.6±0.5 Ma whereas the ZFT age varies between 6.1±0.2 to 19.9±0.5 Ma. The variation of the ages in the area suggests that the FT ages are younging towards the core of the window. Transient exhumation rates from the Miocene to the present suggest that the exhumation rate of the HHC was > 3 mm/yr in the 23-19 Ma period, and decreased to 0.5-0.7 mm/yr between the 19-13 Ma period, remained constant between 13-4 Ma, slightly increased 1-2 mm/yr in the last 3 Ma. Whereas, the transient ER in the LHS region was ~3 mm/yr between 23-13 Ma, and 0.5 mm/yr in the 13-4 Ma period, and 1-2 mm/yr in the last 3 Ma period in the LHS. The change in the rate of exhumation suggests that it might be due to the development of the Lesser Himalayan Duplex. Similarly, the available AFT ages range between 1.7±0.3 to 9.3±0.9 Ma in between MCT and STDS in the Chamba area, which is less than 4 Ma obtained near the MCT zone indicates a Plio-Pleistocene mean erosion rate of 0.8 - 1.9 mm/yr, while ages of more than 4 Ma obtained near the STDS indicate a Plio-Pleistocene mean erosion rate of 0.3-0.9 mm/yr. The exhumational variability within the Chamba region is attributed to continuous thrusting along a major decollement, which results in a flat area beneath the slowly exhuming internal compartments and a steep frontal ramp at the frontal range that is rapidly exhuming. As a result, we can say that the exhumation rate varies in different areas of Himachal Himalaya. Therefore, depending on the region, the impact of tectonics and erosion rate must differ. Moreover, the seismicity pattern also indicates the present-day tectonic activity along the major thrust/faults of the region.

Based on the detailed study of the FT ages, transient exhumation rates and seismicity pattern suggests that the tectonic plays a major role in the surficial processes. Here, we envisage that the tectonics of the region are controlled over the exhumational variability and seismic data.

GENERATION OF SONIC LOG IN THE KG BASIN FROM THE NEIGHBOUR WELL LOGS USING CONVOLUTIONAL NEURAL NETWORKS

D. Haritha[1]*, and N. Satyavani[1]
CSIR - National Geophysical Research Institute, Hyderabad, India
* Email: haritha4274842@gmail.com

Well log data gives the geological information of a borehole and is important for estimating the hydrocarbon reservoirs. However, acquiring the continuous well log data is sometimes difficult to obtain owing the issues like instrument failure, incomplete logging, and so on. In this study, we propose a method that can accurately reconstruct the missing logs using the neural networks. For the purpose of generation of missing well log data, we employed a technique called Convolutional Bidirectional Long short-term memory (CNN-Bi-LSTM) with fully connected layers. We trained the model on 7 wells with different logs from the Krishna Godavari basin (KG) and tested the trained model on blind well. This method extracts the features and predicts the missing data of the well. The missing well data was estimated by CNN-Bi-LSTM and compared those results with ANN and Bi-LSTM methods. From the results, we conclude that the proposed method is effective for improving the accuracy of estimation of missing well data. Keywords: LSTM, CNN, well log, KG.

A PSEUDO 3D FOLD FROM 2D SEISMIC TRACES: A CASE STUDY ON SURIN-MASTGARH ANTICLINE

Madhab Biswas[1,2,*], Kalachand Sain[1,2]
[1]Wadia Institute of Himalayan Geology, 33 GMS Road, Dehradun – 248001, India
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad- 201002, India
[*]madhab.biswas5@gmail.com, kalachandsain7@gmail.com

It has been a challenge to build a 3D fold model from 2D seismic data, and we have attempted to build such a model in the Surin-Mastgarh Anticline (SMA), which is 240km long southern-most range of the NW Himalaya. The SMa has been studied since the late 1970s due to its significance for hydrocarbon potential and evolution of NW Himalayan foreland basin. Most of the previous models on the SMA have been proposed from the field observations based on geological and structural perspective. We have looked into the 2D seismic data for bringing out subsurface geometry of the SMA and its inter-tectonic relations with the surrounding tectonic elements such as the Main Himalayan Thrust (MHT), Medlicott-Wadia Thrust (MWT), etc. Digital tracing of seismic amplitudes has been done to understand the deformation pattern within and around the fold, which shows the 'Z'-, 'M'- and 'S'- shaped smaller folds within the SMA. Thus, the SMA is an Anticlinorium, and implies that the SMA experienced both the flexural flow and flexural slip within the stratigraphic layers: Lower Siwalik, Middle Siwalik and Upper Siwalik. The deformation pattern within the axial planner section reveals that the anticline has experienced minor E-W neo-tectonic stress along with major N-S interpolate compression. Those internal deformation patterns were taken as an input to produce a 3D geometrical model of the SMA as polyharmonic in nature. The study shows that the anticline is a Type-II superimposed fold, and not a detachment fold on the MHT. It is overrun by a Blind Thrust (BT) on its north, which is blinded tangentially by the MWT.

HIGH HEAT FLOW IN GODAVARI GONDWANA BASIN, INDIA: IMPLICATIONS FOR GEOTHERMAL PROSPECTS

Sandeep Kumar Prajapati[a,*], Labani Ray[a], Vishal Vasantrao Sakhare[b], Nishu Chopra[a], Bishnu Prasad Biswal[b], S. Eswara Rao[a]

[a] CSIR-National Geophysical Research Institute, Hyderabad-500007, India

[b] Geological Survey of India, Nagpur-440006, India

* Presenting author: prajapatisandeep133@gmail.com

The Pranhita-Godavari basin, one of the biggest Gondwana basins in India, formed due to the occurrence of extensional tectonic activities and crustal weakness between Dharwar and Bastar Cratons. The sediment of the Godavari basin lies over the gneiss and granulite basement rocks.

The study area, Manuguru, part of the Manuguru–Cherla coal belt, is situated on the southeastern margin of the Godavari basin. Geological Survey of India drilled eight deep boreholes, each ~1000 m deep, where temperature measurements were done. The highest recorded temperature was 83 ^{o}C. Among these boreholes, only two yielded undisturbed geothermal gradients, which were used to determine the heat flow of the region. The borehole formations consist of sandstone, shale and quartzite, with minor banding of siltstone, conglomerate, and coal.

The thermal conductivity of 60 core samples was determined in the laboratory using a steady-state method. The average thermal conductivity varies, with the lowest values for shale (1.95 $Wm^{-1}K^{-1}$) and siltstone (2.34 $Wm^{-1}K^{-1}$); intermediate for sandstone (3.03 $Wm^{-1}K^{-1}$); and highest for quartzite (4.56 $Wm^{-1}K^{-1}$). Heat flow values, determined using the Bullard technique, exhibit similar ranges as observed earlier from southwestern (Parsa: 84.2 mWm^{-2}) and southern (Chintalapudi and Aswaraopeta: 92.1 and 104.3 mWm^{-2}, respectively) part of the basin. In contrast, Bellampalli, the central portion of the Godavari basin and Mailaram, bordering the Gondwana sediments, exhibit low heat flow values of 44.4 and 46.1 mWm^{-2}, respectively.

The high heat flow value in the southeastern, southern, and southwestern parts of the Godavari basin could be due to the existence of a subsurface geothermal reservoir. The high heat flow in Manuguru region is due to upflow of subsurface geothermal hot water along the multiple normal faults. Geological, geochemical, and geophysical results, along with thermal data of the present study, are used to access the temperature distribution of the reservoir.

SHEAR WAVE VELOCITY STRUCTURE FOR THE INDO-GANGETIC PLAIN, FROM INVERSION OF AMBIENT VIBRATION SINGLE-STATION AND ARRAY MEASUREMENTS

Uma Shankar

Department of Geophysics, Institute of Science, Banaras Hindu University, Varanasi-221005

Corresponding author: umashankar@bhu.ac.in

Microtremors are low amplitude ambient vibration or noise of ground cause by natural phenomena. Microtremor measurements are non-destructive, fast, robust and economically effective for study of site characterization and local geology of shallow subsurface structure. Observation of microtremor data provides the useful information on dynamic property of site characteristic such as predominant frequency, amplification and ground liquefaction vulnerability. In this study site-effects and shear wave velocity structure of sub-surface soil obtained using microtremor single and arrays measurements in the cities situated in the Indo-Gangetic plain are presented. Most of the measurement

sites from Horizontal to Vertical Spectral Ratio (HVSR) curves showed a variation of the fundamental frequency peak between 0.4 and 0.65 Hz, with maximum amplitude of ~11. This indicates that the deep thickness of the upper soft soil at about several hundreds of meters. Such huge amount of sediments deposition sources could be associated with fluvial rives system in the area and sediment drain from Himalaya. The shallow sub-surface structure has been explored by Frequency Wavenumber (F-K) analysis. Joint inversion of HVSR and Rayleigh wave dispersion curves showed three layers of soft and stiff sediments of varying thickness overlying the bedrock. The shear wave velocity (Vs) of the sediments varies between 280 and 1300 m/s. The obtained shear wave velocity models support a soil classification ranging from soft soil to very dense soil and rock.

Keywords: Microtremor, site response, predominant frequency, amplification, and shear wave velocity, Indo-Gangetic plain.

HYDRO-GEOCHEMICAL EVOLUTION CHARACTERIZING THE CRYSTALLINE HARD ROCKS AQUIFERS OF NAGAVALI RIVER BASIN, SOUTHERN INDIA

Enatula Appalanaidu[1,2], Sahebrao Sonkamble[1,2,*]
[1] CSIR-National Geophysical Research Institute, Hyderabad 500007 India
[2] Academy of Scientific and Innovative Research (AcSIR), Ghaziabad- 201002, India
Corresponding author: sahebrao@gmail.com

Groundwater quality is a crucial parameter that decides its wide applications. The chemical strength of groundwater resulted from a series of hydrochemical processes and evolution at various depths of aquifer systems needs to be evaluated. In crystalline hard rocks, the aquifers are constrained to shallow weathered mantle and deep fractures zones which also governs the chemical quality. This study aimed at appraising the groundwater quality, water-rock interactions, anthropogenic influences, and suitability for drinking and irrigation purposes in the study area of 300 km^2 belong to Nagavali River basin beset over charnockites, khondalites, and migmatites rock, Southern India. A total of 41 groundwater samples were collected from the study area and analyzed for major ion chemistry including pH and total dissolved solids (TDS). The depth to water level were also measured to correlate with the quality.

The results revealed that groundwater is mainly alkaline and falls under the hard to very hard category. About 61% and 17% samples exceeds the WHO drinking water limits for total hardness and TDS owing to the semi-arid climate, high evaporation rate, and water-rock interactions which is confirmed from the Gibbs diagram and saturation indices. The ionic cross plot of Ca^{+2} + Mg^{+2} vs HCO_3^-+SO_4^{2-} indicates, 60% silicate weathering, 20% reverse ion exchange, and 20% ion exchange dominance. Furthermore, US Salinity Diagram and sodium adsorption ratio (SAR) suggests about 85% samples suiting for irrigation applications, and about 12% of samples indicates a moderate sodium hazard. The study observes that the elevated TDS values recorded at shallow water level wells suggests a local domestic contamination while deep water level wells show comparatively lower chemical concentrations.

Keywords: Groundwater quality; Crystalline rocks; Hydrochemical evolution; Drinking and irrigation; Nagavali Basin; Southern India

NEW MAGNITUDE SCALING RELATIONS FOR EARTHQUAKE EARLY WARNING SYSTEM IN THE KUMAON HIMALAYA USING OBSERVED-SIMULATED EARTHQUAKE DATASETS

Sandeep[1*], Suraj Kumar Pal[1], P. Kumar[2], A. Joshi[3]
[1]Department of Geophysics, Banaras Hindu University, Varanasi, India
[2]Wadia Institute of Himalayan Geology, Dehradun, India
[3]Indian Institute of Technology, Roorkee, India
[*] Corresponding author: sandeepfgp@bhu.ac.in

The Kumaon Himalaya is one of the most seismically active regions of the Uttarakhand Himalaya as it is situated in the central seismic gap Himalaya. This urgently calls for the implementation of an earthquake early warning (EEW) system, which will enhance the region's earthquake risk assessment and mitigation. The P-wave onset data from both actual and simulated records are used in this study to develop the EEW scaling relations for the Kumaon Himalaya. First, we test the modified semi empirical technique (MSET) used to simulate P-waves for the M5.4 Indo Nepal earthquake that struck in the Kumaon Himalaya in 2011. Five stations with relatively low root mean square errors (RMSE) show a similar fit between observed and simulated data, indicating the usefulness of MSET. We then simulate additional future earthquakes at 2011 Indo Nepal earthquake location using MSET. Later, the conventional EEW parameters: Average Period (τ_c), Peak amplitude displacement (P_d) and Peak ground velocity (PGV) are extracted from observed and simulated P-wave onsets. We propose new earthquake magnitude relations with τ_c and P_d using hybrid (observed and simulated) dataset. The developed regression relations are then used to estimate lead times for many major cities located near to the study region. The predicted longer lead times suggests that the development of EEW is crucial for the real-time mitigation of seismic hazards in these areas.

