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Penetration Depths of Energetic Electrons and Ions into the Inner Magnetosphere and Their Contributions to the Ring Current Energy Content

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Deep injections of energetic electrons and ions into the inner magnetosphere occur frequently, but the depths of the injections strongly depend on the species and energies. Electrons with energies of 10s to 100s of keV are injected into the inner belt (L<2) while MeV electrons are hardly seen below L=3. Protons with energies of 10s of keV are also injected into the inner belt but lost quickly. Ions with higher energies have much longer lifetime but cannot be injected as deep. For similar energies (100s of keV), Oxygen are injected a little deeper than Hydrogen and also decayed faster. Those results are obtained based on the measurements from the Van Allen Probes mission. The underline physics mechanisms responsible for these observations are still not clear. The relative contributions of these energetic particles to the ring current energy content have been calculated. Electrons contribute much less than the ions (∼10%) with <35 keV electrons dominating the electron energy content during the main phases of a storm. The enhancement of electron energy content during a storm can get to ∼30% of that of ions, indicating a more dynamic feature of the electrons.