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Comment on hess-2022-98

Anonymous Referee #2

Referee comment on "Frozen soil hydrological modeling for a mountainous catchment northeast of the Qinghai–Tibet Plateau" by Hongkai Gao et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2022-98-RC2>, 2022

This manuscript aims to develop a conceptual hydrological model for frozen ground. The topic is interesting for hydrological modeling in cold regions. I have some major comments:

- Section 1.2 need to be improved to explain what are the gaps between our understanding and the real changes in frozen soil. For example, the author mentioned that most current models project a long-term drying of surface soil, dose this projection agree with the real changes? Can the conclusions of this manuscript or the model developed in this manuscript address or explain this problem? What is the contributions for the model developed for improving the prediction of the streamflow in permafrost regions?
- The method for this manuscript is not easy to follow. The model was developed base on the observations in the small Hulu basin, and then it is validated in the Hulu basin. I suggest to validate the model in other catchment in the upper Heihe basin, the whole upper Heihe basin and other basins in the Qinghai-Tibetan Plateau.
- Figure 5, the discontinuous recession seems only evident in 2014. Why?
- Figure 12, in 2 degree warming, the discontinuous recession seems not found, why?
- Section 4.2.2. There are some empirical parameters and settings, such as the 3 m threshold for the frozen depth and 10% for groundwater storage. I suggest to developed more robust equations to represent these processes.
- I suggest to show the distributions of HRUs in some figures.
- The storage simulated in conceptual models could not be considered as the real "groundwater storage", this should be noted.