

Hydrol. Earth Syst. Sci. Discuss., referee comment RC1
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Comment on hess-2021-538

Anonymous Referee #1

Referee comment on "Description and application of a distributed hydrological model based on soil–gravel structure in the Qinghai–Tibet Plateau" by Pengxiang Wang et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-538-RC1>, 2021

The manuscript modified the a distributed hydrological model based on soil–gravel structure, and applied it to a watershed in the QTP. The topic fell into the scope of this journal and there are some issues need to be addressed as shown below:

About the novelty of the study. Considering the soil layer and unconfined aquifer in the cold region and QTP have been test for some previous studies, the author need to compare the current study with some previous studies. For example:

Song L., Wang L., Li X., et al. Improving permafrost physics in a distributed cryosphere-hydrology model and its evaluations at the upper yellow river basin. *Journal of Geophysical Research: Atmospheres*, 2020, 125(18):1-22.

Sun, A., Yu, Z., Zhou, J., Kumud,A., Ju, Q., Xing, R, Huang, D, Wen, L., 2020. Quantified hydrological responses to permafrost degradation in the headwaters of the Yellow River (HWYR) in High Asia. *Sci. Total Environ.* 712, 135632.

Gao B., Yang D., Qin Y., et al. Change in frozen soils and its effect on regional hydrology, upper Heihe basin, northeastern Qinghai-Tibetan Plateau, *Cryosphere*, 2018, 12(8):657-673

For the study area, the author need to describe the distribution of frozen soil. Where is the permafrost and seasonally frozen ground? For the experiment site, is it in permafrost region or seasonally frozen ground?

For figure 3, how do you determine the thickness of each soil layers? What is the maximum frozen depth of the study area? Do you consider the freezing front when you divide the soil layer?

Eq 14, I suggest to give the equations about how to calculate LE and H.

Are Supra-permafrost water and Sub-permafrost water both exit in the study area?

The radiation transfer in the snow layer are ignored in this study, the author may discuss the uncertainty from this? Another question, how do you estimate the snow albedo to get the net radiation of snow surface?

How do you calibrate the parameters of the hydrological model? And what are the major parameters you calibrated?

There seems an underestimation of river discharge by the WEP-QTP in the freeze season, why?

It seems that at 20 cm, the variation of soil temperature of WEP-QTP is reduced and the variation is lower than observations and WEP-COR, why?

I suggest to show the comparison of long term changes in the simulated runoff in the winter and summer and spring by different models and observations.