Geophysical Research Abstracts
Vol. 14, EGU2012-8774, 2012
EGU General Assembly 2012

Energy exchange rates between the ionosphere-thermosphere system and the magnetosphere at high latitudes

A. Aikio, L. Cai, T. Nygren, and R. Kuula
Dept. Physics, University of Oulu, Finland (anita.aikio@oulu.fi)

The magnetosphere and the ionosphere-thermosphere system exchange energy in the form of electromagnetic energy flux, accompanied by electric fields and field-aligned currents, as well as in the form of precipitating particle fluxes. In this study, we examine the first form of energy exchange by using a one-month database obtained by the EISCAT incoherent scatter radar measurements in Tromso. The electromagnetic energy exchange rate can be further divided into ion-neutral frictional heating rate (sometimes called Joule heating) and work done on neutrals. The ion-neutral frictional heating rate depends on Pedersen conductivity and on ionospheric electric fields, measured in the frame of reference moving with the neutrals. The role of neutral winds has been an open question, since it is difficult to measure them. The CP2 scan mode of the EISCAT radar makes it possible to deduce neutral winds in the E region and hence to estimate the role of neutral air motion (e.g. tidal winds and atmospheric gravity waves) in the energy exchange rates.

In this talk, we will present the magnetic local time (MLT) dependence of height-integrated quantities: electromagnetic energy exchange rates (Q_{EM}), ion-neutral frictional heating rate (Q_J) and work done on neutrals (Q_m) for different magnetic activity levels categorized by the Kp index. We will show that the role of winds is different in different MLT sectors (e.g. dusk vs. dawn) and at different activity levels. We will also show that on rare occasions the ionosphere can act as a dynamo generating electromagnetic energy that may propagate to the magnetosphere.