Editorial

Welcome. We are back with some more information/ details. Hope, you would like them. It is the season of national and international seminars, including SEG, AGU and IGU annual conventions. We wish you develop good contacts, go up the ladder and enjoy the fruits of your scientific achievements.

IGU Annual Convention

Indian Geophysical Union (IGU) is organizing its 49th annual convention at Raisan village, Gandhinagar, Gujarat state, during 29-31 October, 2012, in collaboration with three scientific organizations of Gujarat state. "Towards Energy security" has been chosen as the special theme. We wish a useful interaction between senior and young scientists/ students, as such interactions lead to better implementation of research programs. The three day convention also has sessions covering all the branches of earth system, in addition to a special session on intra and inter plate seismicity. Success of any seminar depends on implementation of recommendations made during the seminar. Such a success is achievable when participants succeed in developing personal and institutional collaborations during the post seminar period, especially the first three months. In the absence of such a development seminars/workshops lose their importance. We urge scientists, technical experts, students to keep this in view and plan their participation organized and productive.

IGU and AGU co-operation

During 48th annual convention Dr.Surja Sharma of US has put forward a proposal for viable co-operation between Indian Geophysical Union(IGU) and American Geophysical Union(AGU).It is essential for us to explore the possibility, as both the organizations are wedded to the basic objective of providing needed platforms to encourage research in all the branches of earthsystem. Before we strengthen the relationship between both the scientific unions(even though in every respect AGU is miles ahead) we need to strengthen the base of IGU.It has neither a permanent office nor permanent staff to carry out various works, as per fixed targets. Present practices cannot be sustained, unless all the members / fellows and well wishers come forward to help the organization.

Co-operation between different research organizations

In the previous editorial we stressed the need for supporting data based research. Since an area is explored by different organizations using different techniques and as most of these studies are supported by the government, the Ministry of Earth Sciences should evolve a mechanism that would enable systematic interaction between different organizations prior to and during a survey/ study. Such an interaction would lead to an integrated/ holistic approach in selection and use of data acquisition methodologies and avoid repetition of surveys and duplication of data acquisition and processing.

Monsoon Vagaries-Data Exchange

Recent studies by US scientists suggest end of La Nina and probable end of tornadoes and hurricanes that have wreaked havoc in US and surroundings during the last 5 to 6 years. If such a change is going to happen, we may witness some changes in our own monsoon pattern. Since global changes in the hydrological cycle have area specific repercussions we need to constantly study, not only local sources of cyclones and varying patterns of monsoon, but also any subtle changes noticed in Pacific and Atlantic oceans (in addition to different segments of Indian Ocean). Because of such a need, we advocate free exchange of data pertaining to various phenomena associated with the entire earth system. Such an exchange of data is needed even internally, to better understand various natural phenomena. The delayed onset and a large scale precipitation deficiency, during South West

monsoon (2012), affected very adversely Kharif crops and power generation. The IMD Forecast Model could not predict these vagaries, due to data deficiencies. Since such monsoon vagaries would be repeated in future, we need to take all measures to save our food production and power generation. It is learnt that to narrow down gaps in our understanding of monsoon perturbations, long and short term, the IMD is going to collaborate in a big way with UK and US scientists---a good development.

Energy Security

Energy security is extremely essential for the overall growth of a nation, including India. We need to take measures that would ensure availability of energy to all the sectors, to ensure overall growth .With population growth, demand for production of essential commodities is growing unabated. It is difficult to meet energy demand through fossil fuels, as our reserves, coal and oil& gas, are fast depleting. Even though on paper we talk of introducing alternative renewable energy sources, we have to go a long way before we achieve success in this sector. Solar energy is successfully utilized by many western countries, even though availability of solar energy is restricted due to prolonged winter season compared to tropical countries and countries like India. We need to go in a big way to meet the demands of both urban and rural populations, as extraction and utilization of this energy is not hindered by any pollution problems and implementation of internationally approved obligatory norms and procedures .Scientists and technologists should take needed steps to make storage and transmission of solar energy through simple gadgets and procedures. Advanced photo voltaic technique has lessened the cost of energy generation, storage and transmission. We need professionals to properly implement solar energy programs. In addition we can tap wind energy, all along our two coasts and inland hilly terrains. Selection and installation of different types of wind turbines can maximize the energy generation. Even in this sector we are short of professionals. Our technologists should come forward and establish centers of training in these two sectors and our entrepreneurs should come out with new gadgets to optimize energy generation and usage. Government and industry should provide needed support to such endeavours.When all the stake holders co-operate with each other; we can definitely have sustainable energy security.

