Comment on gmd-2021-101

Anonymous Referee #1

Referee comment on "Nemo-Nordic 2.0: operational marine forecast model for the Baltic Sea" by Tuomas Kärnä et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-101-RC1, 2021
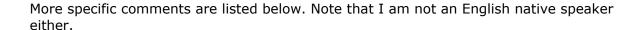
Summary:

The manuscript describes an operational forecast model for the Baltic Sea and illustrates the applicability of the model by comparing a hindcast simulation to observational data from various sources.

Major comments:

The manuscript is well structured and the model seems well suited for the task at hand. I have only some minor points.

(1) The purpose of the model could be stated more clearly - which variables are of interest for the end-users and forecasted? In this context I would find it nice to motivate the model assessment metrics and the choice of the considered observations based on the model purpose (why are these of interest and which precision of the forecast is required for potential end-users?)

(2) The assessment of the simulated sea ice is limited to a time series of sea ice extent. Some more assessment (including a visual impression of the spatial distribution) would be nice because I regard this aspect as very important for potential end-users.

More specific comments are listed below. Note that I am not an English native speaker either.

Specific Comments:

Line 1: The authors could add one sentence which model output they want to provide to the end user.

Line 7: I would suggest to add that the comparison is based on a hindcast simulation and the considered time period.

Line 17: Please add Dietze et al. (2014) (already referenced later)

Line 50ff: For my feeling the part about spurious mixing is a bit long in the introduction and parts of it could be moved to the final discussion when referring to the representation of inflows from the North Sea.

Line 64ff: The following parts seems a bit unrelated to the foregoing text. Maybe the authors could add a few sentences why operational forecasting is required in the Baltic and then come to the operational models.

Line 70: better "….ocean circulation model…."

Line 80ff: I would suggest to add what should be forecasted/is of interest to potential end users.

Line 86: Instead of "skill metrics" I would rather use "model assessment metrics" - especially since the model is evaluated on a hindcast simulation and no real forecasts are considered. Note that this expression occurs rather often in the text and should be changed consistently.

Line 90: I find this confusing. Better? "..is an updated version of Nemo-Nordic 1.0 based

on..."

Line 93: horizontal resolution

Line 93ff: I would finish the description of the model grid before coming to the boundaries. Also, it should be specified which open boundaries are used.

Line 99: was -> were

Line 102: How was the bathymetry modified (what counts as "shallow")?

Line 106: How was the tuning done?

Line 135ff: I would suggest to finalize the description of the ocean part before describing the sea ice.

Line 173: I would rather call this section "Boundary conditions"

Line 174ff: The initial conditions could be described in a bit in more detail (e.g. from which conditions did the spin-up start?) because I expect at least some impact on the representation of the simulated deep water properties. Please note in this context that I see no perfect solution for their choice because the Baltic Sea virtually never reaches some kind of steady-state.

Line 178: Better? "The atmospheric boundary conditions are provided by ...". Also, I would be interested in the spatial resolution of the atmospheric forcing.

Line 182/183: Better move to line 180 (+ delete "in NEMO")

Line 190ff: Better? Observational data were provided by ….

Line 208: Better? "Model assessment metrics"

Line 231: I am not sure what is meant by "datum" in this context.

Line 235ff: The following part sounds like a lengthy excuse why SSH might not be captured perfectly in the model - which for me would rather refer to the discussion of the model results. Also, I would suggest to express this in a more positive way, i.e. what to expect from a SSH forecast. For my feeling the most important aspect for end users are deviations from the mean.

Line 252: When mentioning the locations (Kiel Holtenau etc.) the authors could refer to Fig.1c.

Line 259: This reads a bit confusing for me. Suggestion: The agreement between model and the ssh observations is generally higher in the open Baltic Sea than in Danish Straits. In the open Baltic the NCRMSD is generally below 0.3 and correlations between model and observations are above 0.95 (exceptions are....). In the Danish Straits, stations Frediericia and Copenhagen show much lower correlations of ...., respectively. This local drop in the correlations is expected due to the complex bathymetry in the Danish Straits.

Line 263ff: The BSH provides 2D maps for SST. It might be nice to show an example snapshot – even though the statistical value is of course limited.

Line 265ff: Maybe add "..mixing in the water column" because the other processes mentioned here refer to the atmosphere.

Line 265/266: ?

Line 281: The authors could add that they refer now to one of the ferries (for those who are not so familiar with ferry box data and the respective shipping lines). At which depths do the ferries measure?

Line 288/289: Which gradient?

Line 294ff: I would expect that the deep water properties are still impacted by the initial conditions because Döös et al. (2007) report a residence times of almost 30 years for the Baltic Sea. This can in my eyes not be avoided here but could be mentioned (unless this issue was investigated somehow and ruled out). In this section I personally would include

an assessment of the simulated mixed layer depths.

Line 299: I would use some other wording instead of "Temperature profile skill" (similar expressions are used several times.)

Line 357ff: I regard the representation of sea ice as very important in a forecast model. I would find it nice to see a/some 2-dimensional map(s).

Line 392ff: For my feeling the discussion could focus more on the applicability of the model for forecasts. I like the honest discussion about MBIs.

Line 444: Why would a forecast model require a coupling with an atmospheric model? A coupled ocean-atmosphere model is not suitable for a 1:1 model-data comparison.

Line 445: Code availability: Pease provide doi and the link. I would find it nice if also the extra information to run the model was provided in addition to the code (such as initial conditions (restart), short test forcing/boundary conditions and specific model settings).

Reference

Döös, K., & Engqvist, A. (2007). Assessment of water exchange between a discharge region and the open sea–a comparison of different methodological concepts. Estuarine, Coastal and Shelf Science, 74(4), 709-721.