**Topic editor**

All reviewers are satisfied with the authors' revisions. Please carefully address any additional comments in this round of review.

Reply:

Thank you for your guidance. We have carefully addressed the additional comments raised in this round of review, including revising inappropriate or overgeneralized statements, correcting citation and reference inconsistencies as well as grammatical and copy-editing errors, and supplementing necessary methodological and dataset-usage details.

Detailed point-by-point responses to each reviewer comment are provided below. All revisions in the revised manuscript are highlighted in red.

**Reviewer #1**

The authors addressed my comments in substantial detail and is clearer about the physical meaning, evaluation strategy, and limitations of the dataset. The authors have also added several useful sensitivity and consistency analyses. I do not have remaining major concerns. Some editing errors are provided below.

Reply:

Thank you for your positive evaluation and for acknowledging the revisions made to the manuscript. We appreciate your careful reading and have addressed the remaining editing issues as detailed below.

Q1. Several quantitative summaries remain inconsistent with the figures. L19–20 states that the reported $R^2$ values exceed 0.9, although Fig. 3 includes values of 0.84 and 0.90. Likewise, "RMSE values typically below 2 K" at L380–382 is not supported because four of the eight seasonal RMSE values are 2.0 K or higher, including one value of 3.0 K.

Reply:

Thank you for this careful observation. In the revised manuscript, we corrected these over-generalized statements in both the Abstract and Section 4.2. The revised Abstract now states that GloSVeT "achieves reliable accuracy with coefficients of determination mostly at or above 0.9 and root mean square errors generally around 2 K for both components" (Lines 20–21). In Section 4.2, the corresponding summary was revised as follows: "Overall, these results indicate that GloSVeT achieves consistent and physically reasonable performance across seasons, with strong correlations ($R^2 \geq 0.9$ in most cases) and RMSE values generally around 2 K except for the larger winter error in vegetation temperature, effectively reproducing surface component temperatures at the monthly scale." (Lines 384-386)

Q2. The references require a complete cross-check. For example, Kosaka et al. (2024) and Du et al. (2025) are cited without matching reference-list entries, whereas Duan et al. (2024), Premoli and Tavella (1993), and Sjoberg et al. (2021) remain in the list after the generalized three-cornered-hat discussion was removed. Citation punctuation is also inconsistent; for example, "Liu et al., (2025)" should be "Liu et al. (2025)."

Reply:

Thank you for pointing this out. We have carefully cross-checked the in-text citations and reference list, added the missing entries for Du et al. (2025) (Lines 803-805) and Kosaka et al. (2024) (Lines 857-858), removed unused references including Duan et al. (2024), Premoli and Tavella (1993), and Sjoberg et al. (2021), and corrected inconsistent citation punctuation throughout the manuscript (Lines 78, 130, 172, 222, and 250).

Q3. Please correct the colorbar unit in Figs. 11 and 12 from "k/decade" to "K/decade." Also check L760–761, which states that six flux networks were used but names only five.

Reply:

Thank you for pointing this out. We have corrected the colorbar units in Figures 11 and 12 from "k/decade" to "K/decade" and revised Lines 769–770 to correctly describe the five flux networks used in this study.

Q4. The manuscript still contains recurrent grammatical and copy-editing problems and needs a full proofread. One representative example is "machine learning based datasets" at L45, which should be "machine-learning-based datasets." Another is "GloSVeT currently produced" at L701, where the verb "is" is missing. The annotated PDF contains the full set of line-level examples.

Reply:

Thank you for your careful reading. We have carefully proofread the full manuscript and corrected grammatical and copy-editing issues throughout the revised version.

**Reviewer #2**

The authors have carefully addressed most of my previous concerns and substantially improved the manuscript. The additional sensitivity analyses, internal closure assessment, revised triple-collocation design, and expanded discussion of limitations have strengthened the study. I have only several minor comments that should be addressed before publication.

Reply:

Thank you for your positive evaluation and for recognizing the revisions and additional analyses made in the manuscript. We appreciate your careful reading and have addressed the remaining minor comments as detailed below.

Q1. The polar-region diagnostic does not directly demonstrate retrieval accuracy.

The latitudinal variation of the fitted amplitude parameter Ta shows that the optimization produces different parameter behaviour at high latitudes, but this alone does not establish that the GOT09-based model remains physically valid under polar day or polar night. Please slightly moderate the corresponding interpretation.

