Average field-aligned ion velocity over the EISCAT radars

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Long-term measurements by the EISCAT radars at Tromsø and Svalbard are used to determine the climatology of the field-aligned ion velocity in the F-region ionosphere (175–475 km) at high latitudes. The average ion velocity is calculated at various altitudes and times of day. The magnitude of the average field-aligned ion velocity is on the order of 10 m/s, similar to previous results at middle and low latitudes. During daytime the direction of the average field-aligned ion velocity changes from downward to upward around 350 km, while during nighttime it is upward at all heights. The reversal height of the daytime field-aligned ion velocity depends on solar activity. It is elevated by more than 100 km during high solar flux periods compared to low solar flux periods. The TIE-GCM model reproduces the main features of the field-aligned ion velocity climatology. The simulation results suggest that the plasma pressure gradi1ent force and gravity force play a dominant role for the daytime field-aligned ion motion. The height pattern of the field-aligned ion velocity tends to be preserved in different solar activity conditions at constant pressure surfaces, but not at constant altitudes, which explains the observed dependence on solar activity. During nighttime, the effect of the neutral wind dominates the field-aligned ion velocity.