Latitudinal heterogeneity and hotspots of uncertainty in projected extreme precipitation

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**Text S1. Uncertainty sensitivity to the magnitude of changes**

The other research question addressed in this study is the sensitivity of model uncertainty as the dominant uncertainty source to extreme precipitation changes. To this end, the magnitude of changes in extreme precipitation per K global warming is first categorized into eight classes similar to the spatial maps in figure 2. Afterwards, the spatial medians of the model uncertainty corresponding to different classes are compared for different seasons and intensities (figure S7). Model results are less consistent for decreasing signals of extreme precipitation compared with increasing signals, having the largest uncertainty for decreasing signals of greater than -5% K^{-1}. The smallest uncertainty (highest consistency among models) is found for the change class of 4-6% K^{-1} for all seasons and return periods, followed by the 6-8% K^{-1} and 2-4% K^{-1} change classes. Sensitivity of model uncertainty to changes is similar across different precipitation intensities (figure S7).
Figure S1. Comparison of latitudinal changes in (a) 2-, (b) 5- and (c) 15-year extreme precipitation per K global warming based on the ensemble median of the CMIP5 GCMs.
Figure S2. Latitudinal distribution of the signal-to-noise (S2N) ratio for changes in extreme precipitation of 2-, 5- and 15-year return periods (T) per K global warming for (a) DJF, (b) MAM, (c) JJA and (d) SON. Dashed line denotes the 10% significance level.
Figure S3. Comparison of latitudinal changes in (a, d, g, j) 2-, (b, e, h, k) 5- and (c, f, i, l) 15-year extreme precipitation per K global warming in (a, b, c) DJF, (d, e, f) MAM, (g, h, i) JJA, (j, k, l) SON derived from the ensemble median of the CSIRO-Mk3.6.0 runs and of the CMIP5 GCMs (excluding the CSIRO-Mk3.6.0 GCM).
Figure S4. Sensitivity of model uncertainty to seasons for 15-year extreme precipitation changes per K global warming. The uncertainty difference (in percent) between the highest and lowest uncertainties among seasons is shown.
Figure S5. The local fraction of total uncertainty in (a-h) 2-, (i-p) 5- and (q-x) 15-year extreme precipitation changes per K global warming in (a, e, i, m, q, u) DJF, (b, f, j, n, r, v) MAM, (c, g, k, o, s, w) JJA and (d, h, l, p, t, x) SON explained by (odd rows) model and (even rows) internal uncertainties.
Figure S6. Model uncertainty for different change classes of extreme precipitation of 2-, 5- and 15-year return periods (T) in (a) DJF, (b) MAM, (c) JJA and (d) SON.
Figure S7. Comparison of the latitudinal distribution of the absolute ($\delta$) internal variability uncertainties derived from the CSIRO-Mk3.6.0 and CanESM2 ensembles for (a, d, g, j) 2-, (b, e, h, k) 5- and (c, f, i, l) 15-year extreme precipitation changes per K global warming for (a, b, c) DJF, (d, e, f) MAM, (g, h, i) JJA and (j, k, l) SON. The sample size difference between the ensembles of two GCMs was taken into account by applying the VD-SSS method for uncertainty quantification.
Figure S8. (a) Number of raingauges per 1° grid over the globe for September 2018 and (b) latitudinal distribution of raingauges. Panel a was produced via online Global Precipitation Climatology Centre (GPCC) Visualizer tool.
Figure S9. (a-d) Uncertainty hotspots in the tropics and subtropics (between 35°N and 35°S) for 15-year extreme precipitation changes per K global warming in (a) DJF, (b) MAM, (c) JJA and (d) SON. Uncertainty hotspots are identified as the first quintile (QU) of model uncertainty over the regions (see Materials and methods).