

Interactive comment on “Ocean Forecasting: From Regional to Coastal Scales” by Emil V. Stanev et al.

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Answers on “Ocean Forecasting: From Regional to Coastal Scales” by Emil V. Stanev et al.

Anonymous Referee #1

We are grateful to reviewer for the appreciation of our work and his constructive comments, which we answer point-by-point. The comments, which are not included in our answers are of technical character, and are addressed in the revised manuscript as the reviewer suggested.

The manuscript could be generally improved by making linkages and dependencies between sections a little clearer, so that the whole paper hangs together a little better

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as a coherent discussion.

Authors: In the revised manuscript we include linkages and dependencies between sections, as suggested.

Title – given the quite specific regional focus of research work covered in this paper on the German Bight, I would ask the authors to consider a more specific title for this paper, e.g. “Ocean Forecasting for the German Bight: From Regional to Coastal Scales” as a more descriptive title.

Authors: Thank you for this suggestion. We accept it.

Section 1, please clarify further how your paper adds beyond other review papers (e.g. Kourafalou et al 2015a,b)

Authors: At the end of the revised Introduction we include a paragraph clarifying this. The major point is that we consider only one specific region (the North Sea and Baltic Sea) and focus on the transitions between coastal and regional scale as seen in the analyses for two different transition areas: German Bight and straits connecting the Baltic and North Seas.

Section 2 – this whole section would benefit from clearer sign-posting of what is covered within each section, for example via a short introduction on p4, and clearer titles for sub-sections. At present it reads as a slightly ad-hoc list of different approaches and evaluations of improving model skill.

Authors: The referee is right and we are thankful for this suggestion. We introduce in the beginning of each major section a description of research issues which are addressed and explain the rationale, which justifies keeping the individual sub-sections together. In the revised manuscript substantial restructuring has been done. (1) We explain better the links between individual parts of paper. (2) We removed sub-sections 4.1 and 4.4. (3) We moved sub-section 4.5 into section 3 and explained why. (4) We reordered the remaining part of section 4 starting with coupled wave-circulation

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modelling. (5) We re-structured section 2.3. (6) We changed the titles of some sub-sections.

It would aid the reader to understand how 2.2 links to 2.3? Should Section 2.3 better sit in its own section on model nesting?

Authors: In the revised manuscript we explain the idea behind keeping Section 2.3 (which is on modelling) in the modelling part. In the revised paper (end of introduction), the structure of paper is also explained.

Section 2.1 – on discussing “resolution capacity compliant with the dominant spatial scales”, it would aid the reader to add another line of detail relating to how that choice can be sensibly made (e.g. consideration of the relevant Rossby radius of deformation? What are the relevant length scales for the German Bight?). Is it also possible to discuss sensible choices for vertical resolution in these domains?

Authors: In the revised manuscript we address this comment and provide the missing information and references.

Section 2.2.3 and 2.2.4 – to aid discussion of the different model configurations compared here, it would be helpful to provide a summary table (summarising the annex material) which highlights the key differences between systems shown. E.g. are all systems operating with the same horizontal and vertical resolution, Baltic model, atmospheric forcing, freshwater fluxes, etc?

Authors: In the revised manuscript we provide in section 2.2.2 a new table summarizing the annex material and add a synthesis of model characteristics presented in the Annex.

Section 2.2.4 – please clarify whether differences in M4 tides are purely a function of different model resolutions, or are there other factors?

Authors: Good point, which is very important for the substance of the paper.

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1. When describing the specificity of coastal ocean modelling in section 2.1 we add a paragraph on this explaining that it is not only the resolution in the models, which matters when moving from regional to coastal scales, but also the details in bathymetry, such as the coast-line and bottom roughness, which could change in time. Addressing specific processes and their role in the coastal ocean is basic in order to understand whether by just changing the resolution we could solve the major problems with the transition between the coastal and regional scales. On the road of this transition specific processes, which are sometimes neglected in global and regional forecasting, start to dominate. One second example demonstrating the role of surface waves is presented in section 4.1 (old section 4.6).

2. We address this issue in the revised manuscript in more specific terms in Section 2.2.4 (M4 tides) where we mention that according to the analysis of data and modelling results of Jacob et al. (2016) the morphodynamics could result in a substantial migration of bottom channels in the Wadden Sea. This can be considered as a change in the macro-scale bottom roughness, which triggers non-local responses. In the context of major issue addressed in this section, one needs to mention that response to bottom changes identified by Jacob et al. (2016) is quite strong for the M4 tide, giving further motivation to deepen the understanding of properties of shallow-water tides.

