



United Nations
Educational, Scientific and
Cultural Organization



International Centre
for Water Resources and Global Change
under the auspices of UNESCO



Changes of groundwater recharge at different global warming levels: A global scale multi-model ensemble approach

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Motivation

Billions of people rely on groundwater as accessible source for drinking water.

Its importance will increase with a changing climate.



To what extent will climate change impact the availability of groundwater?

Groundwater recharge is a central indicator but hard to measure and simulate.

- 8 Global Hydrological Models (GHMs)
 - 4 Global Circulation Models (GCMs)
 - Warming levels: 1°, 1.5°, 2°, 3° C
 - Representative concentration pathways (RCPs): 2.6, 6.0, 8.5
- = Ensemble of 96 models

! less for 2° C and 3° C because not all RCPs reach level

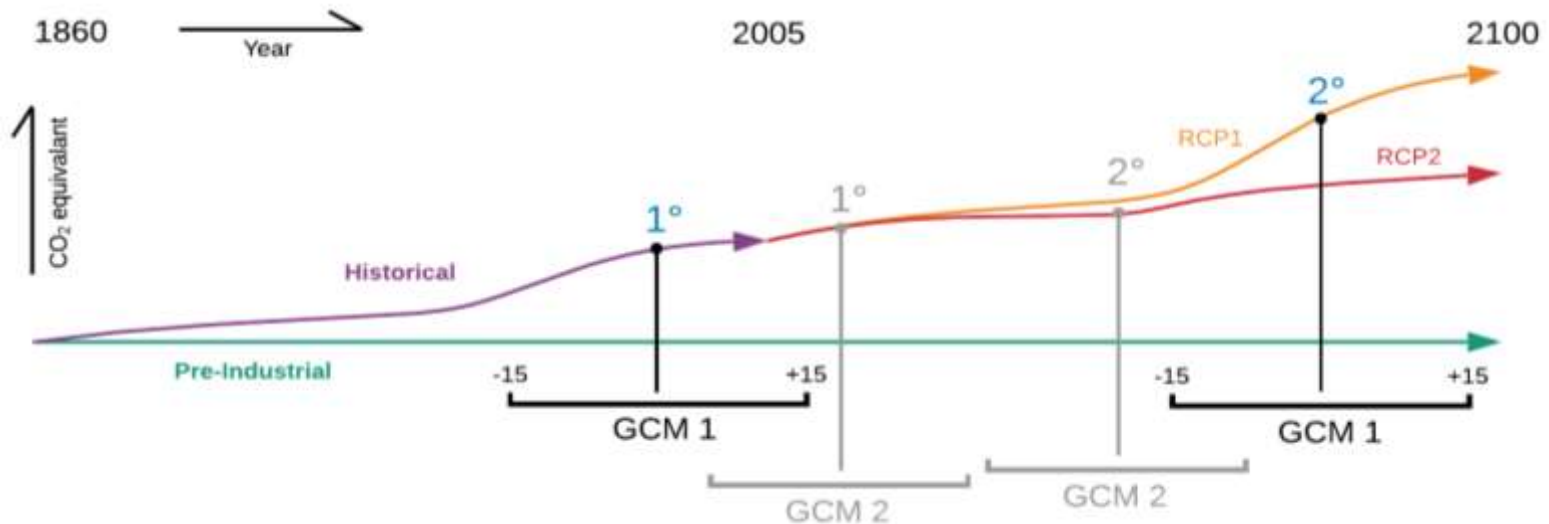
Analysis of 30 year yearly mean around warming level

