

Interactive comment on “Frozen soil parameterization in a distributed biosphere hydrological model” by L. Wang et al.

Anonymous Referee #1

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General comments:

Parameterization of frozen soil processes in distributed hydrological models is very important for cold region hydrology but researches in this aspect are seldom reported. This paper introduced a new frozen soil parameterization scheme for distributed hydrological modeling and tested it in a cold region alpine watershed with successful results, and thus is an important contribution to the hydrological modeling in cold region. The paper is also clearly presented and well organized

My recommendation for the paper is to be accepted with minor revisions. My minor comments on the paper are as follows.

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Abstract P6896, L15. Change “DY station” to “cold regions catchment”. Make the statement more general.

1 Introduction For the mini-review, cold region hydrology modeling in Siberia is suggested to be mentioned, for example, Ye et al., 2009. Ye, B. S., Yang, D. Q., Zhang, Z. L. and Kane, D.: Variation of hydrological regime with permafrost coverage over Lena Basin in Siberia, Journal of Geophysical Research, 114(D07102) doi:10.1029/2008JD010537, 2009. A special issue on frozen soil parameterization on JGR also provides up-to-date knowledge in this field. Zhang, T., F. Nelson, and S. Gruber. 2007. Introduction to special section: permafrost and seasonally frozen ground under a changing climate. Journal of Geophysical Research 112, F02S01, doi:10.1029/2007JF000821.

2 Model description P6898, L21. The radiation budget is calculated by the WEB-DHM or the model uses all (or part of) the radiation components as input (forcing) needs to be clarified. P6899, L8, define the unit of Ta. L9, define the unit of P. L12, How is the Eq 4 derived? A reference is needed. L12, The Mgs needs to be defined.

Datasets for the study area P6904, L3-4, change “with the air temperature increase, snowmelt occurred from the lower regions to the mountain areas” to “with the increase of air temperature, snowmelt occurs from the lower regions to the mountain areas”. L7. Change “was rather small” to “is rather small”. P6905, L9. Change “and can be obtained...” to “can be obtained...”. L 13. Change “hourly time steps” to “hourly time step”.

Model evaluations at the Binggou watershed P6905, L19. change “and then the optimized soil hydraulic parameters were obtained by the calibrations of ...” to “and then the soil hydraulic parameters were optimally obtained by the calibrations of ...”. P6906, L5. “top soil depth” should be “total soil depth”? Figure 8-g. The overestimation of soil moisture at the deepest layer may due to the large gravels distributed in deep soil layers.

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Tables Table 2. The canopy cover fraction is set as 0.3. But in the main text, it is 0.9 (P6906, L1). Please check the consistence. Table 2. $A_{s,v}$ is 0.12 but in the main text it is 0.15. Please check the consistence.

Further discussion with the authors (not an obligation for the authors to answer)

Will the frozen soil process have an impact on lateral flow? How can this be modeled and validated? The authors mentioned that “The much larger diurnal changes of soil temperature than the observed ones (measured with heat flux transducer) from 20 January to March 2008, simulated by the WEB-DHM with the frozen scheme, was possibly caused by the underestimation of snow accumulation on the ground.”. Do the authors have future plan to add a snow melt runoff module in the WEB-DHM?

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 6895, 2009.