電離圏へのエネルギー流入と酸素及び水素イオン流出との経験的関係式の太陽天頂角依存性

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Solar zenith angle dependence of empirical formulas between energy inputs to the ionosphere and O^+ and H^+ ion outflows

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Recent satellite observations and simulations have clarified that plasma outflows play an important role in abrupt changes in the ion composition in the plasmasheet and ring current during geomagnetic storms. Statistical studies by *Strangeway et al.* [2005] and *Brambles et al.* [2011] indicated that fluxes of ion outflows are correlated well with soft electron precipitation (precipitating electron density and electron density in the loss cone), and DC and Alfvenic Poynting fluxes using the data obtained by the FAST satellite near the cusp region in the dayside during the 24-25 September 1998 geomagnetic storm. To evaluate the correlations for H^+ and O^+ ions separately, we performed statistical studies using the ion composition data in addition to the ion, electron, and field data obtained by the FAST satellite during January 1998 and January 1999. The longer dataset enables us to identify empirical formulas between outflowing O^+ and H^+ ion fluxes and precipitating electron densities, DC and Alfvenic Poynting fluxes in a wide solar zenith angle (SZA) range (45°–145°). These empirical formulas would be useful for global magnetospheric simulations as the boundary conditions. Under dark conditions, H^+ ion fluxes increases with increasing precipitating electron density, but not as much as those do under sunlit conditions. The precipitating electron density that corresponds to the H^+ ion flux of ~10^7 /cm^2/s (mapped to 1000 km altitude) decreases with increasing SZA. This SZA dependence is less clear for O^+ ions as compared with H^+ ions. The empirical formulas between outflowing O^+ and H^+ ion fluxes and DC and Alfvenic Poynting fluxes are not so strongly affected by SZA. Under sunlit conditions, the flux O^+ ions tends to be larger than that of H^+ ions, while H^+ ions tend to become dominant under dark conditions. Intense ion (especially O^+ ion) outflow events (number flux larger than ~10^8 /cm^2/s mapped to 1000 km altitude) mostly occurred under sunlit conditions or near the terminator.

References

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