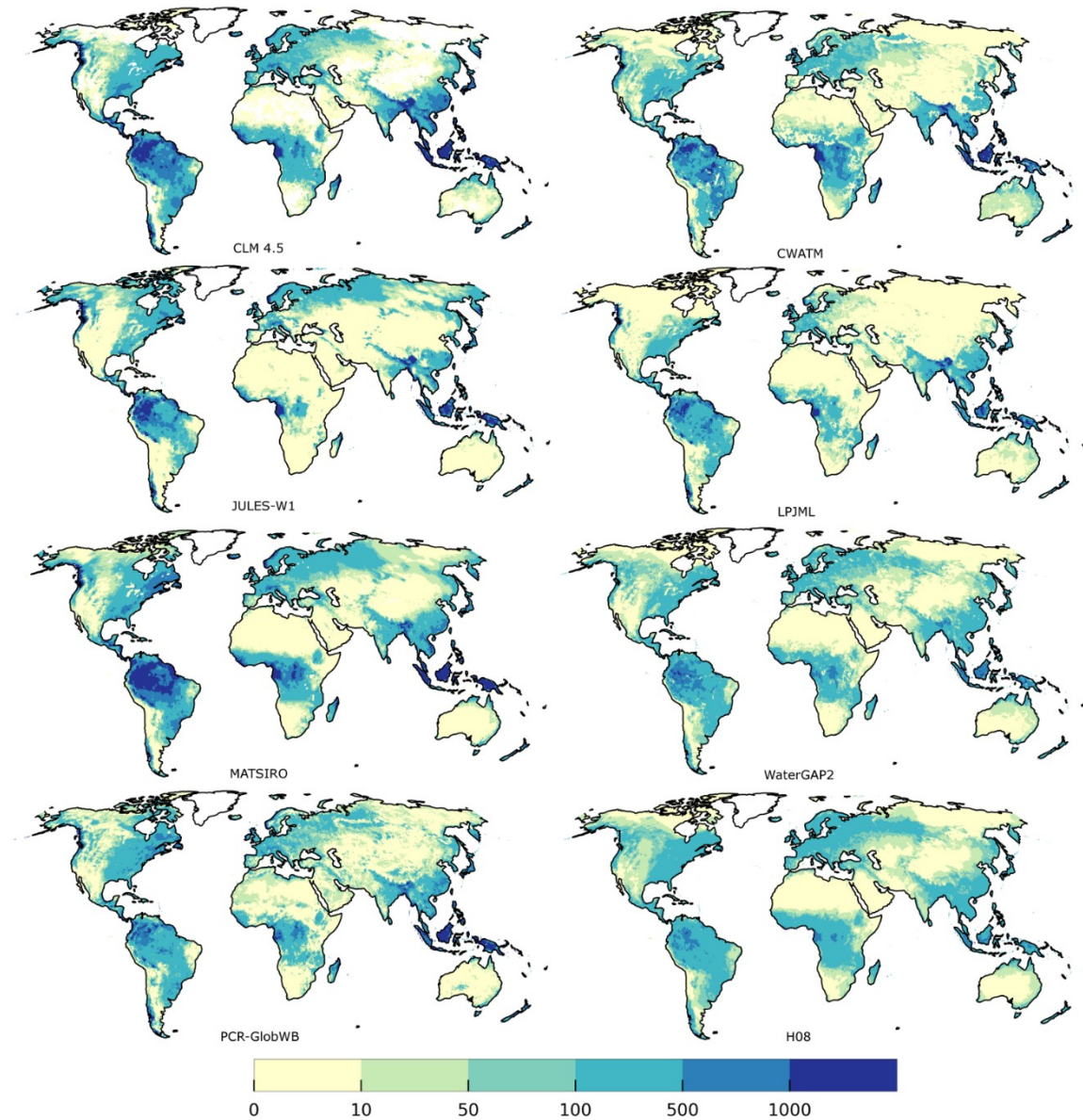
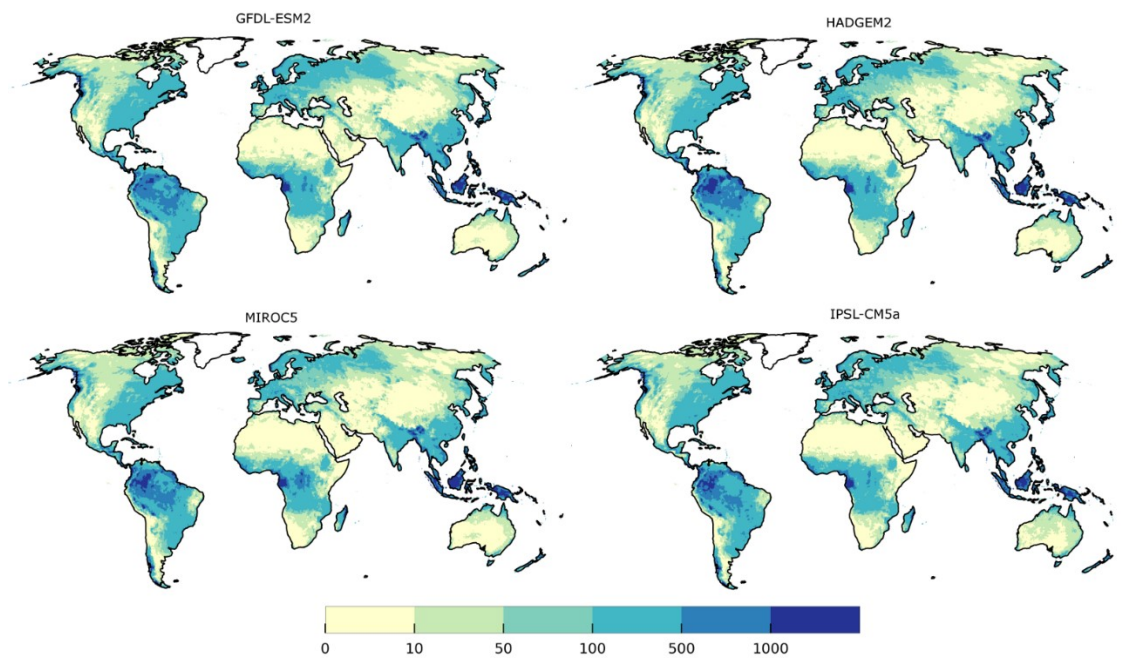


# Supplement

