

Comment on essd-2022-225

Anonymous Referee #1

Referee comment on "A dataset of 10-year regional-scale soil moisture and soil temperature measurements at multiple depths on the Tibetan Plateau" by Pei Zhang et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-225-RC1>, 2022

This manuscript introduces a valuable dataset (i.e., soil moisture and soil temperature at different depth from 5 cm to 80 cm) collected for nearly 10 years (from 2008 to 2019) at three dense networks including Maqu, Naqu, and Ngari built on the Tibetan Plateau. This dataset is a good extension of the surface soil moisture dataset introduced by Zhang et al. (2021, ESSD). The characteristics and trend of the in situ datasets as well as the derived freeze/thaw state were analyzed, and five reanalysis datasets of soil moisture and temperature were also evaluated by these in situ datasets. The paper is generally well written and organized. Prior to accepting this paper, the authors may want to address the following issues.

General comments:

It is good to see the authors conducted a detailed evaluation of five reanalysis datasets, i.e., ERA5, GLDAS CLSM, GLDAS Noah, GLDAS VIC, and MERRA2. But in the current version, the authors only present the results which were not interpreted further. For example, why the ERA5 outperforms the other products in simulating the surface soil moisture? Why the model simulations generally underestimate soil moisture at different depths in Maqu network while generally overestimate soil moisture at Shiquanhe network? Why all the model simulated soil temperature at all depths shown a noticeable underestimation in both Maqu and Shiquanhe networks? Some explanations (or discussion) of these results will be helpful to enhance the robustness of the paper.

To match the depths of in situ SMST measurements, the model-based SMST data were resampled across the vertical soil profile using the linear interpolation method. Did the authors find the linear interpolation is the best choice after testing or just follows the same procedure in previous studies? Can the uncertainty of this linear interpolation be quantified?

Specific comments:

Line 31: it is better to clarify the names of the reanalysis datasets.

Line 63-64: which climate data and land cover data did you use here?

Section 2.2: please give the data portal (where you downloaded the data) here.

Equation (1): did you conduct regional average vs. regional average validation (that means some averaged model grids did not include in situ data but their values still involved in the spatial averaging)?

Line 247: did you already consider the difference of coordinated Universal Time (UTC, and note models provide data at UTC) and local solar time (LST)? BTW, did the Tibet-OBS provides data in UTC or LST?

277-279: did you average the monthly mean values for warm season and cold season per year (i.e., for every grid, one value per year for each season)? If not, how did you distinguish the inter-annual and inter-month influences? Moreover, what do you mean by "and all missing data points are assigned an equal value smaller than existed valid data points", why did you do such step?

Line 294: should be "rainfall" rather "snowfall"?

Line 300: change "diminish" to "diminishes".

Line 319-339, and 365-373, Figs. 4 and 7: it is nice to see the authors investigated the trend of SM and ST in the TP as well as that of some meteorological data. Are there any conclusions about the influencing factors of SM and ST changes in the TP? Are there any similarities and differences in your results (e.g., trend analysis) compared to some similar studies conducted in TP, e.g., Shi et al. (2021, doi: 10.1175/JHM-D-21-0077.1)? What are the possible reasons for these differences? Some discussion of this issue will be helpful for the readability of these parts.

Line 326 and elsewhere: add unit for Sen's slope values, if applicable.

Line 417-419: was only liquid soil water content in frozen soil simulated by the GLDAS Noah and MERRA2? Any references to illustrate this issue?

Table 4 and elsewhere (e.g., figures, and texts): add unit for Bias, RMSD, and ubRMSD.

Fig. 3(a): any possible reasons that the SM at 40 cm is the lowest (lower than that at 80 cm)?

Figs. 5 and 8: the abscissa ST is negative, and the reader may be confused that how did you obtain the thawing results at such situation. Try to make them clearer if possible.