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Earth System Dynamics
Discussions

Interactive comment on "Regional scaling of annual mean precipitation and water availability with global temperature change" *by* Peter Greve et al.

Anonymous Referee #2

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In this manuscript, Greve, Gudmundsson, and Seneviratne examine the scaling of local and regional precipitation and P-E with global mean surface temperature in climate change projections. They diagnose the likelihood of increases or decreases with warming in both quantities, and characterize and identify uncertainty due to internal variability, structural model differences, and differences in emissions scenario. To address the impacts of P and P-E on the 1.5 and 2°C warming targets, they quantify the P and P-E responses and their uncertainty in each of a variety of land regions in response to the two targets. They find that the mean changes in P and P-E are indistinguishable for 1.5 and 2°, but that the two warming targets do differ in the tail of risk estimates, with a higher risk of the largest changes for 2°C warming compared to 1.5.

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Discussion paper

This work makes a useful contribution to the literature, as regional changes in mean precipitation scaling have not yet been diagnosed. The maps and violin plots for individual regions are particularly useful. There are a few issues I think should be addressed to improve the manuscript.

Scientific issues

P3 line 26-27: Why omit locations where P-E<0?

Figures 1, 3, and 4: In all dP versus T plots with the exception of the top panel of Fig. 1, the regressions cross through the origin. The uncertainty in the regression slope is shown as occurring entirely at the upper end of the temperature change axis. These are in conflict with the top panel of Fig. 1, where the regression slopes do not pass through the origin. Internal variability is always present, so we would expect small changes in dP even when dT=0. Is there a better way to visualize the range of regression slopes and their uncertainty? The violin plots are quite useful and do not contain these distortions.

P4 line 28/30: I believe the 10th-90th percentile confidence corresponds to p=0.2, rather than p=0.1. In addition, why do you choose 10th and 90th percentile – since these are wider bounds than is customary? Why not 5 and 95 (p=0.1), or 2.5 and 97.5 (p=0.05)?

P4 line 10, P6 line 28: The methodology of Hawkins and Sutton (2009) assumes that variance is constant over the course of simulations. They only examined temperature, for which this assumption is more or less valid. It seems to me that resampling residuals would rely on the same assumption. For precipitation, it is not the case that precipitation variability is generally constant – instead, it increases in most regions (e.g., Räisänen, 2002). Do you think increasing precipitation variability would affect your uncertainty decomposition, and if so, how?

Typos and grammatical comments

P2 line 31: “comprehensive subset”: This is contradictory, since a subset is by definition not comprehensive.

P5 line 9: “A very likely decrease is rarely found only in South Africa.” I think what you mean is that a decrease with very likely confidence is found only in South Africa, and therefore it is rare; your wording means something else: that very likely decrease is often found in many places, rarely only in South Africa.

P6 line 12-14: “the higher emission scenarios are usually enclosed by the low emission scenarios and the uncertainty is narrowing down”; “partly huge differences”: These phrases are not quite grammatically correct.

Fig. 1: “Global mean Temperature” should probably be “Global mean Temperature Change”

References

Räisänen, J.: COâĆĆ-Induced Changes in Interannual Temperature and Precipitation Variability in 19 CMIP Experiments, J. Clim., 15, 2395–2411, doi:10.1175/1520-0442(2002)015<2395:CICIIT>2.0.CO;2, 2002.

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