NONLINEAR DYNAMICS AND PREDICTABILITY OF GROUNDWATER LEVEL IN VISAKHAPATNAM DISTRICT, ANDHRA PRADESH, INDIA USING BAYESIAN NEURAL NETWORKS

Gathala Vinod Mathews*[1], Rekapalli Rajesh[2], N. Purnachandra Rao[2] and Shaik Kareemunisa Begum[1].
1. Andhra University, Visakhapatnam, Andhra Pradesh, India.
2. CSIR-NGRI, Hyderabad, Telangana, India.
*mathewsvinod36@gmail.com

We attempted here to develop a neural network model for predicting groundwater level changes in Visakhapatnam district, Andhra Pradesh, India by analyzing the dynamics. First, we analyzed the Equivalent Water Thickness (EWT) measured from Gravity Recovery and Climate Experiment (GRACE) and GRACE Follow-On satellite missions for the period 2002 to 2021 using Singular Spectrum Analysis (SSA) to identify the contribution of natural (periodic/predictable) and anthropogenic (random/unpredictable) forces on the changes in EWT. The prediction of dynamic variables depends on forces controlling its dynamics and hence understanding the dynamics is crucial for prediction. We used groundwater levels from 37 sites in the Visakhapatnam district, Andhra Pradesh, India to develop the neural network model. We analyzed the dynamics of the borehole data from their phase plots to appropriately select the neural network model. The first five principal

components in the SSA depict the monotonic trend and oscillations with 69.48 % variance and the rest (~30%) of the variance is associated with chaotic and random dynamics. The analysis of EWT using SSA together with Phase plot analysis of bore-hole groundwater level changes suggests the presence of periodic components and self-organized chaos in the groundwater dynamics over decadal time scales. We noticed ~ 95% predictability of groundwater levels using the Non-Linear Autoregressive (NAR) model considered based on the self-organized dynamics of groundwater level changes. Thoe remaining randomly varying GW changes are possibly linked with anthropogenic activities and catastrophic climatic episodes of shorter duration.

COASTAL PROCESSES AND HAZARDS

IDENTIFICATION OF SITES AND MAPPING OF FRESH WATER MANGROVES ALONG KUWANA AND BISUHI RIVER, GONDA FOREST DIVISION IN UTTAR PRADESH USING GEOSPATIAL TECHNIQUES

P. Kunwar, Kaneez Zaman*
Forest Resources & Ecology Division
Remote Sensing Applications Centre, Lucknow, Uttar Pradesh
✶Corresponding Author: kaneezzaman@gmail.com

Mangroves are lush evergreen forests with trees and shrubs that live in submerged water and are found mainly in tropical and subtropical regions. Mangroves are beautiful, unique, and biologically rich ecosystems and are considered the most productive ecosystem, yet they are vanishing rapidly worldwide. The present study aims to develop a fast and easily mangrove forest identification method based on Remote Sensing Satellite data. Mostly, Mangrove forests are available mainly in the coastal areas but Uttar Pradesh is also having mangroves forest, whereas no Coastal area. The needs for biological and information condition of Uttar Pradesh the study was conducted of distribution of mangroves forests. So that currently, study is trying to find its existence in the fresh water mangroves. The study successfully confirmed the presence of mangroves in freshwater in some districts of the Uttar Pradesh. The Gonda district is one where its existence is approved. The study shows that the forest area of the Gonda forest Division is bequeathed with fresh water Mangroves. The Gonda Division consists of four forest ranges: Kuwana Range, Rehra Range, Sahdullah Nagar Range and Tikri Range based on the information and the interpretation of satellite data along with field survey. Fresh water mangroves area mapping has been done. The number of sites and area occupied by freshwater mangroves is 26 sites in Gonda Forest division. The forest range wise distribution viz. Sahdullah Nagar Range 04 sites (11.29 ha., 32.37%), followed by Rehra Range 04 sites (9.026 ha., 25.89%), Tikri Range 05 sites (7.873 ha., 22.58%) moreover, 13 sites were covered the (6.68 ha., 19.16%) in Kuwana Range. Sadullha Nagar Range sites, Rehra Range sites and Kuwana range site area are located along with the Kuwana River whereas the Tikri range site area is situated along with the Bisuhi River.

Mangroves have the ecological significance and socio-economic benefits. The mangrove forest covers is highly dense and along the river it is inaccessible for conventional survey which should be assesses through Geospatial techniques and limited field survey, freshwater mangroves have been identified and mapped from Geospatial Techniques and limited field survey.

The results of this study provide new dimension on fresh water Mangroves in Uttar Pradesh their availability, growth, soil stabilization and reducing soil erosion, it will be also help in protection of flora, fauna and their environment.

COASTAL RETREAT- A COMPARATIVE ANALYSIS OF BAKKHALI AND MOUSUNI, INDIAN SUNDERBANS

Shreya Das[1*], Srirupa Saha[1*], Tanushree Bose[1], Kamalika Mondal[1], Kanailal Das[1], and Karabi Das[2]
[1]Estuarine and Coastal Studies Foundation, West Bengal, India.
[2]Department of Geography Dr Kanailal Bhattacharyya College, Howrah, West Bengal, India.
*Equal contribution authors
*Presenting authors: dasshreyaa123@gmail.com ; srirupasaha15102000@gmail.com

Coastal erosion refers to displacement of lands along the coasts by the continuous process of erosion and accretion changing the physiography. Coastal islands of Indian Sundarbans have faced severe cyclonic effects of Bulbul (2019), Amphan (2020) and Yaas (2021) triggering embankment breaching and salt water intrusion hampering livelihoods. A comparative study was done between Mousuni and Bakkhali, part of Indian Sundarbans facing Bay of Bengal in the Southern part of Ganges delta. Mousuni island faced a land reduction of about 3.82km^2 along western bank (1979 -2011; Das,2022) whereas coastal stretch of about 2km from Bakkhali in the east to Fraserganj in the west was eroded (Das,2022). The objective of the study was to assess the suitability of embankments to combat the vulnerability regarding coastal erosion in Mousuni and Bakkhali. To observe the beach morphology both quantitative and qualitative approaches were undertaken. Quantitative methods such as measuring various parts of embankments with observations of embankment design (mainly permanent concrete embankment and temporary geojute) were undertaken. A beach profile was done to observe the effects of coastal erosion on beach with the help of dumpy level. A comparison from two field surveys (7th May, 7th October) at Mousuni shows striking effects of coastal erosion at Baliara demolishing the geojute embankments and resorts. The coastal configuration of Bakkhali shows an interesting erosion and accretionary behavior at two adjacent sections unlike Mousuni. High concrete embankments are demanded by the local residents in case of the islands. Qualitative methods such as questionnaire survey was done to understand the people's perception regarding the sustenance of embankment. Armored concrete embankment protected by vegetative wall is required to cope up with the coastal retreat of these two islands.

THE INDIAN COASTAL AREA AND NATURAL DISASTERS THAT ARE AFFECTING IT

B. Satya Madhuri, N. Veera Lakshmi and P.S.H.S.N. Dattatreya
Dept. of Geosciences, Adikavi Nannaya University, Rajamundry, Andhra Pradesh, India- 533296

The Indian/Bharath subcontinent is surrounded its three sides by Arabian Sea, Indian Ocean and Bay of Bengal respectively forming a huge coastal area of about 5422.6 kms in length. This coastal area is being frequently suffered by several natural disasters like cyclones, tsunami, storm surges, coastal erosion, sea level rise etc. leading to submergence of these areas and huge losses to the mankind living in those areas. In this poster we tried to present and discuss about some of these natural disasters that are affecting the coastal areas of our country. We also tried to discuss about some of the possible mitigation measures to reduce the risk of loss due to these disasters.

INTEGRATING SIDE SCAN SONAR DATA FOR ASSESSING ENVIRONMENTAL IMPACTS OF ESTUARINE SAND MINING

K.M. Dubey*, G. Sriram, S.G. Sivalanka, P. Dewangan
CSIR-National Institute of Oceanography
Corresponding author: kanchanmanidubey@gmail.com

Sand mining, a prevalent activity in estuarine regions, has come under scrutiny due to its profound environmental consequences. In response to this concern, our study takes a multidisciplinary approach, integrating side scan sonar imaging with traditional river morphologic analysis, to comprehensively assess the environmental impact of sand mining in the estuarine ecosystem. Multi Geophysical data like high resolution seismic (HRS), Single beam echosounder, and Side Scan Sonar (SSS) was collected from a ~45 km segment of the Mondovi River, Goa, during pre- and post-monsoon seasons in 2020 and 2021, aiming to understand riverbed changes due to sand mining. The side scan sonar data reveals natural features like mud lines, mid-channel and point bars, ripples, rock outcrops, and faunal distributions. It also identifies signatures related to human activities, including sand mining operations, with two distinct types of signatures: Type-1, indicating bar skimming methods, and Type-2, suggesting bed suction mining. Comparison of pre- and post-monsoon side scan sonar images show dynamic riverbed geomorphologic variations, such as sediment bar thinning/thickening, ripple pattern changes, and localized bank erosion. Integrating bathymetry and side scan sonar images provides insights into the impact of sand mining activities on these variations. This research underscores the significance of side scan sonar technology as a tool for formulating sustainable sand mining policies. It offers insights into riverbed morphology and dynamic changes, facilitating environmental assessments and aiding in monitoring and curbing illegal sand mining. This holistic approach contributes to effective strategies for sustainable development.

AN INTEGRATED METHODOLOGY FOR EFFECTIVE MANAGEMENT OF A MULTIFARIOUS COAST

Sai Ganesh Veeravalli, Mridula G M, Subburaj S, Satya Kiran Raju Alluri, Ramanathan V
National Centre for Coastal Research, Ministry of Earth Sciences, Government of India
NCCR, NIOT Campus, Pallikaranai, Chennai, Tamil Nadu 600100
saiganeshveeravalli@gmail.com

Coastal areas worldwide face a multitude of long-term coastal risks, such as coastal erosion, rising sea levels, shoreline modifications, and short-term risks such as storm surge, cyclones and tsunamis. With significant loss of life and extensive property damage being a cataclysmic consequence during these hazard events, the need for integrated management strategies to address these urgent issues is rising. This study introduces a novel framework for coastal management decision-making, amalgamating factors such as shoreline status, demographics, oceanographic parameters, and coastal morphology. Through exhaustive vulnerability assessments, critical areas requiring intervention are identified, and locations are prioritized based on assigned rankings to individual components. This methodology aids in effectively allocating resources and enables informed decision-making by governmental agencies and coastal authorities. Applied to Thiruvananthapuram district in Kerala, a region exemplifying diverse coastal hazards, the methodology demonstrated adaptability and potential as a scalable model for comprehensive coastal management across the varied Indian coastline. The findings contribute

significantly to advancing sustainable coastal management strategies, contributing to the scientific planning and mitigation of coastal hazards through geoscientific investigations.

UNPRECEDENTED FLOODING IN KOCHI: PROBING THE INFLUENCE OF TIDES

Amal George K*, P.S. Sunil
1Department of Marine Geology and Geophysics, School of Marine Sciences,
Cochin University of Science and Technology, Kochi, India
*Email: akg.mgp@cusat.ac.in

The Kochi and its suburban regions are witnessing an annual atypical flooding events, notably in December and January, marked by scant precipitation. This led to extensive inundation of low-lying areas, residences, and roads, impacting both urban and peripheral areas. This study aims to uncover the underlying factors responsible for these exceptional flooding events, and to investigate the specific role played by tidal activity in precipitating such flooding events characterized by minimal precipitation.

Leveraging PSMSL monthly tide gauge data, augmented by precise records of spring and neap tides, apogee, perigee, aphelion, and perihelion events, we establish a robust foundation for probing the anomalous tidal behavior observed in the region. Through meticulous analysis of the tide gauge data, we strive to discern the underlying patterns and dynamics governing these exceptional tidal fluctuations. By cross-referencing tidal records with key celestial events, particularly perihelion and perigee, we aim to establish correlations between tidal behaviour and celestial mechanics. This comprehensive approach, integrating tidal data, celestial events, and geographical considerations, enables a thorough examination of the factors influencing tidal dynamics in Kochi.

Our findings indicate that the heightened tidal ranges during December and January are attributable to the closest orbital positions of the sun and moon, known as perihelion and perigee respectively. This alignment is further accentuated during spring tides, which closely coincide with these dates. In light of these discoveries, we propose targeted flood mitigation measures, including strategic infrastructure elevation and the implementation of advanced warning systems. These recommendations are tailored to address the specific challenges posed by the unusual tidal activity observed in the Kochi region. This study not only enhances our understanding of coastal dynamics but also underscores the importance of proactive measures and comprehensive preparedness in the face of evolving environmental challenges.

