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Three-Dimensional Modeling of High-Latitude Scintillation

Abstract:

Global Navigation Satellite Systems (GNSS) signals exhibit rapid fluctuations at high and low latitudes, believed to be caused by ionospheric refraction and diffraction. This study focuses on the high-latitude problem, where the ionospheric irregularity region cannot be approximated to a thin layer in the direction of signal propagation. The nature of the high-latitude problem necessitates a fully three-dimensional multiple phase screen modeling approach, based on the work of Rino [1979]. Here, scintillation observations are explained using contemporaneous measurements that specify the large-scale dynamics within Deshpande et al.'s [2014] scintillation model, Sigma. Data from Incoherent Scatter Radar and SuperDARN HF radar define the macroscopic environment within which scintillation processes occur.

Rino, C. L. (1979), A power law phase screen model for ionospheric scintillation I – Weak scatter, *Radio Sci.*, 14, 1135-1145

Deshpande, K.B., G.S. Bust, C.R. Clauer, C.L. Rino & C.S. Carrano (2014), Satellite-beacon Ionospheric-scintillation Global Model of the upper Atmosphere (SIGMA) I: High-latitude sensitivity study of the model parameters