

Comment on hess-2021-305

Enda Zhu (Referee)

Referee comment on "Improved parameterization of snow albedo in Noah coupled with Weather Research and Forecasting: applicability to snow estimates for the Tibetan Plateau" by Lian Liu et al., Hydrol. Earth Syst. Sci. Discuss.,
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The paper "Improved parameterization of snow albedo in WRF+Noah. Part II: Applicability to snow estimates for the Tibetan Plateau" systematically and comprehensively evaluates the impact of the improved snow albedo scheme on climate simulation, which is the 2nd part of the research about model development. The authors guide the readers through a series of logical and interesting organized set of analysis. Overall the paper addresses an relevant subject that is well suited for the *Hydrology and Earth System Sciences*. While the overall quality of the paper is good, there are a few minor shortcomings that need to be addressed before it is published. Some suggestions or questions are listed below.

Suggestion:

- In the manuscript, you mentioned the MODIS snow albedo many times, but didn't explain how to use the MODIS snow albedo in the development of scheme. Maybe you have described it in the 1st part; however, I think you still need some illustration in this paper.
- In the work, you mainly focus on the snow of the Tibet Plateau or the plateau above 1000m. I am not familiar with the snow albedo process. Therefore, could you explain what the difference between snow on the Tibet Plateau and plains such as Northeast China?
- Because of the steep terrain, the simulation of event 3, 7, 8 is instability. And you mentioned the cold biases in the other 5 events simulation have been reduced (L278-281). But in the Fig. 2, I think the cold biases have been alleviated in all 8 events. Could you explain why you think the cold bias in the 3 events (3, 7 and 8) has not been corrected? In fact, comparing the green line and black line (Fig. 2), I think the new scheme resulted in a warm bias in the event 2, 3, 4 and 5, especially at lower temperature.
- When comparing the in situ observation with model simulation, it is necessary to explain how to interpolate the grid points to station points in the method part.
- You said the finer resolution (1km) is a better choice (L319), but the RMSE of 1km resolution is larger than 5km resolution simulation for EXP6. In addition, the correlation

coefficients of finer resolution simulation are even smaller than the coarser resolution (EXP2, EXP4, EXP5 and EXP6). Could you explain these phenomena or please discuss it in the discussion part?

- In Fig. 4(a), marking the EXP1-8 on X-axis might be easier to understand and you'd better explain the meaning of the box-and-whisker plot, such as 75% or 25%. Additionally, you said there are 27 stations in domains 01, but why are there only 17 black or red points in Fig. 4 (c)?

Minors:

- There are two "two" in the L183.
- I think the max decrease in air temperature RMSE is 2.03 (L307) (Table 3).