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Energy dependence of relativistic electron flux variations in the outer radiation belt during geomagnetic storms

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Geomagnetic storms can either increase or decrease relativistic electron fluxes in the outer radiation belt, depending on the delicate competition between electron energization and loss processes. Despite the well-known "energy independent" prototype in which electron fluxes enhance after geomagnetic storms at all energies, we present observations of "energy dependent" events, i.e. post-storm electron fluxes at lower energies (0.3-2.5 MeV, measured by MEPED/POES) recover or even exceed the pre-storm level, while electron fluxes at higher energies (2.5-14 MeV, measured by PET/SAMPEX) do not restore. The statistical survey of 84 isolated storms demonstrates that geomagnetic storms preferentially decrease relativistic electron fluxes at higher energies while flux enhancements are more common at lower energies: $\sim$ 82% (3%) storm events produce increased (decreased) flux for 0.3-2.5 MeV electrons, while $\sim$ 37% (45%) storms lead to enhancements (reductions) of 2.5-14 MeV electron flux. Superposed epoch analysis suggests that "energy dependent" events preferentially occur during periods of high solar wind density along with high dynamic pressure. Previous statistical studies have shown that this kind of solar wind conditions account for significant enhancements of EMIC waves, which cause efficient precipitation of > 2 MeV electrons into atmosphere via pitch angle scattering. Two cases of "energy dependent" events are investigated in detail with evident observations of EMIC waves that can resonate effectively with >2 MeV electrons. Besides, we do not capture much differences in the chorus wave activity between those "energy dependent" and "energy independent" events. Therefore, our results strongly suggest that EMIC waves play a crucial role in the occurrences of those "energy dependent" events in the outer zone during geomagnetic storms.