Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2016-296-RC3, 2017

Geoscientific Model Development Discussions
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Interactive comment on "Locally-orthogonal unstructured grid-generation for general circulation modelling on the sphere*" *by* Darren Engwirda

Anonymous Referee #2

Received and published: 19 January 2017

The manuscript is of interest, but I see several points for improvement.

There is a sufficiently detailed description of the techniques used to improve the mesh quality, but the frontal-Delaunay technique is just mentioned. It would be helpful if it is described in some detail, for the intention of this paper is to help the potential user to learn about the technical details of the algorithm, and it is still a bit difficult to do. It would be very helpful to present a schematic of the algorithm at the very beginning, followed by the description of separate steps. This is partly done for the iterative mesh quality improvement, but I think that the entire algorithm has to be included. Also I would advice to be more clear with what is new in the algorithm.

Editorial remarks:

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Fig 1. The coloring used is non-informative. I was struggling to see some familiar topographic features but I could not. I would recommend to omit the topographic height, it does not have any sense here, only distracts you reader. Same concerns other mesh figures.

Page 2, line 6 'A majority of ...' — I do not think this statement is correct. Many of practically used ocean circulation models use so-called tripolar meshes with Mercator-type stretching. Cubed sphere is used less frequently (the internal Rossby radius of deformation in the ocean is decreasing toward high latitudes, and meshes refined in high latitudes are more natural)

Line 10 'leading to significant...' If lon-lat mesh is used for ocean modeling, it is of course rotated, so that poles are on the land and there is no singularity. What is discussed has relevance to the atmosphere, but not to the ocean. Since your mesh examples are related to the ocean, the discussion creates misunderstanding.

Page 3,

line 5 The discussion here misses the point that FESOM, FVCOM, SLIM, Fluidity may work on general triangular meshes. SUNTANS (and its numerous predecessors) need orthogonal (well-centered) meshes (with the circumcenters inside respective triangles).

Line 29 I think the main point of Lambrecht et al. is that a care is taken of the shape of coastlines, resolution of passages etc. This question is not reflected in the manuscript (except for conclusions), although it presents the main challenge. It is quality of triangles close to coastlines that is problematic in many practical cases.

I would also recommend to mention Admesh (DOI 10.1007/s10236-012-0574-0) which relies on the Persson's approach.

Page 4. Section 2. I would start here with brief description of the entire algorithm. Your reader keeps wondering what is the algorithm before the end of section 3. Present details of the Frontal -Delaunay algorithm and explain that in reality it is a 3D procedure

with the central point of the sphere used to form the tetrahedra, and the restriction is just surface triangulation. Otherwise your preliminaries and Fig.2 are a bit embarrassing for a general reader (who would keep asking about v_e and its relation to the surface).

Page 5 Line 13 Restricted Delaunay tesselation — try to explain this better, by using illustrations. I do not see your Fig. 2 to be of much help.

Page 6

It is not clear how mesh spacing functions are used in the mesh construction. Are they taken in account in the frontal procedure? It is not mentioned. Help you reader to clearly see the steps of the algorithm.

Page 7.

Line 10 .. fully inverted elements? Please define what do you mean.

Fig. 3. Is not it generally known?

Page 8 Line 16 Fluid velocity and vorticity are commonly at different locations.

Page 9, Line 4 ... Mention that you mean C-grid type techniques. There are other possibilities.

line 7 'described previously'? It was not really described here.

Beginning from line 9, there is discussion that is either well known or irrelevant to the mesh generation.Why do you need it?

Page 11.

Please define all quantities in (7) and better explain how computations are implemented.

Page 13

line 14 What is the grid-quality vector?

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line 26 What is the lexicographical comparison?

Page 20

Section 5. Please clearly define the novelty. What is describe is the selection of known steps.

page 22 , line 14 (ii)–? I think it is secondary and technical issue. Well-centeredness and coastlines are real algorithmic queastions.

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