Temporal and Spatial Characterization of GPS Fading From Ionospheric Irregularities Under Low latitude

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The ionosphere over the peak of the anomaly represents a treat for navigation systems based on GNSS. Brazilian territory is mostly under this harsh layer for satellite communication in general and in particular for navigation, like GPS users, where their receivers tracking performance are damaged under scintillation conditions. Ionospheric scintillation is responsible for significant degradation in the accuracy of navigation and positioning. Phase shifts accompanied by amplitude fades significantly degrades the signal-to-noise ratio of the received signal disrupting the channel and loosing navigation performance. The stronger the scintillations are, more difficulty will be for the GNSS receiver tracking loops to recover the phase and code replicas. These phenomena under specific geophysical conditions may severely affect the system availability and positioning. In this work the temporal characteristics of amplitude scintillation will be analyzed at the three available GPS frequencies, L1, L2C and L5. Aspect like fading duration and depth will be evaluated and compared among the three available frequencies for the current solar cycle. This work will use GPS scintillation data recorded during six months of data during 2014 to 2015 at three stations under Brazilian territory located near the southern crest of the equatorial ionization anomaly. The analysis will be performed focusing on the fading profile of the three frequencies comparing how the fading of those signals behave statistically between them. Aspects like loss of lock, spatial orientation between the signal across the ionospheric irregularity will also be discussed showing how much more susceptible the new frequencies might be in comparison to the widely used and studied L1 frequency.

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