COASTAL VULNERABILITY ASSESSMENT IN A HIGHLY URBANIZED COAST OF KERALA USING BAYESIAN BELIEF NETWORK AND GIS

***A. L Achu, Girish Gopinath, Sanju Eldhose, Mohamed Fasil CT**
Department of Climate Variability and Aquatic Ecosystems, Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi-682 508, Kerala, India.
E-mail: ggkufos@gmail.com

Coastal vulnerability pertains to the identification of regions and populations susceptible to the impact of coastal hazards, encompassing threats like coastal storms, flooding, and sea erosion that pose substantial risks to human lives and property. Over recent years, the Malabar coast of India,

particularly within the state of Kerala, has exhibited heightened vulnerability to a range of coastal hazards, endangering the lives of millions. In this context, a comprehensive assessment of the Ernakulam district's coastline, a highly urbanized region within Kerala, was undertaken to pinpoint areas of pronounced coastal vulnerability. The study incorporated a range of physical factors, including slope, lithology, geomorphology, and land use/land cover, alongside demographic parameters such as household density, population density, literacy rates, and marginalized population statistics to construct a robust model. Utilizing a Bayesian belief network, the coastal vulnerability was meticulously modelled. The outcome of this investigation revealed that approximately 18% of Ernakulam district falls within the category of very highly vulnerable zones. These findings are instrumental in informing strategies for the sustainable, long-term development of the Malabar coast, thereby aiding in the safeguarding of its communities and resources.

"UNVEILING THE BIO-OPTICAL SIGNATURE: ALGAL BLOOM DYNAMICS IN CHILIKA, ASIA'S LARGEST BRACKISH WATER LAGOON"

Sambit Singh[1]*, Susmita Raulo[2], Tamoghna Acharyya[3], Anu Gopinath[1]
1. Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi, Kerala, India
2. Indian National Centre for Ocean Information Services
3. PG Department of Marine Sciences, Berhampur University
*Corresponding Author: sambitsingh112@gmail.com

Inland water bodies are vital for economic dependence due to their high productivity, yet they remain vulnerable to ecological disruptions from both natural events and human activities. Among these threats, algal blooms stand out as concerning phenomena with the potential to dramatically impact the ecological health of inland waters. Yet there is a lack of understanding regarding the fundamental optical properties of these blooms, which are pivotal for developing bio-optical algorithms to detect such events from space as blooms display distinct optical features. To bridge this knowledge gap, we conducted a field study for the optical characterization of a bloom event happened in Chilika Lagoon in November 2018, after Cyclone Titli. Our study analysed various optically active substances, including spectral absorption coefficient of coloured dissolved organic matter (CDOM), phytoplankton absorption (aph), absorption by non-algal particles (NAP), and phytoplankton pigments in Chilika's bloom patches. The bloom was mainly dominated by cyanophytes, chlorophytes, and euglenophytes. Major marker pigments like β-Carotene, Diadinoxanthin, Diatoxanthin, Divinyl Chlorophyll-a, Fucoxanthin, Peridinin, and Zeaxanthin were identified, shedding light on the key phytoplankton groups behind the bloom. Chlorophyll concentrations ranged from 6.1 to 184.8 mg/m³. The absorbance of CDOM absorption coefficients aCDOM 440 ranged from 0.63 - 3.43 m^{-1} and the spectral slope [$S_{280-500}$] and [$S_{350-500}$] varied from 0.063-0.047 nm^{-1} and 0.0052-0.0314 nm^{-1}. These represented the dominant source of CDOM was from the lagoon (autochthonous) may be a contribution from the phytoplankton bloom. The absorption coefficient for phytoplankton at 440nm [aph (440)] varied between 0.0017 - 34.8 m^{-1} and Chl-a specific absorption coefficient ($a*ph$) varied from 0.036-10.24 m^2mg^{-1}. The average values of ($a*ph$) at 440 nm and 676 nm were 0.015m^2mg^{-1} and 0.165 m^2m^{-1}.

SHORELINE CHANGES ALONG SOUTH-WEST COAST OF INDIA: INFERENCES FROM GEOLOGICAL, GEOMORPHOLOGICAL, GEOPHYSICAL AND REMOTE SENSING STUDIES

Mamatha P.K.*[1], A. Anil Kumar[2], K. S. Jayappa[3], K.G. Mohan[4], Subhradeep Das[2], L.C. Anupama[5], Shaniba V[6]

[1]Geological Survey of India, Marine & Coastal Survey Division, Kolkata
[2] Geological Survey of India, Central Head Quarters, 27 JLN Road, Kolkata
[3]Department of Geology, Mangalore University, Mangalore, Karnataka
[4]Geological survey of India, MCSD, Marripalem, Visakhapatnam, Andhra Pradesh
[5] Geological Survey of India, SU-Karnataka and Goa, Bengaluru, Karnataka,
[6]Geological Survey of India, MCSD, Kendriya Bhavan, Kochi, Kerala
*Corresponding author: mamatha.kanakamma@gsi.gov.in

Integrated geological, geophysical, geomorphological, and remote sensing studies carried out on the coastal area between Chandragiri and Karingote River mouths, Kasaragod District, Kerala State on the South-West Coast of India revealed an interesting relationship between near shore geological structures and the ongoing shoreline changes. Chittari River (a minor river) on the land side and a structural weak plain on the offshore side divide the study area into two sectors. Seasonal to annual scale shoreline changes measured using beach profiles corroborate the results of decadal to centennial-scale changes obtained using remote sensing data. On an annual to centennial scale, the shoreline on the northern part of the Chittari River manifests erosion while the counterpart on the southern side exhibits accretion. Geomorphologically, the results of millennial-scale processes are distinct in the two sectors, where the northern part has characteristic geomorphologic features of a submerging coast, while the southern part has features of an emerging coast. Shallow seismic reflection and refraction studies and gravity data confirmed the presence of several structural faults and lineaments intersecting at the Chittari River mouth. Incidences of recent structural failures along these fault plains confirm that this area is tectonically active. On examining several common causative factors of shoreline changes like anthropogenic influence, sediment movement, sea level changes, and so on, the geological structural factors stand out as the most prominent for the study area.

MARINE GEOSCIENCES

METHANE GAS FLARES IN THE FOREARC BASIN OF THE ANDAMAN – NICOBAR SEA

Ankush*, P. Dewangan, G. Sriram

CSIR-National Institute of Oceanography, Dona Paula, Goa 403004, India
*Corresponding author:pankushpanchal@gmail.com

Gas hydrate deposits within the Andaman Forearc basin were initially identified through seismic data analysis, and subsequently confirmed during the NGHP-01 expedition, which included drilling and coring activities. During the November 2021 SSD-085 expedition onboard RV Sindhu Sadhana, active gas venting was observed and documented using various methods, including multibeam bathymetry, water column imaging (WCI), sub bottom profiling, and high-resolution Air gun seismic data that enabled the visualization of subsurface structures influencing the gas venting process. Our exploration revealed the presence of five distinct gas venting locations situated along an elongated anticline structure. This geological feature includes two noteworthy mounds, namely M1 and M2, each exhibiting distinct geological characteristics. These mounds formed as a result of intense fault-induced compressional tectonic forces, resulting in varying slopes and elevations. Analysis of seafloor samples revealed carbonate rock with visible pores, indicating the potential migration of gas or fluids within the area. A regional seismic profile further revealed three distinct sedimentary sequences: folded and faulted strata, mass transport deposits, and horizontal-to-sub-horizontal sedimentary layers. Additionally, in close proximity to the gas flares, a bottom simulating reflector (BSR) was identified, suggesting the presence of subsurface gas hydrate/free gas. Detailed examination of high-resolution seismic data unveiled a complex fault system within the mounds, serving as a conduit for vertical fluid and gas migration. These findings collectively underscore the existence of gas hydrate deposits, active gas venting, and associated geological features in the Andaman Forearc basin. These discoveries hold significant implications for scientific research and potential resource exploration in the region. Further in-depth investigation and research will be necessary to gain a comprehensive understanding of these gas hydrate deposits and their geological significance.

RESERVOIR CHARACTERIZATION USING HYBRID OF PARTICLE SWARM OPTIMIZATION- A CASE STUDY FROM THE BLACKFOOT FIELD, CANADA

Ravi Kant[1,#], S.P. Maurya[1], Nitin Verma[1], Raghav Singh[1], K.H. Singh[2], Ajay P. Singh[1], Prabodh K. Kushwaha[1], M.K. Srivastava[1], G. Hema[1] , Harsha Raghuvanshi[1] And Richa[1]

[1]Department of Geophysics, Institute of Science, Banaras Hindu University, Varanasi-221005, India
[2]Department of Earth Sciences, Indian Institute of Technology, Bombay, Mumbai-400076, India
[#]Email ID: ravigeo@bhu.ac.in

The development, management, and optimisation of a reservoir all depend on precise reservoir characterisation. There are several methods for doing this reservoir characterisation, however in the current work, seismic inversion based on the hybrid particle swarm optimisation (HPSO) methodology is used. In this method, a local optimisation method called pattern search is combined with a global optimisation method called PSO in order to maximise their benefits and minimise their downsides. The global optimisation method takes a lot of time, whereas pattern search is rapid but

heavily dependent on the initial model. The present study takes these two limitations into account. In order to characterise the reservoir, this method uses post-stack seismic data to predict direct acoustic impedance and porosity in inter-well zone. The effectiveness of this newly devised method was first evaluated using artificial data, and then it was used to actual data from the Blackfoot area in Canada. The findings show that for both the synthetic and actual data scenarios, the inverted outcomes closely match the observed data. Additional statistical measures also support the assertion that HPSO routinely delivers high-quality outcomes quickly. The programme anticipated that the inter-well acoustic impedance and porosity volume would vary from 6000 to 12000 m/s*g/cc and 5-22%, respectively. These volumes display extremely detailed subsurface data. The analysis of inverted findings reveals an abnormal zone inside the two-way transit time frame of 1045 to 1060 ms, ranging low-impedance 6500-9000m/s*g/cc, and high porosity >15%. This atypical area is classified as a reservoir.

GAUSSIAN PROCESS REGRESSION AIDED GAS HYDRATE SATURATION PROXY FROM GEOPHYSICAL LOGS: A CASE STUDY FROM KG BASIN, INDIA

Suman Konar [a, *], Bappa Mukherjee [b], Kalachand Sain [b]

[a] Control Source Seismics and Gas Hydrates, CSIR-National Geophysical Research Institute, Hyderabad, 500007, INDIA
[b] Seismic Interpretation Laboratory, Wadia Institute of Himalayan Geology, Dehradun, 248001, INDIA
[*]Presenting Author: konarsuman2@gmail.com

Resistivity and acoustic logs are commonly used to estimate gas hydrate saturation, but they often overlook limitations like calibration of exponent terms, unknown hydrate morphology, mineralogy, and bulk modulus terms. Hence, we propose Gaussian Process Regression (GPR) based machine learning (ML) approach to estimate gas hydrate saturation using geophysical logs. Initially, we have estimated gas hydrate saturation by employing modified Archie's equation and Indonesian equation from geophysical log data at two wells, as the studied region is clay dominated. Further, to train the GPR network, the log data at these two wells are taken as inputs and corresponding saturations are taken as output. After successful training of the GPR model, the gas hydrate saturation is then predicted at two neighbour wells by feeding the wireline log data of those two wells as input to the trained regressor model. The practicability of the proposed method has been demonstrated with well log data from the Krishna-Godavari (KG) offshore basin (India)**.** Accuracy of the GPR model was measured through the root mean square error and correlation coefficient calculation between the original and predicted saturation values during the model training and validation stage. The predicted saturation in the studied sites varies between 0% to ~43%. The demonstrated method provides very precise values of gas hydrate saturation which is an essential parameter required for accurate resource evaluation and well-planned production.

ESTIMATION OF GAS HYDRATE SATURATION IN NGHP-02 WELLS BY USING ELECTRICAL RESISTIVITY METHODS AND ROCK PHYSICS MODELLING

Sneha devi, Pradeep Kumar Yadav, Uma Shankar*

Department of Geophysics, Institute of Science, Banaras Hindu University, Varanasi
*Corresponding author- umashankar@bhu.ac.in Email Id- dsnehabhu@gmail.com

This study uses national gas hydrate program expedition 02 (NGHP-02), well-log data from areas A and B of the Mahanadi and Krishana-Godavari basins of eastern peninsular India for gas hydrate saturation estimation. The presence of gas hydrate in a sedimentary formation enhances its sonic P-wave velocity and resistivity. Hence, based on these two parameters, gas hydrate saturations can be estimated in a sedimentary formation. This study uses resistivity and sonic P-wave velocity data of wells NGHP-02-11, NGHP-02-12, NGHP-02-13, and NGHP-02-19 to estimate gas hydrate saturation. The gas hydrates are found in young age (Miocene to Pleistocene), unconsolidated sedimentary formations with porosities ranging from 40 to 90%. The Archie, Simandoux, and Indonesia empirical equations are used for gas hydrate saturation estimation using deep resistivity log data of the four wells. Further, sonic P-wave velocity data of wells NGHP-02-11, NGHP-02-13 and NGHP-02-19 has been used for estimating gas hydrate saturation using the Wood-Wyllie bounds effective medium rock physics model. The density porosity is used in both resistivity and effective medium rock physics models. The gas hydrate saturations estimated from the above methods are compared with the core data gas hydrate saturations of the respective wells and were in good agreement.