Higgs-Boson

Even though scientists postulated that Universe was formed due to BIG-BANG, we are yet to confirm in an unequivocal manner the exact mechanism/ process that was basically responsible for the origin and contents of the Universe and its growth in time and space. Answers to riddles associated with Dark Matter, Cryogenic glue, gravity field are needed, to better understand the dynamics of the Universe. In their pursuit, to unravel the mysteries associated with the Universe, scientists have invoked different theories and substantiated theoretical postulations with experimental findings. Theories and experiments are continued and will extend for decades or even centuries, as the riddles are complicated in many ways.

Ever since the ATOMIC Model was postulated by Rutherford, experimental and theoretical research was intensified to understand the existence and behavior of the sub-atomic particles, as scientists believe that these sub atomic particles played crucial role in the genesis and dynamics of the universe. By the time the Atomic model was postulated, the electron, proton, neutron and nucleus were known. Scientists could explain certain interactions in the elements and compounds with these particles. Particle and Nuclear Physicists study these particles, as elementary particles are fundamental objects of quantum field theory. Bosons are fundamental particles of Bose-Einstein statistics. Theoretically, during 1960s, Higgs established the existence of these fundamental particles. It was suggested that Higgs Boson, important sub atomic particle, provided mass to the material and with gravity weight to the matter. To prove that this elusive particle exists, Physicists carried out number of experiments. One such experiment, carried out in the recent past, has yielded positive answer to the theory proposed by Higgs. A friend, retired Geophysicist of GSI , has succinctly explained the discovery. It is given below.

"At the start (?), the exploding hot universe was full of elementary particles, but the particles had no mass. The universe also contained force fields, and one of those fields cooled and condensed into a quantum liquid. The liquid dragged on the other particles, giving them mass. The liquid rippled, and the ripples formed a new particle, called the Higgs Boson. Though it may read like a story, it is the basis of the Standard Model of physics. And till the recent (4th July, 2012) discovery, physicists have found every particle the Standard Model has predicted, but one: the Higgs Boson itself. The Standard Model puts all particles into two camps, those that stick together into matter and those that carry the four forces (electromagnetism, gravity, and the "strong" and "weak" nuclear forces).The theoretical model proposed by Higgs does not belong to either of the two. The present success by the Physicists is path breaking, in every respect".

A well known senior geophysicist / distinguished scientist/renowned teacher has explained the discovery in a lucid manner. The same is given below to help the young researchers in understanding better, the path breaking experiment.

"The present discovery is about Higgs Boson. A very big "Atomic Smasher", a Tunnel 27 km long was specially constructed at the France-Swiss border, some years ago, with facilities for generation of certain known particles [particularly Protons] that could be accelerated to attain extremely high velocities, leading to their high collisions with atoms. Such experiments with high energy collisions are useful to investigate dark matter, anti-matter and creation of the Universe, and to test the similarities with those theorized to have occurred during massive explosion of the Universe called the Big-Bang, which took place some 13.7 billion years ago. The present result [declared on 4th of July, 2012] obtained through a series of experiments purposefully planned, revealed the evidence for a new sub-atomic particle that resembles the theoretically predicted Higgs Boson which was long sought after. The importance of the Higgs Boson lies in the fact that it was postulated from theory that it is the particle which supplies mass (and together with gravitation supplies the weight) for all matter (objects) in the Universe. The science world is abuzz with excitement over the discovery, which could offer clues to the persistent riddle of mass and how objects obtain it -- one of the most sought-after answers in all of physics. But experts cautioned that more analysis was needed over the next several months to uncover the true nature of the discovery".

