

Spatial-scale dependence of temporal variability in the mesoscale plasma flow in the dayside high-latitude ionosphere

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Plasma convection occurring in the high-latitude ionosphere is thought to be largely determined by the solar wind and magnetospheric conditions for large-scale structures with latitudinal spatial scales exceeding a few hundred kilometers. It is also widely accepted that for small-scale structures, such as those below about 10 km, the variability in the plasma flow is associated with Alfvén waves propagating along the magnetic field line. The motivation for this study is to understand what unique properties exist in the mesoscale plasma convection, which is an intermediate scale between the two above-mentioned scales, independent of control by external variables such as IMF and of occurrence of the Alfvén wave variations. In this study we focus on dayside mesoscale plasma flow structures with latitudinal spatial scales from 20 km to 250 km, and identify the spatial scale dependent properties in the temporal variability of the mesoscale plasma flow. We analyzed ion drift data from the Swarm satellites, and examined in detail the data obtained during the period when two of the three Swarm satellites were flying in nearly identical orbits in the MLAT-MLT coordinates with a time difference ranging from about 20 s to 180 s. We show which spatial scale has the most pronounced fluctuations for a given time difference, and discuss this result in terms of MLT.

Keywords: High-latitude ionosphere, mesoscale plasma flow, Swarm satellites, cusp