SEISMIC INTERFEROMETRY OF OCEAN BOTTOM SEISMIC DATA TO INCREASE SUBSURFACE ILLUMINATION

Sanjay Mandal* and Maheswar Ojha
CSIR-NGRI, Hyderabad
*Presenting author: mandalsanjay210793@gmail.com

Seismic Interferometry is a method which operates on a pair of seismic traces to generate new response by redatuming the source or receiver positions, where the knowledge of source position and velocity information are not required. This makes the process more simple and powerful than any model-based redatuming technique. The Ocean Bottom Seismic (OBS) data suffers from poor near-surface illumination due to large and irregular spacing of the OBS receivers. In this study, we use OBS data acquired in the Krishna Godavari offshore basin of India. The seismic interferometry method is applied on the OBS data to redatum the OBS receiver from the seafloor to the sea-surface using the multiples of the primary reflections. The Green's function is extracted from the cross-correlation of the multiples with direct event recorded by the OBS receivers. Deconvolution is another approach to do that with a better resolution as the effect of source wavelets and receiver responses are removed in the division process of the pair of traces in frequency domain. The retrieved Green's function obtained from the cross-correlation or deconvolution of the OBS data produce a new virtual wavefield where the receivers are redatumed. This new wavefield has improved subsurface illumination compared to the original OBS data due to the increase in spatial coverage of the virtual receivers. We analyze the seismic image obtained from the new virtual data to investigate the

subsurface geological structure beneath the seafloor. Our results demonstrate that seismic interferometry is a powerful method for enhancing near-surface illumination in ocean bottom seismic data.

MULTIMINERAL PETROPHYSICAL ANALYSIS WITH MACHINE LEARNING TECHNIQUE OF AN OFFSHORE CLASTIC RESERVOIR

Shahnawaz Salim*, Partha Pratim Mandal
Department of Applied Geophysics, IIT(ISM) Dhanbad
*Corresponding author: 21mc0074@agp.iitism.ac.in , partham@iitism.ac.in

Petrophysical analysis can be challenging when dealing with reservoirs having multiple minerals as rock-forming matrix. In such cases, knowledge of the volumes of minerals and fluid is very important for formation evaluation study and reservoir characterization. This can be achieved by solving a system of linear equations linking the basic wireline logs such as bulk density (RHOB), compressional wave travel time (DT), neutron porosity (NPHI), photoelectric factor (PEF) with known values of different matrix (Sandstone, limestone, dolomite) and fluids (brine, oil, gas). The method is robust and can be applied to various lithologies from carbonate to siliciclastic rocks. The solution of linear equations to calculate the fractional volumes of minerals and total porosity can be achieved in multiple ways such as linear inversion, lower upper (LU) decomposition, and Moore Penrose inversion. Supervised Machine Learning (ML) regression technique is another alternative when mineralogy logs are available for a few wells.

In current research work, non-negative least square linear inversion (Figure) is applied on three wells to find the fractional volumes of the constituent minerals and porosity. The field is producing gas from a tight clastic formation located in Northwest shelf (NWS) of Australia. Three basic wireline logs RHOB, DT, and NPHI are selected as input curves to the inversion engine then multiple iterations are run until error is minimized for modelled and measured porosity. The mineral composition of well-A showed a reasonable match when calibrated with X-ray diffraction (XRD) derived mineralogy datasets.

Further on, acquired wireline logs are pre-processed and conditioned for three supervised regression algorithms (Artificial Neural Network - ANN, Random Forest - RF, and Support Vector Machine - SVM) where input features are basic wireline logs while target features are calibrated mineralogy logs of well-A. Datasets are divided into 70:30 ratios for training and validation respectively. Based on R^2 and mean-squared error matrices of validation datasets, the best model is selected. Once we have the output from the optimum supervised regression model, a comparative study is made between the conventional and machine learning-driven techniques for multimineral analysis.

INSIGHTS OF KG-OFFSHORE BASIN THROUGH SEISMIC REFLECTION AND OTHER GEOPHYSICAL DATA

***Satendra Singh[1], Kalachand Sain[2], Maheswar Ojha[1] and Prakash Kumar[1]**
[1]CSIR-National Geophysical Research Institute, Uppal Road, Hyderabad
[2.] Wadia Institute of Himalayan Geology, Dehradun, Uttarakhand
*Presenting author: satendra.ngri@gmail.com

Krishna-Godavari (KG) offshore is a highly petroliferous, passive marginal, deltaic and sedimentary basin of India which was formed as a moment of continental rifting and seafloor spreading process among India, Antarctica and Australian plates. It is bounded by Eastern Ghats Mobile Belt (EGMB) in north-east, Pranhita-Godavari (PG) graben in north-west, Cuddapah basin in west, Palar-Pennar basin in south and Bay of Bengal deep sea in the east as total covering area around 45000 sq. km both onshore and offshore regions. Krishna and Godavari rivers are continuously filling this basin with huge amount of sediments for enormously hydrocarbon accumulation. CSIR-NGRI has been acquired multi-channel seismic (MCS) and ocean bottom seismic (OBS) data in KG and Mahanadi offshore basins to identification and delineation of gas-hydrates and other hydrocarbons. Seismic attributes in reflection seismic, play a significant role to enhance the information and leading to a better geological and geophysical interpretations.

The present study aims to delineate of subsurface structures in the KG offshore basin using seismic attributes and other geophysical data. The 2D time migrated MCS data, has been utilized for ascertain the geological and tectonic features of the basin. The seismic data is initially conditioned using dip steered median filter (DSMF) to eliminate the noisy events and to make reflectors stronger and continuous so that the resultant image can be easily interpreted. Different types of seismic attributes such as amplitude, frequency, phase, energy, curvature, similarity, and sweetness have been calculated along the seismic profiles. NE-SW profile shows submarine canyon, horst and graben like features in seabed topography while it is constantly dipping in NW-SE profile towards deep sea. The bottom simulating reflector (BSR) which is a prime marker for gas-hydrate occurrence, has also been identified along the profiles. Many other tectonic, geological and structural features such as faults, folds, gullies, mini fill basins, chaotic reflections, channels, gas upthrusts/chimneys, blanking, and mass transport deposits (MTDs) have been delineated along the seismic lines in study region. Bathymetry, free air gravity, bouguer gravity and magnetic grids have been prepared and their anomalies have been extracted and plotted along the profiles to correlate their influence with the subsurface features.

PRINCIPLE INVESTIGATIONS AND OBSERVATIONS OF HIGH LATITUDE SEDIMENT DEPOSITS AT EIRIK DRIFT DURING IODP EXPEDITION 395

Thena Thulasi[1*], Halima Ibrahim[2], Claire Jasper[3], Saran Lee[4], Sevasti Modestou[5], Suzanne O'Connell[6], Leah Levay[7], Anne Briais[8], Ross Parnell-Turner[9] and the Expedition 395 Shipboard Party

[1]Geosciences Division, National Centre for Polar and Ocean Research (NCPOR), MoES, Goa, India
[2]Department of Earth Sciences, Binghamton University, Binghamton, NY, USA
[3]Lamont-Doherty Earth Observatory, Columbia University, NY, USA
[4]Graduate School of Frontier Sciences, The University of Tokyo, Japan
[5]Department of Geography and Environmental Sciences, Northumbria University, UK
[6]Department of Earth and Environmental Sciences, Wesleyan University, USA
[7]International Ocean Discovery Program, Texas A&M University, College Station, TX, 77845, USA
[8]Centre National de la Recherche Scientifique, Geosciences Ocean,
Institut Universitaire Européen de la Mer, 29280 Plouzané, France
[9]Scripps Institute of Oceanography, UC San Diego, La Jolla, CA, 92093, USA
*Presenting author: thenadoss@ncpor.res.in

Contourite drift sediments are a type of marine sedimentary deposit that forms on the ocean floor due to the action of bottom currents. These currents flow parallel to the contours of the seafloor, hence the name "contourite." One characteristic feature of contourite sediments is their distinctive bedding patterns. These layers can vary in thickness and are often parallel to the direction of the current flow. International Ocean Discovery Program (IODP) Expedition 395 had its transect intersecting various contourite drifts and recovered sediments from the sites spanning 32 Ma. Here we present the characteristics and patterns of contourite drift sediments from initial Shipboard observations. The lithologic studies of the marine core sediments are primarily interpreted through visual core description, smear slide examination, color reflectance, natural gamma ray attenuation and bulk calcium carbonate measurements.

The Eirik Drift is one of the prominent contourite drift sediments recovered during IODP Expedition 395. The Eirik Drift is situated in the North Atlantic Ocean, off the southeastern coast of Greenland. It extends across the Irminger Basin and part of the Labrador Sea. The Holocene to late Eocene/early Oligocene sediments cored at Site U1602 are primarily composed of silty clay, silty clay/claystone with nannofossils, nannofossil silty clay/claystone, nannofossil chalk, and sandstone. The site is dominated by terrigenous components, mainly quartz, feldspar, glass, opaque grains, pyrite, and glauconite with smaller amounts of chlorite and Fe/Mn oxides. Biogenic components are dominated by nannofossils, which generally increase downhole. The Eirik Drift sediment exhibits typical sedimentary features including well-developed laminations, graded bedding, alternating grading, cross-bedding, flaser bedding, mud drapes, and sand injections. Studying these features in detail are important for understanding the history of ocean circulation and paleoceanographic conditions in the North Atlantic.

BOTTOM WATER OXYGEN RESPONSE OF THE SOUTHERN BAY OF BENGAL: BASED ON BENTHIC FORAMINIFERAL MORPHOTYPES AND MICROHABITAT

Kavya Aravind[1] and N R Nisha[1*]

[1]Micropaleontology Laboratory, Department of Marine Geology and Geophysics, School of Marine Sciences, Cochin University of Science and Technology, Kochi, Kerala, India 682016

*E-mail: nrnishacusat@gmail.com

In the present investigation, we recorded the benthic foraminiferal response to the bottom water oxygenation of the Southern Bay of Bengal during the last 44 kyr BP. We analysed the distribution pattern of different benthic foraminiferal morphotypes (plano-convex/trochispiral and tapered/cylindrical) and their habitat preference (epifauna and infauna) to elucidate the past bottom water oxygen conditions. The records revealed that during the Holocene, the core site had well-oxygenated conditions in comparison to the last glacial period. The dysoxic species Chilostomella oolina was absent during the Holocene, making its appearance around 12 kyr BP, with a significant increase in abundance noted around 32-33 kyr BP due to decreased bottom water oxygen levels. The benthic foraminiferal records show that the last glacial period is characterized by low species abundance and low-moderate oxygenation. Our records also show that epifaunal and plano-convex/trochispiral taxa prefer high-oxygen and warm climate conditions (Holocene). In contrast, infaunal and tapered/cylindrical taxa prefer low-oxygenated water and cold periods (Heinrich events). In the Southern Bay of Bengal, we observed substantial shifts in benthic foraminiferal morphotypes and microhabitat preferences between glacial and interglacial periods. The Holocene exhibited well-oxygenated water conditions, whereas the last glacial period, dominated by infauna-tapered/cylindrical forms and dysoxic conditions, experienced moderate to low oxygen levels.

ATMOSPHERIC, PLANETARY AND SPACE SCIENCES

WAVE TRAITS FROM THE JANUARY 15, 2022 HUNGA-TONGA VOLCANIC ERUPTION OVER INDIAN AND POLAR REGIONS

M. S. Rose[1, *], P. S. Sunil[1], A. Sooraj[1], A. S. Sunil[1], Priyesh Kunnummal[2], K. Amal George[1], K. K. Ajith[3], Dhanya Thomas[4], V. K. Mini[5]

[1]Department of Marine Geology and Geophysics, School of Marine Sciences, Cochin University of Science and Technology, Kochi, India
[2]National Centre for Polar and Ocean Research, Goa, India
[3]National Atmospheric Research Laboratory, Gadanki, India
[4]CSIR Fourth Paradigm Institute, Bangalore, India
[5]Meteorological Centre, India Meteorological Department, Thiruvananthapuram, India
*rosemaryshajut@gmail.com

The eruption of the Hunga-Tonga Volcano on January 15, 2022, has triggered a diverse range of atmospheric waves globally. To investigate the pattern of surface deformation, we analyzed data from the Sentinel-1 Synthetic Aperture Radar (SAR). It's estimated that an area of approximately 2.47 square kilometers underwent deformation in connection with this event. Examining the propagation of atmospheric waves, we scrutinized barometric pressure data from 1814 stations distributed worldwide. This study is distinctive in its exploration of wave propagation characteristics over four regions, including the Indian and Polar regions, for the first time using barometric data.

