

This is a third review of "SKRIPS v1.0: A regional coupled ocean–atmosphere modeling framework (MITgcm–WRF) using ESMF/NUOPC, description and preliminary results for the Red Sea" by Sun et al.

Accept with technical corrections.

This version of the manuscript is more narrowly focused on the implementation and development of the coupled system, with much less emphasis on the validation of a case study. There are a number of locations with improved explanations / descriptions: how the comparison with observations takes place, the purpose for the domain and case study, use and impacts of the validating data, implications of observations and reanalysis data near the coast, and a clearer presentation on scaling and timing performance. Every figure caption has been modified, making them much easier to understand and making them much more standalone.

1) Scientific significance

Does the manuscript represent a substantial contribution to modelling science within the scope of this journal (substantial new concepts, ideas, or methods)?

This is a coupled ocean-atmosphere system, using a state-of-the-art coupler and highly cited numerical models. Significant documentation and support for the individual components exist. This coupled system could substantially lower the bar for users to get into the coupled ocean-atmosphere arena, particularly with users who are already fluent in one of the models.

2) Scientific quality

Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)? Do the models, technical advances and/or experiments described have the potential to perform calculations leading to significant scientific results?

The reasonable approach to the coupled system would be to test each component separately and then together to determine sensitivity. The authors approached validation in this fashion. They used standard observation and reanalysis to indicate that the coupled system is producing expected results. The test case was long enough to have indicated an incorrect trend. The spatial distribution of errors is explainable and largely expected. Regional climate systems are hampered without access to a coupled ocean-atmosphere system, and this coupled system is directly intended to support that community.

3) Scientific reproducibility

To what extent is the modelling science reproducible? Is the description sufficiently complete and precise to allow reproduction of the science by fellow scientists (traceability of results)?

The authors provided extensive information on the location of component source code repositories, and also to the source of the modified code (to enable the coupled system with existing source code). For the actually running of the system, I think the user community would

benefit from more detailed information than what the authors provide: https://scripps-coupled-atmosphere-ocean-model.readthedocs.io/en/latest/tutorial/tutorial_rs.html. This page (these pages) could serve as both a tutorial and a step-by-step procedure to replicate the coupled system results. For example, instead of "generate the mesh", explicit steps could be given.

4) Presentation quality

Are the scientific results and conclusions presented in a clear, concise, and well structured way (number and quality of figures/tables, appropriate use of English language)?

The paper is reasonably well structured. The conclusions draw correctly from the results and discussion. Data that that should be presented in a tabular form for ease of understanding is done so. Several figures suffer from insufficient visual differentiation, but that is similar to most presentations with even a small ensemble. However, as the authors state in comments (not in the paper) "our goal for this work and manuscript is to (1) introduce the design of a newly developed regional coupled ocean-atmosphere modeling system with a state-of-the-art coupler (ESMF with NUOPC), (2) describe the implementation of the modern coupling framework, (3) validate the coupled model using a real-world example, and (4) demonstrate and discuss the parallelization of the coupled model." The "similariness" of a number of figure components points to the authors conclusions that the coupled system is giving results similar to the results of the standalone well-known models.

Technical Corrections:

P1 L12,13

"The coupled model, documentation, and tutorial cases used in this work are available"

What tutorial cases are used in this paper? Either be more specific, or remove this portion of the sentence.

P3 L7

"(Skamarock et al., 2005)."

(Skamarock et al., 2019).

P5 L24

"(Skamarock et al., 2005)"

(Skamarock et al., 2019)

P9 L4,5

"To validate the coupled model, the following sets of simulations using different surface forcings are performed according to the tests (Warner et al., 2010; Turuncoglu et al., 2013; Ricchi et al., 2016)"

Either I don't know what "according to the tests" means, or this should be stated in a clearer fashion. How are these citations related to "according to the tests"?

P10 L1,2

"The ocean model uses the data assimilating HYCOM/NCODA 1/12 global reanalysis data as initial and boundary conditions"

Remove "data assimilating".

P10 L10,11

"Here we used the default width"

Everything else is present tense.

P10 L21

"The simulated SST is also validated against HYCOM/NCODA data to show the increase of the error."

No idea what this means.

P11 L1

<http://cdo.ncdc.noaa.gov/CDO/georegion>

This link is broken.

P11 L5

"Surface heat fluxes (e.g., latent heat, sensible heat, longwave and shortwave radiations), which drives the oceanic component"

drive

P16 L2

"The SST field snapshots from CPL run on June 2nd and 24th are shown"

Remove "run". The word "run" could be used as a noun or a verb in the sentence, and the meaning of the sentence changes.

P16 L12,13

"To quantitatively compare the errors in SST, the time history of the SST in the simulations (i.e., OCN.DYN and CPL) and validation data (i.e., GHR SST and HYCOM/NCODA) are shown in Fig. 9."

Add a sentence describing the reason for the oscillatory 9a vs 9b (3h vs daily data?).

P17 Fig9b

"Mean SST: CPL 29.28; OCN.DYN 29.29; HYCOM 29.85"

"HYCOM" should be "GHR SST"

P23 L3

"The coupled model is validated by using a realistic application to simulate the heat events in the Red Sea region. "

This is the conclusion so be specific in case readers read only this and the abstract, "The coupled model is validated by using a realistic application to simulate heat events during June 2012 in the Red Sea region."

P23 L15,16

"The CPU time associated with different components of the coupled simulations is also presented, showing the ESMF/NUOPC driver is not a bottleneck in the computation. "
Remove the "is also presented" and state directly "The CPU time associated with different components of the coupled simulations shows the ESMF/NUOPC driver is not a bottleneck in our coupled implementation of SKRIPS. "

P24 L1,2

"Appendix A: Snapshots of Surface Heat Fluxes

The snapshots of the THFs in the simulations at 1200 UTC June 2nd and 24th are presented."
Would you redefine THF in the appendix or do something similar to changing the title of the section to "Snapshots of Surface Turbulent Heat Fluxes".

P24 L2

"The snapshots of the THFs in the simulations at 1200 UTC June 2nd and 24th are presented."
Maybe add "(Fig. A1)" at the end of the sentence. You don't mention A1 until you discuss A3, and then only tangentially.

P31 L33,34

"Skamarock, W. C., Klemp, J. B., Dudhia, J., Gill, D. O., Barker, D. M., Wang, W., and Powers, J. G.: A description of the advanced research WRF version 2, Tech. rep., National Center For Atmospheric Research Boulder Co Mesoscale and Microscale Meteorology Div, 2005."
Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, Z. Liu, J. Berner, W. Wang, J. G. Powers, M. G. Duda, D. M. Barker, and X.-Y. Huang, 2019: A Description of the Advanced Research WRF Version 4. NCAR Tech. Note NCAR/TN-556+STR, 145 pp. doi:10.5065/1dfh-6p97