Some learned scientists from India have compared the wavy nature, as a flash, of the Higgs Boson with the cosmic dance of Lord Shiva. Such visualization needs a philosophical outlook.

Scientists are bound to find some more sub atomic particles and solve many riddles, including the one associated with the Gravitational attraction/ pull. We, however, cannot predict when and how these riddles are going to be solved. However, as every scientist, we are optimistic that solutions would be found one day or the other and probably make clear the linkage between science and religion.

Sumatra Volcanoes

In the July editorial, we detailed about unprecedented high magnitude continued seismicity of Sumatra region. The oft-disaster-battered island of Sumatra may have yet another threat to add to the roster of natural phenomena that afflict the Indonesian island: colossal volcanic eruptions. Although Sumatra residents are likely well-acquainted with the string of volcanoes that line the Indian Ocean Island's western coastline, new research has revealed that some of these volcanoes are capable of far more violence than once thought. Sumatra has a number of active and potentially explosive volcanoes, and many show evidence of recent activity. However, most of the eruptions are small, so little attention has been paid to the potential for a catastrophic eruption.

In 2007, OSU professor Chris Goldfinger led an expedition to Sumatra to dig up evidence of earthquakes that had rocked the region in the past. During the field work, the OSU team, along with Indonesian colleagues, stumbled upon unmistakable evidence of volcanic ash and began conducting a parallel investigation into the region's

volcanic history. The researchers unearthed the signatures of six major volcanic eruptions that hit Sumatra over the past 35,000 years. Most equaled — or surpassed — the explosive intensity of Mount St. Helens' deadly 1980 eruption. Some of the eruptions dumped ash as far as300 kilometers away. Sumatra has more than 30 potentially active volcanoes. And although the mountains do erupt, occasionally belching forth ash and gas, Goldfinger said, residents may not be aware of the potential for catastrophic violence that lurks within the peaks.

In 2004, the Indian Ocean Island was devastated by an earthquake and an ensuing tsunami that killed more than 200,000 people around the world. "Prior to 2004, the risk from a major earthquake was not widely appreciated except, perhaps, in some of the more rural areas," Goldfinger said in a statement. And earthquakes happen more frequently than major volcanic eruptions. A combination of earthquakes and volcanic eruptions can devastate not only Sumatra and adjoining islands but also many segments of the earth, due to eruption related atmospheric perturbations. North of Nicobar Islands we have volcanoes. These have erupted mildly, causing concern to the specialists. It is time we carry out intensive studies in this region to better understand the inter relationship between earthquake activities and volcanic eruptions.

Earthquake Prediction:

Long term prediction helped in locating regions prone for frequent seismic activity of considerable magnitude. Circum Pacific Belt and Alpide-Himalaya-Sunda Arc Belt are known to produce major percentage of high magnitude seismic activity. Almost all other plate boundaries, diffused plate boundaries do contribute to seismic activity, in addition to seismic activities associated with some plate interiors. Since the last 70 to 80 years significant studies have been carried out to understand various mechanisms associated with earthquake activities; both inter and intra plate. Some researchers advocated that these efforts have resulted in identifying pre earthquake warning signals. They have included under this category changes in the Vp/Vs, radon emission from bore wells, ground water fluctuations, rare planetary congregations` gravity pull influence on the earth, solar eclipse influence, Piezoelectricity in internal rock strata, reactions of some animals, birds and insects .However, none of these have been used as definite predictive signals to forecast an earthquake event in space and time that can be termed as short term prediction. New research from Taiwan indicates that ionosphere bubble(Plasma Bubble) is generated by the pre earthquake activity(Kuo, C. L., J. D. Huba, G. Joyce, and L. C. Lee ,2011).They claim that Ionosphere plasma bubbles and density variations are induced by pre-earthquake rock currents and associated surface charges, (J. Geophys. Res., 116, A10317, doi:10.1029/2011JA016628).They have noticed electric coupling between the ionosphere and surface charges in the earthquake fault zone. They have noticed a relationship between pre- earthquake build up of ionosphere bubble and formation of Fox clouds. Interestingly, the famous astrologer from India Varahamihira in his classical book—Brihat Samhita stated that abnormal cloud formations help in predicting earthquakes. We have to see how far in future these studies help in understanding specific role played by different earth system processes, including Lithosphere-Ionosphere Interaction, in short term prediction of earthquakes. This study clearly tells the seismologists to view at the prediction from different angles. It is evident that we cannot visualize the reality associated with earthquake genesis, assuming earth as an independent entity. It is an integral part of our solar system and our galaxy. Earth system processes are inter linked. crustal and lithosphere dynamics is not only associated with internal processes but also processes of extra terrestrial origin .As such ,we need to carry out scientific research of short term prediction deciphering various signals that emanate from different sources, both near and far.

