We sincerely thank the reviewer for the careful and constructive review. We agree with the reviewer's main concern that correlation between LST-based indicators and GLOF timing or magnitude does not necessarily imply causality. We also agree that the physical drainage mechanism of Lake Merzbacher must be described more clearly before the role of LST can be interpreted for early warning.

In a revised manuscript, we will clarify that LST is not interpreted as a standalone causal factor or deterministic trigger of GLOFs. Instead, we will present LST as a process-related remotely sensed indicator that reflects the evolving thermal and hydrological state of the lake–ice-dam system. We will explicitly describe the likely drainage mechanism of Lake Merzbacher as seasonal lake filling, increasing hydrostatic pressure, partial ice-dam flotation, and the activation, connection, or enlargement of englacial and subglacial drainage pathways. We will also distinguish this drainage-initiation mechanism from the possible role of thermal erosion during the drainage-evolution phase, where relatively warm lake water may enhance conduit enlargement after drainage has initiated.

We will also clarify that the 12 °C value is an empirical, site-specific LST reference level rather than a physical trigger threshold, and that the 1.04 °C d^{-2} acceleration criterion is an empirical diagnostic criterion rather than evidence of imminent failure. Finally, we will emphasize that cumulative LST is statistically associated with peak discharge but should be interpreted together with lake volume, lake level, ice-dam geometry, and drainage-pathway development. These revisions will be made throughout the Introduction, Study area, Methods, Results, Discussion, and Conclusions.

Comment: lines 65–67: this could be a bit more precise with explaining what are the physical mechanisms that can lead to lake drainage.

Response: We thank the reviewer for this suggestion. In a revised manuscript, we will expand the Introduction to describe the physical mechanisms of lake drainage more explicitly. We will clarify that glacial lake drainage may occur through different mechanisms, including overtopping or overflow into supraglacial channels, mechanical instability or collapse of the dam, and the opening, connection, or enlargement of englacial and subglacial drainage pathways. For Lake Merzbacher, previous studies indicate that drainage is most likely associated with the activation and enlargement of englacial and subglacial channels under increasing lake level, hydrostatic pressure, and partial ice-dam flotation. We will add this distinction to avoid implying that all GLOFs are controlled by the same mechanism.

Comment: Section 2: the lake itself should be described more precisely, including volume, area, filling and draining periods, evolution over the studied period, etc.

Response: We thank the reviewer for this helpful comment. We will expand the Study area section to provide a more detailed description of Lake Merzbacher, including its ice-dammed nature, glacial setting, seasonal filling and drainage behavior, lake-area variability, and likely drainage mechanism. We will clarify that Lake Merzbacher is impounded by the Southern Inylchek Glacier and drains repeatedly through englacial or subglacial pathways. We will also add information on the observed lake-area range and the shift in GLOF timing over the study period. These additions will better place the LST analysis within the glacio-hydrological context of the lake–ice-dam system.

Comment: line 104: and Aizen., 1998). –> and Aizen, 1998).

Response: We thank the reviewer for noting this typographical error. We will correct it in the revised manuscript.

Comment: Figure 1: Not clear what is land, what is glacier and what is water. Panel a and b should be listed in the caption.

Response: We thank the reviewer for this helpful comment. We will revise Figure 1 to improve the distinction between land, glaciers, and water bodies. In the revised figure, glaciers, water bodies, rivers, non-glacier terrain, and basin boundaries will be shown using more contrasting colours and clearer outlines, and the legend will be updated accordingly. We will also revise the figure caption to explicitly describe panels (a) and (b).

Comment: lines 122–124: what is/are then the mechanism(s) that trigger the 25 observed GLOFs?

Response: We thank the reviewer for this important question. We will revise the Study area and Discussion sections to clarify the most likely drainage mechanism for the 25 documented GLOFs. Since no glacier-surge-triggered GLOFs were reported at Lake Merzbacher during the study period, we will interpret these outbursts as being primarily associated with seasonal lake filling, increasing hydrostatic pressure, partial flotation or uplift of the Southern Inylchek ice dam, and the activation, connection, or enlargement of englacial and subglacial drainage pathways. We will also clarify that LST is not interpreted as an independent trigger of these events, but as a process-related indicator of thermal and hydrological preconditioning and, potentially, of drainage-channel enlargement after drainage has initiated.

Comment: line 157: define what is μ and σ.

Response: We thank the reviewer for pointing this out. We will revise the Methods section to explicitly define μ and σ. In the revised manuscript, μ will denote the mean value of the LST second derivative, d^2LST/dt^2, and σ will denote the standard deviation of d^2LST/dt^2. These statistics will be calculated from the event-aligned second-derivative values within the window from 30 days before to 7 days after the 25 documented GLOF events. The threshold $\mu + 1.5\sigma$ will then be used to identify periods of significantly accelerated LST increase.

Comment: line 158: LST > the –> LST larger than the.

Response: We thank the reviewer for this correction. We will replace the symbolic expression "LST > the threshold" with the more formal wording "d^2LST/dt^2 exceeding this threshold" in the revised manuscript.

