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Self-consistent kinetic numerical simulation model for the dynamics of ring current particles

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A new self-consistent model of the ring current particles in the inner-magnetosphere is presented. A system of nonlinear time-dependent equations is derived that includes the self-consistent coupling of the kinetic dynamics of particles and the field. The particle transport is described by a five-dimensional drift-kinetic equation. We have developed a numerical simulation code solving the five-dimensional drift-kinetic equation coupled with Maxwell equations. It is demonstrated that the propagation of MHD waves can successfully be described by the present model. We find that the self-consistent coupling could affect the transport of energetic particles as well as the ionosphere-magnetosphere coupling through field-aligned current.

Keywords: magnetosphere, geomagnetic storm, ring current