Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., referee comment RC1
https://doi.org/10.5194/gmd-2021-122-RC1, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on gmd-2021-122

Anonymous Referee #1

Referee comment on "UBER v1.0: a universal kinetic equation solver for radiation belts" by Liheng Zheng et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-122-RC1, 2021

This is a very nice paper describing the UBER 1 code, its potential applications and in particular, the advantages of the stochastic approach to solving convection-diffusion equations including mixed diffusion terms. I have mostly minor comments that should be easy for authors to address. I would also recommend adding an example that would show how the code behaves in case of strong gradients and not smooth initial distributions.

- I would clarify around line 20 that Js are the canonical momentums; otherwise alpha would go from 1 to 6.
- I thought that we neglect the phases of J simply because we assume isotropy in all phis . I could not precisely follow the argument of electric potential energy. Please elaborate.
- While the paper discusses in detail the advantages of this approach, it omits the disadvantages. I would suggest clearly saying how long the presented runs take to run on a regular PC and on a supercomputer. I would also specify how much wall clock computing would take to calculate one day charging along a given satellite orbit. Also, specify how much slower this approach than more traditional approaches for the multi-dimensional diffusion equations.
- The presented tests all show examples that are initiated with smooth initial conditions. Please provide examples similar to Aseev et al., 2016 with strong gradients in initial conditions.

Aseev N. A., Y. Y. Shprits, A. Y. Drozdov, A. C. Kellerman, (2016), Numerical applications of the advective-diffusive codes for the inner magnetosphere, Space Weather, 14, 993-1010, doi:10.1002/2016SW001484