

Earth Syst. Dynam. Discuss., referee comment RC2
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Comment on esd-2021-8

Anonymous Referee #2

Referee comment on "Balanced estimate and uncertainty assessment of European climate change using the large EURO-CORDEX regional climate model ensemble" by Guillaume Evin et al., Earth Syst. Dynam. Discuss., <https://doi.org/10.5194/esd-2021-8-RC2>, 2021

The submitted paper holds a thorough analysis of seasonal mean changes in European temperature and precipitation for the mid-century and end-of-century. It utilises the CMIP5-based EUROCORDEX multi-model GCM-RCM experiments, and a specific method to estimate the so-called 'balanced' climate change response and 'balanced' uncertainty. This uncertainty is then attributed to GCM, RCM, RCP (or interactions between those, or internal variability).

This is an important exercise, and hence I am of the opinion that the paper contributes usefully to the existing scientific literature. I recommend acceptance of this manuscript for publication, though would recommend major revisions to the text before doing so. I will try to explain my discomfort with the text in its current form below.

As noted, the results of the study are important, and go beyond existing work and published analyses of EUROCORDEX as far as I know. However, given the conclusions and the recommendations made there, I would like to see much more comparisons between the QUALYPSO method and the 'normal' approach. This to inform the reader of the gains made and the errors that could otherwise be introduced. I also wonder if a sensitivity analysis, e.g. by splitting the ensemble in two smaller ensembles, computing two times the balanced response and the normal response, and showing (rather than telling and trusting) that this is indeed a robust method.

In its present form, the paper does not excite the reader, or invite thorough reading. The method section is confusing, and does not offer a clear explanation of QUALYPSO to the reader. I suggest a more understandable and intuitive explanation is added, maybe with some drawn schematics that show how differences between model runs would be quantified in the balanced outcomes and uncertainty quantifications. The results sections feel like a dump of many figures and tables, with lots of text that tell us what can be seen

in the figures. It would be more useful to explain sources of differences (e.g. climate sensitivity of GCMs is only noted once in line 332!).

The final paragraph of the manuscript is the strongest paragraph of the text by far. I don't think these conclusions currently follow from your written text, but can see how they would relate. Rewriting parts of the manuscript, and adding comparisons/sensitivity experiments I believe would allow these conclusions to be made, and indeed would then form a very welcome addition to the literature.

More detailed questions:

Section 5 - The balanced mean response is very clear, in line with previous analyses/IPCC and well explained. The explanation of scenario-excluded uncertainty however is rather vague. This also goes back to my questions on the methodology, is this uncertainty equal for each scenario? By design of the method, or also in reality? I would have expected differences in, for example, the influence of internal variability and model-interactions between RCPs.

In figures 2-5 I find myself mostly looking at the last column. This is where you split and attribute the uncertainty to the different factors. I wonder if having, for all these figures, all other panels are worth adding. I suggest the authors carefully consider this (I'm not advising any direction, just encouraging thinking this through), fewer panels would allow them to be bigger and make them easier to read and interpret.

Fig 2: can you remove the black lines around the colour shading? It prevents us from seeing the colours of narrow shading/small contributors.

Fig S1a - modify the colour scale so it shows some information please.