Earth System Dynamics Discussions

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Comment on esd-2021-65

Anonymous Referee #2

Referee comment on "The Mediterranean climate change hotspot in the CMIP5 and CMIP6 projections" by Josep Cos et al., Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2021-65-RC2, 2021

The authors analyze CMIP5 and CMIP6 projections over the Mediterranean area and compare the projected changes in temperature and precipitation to global mean changes. Model skill is deduced from comparison to observations datasets during the historical period. Ensemble projections are weighted by the aforementioned skill and degree of independence between members. The subject and methodology is of interest to the scientific community. However, the manuscript needs major revisions, including additional calculations or focusing only on temperature before it can be published.

Major remarks:

- Regarding precipitation: The eastern Mediterranean is characterized by almost completely dry summers and precipitation mostly during winter. Therefore, including it in JJA in the precipitation calculation over the whole Mediterranean basin seems to me problematic. This is seen in the verification against observations for (Fig. S5), and in the lack of robustness and significance in changes (Figs.4). I strongly suggest that the authors do their calculations (not only verification, but all the calculations) considering the very significant differences in precipitation between different regions over the Mediterranean basin.
- Model data and observational data: A table with a list of the grid sizes of each data set is required.
- S5, at least the comparison to observations, should be part of the article body and not a supplement. This is part of the heart of the paper: how to quantify the veracity of the simulations and the results seen in this figure are strongly correlated to the remark #1.
- Due to the complexity of the precipitation analysis I would also suggest limiting the manuscript to temperature only, without the need of additional calculations for precipitation as in remark #1. For instance, as stated in lines 365-366 "Precipitation weighted projections are not shown in this study as we have no proof that the diagnostics used to assess temperature are relevant to evaluate the models precipitation response." Diagnostics should turn clearer by dividing the Mediterranean basin following precipitation climatic characteristics in the different seasons.

Minor remarks:

Abstract:

The sentence: " Results obtained from the model weighting scheme indicate increases in CMIP5 and reductions in CMIP6 warming trends, thereby reducing the distance between both multi-model ensembles." it is not clear what the reference is to the written increases and reductions, and what variable(s) are the authors referring to.

By lines:

38: "while running the same model multiple times under the same experiment samples internal variability (Hawkins and Sutton, 2011)"

using different initial conditions?

55: "to global-mean and large-scale changes" – Not clear

86-88: "The results from CMIP5 and CMIP6 sharing the same 2100 radiative forcing will be displayed together for simplicity, but the reader should always bear in mind that the evolution of GHG concentrations differs between them". – Not clear.

108-113: "The baseline periods 1986-2005 and 1980-2014 are the reference to assess the models performance against observations. The shorter 1986-2005 period (from Collins et al. (2013)) serves as a baseline for the calculation of climate change signals. The longer reference period (35 years) is used to compute historical trends, as 20-year trends are considered to be too heavily influenced by internal variability (Merrifield et al., 2020; Peña-Angulo et al., 2020). The reason for using the older 1986- 2005 20-year period instead of the more recent 1995-2014 (Brunner et al., 2020) is to avoid CMIP5's historical period ending in 2005 to overlap with the corresponding scenario projection runs that start in 2006"

Not clear. For the historical comparison between CMIP5 and CMIP6 to observations to be statistically consistent to say something about the skill of CMIP5 versus CMIP6 the same period has to be used. From the text and from the periods that these projects are available it seems to me that the comparison against observations is done for different

periods. Then we cannot compare between CMIP5 and CMIP6 skills. The text above is not clear. Should it be written separately that 1986-2005 is used for signals and 1980-2014 for performance against observations?

117-119: "The height differences between the model orography and the evaluation grid implies that TAS must be corrected (by means of the 6.49 K/km standard lapse rate) whenever absolute climatologies are used (Weedon et al., 2011; Dennis, 2014)." Not clear

128-129: "A climate change signal is considered robust when at least 80 % of the models agree on the sign of change (Collins et al., 2013)." – Not conditioned to model-observations agreement during the historical period of the aforementioned models?

158-159: "Each multi-model ensemble" – I understood there is one multi-model ensemble, maybe it should be written each "model ensemble"? Or maybe each "member in the multi-model ensemble?

165-168: "Figure 1 compares warming differences of the high radiative forcing scenarios of CMIP5 and CMIP6 over the Mediterranean with respect to the 1986-2005 global mean for winter, summer and the annual means. For precipitation, Mediterranean change is compared to the 30º N-45º N latitudinal belt mean. The Mediterranean region shows a higher annual temperature increase than the global mean." – As written here it is very unclear. What was compared here? My guess is as follows: (a) temperature and precipitation change was calculated globally against 1986-2005, (b) the same as (a) was done only for the Mediterranean region, (c) in the plots we see (b) minus (a). Is this correct? This is not written above.

Fig. 1: Either I missed it or there is no discussion at all about the positive change in precipitation shown in JJA panels of CMIP5 RCP8.5 and CMIP6 SSP5-8.

206: "Mostly, for the remaining seasons,…"- What is not the "remaining season"? It seems a sentence is missing before