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Loss and source mechanisms of Jupiter's radiation belts near the inner boundary of trapping regions

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We have merged a set of physics-based and empirical models to investigate the energy and spatial distributions of Jupiter's electron and proton populations in the inner and middle magnetospheric regions. Beyond the main source of plasma (> 5 Rj) where interchange instability is believed to drive the radial transport of charged particles, the method originally developed by Divine and Garrett [J. Geophys. Res., 88, 6889-6903, 1983] has been adapted. Closer to the planet where field fluctuations control the radial transport, a diffusion theory approach is used. Our results for the equatorial and mid-latitude regions are compared with Pioneer and Galileo Probe measurements. Data collected along Juno's polar orbit allow us to examine the features of Jupiter's radiation environment near the inner boundary of trapping regions. Significant discrepancies between Juno (JEDI keV energy particles and high energy radiation environment measurements made by Juno's SRU and ASC star cameras and the JIRAM infrared imager) and Galileo Probe data sets and models are observed close to the planet. Our simulations of Juno MWR observations of Jupiter's electron-belt emission confirm the limitation of our model to realistically depict the energy and spatial distributions of the ultra-energetic electrons. In this paper, we present our modeling approach, the data sets and resulting data-model comparisons for Juno's first science orbits. We describe our effort to improve our models of electron and proton belts. To gain a physical understanding of the dissimilarities with observations, we revisit the magnetic environment and the mechanisms of loss and source in our models.