Can substorms produce relativistic outer-belt electrons?

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In an effort to explain how magnetic storms can cause strong enhancements in outer-belt MeV electrons, we have studied the substorm-associated acceleration of energetic (tens of keV) plasma sheet electrons and their injection into the outer-trapped region of the magnetosphere. The study is based on tracing test particles in three-dimensional MHD simulations of substorm dipolarization. The test particle traces show that tens-of-keV plasma sheet electrons can be transported from about x=-20 Re to about x=-10 Re and can gain about a factor of ten in energy. If these particles are further transported inward to L=6 while conserving the first adiabatic invariant, they will have energies of an MeV or more. A series of substorms might produce a large enough enhancement.

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