

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
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Comment on hess-2021-382

Anonymous Referee #2

Referee comment on "Regionalization of hydrological model parameters using gradient boosting machine" by Zhihong Song et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-382-RC2>, 2021

This discussion paper examines the use of gradient boosting machine learning to model the dependency of model parameters and estimate model parameters for four climate regions in China. The study also enhances the DTVGM model by incorporating the Penman-Monteith-Leuning (PML) equation. The discussion paper is well-presented, the study design is nicely conceived, and the results and discussion are presented fairly, with references to supporting figures, tables or cited literature, where appropriate.

I only have minor comments to enhance what is already a high quality manuscript.

(1) In several places, the model is referred to as the "China-wide hydrological model" (see L105). This is somewhat confusing. Is this a formal name for the hydrological model? If so, I would expect to see a citation after the phrase to reference the use of this name. If this is not the formal name, it may be more helpful to say "We ran a hydrological model developed by Beck et al (2020), for country of China in a spatially distributed..." In Section 2.1, the title could be changed to "Application of the hydrological model across China."

(2) In my reading, there was some confusion about how you were able to compute evaluation metrics for all 15,640 grid cells (see Figure 5 for example). If you know the "truth" for runoff and ET at every grid cell, then why do you need a regionalization model?

(3) Also in Figure 5, it would be helpful to show the comparison of the model performance with and without the PML addition so that one can see in quantifiable terms how the addition of the equation improves the calibration and validation performance.

(4) Section 2.4: You provide an excellent description of the evaluation criteria; however, in your use of the Taylor skill score, could you clarify how the skill is determined for model parameters when you cannot know the true value of the parameters? L207-209 were somewhat confusing. This could be my lack of familiarity with the TSS, but it may be helpful to look over those lines to see if you could improve the explanation there.

(5) In the figure captions, some of the acronyms are spelled out, while others are not. It may be best to spell out all abbreviated words and their abbreviations in the captions so the reader does not have to refer back to the text.