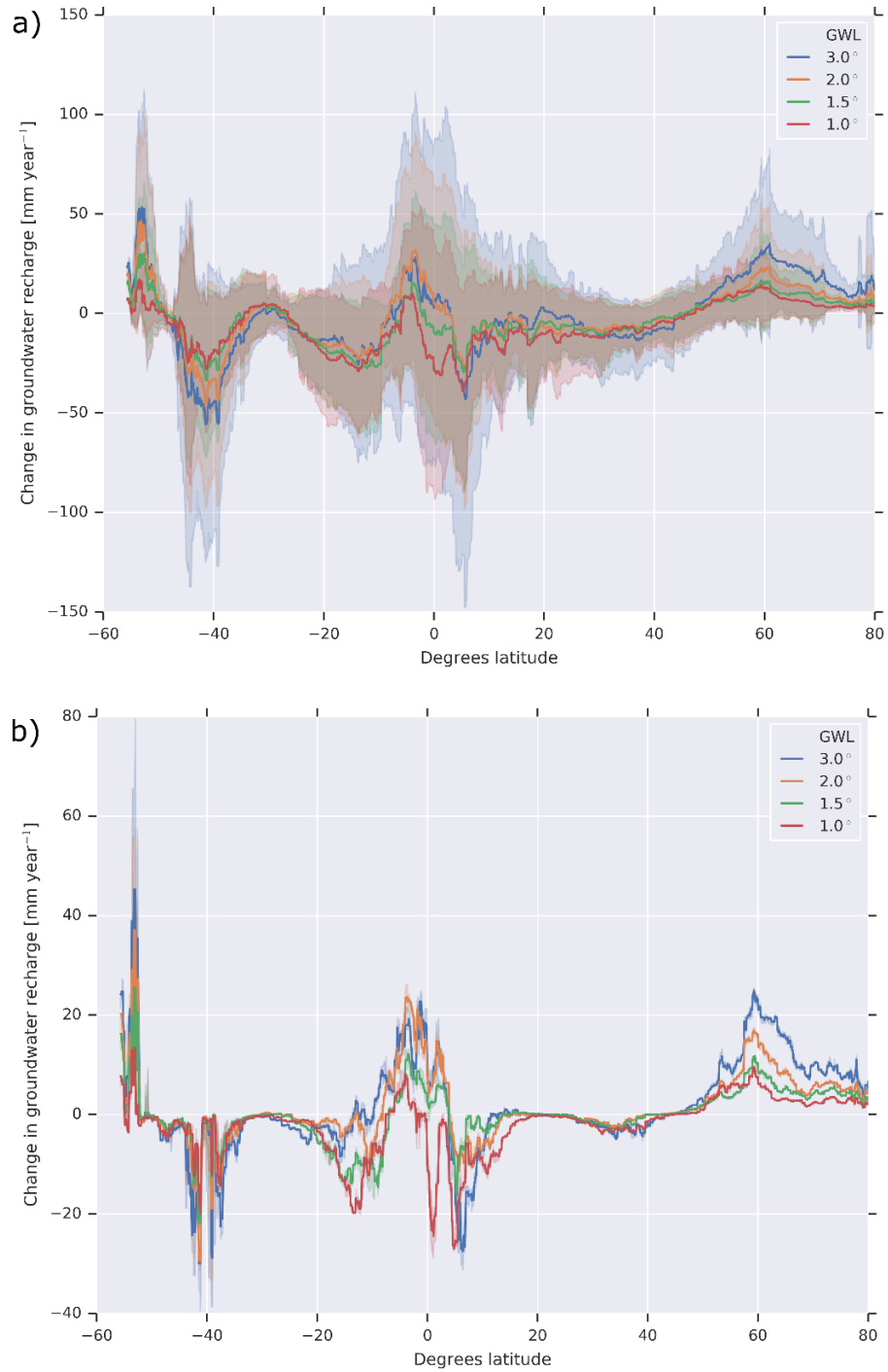
Further additional plots are contained in the supplement.zip file.



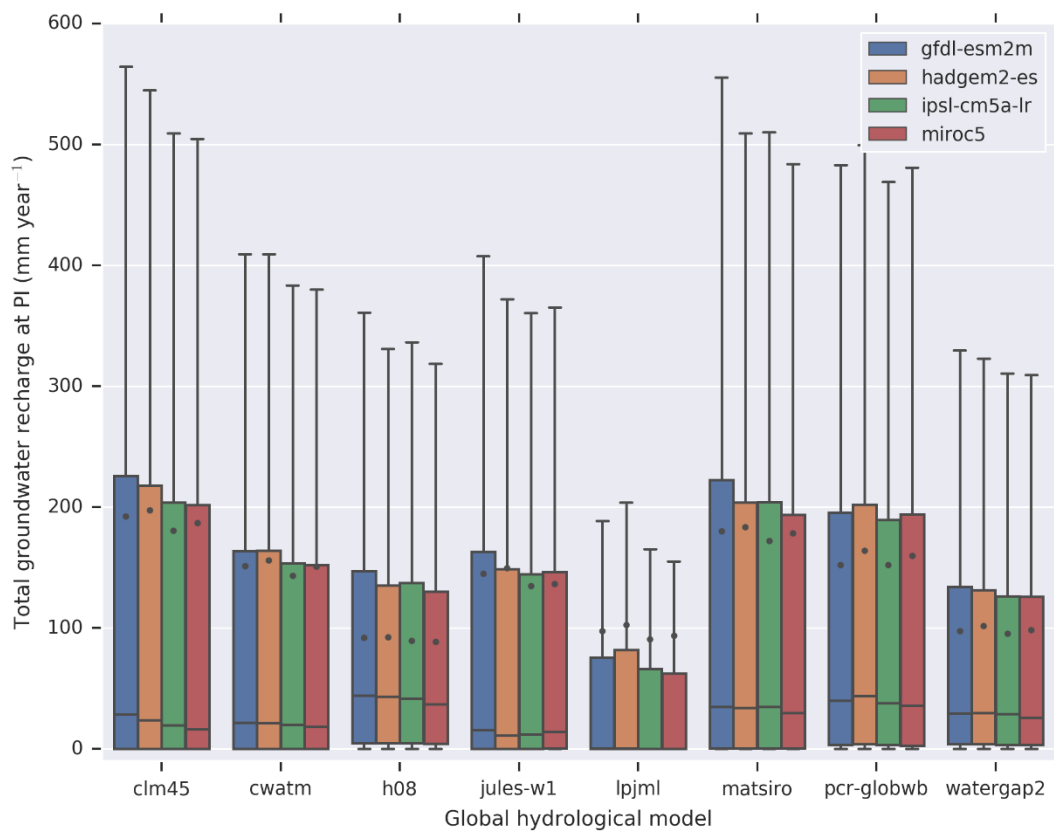
**Figure S1** PI recharge from 1861-2099 averaged over all GCMs per GHM [ $\text{mm year}^{-1}$ ].