GHMs

- WaterGAP2
- CLM4.5
- H08
- JULES-W1
- LPJmL
- PCR-GLOBWB
- CWatM
- MATSIRO

GCMs

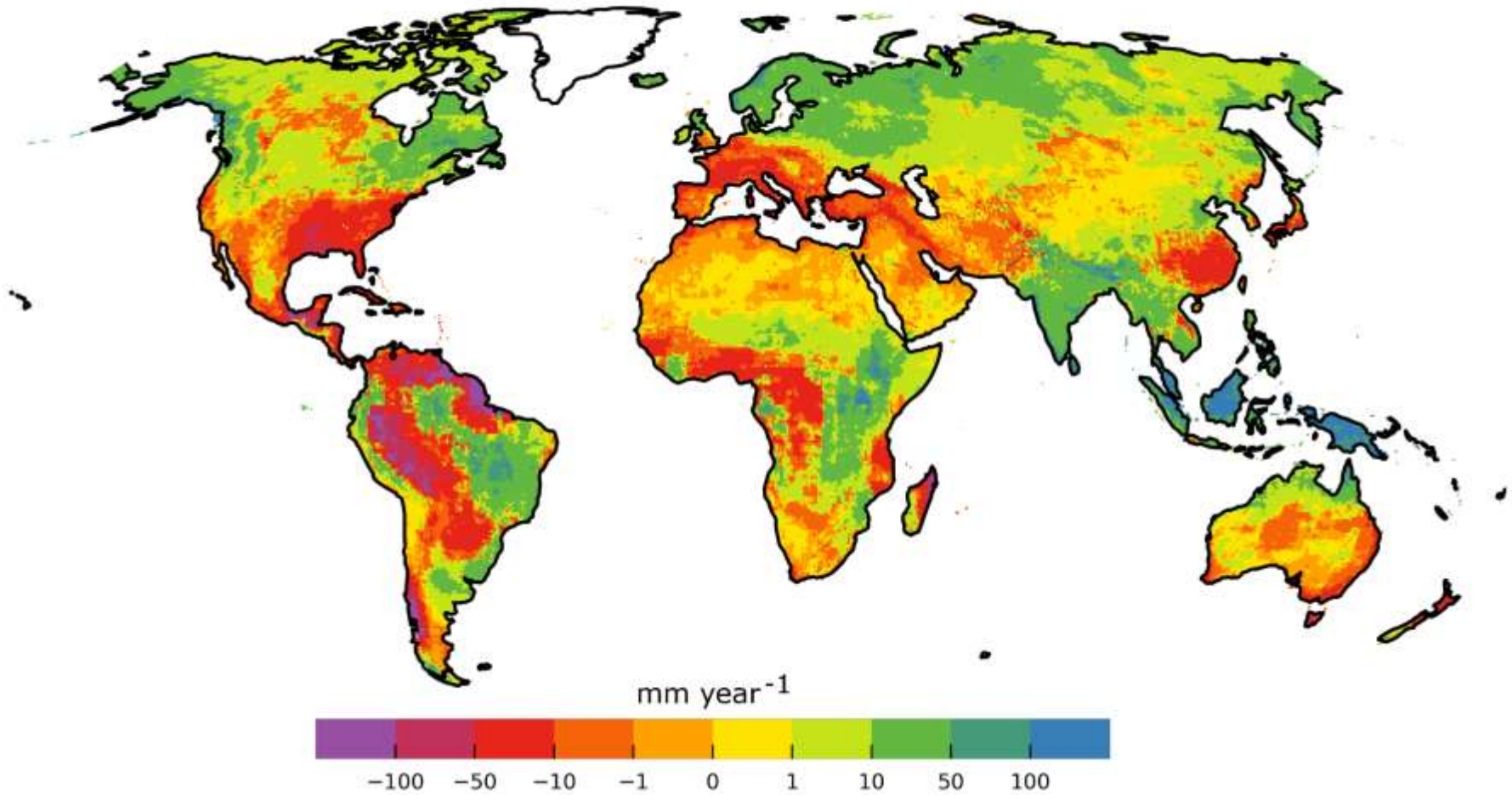
- GFDL-ESM2M
- HadGEM2-ES
- IPSL-CM5A-LR
- MIROC5



Reinecke, R. et al.: Uncertainty of simulated groundwater recharge at different global warming levels: A global-scale multi-model ensemble study, *Hydrol. Earth Syst. Sci. Discuss* DOI: 10.5194/hess-2020-235, *in review*, 2020.

