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Comparison of ionospheric scintillation to in situ electron density variations as measured by the Swarm satellites.

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Ionospheric scintillation is known to be caused by rapid variations in the electron density of the ionosphere. It manifests as rapid fluctuations in the amplitude and phase of radio signals traversing the ionosphere. In the case of navigation signals transmitted from satellites of the Global Navigation Satellite System (GNSS) ionospheric scintillation can cause a decrease in the accuracy of position estimation. During extreme fluctuations, a loss of lock on the satellites can occur, which can result in data outages. The ability to estimate the likelihood of ionospheric scintillation is of great importance for precision navigation applications such as GNSS assisted aircraft landing systems.

The altitude at which the electron density irregularities occur can be inferred from a comparison of the variations in electron density as measured by means of Langmuir probes on the Swarm LEO satellites (Swarm A, B and C) and the L-band scintillations on GPS signals detected both by the scintillation monitors on the Swarm satellites and by dedicated GPS scintillation and total electron content monitors (GISTMs) on the ground. The aim of this research is to derive estimates of the altitudes where electron density irregularities occur and to estimate the spatial extent of the irregularities which give rise to amplitude and phase scintillations on the L-band signals from GNSS satellites.

In this paper we present some preliminary results on the characterization of the electron density gradients that lead to ionospheric scintillation through a comparison of conventional scintillation indices derived from GNSS signals recorded by a GPS receiver installed at Pwani University (Geo. Lon: 39.78oE, Geo. Lat: 3.24oS) in Kenya with in-situ measurements of L-band scintillation and electron density on the Swarm satellites during the equinox period March/April 2016.

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