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Geoscientific Model Development Discussions

Interactive comment on "The hybrid Eulerian Lagrangian numerical scheme tested with Chemistry" *by* A. B. Hansen et al.

A. B. Hansen et al.

ayoebuus@gmail.com

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Anonymous Referee #1

Reviewer: I find it difficult to review the paper. In particular, the description of chemistry in Section 3 is way too short to know how it has been implemented. Since chemistry appears to be a critical aspect of the paper, the authors should be asked to provide a more detailed description.

Answer: A full description of the chemistry in the model is out of the scope for the paper. The air pollution model DEHM includes a typical chemical scheme for these kinds of chemistry-transport models. Furthermore, the choice of chemical scheme is not vital for the results in the paper, as long as the chemical scheme chosen includes

non-linear chemical behavior for e.g. ozone chemistry. The basic test in the paper is that non-linear chemistry introduces very sharp gradients in the concentrations fields, which again is a challenge to all classical advection schemes. The chemistry scheme used here is described in Hansen et al. (2011), and Brandt et al. (2012) and references therein. However, a short section giving an overview of the chemical scheme will be included and the references will be added to the paper.

Reviewer: Also, I find the number of figures excessive and their quality insufficient. For example, it is very hard to distinguish different panels in Figs. 1, 2, 4, and 6. The authors should be encouraged to reduce the number of figures and discuss their salient features, not just numbers. E.g., what are the implications of differences in I1, I2, and I?

Answer: The number of figures will be reduced, e.g. Figure 2 and 4 will be merged to only show results for "pure advection" and "advection and chemistry". The quality of the figures will be improved.

Reviewer: There is an excessive reliance on the authors' unpublished work (Kaas et 2012) with no attempt to place the work in the context of the current state-of-the-science regarding advection schemes.

Answer: We agree with the reviewer, that it was a basic problem for the paper, that the work of Kaas et al (2012) was not published at the time of submission of this paper. The Kaas et al. (2012) reference is in detail describing and testing the new advection compared to other advection schemes and this paper was meant as an extension to this paper, testing the performance of the advection scheme when coupled to non-linear chemistry. However, the Kaas et al. (2012) paper has now been published as Kaas et al. (2013). A proper reference to the now published work is now included in the manuscript.

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