Identification of travelling ionospheric disturbances and perspectives for the development of warning services

Travelling Ionospheric Disturbances (TIDs) constitute an important Space Weather effect in the upper atmosphere driven by the near-Earth space dynamics and by lower atmosphere phenomena. TIDs are the ionospheric manifestation of internal atmospheric gravity waves (AGW) in the neutral atmosphere. Independent of their source, TIDs can impose significant disturbances in the electron density, and Doppler frequency shifts on High Frequency (HF) signals, affecting all technologies using predictable ionospheric characteristics. In general, TIDs affect all technologies using predictable ionospheric characteristics. Recently it is clearly demonstrated that TIDs can have multiple effects in the operation of aerospatial and ground-based infrastructures and especially in the European Geostationary Navigation Overlay Service (EGNOS) and Network Real-Time Kinematic (N-RTK) services, in HF communications, in radio reconnaissance operations and in Very High Frequency – Ultra High Frequency (VHF – UHF) radiowave propagation. The newly funded EC Horizon 2020 Project TechTIDE has the objective to design and test new viable TID impact mitigation strategies for the technologies affected. For this purpose, it is primarily required to develop a system able to calculate in real-time the main TID characteristics (velocity, amplitude, propagation direction), to realistically specify background ionospheric conditions and to specify those ionospheric characteristics whose perturbation, because of TIDs, cause the impact in each specific technology. The talk reviews the most well-known methodologies for the identification and tracking of TIDs based on the exploitation of real-time observations from networks of Digisonde, GNSS receivers and Continuous Doppler Sounding Systems and reports on preliminary results from cross validation studies. Activities planned by the TechTIDE consortium for the development of a warning system able to support the development of mitigation technologies will be also presented.