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Geoscientific Model Development Discussions

Interactive comment on "COSTRICE – three model online coupling using OASIS: problems and solutions" *by* H. T. M. Ho et al.

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Dear Sir/Madam,

Thank you very much for your helpful comments and suggestions to our article in GMDD. Here is our response to the remarks.

1) Page 3262, line 1: omit "for the first time" because this is not true.

Reply: We agreed to remove "for the first time".

2) Page 3263, line 21: It is certainly not HIRHAM. Please check. Either RCA or HIRLAM.

Reply: We corrected: " RCMs HIRLAM and RCA".

3) Page 3266, lines 4-6: I do not agree with this sentence. The coupling frequency should be given by the processes that are important for the spatial and temporal scales under investigation. Please rephrase.

Reply: We rephrased: "A unique answer cannot be given as this frequency is governed by the processes that are important for the spatial and temporal scales under consideration. These vary over different climatic regions and in different seasons."

4) Page 3266, line 16: ...of one hour or less ...

Reply: We corrected it.

5) Page 3270, line 11: Please explain what is FES2004. An ocean reanalysis?

Reply: We added an explanation for FES2004: "... FES2004, the latest version of the FES (finite element solution) global tide model using tidal hydrodynamic equations and data assimilation (Lyard et al, 2006; Lefevre et al., 2002)"

6) Page 3271, lines 12-17: What is used in this study? Please explain.

Reply: The method DISTWGT we used in this study is mentioned on Page 3275, lines 3-5. In order to avoid confusion, we shortened the text: Various interpolation methods are available in OASIS3, which are offered by the Los Alamos National Laboratory SCRIP 1.4 library (http://gcmd.nasa.gov/records/LANL-SCRIP.html).

7) Page 3272, line 1: "... over the Baltic Sea and Kattegat, a part of the North Sea."

Reply: We corrected it.

8) Page 3272, lines 6-9: I don't understand which SST and ice fields do you use for the standalone runs STERva and STERhf for CCLM.

Reply: We rephrased and explained: "... The run STERhf is also uncoupled but the heat fluxes are passed from CCLM. In both cases, the CCLM data are taken from a simulation, in which CCLM was forced by ERA-interim SST, and are then provided

to TRIMNP. In turn, TRIMNP calculates SSTs without sea-ice scheme and does not give it back to CCLM. The third experiment CPERAi is a coupled run where all fluxes including heat fluxes are passed from CCLM to TRIMNP and CICE. In CPERAi, the SST provided to CCLM over the coupled area is the combination of surface water temperatures from TRIMNP and sea-ice skin temperatures from CICE."

9) Page 3272, line 29: OISST has a very coarse resolution. I recommend to use the BASIS data set instead with higher resolution available from SMHI.

Reply: The present manuscript is mainly on the description of the model system itself (that is why we choose GMDD) and basic evaluations of the performance. The model tests necessary to combine the model components in order to setup the system required a large amount of computing resources. To get this done we had to restrict to a coarse model resolution in this phase (grid sizes 50 km for atmosphere and 12.8 km for the ocean). Therefore, we think that for this first evaluation, OISST data are still useful. However, after the model system has been now successfully setup, we will go to higher resolution in our next study, which is absolutely necessary, e.g. to simulate the flow through the Skagerrak and Kattegat. We therefore very much appreciate your recommendation and will use the BASIS data set for evaluating the upcoming high resolution simulations.

10) Page 3273, line 11: add comma after PSMILe

Reply: We added it.

11) Page 3274, lines 5-9: For the albedo calculation also the ice concentration should be coupled. Why do you need both state variables and fluxes for the coupling of TRIMNP and CICE? Please explain better.

Reply: We added: "... Basically, (i) in this initial study, CCLM is linked to TRIMNP through SST as a lower boundary condition for ice-free conditions and to CICE through the ice skin temperature. In the latter case, the albedo parameterization in CCLM

switches from ocean to sea ice. However, no partial sea ice cover, snow on sea ice and water on sea ice is presently taken into account for in CCLM. These are items for future refinements of the model system; (ii) as two individual models, TRIMNP and CICE are both driven by the atmospheric .... ".

