Hydrology and Earth System Sciences Discussions

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Comment on hess-2021-264

Anonymous Referee #1

Referee comment on "Diagnosing the impacts of permafrost on catchment hydrology: field measurements and model experiments in a mountainous catchment in western China" by Hongkai Gao et al., Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2021-264-RC1, 2021

This manuscript attempts to understand the impact of permafrost on catchment hydrology in a small mountain catchment in west China. The topic is important. However, I feel there are some major problems of the manuscript need to be addressed. My comments are shown below:

- The conclusions of exp1-4 is that it is important to consider landscape heterogeneity in models to accurately simulate the hydrological processes in permafrost regions. This finding is not novel because the study area is mountain regions with high elevation gradient, similar conclusion may be found at many previous studies using distributed models. I suggest the author should further analyzed how the landscape heterogeneity influence the permafrost distribution and the impact of permafrost change on runoff, soil moisture and groundwater depth. Another problem is that not all the regions in the study area are covered by permafrost, some are seasonally frozen ground. The vegetation on permafrost and seasonally frozen ground may be different. How about these effects influenced the runoff? I suggest the author further explain them.
- It is not clear what is the physical meaning of parameter D in exp 8. It seems to represent the water flux from surface to subsurface. If so, it should be calculated in the model with time and it obviously can not be set as time-invariant. The parameters in the model need to be better physically explained.
- Figure 7, It seems that the red line is not the best fit for the data points. Why?
- The author found that a linear recession can well describe the flow recession processes, and a fixed parameter Ks = 80 d is identified. That may be related to the short study period (4 years) in this study. If a long period (30-40 years) is analyzed, Ks may be changed.
- Figure 10 seems important. Can the frozen depth simulation be involved in the model to improve the hydrological simulation?