Geophysical Research Abstracts, Vol. 8, 01574, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01574
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Acceleration and loss processes during geomagnetic storms

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Two categories of magnetic storms have been identified based upon their solar origin: a) recurrent, associated with corotating interaction regions (CIRs) formed by the interaction of high-speed streams from coronal holes with the dense, slow-speed solar wind plasma, or b) transient, associated with huge plasma eruptions from the Sun called coronal mass ejections (CMEs). We use our kinetic ring current-atmosphere interactions model (RAM) to simulate ring current evolution during geomagnetic storms representative of each solar origin and compare the mechanisms responsible for energizing particles and for causing their loss. Ring current intensification due to enhanced plasma inflow from the magnetotail and both convective and diffusive transport and acceleration are considered. Using an electric potential model driven by interplanetary parameters, we find that the ring current injection rate calculated with RAM is not always in good agreement with the Dst index; additional intensifications by radial diffusion may reproduce better its evolution. Charge exchange is the dominant loss process during the storms' recovery phase; the net convective losses are larger than charge exchange losses only for few hours near Dst minima. The regions of strong EMIC wave instability occur in the postnoon local time sector and along the plasmapause; these waves cause about 5% decrease of the total ring current energy by proton precipitation. These results suggest that increased injection during the recovery phase combined with smaller losses may be the cause for the slower ring current decay during recurrent storms.