Statistical study of multiple ion band structures observed by the FAST satellite

Yao Yao[1]; Kanako Seki[1]; Yoshizumi Miyoshi[2]; James P. McFadden[3]; Eric J. Lund[4]; Charles W. Carlson[5]
[1] STEL, Nagoya Univ.; [2] STEL, Nagoya Univ.; [3] SSL, UC Berkeley; [4] Space Science Center, Univ. of New Hampshire; [5] SSL, UC Berkeley

During large magnetic storms, the appearance of characteristic distribution functions of O^+ ions named "the multiple ion band structure", which shows existence of multiple O^+ components with discrete energies bouncing along the local magnetic field line, was reported based on the FAST Auroral Snapshot (FAST) satellite observations [Seki et al., 2005]. It is observationally known that O^+ ions sometimes play a significant role in the ring current (RC) evolution and decay processes. O^+ ion contribution to the RC energy density becomes comparable to or larger than that from H^+ ions in some intense storms especially when the Dst index goes down below -200 nT. However, mechanisms of the drastic composition change of the storm-time ring current from H^+ to the ionosphere originating O^+ ions are far from understood. Based on the energy ratio of each band in the multiple ion band structures, [Seki et al., 2005] concluded that the multiple ion components observed during the main phase of the April 2001 storm resulted from direct O^+ supply from the ionosphere to the inner magnetosphere, and their possible role in the O^+ ion supply to the storm-time ring current is suggested.

In this study, we investigated detailed characteristic of the multiple ion band structure of low-energy (<30keV) O^+ ions based on the statistical analysis of the FAST data. The data were obtained in the year 2000 that was the solar maximum period. The analyzed events include not only geomagnetically active times such as during magnetic storms but also quiet times. As a result, the multiple band structures of O^+ ions are mostly observed at CPS and subauroral latitude. On the other hand, those of H^+ ions are in higher region from 70 to 80 degrees. The structures of H^+ ions are often observed in quiet time, while that O^+ ones are mostly observed in storm time, especially in intense storm. Moreover, the multiple band structures of O^+ ions are observed in lower latitude during intense storm time. Magnetic local time dependence of the multiple ion band structure is also found. O^+ bands are mostly observed in dusk side and dayside, while H^+ bands are observed in night and dawn side. In this study, we will also investigate solar wind conditions as well as substorm activities associated with the multiple band structures.