12) Page 3276, line 23: The Baltic Sea has a response time scale of 30 years. Please add this information.

Reply: Thank you for the useful information. We added: " As the Baltic Sea has a response time scale of 30 years (Meier et al., 2006), for the longer runs, ..."

The following reference is added to the Reference list on Page 3289, line 4:

"Meier, H.E.M., Feistel, R., Piechura, J., Arneborg, L., Burchard, H., Fiekas, V., Golenko, N., Kuzmina, N., Mohrholz, V., Nohr, C., Paka, V. T., Sellschopp, J., Stips, A., Zhurbas, V.: Ventilation of the Baltic Sea deep water: A brief review of present knowledge from observations and models, Oceanologia, 48(S), 133-164, 2006."

13) Page 3277, line 7: You should discuss also albedo.

Reply: We added to line 7: "Note that the existence of sea-ice in a grid box also affects the surface albedo that is important for the calculation of surface radiation fluxes in the atmosphere model. Presently, the CCLM does not include a tile approach and cannot take account of partial sea ice in an atmospheric grid box. Moreover, when the model system was built, CCLM did just include a constant albedo of 70% for sea ice. In the new CCLM version, a temperature dependent sea ice albedo is implemented. For the planned long term simulations, this has to be taken into account in COSTRICE."

14) Page 3277, line 11: Strange sentence. Please rephrase.

Reply: We eliminated “are rapid”

15) Page 3278, line 3: Strange sentence. Please rephrase.

Reply: We corrected: "Therefore, in the following paragraph, we investigate the

changes of wind and SST from long term simulations of the uncoupled versions of CCLM and TRIMNP, respectively."

16) Page 3278, line 7: Skagerrak instead of Skagerrak Strait

Reply: We deleted "Strait".

17) Page 3278, line 10: are selected

Reply: Corrected.

18) Page 3279, line 3: Wind driven ice flows should determine the coupling time step.

Reply: We added to lines 4-5: "... in the atmospheric forcing. However, the changes of wind may have an influence on wind-driven sea ice flows. Thus, it's necessary to investigate the dependence of wind-driven sea ice flows on near surface wind speed in the future to determine the air-sea ice coupling time step more objectively. In the scope of this study, a coupling time step of 3-h is chosen to pass CCLM's output to CICE."

19) Page 3279, from line 6: please shorten the text and focus more on the essential findings.

Reply: We deleted lines 15-20 and rephrased lines 22-29. "In the cold season (Fig. 7b) in general, EFCs are quite negligible and similar over the sub-regions and time periods. In the warm season (Fig. 7a), EFCs are higher, especially over longer time periods. In detail, the 3-h changes larger than 0.5 K and 1.0 K occur at EFCs of 30-40 % and 6-8 %, respectively. While, for d6, these EFC values are 55-60 % and 25-32 %, respectively. The EFCs of d12 are much higher than d6 due to the night-day contrast. The daily changes d24 are weaker than d12 but still larger than d6."

20) Page 3280, lines 1-4: We deleted these sentences as the paragraph is rephrased.

21) Page 3289, line 4: We added the following Reference (see also item 12 above): "Meier, H.E.M., Feistel, R., Piechura, J., Arneborg, L., Burchard, H., Fiekas, V., Golenko, N., Kuzmina, N., Mohrholz, V., Nohr, C., Paka, V. T., Sellschopp, J., Stips,

A., Zhurbas, V.: Ventilation of the Baltic Sea deep water: A brief review of present knowledge from observations and models, Oceanologia, 48(S), 133-164, 2006."

With best regards,

Ha Ho and co-authors.

Interactive comment on Geosci. Model Dev. Discuss., 5, 3261, 2012.