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Hybrid Simulation of Foreshock Waves and Ion Spectra and Their Linkage to Cusp Energetic Ions XUEYI WANG, YU LIN, Auburn University, SHEN-WU CHANG, Center for Space Plasma and Aeronomic Research, University of Alabama in Huntsville — A three-dimensional global hybrid simulation is carried out to investigate energetic ions and electromagnetic waves in the quasi-parallel (Q-||) bow shock and cusp for a typical IMF configuration during the cusp energetic particle events. The bow shock, magnetosheath, and dayside magnetosphere form by interaction between the solar wind and geomagnetic dipole field. Ions of solar wind characteristics injected into the system evolve along with electromagnetic waves in a self-consistent manner. Several important features are yielded from the simulation. Solar wind ions are accelerated by the waves and turbulence at the bow shock and foreshock as indicated by the ion distribution. The shock-accelerated ions possess an exponential energy spectrum with their differential flux scaled by the field-aligned distance to the bow shock, consistent with satellite observations. Second, the compressive and transversal waves in the foreshock are strongly correlated with the diffuse ion dynamics. Third, energetic ions in the magnetosheath and cusp downstream from the Q-|| shock also exhibit a spectrum similar to those at the shock. By tracing trajectories of cusp energetic ions in the simulation, the origin of these ions is revealed. Their source is predominantly associated with the Fermi acceleration at the Q-|| shock and foreshock.

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