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Workshop on

IRNSS and GNSS based observations for Crustal Deformation,

Weather and Soil moisture studies

15.03.2019, IIRS, Dehradun

Programme

09.15-09.30: Registration

09.30-10.00: Inauguration

10.00-10.25: Overview on IRNSS system, opportunities and future plans

Dr. Nilesh Desai, Space Applications Ccentre, Ahmedabad

10.25-10.50: IRNSS data processing, data quality and application potentials

Mr. Manish Saxena, ISRO, HQ, Bangalore

10.50-11.15: Tea

11.15-11.40: GNSS based crustal deformation in Indian sub-continent with special reference to Peninsular India

Dr. Vineet K. Gehlot, National Centre for Seismology, MoES

11.40-12.05: GNSS applications for Geodynamics studies in Himalaya-Karakoram-Tibet

Dr. P.K. Champati ray, IIRS, Dehradun

12.05-12.30: GPS Occulation and Reflectometry: Future Space Based Observations

Shri Abhinit Shyam, Space Applications Centre, Ahmedabad

12.30-12.55: GNSS Reflectometry for soil moisture, snow depth and water level studies

Dr. Harishankar, IIRS, Dehradun

12.55-13.20: IRNSS/GNSS applications for precipitable water vapour monitoring and analysis

Dr. Randhir Singh, Space Applications Centre, Ahmedabad

13.20-14.00: Plenary followed by Lunch

Venue: Aryabhatta Lecture Hall, IIRS, Dehradun

Positioning to Plate Tectonics: IRNSS/GNSS on a highest Pedestal

Precise positioning using satellite navigation system, popularly known as Global Navigation Satellite System (GNSS) has led to path breaking studies in earth sciences starting from plate motion, crustal deformation modelling, seismic observation to volcano monitoring and sea level rise including polar ice movement. It has revolutionized the observation technique in modern Geodesy and has become a powerful and default tool for crustal deformation. Continuous IRNSS/GNSS observations at three stations of favourable geometric configurations can perform as a strain-meter and all components of the horizontal strains can be obtained through horizontal displacements. Analysis of strain components, particularly the shear strain, is of great importance in earthquake forewarning studies.

In addition to the long and mid-term precursory anomalous deformations, IRNSS/GNSS can also detect variations in TEC (Total Electron Content) in the ionosphere. The TEC measurement obtained from dual frequency IRNSS/GNSS receivers is one of the most important parameters to characterise Earth's ionosphere. The changes in the Earth's ionosphere can be utilized to obtain information about an impending earthquake as in recent times many studies have supported such observations and thus a new branch of science known as "Ionosphere Seismology" is emerging as a strong candidate in the field of earthquake prediction.

The Himalaya is structurally and lithologically complex mountain system and recognition/delineation of active fault structures are very significant for understanding the potential earthquake/seismogenic setup of the region. GNSS systems can monitor subtle changes across active tectonic features and provide very vital clue to validate and substantiate morpho-tectonic setup and landform evolution. It can provide crucial information on ground deformation and subsidence with sub-centimeter level of accuracy that can help in developing landslide early warning systems (LEWS). GNSS based crustal deformation and regional strain assessment may also help to determine seismic design parameters of dams in DPR stage of Hydroelectric project construction. GNSS based deformation monitoring in dams and associated infrastructures is quickly emerging as default monitoring system.

Apart from these path breaking applications and developments, GNSS also provides opportunities for real-time determination of tropospheric zenith total delays (ZTDs) and integrated water vapor (IWV) to improve numerical weather prediction, particularly for nowcasting or severe weather event monitoring. GNSS reflectometry has also shown promises for soil moisture estimation, water level and snow depth determination. Overall, the application horizon is expanding in earth science, solid earth geophysics and space weather related studies by exploiting GNSS signal propagation and its delays through different atmospheric layers. Realising the tremendous opportunity that GNSS offers, ISRO has operationalized Indian Regional Navigation Satellite System (IRNSS), popularly known as NaVIC. This has generated a lot of interest among research communities in India and there is a spurt of activities on setting up of CORS/campaign mode stations across the mainland, Trans-Himalayan region and Andaman Nicobar islands for various applications related to earth and atmospheric sciences and disaster management. This calls for continuous deliberations and exchange of ideas by technology experts and application scientists to harness the true benefits of this unique technology.