

## **Preliminary Simultaneous Observations of the Ionosphere with Beacons, In-Situ HF Receiver and Incoherent Scatter Radar in the Polar Cap**

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In the summer of 2017, Coherent Electromagnetic Radio Tomography (CERTO) beacon receivers were installed in the Northern Hemisphere Polar Cap region. One of these is collocated at the Resolute Bay Observatory with the two Resolute Bay Incoherent Scatter Radar systems RISR-N and RISR-C. Simultaneous observations have been made with the CERTO receivers, RISR and HF propagation measurements using the Radio Receiver Instrument (RRI) on the Canadian CASSIOPE satellite that carries the Enhance Polar Outflow Probe (ePOP) suite of plasma diagnostics. CASSIOPE/ePOP hosts both the RRI capable of measuring the in-situ waves in the 10 Hz to 18 MHz frequency range and a Coherent Electromagnetic Radio Tomography (CERTO) beacon transmitter broadcasting coherent signals at 150 MHz, 400 MHz and 1067 MHz. The CERTO signals are used to measure ionospheric Total Electron Content (TEC) and Scintillations of the VHF, UHF and L-band signals along the propagation paths between CASSIOPE/ePOP and the ground based receivers. The TEC measurements provide an indication of 1 km and larger-scale structures in the ionosphere as the satellite passes over the ground-based receivers. The existence and motion of such ionospheric structures are known to effect HF wave propagation in the ionosphere. Coordinated observations were scheduled when CASSIOPE/ePOP passed over Resolute Bay. We will discuss preliminary results from these data sets with emphasis on the effects of ionospheric structure on the propagation of HF waves. Observations in the Polar Cap region are relatively rare and it is hoped such measurements will lead to better understanding of HF propagation conditions and phenomena that effect propagation in this region.

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