



Statistical analysis of loss of lock on GPS at the equatorial ionospheric anomaly over Brazil

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Due to its proximity to the South Atlantic magnetic anomaly, the ionosphere over Brazil is subject to high variability related to solar and geomagnetic activity. This causes scintillation on radio signals travelling through the perturbed ionosphere. Ionospheric scintillation has a strong influence on the GNSS signal tracking system and can cause the receivers to experience loss of lock (LoL) which makes receivers lose track of individual satellites and hampers accurate positioning. This study examines the statistics of LoL in six geodetic GPS receivers at different locations in Brazil during the 24th solar cycle by observing cycle slips in the L1 and L2 phase observations, which is an immediate cause of LoL. The locations of the receivers relative the equatorial anomaly (EA) make it possible to examine how EA expansion during geomagnetic storms affects the spatial and temporal distribution of LoL. The number of LoL occurrences in the L1 and L2 signals between 2008 and 2017 are compared to geomagnetic activity inferred from Kp and Dst indices and grouped by year, season, location and solar activity. The data are analysed to determine how ionospheric conditions relate to increased and suppressed LoL occurrences spatially and temporally. The results indicate a spatial correlation between LoL and the EA, as well as the number of LoL occurrences increasing with higher geomagnetic and solar activity. The study also exemplifies how LoL in GPS receivers can be used as an indication of ionospheric activity.