

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2022-71

Anonymous Referee #1

Referee comment on "Brief communication: Improving ERA5-Land soil temperature in permafrost regions using an optimized multi-layer snow scheme" by Bin Cao et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-71-RC1>, 2022

This short communication is easy to read and follow. The conclusion is very clear and also important. Generally, I am willing to recommend its publication after the following comments are considered.

- For the evaluation in Figure 2, the improvement seems to fail on the Tibetan Plateau. Except for very thin snow as a reason, perhaps the comparison itself has an impact? The comparison is based on site (OBS) vs. grid (SIM) scale? if so, such comparison may have partial impacts because of very complex terrain of the Tibetan Plateau.
- I think that the diagnostic method for near-surface permafrost needs to be introduced more detailed. For instance, "permafrost is identified as ground where monthly soil temperature is less than 0°C for 24 consecutive months in at least one layer of the simulated upper 4 soil layers", as the statements from (Guo and Wang, 2017, <https://doi.org/10.1002/2017JD027691>).
- For the evaluation in Figure 3, I think that the authors should add more discussions on why the simulated permafrost extent is still smaller than the IPA map. For instance, different periods for generating the simulation and IPA map; the simulation is only the results at 0~1.9 m depth, may be different from the IPA map.
- For simulation experiment, the period for spin-up (initiation) should be described. Because soil temperature are analyzed in this study and if they reach a stability in the simulation. In my opinion, a recent study shows that this is important for permafrost simulation, especially for the Tibetan Plateau.