Ocean Science

Discussions

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Interactive comment on "The significance of coastal bathymetry representation for modelling the tidal response to mean sea level rise in the German Bight" *by* Caroline Rasquin et al.

Anonymous Referee #2

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Suitability: The subject of the paper, i.e. the study of the significance of coastal bathymetry representation for modelling the tidal response to mean sea level rise in the German Bight falls within the fields covered by Ocean Sciences.

Summary: The manuscript uses together a shelf and regional models to investigate the effect of the bathymetric resolution and the estuary morphology on the modelled tidal response to sea level rise in the German Bight. It shows that the tidal response to moderate sea level rise (0.8m) is strongly affected by the bathymetric resolution, while it is much less sensitive for much higher sea level rise (10m).

General comment: The present work, is, to my knowledge the first study quantifying

the effect of the bathymetric resolution on the estimation of tide changes induced by sea level rise. It highlights the potential limits of existing nearshore tide changes projections. To me, the manuscript deserves to be published, but under the condition of major improvements. Indeed, the paper lacks a clear description of the configuration used in the simulation (see my major remarks below). In addition, the model validation could be reinforced in terms of tide changes validation (see my suggestion in below). The regional model has a spatially varying resolution with a minimal grid size of 100 m in the estuaries. As the paper focusses on the effect of the coastal bathymetry representation, then: (1) a sensitivity analysis of the regional model to the bathymetric resolution would strongly reinforce the manuscript and its impact, (2) some recommendations on the relevant grid size to use in the German Bight would be welcome.

Major remarks

1. Methods and model description. The studies relies on two models. In the description of the models (sections 2.1 and 2.2), it seems that the simulations are done taking into account meteorological forcing, offshore salinity and river discharge. No information is provided on these conditions. In addition, if the regional model accounts for the salinity on its offshore boundary, we can guess that the river salinity is also accounted for. Nothing is said, no value is given. Thus, the manuscript really required improvement on the description of the simulations (input conditions) and justification. Indeed, for the purpose of the study, why using 3D baroclinic simulations rather than 2DH simulations? Nothing is said.

2. Validation. First, the manuscript should provide the validation period over which they validate the tide. Second, even if they do not state it, the authors assume indirectly that the regional model (at high resolution) is better than the shelf model (at low resolution) to reproduce tide changes induced by sea-level rise. To support this assumption, a comparison of observed past tide change trends (using for instance literature results on tide gauges located in the study area) and results obtained simulating an additional and more moderate sea level rise scenario of e.g. 0.2 or 0.3 m, would be useful, with all

the limits that such comparison has (additional mechanisms can contribute also modify the tide). But, as in Schindelegger et al. (2018), this would reinforce the paper.

3. Sensitivity of the tide changes to the bathymetric resolution. The manuscript would strongly benefit from a real sensitivity study of the tide changes to the bathymetric resolution, by investigating different bathymetric resolutions with the regional model, and not only the one corresponding to the shelf model. This would allow identifying if there is a bathymetric resolution below which there is no further improvement. Such result would allow the authors to make recommendations for the German Bight, and would strongly increase the impact of the work.

References

Schindelegger M, Green JAM, Wilmes S-B, Haigh ID (2018) Can we model the effect of observed sea level rise on tides? J Geophys Res Oceans. https ://doi.org/10.1029/2018J C0139 59

"On-line" Remarks

- P1-Line 27: "flat" -> in most of the paper, the authors use "flat". I think that "low lying" is more relevant

- P1-Line 27: add a reference to figure 1 and figure 2 (German Bight).

- P1-Line 29: "estuaries." -> reference?

- P1-Line 29 -> P2, line 5: would better fit in the discussion section? Or remove it?

- Figure 4: hard to see the green star and blue points → make a zoom for ∼RMSE=0 to 0.5

- P15, line 5: make clear what is the mean current velocity. Is it the M2 - depth averaged current velocity? Is it the M2 depth averaged current velocity averaged over a given period (and is so, which period?)

- P15-Line 17: "approx.." -> "approximatively".

- Table 4: the readability could be improved by putting on the same line "global" and "epsilon G" (see the 4th column of the table).

- P19-line 30 -> line32: "In this . . .Bight.": this sentence is not clear to me -> reformulate.

- P20, line 1 -> line 7: I suggest to avoid providing results/conclusion based on a reference with the status "in prep". I would advice to reformulate this part as a perspective, and explain that Wachler et al. already start to explore the reasons of increase or decrease of velocity depending on the amount of sea level rise.

- P20, line 19: same suggestion, reformulate to just say that Wachler et al. (in prep) explored the bathymetric changes issue.

Specific Ocean Sciences questions

1. Does the paper address relevant scientific questions within the scope of OS? Yes

2. Does the paper present novel concepts, ideas, tools, or data? Not really, it mainly explores the effect of some modelling issues that we expect could play a role on previous model results.

3. Are substantial conclusions reached? Fair

4. Are the scientific methods and assumptions valid and clearly outlined? Not completely

5. Are the results sufficient to support the interpretations and conclusions? Not completely

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? No

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes

8. Does the title clearly reflect the contents of the paper? Yes

9. Does the abstract provide a concise and complete summary? Could be more concise

10. Is the overall presentation well structured and clear? Mainly yes

11. Is the language fluent and precise? Mainly yes

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes

14. Are the number and quality of references appropriate? Yes

15. Is the amount and quality of supplementary material appropriate? No supplementary material

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