Characteristics of 1 second baselines from Hyderabad and Choutuppal Magnetic Observatories, India

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Many INTERMAGNET Geomagnetic Observatories are graduating from 1 min definitive data to 1s definitive data. The quality of this new data is very sensitive to the precision and stability of the vector and scalar magnetometers as well as the Declination-Inclination magnetometer used in each Observatory. The effect of small amplitude local fluctuations of the natural and man-made electromagnetic environment around the magnetometers is substantial with the higher frequency of measurement and the noise often affects the quality of the baselines. In this study, we compare such baselines obtained with different magnetometers at Hyderabad and Choutuppal Magnetic Observatories, India.

Magnetic observatories record long-term vector and scalar data and the network of these Observatories (INTERMAGNET) produce complete information about the changes in the spatial and temporal characteristics of the Earth's magnetic field. Due to very high demand from the geomagnetic community for various space weather applications, most of the Magnetic Observatories are now recording 1s data (Chandrasekhar et al. 2017).

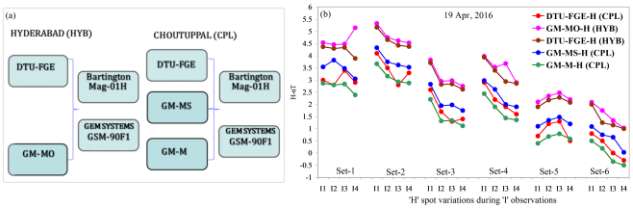

Figure 1: (a) Magnetometers used for the experimental study; (b) Deviations in H-spot variations in magnetometers during absolute observations on a quiet day

For any Observatory, the stability of baselines is a crucial factor; the baseline deviations have to be at least one order less than the long period weak signals (Anil et al. 2017).The accuracy of the baselines are directly impacted by the quality of the 1s data from the various magnetometers.

With the aim of producing 1s definitive data from Choutuppal (CPL) Observatory in the near future, we performed a few experiments under temperature controlled environment to understand the nature of baselines from 1s magnetic measurements at Hyderabad (HYB) and Choutuppal (CPL) Observatories using similar and different magnetometers over a period of 4 months (Mar-Jun, 2016). Details of the magnetometers used for the study at each Observatory are shown in Fig 1a and discussed in detail (Chandrasekhar et al. 2017). 'H' spot variations during the time of D-I observations for 6 sets between the magnetometers on one quiet day is shown in Fig 1b (where I1-I4 are Inclination readings). It is evident from Fig 1b that the 'H' variation trends are relatively same and have a scatter of 0.5nT between the DTU systems deployed at HYB and CPL Observatories and 0.8 nT between the GM systems (MS and MO), whereas in GM-M, variations are confined to 0.2nT range. From 4 months of observations, we found that the drift in baselines are found to be maximum in suspended systems (DTU-FGE, GM-MO and GM-MS, ±0.8 nT) than unsuspended GM-M (±0.3 nT), (Fig 2) and are directly proportional to the obtained deviations in spot variations. DTU-FGE systems show controlled variations than GM systems. It is also evident that baselines at HYB and CPL Observatories show relatively same trend with few exceptions. Being aware of factors mentioned above, is critical for generation of 1s definitive data and a longer time series is required to evaluate the differences in spot variations between the systems, proposed as a future study.

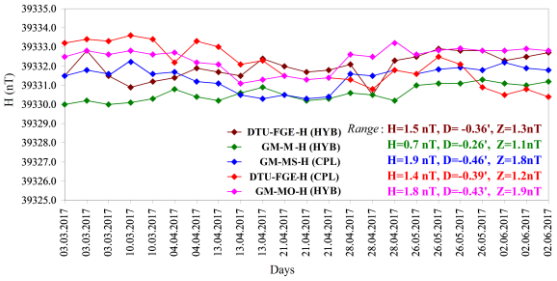

Figure 2: Baseline variations in H-component and the observed differences in D and Z components between the magnetometers.

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