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Regional Arctic observations of TEC gradients and scintillations

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In recent years, there has been growing scientific interest in Arctic ionospheric properties and variations. However our understanding of the fundamental ionospheric processes present in this area is still incomplete. GNSS networks present in Greenland today make it possible to acquire near-real time observations of the state and variations of the high-latitude ionosphere. This data can be employed to obtain relevant geophysical variables and statistics.

In our study GPS-derived total electron content (TEC) measurements have been complemented with amplitude scintillation indices (S_4), and phase scintillation indices (σ_φ). The investigation of the relationship between these geophysical variables will likely lead to new ways to study the underlying physical processes and to build tools for monitoring and predicting large-scale patterns in Arctic TEC and scintillations.

A number of specific ionosphere events will be presented and the underlying geophysical process will be identified and described. In particular, results will be presented where large-scale gradients in the regional TEC are compared with the growth of scintillations.

The statistics of the scintillations will be investigated, with emphasis on how well the scintillations follow the Nakagami-m distribution. The spectra of both the intensities and phase will be calculated, and the corner frequency of these spectra will also be determined. These corner frequencies will be used to compute a number of important geophysical and ionospheric parameters. Furthermore, we will discuss how the spectral characteristics of the scintillations during large TEC gradients vary, and how values of the power spectra slopes change during increasing scintillations. These values will be validated against values found in prior studies. TEC and scintillation time-series and maps will also be presented over the Greenlandic region. We will show how the expansion of the auroral oval during geomagnetic storms can be detected from GNSS-derived data. We will then investigate the correlation between TEC and ionospheric indices.