Comment: lines 172–174: this part about ablation in a lake is not clear. When LST is below the temperature melting point, then the lake, at least its surface, is frozen; when it is above, it is free of ice. Not sure ablation and accumulation are the appropriate terms here. Moreover, the LST might not be representative of the melt condition. For temperature lower than 4 °C, because of the density inversion, you could measure a LST of 0 °C but having higher temperature up to 4 °C close to the lake bottom, one can expect some melt. Or not, if the whole lake column is at zero. The representativity of a surface measurement to deduce the melt condition at depth should be discussed.

Response: We thank the reviewer for this important clarification. We agree that the previous wording was misleading because MODIS-derived LST represents the radiometric surface skin temperature of the lake and should not be interpreted as the temperature of the full lake water column, the lake bottom, or the ice–water interface. We will therefore remove the terms "ablation" and "accumulation" from this part of the Methods section and will no longer describe LST above 0 °C as an "effective ablation threshold".

In the revised manuscript, we will define cumulative LST as a positive cumulative surface thermal index rather than a direct measure of melt energy or ice-dam ablation. We will also add text clarifying that, due to possible vertical stratification and the density maximum of water near 4 °C, surface temperature may differ from the thermal conditions at depth. Therefore, this index will be interpreted only as an empirical indicator of surface thermal conditions and open-water exposure before outburst. We will further note that lake-temperature profiles, lake-level observations, and ice-dam measurements would be required to evaluate melt conditions at depth or at the ice–water interface.

Comment: line 178: Where –> where.

Response: We thank the reviewer for noting this typographical error. We will correct it in the revised manuscript.

Comment: Figure 2: needs some explanation to be understandable. Are the steps listed at the top also following the time axis? What represent the blue and orange lines? The two intermediate panels are showing temperature, but of what?

Response: We thank the reviewer for pointing out this ambiguity. We will revise Figure 2 and its caption to make the figure easier to understand. In the revised version, the boxes at the top will be described as analytical steps rather than a chronological sequence. The figure caption will clarify that daily MODIS-derived LST is first smoothed and differentiated to calculate the rate of LST change and its acceleration. The x-axis in the time-series panels will represent days relative to the outburst date, with negative values indicating days before the GLOF. The blue line will denote the mean or smoothed daily LST, the light-blue shading will indicate variability among historical events, the orange dashed vertical line will mark the outburst date, and the orange shaded areas will indicate significantly accelerated warming periods where the second derivative exceeds $\mu + 1.5\sigma$. These thermal indicators will then be combined with cumulative LST before the outburst to evaluate their relationship with GLOF timing and magnitude.

Comment: Figure 3: how do you explain that lake temperature is higher than air temperature? Especially if the lake is in contact with the ice which imposes a T = 0 °C boundary condition? The temperatures are averaged over which period on this plot? Is it just 3 points per year, mean over June, July and August? This should be specified more explicitly.

Response: We thank the reviewer for this important comment. We agree that the previous version did not sufficiently clarify the physical meaning of the temperature series and the averaging period used in Figure 3. In the revised manuscript, we will change Figure 3 from absolute temperature to temperature anomalies relative to the 2000–2022 monthly and seasonal mean. This avoids a direct comparison between MODIS-derived radiometric lake surface skin temperature and ERA5-Land 2 m air temperature, which represent different physical quantities.

We will also clarify in the caption that the June, July, and August values represent monthly means calculated from all valid daily values within each month, and that the summer mean represents the mean anomaly for June–August. MODIS LST will be explicitly described as lake surface skin temperature rather than bulk lake-water temperature or temperature at the ice–water interface. Therefore, the ice–water interface may remain close to the pressure-melting point, while the open-water surface observed by MODIS can still exhibit positive and seasonally variable temperature anomalies. In addition, we will revise the interpretation of the trends to emphasize that July LST showed the strongest warming tendency, whereas the statistical significance of individual monthly trends should be interpreted cautiously.

Comment: line 221: ice dam failure is a bit vague and may be not appropriate for the type of drainage occurring at Lake Merzbacher, i.e. opening of subglacial channels.

Response: We thank the reviewer for this important clarification. We agree that the term “ice-dam failure” is too vague and could incorrectly imply structural collapse of the ice dam. In the revised manuscript, we will replace this expression with more process-specific wording. We will describe Lake Merzbacher outbursts as being related to the activation, connection, or enlargement of englacial and subglacial drainage pathways, probably controlled by lake filling, increasing hydrostatic pressure, and partial ice-dam flotation. We will also revise the interpretation of the 12 °C value to emphasize that it is an empirical thermal indicator of elevated outburst likelihood, rather than a physical threshold for ice-dam failure.

Comment: line 222: If GLOF happens for much larger temperature than 12 °C, then it means that it is not really a threshold for the GLOF to happen, i.e. the lake can be stable for higher temperature than 12 °C?

Response: We thank the reviewer for this important clarification. We agree that the 12 °C value should not be interpreted as a deterministic threshold above which a GLOF must occur. The previous wording was too strong and may have implied a causal or trigger threshold. In the revised manuscript, we will describe 12 °C as an empirical LST reference level or non-deterministic thermal indicator that marks the seasonal thermal window in which most documented outbursts occurred.

