Origin of the SuperDARN broad Doppler spectra: First observational evidence from Oersted satellite magnetometer

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Field-aligned plasma irregularities in the dayside high-latitude ionosphere are known to have broad Doppler spectra which are distinct from those in the other regions. Simulation study by Andre et al. (1999, 2000a, 2000b) pointed out that the broad spectral widths observed in the dayside high-latitude ionosphere result predominantly from time-varying electric field in the Pc1-2 frequency range. However, no substantial observation has supported their prediction. We perform a case study of a favorable conjunction of overpass of the Oersted satellite with the field-of-view of the SuperDARN Syowa East radar during an interval of the southward IMF Bz. At the time, the radar observed L-shell aligned boundary in the spectral width around the dayside ionosphere. Simultaneously, high-frequency (0.2-5 Hz) magnetic field fluctuations were observed by the Oersted satellite high time resolution magnetometer. These magnetic field fluctuations are considered to be Alfven wave possibly associated with the particle which precipitates into the dayside high-latitude ionosphere when magnetic reconnection occurs. Our observation clearly demonstrates that the boundary between narrow and broad spectral widths is well corresponding to the boundary in the level of the fluctuations, which can provide a direct evidence for the previous theoretical prediction. A close relationship between electric and magnetic field fluctuations and particle precipitations during southward IMF conditions has been confirmed by many authors. The present observation suggests that the boundary between narrow and broad Doppler spectral widths observed in the dayside ionosphere is connected with the signature of the open/closed field line boundary such as the cusp particle precipitations and the red line (630 nm) auroral emissions via electric and magnetic field fluctuations for the case of the negative IMF Bz conditions.