SELF-CONSISTENT SIMULATIONS OF PLASMA WAVE INSTABILITIES IN THE RING CURRENT

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The importance of understanding wave-particle interactions and their effect on energetic particle dynamics in near-Earth space has become widely recognized recently. During geomagnetic storms energetic particle fluxes may increase several orders of magnitude and remain enhanced for hours to days. Relativistic electrons can cause anomalies and even failure of spacecraft systems and may pose serious risk to space-based equipment and astronauts. Both the acceleration and loss of relativistic electrons are associated with two dominant magnetospheric plasma waves, whistler-mode chorus emissions and electromagnetic ion cyclotron (EMIC) waves. We present a self-consistent study of the excitation of these emissions during geomagnetic storms after the convective injection of plasma sheet particles into the inner magnetosphere. We use our kinetic ring current-atmosphere interactions model (RAM) to simulate ring current evolution during storms and compare the mechanisms responsible for trapping energetic particles and for causing their loss. Our model has unique capabilities, including time-dependent convective transport and radial diffusion, all major loss processes, and is coupled with a dynamic plasmasphere model. The boundary conditions are specified from LANL data measured at geosynchronous orbit. We calculate the pitch angle anisotropy of ring current ions and electrons and identify equatorial regions for potential growth of EMIC waves and/or whistler-mode waves. We find that the linear growth rate of whistler-mode waves maximizes in the dawn local time sector, while EMIC waves are most intense in the afternoon sector in agreement with previous satellite observations.

Inner magnetosphere, geomagnetic storms, numerical simulations

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