CME/CIR通過時のリングカレントイオンのダイナミクス

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Dynamics of ring current ions during magnetic storms driven by CIRs and CMEs

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The energetic ions ranging from a few tens keV to a few hundred keV are the main body for the evolution of the ring current during geomagnetic storms. We apply a superposed epoch analysis using the NOAA/POES energetic ion data ranging from 30 keV to 6900 keV for all magnetic storms with minimum Dst less than -100 nT occurred during solar cycle 23. The storms are categorized into following groups in terms of the solar wind structures; storms with Dst > -130 nT associated with CIRs, storms with Dst > -130 nT driven by CMEs, and CME-driven great storms with Dst < -130 nT.

It is found that the intensity and penetration region of 30-240 keV ions during the main phase is strongly correlated with the storm strength as measured by Dst, and the largest flux enhancement is observed during the main phase of CME-driven great storms: The ions of a few tens keV deeply penetrate toward the Earth at around L=2. On the other hand, strong and continuous injections of 30-80 keV ions from the plasma sheet are found during the recovery phase of both CIR-driven storms, associated with HILDCAAs driven by Alfvenic fluctuations within high speed streams, and they are not found in the recovery phase of CME- and great storms. The CIR-driven storms further cause the intense flux by continuous injections of 80-240 keV ions during the recovery phase, leading to the larger energy density at L>5 than great storms. Extending the findings described above, we further discuss the local time asymmetry of the flux distribution and the contributions of different energy range to the total energy density.