極域熱圏の電磁エネルギー散逸と風速ダイナミクス

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Electromagnetic energy dissipation and wind dynamics in the polar thermosphere

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At high latitudes, electromagnetic and particle energies are transferred from the magnetosphere to the ionosphere and the thermosphere. The polar ionosphere and thermosphere act as an energy and particle sink, where the energy is transformed into both heated and accelerated plasmas and neutral particles. The former and latter processes can be regarded as thermal and mechanical energy transformation, respectively. These processes result in wind acceleration and atmospheric gravity waves in the polar thermosphere with various spatiotemporal scales. The majority of these thermospheric wind variations are regarded as the passive response to the energy input from the magnetosphere. However, the thermospheric winds can also play an active role in the coupled Magnetosphere-Ionosphere-Thermosphere system. We have studied the thermospheric wind dynamics at high latitudes analyzing data measured with incoherent-scatter radars and optical instruments. This paper will review our recent results that (1) the polar thermospheric wind can be quickly changed its direction and magnitude within a few minutes responding to the auroral activity even in the lower thermosphere, (2) the vertical neutral-wind speed can exceed a few tens m/s in association with ionospheric heating but not quantitatively understood in the energy budget, (3) horizontal shear of 10 km scale can be generated in the thermospheric wind around the auroral arc, and (4) frictional heating is depressed by the neutral wind if the neutral wind has already responded to the high-speed ions.