XVI IAGA WORKSHOP ON GEOMAGNETIC OBSERVATORY INSTRUMENTS, DATA ACQUISITION AND PROCESSING

7-16 October 2014, NGRI, Hyderabad, India

The International Association for Geomagnetism and Aeronomy (IAGA) is concerned with the understanding of electromagnetic field of the Earth, and its interaction with other processes, planets, and the Sun (http://www.iugg.org/IAGA/). IAGA Observatory workshops are held once in two years at different Magnetic Observatories of the world, where absolute and variation instruments are compared. These Workshops are indeed a unique concept where half the duration is dedicated to hands-on measurement and calibration sessions.This provides an opportunity for observers to come together to implement best practices for highly accurate absolute measurements and calibration and comparison of instruments. The XVI IAGA Workshop (http://www.ngri.org.in/iaga13_14/) on Geomagnetic Observatory Instruments, Data Acquisition and Processing, 2014 was jointly organized by the National Geophysical Research Institute (CSIR-NGRI) and the Indian Institute of Geomagnetism (IIG), Mumbai, India. The Golden Jubilee (1964-2014) of the Hyderabad Magnetic Observatory HYB (CSIR-NGRI) was commemorated by this workshop.

Geomagnetism in India:

Geomagnetic studies have had a long history in South Asia, particularly the Indian subcontinent, with the Survey of India making repeat measurements for over 200 years and the Indian Meteorological Department, making continuous magnetic observations for over 150 years. South and Southeast Asia, has an intermittent history of magnetic measurements from Philippines to Mauritius. It is a swathe of equatorial region mostly covered by ocean and not conducive to a network of observatories. However, with a decade of satellite based magnetic measurements, efforts are underway, by several agencies to improve ground measurements in this region. Carrying this tradition forward, this workshop was jointly hosted by the institutions currently engaged in establishing magnetic observatories and using the data. CSIR – NGRI (www.ngri.org.in) has several programs including airborne and ground surveys, development of electromagnetic techniques in addition to a long series of magnetic data– both daily variation and equatorial magnetic pulsations. The Indian Institute of Geomagnetism (IIG), Mumbai is actively engaged in basic and applied research in Geomagnetism and allied areas of Geophysics, Atmospheric & Space Physics and Plasma Physics and operates twelve modern digital magnetic observatories at various locations in India, in addition to Antarctica (www.iigm.res.in)

Delegate Profile

There were 90 delegates at the Workshop, of which 65 attended the measurement session and were later joined by 25 more for the scientific session. The delegates were from 31 countries. Significant representation was from those working in Germany (5), USA(5), Belgium (4), UK(4),S Korea(4). Delegates from other countries were: Hungary (3), Japan (3), Russia (3), Kazakhstan (3), Sri Lanka (3), Austria (2), Australia(2), Czech(2), and South Africa (2), 1 each from Ireland, Canada, Denmark, Israel, France, Switzerland, and Spain. Sponsored support enabled delegates from W Samoa, Maldives, Sri Lanka, Russia, Syria, Romania, Slovenia, Poland and Ukraine too to attend the Workshop. There were 30 delegates from India

Measurement Sessions

The Measurement Sessions, 7-11 October, were held at NGRI Geophysical Observatories, Choutuppal Campus, about 60 km from NGRI. Choutuppal magnetic observatory (CPL) was established at this campus, in 2012, as an alternate to HYB, in view of increasing electromagnetic noise due to rapid urbanization of Hyderabad.

There are 9 non-magnetic measurement pillars at CPL of which 6 were kept vacant for absolute measurements by participants. 60 slots of 90 minutes each were provided for observers. 28 DI flux instruments were deployed by 42 observers, some of who made novel experimental observations. 6 proton precession magnetometers were calibrated with a fixed frequency signal generator. Continuous mode recording of total field was also carried out.

Temperatures have been unseasonably high about 35 ° C. Teams from NGRI and CPL extended unequivocal support in making available all the facilities. In spite of some hardships the Observers obliged and co-operated with the measurement organisers. For the first time, training sessions were conducted at this workshop, including lectures, theoretical and practical training for 12 novice observers and a session on low-latitude azimuth observations. Several observers participated voluntarily in training sessions.

Inaugural Session & Golden Jubilee of HYB Observatory:

The Workshop, was formally inaugurated by Prof. Harsh Gupta, President IUGG on 13th October. Dr. Y.J. Bhaskar Rao,Acting Director CSIR-NGRI, Dr. S. Gurubaran (IIG), Dr. Archana Bhattacharyya, Member, IAGA Executive Council member, Dr. Pavel Hejda, Co-Chair IAGA Division V, Dr. B.K. Bansal, Chief Scientist from the MoES, Dr. Jurgen Matzka, Head of Observatories, GFZ, Germany, spoke on the occasion.