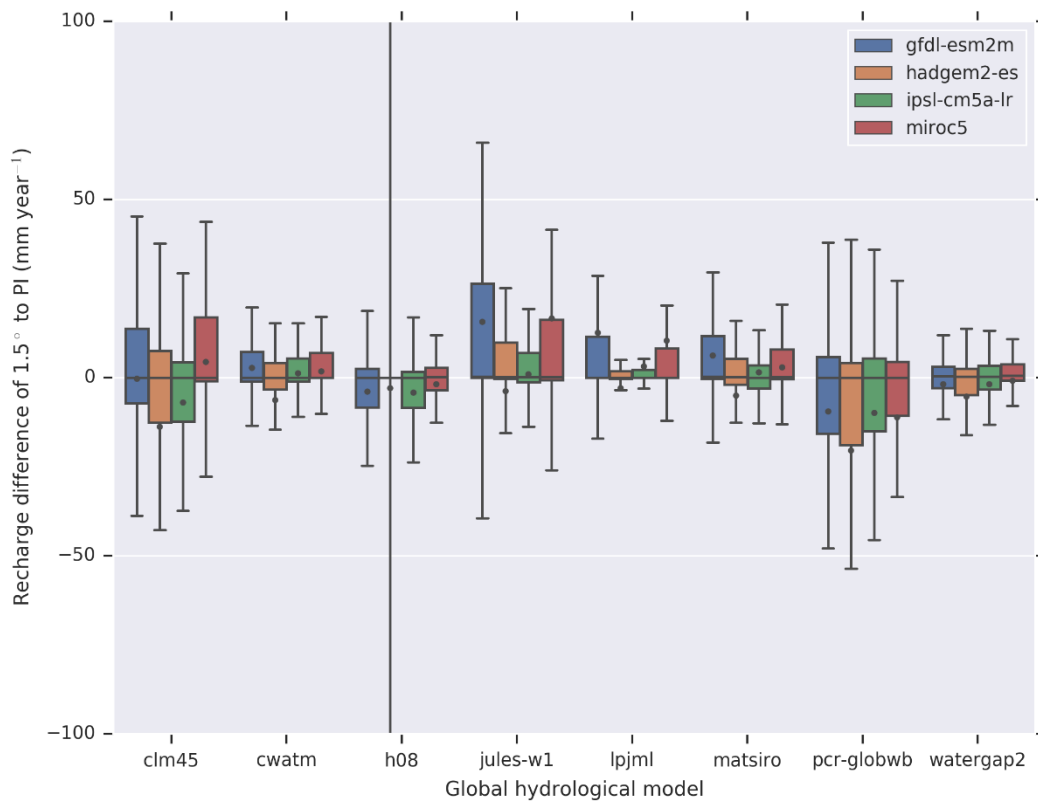
**Figure S2** PI recharge from 1861-2099 averaged over all GHMs per GCM [ $\text{mm year}^{-1}$ ].



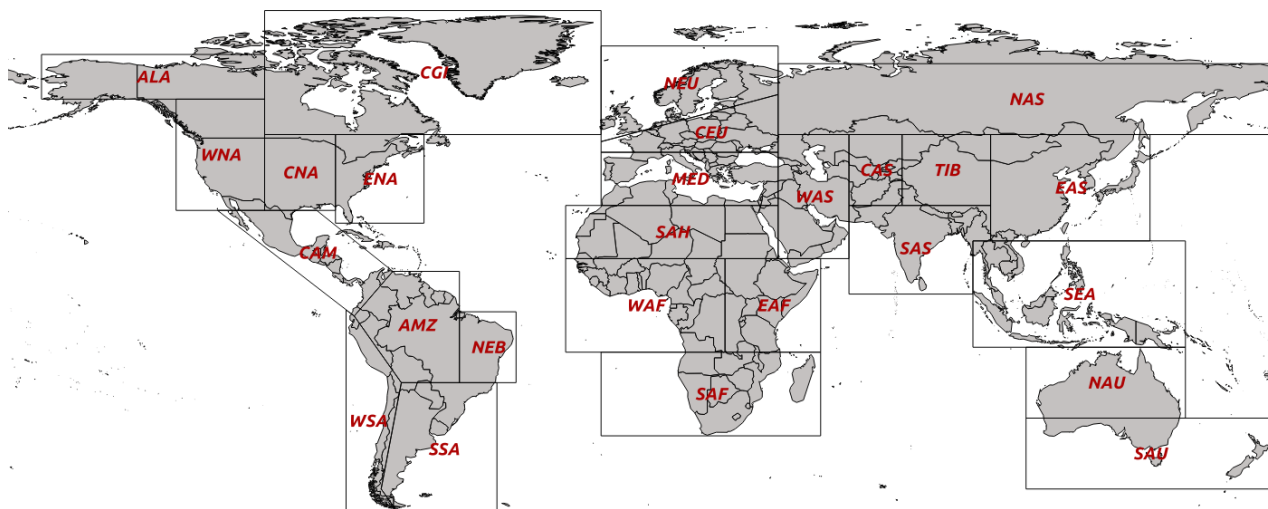
**Figure S3** Changes in GWR compared to PI [ $\text{mm year}^{-1}$ ] per latitude. Panel a) shows the ensemble mean as solid line, b) the ensemble median as solid line. The shaded area represents the standard deviation in a) in b) the  $Q_{25}$  and  $Q_{75}$ . Per latitude, the size of the landmass included in the values varies significantly. For  $40^\circ \text{S}$ , only South America and New Zealand are included, whereas at the Equator large landmasses of almost all continents are included leading to a more extensive spread.



