GNSS observations in equatorial Africa at two spatially dispersed locations

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Several GNSS receivers were installed in equatorial Africa in 2010. This region is of particular importance to the ionospheric community because of the highly dynamic equatorial ionosphere which is associated with a number of phenomena, among which equatorial spread F is the most prominent. Despite extensive research efforts recently put into the study of this phenomenon and overall understanding of the physics, there are still a number of unanswered questions in the mechanics of its development, such as the role of ionospheric disturbances in the seeding of the Raleigh-Tailor instability. Moreover, spread F activity on the African continent simultaneously exhibits high levels of occurrence and much greater variability than is present in the American longitude sector. A network of GNSS receivers installed in the region offers a great opportunity for experimental investigation of these questions, e.g., [1].

GNSS and UHF receivers at Nairobi collected data routinely starting from 2008, and a GNSS station at Maseno was put into operation in 2011. Equatorial spread F is monitored by the presence of signal scintillations which characterize the severity of the disturbances. Comparison of the scintillation in L-band and UHF-band provides important information on the scale size of the irregularities. Also in 2012 a VIPIR ionosonde was installed at Maseno University which made it possible to measure the altitude distribution of the electron density. The sounder provides an important characterization of the background electron density of the ionosphere which is one of the factors in the spread F development. This work presents first analysis of the statistics of the spread F and scintillation occurrence as observed at Nairobi and Maseno locations. We analyze the climatological distribution of irregularity occurrence at the two locations and also its dependence on solar activity by comparing the data from different years of observations.

Key words: GNSS diagnostics, equatorial spread F, ionospheric scintillations.

References:

[1] Paznukhov et al., (2012), Equatorial plasma bubbles and L-band scintillations in Africa during solar minimum. Ann. Geophys., 30, 675–682