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Geoscientific Model Development Discussions

Interactive comment on "NCAR global model topography generation software for unstructured grids" *by* P. H. Lauritzen et al.

Anonymous Referee #1

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General comments:

This paper describes a method for generating topography and computing sub grid variances of topography for use in parameterizations that need it (e.g. gravity-wave drag). It is clearly written and reproducible. The method is fine as far as it goes and my main complaint is that the approach is mostly an application of previously developed tools for a new use, rather rather than a taking a more novel approach to topography generation. So, for example, the authors make use of an intermediate cubed-sphere grid to do the scale separation, primarily so they can re-use their work developed for CSLAM and previous regridding related to cubed sphere approaches. The discontinuous/fractal nature of topography and more rigorous scale separation would seem to make this an ideal application for, say, wavelets or other techniques rather than the cubed sphere

approach they describe. This doesn't detract much from the utility of their method and this paper serves as useful documentation of the methods currently employed.

The results section is focused on topographic smoothing which is largely unrelated to the method they describe. It would have been better to have an application or test that demonstrates to what extent they have achieved the scale separation desired or, for example, that the GWD parameterization is affected by their (presumably improved?) estimate of sub grid variance. Smoothing is done after topography generation using known techniques, with the fairly obvious statement that "It can clearly be seen that there are large differences between the height of the mountains with different smoothing operators and smoothing strength." I don't think this section adds much to the paper and is not that relevant to what I thought was the point of the paper.

Specific comments:

At one point the authors state that the target grid must have great circle arcs (p4633, line 20), but figure 3 shows the target as "any structured or unstructured grid." It should be noted that lat/lon grids (namely, latitude circles) are not great circle arcs and in fact near the poles are very different from great circle arcs, so this would appear to eliminate a large class of grids?

It is unclear how the authors estimate which scales are represented in the cubed sphere, stating in 2.2 (p4629 around line 20) that "A quasi-uniform approx. 3000m resolution. . .results in a scale separation of 6000m". Is this just a 2-dx assumption? Or how is this estimated? This partly illustrates my earlier point that using the intermediate cubed sphere is not a particularly rigorous form of scale separation.

The section on continuous scale separation is really just a description of spherical harmonic decomposition and is maybe only useful for the first couple of figures showing spectra. Spectral transforms are not used as part of the method so later discussions of scale separation in wavenumber space are a bit misleading since there is no guarantee, and indeed there should be no expectation, that the method really does correspond to

a particular truncation in spectral space.

Technical corrections:

4625 line 2 - eliminate foot note and include in text? (personal preference)

4626 line 3 - should be “drag to be produced”

4626 line 14 - reduce triple quotes to double quotes?

4627 equation 3 - first sum should be bounded by M at the top, not infinite

4633 line 22 - where -> were

4634 line 3 - variable-resolution, not variables resolution

4638 line 2 - is not significantly ? by the roughness

Interactive comment on Geosci. Model Dev. Discuss., 8, 4623, 2015.