Earth System
Dynamics

Discussions

EGU

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

Peter Greve et al.

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Dear reviewer,

thank you very much for the helpful comments which will substantially improve the manuscript. We will address all your comments in detail in our final response and focus on the major issues in this response.

The reviewer asks if internal variability estimated from one run (through resampling) is similar to internal variability estimated from different realisations of one model: The only model from the chosen subset available to us providing a sufficient number of

realisations (10 different realisations) was CSIRO-Mk3-6-0. We already produced violin plots for each SREX region comparing the internal variability distributions estimated from (I) the different realisations of CSIRO against (ii) those estimated from the multi-model ensemble (this was not shown). The differences are marginal and we will include these results as a supplementary figure in the final response.

Regarding the potential influence of aerosol concentrations on our results: We are further aware of the potential influence of different aerosol concentrations on mean precipitation. We referenced in particular the work of Pendergrass and Hartmann (GRL, 2012) and Pendergrass et al. (GRL, 2015) to clarify that mean precipitation scaling depends on the emission scenario (whereas the scaling of extreme precipitation is independent of the scenario). We did, however, not explicitly mention that the differences in mean precipitation scaling can be attributed to differences in the prevailing aerosol concentration, but will do so in the revised version of the manuscript. We will further discuss the scenario uncertainty also in the context of these studies. Nonetheless, quantitatively assessing the extent to which the scenario-specific differences in aerosols relate to the scenario differences in P and P-E requires additional work that goes beyond the rather simplistic approach to attribute relative uncertainty contributions that is used here.

Regarding the linearity assumption: In the final response we will provide supplementary information testing characteristics of the residuals as e.g. autocorrelation and we will provide residual plots for all SREX region allowing for a visual inspection of the linearity assumption. However, if the linearity assumption is not robust due to e.g. heteroscadisity, this results in a higher uncertainty of the linear scaling approach and is therefore accounted for through uncertainty estimation.

Regarding the work of Sippel et al. it is important to mention that our reference period (1980-1999) lies outside the study period (2000-2099) and values from the reference period are hence not used to estimate the scaling factors.

We will further explicitly mention in the revised version of the manuscript that we will focus on global land areas. However, for completeness we will reproduce Figure 2 as a supplementary figure for oceans only.

We will address all other minor corrections and typos in the final response. Thank you!

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