Vita

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Universities Attended:

University of Toronto (2018)
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<u>Conferences Presentations/Publications:</u>

L. Nikitina, R. Fiori, E. Braden. Space Weather Services for the Canadian Coast Guard (CCG). Preparation of Services related to Space Weather Impacts to the Canadian Coast Guard: Development of a scintillation forecast with use of a geomagnetic forecast operational system. Natural Resources Canada, 2021.

Braden, E. J., Jayachandran, P. T. (2020, February). A statistical look at the Fresnel frequency of ionospheric scintillation in the high latitude region using a new piecewise fitting technique. In Division of Atmospheric and Space Physics (DASP), 2020.

Braden, E. J., Jayachandran, P. T. (2022, February). A statistical look at the 98 Fresnel frequency of ionospheric scintillation in the high latitude region using a new piecewise fitting technique. In Division of Atmospheric and Space Physics (DASP), 2022.

Braden, E. J., Jayachandran, P. T. (2022, July). A statistical look at the Fresnel frequency of ionospheric scintillation in the high latitude region using a new piecewise fitting technique. In Committee on Space Research (COSPAR), 2022.

A statistical analysis of the Fresnel frequency of ionospheric scintillation in the high latitude region using a piecewise fitting technique

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Edward J. Braden

in the Department of Physics

U.N.B., Fredericton, N.B.

Wednesday, August 31st, 2022
2:00 p.m.

Via MS TEAMS

Examining Committee

Dr. P.T. Jayachandran	Supervisor
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Abstract

Changes in electron density in the ionosphere affect the refractive index of the medium and as a result can affect the amplitude and phase of a trans-ionospheric radio wave. For an L-band signal, such as that used in the Global Positioning System (GPS), large-scale changes in electron density will cause purely refractive changes in the signal, while smaller scale structures may induce diffractive changes. Disturbances which cause these diffractive changes are called ionospheric scintillation. Refractive changes to a signal are deterministic and are therefore mitigatable, where as diffractive changes are stochastic. In order to differentiate between these effects, it is important to determine the Fresnel frequency, the threshold frequency in which diffraction can affect the signal. The Fresnel frequency depends upon the frequency of the trans-ionospheric wave, the relative height of the ionospheric inhomogeneity to the receiver, as well as the relative drift speed between the wave source and ionospheric irregularity relative to the receiver. In this thesis, an automated technique to determine the appropriate Fresnel Frequencies of a given scintillation event will be discussed. To determine the values, the technique uses a piecewise linear regression with dynamic breakpoints to fit the frequency spectra of the amplitude of a signal. Using this method, 3 years worth of scintillation data from three different stations from CHAIN has been used to take a statistical look at the Fresnel frequencies using numerous scintillation events. The resulting data suggests that the Fresnel frequencies are dynamic in the high latitude region and indeed do range well above the 0.1 Hz detrending frequency.