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Interactive comment on "Non-orthogonal version of the arbitrary polygonal C-grid and a new diamond grid" *by* H. Weller

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Comment: P6041 and Table 1. Not only is the ratio Delta x_max / Delta x_min a bit worse for the diamondized grid, it seems to be getting worse (more rapidly) with increasing resolution. So, is the new grid really quasi-uniform? I.e. does this ratio tend to some limit as resolution is refined ? (Maybe the author could do some geometry to check ? Otherwise it might just be worth checking the ratio on one or two finer grids.)

Reply: Many thanks for this comment. I've done the geometry. In the limit of an infinite sphere or infinite resolution, the diamond grid should be orthogonal, have no skewness and the ratio Delta x_max / Delta x_min should be sqrt(3). In this limit, the diamond grid becomes a grid of rectangles each with aspect ratio sqrt(3) apart from at the edges where there are kite shaped cells which also have the max/min ratio of sqrt(3). The

grids presented in the manuscript do not have this limit. After checking I realise that the grids that I used actually have one iteration of Laplacian smoothing and so the min/max ratio was worse. I am currently re-running everything and re-calculating the stats for grids with no smoothing. I will describe the geometry in the revised manuscript.

Comment: P6045 '...without serious oscillations in pv.' Some ripples are visible in the vorticity field in the Galewsky test, and the author does point them out on p6056.

Reply: My implication is that these ripples are not "serious". I should re-word. How about "without grid-scale noise in pv".

Comment: P6047. The H given by (13) would be diagonal if d_e and d_e' were orthogonal for all the e' in the stencil. So is the point that a grid can tend towards primal and dual edges being orthogonal but without the above property holding?

Reply: The off-diagonal terms of H do not vanish on an orthogonal grid of triangles. Only for an orthogonal grid of quadrilaterals. This will be clarified.

Comment: I got confused on P6054 in the discussion of using the asymmetric H on the orthogonal HR grid. Surely the original Ringer et al H is diagonal on this grid, and any diagonal H is symmetric. This led me back to sections 3.2.9 / 10 / 11 where I realized it was not clear to me, after all, which H's had been used with which grid. Could this be made clearer?

Reply: Yes, I can see that this would be confusing. The point of the asymmetric H is that it tends towards diagonal as the grid tends towards orthogonal. So on an orthogonal grid the asymmetric H is diagonal (and orthogonal). The symmetric H does not tend towards orthogonal for the icosahedral grid. This will be clarified.

Comment: P6051 L13-14. If you take more iterations or reduce the time step does the amplification factor get closer to 1 ? (Just a sanity check.)

Reply: I will do this.

Comment: P6053 L10. The symmetric H does indeed have better energy conservation, but the non-conservation with the asymmetric H is rather weak.

Reply: This will be clarified

Comment: A few places you use the phrase 'more orthogonal'. Being pedantic, edges are either orthogonal or not. How about 'more nearly orthogonal'?

Reply: Many thanks. I will rectify.

Comment: P6037 L3. These authors certainly weren't the first to consider a hexagonal C-grid, but what they did was to figure out what to do with the Coriolis terms to get steady geostrophic modes.

Reply: I will put in a reference to an earlier work on hexagonal C-grid and clarify this part of the introduction.

Comment: P6073 L11. Use \citep instead of \citet to get the parentheses in the right place.

Reply: Many thanks, I will do that

Comment: P6043 L18. to calculate

Reply: Thanks. I will fix.

Comment: P6049 L4. the we -> then we

Reply: Thanks. I will fix

Comment: P6057 L12-13. The first time I read this it seemed like a non sequitur. Perhaps add half a sentence to say that damping of the computational modes by the advection scheme is what leads to the enstrophy loss.

Reply: Thanks, I will clarify as you suggest. This will also answer one of Almut Gassmann's comments.

Comment: Fig.4 . Caption: 'Amplitudes' here means amplitudes of the amplification factor, not amplitudes of the normal modes.

Reply: Many thanks, I will clarify.

Interactive comment on Geosci. Model Dev. Discuss., 6, 6035, 2013.