Time-series observations unveil that the waves propagated globally multiple times. In the Indian region, three minor arc passages and one major arc passage were identified. Japan exhibited two minor arc passages and one major arc, while in North America, both minor and major arc passages were detected, occurring at least three times. Moreover, we compared the attributes of these waves, encompassing their propagation speed and periodicity, across these four regions. The estimated phase speed and periodicity fall within the ranges of approximately 291 to 314 m/s and 45 to 50 minutes, respectively, encompassing the Polar Regions. These measurements of speed and periodicity suggest that Lamb waves dominate the wave propagation generated during the Tonga volcanic eruption. Additionally, a slower propagation phase speed of about 226.6 m/s was identified in Japan, corresponding to the Pekeris mode of waves.

EVIDENCE OF TWO-STEP NONLINEAR INTERACTIONS IN THE PRESENCE OF ZONALLY SYMMETRIC WAVES DURING MAJOR SUDDEN STRATOSPHERIC WARMINGS

G. Mitra1,2*, A. Guharay1, J. F. Conte3, and J. L. Chau3

1 Space and Atmospheric Sciences Division, Physical Research Laboratory, Ahmedabad, GJ, India
2 Department of Physics, Indian Institute of Technology, Gandhinagar, GJ, India
3 Leibniz-Institute of Atmospheric Physics at the University of Rostock, Kühlungsborn, Germany
Corresponding author: gourav@prl.res.in

Atmospheric tides and associated dynamics during two major boreal sudden stratospheric warmings (SSW) have been investigated. The evolutionary Lomb Scargle and wavelet spectral analysis of specular meteor radar (SMR) derived hourly winds reveal evidence of nonlinear interactions between the semidiurnal solar tide and the quasi-20-day wave (Q20dw) during SSWs. The zonal wavenumber diagnosis indicates possible nonlinear interaction between the dominant semidiurnal migrating tide (SW2) and the zonally symmetric 20-day wave (20dw0) component. The nonlinear interaction

between the zonal wavenumber 2 component of stationary planetary wave (SPW2) and westward propagating 20-day wave (20dwW2) in the stratosphere seems crucial to produce the 20dw0. As observed in the SMR-derived wind spectra, the excited 20dw0 possibly interacts non-linearly with SW2 to generate secondary waves. Therefore, the present study provides observational evidence of a two-step nonlinear interaction associated with zonally symmetric planetary waves during major SSWs.

ON THE RESPONSE OF EQUATORIAL PLASMA TO NOCTURNAL PROMPT PENETRATION ELECTRIC FIELDS: A CASE STUDY

Meenu Krishnan 1, Ajesh A. 1 , T.K. Pant 2
1 Department of Physics, University of Kerala, Trivandrum-695581, India.
2 Space Physics Laboratory, VSSC, ISRO, Trivandrum-695022, India.
E-mail: meenusree2000@gmail.com

The present study examines the response of nighttime Thermosphere-Ionosphere-System (TIS) system over a dip equatorial station, Thumba (Trivandrum, 8.5 o N, 77 o E, 0.5 o dip lat.) to two distinct Prompt Penetration Electric Field (PPEF) events that occurred on 06 and 14 March 2016. The investigation is based on the DPS-4D digital ionosonde measurements installed at Thumba along with data from ground and satellite based observations in the Indian longitude sector. Observations revealed that the equatorial plasma respond promptly to multiple PPEF events during nighttime. The base height of the ionosphere showed a sudden downward movement, during the PPEF events when the electric field is westward and vice versa during polarity reversal of the field. Correspondingly the low latitude plasma exhibits redistribution. It was also observed that the topside ionosphere (>300 km) exhibited sudden compression during the event. Simulation studies indicate that this has significant ramifications as far as the neutral thermosphere is concerned; particularly 630 nm redline emission intensity emanating from ~220 km. The study unequivocally demonstrates the coupling between the interplanetary medium and the ionospheric plasma during nighttime PPEF events.

A CASE STUDY OF FLUCTUATIONS IN GROUNDWATER LEVEL THROUGH REMOTE SENSING IN KURUKSHETRA DISTRICT, HARYANA

Aashu Mehra*, Shreya Mondal, Hemant Yadav, Akash Deep, B S Chaudhary
Department of Geophysics, Kurukshetra University, Kurukshetra, Haryana
Email id of presenting author*: aashumehra2001@gmail.com

Groundwater is vital for sustainable development, but relentless population growth, urbanization, and industrialization, especially in developing countries, have deteriorated groundwater resources. Assessing spatio-temporal groundwater distribution is crucial for prudent water resource management. This study aims to monitor changes in groundwater depth in Kurukshetra district, Haryana, spanning an area of 1684 sq. km in the Indo-Gangetic plain. Kurukshetra, located at the convergence of the Upper Yamuna and Upper Ghaggar basins, lacks perennial rivers and relies on canals for irrigation. The data from 52 observation wells between 1985 and 2020 was analyzed using the Inverse Distance Weighted (IDW) interpolation technique. The findings are alarming. In 1990, 91% of the district had a depth of 10-15 m or 15-20 m, with only 0.5% at 0-5 m. By 2010, 45% of the

area had dropped to 30-35 m, a range that didn't exist in 1990 or 2000. In 2020, 40% of the district was at 40-45m, a severe decline from 1990. The results highlight a significant depletion in groundwater over 35 years, with the northern region experiencing the most severe decline, followed by the central and southern areas. Excessive groundwater extraction for wheat-paddy crop rotation, primarily in agriculture, is the main cause.

CLIMATOLOGICAL ANALYSIS OF LIGHTNING ACTIVITY OVER KERALA AND ITS ASSOCIATION WITH DYNAMICAL AND THERMODYNAMICAL VARIABLES.

***Nandhulal K., Hamza Varikoden, Vishnu R.**
Sreekrishna College Guruvayur, Guruvayur
nandhulal270996@gmail.com

This study delves into the intricate relationship between lightning activity and meteorological factors over the Indian state of Kerala during active lightning periods. The study also investigates the influence of Convective Available Potential Energy (CAPE) and moisture transport in the atmospheric column extending from 1000 to 300 hPa on lightning occurrence. The analysis pinpoints regions within Kerala that consistently record the highest lightning activity during these active periods and explores the temporal variations within the Kerala region. A comprehensive 16-year climatology analysis reveals the remarkable diurnal cycle of lightning activity, with a distinct peak occurring at 3 PM local time. Furthermore, this research elucidates the direct relationship between CAPE and lightning frequency through a monthly climatology analysis. By tracing the path of moisture transport during active lightning periods, we gain insights into the formation of thunderclouds and the subsequent lightning activity, contributing to a more profound understanding of the complex interplay between meteorological parameters and lightning occurrences in Kerala. This study not only enhances the comprehension of lightning phenomena but also has practical implications for weather forecasting and risk mitigation in the region.

COMPOSITIONAL AND MORPHOLOGICAL CHARACTERISTICS OF AITKEN CRATER, FARSIDE OF THE MOON: IMPLICATIONS FOR VOLCANIC AND TECTONIC ACTIVITIES

B. B. Deepak[1,2,*] and A.V. Satyakumar[1]
[1]CSIR-National Geophysical Research Institute (CSIR-NGRI), Hyderabad, India-50007
[2]Department of Marine Geology and Geophysics, School of Marine Sciences, Cochin University of Science and Technology, Kochi, India-682016
*Presenting Author: deepakbb1216@gmail.com

Lunar surface is filled with craters which are differentiated according to their size and morphological characteristics. Compared to the nearside of the Moon, the far side has fewer and smaller mare basalt-filled craters. Aitken is a complex crater with a diameter of 135 km and an average depth up to 5-6 km, situated on the northern rim of South Pole Aitken basin, the largest impact basin on the Moon. This crater features a central peak, swirls can be seen on the floor, and much of the original floor has been buried by younger rock. We noticed a linear, low-relief scarp close to the southeast rim of

Aitken, where mare basalts and hummocky crater rim material meet. It is not well understood where the tectonic forces came from that created this lobate scarp and the mare basalt that led to subsidence and contraction. An extensive investigation is therefore conducted to comprehend the crater's morphological and mineralogical characteristics as well as its gravity signatures. Clinopyroxene (Cpx) dominates the crater floor, indicating that it is basaltic in origin. The wall, which is made of the mineral orthopyroxene, serves as proof that the crater was created by impact. The presence of Mare on the crater floor is confirmed by the FeO and TiO_2 abundance map from the M^3 data, which suggests that post-volcanic activity contributed to the creation of Mare. On the crater walls, intense mass-wasting had occurred. On the crater floor, various small-scale tectonic and volcanic structures were visible. In certain places, geological activity was clearly visible as boulder fields and boulder trails. Since the thickness of the mare basalts in this crater is so low, there was not much subsidence and contraction produced by the mare basalts, as evidenced by the numerous locate scraps seen close to them. As a result, the lobate scarp in the mare basalts of Aitken was probably caused by the Moon's thermal contraction. The crustal thickness has been defined using gravity data from the GRAIL, and a thicker crust is discovered beneath the crater. The existence of deep-seated subsurface material (i.e., magmatism that caused mare to form on the crater floor) is indicated by the Bouguer and free-air anomalies. On the basis of these integrated (compositional, morphological and gravity) studies, we conclude that the floor of crater is filled with mare of basaltic origin and walls of the crater indicate impact melt crystallization.

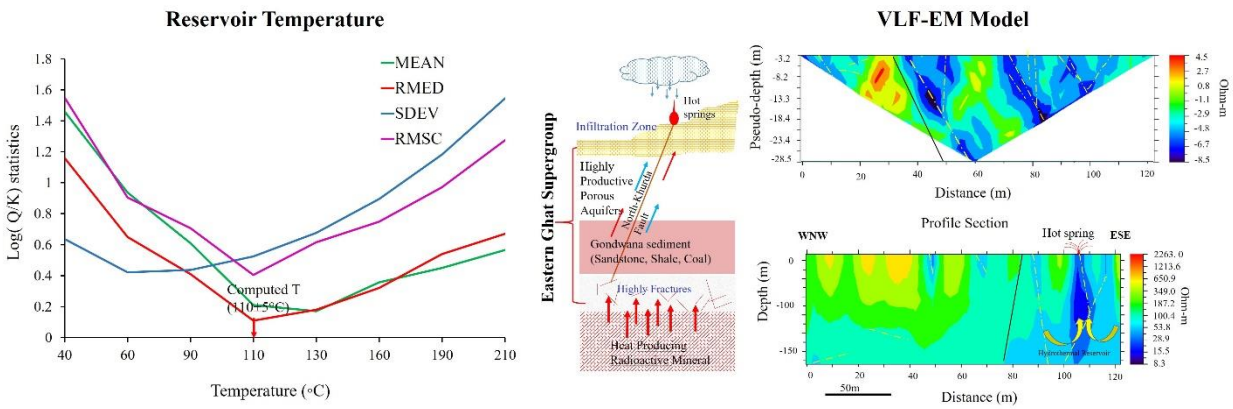
IGU-ANNI TALWANI MEMORIAL GRANT FOR YOUNG WOMEN RESEARCHERS

ROLE OF REGIONAL GEOLOGY IN HOT-SPRINGS OF THE EASTERN GHAT, INDIA

Susmita Goswami, Abhishek. Kumar. Rai
Center for Oceans, Rivers, Atmosphere and Land Sciences
Indian Institute of Technology Kharagpur, Kharagpur-721302, WB, India
Email: susmitageol@gmail.com

Geothermal hot springs are an important renewable energy source worldwide. The study aims to understand the fluid circulation, reservoir depths, and temperature of the hot springs located in the Eastern Ghat using hydrogeochemical and geophysical methods besides understanding their role in regional tectonics. The satellite-derived LST temperature in the region varies between 20.62°C and o 43.12°C in the region of Attri, Tarabalo, and Atmalik (Deuljhari) hot-spring complex. Two major water types are dominant i.e., Na^{+}-Cl^{-} and Ca^{2+}-Mg^{2+}-HCO_3^{-} in the region. The maturity index of subsurface water varies from -1.10 to 1.96 mg/kg, indicating thermal water samples of the immature water type. Furthermore, the Giggenbach diagram also suggests immature in-equilibrium conditions having short residence time. The Na^{+}/Cl^{-} ratios (>1) indicates intensive convection of thermal waters in structural fracture. The pyrite, gypsum, and anhydrite minerals in under saturated conditions are common hydrothermal mineralization in these areas, also indicates dissolution of SO_4^{2-}bearing rock and minerals. Water samples in the region show higher concentrations of HCO_3^{-}, presumably due to upwelling of gasses from deep sheeted fractures which have a dominant trend along the WNW-ESE direction. Very low-frequency electromagnetic surveys (VLF-EM) have been used to map shallow subsurface conductive fracture zones. The fracture zone close to the hot spring extends to deeper depths and may provide pathways to circulate water into the geothermal system, after getting heated at depths due to radioactive disintegration or due to high thermal gradient heating in the basement. The reservoir temperature of Atri, Deluajhari, and Tarabalo thermal springs in Odisha, have been estimated around 110±5°C (based on RMED), and reservoir depth of 1.37±0.32 km. Low enthalpy geothermal water in the region can be used for medical, bathing, cooking, small-scale industries greenhouse farming, and aquaculture.

