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Wave-induced particle precipitation into the ionosphere from the inner magnetosphere

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The Earth inner magnetosphere is a donut-shape large reservoir of magnetized plasma, energetic particles (keV – MeV), and various plasma waves. Plasma waves play important roles in the Earth's magnetosphere. Plasma waves with very low frequency (VLF) of ~ kHz and ultra low frequency (ULF) of ~ Hz, can interact with energetic electrons and ions trapped in the magnetic field in the magnetosphere at approximately 3 – 10 Earth radii. Thus, these waves can change pitch-angle (angle to the magnetic field line in momentum space) and result in charged particle precipitation into the ionosphere and upper atmosphere. This can in turn cause charged-particle-impact ionization and change ionospheric densities and conductivities [*e.g.,* 1]. Here we comprehensively study charged particle precipitation from the inner magnetosphere into ionosphere and their effects. We simulate ion and electron dynamics in the inner magnetosphere during moderate and strong storms, using the CIMI/BATS-R-US model [2, 3], which solve the bounce-averaged Boltzmann' transport and magnetohydrodynamics equations including quasi-linear wave-particle interactions. We also simulate ion and electron precipitation into the mid-latitude ionosphere and estimate their impact on the ionosphere calculating ionospheric chemistry and conductivity, which affects magnetosphere-ionsphere coupled current system and Joule heating in the ionsphere.

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