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SPATIAL PHASE DECORRELATION OF TRANS-IONOSPHERIC SIGNALS IN THE EQUATORIAL REGION DERIVED FROM C/NOFS TRI-BAND BEACON TRANSMISSIONS

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Abstract. The spatial decorrelation of V/UHF signals by equatorial ionospheric turbulence was studied by monitoring 150 and 400 MHz signals transmitted from low-earth-orbiting beacon satellites. Analyzing signals from the low-inclination satellite, C/NOFS uniquely revealed longitudinal ionospheric structures. Coherent processing of signals from a linear array of spaced antennas located on Ascension Island was employed to determine the cross-correlation of the phases of the received signals. In order to make these analyses it was necessary to remove the geometrical component of the phase difference between the antennas; this was achieved by adjusting the satellite orbital elements to match the received phase curves.

A series of snapshots (ie independent of temporal effects) of the phase correlation was determined for various satellite overflights. As expected, the VHF signals were more affected by scintillation than the UHF signals. When the signal propagated through patches of strong scintillation, the VHF signal became completely uncorrelated over an ionospheric distance of 130 m, whilst over the same distance the UHF phase correlation decreased to 0.55.

The snapshot approach limited the spatial variations assessed to east-west distances of $\sim 300m$. To extend this range, a novel phase-reconstruction technique was developed to link the snapshots together. In the absence of scintillation the measured decorrelation

distance was $\sim 10km$ at both frequencies, but with increasing scintillation, the decorrelation distance fell to $\sim 100m$ at VHF and 300 m at UHF.

A clear relation between the decorrelation distance of the measured phase and S_4 was observed and a simple empirical model derived.