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**Geoscientific
Model Development
Discussions**

Interactive comment on "A standard test case suite for two-dimensional linear transport on the sphere" *by* P. H. Lauritzen et al.

P. H. Lauritzen et al.

pel@ucar.edu

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Dear Prof. Behrens,

The author's would like to thank you for your thorough review of our manuscript. Below is a point-by-point response to your comments:

1. In order to be called a test suite, a number of simpler and at least one or two more realistic test cases should be included in the suite. The paper would be even more useful, if the authors did not just refer to other test cases but would include those test cases with similarly comprehensive descriptions and template implementations.

Reply: It is not the intention of this manuscript to present an exhaustive transport test case collection that basically contains all published test cases in the literature for

linear transport on the sphere. Rather we propose a "minimal" set of test cases to minimize the workload on model developers while still assessing accuracy in terms of a wide range of diagnostics relevant for geophysical fluid dynamics. With reference to the dictionary definition of "suite", which, according to http://www.thefreedictionary according to.com/suite, is "a series of items intended to be used together", we believe that the title "A standard test case suite for . . ." is adequate for the proposed set of test cases.

2. The assessment of computational cost is a weak part of the paper. In fact, since this issue would require a lot more in depth assessment in order to come up with some sort of objective measure of computational efficiency, I would recommend to skip this part altogether. The somewhat heuristic remarks on what influences computational efficiency are not really a good guidance to assessing ones code's efficiency.

Reply: The intent of the "Computational cost" section was to provide overall algorithmic information rather than metrics to directly diagnose efficiency which, as the reviewer points out, would require a much more in depth assessment. The information asked for provides a quick overview of the transport algorithm in terms of computational stencil, stability conditions, etc. that may or may not influence performance on a particular compute platform. The section has therefore been renamed "Algorithmic considerations".

Response to minor comments:

a. fixed (CFL replaced with Courant number) – text and Figures updated. Thanks!

b. fixed

c. the current notation is more compact and emphasizes how the Gaussian surfaces are derived/designed

d. fixed

e. fixed

f. fixed. The overview list of the test cases has been modified to more accurately describe what diagnostics are asked for.

g. the resolution range is based on the current resolution range used for climate modeling (paleo climate models are usually run at approximate 3 degrees resolution whereas cutting edge high resolution runs for climate are around 0.3 degrees with exploratory, but short integrations, at even higher resolutions). We expect that any scheme will resolve the distributions at 0.3 degrees so running at even higher resolution is not expected to show new insights. That said, running at even higher resolutions will improve converge rates for the schemes that are not yet in their convergent regimes at 3 degrees, however, we leave that as a challenge.

h. The manuscript explains the choice of threshold as follows:

"The choice of threshold for $\Delta \lambda_m$ is based on results for CSLAM (a resolution for which the thin filaments are marginally resolved). The 'minimal' resolution (as defined here) for CSLAM is $\Delta \lambda=1.5^\circ$ ..."

This definition has some arbitrariness associated with it as we do not define "marginally resolved" and "marginally resolved" will always be scheme dependent; "marginally resolved" is, in our definition, basically when CSLAM starts to converge at 3rd-order and less than 15-20% of the filament (according to the filament diagnostic metric ℓ_f) is dissipated. From the data gathered in an NCAR workshop on transport schemes (not presented in this manuscript but in the follow-up manuscript) CSLAM appears as a good reference in the sense that roughly half the schemes have minimal resolutions at coarser grid-spacings and roughly half need higher resolution to match CSLAM.

Interactive comment on Geosci. Model Dev. Discuss., 5, 189, 2012.