VII Brazilian Symposium on Space Geophysics and Aeronomy

05 – 09 November 2018
Southern Regional Space Research Center,
CRS/COCRE/INPE-MCTIC & UFSM, Santa Maria-RS

AN EXPERIMENTATION AND VERIFICATION NETWORK TO ANALYZE SMALL SCALE IONOSPHERIC DISTURBANCES

Kriegel, M. [1]; Berdermann, J. [1]; Wilken, V. [1]

[1] German Aerospace Center (DLR), Institute of Communication and Navigation (IKN), Germany

ABSTRACT

Trans-ionospheric radio signals of global navigation satellite systems (GNSS) like GPS, GLONASS, and GALILEO may suffer from rapid and intensive fluctuations of their amplitude and phase caused by small-scale irregularities of the ionospheric plasma. Such disturbances occur frequently during the evening hours in the equatorial region due to plasma flow inversion causing “Plasma bubbles” or during geomagnetic storms in the polar region. This phenomenon, which is called radio scintillation, can strongly disturb or even disrupt the signal transmission. We investigate the effect of small scale ionospheric irregularities on Global Navigation Satellite System (GNSS) positioning using an Experimentation and Verification Network (EVNet). The EVNet is a high rate GNSS receiver network for scintillation measurement from high latitudes down to equatorial region operated by DLR. We will inform about the recent status of the EVNet as well as its recent and future development. We will inform about new equipment used and present related research. Therefore we will present analysis results obtained primarily from two equatorial high-rate EVNet GNSS receiver stations designed and operated by the German Aerospace Center (DLR) in cooperation with Bahir Dar University (BDU) at 11.6° N, 37.4° E. Both receivers collect raw data sampled at up to 50 Hz, from which characteristic scintillation parameters such as the S4 index are deduced. Both stations are located close to one another and aligned in an east–west, direction which allows us to estimate the zonal drift velocity and spatial dimension of equatorial ionospheric plasma irregularities. Therefore, the lag times of moving electron density irregularities and scintillation patterns are derived by applying cross-correlation analysis to high-rate measurements of the slant total electron content (sTEC) and to the associated signal power, respectively. Finally, the drift velocity is derived from the estimated lag time, taking into account the geometric constellation of both receiving antennas and the observed GPS satellites.
Furthermore, we will show EVNet capabilities for space weather research and service as well as for other possible uses and investigations.

Contact author: Martin Kriegel (Martin.Kriegel@dlr.de)