Geosci. Model Dev. Discuss., 8, C4006–C4007, 2016
www.geosci-model-dev-discuss.net/8/C4006/2016/

Geoscientific Model Development Discussions

Interactive comment on "InMAP: a new model for air pollution interventions" *by* C. W. Tessum et al.

C. W. Tessum et al.

tess0050@umn.edu

Received and published: 13 February 2016

Comment:

Firstly, I hope I have not erred, but here is the derivation.ÂăÂăStarting with Tessum et al., eqn. 3 (simplifying to one direction, letting fw,e=1), and dividing by ïĄĎt: [equation omitted] First, let the west cell be the iâĂŘ1 cell and the east cell be the i+1 cell.ÂăÂăThen put the Upos and Uneg terms together: [equation omitted] Now add and subtract [equation omitted] (the two middle terms): [equation omitted] Rearranging gives: [equation omitted] Multiply the numerator and denominator of the first term by ïĄĎx: [equation omitted] The authors may wish to consider if the last term may have some numerical/physical issues in some cases.ÂăÂăÂă I do believe that if you have the first term using (Upos+Uneg)/2, you get: [equation omitted] This leads to a central difference form for both advection and diffusion.ÂăÂăBoth the first order ad-

vection and central difference advection adds increased numerical diffusion, on top of the diffusion from the first term, and the advection term is not dependent upon the concentration in the i cell.ÂăÂăThe authors might consider dividing their solution to four periods, and during each period use the different combinations of Upos , Uneg , Vpos and Vneg.ÂăÂăThis would remove the large diffusion term introduced in the current method, though the advection approach used is still diffusive.ÂăÂăThey might consider using a higher order advection scheme that is less diffusive.ÂăÂăThey should also consider making FA equal to 1 to maintain concordance with the original equation and have the correct asymptotic behaviour.ÂăÂăÂă Whichever approach is chosen, it should be tested against cases with a known solutions.

Response:

We thank the reviewer for this derivation and comment. We have redesigned InMAP's advection scheme to address these issues and have added an additional test comparing InMAP and WRF-Chem predictions of a single source of nonreactive PM2.5.

Changes:

We have redesigned the InMAP advection scheme and updated the manuscript text and figures accordingly. We have also added a test of InMAP performance against WRF-Chem for a single point source of nonreactive particles.

Interactive comment on Geosci. Model Dev. Discuss., 8, 9281, 2015.