

Climatology of the polar thermosphere and ionosphere

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Recent observations from satellites and ground-based instruments have clarified various phenomena in the polar thermosphere and ionosphere, in particular, the cusp and polar cap region. The CHAMP satellite observations for a decade were the great success to understand the mass density variations in the global thermosphere. However, some basic features and/or climatology of the polar thermosphere and ionosphere seem to be still unknown. For example, amplitudes of the temperature and wind variations during a solar cycle are not exactly known in the local area in and/or in the vicinity of the cusp/polar cap region. In addition, contributions of the lower atmosphere to the temperature and wind variations in the thermosphere seem not to be understood quantitatively in each local area. In order to understand climatology of the polar thermosphere and ionosphere, we have made some observations with the EISCAT radar system and optical instruments in 2011-2015 and performed numerical simulations with a whole atmosphere GCM. The five-year observations of the polar ionosphere with the EISCAT radar system show the large difference between the ionospheres over Longyearbyen and Tromsø; variations of the dayside ion temperature and ion motion at Longyearbyen are larger than those at Tromsø on average during geomagnetically quiet periods. The EISCAT data during the extremely low solar activity 2007-2008 have also clarified the basic state of the ionosphere which would be strongly affected by the lower atmosphere. We will show the recent progress of our understandings of basic features of the polar thermosphere and ionosphere from the observations and GCM simulations.

Keywords: thermosphere, ionosphere, polar region, EISCAT, GCM, simulation