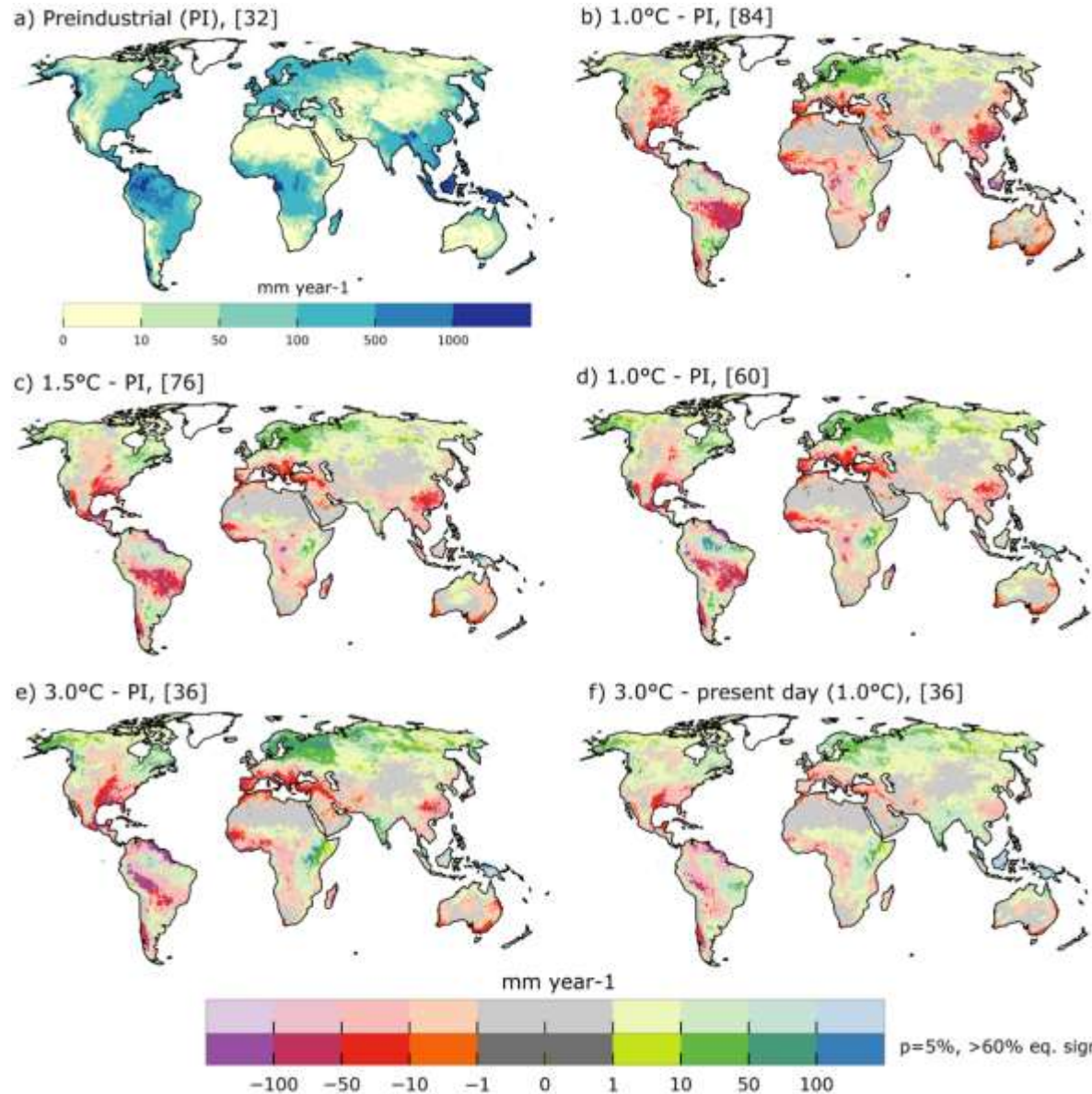
Groundwater recharge change

3 °C compared to present day (1 °C)



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Results



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Discussion

Limitations

- Limited number of GCMs
- Large uncertainties
- Only yearly mean analyzed
- Assumption of a stabilized warming level
- Limited number of observations for comparison

Conclusions

- Only 4 out of 8 models simulate effect of changing CO₂ levels on vegetation (change in stomatal conductance) -> possibly large effect on groundwater recharge
- Recharge is most difficult to simulate in GHMs (uncertainties accumulate) -> improvements are necessary
- Better estimates together with global groundwater models (e.g., globalgroundwatermodel.org) can improve our understanding of groundwater under climate change



Thank you for your attention!

www.waterandchange.org

globalgroundwatermodel.org

https://www.researchgate.net/profile/Robert_Reinecke2