Simulation of the substorm injection of high-energy electrons observed by ERG and GOES

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One of the indicators of magnetospheric substorms is the injection of high-energy particles. The ERG and GOES spacecraft observe the injection of high-energy electrons associated with the substorm, initiating on Apr. 5, 2017. The ERG satellite observes the nearly-dispersionless injection and the subsequent drift echoes while the GOES spacecraft observe the dispersion features of the drift echoes. Assuming that a substorm-associated electromagnetic pulse propagates earthward, motions of the high-energy electrons are analyzed in the combined electric and magnetic fields. We proposed a particle motion model including the relativistic effect to simulate the observed features. Considering the relativistic effect, the particle drift motion, the adiabatic invariant and particle magnetic moment differ from the non-relativistic ones. Our simulations successfully reproduce the features of the nearly-dispersionless injection and the subsequent drift echoes observed by the three satellites. We discuss the differences among the results of spacecraft observations and the relativistic /non-relativistic computations.