Keywords: Hot-springs, Reservoir Temperature, Reservoir Depth, VLF-EM.



FLUID-INDUCED METASOMATISM IN NEO-TETHYAN SUB-ARC MANTLE: INFERENCES FROM MANTLE SECTION FROM NAGA HILLS OPHIOLITE

Anisha Verencar[1,2*], Abhishek Saha[1]

[1]CSIR-National Institute of Oceanography, Dona Paula, Goa 403 004, India

[2]School of Earth, Ocean and Atmospheric Sciences, Goa University, Taleigão Plateau, Goa 403 206, India

*Email: anishaverencar@gmail.com

The ancient slivers of Neo-Tethyan oceanic lithosphere (~ophiolite) accreted and emplaced in ocean-continent transition zone, during the late Cretaceous-Eocene collision of Indian and Eurasian plate; preserves distinct magmatic signatures underpinning the depletion and enrichment events in mantle domains resulting in the upper mantle heterogeneity. The mantle peridotites and associated melt channels of Naga Hills ophiolite, provide a window to understand the refractory nature of the Neo-Tethyan mantle and its subsequent refertilization through fluid induced metasomatism. Here, we present mineral chemistry and whole-rock geochemistry of mantle peridotites and peridotitic melt channels to comprehensively understand primary refractory nature of the source mantle and their refertilization triggered by fluid and/or melts; that governed the chemical evolution of the sub-arc mantle. The harzburgitic mantle peridotites are enriched in transitional metals. Distinct melt depletion trends in $(Pt/Ir)_N$ vs. Al_2O_3 diagram and chondrite-normalised REE patterns invoke a refractory source composition that experienced ~5–15% of melt extraction. The influx of slab-dehydrated fluids in modifying the refractory mantle is accounted from the high values of Ba/Th (avg.239.5) and Ba/La (avg.48.16). The melt-rock interaction is indicated by the U shaped chondrite normalized REE pattern [LREE>MREE<HREE; (La/Sm)N : avg. 1.78; $(La/Yb)_N$: avg. 1.51; (Sm/Yb)N : avg. 0.82; (Gd/Yb)N : avg. 0.84] underpinning role of boninitic melt in the refertilization of mantle wedge. The primary chromites from peridotitic melt channels with high Cr# (0.76-0.77) and TiO_2 (0.03-0.2) wt.% show the boninitic trend. These peridotitic melt channels are characterized by their higher ∑PPGE/∑IPGE (>1; 1.23–1.90, avg. 1.51) and Pd/Pt (0.74–0.92, avg. 0.85) with respect to mid oceanic ridge peridotite (∑PPGE/∑IPGE: 1.07 and Pd/Pt: 0.84) and are consistent with the S-under saturated nature. The refertilized character of the sub-arc mantle wedge is also contributed by subduction derived metasomatic fluids as testified from presence of hydrous uvarovite garnet.

TAPHONOMIC INSIGHTS INTO SHALLOW-MARINE SHELL BEDS: EVIDENCE FROM THE OLIGOCENE (CHATTIAN) CORAL LIMESTONE MEMBER, KUTCH BASIN,

Gujarat Kanchan Prasad*, Sudipta Dasgupta, Abhishek Natarajan

Bombay Ichnos Research Group, Department of Earth Sciences, Indian Institute of Technology Bombay, Powai, Mumbai 400076, India

*Email: kanchan.geo@iitb.ac.in

In the Kutch Basin of western India, the upper Oligocene (Chattian) shallow-marine carbonates of the Coral Limestone Member within the Maniyara Fort Formation hosts repeated occurrences of shell beds in it. Shell concentration is dominated primarily by larger foraminifera along with bivalves, gastropods, echinoids, corals, and bryozoans. This study aims to examine the bioerosion and

encrustation processes in elucidating the taphonomy of natural shell accumulations on the inner- to middle-ramp settings. The most common bioerosional trace fossils found in the shell assemblages are sponge borings (identified as Entobia isp.), bivalve borings (Gastrochaenolites isp.), polychaete dwellings (Trypanites isp., Caulostrepsis isp., Meandropolydora isp.), predatory drill holes by naticid gastropod (Oichnus simplex), exploratory bite scars of elasmobranchs, and grazing scars of gastropods (Radulichnus isp. and Rogerella isp.). The encrusting organisms include polychaete serpulids, bryozoans, microbes, ostreids and megalospheric foraminifera. Corals found in the lower parts of the member bear multiple stages of complex encrustation and extensive bioerosion. Other invertebrate shells (i.e., bivalves, gastropods, and echinoids) also display various bioerosional traces. Clionid sponges, mytilid bivalve, and sclerobionts are likely the most common colonizers in them, offering opportunities to study interactions among organisms in the fossil record. The taphonomic characteristics of bioeroded and encrusted fossil shells/tests can serve as valuable paleoecological indicators of deposition under conditions of low to moderate sedimentation rates. The possible taphonomic pathway of the fossil assemblages suggest following events: (1) pre-mortem stage; (2) predation stage (naticid gastropod); (3) thanatocoenosis stage; (4) multiple possible bioerosion/encrustation windows involving predation, bioerosion, and encrustation traces; (5) taphonomic resedimentation, i.e., set of processes involving displacement and possible deterioration by abrasion, corrasion, and fragmentation of shells; and (6) final burial stage. Taphonomic and biofabric analyses suggest that the development of various shell/test concentrations is influenced by the storm-induced waves and currents, limited sediment input and low aggradation, biomorphodynamic settling behaviour of organisms, and a high abundance of hard biogenic structures. These factors contribute to the development of shell beds and their individual uniqueness. The present study contributes to our understanding and comparison of different carbonate-platform environments belonging to the paleomarine ecosystems and the processes that have shaped the Oligocene fossil record in the Kutch basin. Keywords: Kutch Basin, Carbonate platform, Taphonomy, Oligocene, Bioerosion

IMAGING OF GONDWANA SEDIMENTS HIDDEN BELOW THE DECCAN BASALTS IN SOUTH REWA BASIN OF CENTRAL INDIA USING RAY TRACE INVERSION OF SEISMIC DATA

Sudeshna Moharana[1,2] and Laxmidhar Behera[1,2]

[1]CSIR-National Geophysical Research Institute (CSIR-NGRI), Uppal Road, Hyderabad – 500007, India
[2]Academy of Scientific and Innovative Research, Uttar Pradesh, Ghaziabad 201002, India.
E-mail:sudeshna.ngri19a@acsir.res.in; laxmidhar@ngri.res.in

The south Rewa rift-basin is a part of Son-Mahanadi rift system having complex tectonic activity forming numerous faults, folds, horsts and grabens with widespread lava flows (Deccan basalts). The Gondwana sediments are hidden below the Deccan basalts and imaging of these sediments are important for hydrocarbon potential. We have used long-offset seismic refraction and reflection data along the 155 km long N-S trending Hardi-Samatpur profile in south Rewa basin of Central India. We have derived both P- and S-wave velocity models (V_P and V_S) using ray-trace inversion of the seismic data to image subsurface geological structures with basement configuration down to a maximum depth of 15 km and obtained different rock compositions of this sedimentary basin. The first layer is

maximum 1.2 km thick having low V_P (3.20-3.40 km/s) and V_S (1.92-2.05 km/s) values indicate top soil and loose sediments, which corresponds to the Pali-Tihki formations. Below this layer, the high-velocity-layer (HVL) basalt flows are intruded through the Gondwana sediments. The low-velocity-layer (LVL) sediments are imaged (1.5-2.0 km thick) below the HVL basalts, which are mainly considered as Gondwana sediments and potential for hydrocarbon are confined within the graben. The basement is highly undulated forming horst and graben structures confined by deep basinal faults having V_P (5.95-6.10 km/s) and V_S (3.43-3.60 km/s) values mainly corresponds to granite. The sub-basement has V_P (6.45-6.52 km/s) and V_S (3.7-3.72 km/s) corresponding to upper crust mafic materials. From the above V_P and V_S values, we have computed the corresponding V_P/V_S and Poisson's ratio (σ) for each layer to understand the compositional changes along the profile of the sedimentary basin.

APPLICATION OF SEISMIC REFRACTION TOMOGRAPHY FOR IDENTIFICATION OF SHALLOW COAL SEAMS IN MAHANADI BASIN COALFIELD

Muthulakshmi V[1, 2,*], Dhanam K[1] and Nimisha Vedanti[1, 2]
[1] CSIR-National Geophysical Research Institute, Hyderabad-500007, India
[2] Academy of Scientific and Innovative Research (AcSIR), Ghaziabad-201002, India
*Presenting author: muthulakshmi.ngri22j@acsir.res.in

This study introduces an application of refraction tomography for the detection of shallow coal seams within sedimentary formations in an Ib Valley coalfield of Mahanadi Basin, India. In this technique, a Wavepath Eikonal Traveltime (WET) inversion is applied on 3D High-Resolution Shallow Seismic data to obtain a refraction velocity model, which was used to depth migrate the shallow seismic events. The improved shallow seismic image was used to identify the shallow coal seams in this region. The local coal seams in this region are very thin and are located at shallow depths. The regional coal seams are thick and contain enormous coal reserves. The image obtained after the refraction tomography was compared with the conventional processes section and it was found that the refraction tomography has improved the resolution of the shallow events and generated an improved velocity model. Using this technique, we generated a 300 m high-resolution depth section of the region.

IGU Awards/Medal/ Prize-2023

IGU Awards/Medal/ Prize-2023

Name of the Candidate	Award/Medal/Prize
Dr. Somnath Das Gupta	IGU-Dr Hari Narain Lifetime Achievement Award
Dr. Ranjit Rath	IGU-Prof. K.R. Ramanathan Memorial Lecture
Dr.M. Ravichandran	IGU-Decennial Award
Dr. Abhishek Saha	IGU-Krishnan Medal
Dr. Labani Ray	IGU-Anni Talwani Memorial Prize
Dr. Uma Shankar	IGU-Anni Talwani Memorial Prize
Dr. Hridaya Chauhan	IGU-Dr JG Negi Young Scientist Award
Dr.Onkari Prasad, Dr.O. P. Singh & Dr.K. Prasad	IGU-Prof.D.Lal Best Paper Award
Ms.M. Parveen, Dr.C. P. Dubey & Dr.M. Mishra	IGU-Prof.D.Lal Best Paper Award

IGU- Decennial Award

BLUE ECONOMY: CHALLENGES AND OPPORTUNITIES

M. Ravichandran
Secretary, Ministry of Aerth Scieneces (MoES), New Delhi

We live on a blue planet, with oceans and seas covering more than 70 per cent of the Earth's surface. Oceans provide countless benefits to our planet. Oceans feed us, regulate our weather and climate, and generate most of the oxygen we breathe. It also provides living and non- living resources, from fisheries to marine biotechnology, and minerals to renewable energy. It also offers social and economic goods and services such as tourism and recreation, maritime transport and security and coastal protection. It is imperative to understand our Ocean for better management to conserve, protect, and restore future generations. To accelerate the sustainable development of marine areas and the resources to enhance the contribution of the Blue Economy to India's GDP, Govt. of India has brought out a draft Blue Economy Policy. The main objectives are to provide broad guidelines for the implementation of the Blue Economy in India and to define the priority areas for the growth of the Blue Economy with an aim to develop investments in financial, physical, natural and human capital to accelerate employment generation ensuring sustainable development. The presentation will cover various pririty areas of Blue Economy, including challenges and opportunities, to harness ocean resources in an environmentally sustainable manner. Also, will be highlighted various components of the newly launched Deep Ocean Mission project.

