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.

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General comments:

Regarding the layout of the paper, I believe it's because it is in discussion form, and will be changed to normal article form after the review.

1: True. Mixing ratio is now ζ and mass is m.

2: That is true but my main point with the test is to show the difference between the local filter and the global filter. The constant wind reduces the LMCSL to a traditional SL scheme since the weights are all one. I believe that introducing divergence would

just complicate the figure.

3: The section has been rewritten slightly and I understand the point concerning the name, LMCSL-3D, but this name is now our "official" name. While it is true it does not incorporate a filter, I think that it is the right choice, since it can be used with other filters (or without filters altogether).

4: Modified the first paragraphs to introduce the following subsections.

5(a): Agreed and corrected.

5(b): Agreed and corrected.

5(c): Definition added.

5(d): Footnote will be removed, since both $\Delta m+$ and $\Delta m-$ are defined to be positive.

5(e): Very good question. The short answer is that the filter routine treats one grid box at a time and in that sense (as the comment describes) cannot be parallelized to handle several grid boxes at the same time without the possibility of changing the same value on different threads. At the moment OpenMP is not introduced into the filter routine itself, but it would be possible (very easily) to compute several of the loops in the routine in parallel with OpenMP (sums over neighbor cells, and the following mass correction), which in 3D should scale quite well up to at least 26 threads (the number of neighboring cells in the innermost shell). However, since this is implemented into the HIRLAM code it is parallelized as the rest of the model. The model itself is parallelised using both OpenMP and MPI, although only MPI is generally used. Therefore each processor (MPI) has a subdomain of the full domain (split in the horizontal). That means that as the filter is currently implemented it will not distribute mass across the horizontal boundaries to the other subdomains (processors), thus introducing some inconsistencies in the redistribution at subdomain edges. However, it has been tested with varying the number of processors (which changes the location of the boundaries) and the results are virtually indistinguishable also the effect of changing the order of

the directions (currently x,y,z) has tested with the same results.

The global filters are swapping information with all processors for full consistency independent of the number of processors.

6: Agreed and corrected.

7: Agreed and corrected.

8: Reference added.

9: Agreed and corrected

10: Agreed and added.

Typos all corrected.

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