Geoscientific Model Development Discussions

Geosci. Model Dev. Discuss., author comment AC3
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Reply on RC1

Zhenming Wang et al.

Author comment on "Monthly-scale extended predictions using the atmospheric model coupled with a slab ocean" by Zhenming Wang et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-159-AC3, 2022

This study compares the month-scale predication with WRF coupling with two different modes: Slab-ocean model (SOM) or ROMS. It shows that the SOM performs better than the ROMS by avoiding the SST bias in ROMS. The result are interesting and the topic fits GMD well. The experiments are well designed and manuscript is well written. I suggest major revision for with my comments listed below:

RE: Thanks for the reviewer's thorough examination of our manuscript (MS) and comments. All of coauthors agree that the comments are very constructive to improve the presentation of the MS, and all the major comments and other points have been fully addressed in the revision. Specifically, in the revision, we have added: 1) more detailed descriptions of the WCDA, 2) SST prediction skills over different seasons in Figure 2e, 3) more detailed descriptions of the possible error sources, etc.

The point-by-point replies are followed.

Your model domain covers north Pacific high latitude. Some of the area should be covered by sea ice, especially in winter. How do you deal with the sea ice in your SOM? The sea-ice region overlap with the region with large cold SST error in (Figure 3). What is the forecast sea ice error in ROMS?

RE: Yes we agree that the sea-ice region overlap with the region with large cold SST errors and we do believe that the inaccuracy of sea ice simulation would aggravate the SST errors. Firstly, SOM does not calculate sea ice separately and it reads sea ice data from CFS data every six hours. For ROMS, the regional prediction system does not include a separate sea-ice module. We have added the detailed descriptions of dealing with the sea ice in the revision. Please see lines 218-222. Figure 5e shows that the errors of SST errors are mainly from the subsurface in this area at the start of the simulation. This paper mainly aims to propose SOM to avoid the complex errors from dynamic processes and inappropriate model configuration. Thanks for your good suggestions and we will evaluate the influence of sea ice on the SST predictions in the extended-range predictions in the follow-up work.

Section 2.3 Can you provide some details about your WCDA in terms of DA method and assimilated observations? The details of generating initial conditions of SOM are missing, for example, how do you derive the mixed layer depth.

RE: Thanks for your good suggestion. We have added the details of the WCDA in the revision. Please see lines 151-155. The observations assimilated in the forecast system including: 1) GTS observation packages for the atmosphere (air pressure, wind, geopotential height and temperature) are from China Meteorological Administration. 2) The observations for the ocean (ocean temperature and salinity) are from AVHRR, OSTIA, ARGO, and AVISO, etc. In SOM, we calculate the depth of the mixing layer by the joint action of surface wind stress and heat budget of the ocean mixing layer. Please see Equation 1-4.

It will be good to show the prediction improvement over different season.

RE: Thanks for your suggestions. We have added the prediction improvement over different seasons in Figure 2e and relevant analysis. Please see lines 207-211.

Ln 148 “for each example” to “for each experiment”

RE: Thanks for your suggestions. We have changed the statement from “for each example” to “for each experiment”. Please see line 164.