Remote Sensing of Ionospheric Irregularities over Resolute Bay with GNSS and Beacon Signal Propagation through Gradient-Drift Instability

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Ionospheric irregularities produce scintillations on the signal propagating through them. SIGMA (Satellite-beacon Ionospheric-scintillation Global Model of the upper Atmosphere) is a model that simulates radio signal propagation through random media (Deshpande et al., *J. Geophys. Res. Space Physics*, 119, 4026-4043, 2014). We have recently combined SIGMA with first principles-based plasma model, GEMINI (Geospace Environment Model of Ion-Neutral Interactions) that generates irregularities with very high resolution (200 m) and mesoscale extent (50-100km) (Zettergren et al., *Geophysical Research Letters,* 42 (23), 2015). We simulate gradient drift instability (GDI) over Resolute Bay through GEMINI depicting polar cap patches and propagate radio frequencies at GPS signal frequencies as well as VHF (150.012 MHz) and UHF (400.032 MHz) frequencies using SIGMA. The GDI will be initialized using medium-scale contextual information from RISR observations. The simulated data will be compared with the observations over Resolute Bay from a GNSS receiver and Coherent Electromagnetic Radio Tomography Beacon (CERTO beacon). We will perform inverse modeling (Deshpande et al., *J. Geophys. Res. Space Physics*, 121, 9188–9203, 2016) to estimate some of the physical characteristics of the irregularities. This study will provide us with some answers to how ionospheric structures of intermediate scale sizes especially from polar cap patches impact navigation and communication signals.