

This manuscript, titled "An observational record of global gridded near surface air temperature change over land and ocean from 1781", a new gridded data set of air temperature change across global land and ocean extending back to the 1780s. This data set, called the GloSAT reference analysis, has two novel features: it uses marine air temperature observations rather than the sea surface temperature measurements typically used by pre-existing data sets, and it extends further into the past than existing merged land and ocean instrumental temperature records which typically estimate temperature changes from the mid-to-late 19th century onwards. This study is important and interesting, and the results have practical implications for climate professionals. Therefore, I recommend accepting this article for publication on ESSD after some revisions.

1. It seems that the ESSD format requires the dataset's DOI to be included in the abstract section.
2. Section 3.1.2, "Handling of Early Exposure Bias," seems to be a good improvement, but from the text, we do not see the extent of this adjustment. It seems to still follow the approach of Morice et al. (2012)? In that case, there might be no need to elaborate so much on the method of Wallis et al. (2024); I suggest significantly condensing this section.
3. Section 3.1.3, "Treatment of Climate Normals," is also an advancement, but I am concerned about how different the new standard values' treatment is compared to the previous method, which used both standards climate normal and provisional normal. At the very least, a distribution of differences should be provided.
4. In Section 3.2, regarding the handling of ocean data, it is recommended to include a table that presents the differences brought about by the corrections and adjustments in each part.
5. In Section 3.3.4, The article mentions that sea ice regions are treated as land for weighting purposes. However, given that the extent of sea ice varies over time, could the authors provide further clarification on how the climatology is handled when calculating anomalies? Specifically, as the sea ice extent changes over time, regions may be influenced by both LSAT and MAT at different points, which could affect the calculation of climatology. Is there any method to adjust for or account for these dynamic changes to ensure the accuracy of the climatology calculations?
6. From Figure 4, the LSAT component of GloSATref has a slight cold bias compared to CRUTEM5 prior to 1950, while the bias in the MAT component is more pronounced. Between 1900 and 1960, the cold bias is more prominent (including GloSAT). Recently, a paper in Science pointed out that all existing SST datasets exhibit a significant cold bias before 1930, which is also reflected in GMST. However, in this study, GloSATref seems to show a certain degree of cold bias as well. Why? Given that SST exhibits a cold bias and GloSATref uses SAT, why is there still such a negative bias? This seems difficult to explain.
7. Similarly, Figure 5 also shows that the cold bias of GloSATref between 1900 and 1930 is more prominent.