We will clarify that Lake Merzbacher can remain stable when LST is above 12 °C if lake level, hydrostatic pressure, partial ice-dam flotation, and englacial or subglacial drainage connectivity have not yet reached a critical hydromechanical state. Therefore, the 12 °C value will not be treated as a physical trigger threshold, but as one component of a multi-parameter early-warning framework. We will also revise the text to emphasize that LST should be combined with LST change rate, LST acceleration, lake filling, floating-ice coverage, water level, and ice-dam motion.

Comment: Figure 5: I guess it is one particular year? Which one? From the text it seems that it is a mean? Then the envelope of all years should be presented or all the 25 years also plotted with thin curves. What are the units for the x-axis? I guess it is days? There is no a and b on the two panels.

Response: We thank the reviewer for this helpful comment. We will clarify that Figure 5 represents a multi-event composite rather than one particular year. In the revised figure, all 25 documented GLOF events will be aligned to their outburst dates, and the composite mean will be presented together with the interquartile range, 25–75 %, to show the variability among events. We will also revise the x-axis label to "Days relative to GLOF date (d)", where day 0 indicates the outburst date, negative values indicate days before the outburst, and positive values indicate days after the outburst. Clear panel labels "(a)" and "(b)" will also be added to the two panels.

Comment: line 250: can you define what is "accelerated warming events"?

Response: We thank the reviewer for pointing out this ambiguity. We will revise the terminology and definition in the manuscript. To avoid confusion with GLOF events, we will use the term "accelerated LST warming occurrences". In the revised manuscript, an accelerated LST warming occurrence will be defined as a daily value within the event-aligned GLOF windows for which the LST acceleration, d^2LST/dt^2, exceeds the empirical acceleration threshold $\mu + 1.5\sigma$, corresponding to 1.04 °C d^{-2} in this study. These occurrences therefore refer to threshold-exceeding LST acceleration days, not to independent GLOF events.

Comment: line 267: Here again, I am missing the process that conduct to the lake drainage. I would say that at first order, the flood magnitude is proportional to the lake volume, then its temperature can play a role especially if the drainage mechanism involves the melting of a supra-, intra-, or subglacial channel.

Response: We thank the reviewer for this important comment. We agree that flood magnitude should not be interpreted as being primarily controlled by LST. In the revised manuscript, we will clarify that peak discharge is expected to be controlled at first order by the volume of water available for drainage, lake level, hydraulic head, drainage-pathway geometry, and the rate of enlargement of englacial or subglacial channels.

We will also revise the interpretation of lake area and cumulative LST. Because direct lake-volume observations are not available for all events, we will use lake area only as a first-order geometric proxy for lake storage, not as a direct estimate of volume. Cumulative LST will be described as a supplementary surface thermal index that may be statistically associated with peak discharge and may influence drainage efficiency through thermal erosion of supra-, intra-, or subglacial channels once drainage has initiated. We will revise the Results and Discussion accordingly to avoid implying that LST alone controls flood magnitude.

Comment: line 318: which mechanisms?

Response: We thank the reviewer for this comment. We agree that the previous version did not specify the relevant drainage mechanisms clearly enough. In the revised Discussion, we will explicitly describe the mechanisms that may link LST to Lake Merzbacher outbursts. We will distinguish between three related processes: (1) thermal and hydrological preconditioning, in which elevated LST reflects enhanced energy input, open-water exposure, and meltwater supply; (2) drainage initiation, which is primarily controlled by lake filling, increasing hydrostatic pressure, partial ice-dam flotation, and the activation or connection of englacial and subglacial drainage pathways; and (3) drainage evolution, in which relatively warm lake water may enhance thermal erosion and enlargement of supra-, intra-, englacial, or subglacial channels after drainage has initiated.

We will revise Section 5.1 to make clear that the primary mechanism for drainage initiation is likely hydrostatic-pressure-induced ice-dam flotation and drainage-pathway activation, whereas LST is interpreted as a process-related precursor that reflects the evolving thermal and hydrological state of the lake–ice-dam system.

Comment: line 339: factor or indicator?

Response: We thank the reviewer for pointing out this important distinction. We agree that LST should not be presented as a standalone causal factor or physical trigger of GLOFs. In the revised manuscript, we will consistently describe LST as a process-related indicator or remotely sensed precursor. Elevated LST may reflect conditions that favor lake filling and drainage-system development, and it may also contribute to conduit enlargement through thermal erosion after drainage has initiated. However, drainage initiation itself is more likely controlled by lake level, lake volume, hydrostatic pressure, ice-dam geometry, partial flotation, and englacial or subglacial drainage connectivity.

Accordingly, we will replace terms such as “primary driver”, “controlling factor”, and “critical threshold” with more cautious expressions such as “process-related indicator”, “precursor”, “empirical reference level”, and “diagnostic signal”. We will state explicitly that the 12 °C value is not a deterministic trigger threshold, but an empirical LST reference level associated with the warm-season window in which most documented outbursts occurred.