EFFECT OF EQUATORIAL AND LOW LATITUDE IONOSPHERIC IRREGULARITIES ON SBAS

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Ionosphere gives major challenge to Global Navigation Satellite System (GNSS) and Satellite Based Augmentation Systems (SBAS). Investigations have shown that radio-waves propagating through the equatorial and low-latitude regions are more affected than middle and high latitudes. This may influence on a possible SBAS usage in equatorial and low-latitudes regions for safety of life applications. This study is set out to investigate the effect of African equatorial and low-latitude ionosphere on SBAS system performance. The data engaged for this work were obtained from the ground-based GNSS receiver stations within the Northern and Southern crest of the African Equatorial Ionization Anomaly (EIA) region, during solstitial months and equinoctial months of 2013. The rate of change of Total Electron Content (ROT) and rate of change of TEC index (ROTI) were estimated to examine the equatorial ionospheric gradient and irregularities. The SBAS system performance was assessed using two algorithms: a mid-latitude EGNOS-like one and a specific low-latitude one to investigate a potential SBAS system in African sub-Saharan regions. The results have shown a significant correlation between SBAS performance and the rate of change of TEC index. The performance during solstitial months is better than the one during equinoctial months. It is also shown that ionospheric irregularities affect the system after post-sunset hours till mid-night and even post-midnight in some locations. The study revealed that ROT and ROTI are not only a good proxy for the presence of ionospheric gradient and irregularities, but also a representative index for SBAS performance.

Keywords: GNSS, SBAS, Equatorial Ionosphere, ROTI, Performance