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Comparison of Ionospheric Scintillation recorded by the Gough Island stationary receiver and by a receiver on the SA Agulhas II Polar Research Vessel

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This paper reports the novel use of a dual-frequency GPS Ionospheric Scintillation and Total Electron Content Monitor (GISTM), located on the polar research vessel SA Agulhas II, to identify instances of ionospheric scintillation in the South Atlantic Magnetic Anomaly (SAMA). The SAMA is a region in the South Atlantic Ocean where the Earth's magnetic field is weakest at comparable latitudes resulting in an increased likelihood of precipitation of high energy particles into the ionosphere during geomagnetic storms.

Ionospheric scintillations are rapid fluctuations in the phase and amplitude of trans-ionospheric radio signals resulting from electron density variations along the signal ray path. In this study, the radio signals between Global Positioning System (GPS) satellites and terrestrial receivers are specifically used to quantify these fluctuations.

Traditional scintillation measurements are done using dedicated dual-frequency GPS receivers at fixed terrestrial locations. The SAMA lies predominantly over the ocean and significant portions are beyond the reach of land-based instruments. The GISTM installed on board the SA Agulhas II in 2012 has enabled for the first time the terrestrial measurement of ionospheric scintillation over an extended part of the SAMA. The South African National Space Agency (SANSA) also operates a fixed GISTM on Gough Island, located at 40° 58.90' S, 9° 52' 49.35' W, which falls within the SAMA.

In this project, the amplitude scintillation index (S_{4+}) and phase scintillation index (σ_{Φ}) from 50 Hz L1 signals recorded on board the SA Agulhas II and on Gough Island during the period 15 - 28 September 2014 are analysed and compared for the first time. Position and movement data, as well as Total Electron Content (TEC), number of satellites, and satellite lock-time are used in this study.

It is shown that the movement of the ship introduces significant noise in the phase scintillation data. The noise levels are related to the motion of the ship. Ship-to-Shore comparisons are confined to the period in which the ship is less than 100 km from Gough Island. Geomagnetic storm conditions for the period in question are also investigated to determine whether a significant solar event might have had an influence on the levels of scintillation.

Summary

A comparison study of ionospheric scintillation recorded by the Gough Island stationary receiver and by a receiver on the SA Agulhas II polar research vessel, for the period 15-28 September 2014 during which the instruments were located less than 100 km apart.

Apply to be considered for a student award (Yes / No)?

Yes

Level for award (Hons, MSc, PhD, N/A)?

MSc

**Main supervisor (name and email)
and his / her institution**

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**Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?**

Yes

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