EGUsphere, referee comment RC1
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Comment on egusphere-2022-1097

Anonymous Referee #1

Referee comment on "Evaluation of E3SM land model snow simulations over the western United States" by Dalei Hao et al., EGUsphere,
https://doi.org/10.5194/egusphere-2022-1097-RC1, 2022

General comments:

The manuscript by Hao et al. (egusphere-2022-1097) evaluated the performance of E3SM land model in simulating a number of snow parameters, e.g., snow cover fraction, surface albedo, snow water equivalent and snow depth, and snow phenology using in situ, remote sensing, and reanalysis data. The paper presented a comprehensive model evaluation and thoroughly discussed the sources of the model uncertainties and biases. I think the results of the paper are useful for the related researchers to understand the capacity and drawbacks of E3SM land model in snow simulations, and to get insights of how to further improve the model.

Specific comments:

- I would suggest revising the title of the paper. As this paper mainly evaluated the performance of the E3SM land model in simulating snow processes against a number of observation datasets. Basically, this is not an evaluation of snow processes.
- L208-209. "The snow accumulation and snowmelt seasons are defined as the periods from September to January and from February to August, respectively." However, as I know, many regions in the Northern Hemisphere have the peak SWE in February. Please discuss more about the rationality of this definition in snow season.
- Fig. 3. I notice that the temporal correlations between the simulated and observed snow fractions in winter are obviously lower than those in spring. Please explain the reason. Are they caused by different parameterizations of the model for the two seasons? Normally, it is more challenging for the snow models to simulate the complex snow processes during the melt season. Thus, the results in Fig. 3 are confusing. Pleas add more discussions.
- Table 2. Some simulated snow variables showed small correlations with some observations (R=-0.2~0.2) but obviously higher correlations with other observations (R>0.5). Please explain the reason.

Technical corrections:

- L264-265. "The regional average f_{sno} is 0.41 and 0.15, respectively for spring and winter." However, Fig. 3 shows winter has higher f_{sno} than spring. Please recheck whether it is a typo.
- Fig. 3. I would prefer using blue for areas having more snow and using red for snow-rare areas in figures.
- Figure captions. I would suggest giving the full names of the variables in the captions, instead of abbreviations.
- Table 2. It is likely the typesetting of Table 2 is problematic. It is not easy to match the products with the corresponding error metrics. Please improve.