Dynamics of duskside proton aurora associated with fast sunward convection flows : November 26, 2000 event

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Imaging of proton aurora is one of excellent probes to monitor magnetospheric dynamics.

In the period 15-16 UT on November 26, 2000 large enhancements of proton aurora activity occurred in the cusp and duskside region. Before this time period, two distinct solar wind fast shocks observed by the ACE spacecraft identified SSCs at 07:58 and 11:58 UT on the ground.

By comparing the IMF data obtained by ACE in the interplanetary region at (220, 30, -15 Re) and the Geotail at the dusk side magnetopause at (2, 9, -2 Re), the IMF condition observed by ACE is estimated to arrive on the magnetosphere by 43 minutes later.

The FUV data from the IMAGE satellite showed that IMF southward turning from 10 nT to -10 nT in the Bz component induced large enhancements of proton aurora in the cusp region at 15:25 UT, and that the enhanced proton aurora decayed at 15:35 UT when IMF turned northward again. It should be noted that solar wind pressure decrease from 20 nPa to 10 nPa and IMF westward turning from 15 nT to -15 nT in the By component were also occurred around 15:30 UT.

Intense proton aurora appeared in the dusk sector at 15:25 UT and it was further intensified gradually until 15:42 UT. Then proton aurora activity decreased gradually and returned to the previous level at 15:56 UT. On the other hand, proton aurora activity was enhanced in the midnight sector associated with a small substorm appeared at 15:48 UT. Proton aurora oval in the cusp and dusk sector was shifted equatorward by 5 degrees during the period of 15:25 - 15:42 UT.

The SuperDARN network data showed that the two-cell convection pattern was intensified and plasma convection velocity greatly increased after the IMF southward turning. In the dusk sector the region of strong sunward flow with a speed of more than 1 km/s appeared with its center around 16 MLT and 75 MLAT at 15:30 UT. The center of the intense sunward flow region shifted gradually to the dusk sector around 18 MLT and 68 MLAT at 15:50 UT. The flow velocity became weak after 16:02 UT. These intense sunward flow region was located close to the enhanced proton aurora region but with a slight sunward shift.

During this time interval, KH-wave like structures were observed by Geotail satellite in the duskside LLBL region when IMF was under southward conditions.

By comparing proton aurora images obtained by the IMAGE/FUV instrument with charged particle data obtained by DMSP and GEOTAIL spacecraft, it is inferred that these proton aurora enhancements are due to precipitation of protons with energies of about 10 keV in the boundary plasma sheet (BPS) adjacent to the dusk sector magnetopause. From the obtained relationships between proton auroral dynamics and solar wind variations, we will discuss the mechanisms of solar wind - magnetosphere interaction