

## Comment on hess-2020-558

Anonymous Referee #1

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Referee comment on "Combined impacts of uncertainty in precipitation and air temperature on simulated mountain system recharge from an integrated hydrologic model" by Adam P. Schreiner-McGraw and Hoori Ajami, Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2020-558-RC1>, 2021

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This manuscript reports on a study that evaluates the influence of uncertainties in meteorological forcings mainly precipitation and temperature, on the mountain system recharge. The study finds substantial differences in various components of mountain system recharge when the same hydrologic model, used to simulate those components, are driven by different combinations of meteorological forcings. The study highlights the need for improvement in quality of atmospheric forcings in mountainous regions. The topic of this study is certainly suitable for publication, the manuscript is well written and easy to follow. In my opinion though more could be done to address the robustness of the results of this study which would make this an important study and definitely suitable for publication

- It needs to be demonstrated how/if the results of this study depend on the single year of the simulation. Why not extend the study period to include the last 30 years or so? All of the forcings used in this study go back to early 1980s. Even MODIS goes back to the early 2000s. A longer period of analysis can also help address the question of impact of forcing uncertainties on the long-term changes in mountain system recharge, which would be of interest given the focus on global warming driven changes in precipitation and temperature. A longer analysis period could also allow for independent verification of the mountain system recharge simulations such as by using GRACE based estimates of recharge, which goes back to early 2000s. This could help identify the set of atmospheric forcings which yield the most realistic estimates of the recharge.
- Additionally, how are the results of this study dependent on the choice of the hydrologic model? As shown by Vano et al, 2012 (cited by this manuscript too) depending on the choice of hydrologic model sensitivity of hydrologic variables (such as runoff) to changes in precipitation and temperature can vary substantially.
- Finally, it also should be at least discussed how the results of this study may depend on

the choice of the study domain.

Minor comments:

- I am surprised a bit about the differences in the simulated variables generated using GridMET, NLDAS and PRISM datasets. As described in Abatzoglou 2013, GridMET is based on the NLDAS-2 and PRISM dataset. Please at least discuss why this might be the case.
- Page 1, line 28: "high qualify" should be "high quality".
- Page 8, 217-219, how does this chosen threshold of 2.5 deg C for partition of precipitation into rainfall and snow, affect the results of this analysis, especially in the mid to low elevation parts of the domain?
- Page 22, lines 496-498, I am not sure why land surface temperature and soil moisture would not be affected by the choice of forcings, wouldn't changes in ET affect both? Please clarify.

### References:

Vano, J. A., Das, T., & Lettenmaier, D. P. (2012). Hydrologic Sensitivities of Colorado River Runoff to Changes in Precipitation and Temperature, *Journal of Hydrometeorology*, 13(3), 932-949. Retrieved Mar 29, 2021, from [https://journals.ametsoc.org/view/journals/hydr/13/3/jhm-d-11-069\\_1.xml](https://journals.ametsoc.org/view/journals/hydr/13/3/jhm-d-11-069_1.xml)

Abatzoglou, J.T. (2013), Development of gridded surface meteorological data for ecological applications and modelling. *Int. J. Climatol.*, 33: 121-131. <https://doi.org/10.1002/joc.3413>