Geoscientific
Model Development
Discussions

Interactive comment on "OceanMesh2D 1.0: MATLAB-based software for two-dimensional unstructured mesh generation in coastal ocean modeling" *by* Keith J. Roberts et al.

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Received and published: 28 November 2018

A new mesh generation library: OceanMesh2D is described, focusing on the construction of multi-scale unstructured triangulations for applications in coastal ocean modelling. Adapting the well-known DISTMESH algorithm (Persson and Strang), and building on top of other open-source contributions for various mesh-based and geo-spatial processing tasks, the authors present a MATLAB-based meshing library designed to automate the unstructured grid generation work-flow for coastal ocean modelling configurations.

In addition to a description of their MATLAB-based implementation, the authors present a variety of mesh-resolution heuristics to control element size throughout the domain.

As well as a number of existing resolution functions appropriate for coastal modelling (distance-to-coast, barotropic wave-length scaling, etc) a set of new metrics (Rossby-radius filtered bathymetric gradients, channel thalweg scaling, etc) are introduced — focusing on better resolution of various dynamical processes and/or topographic features in unstructured models.

While much useful information is contained in the paper, I am overall somewhat unsure what its focus is or should be. Currently, I feel the authors have provided a detailed description of their MATLAB-based implementation, with much specific discussion of various classes and routines to be found in the OceanMesh2D code-base. To me, this reads a little like a software user manual.

If the authors intend to focus on algorithmic innovations, I suggest that a higher-level and more mathematically-focused description of the algorithms be presented. While detailed discussions of various MATLAB functionality and the availability of open-source code may undoubtedly be useful to model users, I do not feel that algorithmic discussions need to be focused on any particular implementation, and that in fact to do so may diminish adoption and re-implementation by other authors. If algorithmic innovations are to be the focus of this paper, I suggest it may be necessary to better compare against (and demonstrate improvement over) existing coastal meshing strategies and packages — highlighting the impact of any new algorithmic techniques.

I feel the discussion of mesh-resolution heuristics would be much enhanced by actual simulation results and comparisons. The authors have introduced a number of new mesh scaling functions based on, for example, filtered bathymetric gradients and channel thalweg resolution. While these ideas are interesting, and may be expected to improve model skill under certain conditions, it would be beneficial to prove this was actually the case in practice and to document the impact of mesh resolution selection and design on model output. Without studying the effect on model physics, I feel it is difficult to judge the performance or utility of any particular mesh resolution heuristic. It may be possible to undertake several multi-mesh comparison studies: demonstrating

that simulations run on meshes generated using the new resolution heuristics compare more favourably with high resolution numerical studies or observational data.

Overall, I feel that major revisions to the paper are required.

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