Geoscientific Model Development Discussions

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Comment on gmd-2021-155

Anonymous Referee #1

Referee comment on "Performance of the Adriatic Sea and Coast (AdriSC) climate component – a COAWST V3.3-based one-way coupled atmosphere–ocean modelling suite: ocean results" by Petra Pranić et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2021-155-RC1, 2021

The paper of Pranic et al. entitled '*Performance of the Adriatic Sea and Coast (AdriSC) climate component – a COAWST V3.3-based coupled atmosphere-ocean modelling suite: ocean part*', presents an evaluation of the ocean component of the AdriSC climate system against a huge data collection. This study complete a previous evaluation paper that was dedicated to the atmospheric component of the same numerical model run of a 31-year long period (1987-2017). The ocean evaluation is conducted for sea surface, thermohaline properties and circulation.
My main concern, that I detail below, is about the numerical set-up. In particular I have difficulties to understand the ocean-atmosphere interface, as information about coupling/forcing are clearly missing. See also in the following for some questions about the ocean model itself.
The comparison to observations is fully described and very well presented, even if a small number of conclusions appears rapidly set. Also, some paragraphs are difficult to follow, when describing the subdomains results notably, but this appears inherent of the text insertion of the results put in the supplementary material.
That said, I suggest a minor revision will be useful to improve the paper before accepting its publication.

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Main comments:

Coupling:
The first paragraph of section 2.1 seems to stand that WRF 3km and the ROMS models are coupled. In particular, the sentence "Finally, the data exchanges … are achieved with the Model Coupling Toolkit…". This needs some precision in my opinion.
Denamiel et al. 2021 introduced the fact that "the SST from ROMS grid is not prescribed to the WRF models". This means that WRF and ROMS executions are parallel but there is one-way interaction only? If so what are exactly the fields exchanged from WRF to

ROMS?
Do you plan to test the two-way coupled mode for future climate simulations? If yes, how will be managed the use of two ocean models? Do you think the dQ/dSST procedure will still be appropriate in the fully coupled run?

Ocean model:
- I understand from run_coaswst_model.job0 in the package that the simulation start on 1st January 1987. This must be indicated in the text. Is there any spin-up of the ocean that affect the results for the first simulation years or the use of the MEDSEA re-analysis permits to rapidly have an equilibrium? Does the choice of starting in winter have an impact on dense water formation?
- l161: Are the river flows distributed homogeneously on the 20 first levels or is there any flow vertical profile?
- l162-165: It seems that it could be relevant for the Adriatic Sea to take the sea water colour and turbidity effect on the solar radiation penetration. This is also mentioned in the conclusion. Is there something in ROMS that can be tested or introduced in this direction? Or is there any interest to add the sediment component of COAWST?

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Other comments:

1. Introduction
- l59: It can be relevant to complete with Carniel et al. (2016)'s study which is more focusing on dense water formation during the 2012 Bora event.

2. Model, data and methods (see my main comments)
- l278: Fig. 1b ☐ Fig. 1c (for the 7 subdomains)
- l281-282: the sentence is cut

3. Results and Discussions
- l370-372: In my opinion, the results summary in section 3.1.2 should be separated in two sentences to be fair.
"... the model is capable to reproduce the BiOS, even though with a weaker intensity due to the overestimation of both seasonal and interannual signals..." "... the SST is quite well reproduced despite presenting a persistent cold bias within the Adriatic Sea."
- l400 and 403: to avoid some confusion (like mine), I suggest to use "the CSP01 dataset" instead of "experiment".
- Paragraphs from lines 501-516 and lines 606-616 are difficult to follow. This of course is related to the separation with the supplement material (that is a good option), but if possible, it would be better to find a clearer organization for these two parts either by describing region by region, or by separating temperature results from salinity results for the first paragraph.
- l519: "… the analysed subdomains and mostly with a good accuracy." For me, you

should delete “and”.
- l537: The fact that the highest biases are found around the thermocline and halocline is generally due too smoothed vertical gradients at the ocean mixed layer base. Is this what you obtain in the AdriSC ROMS models? If yes is it equivalent in the 1km-resolution than in the 3-km resolution? Is it somehow related to a similar default in the MEDSEA reanalyses that persists from initial condition or propagates through the open boundaries?
-l637-640: “This highlights… the hurricane strength bora winds.” This conclusion about the role of wind variability appears quite rapidly set here. Maybe you should precise the resolution of ALADIN? Did you make some tests using WRF 15km to drive the AdriSC ROMS models?
There is also a typo in “particular”.

4. Conclusion
- l645: To be fair the word “coupled” may be changed. But yes to my knowledge too this is the first time despite several initiatives and still many challenges (see Schär et al. 2020 for instance)

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Carniel, S., Benetazzo, A., Bonaldo, D., Falcieri, F. M., Miglietta, M. M., Ricchi, A., Sclavo, M.: Scratching beneath the surface while coupling atmosphere, ocean and waves: Analysis of a dense water formation event, Ocean Modelling, 101, 101-112, 2016. https://doi.org/10.1016/j.ocemod.2016.03.007.
Schär, C., Fuhrer, O., Arteaga, A., Ban, N., Charpilloz, C., Di Girolamo, S., Hentgen, L., Hoefler, T., Lapillonne, X., Leutwyler, D., Osterried, K., Panosetti, D., Rüdisühli, S., Schlemmer, L., Schulthess, T. C., Sprenger, M., Ubbiali, S., & Wernli, H. (2020). Kilometer-Scale Climate Models: Prospects and Challenges, Bulletin of the American Meteorological Society, 101(5), E567-E587. https://doi.org/10.1175/BAMS-D-18-0167.1