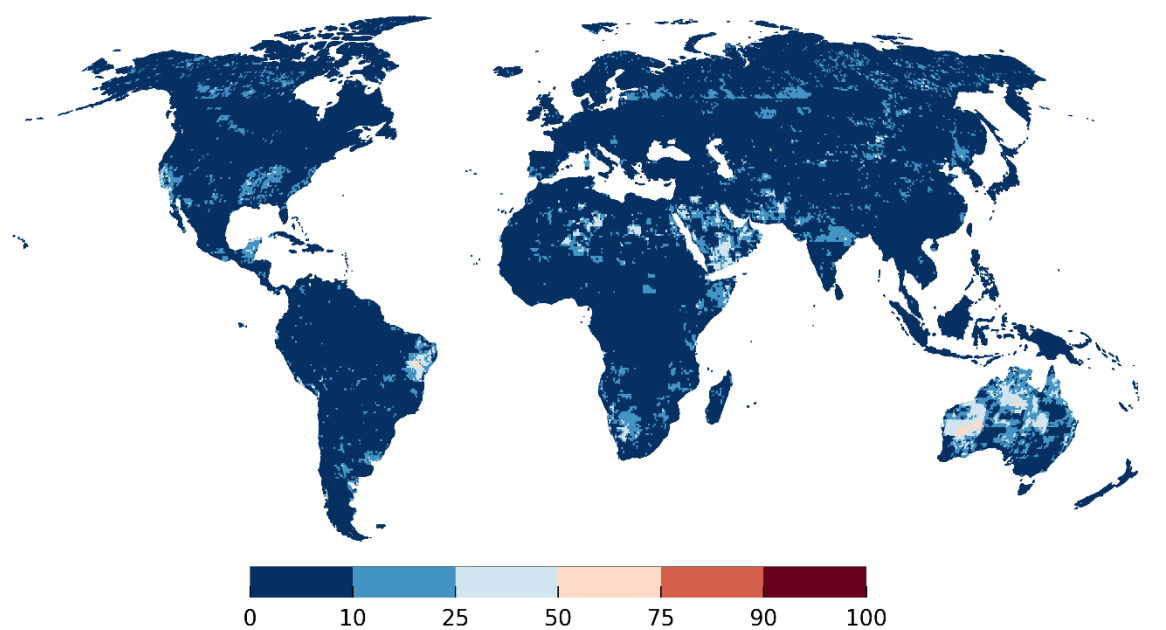
**Figure S4** Global PI recharge for the year that the GCMs reach 1.5°C GW.



