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On the bounce-averaging of scattering rates in a realistic field model

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Radiation belt diffusion codes require as an input precomputed diffusion coefficients. Usually scattering rates are bounce-averaged in the dipole magnetic field**.** We present the results of computations of bounce-averaged quasi-linear momentum $< D_{pp} >_{ba}$, pitch-angle $< D_{\alpha\alpha} >_{ba}$, and mixed $< D_{\alpha p} >_{ba}$ diffusion coefficients in a realistic magnetic field model. We assume that electrons (from 10 keV to 10 MeV) are scattered by oblique whistler mode chorus waves. We compare bounce-averaged scattering rates in different Tsyganenko models with those in the dipole field and discuss the differences. Our study shows that while there are still a number of unknown parameters that determine scattering rates, inclusion of bounce-averaging in the realistic field is crucially important for radiation belt modeling.

Averaging of physical quantities over bounce time can be used for a number of applications for planetary magnetospheres and for plasmas in other parts of the Universe. We show how to perform bounce-averaging and avoid singularities which arise during calculation of bounce averaged quantities in an arbitrary magnetic field model. The inaccuracies of the approximate approach can introduce errors up to an order in magnitude. We also give the new more accurate approximations for particle bounce time in the dipole magnetic field.