

Variations of Plasma Sheet Ion Composition during the 23rd Solar Cycle

Masahito Nose[1]; Akimasa Ieda[2]; Stephen P. Christon[3]; Richard W. McEntire[4]

[1] DACGSM, Kyoto Univ.; [2] STEL, Nagoya Univ.; [3] Focused Analysis and Research; [4] JHU/APL

One of important issues of the terrestrial plasma environment is ion composition. Plasma around the Earth predominantly consists of H^+ , but it includes other ion species, such as O^+ and He^{2+} . Since these ions are heavier than H^+ , even small amounts of them will modify properties of the plasma. Some previous studies have shown that the He^+ and O^+ densities (or energy densities) are correlated with the F10.7 index, but the results were derived from data sets covering a period much shorter than one solar cycle (less than 4.5 years). To confirm the solar activity dependence of ion composition, it is desirable to use a long-term data set that covers more than 11 years. The Geotail spacecraft was launched on July 24, 1992 and is still operating as of July 2007. In the early phase of operation the spacecraft surveyed the distant tail of $X_{GSM} = -50 R_E$ to $-210 R_E$. In March of 1995, the spacecraft was maneuvered into the final near-Earth orbit having a perigee of 8-9 R_E , an apogee of 30 R_E , an orbital period of about 5.5 days, and an apsidal period of about 1 year. The EPIC (energetic particles and ion composition) instrument onboard Geotail can measure energetic ion flux with mass and charge state information. The energetic ion flux data have been accumulated for more than 14 years, covering the entire 23rd solar cycle. Thus this unique data set makes it possible to investigate variations of ion composition in the plasma sheet over one solar cycle for the first time.