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CHARACTERISTICS OF THE DIFFUSE ION PRECIPITATION DURING NORTHWARD IMF COMPARED TO THE CUSP ION PRECIPITATION (EXTENDED ABSTRACT)

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The low energy particle (LEP) detector on the polar-orbiting satellite Akebono (EXOS-D), at altitudes of several thousand km, detected ion precipitation along the polar cap boundary (about 72 to 79 invariant latitude) at all local times except the midnight sector. The ion energy is not sharply peaked but ranges from several hundred eV to a few keV. These ions were observed on the polar side of the CPS-type diffuse electron precipitation, and almost under the northward interplanetary magnetic field (IMF) conditions. The electron precipitation observed with these ions has the average energy of a few hundred eV and sometimes shows spiky structures. These electron characteristics resemble those accompanying the cusp ion precipitation around noon. The ions in question, however, can be distinguished from the cusp ion precipitation on the following grounds. One of the characteristics of cusp ions is that their energy depends on their pitch angle due to the time-of-flight effects from the injection points. Another known characteristic of cusp ions is that an energy-time dispersion can be seen along the convection path of magnetic field lines. The ions in question do not possess these characteristics.

Our analysis indicates that the temperature of these ions is correlated with the sheath ion temperature deduced from solar wind parameters. This correlation is also found for cusp ions. Cusp ions originate in the solar wind and are injected along the field lines connecting to IMF, so that they are expected to be on open field lines. Do the ions in question also occur on open field lines? From the several EXOS-D paths for which cusp ions are observed in juxtaposition to these ions, we confirmed that these ions occur at latitude lower than the open-closed boundary of field lines, as determined from the lower latitude edge of the cusp ion energy dispersion. We conclude that these ions occur on closed field lines.

However, it is hard to consider that the source of these ions is the plasma sheet. One of the reasons is that these ions are scarcely observed in the midnight sector (about 2200 to 0200 magnetic local time) regardless of IMF conditions. Secondly, the energy (about a few hundred eV) of electrons simultaneously observed with these ions is lower than that of discrete auroral electrons seen at the midnight sector

(about 1 keV). Finally, mapping of the ion layer to the magnetospheric equator using the Tsyganenko magnetic field model suggests that the layer is mapped to the region inside the dawn/dusk magnetopause.

It is expected that these ions precipitate along closed field lines, not from the plasma sheet but from the region close to the magnetopause. In many cases, these ions are observed when the IMF is directed northward. We infer that, during the northward IMF, a unique region is formed inside the dusk and dawn magnetopause, to which plasma sheet electrons do not have access because of a weak night-to-day convection, whereas the sheath ions can enter probably through the formation of LLBL (We set aside the question of how LLBL itself is produced).

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