Dear Authors,

Thank you for considering all the comments from two reviewers. The paper starts to shape up. Congratulations! My only concern is the less comprehensive discussion about existing cold region hydrological modeling studies on the TP. Most referred models in the Introduction are dated back to twenty years ago. I'd like to suggest to add more current new development in this field, including but not limited to the models of GBHM, WEB-DHM, FLEXG, FLEX-Topo-FS, and also the improved SWAT in cold regions.

I am happy and looking forward to receiving your revised MS.

Best regards,

Hongkai

Dear Editor:

We are grateful to you and the reviewers for your thoughtful suggestions and insights; the manuscript has greatly benefited from them. We apologize for not adding current new developments in the field to the introduction in the previous rounds of revisions.

As per your suggestion, we have supplemented the introduction with cold region hydrological modeling studies as follows:

Change from:

"The existing hydrological models for cold regions, such as the SHAWDHM model (Zhang et al., 2013), GEOtop model (Rigon et al., 2006), cold regions hydrological model (CRHM) (Pomeroy et al., 2007), and variable infiltration capacity (VIC) model (Cherkauer and Lettenmaier, 2003), consider the processes of water and heat transport in the soil and can simulate water cycling in cold regions to a certain extent. However, these models define the simulated object of the water–heat coupled transport process as a homogeneous medium, while overlooking the stratified soil structure of the QTP. By calibrating certain parameters, the effect of gravel on water and heat transfer can be hidden to some extent, and the simulation effect can be improved. However, some errors remain in the simulation, and it is difficult to objectively reflect the influence of the stratified geological structure on water–heat transport and the hydrological cycle."

To:

"Many hydrological models have been applied to the QTP, including those developed specifically for water cycle processes in cold regions, such as the CRHM (Zhou et al., 2014), WaSiM (Sun et al., 2020), GEOtop (Pan et al., 2016) and DWHC models (Chen et al., 2018). As these models were constructed for cold regions from the outset, modeling soil freeze-thaw processes and accumulation and melting processes of snow and glaciers is detailed and based on physical mechanisms. However, these models require more input parameters and are generally suitable for small catchments. Some models are improved for the characteristics of cold regions based on non-cold hydrological models, such as the improved SWAT (Sun et al., 2013), VIC (Cuo et al., 2015), HBV (Bergström et al., 2015), WEB-DHM (Wang et al., 2010), and GBEHM models (Gao et al., 2018), amongst others. These models exhibited improved performance in cold regions by using heat transfer models or temperature-index models to simulate the freeze-thaw process of soil and melting process of snow (Ala-Aho et al., 2021; Gao et al., 2021). A few studies have also coupled soil freeze-thaw processes or accumulation and melting processes of snow and glaciers

with conceptual hydrological models, such as the FLEX-Topo-FS (Gao et al., 2022) and FLEX-SG models (Gao et al., 2020), based on the perceptual model and FLEX-Topo model (Savenije., 2010), the flexible modeling framework of which can improve the performance of the model in information-poor cold regions while avoiding over-parameterization. However, these models above generally define the simulated object of the water–heat coupled transport process as a homogeneous medium and ignore the stratified soil structure when applied to the QTP. Further, the effect of gravel on water and heat transfer can be hidden to some extent by calibrating certain parameters. The bias in the simulation of interlayer water and heat transport due to the differences in the hydrodynamic and thermodynamic properties between soil and gravel remain, making it difficult for these models to objectively reflect the hydrological cycle processes under geologically stratified structural conditions in the QTP."

Thank you for your consideration. We look forward to hearing from you.

Sincerely,

Pengxiang Wang