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Regional Arctic observations of TEC gradients and scintillations

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There has been a growing scientific interest in the Arctic ionospheric properties and variations during the recent years. However, our understanding of the fundamental ionospheric processes present in this area is still incomplete. Today GNSS networks present in Greenland 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 relations of these geophysical variables can lead to possible new ways to study the underlying processes and to build tools for monitoring and predicting Arctic TEC and scintillation large-scale patterns.

A number of specific ionosphere events will be presented and the underlying geophysical process will be identified and described. Especially results 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.