We would like to thank the reviewer for the advises that greatly have helped to improve our manuscript "The climate change signal in the Mediterranean Sea in a regionally coupled atmosphere-ocean model". The review comments point-by-point response are reported in blue whereas our answers are in bold letters.

Major remarks

Referee #1: «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 subtracting 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. »

Response: Thank you for the suggestion. We have added names for each of our simulations in the revised manuscript (Page 4 Line 24-30):

ROM_P0 → ROM forced by ERA-Interim (1980-2012).
ROM_P1 → historical forced by MPI-ESM-LR (1976-2005).
ROM_P2 → future projection forced by RCP 8.5 (2070-2099).

The climate change signal was calculated as the differences between (ROM_P2 – ROM_P1).

Referee #1: «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? »

Response: As we mention in the paper (section 2.3) the ROM_P1 was forced by MPI-ESM-LR, that is the main reason why it shown similar distributions (see Page 13 Line 25-27).

The potential reason for those different trends is due to the North Atlantic influence over the western basin (Page 13 Line 34).

Referee #1: «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. »

Response: Thank you. We have rewritten the paragraph in the revised manuscript (Page 8 Line 9-11).

Referee #1: «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. »

Response: Thank you. We have removed the MPI-ESM results from the Figs. 6, 7, as well as Fig. 15 has been deleted in the revised manuscript.

Referee #1: «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. »

Response: We have added a new Table 1 where the characteristics of ROM atmosphere-ocean regional coupled model has been summarized. Furthermore, we have included the list of variables which exchange info between REMO and MPI-OM via OASIS in section 2.1 (see Page 3 Line 24-27 and Fig. 2.).

Referee #1: «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. »

Response: Thank you for the suggestion. We have reviewed the introduction and made reductions of previous works without results. Moreover, we have updated the introduction with recent information of climate change signal in SST and SSS in the revised manuscript (Page 2 Line 16-28).

Minor Comments

Referee #1: «Should it be "AORCMs" for coupled "atmosphere-ocean regional climate models" as used in many previous studies instead of RAOCMs? »

Response: Ok, we have used the acronym AORCMs instead of RAOCMs in the revised manuscript.

Referee #1: «Page 1 Line 24 is repeated at line 27. »

Response: The sentence (Page 1 Line 24) has been deleted in the revised manuscript (see section 1).

Referee #1: «Page 2 Line 34 & page 3 Line 4 have the same typo of "Asses" »

Response: Thank you. We have corrected the typos in the revised manuscript.

Referee #1: «Please follow the citation rule of the journal. At several places, "el al., (20xx)" was used where either "," or "(" is needed. »

Response: Thank you. We have made the correction in the revised manuscript.

Referee #1: «Page 2 Line 22: "Finally, Sevault et al. ...": does it mean it's the last fully coupled regional climate system model has been developed? »

Response: No, we just used "Finally" as a connector in the paragraph. Fully coupled models such as COSMO-NEMO_MFS (Cavicchia et al. 2015) or COSMO-CLM v4.21 (Akhtar et al. 2017) have been developed later than CNRM-RCSM4 (Sevault et al. 2014). For an updated revision of regional climate system models used in the Mediterranean region see Somot et al. (2018).

Referee #1: «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). »

Response: We have made the correction in the revised manuscript.

Referee #1: «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. »

Response: We have switched the sequence of 2.1 and 2.2 according with the abbreviation AROCM. The model abbreviations and reference have been removed from section 2.1 and 2.2. Furthermore, the sequence of ocean-atmosphere has been replaced for atmosphere-ocean in the title.

Referee #1: «Page 3 Line 9: For this work, the ROM climate model (Sein et al. 2015) has been used. »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 3 Line 12- ..., the soil model of REMO (Rechid ... »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 3 Line 13: Which version of OASIS was used? »

Response: OASIS version 3.0 was used.

Referee #1: «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. »

Response: We have replaced the list of REMO's prognostic variables for the variables which exchange info between REMO and MPI-OM via OASIS (Page 3 Line 24-27, see Fig. 2).

Referee #1: «Page 4 Line 14: double "with" »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 4 Line 16: ... with a resolution of about 25 km ... »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 4 Line 18: why different coupling time steps (3 hrs & 24 hrs) are using? »

Response: For river runoff we do not need to reproduce diurnal cycle. Nevertheless, the REMO-MPI-OM coupling frequency is 60 min instead of 3h (it was a mistake in the old manuscript). It has been corrected in the revised manuscript (see Page 4 Line 23 and Table 1).

Referee #1: «Page 4 Line 21: "... scenario were analysed." »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 5 Line 18: ...of ROM's potential to improve the ... »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 6 Line 8: "can be found in DJF"? »

Response: We have made the correction in the revised manuscript.

Referee #1: «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! »

Response: We have rewritten this part more thoroughly in the revised manuscript (Page 7 Line 3-5).

Referee #1: «Page 7 Line 3: ... than expected ... »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 7 Line 5: ... have been done... »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 8 Line 10: "It is clearly seen how ..." »

Response: We have made the correction in the revised manuscript.

Referee #1: «Page 8 Line 11: "penetrate to the Western Mediterranean by the African continent": what do you mean? »

Response: We mean that the Atlantic inflow jet run close to the African continent when it goes to the Western Mediterranean. The sentence has been corrected in the revised manuscript (see Page 9 Line 8-10).

Referee #1: «Page 8 Line 14-15: sentence is incomplete. »

Response: We have made the correction in the revised manuscript (Page 9 Line 11-13).

Referee #1: «Figure 2: HD is missing. How are u & v surface currents passed from MPI-OM used in REMO? »

Response: We have included HD model in the scheme of ROM (see Fig. 2).

In REMO calculating turbulent fluxes we use relative surface winds, i.e. wind velocity minus ocean surface velocity (for details see Sein et al. 2015).

Referee #1: «Figure 6, 7 & 15: please remove the MPI-ESM_LR and MPI-ESM_MR as their SST temporal timeseries have non-sense. »

Response: We have removed the MPI-ESM results from the Figs. 6, 7, as well as Fig. 15 has been deleted in the revised manuscript.

Referee #1: «Figure 10: vector is too small. Why level 31m depth was chosen to be shown here? »

Response: We have chosen level 31m to remove the high-frequencies variability generated by the atmosphere (e. g. wind). Thus, allows us to represent averaged behavior of the surface Mediterranean circulation without altering as in previous works (L'Hévéder et al 2013; Sevault et al. 2014).

We have made bigger the vectors in Fig. 10.

Referee #1: «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. »

Response: We have included figures for DJF and JJA as supplementary material. The trend analysis is not affected by the SST bias (Page 10 Line 12-14), especially in summer where ROM had shown a strong cold bias into whole Mediterranean Sea (see supplementary figures).