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Geoscientific Model Development Discussions

Interactive comment on "Conservative interpolation between general spherical meshes" *by* E. Kritsikis et al.

Anonymous Referee #2

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General comments: the extension of supermeshing and conservative interpolation to spherical meshes is interesting and useful. I agree, however, with the first reviewer that the paper would be improved by a lot more technical detail and by the addition of figures illustrating the algorithms proposed.

Specific comments: I would like to see some mention of the key differences between this work and 10.1002/nme.2951, 10.1016/j.cma.2010.07.015, 10.1006/jcph.1998.6125, 10.1002/nme.1147. In particular the work of Alauzet seems very similar in spirit (a focus on finite volume discretisations, piecewise linear reconstruction, etc), although that paper focusses on simplicial meshes. It is also related to that of Jiao and Heath, who considered the problem on (possibly non-matching) manifolds.

The method of Farrell et al (2009) is explicit (no iterative solver required) if the target field is discontinuous, as the target mass matrix becomes block diagonal (or just diagonal, for DG0). This work always assumes a DG0 representation of the target field, so this point of contrast is not valid.

The projection step in section 2 is fairly standard, from my knowledge of the literature. The real novelty of the paper is in section 3, the supermesh construction on a sphere. Here the paper would be greatly improved by adding a lot more technical detail on how the spherical supermesh is constructed, given the map of possibly intersecting cells (section 3.1). Each edge is represented by the plane whose intersection with the sphere generates it — why? What advantage does that serve? How does it facilitate intersecting the edges that do intersect? Once the intersecting segments are computed, how are the cells of the supermesh reconstructed? In particular, the authors should highlight the differences with the supermesh construction algorithms given by previous authors.

From my reading of the literature, I believe that intersection identification algorithms that exploit connectivity (like that of Farrell and Maddison cited above) are in general faster than tree-based approaches. The differences between the two classes of algorithm should be highlighted in section 3.2.

I second the recommendation of the previous reviewer that all of these steps should be illustrated with diagrams.

Technical corrections: what is the significance of the circle over S in (4)? This is not explained in the text.

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