Response to Reviewer #1

The authors have addressed my concerns in the previous discussions, and I only have several comments on technical corrections.

Q1. Line 70: space missed after 0.5°

Response: Thank you for your careful reading. We have corrected this issue.

Q2. Based on Fig 12, the MMLST (monthly mean LST) still has clear gaps, so the statement 'all-sky' or 'gap-free' (line 28) is not completely accurate, even though the improvement for minimizing the cloud gaps is quite significant.

Response: We appreciate your careful reading, the phrase “under all-sky conditions” in Line 28 has been removed.

Q3. Obtaining monthly mean could be a considerable contribution to the community while as the authors mentioned in the manuscript, the data are still limited by the orbital drift issue. I would recommend the authors provide some additional statistics to verify how much the RMSE of MMLST would change due to orbital drift after several years, probably temporal accuracy variation analysis for N14 would be enough.

This would help to assess the impact of the orbital drift issue on the accuracy of the MMLST product over time, providing motivation for future studies. By analyzing how the RMSE changes over time, the authors could provide a better understanding of the limitations and potential biases of the data, which would be useful for the community using this product.

Response: Thanks for your suggestion. Many studies have shown that two satellite observations that are separated by approximately 12 h can be used to estimate a relatively accurate daily and monthly mean LST (i.e., DMLST and MMLST) by weighted average method (Chen et al., 2017; Liu et al., 2023; Xing et al., 2021). Based on the in situ LST measurements, the weight for every moment in every combination (one daytime and one nighttime) is determined. Fig. R1 displays the density scatter plots that depict the true in situ DMLST against the weighted average of the in situ

day/night observations (one daytime and one nighttime) at the time of NOAA satellite overpass. The results show that the DMLST obtained by the proposed method is not influenced by the orbital drift of the satellite. We applied the same methodology to compute the MMLST, as described in Appendix B. Theoretically, the MMLST is also independent of the satellite orbit drift, resulting in a constant RMSE over time.