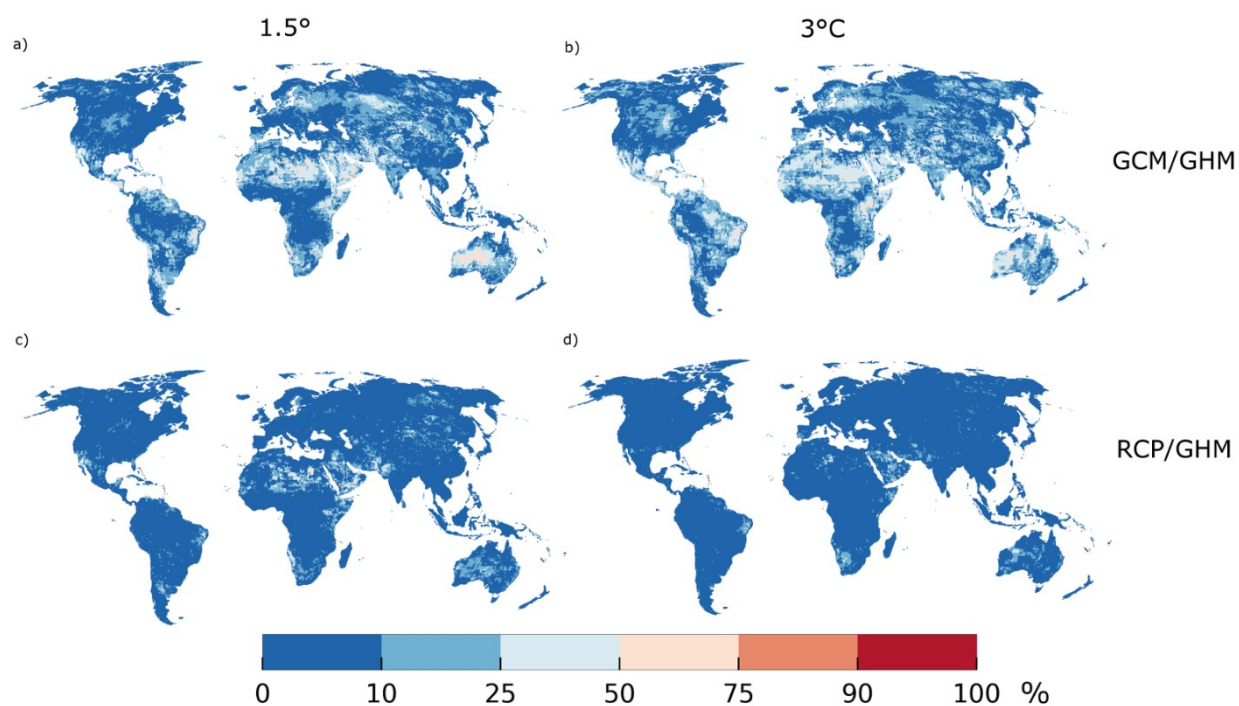
**Figure S5** Global recharge change for the year that the GCMs reach 1.5°C GW.



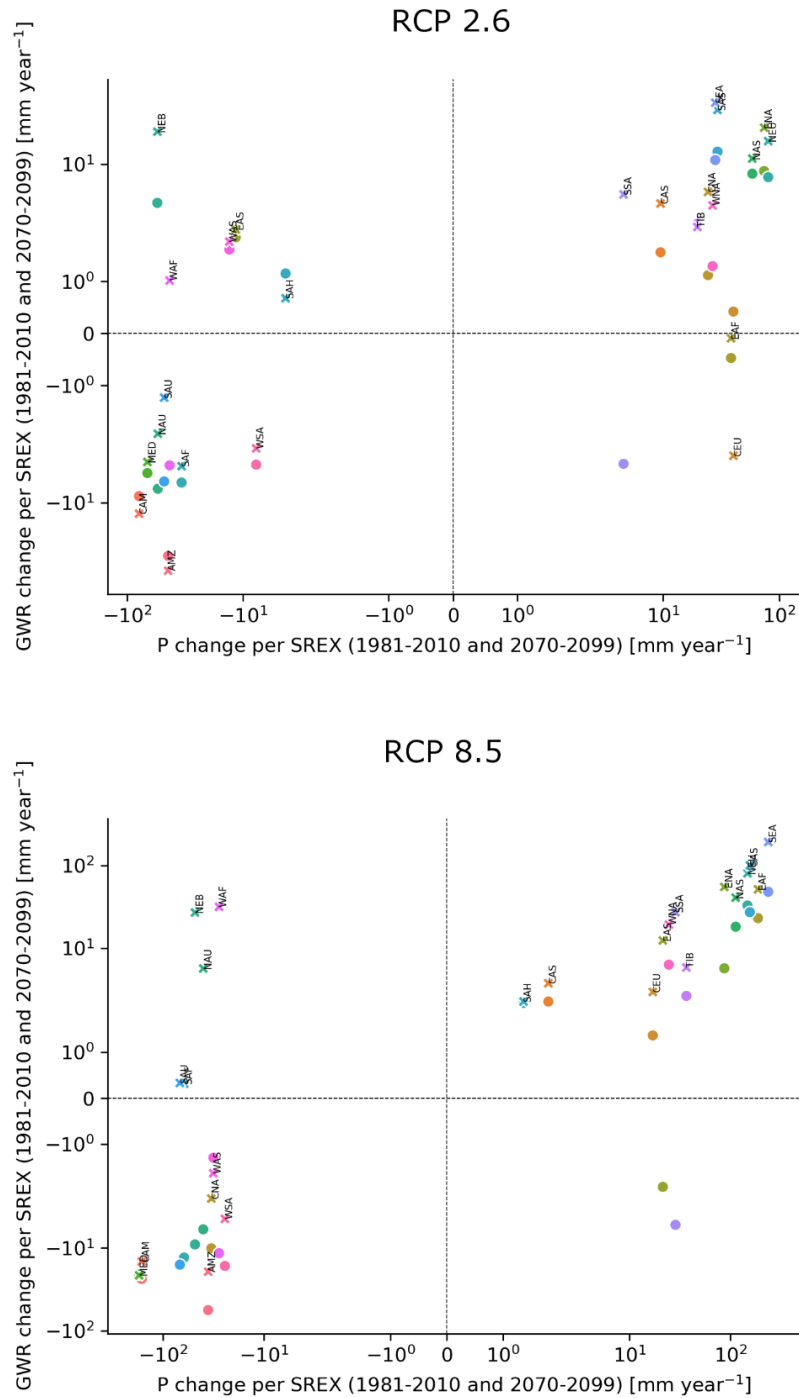
**Figure S6** Map of the SREX (Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation, Murray and Ebi (2012)) regions referred to in this study.