IGU-Krishnan Medal

THE MANTLE CAULDRON BENEATH THE INDIAN OCEAN

Abhishek Saha[1*] and Arghya Hazra[1,2]
[1]CSIR-National Institute of Oceanography, Dona Paula, Goa 403 004, India
[2]School of Earth, Ocean and Atmospheric Sciences, Goa University, Taleigão Plateau, Goa 403 206, India
*E-mail: asaha.nio2015@gmail.com; asaha@nio.org

The thermo-tectonic evolution of global mid oceanic ridge rift systems squares with the geochemical changes in the mantle over the geological history in terms of periodic melt extraction, refertilization, fluid-melt infiltration and crustal recycling. The two viable processes that attribute to chemical and isotopic heterogeneity of the mantle include (i) multiple episodes of melt replenishment and melt-rock interaction in open magma systems and (ii) recycling of oceanic and continental crustal materials and components of sub-continental lithospheric mantle. The Carlsberg Ridge (CR) and Central Indian Ridge (CIR) basalts exhibit tholeiitic to transitional composition of precursor melts and E-MORB affinity with selective enrichment in incompatible trace elements. Sr-Nd isotopic signatures ($^{87}Sr/^{86}Sr$: 0.702668-0.702841 and $^{143}Nd/^{144}Nd$: 0.512972-0.513068) of CR basalts suggest a HIMU source component preserved in the northwest IOR mantle. They show E-MORB affinity with selective enrichment in incompatible trace elements. Negative Nb anomalies with lower Nb/Y and Zr/Y for majority of the samples conform to a non-plume origin of these basalts. Higher Zr/Nb and Th/Nb

compared to OIB substantiate contributions from recycled subduction-processed components in the source mantle. Lower Nb/U values with higher Ba/Nb, and Ba/Th, Zr/Nb and Th/Nb compared to OIB and N-MORB attest to role of a metasomatized oceanic lithosphere that recycled into the depleted upper mantle attributing to the source heterogeneity. The compositional diversity of the Indian Ocean mantle can be translated in terms of periodic refertilization of depleted N-MORB type mantle through delamination and recycling of oceanic (HIMU component) and continental lithosphere (EM I component) concurrent with Neoproterozoic-Palaeozoic amalgamation and Jurassic dispersal of Gondwana Supercontinent respectively. The preservation of ~3.0 Ga - 250 Ma zircon grains of continental origin within oceanic gabbros of CIR can be correlated with subduction-driven delamination, convective downwelling and recycling of older continental lithosphere into the mantle during the Gondwana amalgamation at around 750 Ma, and (ii) delamination, convective removal and incorporation of older continental fragments into the upwelling mantle asthenosphere during the dispersal of Gondwanaland at ~167 Ma.

Key words: IOR mantle; melt-rock interaction; sub-continental lithospheric mantle; refertilization; Supercontinent

IGU- Dr. J. G. Negi Young Scientist Award

CRUSTAL EVOLUTION IN THE WESTERN CENTRAL INDIAN SHIELD THROUGH PRECAMBRIAN TTG- GRANITOIDS AND THE MAGMATIC ROCKS OF THE WESTERN HIMALAYA, LADAKH REGION.

Hiredya Chauhan*
Wadia Institute of Himalayan Geology, Dehradun
pradyumanah@gmail.com

Remnants of the earliest crust can be found mostly in the Archean tonalite-trondhjemite- granodiorite (TTG) gneisses which helps in understanding the crustal evolution and is a matter of scientific debate. TTGs of both the Aravalli and Bundelkhand craton show distinct groups at microscopic scale based on mineral assemblages though the geochemical results are almost similar. Geochemical data of TTGs from both the craton shows a wide spectrum of SiO 2 composition exhibiting peraluminous characteristics with a modal range from trondhjemite to granodiorites. The tectonic discriminant plot suggests a volcanic arc setting while REE pattern shows fractionation of Ti-bearing phases along with the involvement of crustal components. U-Pb TIMS Zircon chronology of Aravalli TTGs yield the discordant age of 2680 + 30 Ma and is interpreted as an age of magmatic crystallization of tonalite for the Aravalli Craton. These zircons have moderate to high U contents with low Th/U ratios characteristic for magmatic zircons. EPMA mineral chemistry data of biotite and

calcic amphiboles from Bundelkhand granitoid, suggests that these granitoid formed from calc-alkaline magma produced in subduction environment, however, the geochemical proxies for slab-melts are solely not in favour of a slab melting origin for the Aravalli TTG rocks. In the given scenario, the evolution of the TTGs can be best explained by the episodic partial melting of the thickened mafic crust formed at variable depths. In Ladakh Himalaya, the Cretaceous mafic magmatism is represented by Ophiolitic rocks of the Indus Suture Zone, which are considered to represent remnants of the Neo-Tethyan Ocean. The rocks vary in composition from tholeiite (N-

MORB) and alkaline (OIB), intercalated with highly serpentinised ultramafic rocks tectonically intermixed with deep oceanic sediments. The Zildat ophiolitic mélange of the eastern Ladakh comprises of a minor unit of N-MORB with epsilon Nd(t) of ~+8 and a dominant unit of the Oceanic Island Basalt (OIB-type) with epsilon Nd(t) of ~+4. The epsilon Nd values for the Zildat rocks (N-MORB and OIB) indicate their derivation from depleted but unrelated mantle source regions. Similar

lithological packages are reported from the Shergol ophiolitic mélange in western Ladakh. Trace element and isotopic data indicate presence of intra-oceanic island arc system being represented by the Nidar Ophiolitic Complex, these are equivalent to the Dras arc of the western Ladakh. The epsilon Nd(t) for the mafic magmatic rocks of the Nidar ophiolitic complex is about +8, indicate their derivation from depleted mantle source(s).

IGU- Prof. Jegdeo Singh and Dr. S. Balakrishna Memorial Grant for student toppers

STUDENTS TOPPER LIST

S.No	Name of Student	University	Department
1	Chintala Tejaswi	Osmania University, Hyderabad	M.Sc. Geophysics
2	Ashwini Kota	Osmania University, Hyderabad	M.Sc. Geophysics
3	Yanda Sateesh	Andhra University, Visakhapatnam	M.Sc. Tech Geophysics
4	Gondu Lahari	Andhra University, Visakhapatnam	M.Sc. Tech Geophysics
5	Ruppa Bala Venkata Sasi Kumar	Andhra University, Visakhapatnam	M.Sc. Marine Geophysics
6	Challa lasya Priya	Andhra University, Visakhapatnam	M.Sc. Marine Geophysics
7	Pulipaka S H S N Dattatreya	Adakai Nannaya University, Rajamahendravaram	M.Sc. Geophysics
8	Narla Veeralakshmi	Adakai Nannaya University, Rajamahendravaram	M.Sc. Geophysics
9	Ms T Mercy	MSU University, Tirunelveli	M.Sc. Geophysics
10	Mr I. Reegan Raj	MSU University, Tirunelveli	M.Sc. Geophysics
11	Miss Rutuja Panchal	SRTM University, Nanded	M.Sc. Geophysics
12	Mr. Sai Parikh	SRTM University, Nanded	M.Sc. Geophysics
13	Mohit Patel	IITB,Mumbai	M.Sc. Geophysics
14	Shivanshu Kalia	IITB,Mumbai	M.Sc. Geophysics
15	Navaneeth Babu M	IIT ISM,Dhanbad	M.Sc. Tech Applied Geophysics
16	Arnab Das	IIT ISM,Dhanbad	M.Sc. Tech Applied Geophysics
17	Sai Satyam Jena	IIT ISM,Dhanbad	MTech Integrated Applied Geophysics
18	Aditya Chowdhury	IIT ISM,Dhanbad	MTech Integrated Applied Geophysics
19	Tulika K.	CUSAT,Kochi	M.Sc. Marine Geophysics
20	Bhadran S. V.	CUSAT,Kochi	M.Sc. Marine Geophysics
21	Mr. Vishal Vishwakarma	Dr Rammanohar Lohia Avadh University Ayodhya	M.Sc. Geophysics

NATIONAL REMOTE SENSING CENTRE (NRSC)

National Remote Sensing Centre (NRSC), Department of Space, Government of India, is a key player in the Earth Observation segment of Indian Space Programme, to help and realize India's space vision. It ranks among the premier organizations in the world in operationalization of Remote Sensing and geo-information technologies, for use at the grassroot levels and provides last mile connectivity with users.

The core activities of NRSC include – acquisition and processing of earth observation satellite data, establishment of ground stations for receiving satellite data, generation of data products, dissemination to the users, development of techniques for remote sensing applications including disaster management support both in India and abroad, web-based geospatial services for good governance and capacity building for professionals, faculty and students and research in land, and atmosphere and ocean sciences.

NRSC has a world class facility – the Integrated Multi-mission Ground Segment for Earth Observation Satellites (IMGEOS) at Shadnagar near Hyderabad, to acquire, process and disseminate Satellite data from both Indian and foreign satellites. The facility also supports NRSC's data acquisition activities at other international ground stations.

NRSC also carries out Aerial Services and Data Management (ASDM) activities to facilitate generation of large scale topographic maps and very high resolution Digital Terrain Models (DTM) using state-of-the art sensors.

NRSC provides end-to-end solutions for utilization of data for Natural Resources Management, Geospatial Applications and Information Services catering to food security, water security, energy security and sustainable development. It has a single window Disaster Management Support Service for major natural disasters like floods, agricultural drought, forest fires, cyclones, earthquakes and landslides.

The NRSC Data Centre (NDC) is the interface between the remote sensing data user community and the ISRO system. NDC supports all activities related to Indian and foreign satellite data dissemination including on demand supply over any part of the globe, satellite payload planning and scheduling.

The geospatial services are provided to the users through the Bhoonidhi and Bhuvan Portals.

Brief Write-up of WIHG

Dehradun-based Wadia Institute of Himalayan Geology (WIHG) - an Autonomous Institute of DST, Govt. of India, came into being in 1968 and has been involved in pursuing both basic and applied geoscientific researches to unravel the mountain-building processes of the Himalaya, and provide an improved understanding on seismogenesis, geodynamics, climate-tectonic interactions, biotic evolution and extinction, glacial dynamics, river system, geo-hazards (landslides, floods, and earthquakes), natural resources (geothermal, minerals/ores, hydrocarbons, springs), anthropogenic impact etc., towards the well-being of the population and safeguarding the properties and structures in the Himalaya and adjoining regions. The Institute also serves as a database/national reference center for Himalayan Geology based on several branches of Geosciences: structural geology, petrology, paleontology, stratigraphy, sedimentology, geomorphology, passive & active seismology, geophysics, remote sensing, engineering geology etc. It is equipped with state-of-the-art laboratories and field equipment facilities for geoscientific data acquisition, data analysis/processing, and interpretation. The facilities are being utilized not only by the research scientists of WIHG but also by the researchers of the state & central universities, other institutes and organizations. Some important instruments are LA-MC-ICP-MS, Stable Isotope Mass Spectrometer, ICP-MS, XRF, SEM, Ion-Chromatograph, Raman Spectrometer, TL/OSL, Rock Cutting, Polishing, Powdering and Mineral Separation, Dendo Chorology Lab, Rock Magnetic Lab, Fluid Inclusion Lab, Susceptibility Meter EPMA, XRD, etc. Besides analytical data generation, the Institute also provides consultancy services related to geoengineering projects, georesources, geo-hazards, and road and rail alignments, etc. Special emphasis has been laid on providing implications of upstream climate change on the Himalayan glaciers and their consequences to slope instability to landslides, glaciers avalanches, glaciers lakes outbursts, flash floods etc. WIHG has also established a Centre of Excellence of AI/ML to Geosciences for monitoring and early warning of geo-hazards, and automatic delineation of 3D configuration of subsurface geologic features from surface seismic data.

