

Review of:

GloSVeT: a global 0.05° monthly mean surface soil and vegetation component temperature dataset (2003-2023)

This review is structured: summary of the study and conclusion, major considerations, minor considerations.

Summary:

This study presents a new dual-dataset product called GloSVeT, which provides both soil and vegetation temperatures. Results are validated against 8 in situ sites, as well as ERA5-Land and GLDAS using triple collocation. There is also separate analysis of the results by biome, including trend analysis. The author's conclusions are that this dataset demonstrates high correlations, high accuracy, and shows evidence of physical consistency.

I would recommend major considerations before further consideration.

Major Considerations:

1. ERA5-Land Skin Temperature is used for the generation of GloSVeT, and ERA5-Land Top-layer soil temperature and ERA5-Land Air temperature are used for the evaluation. Are these datasets suitably independent for triple collocation? I would like to read a justification of this.
2. How are the total percentages of statistically significant pixels calculated in section 4.3, paragraphs 2 & 3 (L366-390)? To me it seems like simple additions of all the percentages from each lag within each biome (shown in Figure 7). This wouldn't account for the fact that the grid is considered once for each lag (so the total is out of $6 * \text{grid-size}$) and would lead to inflated percentages. If it's simple addition this needs to be corrected by the authors. If they use another method, and it's coincidental that that percentages add-up, this may need to be stated by the authors.
3. L280-290 attributes a lot of the error in soil temperature to vegetation cover, and vice versa. If this is the case are the temperatures truly separable? This contradictory to the study's aims, but I am not an expert in FuSVeT.

Minor Considerations

L50-52: If there is strong coupling between air temperature and canopy temperature.

L84-85: Mentioned the generalized three-cornered hat but not used in this paper. My suggestion would be to remove this and also briefly expand on the triple collocation method.

Table 1: This shows that skin temperature is the monthly mean but does not clarify the measure used for the other datasets. Add whether other datasets are means or not.

112: is MODIS suitable post-2021? I believe either one or both of the satellites are in orbital drift. Is this important to the GloSVeT development?

L117-118: How are 4 instantaneous observations per month used to construct the mean MDC? Are not more observations needed produce a mean MDC?

L138-140: What do you do about urban pixels?

L195: The reference here is Göttsche & Olesen 2009 and the text states the "well established GOT09 model", though this is not in the reference. There is a "Goe2008" model, is this what the authors are referring to?

L219: State explicitly which parameters are temperature-independent and -dependent. Will make the reader do less work and improve ease of reading.

L230-231: In the current context, this maybe a slightly confusing/misleading of the word “downscaled” as the values are just being duplicated. Suggest finding a different description.

L246: When “corresponding daytime values [are] shifted by 12 hours”, is this using the MDC? If not, how?

L275-276: Offsets partially attributed to the “imperfect representation of near sunrise temperature conditions” – but isn’t this what is resolved in Göttsche & Olesen 2009?

L283-285: Reduced correlation in summer Ts partially attributed to fewer stations, though Autumn does well with only ~30 more stations. Similarly, with Tv in winter, as spring bias is smaller with on an extra 11 stations. Are these dominated by the vegetation cover? Suggest is more important.

L289: Could be worth a discussion about the RMSE values, as GCOS requirement for LST is <1K if I recall. How does this impact the usefulness of the dataset?

Figure 4: Minor comment – change “vermillion” to orange/red/pink, for ease of reading.

Figure 6: Personally, I prefer more explanatory figure captions, over “Same as...but...”, so would suggest repeating the figure 4 caption and mentioning this it’s for vegetation temperature. There’s only 4 biomes, so these could be repeated too.

L356-357/Figure 7a: Is this in reference to the 0 lag?

Figure 8: The changing font size/colour is quite hard read in some instances and may be less accessible to some. I would suggest introducing a twin-axis or another subplot (e.g. barplot) to demonstrate the numbers and proportions of pixels.

L430-431: What are the uncertainties associated with these trends?

Figure 9: It could be suggested that there are two regimes in this timeseries, pre- and post-2015. Are there any changes in the input data between 2013-2016 (e.g. satellite sensor changes)? Looks like a possible step change, which could impact trends – worth confirming if a change is present to be sure they are real trends.

L448: What do you mean by “major warming and cooling centres”?

L453: Suggest swapping “patchier” for “more heterogeneous”.

L453: What impacts would “limited land area and weaker radiative forcing contrast” have on per grid-cell temporal trends? Is this related to uncertainty?

Figure 11: Personally, I prefer more explanatory figure captions, over “Same as...but...”, so would suggest repeating the figure 10 caption and mentioning this it’s for July.

L522: Is this *statistically* significant, or significant in *magnitude/importance*?