



EGUsphere, referee comment RC2
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Comment on egusphere-2022-568

Anonymous Referee #2

Referee comment on "Robust global detection of forced changes in mean and extreme precipitation despite observational disagreement on the magnitude of change" by Iris Elisabeth de Vries et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-568-RC2>, 2022

Overall comments:

This study conducts a signal detection analysis for global changes in mean and extreme precipitation using three observational datasets and CMIP6 multi-model outputs. The authors apply a ridge regression (RR) method to construct fingerprints, which helps increase a signal-to-noise ratio of precipitation change patterns. Results show a robust detection of anthropogenic signals in all observations for both mean and extreme precipitation even when removing global mean trends, further supporting the human-induced intensification of global hydrological cycle. I find this paper very well written with sufficient details provided about methods as well as various sensitivity tests and therefore suggest publication after addressing some minor issues.

Major comments:

1. Although method details are provided, it would be useful to explain more clearly what are benefits of the attribution approaches employed, including ridge regression, EOF-based metric for target variable, and GMST-based signal estimation. All of these procedures seem to contribute to increase signal-to-noise ratio but how they do and what step is more important. The authors provide some associated results from sensitivity tests but an overall explanation of their method possibly with a schematic would be helpful for readers to understand the contribution of each step to the final signal detection.

2. An important motivation of considering different periods and datasets is opposing conclusions by previous studies about model overestimation or underestimation of the observed trends. I am wondering if the authors can go further and compare their results with some previous studies. For instance, if studies based on the latter half of 20th century trends find model underestimation, the authors can assess their model trends for the same/similar periods. Another point here is that the present study uses absolute units of precipitation while most of previous studies considered relative changes or aggregated values. It would be good to discuss possible influences of this difference.

3. The lower detectability in GHCNDEX observations are suggested to be due to the poorer spatial coverage. Regarding this issue, I would suggest using Rx5d. As I understand, Rx5d has larger spatial coverage than Rx1d and comparison with Rx1d-based results may provide a way to support the authors' interpretation. Another way would be to compare detection results from using a selected model run but with different spatial coverages applied.

Minor comments:

L8: Indicating analysis period or trend period with signal detection would be useful here.

L17-19, L58-64: Better comparisons can be made by applying the same periods as those used in previous studies. See my major comment above.

L20-21: Is this confirmed by repeating detection analysis using NH-extratropics only?

L34: "discrepancies with respect to observations". Its meaning is unclear.

L69-71: Need to explain what the previous studies have found additionally using these "data-science methods". Also, what's the novelty of this study compared with them? Is it detection based on spatial pattern information alone?

L108-109: "Trend biases due to this structural difference ... negligible". But the cited reference considered south-east Australia only?

L201: How to define S when global means are removed?

L212: "CMIP6 ssp245" should be "CMIP6 historical"?

L227: "virtually identical". adding spatial correlation would help with this.

L314-316: This suggests possible dependence of Rx1d FRE on temperature, resembling global warming slowdown due to PDO influence?

L331-332: "results ... hold when the global mean is used as FR target". Then what are benefits of using EOF-based metric for target variable?

L382-383: "accuracy of the CMIP6 climate models in simulating the processes ...". It's unclear how the authors get this conclusion. Observation-model agreement in residual variability? More explanation would be useful.

L394-395: "(not shown)". This looks important and I suggest showing them in the supplement.

L428: "value of RR-based fingerprint construction". What happens in detection or SNR without applying RR? See my major comment above.