Countering Ionospheric Effects on EGNSS at Low-Latitude

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SUMMARY

GNSS signals passing through the upper atmosphere are affected by changing in the refractive index and by small-scale ionospheric plasma irregularities causing refraction and diffraction ("scintillations"), respectively. At low latitudes, the interplay between ExB drift, gravity and pressure gradients, leads to an enhancement of ionization in the regions close to ±15° magnetic latitude, commonly referred as the northern and southern crest of the Equatorial Ionization Anomaly (EIA), respectively. The Rayleigh-Taylor instability, caused by the formation of the crests, allows the formation of Ionospheric Plasma Bubbles (IPB), when some forcing from below (e.g. gravity waves) is present. The small-scale irregularities embedded in the IPB's are the main sources for the equatorial scintillations that occur in particular during the post-sunset hours. Forecasting and mitigating the impact of ionospheric threats is undoubtedly essential for the establishment of GNSS as a technology that can be exploited for different high precision applications at low latitude. SpacEarth Technology, a young company spin-off of INGV (Istituto Nazionale di Geofisica e Vulcanologia) thanks to the collaboration with INGV, the University of Nottingham and the Polish Space Research Centre of Academy of Science, has developed a series of prototype solutions able to forecast and mitigate the ionospheric impact on GNSS services. Solutions leverage of the available Galileo satellites to forecast and mitigate the impact of ionospheric effects on GNSS applications.

One of the SpacEarth prototype solution has been adapted to the Vietnam case, aiming at showing the high-spatial resolution nowcasting of the ionospheric Total Electron Content and range error to assist GNSS operations. The demonstrator, hosted in the NAVIS Demo Centre, leverages on the data provided by the geodetic network managed by the Institute of Geophysics of the Vietnam Academy of Science and Technology consisting of about 20 stations covering the North Vietnam area.