Analysis of Scintillation Events in the Auroral and Polar Cap Regions

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High-rate Global Positioning System (GPS) scintillation data were acquired by the Canadian High Arctic Ionospheric Network (CHAIN) of receivers during a geomagnetic storm which occurred on 11/06/2015. During the storm, a series of phase scintillation events were identified by the Arctic Bay, Eureka, and Resolute receivers. These events, which were located in the Auroral and Polar Cap regions, are thought to be associated with a series of polar cap patches, auroral precipitation, a flow channel, and an auroral arc. The data acquired during these events were inverted using the Satellite-beacon Ionospheric-scintillation Global Model of the upper Atmosphere (SIGMA) (K. B. Deshpande, et al., J. Geophys. Res. Space Physics, 119, 2014, 4026– 4043) numerical phase screen model, and Rino's classic analytic phase screen model (C.L. Rino and E.J. Fremouw, Journal of Atmospheric and Terrestrial Physics, Volume 39, Issue 8, 1977, 859-868). The goals of the inversion were to estimate the ionospheric irregularity parameters associated with the structures, while exploring the limitations of the models. Initial results indicate that the irregularities associated with the polar cap patches were predominantly composed of moderately elongated rods interbedded within sheet and wing like electron density structures. Analysis of the spatial and temporal distribution of the axial ratio values indicates that the measured phase scintillation indices increase roughly proportionally with axial ratio values for the rods but remain roughly constant for wings and sheets. These findings indicate that while wings and sheets can produce phase fluctuations, it is the apparent existence of rods that mark the occurrence of plasma processes that lead to the formation of field-aligned irregularities that produce phase scintillations which are most significant.