The Golden Jubilee of Hyderabad INTERMAGNET Observatory (HYB), was marked by the presence of several founder members and retired staff who were felicitated by the Chief Guest, Prof Harsh Gupta. HYB, established by NGRI, within its 150-acre campus, is situated just outside the influence of the quiet-day equatorial electrojet in India, and free from anomalous oceanic or geological induction effects. It has provided accurate and stable data for 50 years and is an ideal low-latitude location to monitor ionospheric and magnetospheric signals. Research contributions from HYB include examination of regional and local secular variation trends, migration of the dip equator, electromagnetic induction and study of low-latitude signature of ionospheric and magnetospheric events.

Scientific Sessions:

There were 45 oral and 35 poster presentations made at the 6 scientific sessions. A wide range of topics were covered related to measurements and data applications.

Session I: Golden Jubilee of HYB & Long data series: Adjustments, Shifts: Efforts to retrieve, digitize and maintain archives of valuable long data series, along with meta data were described, with examples from Germany, Czech and India. A historic perspective of HYB Observatory, the experiments, performance, data quality, upgrade of instruments, as well as research contributions were also presented.

Session II: MAGNIO:

This session was dedicated to the launch of the new IUGG project 'Uniting and Networking the magnetic community in the northern Indian Ocean region', funded by ICSU. Global efforts towards obtaining and integrating data sets were presented, with a view to outline the steps being taken to induct more organizations in the Northern Indian Ocean region in participating in data acquisition and interpretation. Several possible applications of such data, to understand ocean and tectonic processes better in the region were presented. On-going works in the NIO, primarily, study of EEJ and induction at ocean-continent boundaries were described.

Session III: Observatory Instruments and Techniques:

This session revolved around new or modernized instruments, new calibration facilities and procedures with the aim of quality improvement and automation in data acquisition. Manufacture of non-magnetic theodolites for magnetic measurements has seen several challenges in the recent decades. A new nonmagnetic theodolite from China promises to resolve this issue. AUTODIF, which makes automatic absolute measurements, was deployed throughout the measurement session with full functionality.

Session IV: Observatory Data Acquisition and Processing:

This session highlighted the challenges of the requirements for 1 second data and how groups are working to meet the required standards. It included examples of advances from specific observatories in Russia, Korea, Romania and Belgium.

Session V: Scientific Applications of Observatory data:

Diverse applications of observatory data were presented, such as: Earthquake and tsunami signatures, historical geomagnetic events, equatorial

electrojet, equatorial plasma bubbles and application to GPS signals and modelling of Sudden Impulse events.

Session VI: Repeat stations, Results of Measurement sessions, Azimuth Determination, Review of posters:

The results of the Measurements sessions were presented. Comparison of baselines determined by each observer was made and corrections validated and certified.

- No. of DI-flux observers: 42
- No. of DI-flux instruments: 28
- No. of DI-flux measurements: 173
- Total field measurements – (ppm): 6

Temperature effects, noise characteristics and baselines of the new magnetometer, AUTODIF were presented. Adaptation of magnetometer for greater portability was presented. Comparison of Repeat station networks in South Africa and Central USA, separating magnetospheric and secular contributions and observations from a long series of repeat station data archived by Survey of India were also presented.

Session VII: Magnetic observatories of the future, Observatory networks and IAGA's supporting role

The last session was held in the form of a panel discussion, which became very lively due to participation from the panelists as well as other delegates. Observers expressed desire to learn more about data processing. Observers would like to have access to codes, error analysis, dialogue with more experienced scientists to continue the learning process. Internet is being successfully used to transmit and share data. The internet facility should be used to provide forums for learning and problem solving, since many observers work in comparative isolation. A suggestion was made to have a page on the division V website, where observers could post queries, obtain codes and short articles. Some volunteered to write articles.

It was unanimously resolved that the Workshop has been successful in several aspects.

Budgetary and infrastructure support:

The success of this Workshop has been possible due to the unstinting monetary and infrastructural support provided by CSIR-NGRI throughout the process of planning, establishment of CPL Observatory, as an alternate to HYB, and specialized infrastructure for deployment of high precision instruments.Substantial and critical budgetary support has been provided by scientific agencies and ministries of the Government of India: Indian Institute of Geomagnetism (IIG, Ministry of Earth Science (MoES), Department of Science & Technology (DST), Council of Scientific & Industrial Research (CSIR), Indian Nation Centre for Ocean Information Services (INCOIS), and Indian National Science Academy (INSA). Financial support to international delegates was provided from grants given by International Union of Geodesy and Geophysics (IUGG), International Association of Geomagnetism and Aeronomy (IAGA) and International Council for Science (ICSU).

Kusumita Arora & B. Veenadhari
(On behalf of the Local Organising Committee)

Absolute measurements at CPL

Golden Jubilee felicitation

Group photograph of delegates