Response of the thermospheric wind to electromagnetic energy inputs from the magnetosphere

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Electromagnetic energy transferred from the magnetosphere to the high-latitude ionosphere is one of important sources that drive the electrodynamics and dynamics in the coupled ionosphere-thermosphere system. Based on measurements by the European Incoherent Scatter (EISCAT) radar in Tromso, we studied dependences of electromagnetic energy exchange rates on the magnetic local time (MLT) and the geomagnetic activity in the E-region ionosphere. We found that the neutral wind play an important role in the partition of electromagnetic energy. Most of the electromagnetic energy is converted to Joule heating, but some residual parts can be consumed for accelerating the neutral wind in the lower thermosphere. Partition process of the electromagnetic energy highly depends on altitude according to the height profile of neutral winds.

Although most of the electromagnetic energy dissipates in the E region, the energy dissipation rate per unit mass has a peak in the F region due to the exponential decrease of the neutral density. As a result, neutral temperature, density, and neutral wind velocity have stronger response in the upper thermosphere. We utilize Fabry-Perot interferometer (FPI) with the wavelength of 630.0 nm in Tromso to measure the neutral wind velocity in the F region. We will show clear westward acceleration of winds in the evening sector in association with large electromagnetic energy inputs and auroral activities. The mechanism of acceleration has not been fully understood yet. Ion drag force is usually thought to be the dominate force. On the other hand, Joule heating can increase the pressure gradient that contributes to the wind acceleration. The relative importance of the two forces will be discussed.