

Characteristics of the electron density profiles in the polar ionosphere using long-term incoherent scatter radar observations

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We investigate the climatological characteristics of the polar ionosphere in comparison with the mid-latitude ionosphere using incoherent scatter radars (ISR) observations at Svalbard (78.15N, 16.05E), Tromso (69.59N, 19.23E), and Millstone Hill (42.6N, 288.5E) during the 20-year period of 1995 - 2015. Diurnal variations of electron density profiles from 100 to 500 km are compared among the three radar stations during equinox, June solstice and December solstice for different solar and geomagnetic activities. In the polar ionosphere, the diurnal variation is much weaker in summer than that in other seasons. In winter, there are two peaks in the polar cap region (Svalbard) and a distinct daytime peak with secondary peak near midnight in the auroral region (Tromso), which is dramatically different from the mid-latitude ionosphere. There are also significant differences in the seasonal variabilities. The winter anomaly is apparent at Millstone Hill, while it is not evident at Svalbard. At Tromso, the winter anomaly is seen only during high solar activity. The semi-annual anomaly occurs at Tromso but it appears only during high solar activity at Svalbard. Regarding the height profiles of the electron density, the daytime hmF2 in the mid-latitude ionosphere increases gradually with time until midnight at Millstone Hill. During geomagnetically disturbed time, however, the density peak appears at nighttime in the lower altitude region at Tromso, but not at Svalbard. We also investigate the correlation between ionospheric peak parameters and geophysical indices (F10.7, Kp, and AE) in the polar and mid-latitude ionosphere, and the results and related discussions will be presented.