

On the relationship between zonal velocity of the ionospheric irregularities and the occurrence of amplitude scintillation in Brazil.

Cesaroni C.*⁽¹⁾, Spogli L.⁽¹⁾, Alfonsi L.⁽¹⁾, De Franceschi G.⁽¹⁾, Romano V.⁽¹⁾, Park J.⁽²⁾,
Monico J.F.G.⁽³⁾, Aquino M.⁽²⁾

(1) INGV, Department of Upper Atmosphere Physics

(2) Nottingham Geospatial Institute, University of Nottingham, UK

(3) Universidade Estadual Paulista “Julio De Mesquita Filho”

The Brazilian ionosphere is characterized by the southern crest of the Equatorial Ionospheric Anomaly (EIA), i.e. a region of enhanced electron density located at about -15° off the dip equator. Such peculiar distribution of electron density results in a complex variability of the ionospheric plasma in space and time, leading to strong L-band scintillation events. In the framework of the FP7 project CALIBRA (Countering GNSS high Accuracy applications Limitations due to ionospheric disturbances in BRAzil), three dual-frequency receivers have been installed in the region of Presidente Prudente (São Paulo state, $2^\circ 07' 32''$ S, $51^\circ 23' 20''$ W) to study the behaviour of small scale irregularities near the southern crest of EIA. São Paulo state, in fact, is one of the most active regions in terms of scintillation events especially during the spring/summer seasons. In the present study 2 receivers, located along the E-W magnetic direction, have been used to investigate the dynamics of the ionospheric irregularities of the Fresnel scale size (~ 250 m for L-band signal) in order to highlight the relationship between their zonal velocity and the occurrence of amplitude scintillation ($S_4 > 0.25$). GPS L1 amplitude data (sampled at 50 Hz) acquired during a measurement campaign carried out from September 2013 to February 2014 have been analyzed by means of a cross-correlation technique to obtain the daily and monthly variation of the zonal velocity of the ionospheric irregularities. Such velocity is then compared with the amplitude scintillation occurrence obtained by means of the Ground Based Scintillation Climatology to investigate their possible correlation. Results of the analysis, showing good correlation between the zonal velocity and scintillations occurrence, and an explanation as to the possible physical process behind this correlation are discussed.