

## Substorm-associated particle injection near/at geosynchronous orbit: Observations from ERG and GOES

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The injection of electrons during the substorm event, occurring on Apr. 5, 2017, was observed by the ERG (Arase), GOES-15 and GOES-13 spacecraft near/at geosynchronous orbit. The ERG satellite observed the nearly-dispersionless injection and the subsequent drift echoes while the GOES-15 and GOES-13 captured the drift echoes with dispersion. The multipoint observations provide constraints for us to simulate the substorm-associated injection. We improve an existing model in the literature to study the substorm injection event. Since the electron energies of interest are comparable to the rest mass energy, our work further provides the relativistic form of the previous model and employs a semi-empirical model instead of a dipole-based one in the previous study. Our simulations successfully reproduce the key features of the nearly-dispersionless injection and the drift echoes. The periods of drift echoes show a better fit to the spacecraft observations when relativistic effects are taken into account. The substorm-associated injection event can be better simulated by the further-developed model shown in this study.

Keywords: ERG, Arase, substorm injection, drift echoes, relativistic effects