D- and E-region ion temperature measured with EISCAT radar facility

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The energy from the solar wind is mainly transported to the polar upper atmosphere and causes various phenomena such as auroras characterized by their rapid variability in time and space. Incoherent scatter radars (ISR) located in high latitude are one of the most powerful tools to investigate generation mechanisms of such phenomena and their effects on the atmosphere. The ISR basically gives information of plasma parameters between the bottom-side and topside ionosphere. However, ISRs have several unavoidable limitations to derive ionospheric parameters in the D- and E-region ionosphere, due to limited information in the ISR spectra. In particular, D- and E-region temperature in the polar ionosphere measured with ISRs has not been fully verified by using other temperature measurements.
We have investigated ion temperature variations in the D- and E-region using the EISCAT UHF radars located in Tromsoe, Norway. Our results show that a lower limit of reliable ion temperature derivation was about 87 km altitude at noon in winter. Time variations of the daytime ion temperature at altitudes between 88 and 95 km derived from EISCAT were very close to those of ambipolar diffusion coefficients at the same altitudes from the Tromsoe meteor radar data even when geomagnetic activity was high. This indicates that ion temperature at 88-95 km altitudes seems to be equal to neutral temperature at the same altitudes. We discuss what decides lower limits of the reliable ion temperature derivation, based on EISCAT data analysis under several geomagnetic/geophysical conditions.

Keywords: upper atmosphere, temperature , Incoherent scatter radar