Section 2 – freshwater fluxes: there is no mention in this section of the importance of accurate freshwater fluxes for prediction in the coastal ocean (or indeed whether this is an issue in the German Bight). It could be helpful to the reader to provide a brief discussion on this, particularly in light of Section 4.3.

Authors:

1. After “In addition, more flexible coupling is needed between regional and coastal models, including estuarine models.”(Section 2.1 of the first submission) we mention the issue about the river runoff.

2. In Section 2.2 when describing the general characteristics of models we focus also

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on possible problems with the representation of river run, referring to section 4.2 (old section 4.3) where we discuss this issue in more detail. The importance of this for the North Sea and Baltic Sea is also mentioned there.

Section 3.2 – HF radar. Please provide summary statistics of the value of HF radar within the COSYNA system. It is difficult for the reader to understand the value of these data from the discussion alone as it stands (see also comment re. Figure 4). This is more complete in the discussion of SST assimilation.

Authors: In the revised manuscript we provide summary statistics (new table) and text summarizing the statistics.

Figure 4 – Can the authors provide any longer-term analysis of HF radar data vs model analyses and free run? E.g. long-term statistics (as provided in Figure 5 for example).

Authors: In the revised manuscript we provide some new summary statistics (new table).

Section 3.3 – please comment on the errors in OSTIA in the coastal zone, given its dependence on satellite products for which errors are increased here. To what extent would the authors expect assimilation of OSTIA to provide information on the detailed structures in the coastal zone? This seems particularly relevant to the discussion relative to DA_BLEND results.

Authors:

1. We refer in the revised manuscript to our previous publication where the errors in OSTIA data are presented.

2. In the revised manuscript we address issue about benefit of assimilating OSTIA data in the coastal area admitting that the major impact of OSTIA data assimilation is in the improvement of the large-scale temporal and spatial characteristics.

Figure 5 – while Figure 4 refers to a snapshot comparison (see above comment),

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it would be valuable to compare snapshots, or some assessment on sub-annual timescale of differences between OSTIA and the numerical model, to compare how well captured the near-coastal variability might be between OSTIA and the model.

Authors: We make clear in the revised manuscript that neither OSTIA data nor the numerical model with a resolution of 1 km can well resolve near-coastal variability. Just to visualize the problems with resolving small-scale features in OSTIA data we add to Fig. 5 new frames to illustrate OSTIA data and fine-resolution observations and free model run for the same time. The problems with resolving small scales are used to bridge the results in this section with the ones where discuss simulations of near-coastal zone and estuaries.

Section 4.3 – it would be helpful to better link this section in to the preceding discussion. The key question, is how does the estuary-specific configuration interface with the larger-scale German Bight models, if at all, and what are the challenges to address in nesting right across scales from North Sea to estuary scale? Is this a ‘solved’ issue? It is currently difficult to understand how the Ems Estuary model fits relative to other tools available to provide services.

Authors:

1. The title of this section has been changed.

2. The first part of this section was written new, addressing the comment of the referee.

3. The focus of the presentation of results has been also changed accordingly, to link this section in to the preceding discussion about the consistence between the estuary-specific modelling and the larger-scale German Bight model.

4. More weight in the revised section is given to the transformation of fresh water in the estuary and beyond.

Section 4.6 – please provide some context for the quantitative differences discussed. E.g. is a 40cm difference important for end-users and responding to natural hazards?

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How do underestimation of 30cm relative to gauge compare with long-term statistics for sea level predictions in this region – is this specific to extreme events or typical?

Authors: In the revised manuscript we address this issue with respect of the uncertainties of storm surge predictions and the quantification of associated coastal hazards. We stress that the results of our experiments showed that the wave-dependent approach yields to ~30% larger surge for the period of “Xavier”.

P2, Para including line 20: “. . .similar devastations never happened again.”. Please consider addressing the language in this sentence to something like “. . .”similar devastation has not occurred since” – there are of course a number of reasons for this (e.g. have similar magnitude storms hit the region since?).

Authors: We rephrased this sentence.

P3, line 25 – please check language concerning “data problematics”, suggest rephrasing this point.

Authors: We rephrased this sentence.

P9, line 5 – please clarify status of “in preparation” paper ahead of publication

Authors: We removed this reference.

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