

Interactive comment on “Uncertainty of simulated groundwater recharge at different global warming levels: A global-scale multi-model ensemble study” by Robert Reinecke et al.

Anonymous Referee #1

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This study is impressive in the number of global models included (8) driven by four global circulation models considering three representative concentration pathways, totaling 86 different cases. Although the title of the paper and the results emphasize model uncertainties, I think the primary result based on the analysis is that recharge is not very sensitive to climate change as only 15% of cells show significant increases or decreases in recharge based on pre-industrial baseline and only 8% of cells show significant change in recharge from current 1 degree to projected 3 degree condition. It would be good to acknowledge that recharge is likely the most difficult component of the water budget to simulate because it is modeled as a residual, accumulating uncertainties in other water budget components. In addition, it is extremely difficult to

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simulate in semiarid regions because small uncertainties in precipitation and evapotranspiration can result in large uncertainties in recharge. Many studies suggest that climate change will result in increased climate extremes (floods and droughts) that may result in increased recharge from focused rather than diffuse recharge; however, it seems that few of the models consider focused recharge. The authors refer to groundwater levels throughout the paper with respect to temperature levels; however, this is confusing as groundwater levels are generally considered water table levels. It might be good to include temperature when referring to these. I agree that it is good to focus on absolute changes in recharge rather than relative changes. The authors suggest that underestimating runoff would result in increased GWR; however, this would not be the case if GWR is focused and derived from runoff as in semiarid regions (L. 74). The authors repeatedly use present tense to refer to work that was done for this study. I think it would be more appropriate to use past tense. The model CLM-5 has been upgraded substantially relative to CLM-4.5. It might be good to consider CLM-5 rather than CLM-4.5. Soil thickness varies substantially among the models (e.g. LPJ 13 m thick). It would be good to comment on the impact of varying soil thickness on model results.

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