

## ***Interactive comment on “Locally-orthogonal unstructured grid-generation for general circulation modelling on the sphere\*” by Darren Engwirda***

**Anonymous Referee #1**

Received and published: 9 January 2017

The current paper deals with high quality surface triangulation applied to general circulation modelling. The paper bypasses a parametric representation of an arbitrary surface by limiting the surface definition to an ellipsoid representing the earth. The main algorithm relies on a coupled Frontal-Delaunay approach. Various examples are provided to illustrate the method.

Overall, the paper is clear and there is obviously a lot of work in it. However, my main critic is that there is not much new brought by the paper, as opposed to what is claimed in the conclusion, except for the fact of applying it to a general circulation modelling. The curvature of the Earth is almost constant so technically it is not difficult to surface mesh it. The paper introduces a lot of concepts such as restricted Delaunay, Frontal-

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Delaunay, Hill-climbing, Gradient based smoothing, etc, which are very classic and well established unstructured mesh techniques. At least, it should be clearly stated what is new.

- The claim that Voronoi edges are always perpendicular to mesh edges is wrong. It is only valid for an acute triangulation, which is not true in general, particularly because of the boundaries. This is a property that has been pursued by the electromagnetic solvers for a long time for the same reason but only partially reached. This is only briefly mentioned in Section 4.
- line 28. It is not clear at all in general that maximisation of the minimum angle is beneficial. Add references.
- The pictures do not clearly show the mesh transitions for size variations in details.
- The abstract mentions a-priori guaranteed quality bounds while nothing is proved. Empirical studies show good results but no bounds are provided.
- The abstract is misleading. The code may be recently developed but the techniques used in it are not recent.
- There is not detail about the initialization on the sphere of the algorithm. You mention that the algorithm scans the triangles that do not verify given criteria, but how are these initial triangles created?

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Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2016-296, 2016.

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