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Evolution of the Proton Ring Current Energy Distribution During April 21-25, 2001 Storm

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The evolution of the proton ring current during the April 21-25, 2001 storm is modelled using three different approaches: The ring current model combined with tracing particles numerically in the drift approximation by Ganushkina et al. [2005], the empirical model of proton fluxes in the inner magnetosphere developed by Milillo et al. [2003], and the kinetic ring current-atmosphere interaction model (RAM) by Liemohn et al. [2001]. The study focuses on the effects of the electric and magnetic field models and initial particle distributions on the final energy distribution. We examine a variety of large-scale magnetic field and convection electric field models as well as substorm-associated, smaller-scale and time-varying electric fields. The model results are evaluated by comparison with observations from the Polar CAMMICE/MICS instrument. Each of the models, using very different formulations and physical principles, is able to reconstruct the key characteristics of the storm-time ring current evolution, especially the rapid growth of the medium-energy protons. The results emphasize the role of time-dependent electric fields in producing the observed high-energy proton contribution during the storm recovery phase, and the role of realistic magnetic field models in allowing sufficient amount of particles to escape the inner magnetosphere to yield the observed total fluxes.