

We thank again the reviewers for their valuable comments and provide hereby our responses on how we have addressed the remaining issues.

RC1:

I agree with the changes to the manuscript and I also confirm that the database is now fully available in Zenodo, which in my opinion, makes the manuscript acceptable for publication.

Please, consider including the following small edits:

- Throughout the manuscript, replace "hr" for hours by "h", which is the correct symbol

*We updated all occurrences to read now as "h" instead of "hr" throughout the text.*

- line 395: Correct the symbol for degrees " angle in Syrdakh of about  $51^\circ$  at summer solstice".

*Has been superscripted.*

- Figure D6 should be enlarged for easier reading

*Figure has been enlarged from 8 cm width to 16 cm width.*

In what concerns to the raw UAS imagery, I think you may add in the text body, which author to contact.

*The information is now included in the data availability statement.*

RC2:

The article "Thermo-hydrological river valley observatory in Yedomá permafrost from 2012 through 2022 in Syrdakh, Central Yakutia" presents a diverse and comprehensive dataset from a thermokarst lake landscape. Though there are many data gaps and clearly denoted sources of error, the measurements are highly useful in this data-scarce region as the authors note. Some important changes to the abstract clarifying the context of this work, as well as some small clarifications to the presentation of the data are needed before publication.

Abstract: clarification needed for the following sentences:

"These features of Arctic landscapes exhibit particularly high variability in water and energy transfer, and thus provide an excellent field laboratory for analyzing how expected changes in meteorological forcing under climate change affect permafrost dynamics and carbon exchange within the land- and limnoscape. "

This sentence either needs rewording or justification, it is not self-explanatory that rivers have disproportionately high variability, nor that this variability would make them more susceptible to change. They may very well be more susceptible to change, but further clarification is needed.

*We rephrased the sentence to clarify that the same absolute change in river water level – and thus in the heat content of the water column above the water-land interface – results in a relatively larger change in heat flux compared to lakes. In deeper thermokarst lakes, an equivalent absolute change in water level represents a smaller relative change in heat content above the sediment-water interface. The revised sentence now reads as:*

*“These features of Arctic landscapes exhibit particularly high variability in water and energy transfer because, in lakes with larger water storage, excess water leads to comparatively small changes in water level and discharge, whereas in streams the channeled flow produces much larger fluctuations. Consequently, an equivalent absolute change in water level represents a much smaller relative change in lakes than in streams, resulting in a comparatively minor impact on overall heat content and energy transport. Such rivers thus provide an excellent field laboratory for analyzing how expected changes in meteorological forcing under climate change affect permafrost dynamics and carbon exchange within the land- and limnoscape.*

"We instrumented two main stream cross sections with multiple thermistor chains to record temperature evolution from the surface to soil depths of up to 5 m "

Was water temperature monitored (fig 12)? The sentence makes it sound like you were monitoring the subsurface of the stream bed, but I think you had transects including a stream? Clarification needed.

*Thermistor chains were exclusively installed in the ground. The section now reads as: “We instrumented two main stream cross sections with multiple subsurface thermistor chains to record temperature evolution from the land or water-land interface ( $\geq 5$  cm depth) to soil depths of up to 5 m.”*

"The main focus was set on the cross section midway between the two lakes due to the absence of a thermal imprint from the lake."

Which of the two transects above is this?

*We added that this is cross section CS 9:*

*“ The main focus was set on the cross section midway between the two lakes (CS~9) due to the absence of a thermal imprint from the lake.”*

Largely, the text is precise and detailed in description of data collection methods and data storage. Some specific elements could be clarified:

Figure 6 - were all 3 methods used at each point? Some clarification in the figure as to how many measurements went into each point and which techniques were used would be helpful, or perhaps mention in text or in the caption which methods were used predominantly.

*We use different markers now in the figure to represent the measurement method. We added into the figure caption that each point represents a single measurement. The measurement method is provided also in the CSV files for each measurement individually; this is mentioned in the text already under section “ Thaw depth measurements - td”.*

4.1.4 The reported VWC is calculated based on the Topp et al. conversion curve. This empirical relation could be significantly improved given information on soil texture etc. presented late in the manuscript. If access to the raw or un-converted data remains, these files would be helpful. If impossible, please include the default calibration curves such that the dielectric values might be computed.

