Geosci. Model Dev. Discuss., 5, C1615–C1617, 2013
www.geosci-model-dev-discuss.net/5/C1615/2013/

Geoscientific Model Development Discussions

Interactive comment on "A mass conserving and multi-tracer efficient transport scheme in the online integrated Enviro-HIRLAM model" *by* B. Sørensen et al.

B. Sørensen et al.

sorensen@gfy.ku.dk

Received and published: 12 April 2013

Specific comments.

1: The filter descriptions (ILMC and DEPDEP) has been updated and the term necessary has been removed from the descriptions.

2: The in-depth validation of the scheme will be reserved for later work, however the suggestion to validate against extra-tropical geopotential height observations, in particular with respect to the mass-wind inconsistency, has been noted and will be considered for further studies. It should be noted that the conventional HIRLAM NWP model also has mass-wind inconsistencies.

3(a): We agree and contour plots and changes in maximum values for the ETEX plume will be included in the revised manuscript. The ETEX-case used in the last test (large time steps) is an obvious comparison scenario. What can be seen is that although the maximum value of the plume is reduced by the LMCSL3D (with ILMC) the shape of the plume as well as the extreme values are very similar later in the simulation. The simulations are so similar that both solutions are equally realistic (when ignoring mass conservation) which is one of the main conclusions, namely that the LMCSL scheme (with the ILMC filter), generates equally realistic results, while improving on the conservation property, with a computational impact which is acceptable. It is not actually that surprising that the maximum values are not affected more for a plume test, since the gain of mass is around the plume edges (where negative values occur), so the mass change is in the bulk of the plume and not in the 'center'.

3(b): For the ETEX case (or other plume tests) the global filters perform very well since they only redistribute mass where it is present. Considering a case with several emissions of different strengths they will move mass between the different plumes (as in the 1D test), but in general they perform quite well and the results are not that different. Again the main point is that the ILMC filter is local and not too computationally expensive. Using the global filters will not ruin the simulation but just be slightly less accurate, while being faster to run. So I think all the filters should be considered (which is also one of the reasons they are all implemented). Figure 6 has been changed so it includes the fields for the other filters as well for comparison. The globality will only start to have an impact when the non-linearity of the chemistry kicks in.

4: The DEPDEP filter description has been modified to better describe the advantages.

Spelling and minor comments

1: The discretization has been included.

2: The spelling mistakes have been corrected.