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Modeling electron dynamics in the inner magnetosphere

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Energetic particles in the inner magnetosphere can be hazardous for satellites in space and for the ground infrastructure. Dominant transport, acceleration and loss mechanisms for the energetic electrons include radial and local diffusion, loss to the atmosphere, magnetospheric convection and magnetopause shadowing. We present long term 3D simulations using Versatile Electron Radiation Belt VERB-3D code with newly developed models of the wave environment that includes, hiss, chorus, EMIC and hiss in plumes waves. We compare results with long term observations from Van Allen Probes and identify and discuss missing physical processes. Importance of each of the physical mechanisms is also evaluated using data assimilative tools. The calculation of diffusion coefficients for different types of waves such as whistler mode chorus and hiss waves, electromagnetic ion cyclotron waves (EMIC), is needed to describe their specific effects on particle dynamics. To extend our modeling to ring current energies we first present a coupled model that combines convection and diffusion processes followed by a presentation of the full VERB-4D code simulations that accounts for convection, diffusion and adiabatic variations. We also present first results of the data assimilation for the ring current electrons and show the sensitivity of the code to the boundary conditions, assumed electric and magnetic fields, models of the magnetopause and plasmapause and discuss the dominant mechanisms of the injections of electrons in the inner magnetosphere.