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Multi-instrument observations of solar EUV irradiance induced ionospheric variations in the Arctic polar cap

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In this study we investigate the long-term changes in Arctic TEC and phase scintillations at larger spatial scales. We employ 4-year (2012 to 2015) data of TEC observations derived from GNSS ground stations, digital ionosonde data, northern polar cap index (PCN) data, solar F10.7 and EUV emissions, and various solar wind parameters. At these long time-scales the effects of individual geomagnetic storms are considered to be negligible for nearly all practical considerations. In order to eliminate local disturbances and be able to assess large-scale TEC variations, mean vertical TEC (MVTEC) was selected as a measure of mean electron content over a large area at a certain epoch. The particular GNSS ground station location was selected to minimize auroral oval and midlatitude effects in the data set. At these spatial and temporal scales, climatological TEC effects are being observed in the polar cap ionosphere. The main drivers behind the space weather variations are the Sun, the solar wind, and magnetospheric reconnections. Three distinct phenomena will be discussed that could explain the main features of a set of 4-year regional electron density observations obtained from the Thule GNSS site, deep in the Arctic region. (1) The high MVTEC variability near the equinoxes. (2) Solar spectral irradiance (SSI) EUV-related 27-day fluctuations. (3) Significant variability in seasonal MVTEC time-series will be investigated by an E-layer conductance dependent diffusion model.