Effects of solar wind conditions on the variation of low energy O+ populations in the magnetosphere during magnetic storms

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The relationship between solar wind conditions and variation of low-energy (<30keV) O^+ ions during magnetic storms was investigated by using Fast Auroral Snapshot (FAST) observations. It is observationally known that ionosphere originating O^+ ions sometimes play a significant role in the Ring Current (RC) buildup and decay process. O+ ions 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 responsible for the behavior of O^+ ions during magnetic storms, how O^+ ions production depends on the solar wind conditions and how banded structure forms, are far from understood.

In this study, we selected six magnetic storms in 2000 with the following criteria: 1. Time profile of Dst is simple (no multiple main phase), 2. FAST orbit has a good coverage in the midnight and/or dusk side sector, 3. There is no other storm before the storm event. Middle-latitude particle data are available from the FAST satellite. For each orbit in the course of the six magnetic storms, the simultaneous solar wind data are compiled and the effects of each solar wind condition such as the dynamic pressure, dawn-dusk electric field, velocity, and density of the solar wind are investigated. The results indicate that density of solar wind protons has little effect on the O+ ions density (N_{O+}) in the RC region, while solar wind dynamic pressure (Psw) has positive correlation to the N_{O+} variation in the inner magnetosphere. It is also found that fluctuation and shock-like jump of the dynamic pressure have important effects on the NO+ variation. These results suggested that Psw play an important role in the N_{O+} variation in inner magnetosphere. FAST observations also show characteristic banded structure of ions during the storm main phase. The longitudinal distribution of the banded ions was studied by comparison with Los Alamos Magnetospheric Plasma Analyzer (MPA) observations. In the presentation, a preliminary result of the FAST and MPA comparison will be also shown.