Comments for the manuscript **"**The climate change signal in the Mediterranean Sea in a regionally coupled ocean-atmosphere model"

General comments

This study has two main parts, (1) a performance evaluation for the regional coupled model REMO-OASIS-MPI-OM (ROM) which has been set up for the Mediterranean Sea and forced by the ERA-Interim reanalysis data for the present climate, and (2) a production of climate change signals in sea water temperature and salinity using ROM forced by the global model MPI-ESM with the RCP8.5 scenario. Main results are (1) simulations of ROM forced by ERA-Interim show a good representation of the present Mediterranean Sea climate and (2) climate change signal in the Mediterranean Sea is found to be similar to previous studies.

New findings of the study are not highlighted, neither in the abstract nor in the main text. In the Introduction, the authors mentioned that using the global ocean model could help to avoid some problems associated with the open boundary conditions for the Mediterranean Sea. However, no reference of previous studies was cited and no results were shown to support the argument. Moreover, this study compared the climate change signal produced by ROM with previous studies. The authors concluded that the ROM simulations under RCP 8.5 scenario provided integrated estimates of climate change similar to other models. The study would be more highlighted if the authors recommend ROM as one more ensemble model member to provide more robust information of climate change signal for the Mediterranean Sea.

I suggest accepting the paper for publication after major revisions are made.

Major remarks

- It's not clearly described how the simulation (ROM forced by ERA-Interim for 1982-2012) and the hindcast (ROM forced by MPI-ESM for 1976-2005) were set up and used in the study. It's confusing to the reader that authors seem to have calculated the change signal by substracting the climate projection for 2070-2099 to the climate simulation (ROM forced by the reanalysis data ERA-Interim) for 1976-2005 (which is an invalid calculation of the climate change signal). Please clarify! A suggestion could be: The present simulation of ROM forced by the reanalysis data ERA-Interim should be named as ROM_P0, and the hindcast of ROM force by MPI-ESM for the present climate as ROM_P1, the climate projection for 2070-2099 as ROM_P2. Consequently, the climate change signal should be yielded by subtracting ROM_P1 from ROM_P2.

- Through the Results section, details of bias, difference and changes of ROM compared with other data sets were shown which could help readers to have a good overview of ROM performance. However, there is a lack of deep analysis about potential reasons for such biases or differences. For example, on Page 9 Line 23-24: "MPI-ESM-LR and ROM show a similar distribution …" Can the authors speculate why? In previous parts, usually MPI-ESM-MR and ROM are similar. Or what is the potential reason for the different trends in Western and Eastern Mediterranean Sea mentioned on Page 10 Line 8-10?

- The paragraph on Page 7 Line 6-10 only describes how the SST seasonal cycle amplitude of ROM is different to (i.e. smaller than) MPI-ESM but it doesn't support the statement of the authors that ROM is better than MPI-ESM due to the higher resolution. Moreover, "ROM *overestimates* the SST simulated be MPI-ESM" should be rephrased because "overestimates" is often used while comparing with an observation. Please rewrite this part.

- A comparison between SST time series of MPI-ESM with OISST (Figure 6) or an analysis about temporal correlation between MPI-ESM and OISST (Figure 7 & 15) make no sense as MPI-ESM doesn't know anything about SST of a certain 'real' year. Please remove these figures or at least the part of MPI-ESM and focus more on other results.

- Section 2: details of basis configuration of REMO, MPI-OM such as horizontal and vertical resolution as well as running time step should be described. It's also necessary to give a list of variables exchanged between REMO and MPI-OM via OASIS.

- Introduction: Page 2 Line 10-27 simply listed the previous study without any results mentioned. I suggest to summarize this part of introduction and mention more details about only the previous studies which gave information of climate change signal in SST and SSS that relates to the main topic of the current study. The authors should make it clearer what has been done in the past, what is still missing and why this study is important.

Minor Comments

- Should it be "AORCMs" for coupled "atmosphere-ocean regional climate models" as used in many previous studies instead of RAOCMs?

- Page 1 Line 24 is repeated at line 27.

- Page 2 Line 34 & page 3 Line 4 have the same typo of "Asses"

- Please follow the citation rule of the journal. At several places, "el al., (20xx)" was used where either "," or "(" is needed.

- Page 2 Line 22: "Finally, Sevault et al. …": does it mean it's the last fully coupled regional climate system model has been developed?

- Page 2 – Line 30 – Abbreviation MPI-OM is only introduced on page 3, Sect. 2. Please remove here. The abbreviation ROM has to be described as it is mentioned the first time in the main text (the abstract does not count).

- Sequence of 2.1 and 2.2 should be switched as REMO was mentioned before MPI-OM at the beginning of Section 2 Methods and also in sequence of abbreviation "AORCM". The author should also think about the sequence of "ocean-atmosphere" or "atmosphere-ocean" in the title to ensure the consistence for the whole manuscript. In addition, model abbreviations and references are provided in Sect. 2, and, hence can be removed from Sect. 2.1 and 2.2.

- Page 3 Line 9: For this work, the ROM climate model (Sein et al. 2015) has been used.

- Page 3 Line 12 - …, the soil model of REMO (Rechid …

- Page 3 Line 13: Which version of OASIS was used?

- Page 3 Line 30: "REMO's prognostic variables are …": for what are they important to be mentioned here? More important should be which variables are exchanged between REMO and MPI-OM via OASIS.

- Page 4 Line 14: double "with"

- Page 4 Line 16: … with a resolution of about 25 km …

- Page 4 Line 18: why different coupling time steps (3 hrs & 24 hrs) are using?

- Page 4 Line 21: "… scenario were analysed."

- Page 5 Line 18: …of ROM's potential to improve the …

- Page 6 Line 8: “can be found *in* DJF”?

- Page 6 Line 21: deviation of 3.5 mm/d is not a small amount. This corresponds to ~315 mm/season. Please comment more thoroughly!

- Page 7 Line 3: … than expected …

- Page 7 Line 5: … have been done…

- Page 8 Line 10: “It is clearly *seen* how …”

- Page 8 Line 11: “penetrate to the Western Mediterranean by the African continent”: what do you mean?

- Page 8 Line 14-15: sentence is incomplete.

- Figure 2: HD is missing. How are u & v surface currents passed from MPI-OM used in REMO?

- Figure 6, 7 & 15: please remove the MPI-ESM_LR and MPI-ESM_MR as their SST temporal timeseries have non-sense.

- Figure 10: vector is too small. Why level 31m depth was chosen to be shown here?

- Figure 12: why do not show figures for DJF and JJA separately? A strong SST bias in summer of ROM (Fig.4) may affect the trend analysis if it’s not system bias.