

This manuscript presents an important update and improvement based on a widely recognized dataset. I commend the authors for their excellent work. Building on the C-LSAT 2.0 dataset, the authors have integrated nearly 3,000 additional global observational stations to develop the C-LSAT 2.1, along with high-resolution ( $0.5^{\circ} \times 0.5^{\circ}$ ) LSAT and DTR datasets. The new version significantly enhances data coverage, refines processing techniques, and provides valuable high-resolution products. The manuscript is comprehensive, logically structured, and the conclusions are sound. It fits well within the scope of Earth System Science Data (ESSD). However, the following minor revisions are recommended prior to publication:

**Response:** Thank you very much for your positive and constructive comments. We have tried our best to substantially modify the paper according to your review.

1. Please supplement the temporal coverage of observation stations at both annual and monthly scales.

**Response:** Thank you for your suggestion. We have now added a detailed summary of station temporal coverage at both annual and monthly scales. (Lines 150–153 and Table S1)

2. In section 4.1.2, the authors used the MAE, RMSE to evaluate the different datasets. However, sometimes, MAE and RMSE only provide one aspect performances of different datasets. DISO as a comprehensive performance evaluating index can illustrate the overall performance for all the datasets. Therefore, the DISO should be added in this study.

**Response:** We have now computed the DISO index for all datasets and included these results alongside MAE and RMSE in Section 4.1.2 and Section 4.1.3. (Lines 319–336, Line 376–379 and Figs. S1–S2)

3. If feasible, consider adding additional validation in representative regions, particularly in high-altitude or complex terrain areas.

**Response:** We have added validation for the Tibetan Plateau. (Lines 330–336, Line 378–379 and Figs. S1–S2)

4. All variables in equations should be consistently italicized.

**Response:** We have revised the equation descriptions to ensure that every variable is consistently set in italics.

5. Insert appropriate spaces between numbers, symbols, and units (e.g., in line 230).

**Response:** Thank you for highlighting this formatting issue. We have inserted appropriate spaces between numbers, symbols, and units throughout. (Lines 227–230)

6. Add a space before parentheses in Table 1 for clarity.

**Response:** We have modified it. (Table 1)

7. Please explain the observed increases in MAE and RMSE since 1990 as shown in Figure 7.

**Response:** This is due to the reduction in the number of stations after 1990. (Lines 366–369)

8. The abnormal warming pattern in northern North America depicted in Figure 12(d) requires

verification.

**Response:** We have examined the data in this region and corrected or removed some problematic records.

9. The colorbars in Figures 11 and 17 hinder regional comparisons; consider revising them for clarity.

**Response:** We have adjusted the colorbar of these figures.

10. There are citation errors that need correction (e.g., in line 776).

**Response:** We have carefully revised the references.