Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., community comment CC1
https://doi.org/10.5194/gmd-2021-51-CC1, 2021

Comment on gmd-2021-51

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Community comment on "Australian tidal currents – assessment of a barotropic model (COMPAS v1.3.0 rev6631) with an unstructured grid" by David A. Griffin et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-51-CC1, 2021

This paper describes the results of tidal simulations using a new unstructured grid model for Australian coastal waters, initially developed for a tidal renewable energy project. The model results, from depth-averaged simulations, are compared with observations from an unprecedented collection of tidal height and tidal current locations at which a minimum of 11 tidal constituents are available. This assembly of observed tidal constituents is valuable in its own right, and the published model tidal constituents form a useful dataset. The paper is divided into sections describing the model setup and preliminary experiments, the two observational datasets, the model-observation analysis methodology, followed by the results and a discussion. A comprehensive set of statistics is offered, resulting in a regional approach to assessing the quality of the model results. Overall the paper offers the reader several new perspectives: on the observation coverage of the tides around Australia; on the diversity of its tidal regimes; and on the ability of this new model to accurately represent these regimes. As such it is a valuable contribution to the journal and the published datasets of value to the community. Some thoughts and suggested minor modifications are discussed below.

The discussion of model configuration suggests the use of the unstructured grid is a computational saving, indicating a regular grid model of similar resolution would require 1.5 million points to match the 'mean resolution' (not defined). This is not a large array for a simple 2D model so the saving, if any, may not be great. The smallest cell in the unstructured mesh is ~330m which is relatively large for some of the areas in question. I wondered if the computational constraints of the explicit scheme was limiting the calculation.

Lines 75-80 discuss the bathymetry used, and points to use of minimum depths, which would limit any wetting and drying, which may impact on results with large tidal range; was this tested in the preliminary experiments?

Line 90+ describes the open boundary set up which is indeed quite unusual. A sentence or two to explain why this works would be helpful, particularly on how internally generated motions reaching the open boundary are handled.

Line 100+ describes the intitial experiments conducted to arrive at the finally chosen

parameter settings (e.g. drag coefficient). Given that later in the paper, in discussing the results, there are several assertions as to discrepancies between model and observation, e.g. line 375, line 388, could these initial experiments offer any explanations?

Line 135-140 … how close to the island? The text seems to suggest that the model cell size may also need refining to capture the variability.

Line 155 … 'for all the usual reasons' might need an explanation.

Line 174, the penalty function; this is dimensionally imbalanced and needs an explanation for the D/5C component.

Many of the figures, e.g. Figure 3, include tables of percentiles. Provide a sentence explaining these. Similarly, some tables (e.g. Table 2), have '%obs' values which need an explanation.

Line 281 refers to sites in Banks Strait but in the table they are labelled Bass.

Line 356, spell out RIB.

Line 380 … it would be helpful to have Broad Sound marked on Figure 11.

Line 384 … explain why you query the mechanical current meters. Mark Lady Musgrave on a figure.

Line 394 … suggest changing 'the amplitude of S2 exceeds that of M2 (barely),' to say 'the amplitude of S2 is of similar magnitude to that of M2,'.

Line 408 … 'and thus underestimates the errors'. How do you know?

Line 415 … Given that the official predictions are available, might be a useful addition if you did compare. Even to demonstrate the adequacy, or otherwise, of the official predictions.

Line 416+ This doesn't offer an explanation of why the you think the tidal currents are poorly predicted in this region.

Line 430 … As we know, M4 and other higher harmonics are generated internally through non-linear model terms. Do you have anything to say on this generation mechanism within the model?

Line 441 … Can I suggest rewriting this sentence 'Over the continental shelf, this is the case for the southern half of the continent from Ningaloo Reef in the west to Fraser Island in the east, excepting Bass Strait and the South Australian gulfs (i.e. the sections where the shelf is narrow).' as " Over the continental shelf, this is the case for the southern half of the continent from Ningaloo Reef in the west to Fraser Island in the east (i.e. the sections where the shelf is narrow).' Exceptions are Bass Strait and the South Australian gulfs."

Line 480 … Whilst the focus of the paper is on tidal currents, the statement that non-tidal currents play an important role in many parts of the Australian coastal domain leads the reader to wonder whether future versions of the model will attempt to provide this missing component. In this context, lessons learnt by Witeranje et al (2018) may be useful. Also, some insight into what improvements are intended (or are in development) and why these are seen as improvements would be useful.

Ref: Wijeratne, S., Pattiaratchi, C., & Proctor, R. (2018). Estimates of surface and subsurface boundary current transport around Australia. Journal of Geophysical Research: Oceans, 123, 3444–3466. https://doi.org/10.1029/2017JC013221