Reg.34/2012

MRK GEOMATICS

SURVEYING AND MAPING SERVICES

An ISO 9001:2015 Certified

PROVIDING THE FOLLOWING AREAS OF SURVEYING AND GIS MAPPING SERVICES SINCE FROM LAST 12 YEARS:

- BASIC SURVEYING OPERATIONS FROM AUTO LEVELLING TO GNNS GEODETIC SURVEY
- DGPS SURVEY: STATIC, RTK, PPK AND FAST STATIC SURVEY AND ALSO PROVIDING RTX SERVICES FROM "OMNISTAR", TRIMBLE RTX CENTRE POINT SUBSCRIPTIONS ETC
- MAIN AREAS OF SURVEY EXPERIENCED
- IRRIGATION: Canal Alignments, Watershed area studies etc HIGHWAYS: Road Alignment survey Traffic survey
- FOREST: STATIC and RTX SURVEY FOR FOREST LAND BOUNDARIES REVENUE: LAND SURVEY(CADASTRAL)
- RURAL WATER SUPPLY DEPARTMENT: WATER GRID SURVEY (DGPS RTK)

OTHER SERVICES:

DRONE SURVEY, LIDAR SURVEY FOR LARGE SCALE MAPPING AND TOPOGRAPHIC SURVEY

OUR STRNGTH:

SURVEY INSTRUMENTS: AUTOLEVEL (SOKIA)-2 TOTAL STATION -1 LEICA TS02

DGPS EQUIPMENT: TRIMBLE SPS986 GNNS RECIEVERS:8 NOS SPECTRA SP 60:18 NOS

TRIMBLE R4 2NOS (Total 28 receivers from Trimble products and TBC 5.5 POST PROCESSING SOFTWARE LICENCE)

FIELD STAFF: GNNS OPERATORS-16 NOS CAD OPERATOR:2 NOs

GIS EXPERTS :3 NOs

"WE ACHIEVE HIGH LEVEL OF ACCURACY IN HORIZONTAL AND VERTICAL POSITIONS" AND EXPERTISED IN CARRYING OUT ALL SURVEY OPERATIONS

OUR CLIENTS:

GOVT SECTOR: CSIR -NGRI, GSI, FOREST DEPARTMENT, WATER RESOURCES DEPARTMENT, ROADS & BUILDINGS DEPARTMENT, LAND RECORDS DEPARTMENT OF ANDHRAPRADESH

PRIVATE SECTOR: L&T, MEIL, GAYATRI PROJECTS and OTHERS

SOME PHOTOGRAPHS OF FIELD WORK




9+ Decades of Excellence Since 1932

GSSI

Geophysical/Geotechnical Investigation

Ground Penetrating Radar

güralp

- Broadband Seismometer
- Surface & Borehole Seismometer
- Strong Motion Accelerograph
- Sophisticated Seismic Digitizers
- Ocean Bottom Seismometer

IRIS INSTRUMENTS

- SYSCAL Pro Resistivity & IP Imaging System
- 3KW, 5KW, 10KW 3D distributed IP System
- VLF System

PHOENIX GEOPHYSICS

- Multi-Function EM & IP System
- MT System AMT, CSMT & UMT System

ROBERTSON GEO
Unlocking Your GeoData

Slimhole Wireline Borehole logging System

OYO
OYO Corporation

- McSeis Engineering Exploration Seismograph
- Pressure Meter-200Bar
- MT-Neo Microtremor System
- Ultrasonic Velocity Measuring System for Rock Sample (P&S)-Sonic Viewer-SX

Consultancy in Civil Engineering
Advanced Technology and Engineering Services (ATES)

- Numerical Analysis and Design
- Geotechnical Interpretative Reports & Design Input Recommendations
- Geophysical Surveys
- Structural Health Assessment and Monitoring & Design of Instrumentation Scheme
- Soil, Rock & Construction Material Testing
- Non Destructive Testing (NDT)
- Building Condition Survey and Risk Assessment (BCS & BRA)
- Engineering Geology & Geo-hazards

Aimil Testing Laboratory
NABL Approved
(Accreditation No. TC-7287)
- Soil, Rock Testing, Construction Material & Petrography

Think Instrumentation. Think Aimil.

Aimil

For further information, please contact us:
E-mail: delhi@aimil.com | Tel: 91-11-6131 0244 | **www.aimil.com**

Offices at :
• Delhi (H.O.) • Mumbai • Bengaluru • Kolkata • Chennai • Vadodara
• Hyderabad • Chandigarh • Guwahati • Bhubaneswar • Indore
• Nagpur • Pune • Bangladesh • Thiruvananthapuram • Lucknow

Aimil/Ad/Civil/23-24/09/19

Complete
Instrumentation Solutions

www.instrumentation-solutions.com

Land Gravity Meter

- Fully quartz core sensor - no metal parts
- Resolution of 0.1 micro Gal
- Operating Temperature -20 deg to 50 deg Centigrade
- Operating range of 10000 mGal
- Detachable Control Unit

Ground Penetrating Radar

- MALÅ ProEx is a versatile, full range, GPR that supports an application range no other GPR can match.
- Modular System can be used for single- and multi-channel measurements.
- Compatible with Broad range of antennas including snake antenna

High Power Earth Resistivity/IP System

- Resistivity and Time Domain Induced Polarization measurement
- Displays waveform, electrode contact, noise, Vp, IP decay curves, apparent resistivity
- Provides real time feedback

Ultra wide band MT System

- Reservoir monitoring
- Oil and gas exploration (land & marine)
- Hydrocarbon reservoir dynamics monitoring
- Earthquake prediction research
- Deep crustal research

Complete Instrumentation Solutions Private Limited
Suite-512, Suncity Business Towers Golf Course Road,
Sector-54, Gurugram-122002, Haryana
Tel:+91-0124-4929000, (E):info@instrumentation-solutions.com
www.instrumentation-solutions.com

National Centre for Earth Science Studies

Ministry of Earth Sciences, Government of India

The National Centre for Earth Science Studies (NCESS) is an autonomous research institute under the Ministry of Earth Sciences (MoES), Government of India. The vision of NCESS is to excel in understanding the deep internal and surface processes of solid earth, its interactive mechanism with the hydrosphere and atmosphere, and to address various scientific issues of concern to the society. The institute hosts a state-of-the-art laboratory infrastructure which enables multidisciplinary research in emerging areas of solid earth research in the country. The Centre has made significant contributions in the fields of geodynamics and deep interior of Earth, palaeo-climate, surface processes, interplay between surface and subsurface processes, coastal hydrodynamics, landslides and land subsidence, coastal erosion, submarine ground water discharge, coastal zone management and cloud physics.

Scientific Infrastructure

NCESS is equipped with modern laboratory facilities which include:

- X-ray Fluorescence, EPMA, , Isotope Geochemistry Facility with LA/MC-ICP-MS, Petrology Laboratory, Thin Section Preparation Laboratory.
- Palaeomagnetism laboratory and Resistivity imaging system required for study of internal / surface processes.
- Seismological Observatories with 7 broadband seismographs for earthquake and crust-mantle studies.
- Fluid inclusion laboratory with Raman spectrometer coupled to microscope.
- Critical Zone Observatories (CZOs) installed in the field at Munnar, Attapadi and Aduthurai.
- Central Chemical Laboratory with LC-MS/MS, GC-MS/MS, MP-AES, GC, UHPLC, AAS, UV-Vis-NIR Spectrophotometer, CFA, Flame photometer, CHNS-TOC-Mercury-Surface Area Analyzers, Sedigraph. Microbiology, Aquatic Biology, Wet Chemistry Laboratories.
- Sedimentology Laboratory, X-ray Diffraction laboratory, SEM-EDS, Particle Size Analyzer Laboratory. Marine field equipment like Acoustic Doppler Current Profiler (ADCP), Wave Rider Buoy, Current meter, Echo sounder, Tide gauge for near shore hydrodynamic study.
- High Altitude Cloud Physics Observatory at Munnar, Mid Altitude Observatory at Braemore and NCESS Campus Observatory with Disdrometer, Micro rain Radar, Ceilometer, Rain drop charge sensor, Automatic weather stations, etc., to measure drop size distribution and cloud base height. Air Quality Monitoring Lab, Lightning Detection Network.
- Central Geomatics Laboratory with Remote Sensing and GIS facility for producing thematic maps including cadastral scale maps for demarcating coastal regulation zone.

Scientific Groups

NCESS functions under six scientific groups, viz.,

Solid Earth Research Group (SERG) primarily envisages geodynamic evolution of Archean cratons, Proterozoic mobile belts, Western Ghats and active subduction zones.

Crustal Dynamics Group (CDG) addresses dynamic processes taking place at or near-surface conditions on the earth's crust, hydrocarbon movements in sedimentary layers and landslides.

Hydrology Group (HyG) focuses on research in hydrology and water resources with specific reference to Earth's Critical Zone.

Biogeochemistry Group (BgG) focuses on evolution of springs, biogeochemistry, solute dynamics, water quality monitoring, pollution assessment and mitigation.

Marine Geoscience Group (MGG) focuses on understanding of waves, currents, sediment transport and their effects on beaches and nearshore, and the national network project on Submarine Groundwater Discharge to quantify the amount of groundwater discharge through coastal aquifers.

Atmospheric Science Group (ASG) is engaged in the research on atmospheric clouds, thunderstorms, lightning, atmospheric electricity, and regional climate over Western Ghats.

NCESS

NATIONAL CENTRE FOR EARTH SCIENCE STUDIES
राष्ट्रीय पृथ्वी विज्ञान अध्ययन केन्द्र
Ministry of Earth Sciences, Government of India
पृथ्वी विज्ञान मंत्रालय, भारत सरकार

PB No. 7250, Akkulam, Thiruvananthapuram-695011, India
पि.बि.नं 7250 आक्कुलम, तिरुवनन्तपुरम - 695011, भारत
दूरभाष/PHONE +91-471-2442213, 2511720, 2511501
फैक्स/FAX +91-471-2442280 ई-मेल/E-MAIL director@ncess.gov.in
वेबसाइट/WEBSITE www.ncess.gov.in

Committed to Our Earth Our Future | हमारे भविष्य हमारी पृथ्वी केलिए प्रतिबद्ध

CSIR-National Geophysical Research Institute

Exploring Earth for 60 Eventful Years

Unique Geophysical Research institute of the country for Near Surface to Deep Earth Exploration

CSIR- National Geophysical Research (CSIR-NGRI) established in 1961, with a vision for the pursuit of earth science research, which strives for global impact and its application for optimizing sustainable societal, environmental, economic benefits for the Nation. CSIR-NGRI carries basic and applied research in the fields of Geophysics, Geology, Geochemistry and Geochronology

Overview

Research : From academic to field stations, research is lifeline of CSIR-NGRI. Excellent laboratory and infrastructure to carryout cutting-edge research in Hazard, Water, Energy, Geodynamics, Minerals. It is supported by High Computing facility.

Academic : A large number of PhD programs are running with vibrant campus life. It has two hostels with canteen facility.

Campus– Performances, events, fitness center, Club, gym facility and dispensary within the campus.

Knowledge Center : One of the largest libraries in India in Geosciences. It subscribes to 102 research journals and holds more than 20000 books.

Publications : ~ 5000 SCI research papers, ~ 1260 technical reports, more than 100 books, 31 patents.

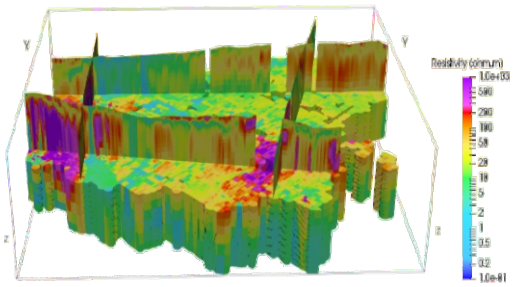
Significant Achievements

- Pioneer in Airborne Geophysical Research in India
- Gravity Map Series of India (GMSI)
- first indigenous airborne geophysical instruments
- Largest Seismological Network across the country
- Expertise of sub-Basalt imaging for oil and gas exploration
- Simulation of deep Earth processes and magnetic field

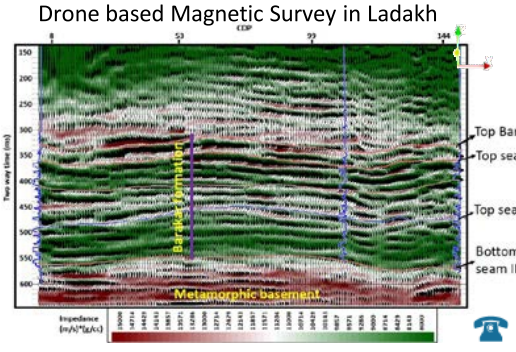
Future R&D

- ✓ Geological Hazard Assessment – Early Warning System
- ✓ Water Security – Sustainable Groundwater Resources Management
- ✓ Energy Security- Hydrocabon, Uranium, Geothermal
- ✓ Mineals – Lithium and REEs
- ✓ AI/ML for Geosciences

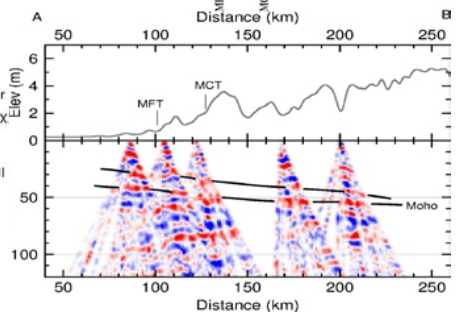
Drone based Magnetic Survey in Ladakh



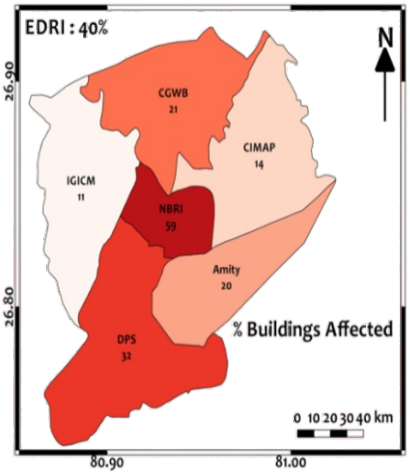
3D AEM Resistivity Model



3D Seismic Data for CBM Exploration



Seismic image of the Moho in Kashmir Himalaya



Earthquake Risk Map – Lucknow

Contact :

+91-40-2343 4600 91 40 27171564 director@ngri.res.in www.ngri.res.in

https://www.facebook.com/csirngrihyd/ https://twitter.com/csirngri