Scintillation and TEC Receiver in Space (CITRIS) Instrument for Ionospheric Research

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Global ionospheric measurements of total electron content and radio scintillations provide direct inputs for space-weather models and for tracking of ionospheric disturbances. These measurements are acquired with propagation from radio transmitter beacons and receivers through large portions of the F- and E-region plasma. The Naval Research Laboratory (NRL) CITRIS receiver is currently orbiting at 560 km altitude on the STPSat1 satellite in a 35 degree inclination. CITRIS records TEC and radio scintillations from the global network of French the 401.25/2036.25 MHz DORIS beacons and from 150/400 MHz beacon transmitters on the Taiwan ROCSAT3, DMSP/F15, RADCAL, GFO and other satellites in low earth orbit. CITRIS provides ionospheric TEC and radio scintillations in remote regions of the Earth because of the distribution of the 56 DORIS beacons around the globe. The CITRIS satellite-to-satellite measurement capability is new and exciting. A pass can go through the three stages of 1) an ionospheric occultation geometry at large distances, 2) a nearly vertical sounding as the radio beacon passes directly over the receiver and 3) a second occultation. In such cases, it is possible to retrieve absolute TEC with less than 0.1 TECU errors by extrapolating to zero TEC for zero separation between transmitter and receiver. Another new capability for CITRIS is the ability to use three frequencies (150, 400, and 1067 MHz) for TEC measurements, which can also help resolve 360 degree phase ambiguities. We will report on the first six months of measurements for the CITRIS receiver. Future missions in space would benefit from flying CITRIS receivers to give global radio measurements of the ionosphere at 150, 400, 1067, and 2036 MHz.