

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Fixed and Broadcast Communications (3)

Author: Dr. Ben Opperman
National Research Foundation (NRF), South Africa

INVESTIGATING POSSIBLE CORRELATIONS BETWEEN MID-LATITUDE ELECTRICALLY
CHARGED PARTICLE PRECIPITATION AND L-BAND IONOSPHERIC SCINTILLATION**Abstract**

Purpose To investigate possible correlations between Energetic Charged Particle Precipitation (ECPP) radiation and L-band ionospheric scintillation over Southern Africa in support of South Africa's bid to host the SKA radio telescope. Reduced geomagnetic shielding over the South Atlantic Magnetic Anomaly (SAMA) leads to increased electromagnetic and energetic charged particle precipitation (ECPP) radiation over this region which extends eastwards over southern Africa. This study was undertaken in the context of radio astronomy-related ionospheric stability requirements for South Africa's bid to host the Square Kilometre Array (SKA) radio telescope. **Methodology** In situ ECPP observations of electron and ion energies observed at 800 km from the Defense Meteorological Satellite Programme (DMSP4), satellite F13's SSJ4 sensor, were compared to Global Positioning System (GPS)-derived S4-proxy amplitude scintillation as observed at three southern hemisphere locations, Gough Island (South Atlantic), Cape Town (South Africa) and Perth (Australia) over solar cycle 23 from 2000 to 2008. The S4-proxy scintillations were derived from 30 second-sampled GPS-derived ionospheric total electron content (TEC) referenced to the GPS L1-frequency (1575.42 MHz). A statistical analysis of the resultant scintillation and ECPP observations were conducted per year, results obtained and conclusions inferred. **Results** The results indicated various levels of ECPP and S4-proxy scintillations. ECPP flux and energy levels were nominally larger over the SAMA region than at the other two locations. As expected, increased ECPP flux and energy levels and increased S4-proxy scintillation were observed during periods of geomagnetically disturbed conditions. The increased occurrences, however, were not necessarily correlated in time and in general very low correlation coefficients between ECPP and S4-proxy scintillations values were observed. **Conclusions** A statistical analysis of the resultant scintillation and ECPP observations could not establish a direct relationship between L-band ionospheric scintillation and energetic charged particle precipitation in this study.