**Figure S7** RCP variance in percent of total variance of GWR change from eight GHMs and four GCMs in a 3°C world (see also Sect. 2.4). Red depicts areas where the RCPs are responsible for the majority of the variance in absolute GWR. Blue areas where the main variance is introduced through GHMs.

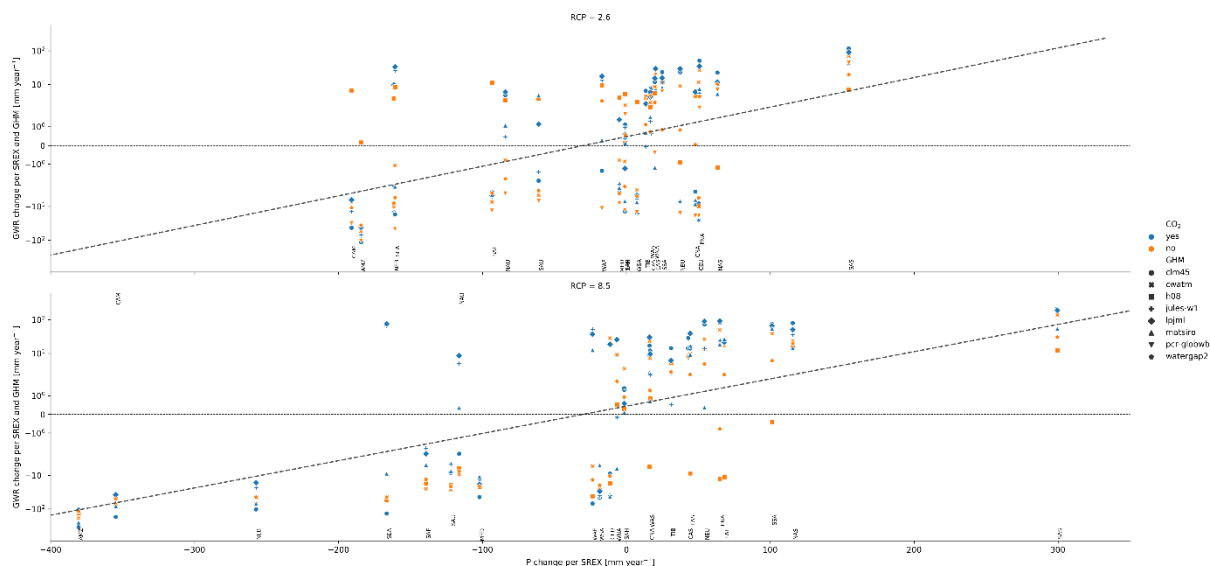


**Figure S8** GCM and RCP variance in percent of total variance of absolute GWR in a 1.5°C (a) and a 3°C (b) world (see also Sect. 2.4). Blue depicts areas where the GHMs are responsible for the majority of the variance in absolute GWR. Red areas where the main variance is introduced through GCMs/RCPs.



**Figure S9** Relation of changes in precipitation (P) (mean(1981-2010) – mean(2070-2099)) to changes in GWR (mean(1981-2010) – mean(2070-2099)) depending on the model type per SREX (selection as in Table 1) for RCP 2.6 (a) and RCP 8.5 (b). Change values per model represent a mean over all available GCMs for that RCP and model. Models that account for impacts of changing CO<sub>2</sub> on vegetation are shown as a star instead of a circle. Both axes are log scaled. SREX regions are marked at the stars only.





**Figure S10** Relation of changes in precipitation (P) (mean(1981-2010) – mean(2070-2099)) to changes in GWR (mean(1981-2010) – mean(2070-2099)) depending on the model type per SREX (selection as in Table 1) for RCP 2.6 and RCP 8.5 for the GCM HadGEM2-ES. Y-Achis is log-scaled. The dashed line is the 1:1 line.