Heki reported a possible ionospheric precursor to the devastating 11 March 2011 M 9 Tohoku earthquake of Japan. Analyzing data from the Japanese GPS network, he detected an increase in the total electron content (TEC) in the ionosphere above the focal region of the earthquake beginning about 40 minutes before the earthquake. The TEC enhancement reached about 8% above the background electron content. The increase in TEC was greatest above the earthquake epicenter and diminished with distance from the epicenter. He stated that similar ionosphere anomalies occurred before the 2010 8.8 M Chile earthquake, 2004 9.2 M Sumatra earthquake, 8.3 M Hokkaido

earthquake, but TEC enhancements were not seen before smaller earthquakes. Although previous studies have shown that earthquakes could trigger atmospheric waves that travel upward and disturb the ionosphere, it is unclear how an ionospheric disturbance could occur before an earthquake began. Since solar storms can also enhance TEC non earthquake causes of any TEC enhancement need to be ruled out before considering TEC enhancement as an earthquake precursor(Courtesy: EOS vol.92, no 45, Nov, 2011).On 4th June, when lunar eclipse occurred the "outgoing long wave radiation(OLR) anomalies have clearly shown a closure near Java. The satellite imagery also shown, but on 8th June, a significant ionospheric total electron content(TEC) anomaly closure in the same region.OLR is the long wave radiation emitted from the Earth-atmosphere system to outer space. It reflects much information about the Earth`s surface and the atmosphere. Java and surroundings including Sumatra have been witnessing considerable seismic activity, making the region`s surface and sub surface columns significantly affected by subduction and strike-slip processes. We do not know to what extent this OLR signature is adding to our knowledge regarding ongoing disturbance in the region. However, it is essential to study the signatures to better understand the interaction between ionosphere and lithosphere. The TEC anomaly closure on 8th at the same place has some significance. Since no known ionospheric activity (especially solar eclipse) occurred on 8th, it is difficult to correlate this signature in light of ongoing seismic activity. No significantly high magnitude earthquake occurred in Java and surrounding region either on 8th or during subsequent period. Similar TEC anomaly has been noticed, for more than a week in the last week of June in the Haiti region, which was devastated couple of years back by a high magnitude earthquake. It is not clear why such anomalies are noticed both in Java and Haiti, the two regions that have been battered by recent seismic activities. Since both the Japanese and Taiwanese seismologists claim a clear ionospheric disturbance prior to a high magnitude earthquake, we advocate a closer and clinical evaluation of various signals, including the above cited signals from ionosphere, to add to our knowledge base. As of now these signals are not deciphered as precursors, due to number of unknowns that are contributing to the seismicity. Even though we do agree that there is influence of extra terrestrial bodies and ionospheric perturbations on Earth we cannot unequivocally claim these signals, as of now, as earthquake precursors. As such, until a firm correlation is achieved prior to an earthquake activity, we urge one and all to desist from declaring that atmospheric/ astronomical / astrological signatures do help in short term prediction. Such a declaration only confuses one and all. We urge the seismologists to continue their prediction studies, taking into consideration the above said signals, but avoid statements claiming short term prediction. Please do not degrade the importance of atmospheric / astronomical/ and astrological studies, for personal gains. An Astro-Seismologist predicted an earthquake during 21-27 May, 2012 and another on 4th June and sent e-mails to many. Some astrologers predicted an earthquake on 30th May in north-east India. Both the predictions turned out to be false. These experts are not bothered about the unrest created. It is better to keep quiet than disturbing the peace with uncalled for predictions.

