

Energy budget in the polar lower thermosphere under the existence of strong horizontal wind/shears

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The strong horizontal neutral winds with strong vertical shears have been found in the upper mesosphere and lower thermosphere by many previous studies. These winds seem to be blowing usually and exist globally in this region (e.g. Larsen, 2002). The generation mechanism of the winds is, however, still unknown and is one of the most important issues for physics of the mesosphere and thermosphere. Furthermore, transports of molecules, momentum, and energy under the existence of such a wind field are also interesting. In particular, since the electromagnetic energy transferred from the magnetosphere is strongly affected by the neutral wind (e.g. Fujii et al, 1999; Thayer, 2000), the electromagnetic energy dissipation rate in the presence of such a wind field should be estimated quantitatively. Strong wind shear (more than 50 m/s/km), which is occasionally observed in the lower thermosphere, suggests the generation and maintenance of turbulence and the turbulent energy dissipation, and transport processes are expected in the region. Fujiwara et al. [2004] estimated both the electromagnetic and turbulent energy dissipation rates simultaneously using the European incoherent scatter Svalbard radar data. In the present study, we estimate the auroral particle heating, solar ultraviolet heating, heat conduction and infrared cooling in addition to the above energy dissipation rates. It is known that these heating/cooling rates show almost the same magnitudes in the mesosphere and lower thermosphere. The quantitative estimation for all the heating/cooling rates is, therefore, quite important at each altitude in the mesosphere and lower thermosphere in various conditions. We also discuss the effects of the heating/cooling processes on the energetics and temperature in this region.