Review of the GMDD manuscript:
WAVETRISK-1.0: an adaptive wavelet hydrostatic dynamical core

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Summary:
The manuscript documents the design of a new wavelet-based, dry, hydrostatic 3D atmospheric dynamical core on the sphere with embedded 2D (horizontal) adaptive mesh refinement (AMR). The 3D model is built upon the 2D AMR shallow water model described in Aechtner et al. (2015). The 3D extensions of the model equations and the numerical treatment of the vertical dimension are based on the work by Dubos et al. (2015). The manuscript briefly reviews the conservation properties and numerical design of the model, the hexagonal/icosahedral grid structure, the wavelet-based AMR approach, the parallelization technique, data structure, and the AMR selection criterion. The latter is based on a numerical error tolerance ε, and not on commonly-used flow features (like vorticity) of the simulation. The dynamical core and its AMR & parallel performance characteristics are tested via standard test cases which include a deterministic mountain-induced Rossby wave train, a baroclinic instability test case and the climate-like Held-Suarez test.

Overall, the manuscript is very well written. It is an important contribution to the literature since atmospheric 3D AMR research on the sphere is still extremely sparse. My comments below mostly suggest minor changes and clarifications. However, the quality of most spherical figures (their color schemes) should be improved to more clearly visualize the flow fields.

1) Abstract: Most journals do not allow references in the abstract. Check the GMD guidelines.
2) Reformulate page 2, line 25. It is true that adaptive 3D atmospheric flows, especially in spherical geometry, have not been extensively studied in the past. There are, however, at least two Ph.D. theses in the literature (Jablonowski (2004) and Ferguson (2018)) and have some discussion of 3D dynamical cores on the sphere with dynamic grid refinements. There are more examples for 3D atmospheric flows in limited-area AMR models, like e.g. Skamarock and Klemp (Mon. Wea. Rev., 1993).
3) Page 9, line 12, also page 27, line 3: Typo, either state 'by Dubos et al. (2015)' or use citation format '(Dubos et al., 2015)
4) Page 12, line 13 and 25: The AMR criterion needs to be clarified. Are the grid adaptations invoked if all three indicators ε_μ, ε_θ, ε_u exceed the threshold or is it enough that one of them exceeds the tolerance? It is not clear how the maximum norm is computed. Please provide some insight into its evaluation in this wavelet-based method.
5) Page `5, line 28, define the acronym DCMIP
6) Figures 5, 6, 10, 12: Provide more explanation for the selected map projection. Are these stereographic projections? Which point are they centered on (e.g. north-polar stereographic projections)? The blue-red color scheme for all flow figures is very hard to read. Please improve the quality of the figures and e.g. use the examples by Aechtner et al. (2015), Figs. 17 and 18.
7) Figs. 9 and 10: It it intentional that Fig. 9 documents the parallel characteristics with ε=2 (when adapting on the trend) and ε=0.06 in the actual visualization of the flow? The tolerances also differ when the adaptations on the solution are documented. This these two

figures both document the baroclinic wave test case, why is the reader not shown the flow fields t(Fig. 10) hat correspond to Fig. 9? Explain or modify.

8) Page 24, line 19-20: Add the physical units for the diffusion coefficients
9) Page 25, line 2: typo, should read '… we find for the …'