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STATISTICS OF TEC DEPLETIONS OVER SOUTH AMERICA FROM LISN NETWORK

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Abstract. Global Positioning System (GPS) is a satellite based navigation system developed by USA. It is being widely used for navigation, mapping, accurate timing and many numerous applications. The positional accuracy of GPS is subjected to various effects like clock biases, ionospheric and tropospheric delays and receiver noise. Among these, the effects of accuracy degradation due to group delays introduced by ionospheric total electron content (TEC) and electron density gradients, scintillations are the most significant. Therefore, the standalone GPS is augmented with a Satellite Based Augmented System (SBAS) like WAAS. The plasma depletions that are observed as TEC depletions in GPS TEC measurements degrade the GPS accuracy even if it is augmented by the SBAS or LAAS, due to presence of large electron density gradients. These electron density gradients often generate small scale irregularities that result in scintillations at the GPS receiver that can worse the performance of the GPS receiver. Hence a prior knowledge on the statistics of TEC depletions is of immense use in the mitigation of range errors for GPS navigation.

This paper presents statistics and occurrence pattern of the TEC depletions obtained from the dual frequency GPS receivers of LISN network during the low solar activity period of year 2008 over the South American region. The Low latitude Ionospheric Sensor Network (LISN) comprises of about 35 dual frequency GPS receivers, VIPIRs (ionosondes) and magnetometers that are deployed in South American region with the purpose of studying the equatorial ionospheric dynamics. A total of about 127 GPS receiver stations data was used from LISN and other networks in the South American region for this study. During the equinoxial months, the TEC depletions are detected almost every day near the equatorial regions, sometimes resulting in moderate scintillations because of the low ambient ionosphere attributing to the low solar activity. The threshold values of TEC for the detection of the bubbles are computed and defined after removal of the diurnal variability in TEC. It is known that gravity waves traversing upto bottomside of the F-layer might be one of the causes for the generation of plasma depletions. These gravity waves are detected from the small perturbations in the TEC, can be validated from Ionosonde (VIPIR) data. This paper presents the TEC depletion characteristics

both spatially and temporally, highlighting their longitudinal dependence in the South American region. The gravity waves that are detected from the perturbations of TEC measurements explain some features of the characteristics of TEC depletions occurrence.