*We provide the transformation equation to obtain VWC from the raw output of the Em50 data logger, according to the provided information in the EC-5 manual. The information was added to the relevant section “ Soil water content - swc“. We do not have any other information or data available that would support a more sophisticated transformation.*

4.1.6 Should be titled infiltrability, no? the vertical hydraulic conductivity is measured, but given the water level data, are these tests saturated fully? I would expect slug tests or bail test to measure K<sub>Sat</sub>.

*This is a very good point and an oversight on our side. We agree that the wording saturated hydraulic conductivity for the ring infiltrometer tests are wrong, but we think that the main point here is still the hydraulic conductivity rather than infiltrability; the Rosetta 3 estimates are also considered saturated hydraulic conductivity. We have changed the variable name to k<sub>fs</sub> (field-saturated or saturated hydraulic conductivity). All occurrences in figures and in the text have been changed accordingly and we added a sentence to the start of the paragraph:*

*“Hydraulic conductivity, either field-saturated or saturated (k<sub>fs</sub>), were estimated using two different methods.”*

Fig 11 - more info needed in caption - what do the different error bar shapes refer to? how can we locate the names on Figure 2? Do the colours match here? Metadata characterizing the sample would also be really helpful - were the frozen samples permafrost or frozen active layer? Was there any notable organic content in the samples? etc.

*We added additional information in the figure caption as well as in the text. This includes the transformation from 14C activity to ages, and how the errors are derived. The error bars have the same shape for all points; whiskers were chosen instead of simple lines due to sometimes very narrow uncertainty ranges, which would have resulted in error bars being hidden behind the data points. We use different colors here to highlight different locations; the colors in Figure 2 refer to instruments or categories rather than different locations within one category. All pits are represented for example in a brownish color. Here the idea is to differentiate the different soil pits. We use a new colormap here to not infer any contextual connection with any of the other figures. The CSV files comprise information on whether a sample was taken below (and how deep below) the thaw depth horizon. As outlined in the section on thaw depths, we assume our thaw depths are close to the actual active layer depths, but this remains unvalidated. This is stated with a link to the relevant section on thaw depths in the figure caption now. The locations (legend) are the exact names that can be found in the QGIS database and throughout all other data presentation within the manuscript and figures. For example, Figures 5, 7, 8, and 9 all use the same location identifiers. We believe it would be redundant to explicitly state this again.*

Fig 12 - similarly, what do the different colours refer to and why do they seldom overlap? same comment for figure 14

*Colors simply highlight a different location and thus time-series. The main purpose of the coloring is to highlight differences between the locations. As mentioned in the earlier comment, the colors in Figure 2 differentiate instruments and categories, not the location. In Figure 12 and 14, a single category is displayed, and the aim is to differentiate between the locations within one category. There is overlap, usually if two different loggers were simultaneously measuring in close vicinity or within a similar thermal or hydrological regime. Stronger offsets are resulting for further away locations (in the case of lake levels also at short distance but different installation depth), and different thermal and hydrological regimes. Gaps for a same or similar location are the result of exchanging loggers.*

Description of figure 15 not found in text?

*We are not sure if we understand this comment correctly. The figure caption mentions that these are water depths measured along the river at different cross sections. In the text, we reference this figure in lines 434ff on how and where these measurements were taken. We added a sentence on the position naming with reference to the section about the QGIS database after line 435.*

Fig 17 - how was the LMWL calculated or was it pulled from another work?

*These are pulled from another work. The reference for all three (Global, Local, Local Evaporation) is provided in the figure caption:*

*“Global meteoric water line (G.M.W.L.), Local meteoric water line (L.M.W.L), and Local evaporation line (L.E.L.) from Ichiyanagi et al. (2003).”*

*We rephrased the sentence to:*

*“Global meteoric water line (G.M.W.L.), local meteoric water line (L.M.W.L), and local evaporation line (L.E.L.) are adopted from Ichiyanagi et al. (2003).”*