The Mauritius-Reunion Earthquake (6.7 Mw) of 26th July, 2012 has direct/ indirect effect on the regional seismicity. It is essential for us to study in detail this earthquake`s mechanism, as it may have an effect on seismicity of the Indian continent.

In India we need to initiate needed measures to face earthquake resultant devastations. Roger Bilham stated during 2011 AGU Fall meeting that GPS measurements of crustal deformation are showing that a magnitude 9 earthquake could occur in the Himalayas. He and his team of scientists found that the potential rupture zone is larger than scientists had believed-the region where strain is building is twice as wide as expected. The Sumatra-Andaman region continues to be active. So, our major concern is how to meet a significantly high magnitude Himalayan earthquake that can affect large segments of Northern and North Eastern India and probable Tsunami that can devastate the coastal belt. At the same time our seismologists should try to integrate various studies (involving geosphere, ionosphere and hydrosphere) that can decipher various precursory signals. These important studies/ assignments require highly professional approaches. The biggest problem is to have good number of trained professional seismologists to deploy different instruments in remote areas, collect good quality data,

process the data using state of the art processing methodologies and take appropriate measures to meet post disaster effects. The experienced professionals, limited in number, are getting old. The new blood is more tuned to in house scientific research and is not enthusiastic to go to field to judiciously carry out data acquisition works. Before situation goes beyond our control we need to develop a dedicated young brigade of seismologists. Institutes like NGRI,Hyderabad; ISR, Gandhinagar;IMD,New Delhi; IIT, Roorkee; GSI, Kolkata need to come together in achieving this target. Ministry of Earth Sciences and National Disaster Management Authority can co-ordinate this program. If this is approved in principle, a new division can be opened in each of these institutes exclusively to train young researchers, utilizing support from UNESCO and expertise from US, Japan and Germany, in addition to indigenous expertise and facilities.

Greater Insight into Earthquake Cycles

For those who study earthquakes, one major challenge has been trying to understand all the physics of a fault -- both during an earthquake and at times of "rest" -- in order to know more about how a particular region may behave in the future. Recently, researchers at the California Institute of Technology (Caltech) have developed the first computer model of an earthquake-producing fault segment that reproduces, in a single physical framework, the available observations of both the fault's seismic (fast) and aseismic (slow) behavior. Caltech study describes a methodology to assimilate geologic, seismologic, and geodetic data surrounding a seismic fault to form a physical model of the cycle of earthquakes that has predictive power. Previous research has mostly either concentrated on the dynamic rupture that produces ground shaking or on the long periods between earthquakes, which are characterized by slow tectonic loading and associated slow motions -- but not on both at the same time. Caltech research group developed the numerical methods used in making the new model. In their study, they have modeled the entire history of an earthquake-producing fault and the interaction between the fast and slow deformation phases. Using previous observations and laboratory findings, the team modeled an active region of the San Andreas Fault called the Parkfield segment. Located in central California, Parkfield produces magnitude-6 earthquakes every 20 years on average. They successfully created a series of earthquakes (ranging from magnitude 2 to 6) within the computer model, producing fault slip before, during, and after the earthquakes that closely matched the behavior observed in the past fifty years. The researchers claim that their model explains some aspects of the seismic cycle at Parkfield that had eluded us, such as what causes changes in the amount of time between significant earthquakes and the jump in location where earthquakes nucleate, or begin. It is demonstrated that a physical model of fault-slip evolution, based on laboratory experiments that measure how rock materials deform in the fault core, can explain many aspects of the earthquake cycle -- and does so on a range of time scales. The team of scientists believes that Earthquake science is on the verge of building models that are based on the actual response of the rock materials as measured in the lab -- models that can be tailored to reproduce a broad range of available observations for a given region. This implies that seismologists are getting closer to understanding the physical laws that govern how earthquakes nucleate, propagate, and arrest.They further claim that they may be able to use models much like the one described to forecast the range of potential earthquakes on a fault segment, which could be used to further assess seismic hazard and improve building designs.

