Geosci. Model Dev. Discuss., author comment AC2
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Reply on RC2

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Author comment on "Strategies for Conservative and Non-Conservative Monotone Remapping on the Sphere" by David H. Marsico and Paul A. Ullrich, Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-248-AC2, 2022

- The one thing that I saw that should probably be changed is that you make a general statement about how it was shown that the integrated versions are capable of maintaining accuracy across arbitrary source mesh resolutions (line 318). However, in section 4.4 test 2 you only show the bilinear results for integrated vs. non-integrated for a source refined beyond the resolution of the target mesh. Given this, I think that you should either add graphs for the other 2 non-conservative methods in that second test or just mention the bilinear in that conclusion sentence. It could be that I'm misunderstanding what's being shown in that section (4.4.), if so a bit more explanation in there about why just bilinear is being shown in the second test would be useful. Also, I think "arbitrary" is a bit strong for that sentence, maybe something like "wide range" would be better to describe what you show.

All of the integrated versions of the schemes are capable of maintaining second order accuracy when the source mesh resolution is refined significantly beyond that of the target mesh, not just the bilinear one. Thank you for pointing out a potential source of confusion, and we'll add a clarifying sentence or a graph showing the results for all of the integrated schemes. The reason why we only included bilinear is because the figures look nearly identical in all cases, and we thought it would sufficient to just show one, and then mention how the other schemes are similar. For example, we've included a figure that shows a comparison of the error for the integrated and non-integrated Delaunay triangulation weighting (in the figure "Delaunay_IntegratedDelaunay_error"). Note how similar it looks to Figure 12. We can provide the raw error noms for these tests if necessary.

+ Questions and comments:

- Line 26: I wondered if you meant "non-conservative" at the end of this line, since you talk about conservative in the next part.

We do mean conservative here. The next sentence, the one that begins with "In the conservative case…", is meant to describe the way monotonicity in the conservative case has been achieved in other contexts, i.e. through limiters. In the sentence after that, we describe the specific way we achieve monotonicity, i.e. through the CAAS algorithm.

- Line 191: ESMF also supports regridding where the data values are on the nodes, so dual conversion isn't always necessary.

Thank you for letting us know. We'll be sure to mention this in a revised manuscript.

- Section 4.1.1. It would be useful to have a diagram showing how this algorithm works (e.g. with the 6 panels on the sphere showing a coarse triangulation and destination point.)

We've attached a file with a potential figure to be included in the paper as an illustration of the algorithm (the file called "Delaunay_picture.pdf"). Is this what you had in mind? The figure shows a simple representation of how the source faces on each panel are projected onto a plane and then triangulated.

- Line 220: What happens if a set of source point spans two panels? (e.g. do you have an overlap region so that a destination point can't land between two panels)

Yes, we have a such a region of about 10 degrees on each side of the panel to prevent something like this.

- Line 221: You could add a sentence or two about how you find the triangle that contains the point (e.g. do you just loop or is there a search structure involved)

We use a kd-tree to accomplish this. First, we use the tree to find the face whose center is nearest the target point. If the target point is in this source face, we stop. Otherwise we search through neighboring source faces until we find one that contains the target point. This algorithm works efficiently in practice.

- Section 4.1.2: I thought that the broader algorithm could be fleshed out a bit more so that the description was at a similar level to other sections. Even a few sentences describing how you find the polygon that would contain the point (or a pointer if you're doing it the same as in another section)

Thank you for the suggestion. We will add more of a description, and perhaps another figure to provide an intuitive understanding of these weights (similar to Figure 8). And yes, the way we find a polygon that contains a given point is the same for each method (see the previous comment for a description). We'll be sure to point this out.

- Line 245: Does this scheme for calculating the weights work if the polygon is concave?

The scheme will not necessarily work for concave faces. However, it can be adapted by triangulating it and then applying the weighting formula for each sub-triangle.

- Line 318 it says " second accuracy" should it be "second order accuracy"?

Thank you for pointing out this typo.

Please also note the supplement to this comment:
https://gmd.copernicus.org/preprints/gmd-2022-248/gmd-2022-248-AC2-supplement.zip