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Geoscientific Model Development Discussions

Interactive comment on "GlobSim (v1.0): Deriving meteorological time series for point locations from multiple global reanalyses" *by* Bin Cao et al.

Anonymous Referee #1

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1 General Comments This paper proposed by Cao et al. presents a new tool, GlobSim, to derive meteorological variables from multiple reanalyses (ERA-Interim, ERA5, JRA-55, MERRA-2) for ensemble simulation. The motivation and novelty of the paper–as stated by the authors–lie in the technical challenges which limit the ease of reanalysis data can be applied to models at site scale. As far as I know, a tool like GlobSim does not exist so far. The authors show the suitability of GlobSim via applying it in a large number (156 sites) of soil temperature simulation in permafrost-affected regions. I am very impressed by the strength of GlobSim, combined with GEOtop, in capturing fine-scale temperature variability due to local scales, such as snow and vegetation cover, soil moisture, and a peat layer. In general, the paper and tool are well written and described, this is an interesting study. Although it lacks additional scaling methods

and is limited to site scale, GlobSim would be a useful tool in modeling a number of land surface processes. I have two concerns. (i) Long-term simulation The authors showed the changes of permafrost temperature at different depths (0.1, 10, and 20 m) since 1980. However, only the upmost 12 m soil profile is shown in Figure 7. How did the author conduct a simulation at the depth of 20 m. Please clarify. I can understand this is provided as a demonstration of the utility of GlobSim for supporting long-term simulation. However, permafrost temperature change at a long-term scale is normally complex. This is because it is driven by both climate conditions (air temperature, precipitation as already considered by the authors) and related factors, such as such as soil moisture and vegetation. Unfortunately, the authors have not mentioned these at all. Given the description in Table 3, I assume the simulations present here is heavily simplified by ignoring such important processes. Please clarify. I suggest the authors, at least, discuss the potential influences on the temperature influences. (ii) Spatial interpolation A number of metrological variables from three fields are derived and processed (interpolation and scaling) in GlobSim. As authors mentioned, the pressure level is also interpolated or derived via 3D interpolation. However, some of the variables, such as air temperature, wind speed and direction, are available for both the surface analysis and pressure level analysis. In this context, what's the field (surface analysis or pressure level analysis) used here in permafrost simulation? More general, what is the selection strategy for such variables? This is important because different treating ways, 2D interpolation for surface analysis and 3D interpolation for pressure level analysis, would lead to different values for the same variable. This has been demonstrated by authors' another paper (Cao et al, 2017). 2 Specific comments P7, L8: Should it be term "scaling"?

P9, L31: change . . .types in in the area to . . .types in the area. . .

P10, Figure 3: Relative humidity of MERRA-2 is missing. Also consider adding label for each subplot as you've done for the other figures since you have eight figures here.

P11, Figure 4: what is the background, DEM or hillshade, please clarify. What does the

blue part in the upper right subplot? Seems the legend of Mine is not used, suggest delete it.

P12, L6: What do you mean Surface offset is defined is used here. . .? Please clarify.

P13, Table 2: Seems the minus symbol (-) for the units of thermal capacity (should be 106 J m-3 K-1) and thermal conductivity (should be W m-1 K-1) is missing

P14, Table 3: Similar with Table 3, the minus symbol in many units are missing, please double-check.

P14, Table 3: simulation depth is not sufficient for the long-term simulation, which exceeds 20 m, please clarify.

P16, L10–12: The last sentence of this paragraph is very unclear. Please clarify.

P22, L19: Should it be at a site scale or at the site level? Finally, I look forward to further development of GlobSim. References Cao, B., Gruber, S., and Zhang, T.: REDCAPP (v1.0): parameterizing valley inversions in air temperature data downscaled from reanalyses, Geoscientific Model Development, 10, 2905–2923.

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