Since currently, seismic hazard studies rely on what is known about past earthquakes the study can help in better understanding the fault mechanism. However, the relatively short recorded history may not be representative of all possibilities, especially rare extreme events. This gap can be filled with physical models that can be continuously improved as we learn more about earthquakes and laws that govern them. As computational resources and methods improve, dynamic simulations of even more realistic earthquake scenarios, with full account for dynamic interactions among faults, will be possible. This study is a step in the right direction. But, short term earthquake prediction is still beyond our comprehension as fault dynamics is influenced by various factors and understanding specific roles played by different internal and external factors need a comprehensive understanding of various earth system processes.

Contents-A brief Introduction

This issue has one invited review article and five research articles. Umesh Kulsrestha,JNU, New Delhi has brought into focus various aspects of global warming. It is now well established that climate change is adversely affecting our environment and we need to take at the earliest, appropriate measures to lessen the impact of the climate change. It is now well established that emission of green house gases has to be reduced considerably to save our environment. The author suggests that clean development mechanism (CDM) is the best adaptation option for developing countries to participate in emission reduction strategies. As such, we earnestly request the scientists to study the review in detail and impress upon both the Government and the common man the necessity to arrest further pollution. In the first scientific article entitled "Electrical resistivity Logging for Assessing ----- Power plant ", Kamble.et.al have emphasized the importance of electrical resistivity logging in assessing the nature of the foundation strata at Kaiga Nuclear power plant and its utility of providing parameters for deciding design of the foundation of the structure . In the second article entitled "Delineating uneven bed rock topography by continuous seismic refraction study" Subba Rao and Chaudhari have brought into focus the importance of continuous seismic refraction study in delineating bed rock topography. They suggest a combination of seismic study and limited bore hole data would provide apt results that are cost effective. In the third article entitiled "Extreme hydro-meteorological Events and urban development " , De and Jamadar have pointed out that extreme weather events, in particular heavy rains and floods cause huge losses. They have stressed the need for a sustainable way of development for cities, to lessen the losses. In the fourth article entitled "Studies on Coastal Geomorphology along Visakhapatnam to Bhimunipatnam Coast, East Coast of India", Jagannadha Rao .et.al have shown that the Coastal geomorphology clearly establishes not only the sea level oscillations but also variations in climatic conditions in this part of the coast. In the fifth article entitled "A Study of Aerosol Distribution Over Indian Region based on Satellite Retrieved data ", Sheshu Kumar et.al have pointed out that atmospheric aerosols play a major role in climate change. They have noticed a significant variation in the vertical distribution of aerosols from day to night.

In the subsection on "News & Views at a glance", we have introduced a new format. Under Science News we want to concentrate on topics that are scientifically and societally important. We wish to concentrate on one or two major issues/ topics. In the present issue we have included topics on LIFE on Earth and its evolution with time and Earth`s origin. Our intention is to make this section useful to not only earth-system scientist but also to others who want to know about our Earth and the problems faced by the LIFE. It is paramount to know that the Earth formed 4.6 billion years back had life after about 400 to 500 million years. The exact cause for origin of life on earth is not yet clearly understood. But, it is well established that the first form of life was limited to micro organisms and for a considerable period of time was confined to flora and fauna. Man came into existence hardly 1 or 2 lakh years back. But his greed has led him to dominate over all forms of life. The present ails to the life on Earth are caused by the greedy Man. Our environment is degraded, our natural resources are plundered and our flora and fauna are destroyed, our land/oceans/atmosphere is polluted by the Man. This reality, if not understood by one and all, we will demolish our environment and with it the life on the Earth. Let us find ways and means to avoid such a calamity.

We once again solicit your continued support.

P.R. Reddy
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