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Energetic electron precipitation from the outer radiation belt during geomagnetic storms

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Relativistic electron precipitation changes the chemistry of the upper atmosphere and depletes ozone, but the spatial and temporal distributions are poorly known. Here we survey more than 9 years of data from low altitude satellites for different phases of geomagnetic storms. We find that for the outer radiation belt, electron precipitation >300 keV peaks during the main phase of storms whereas that >1 MeV peaks during the recovery phase. Precipitation >300 keV can occur at all geographic longitudes in both hemispheres whereas that >1 MeV occurs mainly poleward of the South Atlantic anomaly (SAA) region. The data suggest that wave-particle interactions are strong enough to precipitate >300 keV electrons into the bounce loss cone, but precipitate >1 MeVelectrons into the drift loss cone. We find that whistler mode chorus waves alone cannot account for the higher MeV precipitation flux during the recovery phase. We suggest that whistler mode chorus waves accelerate electrons up to MeV energies during the recovery phase which are then precipitated by EMIC waves. The effects on atmospheric chemistry due to MeV electron precipitation are more likely to occur in the southern hemisphere poleward of the SAA region with a delay of 1–2 days or more from the peak of the storm.