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Interactive comment on "Pangolin v1.0, a conservative 2-D transport model for large scale parallel calculation" *by* A. Praga et al.

Anonymous Referee #1

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The paper describes the conservative 2-D transport model Pangolin.

This new model is designed for large scale parallel systems. The discrete system is built up on a classical flux-form finite volume (semi-Lagrangian) scheme with a special focus on the grid. The fluxes are approximated with the aid of a linear reconstruction and the overall scheme is expected to be second order. To avoid the pole problem in the lat-lon coordinates, the authors describe an efficient way which decreases the number of cells towards the poles. The grid cells have almost the same area but not avoiding hanging nodes. However, the grid features an easy data structure (memory friendly aso.) and there is not a special treatment of the scheme on the poles or any other points necessary. The paper investigates all classical properties for a transport model on a benchmark problem first published in Nair et.al, JCP 229 (23) (2010).

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Comments: I am very surprised about the convergence rate since Pangolin behaves like a first order scheme? Why is there almost now difference between the shape-preserving and unlimited error plot? Usually the unlimited version should reflect the convergence rate.

Since the title of the work already reflects the main purpose about the parallelization, there should be more work done in this direction. Lauritzen (2014) surely compares some of currently in use transport schemes but does not discuss their performance on a multi core platform. 'State of the art' transport schemes on multi core platforms with mass preserving and some limiting options were recently discussed in Guba et.al. JCP 176-195 (2014) or Erath et.al. JCP 256:118-134, 2014 to mention only a few but not all.

I would be careful with a statement like 'Scalability of Pangolin is already very good, providing the resolution is fine enough.' and providing a scalability plot on only 294 cores. Clearly, the finer the grid the more cells are on a grid and the better will be the scalability. In this term it is interesting how much time the two communications on each time step need. How many cells (=unknowns) are the in the strong scalability test on one of the 294 cores?

Minor: -check the signs in (3) and (4) and define the normal vector more precisely (pointing outward?) -mq is misleading, I suggest to write q as subscript, e.g., m_q. -(S. 4539) CAM-FV does not belong to NCAR, since it is a Community Atmosphere Model and major parts are developed outside. -use also different markers for different curves in plots or different line types. Some people have problems to distinguished colors aso.....

Interactive comment on Geosci. Model Dev. Discuss., 7, 4527, 2014.