

Editors review Wehrli et al. ESD-2021-58

Dear author, co-authors,

First of all, sorry for the delay in this editors decision, due a misunderstanding, on your ms submitted for publication in ESD. Having read in detail your response to the reviews as well as the suggested revisiond of the manuscript, I thought that I could basically accept the revision for publication in ESD but then reading once more carefully the revised ms (including the one with track changes, note the differences in line numbers), I came still across quite some (revised) statements that were not optimally formulated/require further editing/triggered some additional questions. In addition, there were also some other issues being raised in reading the ms in terms of the overall context. Below you can find all these and would like you to handle these comments for my final decision on your paper.

Line 37: "and new, **yet unseen**, **not yet seen** extreme intensities are appearing"

Something that has not been seen yet has also not appeared..... I would suggest here to use wording; "are anticipated"

Line 51: "predecessor paper", suggest to refer here to "**previous study**"

Line 58/59: "atmospheric nudging and/or **prescribed** soil moisture"

Line 60-61: " This nudging approach has previously been verified for CESM (Wehrli et al., 2018) also analyzing biases...."

Line 61: "Here, the same experiments are carried out for three ESMs". Now that it becomes much more clear how the presented study compare to the previous studies only having used the CESM system, it would be good to stress this: "Here, building further upon the studies with CESM, we here present the results of the same experiments but carried out for"

Line 64/65: "Other applications have not been tested so far and will be left to explore in future studies". Now that you have included this to address the reviewers comments, e.g., on more detailed analysis of the water balance but now this statement, especially mentioning "other applications"" is way to vague. Can you indeed indicate how the ExtremeX experiment results can be diagnosed in a different manner to further unravel the role of land surface processes versus circulation (and the oceans)?

Line 82: for consistency use the term "observation-based data"

Line 85: "All experiments prescribe SSTs, sea ice and vegetation.." would be good indicate here what sea-ice and vegetation characteristics are prescribed, cover? Or other properties?

Line 92-93; had to read this sentence multiple times: suggest to change to "...experiments both components are constrained prescribing soil moisture varying over time or prescribing soil moisture using a climatological soil moisture, respectively"

Line 95: "As ExtremeX was initiated in 2017, no longer time horizon was proposed". Should have commented on this earlier but what is meant with this? I don't get what you exactly want to express with this statement.

Line 103: "observation-based products" or "observation-based data"? be consistent

Line 113: "...to generally refer to the applied method of nudging the atmospheric large-scale circulation and prescribing soil moisture"

Line 130: "2.2.2 Prescribing Soil moisture"

Line 146: having referred before to the specific method of prescribing soil moisture and then introducing here in a very general way “2.3 Reference data sets”, I would put soil moisture here under the same heading. But here you are introducing more the “Atmospheric circulation and hydrology data”

Then reading the introduction again of the three models that have been included in these ExtremeX experiments, I realized that I miss(ed) a motivation on the actual of these three models. What has been the main reason that these experiments include these three different modelling systems, is there a specific reason why these models have been selected and what would be the expected differences based on the main (different) features of these models? It would be good to shortly include this in the introduction of the paper.

Line 233: “...some variability in wind speed between the five members..”

Line 234: “..representation of the reference wind speed”, to stress that this evaluation/validation step is mainly relying on comparison of wind speeds and not other meteo. properties

Lines 270/271: “This contradicts the initial intuitive assumption and suggests that no sole component of the model is responsible for the biases, and hence the latter cannot be corrected in isolation”. I was somewhat puzzled by what you want to express by those last three words; I guess would like to express that the biased cannot be corrected by overcoming the causes of those simulated biases by improving the model representation of only one (in isolation) of the model components”. If this is indeed what you mean, possibly rephrase (more explicitly)

Line 292: “Nonetheless, for EC-Earth AF_SF shows larger biases than AI_SI as the temperature biases introduced in AF_SF outweigh the biases corrected, and for precipitation, the biases remain of similar magnitude”. What do you mean here with biases corrected?? Corrected for what?

Line 359: “which both found a weak role of the ocean in??” explaining the Russian heatwave or heatwaves in general?

Line 374: “by Duchez et al. (2016) finding that the SST patterns set important preconditions for the 2015 summer”, same comment here; just for the 2015 summer in general or in explaining the 2015 European summer heatwave?

Line 399: “This is in line with the La Niña conditions that established in 2010 and 2011 and transitioned to cool to neutral during...”, this statement does not read well and suggest to change to “This is in line with the La Niña conditions that prevailed in 2010 and 2011..” but what do you want to express with “transitioned to cool to neutral”?? a change to a more cool or neutrals state/contribution by La Niña to conditions in Australia?

Line 407: “whereas for the other two models the individual ratios are balanced to slightly circulation-dominated”, another puzzling statement, I guess you want to express that “whereas for the other two models the individual ratios reflect that there might an even-to a slightly circulation-dominated contribution by the two main drivers of the Australian heatwave according to the experiments”

Line 418: “– thus not favoring a heatwave –” a would rather say “– thus not strongly enhancing the heatwave–”

Line 442: “This shows the growing relative importance of the **land surface-atmosphere coupling** for long-duration events” (instead of only the state of the land surface, correct?)

Line 457: “Five experiments with varying levels of constraining were run with all models”; this is bad revised sentence, alternative; “Five experiments, with different sources of information to constrain these experiments, were run with all models”

Line 463: “even larger biases appear in the constrained experiments”, alternative also given that there were already biases in the default experiments, “the biases are even further enhanced in some of the constrained experiments”

Line 468: “including atmospheric circulation and soil moisture (dynamics) interactions”

Line 474: “For events that are mainly ocean-driven, we would recommend a setup with interactive ocean experiments to compute the ocean contribution more accurately.” Could you possibly shortly indicate/hypothesize on extreme events that might strongly affected by ocean-atmosphere-driven process interactions. Would there be a role in heatwaves (in suppressing, or, enhancing) or other extreme events?

Line 476: “..the potential ocean contribution..”

Line 493: “The largest contribution **by recent warming** is found for the U.S. heatwave..”

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