Reply:

Thank you for this helpful clarification. We agree that the parameter diagnostic based on the fitted amplitude parameter $T_a$ does not directly demonstrate retrieval accuracy under polar-day or polar-night conditions. Following your suggestion, we have further clarified this limitation and moderated the corresponding interpretation in the revised manuscript. The revised text reads: "Under such conditions, GloSVeT retrievals

may have larger uncertainties and therefore require cautious interpretation. Further refinements to GloSVeT should consider diurnal temperature cycle formulations that are better suited to polar illumination conditions and irregular diurnal temperature cycles." (Lines 703-705)

Q2. Dataset quality flags and recommended usage ranges should be described more clearly.

The manuscript identifies larger uncertainty for polar regions, persistently cloudy regions, extreme FVC conditions, and weakly represented components. It would substantially improve dataset usability if these limitations were translated into explicit quality-control information. Please clarify whether the released dataset includes variables such as valid MODIS observation count, reconstruction residual, FVC, closure error, optimization convergence status, or recommended reliability flags.

Reply:

Thank you for this helpful suggestion. We agree that clearer information on dataset quality control and recommended usage would improve the usability of GloSVeT. The current released dataset includes monthly mean soil and vegetation component temperatures, but does not include separate pixel-level quality-control layers, optimization convergence status, closure-error layers, or recommended reliability flags. Ancillary information useful for quality screening, including clear-sky MODIS sampling, FVC, and land cover, can be obtained from the original input products, namely the Clear_sky_days and Clear_sky_nights layers in MxD11C3, GLASS FVC, and MCD12C1 land cover. Therefore, these ancillary variables were not duplicated as separate layers in the current GloSVeT release. The reconstruction residual, or closure error, was used only as an internal consistency diagnostic at the four MODIS overpass times, rather than as a monthly mean pixel-level quality-control variable, and was therefore not released as a separate layer.

Following your suggestion, we have clarified this point in the **Code and data availability** section: "The current GloSVeT release does not include separate pixel-level quality control layers or recommended reliability flags. Users who need additional screening information can refer to the original input datasets, including the Clear_sky_days and Clear_sky_nights layers in MxD11C3 for clear-sky MODIS sampling, GLASS FVC for component dominance, and MCD12C1 land cover for identifying surface types that require cautious interpretation." (Lines 720-724)

Q3. Please clarify the meaning of the validation sample number.

The reply states that the 66 summer soil-temperature records correspond to monthly matched records collected over several years. Nevertheless, the effective independence of these samples remains unclear because repeated observations may originate from the same sites. Please report both the number of site-month records and the number of independent sites. Where possible, validation statistics should also be summarized by site, rather than treating all monthly records as fully independent samples.

Reply:

Following your suggestion, we have reported both the number of matched site-month records and the number of independent sites in the caption of Figure 3. The revised caption states: "The Count value in each panel denotes the number of matched site-month records, and the corresponding numbers of independent sites for panels (a–h) are 14, 5, 12, 16, 16, 13, 20, and 15, respectively." (Lines 366-368)

Q4. The internal closure check should not be described as independent validation.

Reconstructing the mixed-pixel LST from the retrieved component temperatures is useful for checking numerical consistency, but the reconstruction uses quantities and assumptions involved in the retrieval itself. Therefore, a small closure error demonstrates internal consistency rather than independent accuracy. Please ensure that this distinction is clearly maintained throughout the manuscript.

Reply:

Thank you for this helpful comment. We agree that the internal closure check should be clearly distinguished from independent validation. In the revised manuscript, we clarified this point in both the Introduction and the Method section. In the Introduction, we now describe this analysis as "an internal closure check of the decomposition–reconstruction process" (Line 109). In Section 3.3, we further emphasize this distinction as follows: "The resulting monthly global RMSE and bias statistics were used to assess the long-term internal closure of the decomposition–reconstruction process and its dependence on MODIS overpass time, rather than to provide an independent validation of component temperature accuracy." (Lines 295-297)

Q5. The discussion of component-temperature representativeness should be better connected to recent related studies.

For physical, the thermal-radiation directionality is caused by the distinguishing component temperatures of vegetation, sunlit soil, and shaded soil (such as 10.1016/j.rse.2024.114532; 10.1016/j.rse.2025.114794). The conventional two-component vegetation&soil framework may overlook the thermal heterogeneity. The authors should enhance this limitation of GloSVeT in the discussion.

Reply:

Thank you for this valuable suggestion and for pointing us to recent studies on thermal radiation directionality. In the revised manuscript, we strengthened this limitation as follows: "This simplification also does not explicitly distinguish between sunlit and shaded fractions. Temperature differences among vegetation, sunlit soil, and shaded soil can be substantial and represent an important source of thermal radiation directionality (Ermida et al., 2014; Liu et al., 2020a; Qin et al., 2025; Lu et al., 2025). As a result, the conventional two-component framework adopted in GloSVeT may overlook sub-pixel thermal heterogeneity, especially for the soil component." (Lines 659-663)