Modeling of the global structure of vertical winds in the polar thermosphere

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There have been a number of reports on very strong vertical winds in the polar thermosphere. The magnitude of the vertical winds sometimes exceeds 50 m/s in the upper thermosphere. Although vertical winds less than about 20 m/s could be generated by Joule heating or particle precipitation in the auroral region, large vertical winds exceeding 50 m/s in the thermosphere are unlikely to be driven by local heating processes alone. Two- and three-dimensional non-hydrostatic thermosphere-ionosphere models have been developed and used to investigate the cause of the very large vertical motion in the polar thermosphere. The results were compared with data obtained by the Fabry-Perot Interferometers and by the EISCAT (European Incoherent Scatter) radar in the polar thermosphere.

The polar thermosphere has been studied for a long time. Recent observations from ground and space have shown that the dynamics of the thermosphere is far more complicated than we thought. Although a number of simulation models of the thermosphere have been developed, behavior of the thermosphere has not been fully understood. In particular, large vertical wind in the polar thermosphere is still a mystery. There have been a number of reports on very strong vertical winds in the polar thermosphere. The magnitude of the vertical winds sometimes exceeds 50 m/s in the upper thermosphere. Although vertical winds less than about 20 m/s could be generated by Joule heating or particle precipitation in the auroral region, large vertical winds exceeding 50 m/s in the thermosphere are unlikely to be driven by local heating processes alone. In fact, some of the large upwelling and downwelling events do not associated with strong heating processes. In such cases, interaction processes between the global wind system and the local wind system might play an important role in generating strong vertical winds. Two- and three-dimensional non-hydrostatic thermosphere-ionosphere models have been developed and used to investigate the cause of the very large vertical motion in the polar thermosphere. The results were compared with data obtained by the Fabry-Perot Interferometers and by the EISCAT (European Incoherent Scatter) radar in the polar thermosphere.