

Cutoff latitudes of solar protons during geomagnetic storms observed by NOAA/POES multi-satellites

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Solar energetic particles are injected into the Earth's magnetosphere but do not reach the inner magnetosphere connected to the low-latitudes by the field lines, based on the well-known Störmer theorem. Geomagnetic cutoff rigidity and cutoff latitudes of energetic particles have been investigated in the past studies and are reported to be controlled by the geomagnetic activities (Obayashi 1961, Flückiger et al. 1990, Leske et al. 2001, Smart and Shea 2001, 2005, Birch et al. 2005, etc.). The polar orbiting NOAA/POES satellites (N15, N16, N17, and newly N18) have observed particles in a wide range of local time at altitudes of about 850 km. The onboard radiation monitors detect solar energetic protons (16 - 500 MeV). We have analyzed the combined data from the three or four satellites with time resolution of 1.5 hours which is near the orbital period of about 100 min in order to investigate local time dependences. The observations show that the cutoff latitudes (L -values) of solar protons change accompanying with the phases of geomagnetic storms with local time dependence. In particular, during the big November 2004 storms with the minimum Dst of -380 nT, the cutoff latitude in the nightside sector was about 5 degrees lower than those in the dayside sector. The cutoff L -values averaged for all local time regions were correlated with variation of the Kp index better than the Dst index. This fact indicates that the cutoff latitudes of > 16 MeV protons are due to the magnetospheric structure affected by magnetospheric convection.