E112-022 **Room: 201B** **Time: May 28 14:30-14:45**

Observation of plasma density enhancement during geomagnetic storms by Akebono and DMSP

Naritoshi Kitamura[1]; Atsuki Shinbori[2]; Yukitoshi Nishimura[3]; Takayuki Ono[4]; Masahide Iizima[5]; Atsushi Kumamoto[6]; Manabu Yamada[7]; Shigeto Watanabe[8]; Takumi Abe[9]; Andrew Yau[10]; Marc R. Hairston[11]

[1] Geophys. Sci., Tohoku Univ.; [2] Solar-Terrestrial Environment Laboratory, Nagoya Univ.; [3] Department of Geophysics, Tohoku University; [4] Department of Astronomy and Geophysics, Tohoku Univ.; [5] Geophysical Inst., Tohoku Univ.; [6] Tohoku Univ.; [7] PPARC, Tohoku Univ.; [8] Earth and Planetary Sci., Hokkaido Univ; [9] ISAS/JAXA; [10] Dept of Phys and Astronomy, Univ of Calgary; [11] Center for Space Sciences, Univ. of Texas at Dallas

Plasma outflows from the polar ionosphere into the magnetosphere are important phenomena in the magnetosphere-ionosphere coupling in the polar region. The IMAGE satellite observed enhancement of the electron density at about two orders of magnitude above the polar cap in an altitude range of 20000-45000 km during an intense geomagnetic storm [Tu et al., 2007]. Akebono observations showed that the plasma density enhancement occurred during the main phase of geomagnetic storms. These results indicate that a large amount of the ionospheric plasma flows upward to the polar magnetosphere especially during the main phase of geomagnetic storms. In order to clarify the source location and transportation process of the enhanced plasma density in the polar region, it is important to perform simultaneous measurements of the plasma flow at both the topside ionosphere and the magnetosphere during geomagnetic storms. In the present study, we perform case studies of enhancement of the plasma density during geomagnetic storms using the data observed by the Akebono, DMSP-F8 and F9 satellites.

We use the electron density data observed by the plasma wave and sounder experiments (PWS), and the ion composition and field-aligned velocity measured by the suprathermal ion mass spectrometer (SMS) onboard the Akebono satellite in an altitude range of 275-10500 km. The SSIES-1 packages onboard the DMSP-F8 and F9 satellites provide the ion density and drift data observed at an altitude of about 840 km.

During the main phase of the geomagnetic storm observed on March 30, 1990, Akebono crossed the dayside polar region from dawn to dusk, and observed enhancement of the electron density up to 30 times larger than the quiet-time level in the auroral zone and dayside polar cap in an altitude range of 7000-10000 km. The SMS instrument measured ion upflows in the entire polar cap along the satellite path. Eighty percent of the upflowing ions were composed of oxygen ions and the upward velocities along the field lines of oxygen were 5-10 km/s. The existence of ion upflows dominated by oxygen ions indicates that the plasma is originated from the ionosphere. The upflow flux of the oxygen ion mapped to 1000 km altitude corresponded to $1\text{-}4*10^9$ /cm^2/s. This flux is about the same as the maximum flux observed by DE-1 [Pollock et al., 1990] and Polar during a geomagnetic storm [Moore et al., 1999]. In the period of the Akebono observation, DMSP-F8 and F9 observed ion upflows with peak fluxes of $5\text{-}33*10^9$ /cm^2/s mapped to 1000 km altitude in the auroral zone. On the other hand, downflows were observed with a speed of less than 0.2 km/s in the polar cap. This result indicates that the ion upflow observed by Akebono is not originated from the polar cap ionosphere.

Akebono observed the enhanced electron density more than a factor of 10 compared to the quiet-time density in the polar region in an altitude range of 3000-10000 km during the main phase of the geomagnetic storms occurred on June 6, June 9, September 25, and November 17. In these events, ion upflows measured by DMSP intensified in the cusp and cleft regions, where energetic ions and soft electrons precipitated into the ionosphere. The upward ion flux mapped to 1000 km altitude was $5\text{-}40*10^9$ /cm^2/s. The ion upflow also enhanced in the region where soft electrons precipitated with energies of less than a few hundreds eV in the auroral zone. The flux of the ion upflow mapped to 1000 km altitude sometimes exceeded 10^{10} /cm^2/s. These results indicate that intense ion upflows at the ionospheric altitude are caused by increases of soft electron precipitations into the cusp, cleft, and auroral zone during geomagnetic storms. These upflowing ions drift into the polar cap due to the enhanced storm-time convection, and cause plasma density enhancements observed by Akebono.