Response to CC2

This is a well-conducted and timely study that provides quantitative evidence for the thermal perturbation of ice-covered lake surfaces by aeolian sediments on the Tibetan Plateau. The application of spatial regression models, particularly MGWR, to quantify sediment-induced thermal anomalies is appropriate and helps address an important knowledge gap regarding cryosphere–aeolian interactions. The results indicate that sediment-covered areas exhibit surface temperature increases of 0.83–2.36°C, highlighting the potential role of aeolian sediments as an important non-climatic driver of lake ice thermal heterogeneity. The manuscript is generally well organized, and the methodology appears robust. I have a few comments that I believe will further strengthen the manuscript.

Comment 1: The Landsat 8 and MODIS datasets are not always acquired on the same date. Given that aeolian sediment streaks can migrate rapidly under strong wind conditions, this temporal mismatch may introduce uncertainty into the spatial correlation analysis. The authors should discuss the likely migration rate or persistence of these sediment streaks and evaluate how such temporal offsets may affect the reported relationships. If available, daily meteorological observations from nearby weather stations could also be used to demonstrate that background thermal conditions remained relatively stable during the interval between the two satellite acquisitions, thereby helping to constrain this source of uncertainty.

Reply: We thank Dr. Ke Zhang for this insightful comment. We agree that the temporal mismatch between the Landsat 8 observations used to identify aeolian sediment deposits and the MODIS LST observations may introduce uncertainty into the spatial analysis.

We attempted to identify Landsat 8 and MODIS observations acquired on the same date.

However, because of the 16-day revisit interval of Landsat 8 and the frequent missing or low-quality MOD11A1 observations over the ice-covered lake, suitable same-day image pairs could not be obtained for the selected events. We therefore used the temporally closest available Landsat–MODIS pairs that met the image-quality requirements, which helped reduce, although not completely eliminate, the temporal mismatch.

We acknowledge that aeolian sediment streaks may be redistributed under strong wind conditions. With the available satellite observations, however, we cannot quantitatively estimate their short-term migration rates or determine their persistence between the two acquisition dates. We will therefore explicitly acknowledge this limitation and discuss the potential effects of short-term sediment redistribution on the spatial sediment–LST relationship in the revised manuscript. In particular, we will treat the temporal mismatch as an important source of uncertainty in the spatial correspondence between sediment distribution and LST, rather than interpreting it as evidence that the observed relationship is absent.

Regarding meteorological observations, continuous ground-based observations directly representative of Zonag Lake are not available for the selected periods because of the remote location of the study area. We therefore cannot quantitatively characterize the meteorological conditions between the two satellite acquisitions or use local observations to constrain sediment migration during these short intervals. We will clarify this limitation in the revised manuscript and emphasize that higher-temporal-resolution satellite observations, together with continuous meteorological measurements, would be valuable for quantitatively constraining sediment redistribution and reducing this source of uncertainty in future studies.

Comment 2: The 2011 Zonag Lake outburst and the subsequent reorganization of the regional lake system, which resulted in extensive exposure of former lakebeds, represent a major environmental change in the study area. Although this event is briefly

introduced in the study area description, its potential implications are not fully explored in the subsequent analysis. Since the newly exposed lakebed likely became the dominant source of aeolian sediments, it would be informative to examine whether the observed sediment–temperature relationship became stronger or more evident after 2011 compared with earlier periods. At a minimum, the authors should discuss this possibility in Section 5, as it would provide valuable environmental context for interpreting the results.

Reply: We thank Dr. Ke Zhang for this constructive comment. We agree that the 2011 Zonag Lake outburst and the extensive exposure of former lakebeds that followed represented a major environmental change in the study area, with potentially important implications for aeolian sediment sources and lake thermal conditions.

We will therefore further analyze and discuss the changes in lake surface temperature and aeolian sediment deposition before and after the 2011 outburst in the revised manuscript. Our long-term analysis indicates that aeolian sediment deposition increased substantially after the outburst, with a significant change point around 2011. This increase is consistent with the extensive exposure of former lakebeds, which likely provided additional sources of aeolian sediment to the lake-ice surface.

At the same time, we recognize that lake surface temperature also exhibited changes during the same period. These changes may have been influenced not only by the increased availability and deposition of aeolian sediments, but also by variations in regional climate and lake thermal conditions. Therefore, we will avoid attributing the post-2011 changes in lake surface temperature solely to aeolian sediment deposition and will instead consider aeolian sediments as one of the important factors influencing lake-ice thermal conditions. We will also discuss the 2011 outburst as an important environmental transition, emphasizing its influence on aeolian sediment availability and the subsequent increase in sediment deposition, as well as its potential contribution to changes in lake-ice thermal conditions. This additional discussion will provide a

more appropriate environmental context for understanding the relationship between aeolian sediment deposition and lake surface temperature.

Comment 3: Line 77: A punctuation mark is needed between "conditions" and "Monitoring" because these are two independent sentences. The sentence should read:"...regional aeolian conditions. Monitoring data revealed..."

Reply: We thank Dr. Ke Zhang for pointing out this language issue. We will revise the sentence by inserting a period between “conditions” and “Monitoring”, as suggested. The sentence will read: “...regional aeolian conditions. Monitoring data revealed...”

Comment 4: The first paragraph of Section 5.2 would fit better in the Introduction. It clearly outlines the scientific significance of the study and identifies the key research gap, providing a stronger rationale for the work at an earlier stage of the manuscript. Moving this paragraph to the Introduction would improve the overall flow and better frame the objectives of the study.

Reply: We thank Dr. Ke Zhang for this helpful suggestion. We agree that the first paragraph of Section 5.2 would be more appropriate in the Introduction, as it provides important context regarding the scientific significance and research gap of this study. We will move this paragraph to the Introduction to improve the overall structure and better frame the objectives of the study.