Review **egusphere-2025-832** *"Lake Surface Temperature Dynamics as Precursors to Glacial Lake Outburst Floods: A Case Study of Lake Merzbacher, Central Tianshan"* by Wang et al.

This article analyses the Lake Surface Temperature (LST) before the occurence of an outburst flood to infer early warning indicators that can be used for the future prediction of the GLOF. The study area is the Lake Merzbacher in Central Tianshan. The analysis is based on indicators build from the LST, its first and second derivatives, averaged over ad-hoc periods. The analysis is made on a dataset that cover 25 years from 2000 and 2024 and corresponding to 25 GLOFs (one per year).

The aim of this paper is to propose indicators based on the LST that show a strong correlation with the date of the GLOF event. My main criticism is that correlation does not necessarily imply causality. More physical arguments should be put forward to help the reader become convinced that there is indeed a plausible causal link between the indicators and the occurrence of the GLOF. I agree that lake temperature certainly plays an important role in triggering the lake drainage, but it certainly depends on the mechanisms that conduct to this drainage. If the lake drains by overflow in a supra-glacial channel, the best indicator would be the difference between the lake level and the ice dam minimum elevation, rather than the LST (which will influence then the drainage cinematic). If the lake drainage is due to the collapse of the ice dam, then again, I am not certain that the LST play a more important role than the water pressure on the ice dam. What is therefore missing in the paper is an appropriate description, if it is known, of the mechanisms leading to the lake drainage: the opening of a supra-, intra- or sub-glacial channel or the mechanical collapse of the ice dam. From the literature, I understand that Lake Merzbacher drains through the opening of intra- and sub-glacial channels. This should be mentioned. Also, it renders even less universal the indicators inferred for this lake because not all glacial lakes drain the same way.

I have compiled a list of comments below that I hope will help improve the current manuscript (listed in order of appearance).

- lines 65-67: this could be a bit more precise with explaining what are the physical mechanisms that can lead to lake drainage.
- section 2: the lake itself should be described more precisely (volume, area, filling and draining periods, evolution over the studied period, etc).
- line 104: and Aizen., 1998). –> and Aizen, 1998).
- Figure 1: Not clear what is land, what is glacier and what is water. Panel a and b should be listed in the caption.
- lines 122-124: what is/are then the mecanism(s) that trigger the 25 observed GLOF?
- line 157: define what is μ and σ
- line 158: LST > the –> LST larger than the
- lines 172-174: this part about ablation in a lake is not clear. When LST is bellow 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.

- line 178: Where –> where
- 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?
- 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 temperature are averaged over which period on this plot? It is just 3 points /year, mean over June, July and August? Should be specified more explicitly
- line 221: ice dam failure is a bit vague and may be not appropriate for the type of drainage occurring at Lake Merzbacher (opening of subglacial channels)
- 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?
- Figure 5: I guess it is one particular year? Which one? From the text it seems that it is a mean? Then the envelop 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.
- line 250: can you define what is "accelerated warming events"?
- line 267: Here again, I am missing the process that conduct to the lake drainage. I would said that at the first order, the flood magnitude is proportional to the lake volume, then its temperature can play a role especially if the drainage mechanisms involves the melting of a supra, intra or sub glacial channel.
- line 318: which mechanisms?
- line 339: factor or indicator?