Studies of disturbances in the polar ionosphere and thermosphere with the EISCAT radar system and whole atmosphere GCM

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We have investigated the effects of the energy inputs from the magnetosphere into the polar ionosphere and thermosphere on the energetics and dynamics of plasmas and neutrals using the EISCAT radar system. The EISCAT observations have revealed that some ionospheric disturbances are generated in the northward of Longyearbyen even during geomagnetically quiet periods although solar wind variations would cause stronger heating of the ionosphere at Tromsø than that at Longyearbyen. These observations suggest that the strength of the local electric field and size/location of the auroral oval would be important for enhancements of plasma density, temperature, and drift velocity. Numerical simulations by a whole atmosphere GCM also show changes in the neutral wind and temperature in the polar cap thermosphere depending on the size of the auroral oval. In order to understand the weather of the polar ionosphere and thermosphere, particularly in the polar cap region, we should clarify basic features of the plasma and neutral atmosphere in the region. In the present study, we will show the ionospheric variations quantitatively, e.g., amplitudes of the variations, locations of the disturbances, and their spatio-temporal scales, from the EISCAT observations. In addition, we will perform numerical simulations to examine contributions of Joule heating (or pressure gradient force) and ion drag force to set up the thermospheric temperature and wind distributions.