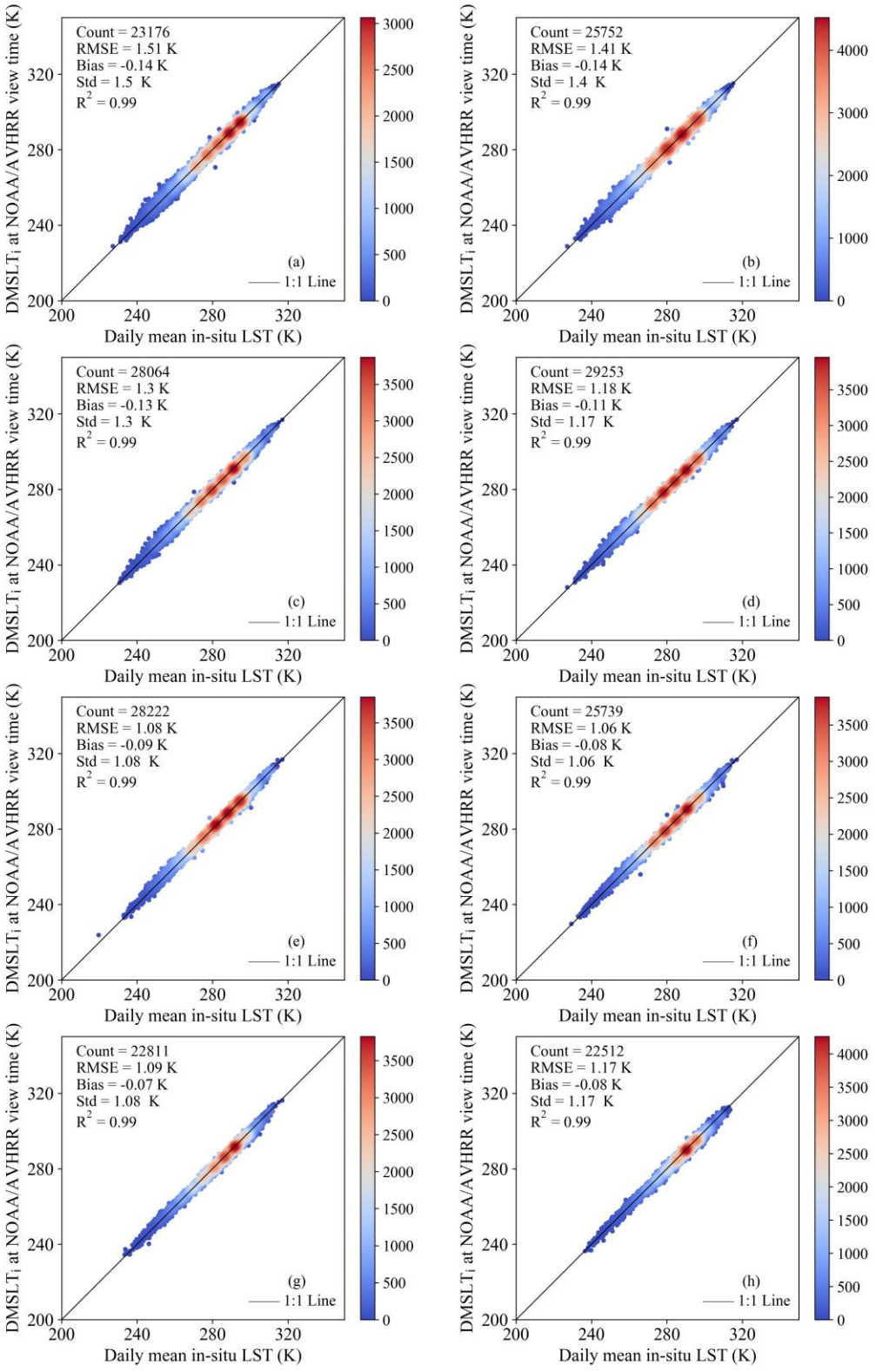

Figure R1. Comparison of the actual in situ DMLST and the in situ DMLST estimated using a weighted average method based on NOAA satellites with orbital drift effect at 76 stations from 2003 to 2018: (a) 13:30/01:30, (b) 14:00/02:00, (c) 14:30/02:30, (d)

15:00/3:00, (e) 15:30/03:30, (f) 16:00/04:00, (g) 16:30/04:30, and (h) 17:00/05:00 (Li et al., under review).

References for the above responses are listed below:

Chen, X., Su, Z., Ma, Y., Cleverly, J., and Liddell, M.: An accurate estimate of monthly mean land surface temperatures from MODIS clear-sky retrievals, J. Hydrometeorol., 18, 2827-2847, https://doi.org/10.1175/JHM-D-17-0009.1, 2017.

Li, J.-H., Li, Z.-L., Liu, X., Duan, S.-B., Si, M., Shang, G., and Zhang, X.: A generalized method for retrieving global daily mean land surface temperature from polar-orbiting thermal infrared sensor instantaneous observations, Int. J. Remote Sens., Under review.

Liu, X., Li, Z.-L., Li, J.-H., Leng, P., Liu, M., and Gao. M.: Temporal upscaling of MODIS 1-km instantaneous land surface temperature to monthly mean value: Method evaluation and product generation, IEEE Trans. Geosci. Remote Sens., https://doi.org/10.1109/TGRS.2023.3247428, 2023.

Xing, Z., Li, Z.-L., Duan, S.-B., Liu, X., Zheng, X., Leng, P., Gao, M., Zhang, X., and Shang, G.: Estimation of daily mean land surface temperature at global scale using pairs of daytime and nighttime MODIS instantaneous observations, ISPRS J. Photogramm., 178, 51–67, https://doi.org/10.1016/j.isprsjprs.2021.05.017, 2021.

Response to Reviewer #2

Overall, I think the authors have done a good job with the revision.

With a journal such as ESSD however, I am concerned about the dataset being artificially restricted to the year 2005, which will limit its use for examining long-term LST trends, the primary goal of releasing the dataset. The authors have mentioned in the response letter that they are processing the data till the year 2021. It may have been helpful to just include those years of analysis to this paper for a more complete dataset paper.

However, this is not a fundamental flaw with the science behind the study. As such, I don't have a strong opinion and will leave the decision up to the editor.

Response: Thanks for your valuable comments. We have followed your suggestion and generated the GT-LST product for the period 2006-2021, which is now publicly available at https://doi.org/10.5281/zenodo.7813607 (Li et al., 2023).

References for the above responses are listed below:

Li, J. H., Liu, X., Li, Z. L., and Duan, S. B.: A global historical twice-daily (daytime and nighttime) land surface temperature dataset produced by AVHRR observations from 1981 to 2021 (2006-2021), https://doi.org/10.5281/zenodo.7813607, 2023.

Response to Editor

Overall all the four reviewers are satisfied with the authors' revision. However, I agree with the Reviewer #4's comments on the covered perids of the dataset. I strongly recommand the authors to include the recent 20 years' data in this paper, considering that the authors are already processing other years' data. Extending the time series to cover the nearly 40 years will make this dataset more useful and valuable. Restricting the data to the year 2005 which limit its use and is not reasonable, considering that the same methods can be applied to other years.

Response: Thank you for your valuable suggestion. According to your suggestion, we have extended the time span of the GT-LST product to 2021. The GT-LST product for the period 2006-2021 can be freely available at https://doi.org/10.5281/zenodo.7813607 (Li et al., 2023). Our revised article is titled "A global historical twice-daily (daytime and nighttime) land surface temperature dataset produced by AVHRR observations from 1981 to 2021", which more accurately reflects the scope of our study. Furthermore, we have updated several figures in our manuscript, including Fig. 1, Fig. 2, Fig. 3, and Fig. 15.

References for the above responses are listed below:

Li, J. H., Liu, X., Li, Z. L., and Duan, S. B.: A global historical twice-daily (daytime and nighttime) land surface temperature dataset produced by AVHRR observations from 1981 to 2021 (2006-2021), https://doi.org/10.5281/zenodo.7813607, 2023.