Satellite-Based Measurements of Radio Phase Scintillation using CITRIS, DORIS and CERTO

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Unique data on ionospheric plasma irregularities and radio scintillations were collected using the Naval Research Laboratory (NRL) Scintillation and TEC Receiver in Space (CITRIS) instrument. CITRIS is a multi-band receiver that recorded Total Electron Content (TEC), amplitude and phase scintillations from Low-Earth Orbit (LEO) on STPSat1. The 555+/5 km altitude 35° inclination orbit covers low and mid-latitudes, large portions of the Earth (including the Pacific, African and South American sectors), during unusually quite solar activity from April 2007 to March 2009. The measurements require propagation from a transmitter to a receiver through the F-region plasma. CITRIS used both 1) the French global network of ground-based Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) beacons transmitting at 401.25 and 2036.25 MHz and 2) satellite beacons in LEO, such as the NRL Coherent Electromagnetic Radio TOmography (CERTO) three-frequency beacons transmitting at 150/400/1067 MHz.

This talk will concentrate on the analysis of DORIS-to-CITRIS (ground-to-satellite) measurements of phase scintillations. The CITRIS instrument was typically operated on a one second cadence, which is shorter then most phase scintillation measurements reported using ground based receivers (typically 10s to 100s). The rapid apparent motion of the LEO satellite, where a ground pass lasts only ~10 minutes, dictated the shorter time interval for the measurements. We will discuss the analysis of the CITRIS phase measurements for both the DORIS-to-CITRIS and CERTO-to-CITRIS links and compare these with simultaneous amplitudes, amplitude scintillations and TEC data. The CITRIS data indicate that a receiver in space is useful for monitoring and studying ionospheric irregularities and their effects on radio communications and navigation.

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