IMF dependence of the midnight thermospheric wind at an auroral latitude based on 9 winter measurements in Tromsø, Norway

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The ionosphere is partially ionized plasma, but the particle minority of ions plays an important role in controlling dynamics of the thermosphere. Particle collision is the fundamental process for momentum transfer from ionospheric ions to thermospheric neutral particles (Oyama et al., 2023). The ionospheric plasma flow pattern at high latitudes depends on the direction of the interplanetary magnetic field (IMF), and the pattern may be projected on the thermospheric wind. However, the dependence is not yet well understood. A thermospheric wind dataset from a Fabry-Perot interferometer (630 nm) and the ion velocity from a Dynasonde in Tromsø, Norway, was analyzed for 9 winter seasons to study the dynamics of the thermosphere and F-region ionosphere at an auroral latitude. This study focused on bifurcation in the zonal component of the neutral wind and ion velocity at midnight and its dependence on the Y component of the IMF. Ionospheric plasma convection patterns are evidently imprinted on the thermospheric wind variations as aspects of the westward and eastward accelerations at dusk and late morning, respectively. The zonal wind bifurcates immediately before midnight for IMF $B_y<0$, but for $B_y>0$, it inverts gradually into the postmidnight sector. Neutral wind streams, originating from higher latitudes, may result in the dependence because of anti-sunward plasma flow distorted in the polar cap.

References

Oyama, Si., Aikio, A., Sakanoi, T. et al. Geomagnetic activity dependence and dawn-dusk asymmetry of thermospheric winds from 9-year measurements with a Fabry–Perot interferometer in Tromsø, Norway. Earth Planets Space 75, 70 (2023). https://doi.org/10.1186/s40623-023-01829-0