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USING CITRIS RECEIVER TEC AND RADIO SCINTILLATION DATA TO STUDY LOW-LATITUDE IONOSPHERIC IRREGULARITIES

Carl L. Siefring[⋆], Paul A. Bernhardt[⋆] ans Patrick Roddy[†]

[⋆]Naval Research Laboratory
Plasma Physics Division, Washington
DC 20375, United States

[†]Air Force Research Laboratory
Space Vehicles Directorate Hanscom Air Force Base
MA, USA

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Abstract.

Unique data on ionospheric plasma irregularities from the NRL (Naval Research Laboratory) CITRIS (Scintillation and TEC Receiver in Space) instrument will be presented. CITRIS is a multi-band receiver that recorded TEC (Total Electron Content) and radio scintillations from Low-Earth Orbit (LEO) on STPSat1. The 555+/5 km altitude 35^o inclination orbit covers low and mid-latitudes. The measurements require propagation from a transmitter to a receiver through the F-region plasma. CITRIS used both 1) satellite beacons in LEO, such as the NRL CERTO (Coherent Electromagnetic Radio TOmography) three- frequency beacons transmitting at 150/400/1067 MHz and 2) the French global network of ground-based DORIS (Doppler Orbitography and Radiopositioning Integrated by Satellite) beacons transmitting at 401.25 and 2036.25 MHz.

CITRIS was operated in a complementary fashion with the C/NOFS (Communication/Navigations Outage Forecasting System) satellite during most of its first year of operations. C/NOFS is in an elliptical, 400 km x 850 km altitude, 13 inclination orbit. Along with in-situ diagnostics, C/NOFS carries a three-frequency CERTO beacon. CITRIS and ground receivers can simultaneously measure TEC and scintillations on different paths using the C/NOFS CERTO beacon. When C/NOFS is not in view, CITRIS makes measurements from DORIS beacons and other LEO satellites. Because of the orbital periods, CITRIS will always make measurements at the same longitude as C/NOFS within 48 min. The ability to look at multiple paths is unique and useful for studying the spatial

extent and time duration of irregularities. In the case of Spread-F, ionospheric irregularities start with large scale size density gradients (100s of km) and cascade through complex processes to short scale sizes (10s of meters). It is typically the 100 m to 1 km scale features that harm communication and navigation systems through scintillations. A multi-sensor approach is needed to completely understand this complex system, such as, the combination of CITRIS remote radio sensing and C/NOFS in-situ data. This unique joint data set on plasma structures at low latitudes is a focus of our presentation.

Several types of irregularities have been studied including SpreadF and the newly discovered dawn-side depletions. The data covers large portions of the Earth during a uniquely quite portion of the most recent solar minimum. Irregularity and scintillation characteristics in the Pacific, African and South American sectors where monitored. Comparisons with the physics based SAMI3 model are being performed to help our understanding of the morphology of the irregularities.