RC2: 'Comment on essd-2023-431', Haijun Qiu:

Data:

The file name of the data seems not normalized, e.g. 'shp'. I suggest the Polygons revised as HTs.

The meaning of HTs_V1 seems not clear, which could be as HTs_Shapefile.

The data "read me" (file description) file needs more detail and clear for readers, e.g. '"O_Name" field indicates the time of the satellite imagery for this morphological element,'. These should be more detail for the name of satellite.

AC: Thank you for your specific suggestions regarding our dataset. Based on these, we have updated our dataset and rewritten the data documentation (readme.txt) "Before downloading and applying this dataset, please read this text carefully.

----------------------------general information--

The HTs_shapefile primarily consists of two datasets: HT point data within the Qilian Mountain range (named HTs_points.shp) and vector boundary data (named HTs_polygons.shp).

1. The HTs_points.shp file includes three attributes: "Latitude," "Longitude," and "IT." The first two attributes represent the latitude and longitude of the HT locations, while the "IT" field indicates the initiation time of the HT, categorized into three classes: A, B, and C. Class A signifies HTs initiated after 2015 (including 2015), class B represents those initiated between 2010 and 2015, and class C represents those initiated before 2010 (excluding 2010).

2. The HTs_polygons.shp file comprises three main attributes: "Area," "Round," and "Sat Date." The first two indicate the area and perimeter of each HT boundary polygon, while the "Sat Date" field represents the satellite overpass time used to delineate the HT polygon, respectively.

----------------------------coordinate information--

Data Type: Shapefile Feature Class

Geographic Coordinate System: GCS_WGS_1984

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Specific Comments

As we know that, the thermokarst are mostly used or defined in the permafrost regions. However the hillslope thermokast is unusual. So, please explain it in detail for hillslope thermokarst.

AC: Thank you for allowing us to clarify. Hillslope thermokarst refers to a specific type of thermokarst formation that occurs in permafrost regions. While it is similar to regular thermokarst features, what distinguishes hillslope thermokarst is its occurrence on sloped terrain or hillsides, where permafrost thaw leads to slope instability. This can result in various landforms like retrogressive thaw sumps, thermo-erosion gullies, or active layer detachments, affecting the stability and shape of hillslopes in permafrost regions. These features can significantly impact the landscape and have implications for infrastructure, ecosystems, and land use in areas affected by hillslope thermokarst processes (Kokelj and Jorgenson, 2013; Olefeldt et al., 2016; Gooseff et al., 2009).

Kokelj, S. V. and Jorgenson, M. T.: Advances in Thermokarst Research: Recent Advances in Research Investigating Thermokarst Processes, Permafrost and Periglac. Process., 24, 108–119, https://doi.org/10.1002/ppp.1779, 2013.

Olefeldt, D., Goswami, S., Grosse, G., Hayes, D., Hugelius, G., Kuhry, P., McGuire, A. D., Romanovsky, V. E., Sannel, A. B. K., Schuur, E. A. G., and Turetsky, M. R.: Circumpolar distribution and carbon storage of thermokarst landscapes, Nat Commun, 7, 13043, https://doi.org/10.1038/ncomms13043, 2016.

Gooseff, M. N., Balser, A., Bowden, W. B., and Jones, J. B.: Effects of Hillslope Thermokarst in Northern Alaska, Eos Trans. AGU, 90, 29–30, https://doi.org/10.1029/2009EO040001, 2009.

The sentence in line 103: "Permafrost instability in the Qilian Mountains has gradually increased, resulting in HT formation including RTSs, thermokarst lakes, and thermal erosion gullies" is incorrect. As thermokarst lakes are not included in the hillslope thermokarst hazard.

AC: Thank you for alerting us to this mistake, we have replaced "thermokarst lakes" with "active-layer detachment slides" on line 115 of the manuscript.

I suggest changing "freeze/thaw-induced hazards" to "hillslope thermokarsts" in line 84.

AC: The expression "freeze/thaw-induced hazards" in the original manuscript was indeed ambiguous to the reader, and we have changed it to "hillslope thermokarsts."

Line 1 invertony should be as inventory.

AC: Thank you, we have corrected that spelling error.

Please note that there are some English grammar and presentation problems in the article, as well as formulas in lines 122, 204-205 that do not appear properly in the manuscript.

AC: Thank you, we also noted grammatical and presentation problems in the manuscript, which we have now improved in the new manuscript. The reason the equations on lines 122, 204-205 do not display correctly in the manuscript may be due to format conversion of the preprint file, thanks for the heads up.

Lines 600-602 do not have DOI added to the citations of the reference, please uniform the citation in manuscripts.
AC: Thank you very much for your reminder, however, we no longer cite this document in the new manuscript.

I think you have some problems in section 4.1, such as the lack of precision and clarity of "HT", "thermokarst landslides" and "landslides" in lines 161-163.
AC: Thank you very much for your comments, the presentation in the original manuscript did have some problems and we have modified it in lines 169-171 of the new manuscript: "These features are tonally and morphologically different from their surroundings in color satellite images during the thawing season."

The Jilin-1 satellite image you mention in "7 Data Availability" does not seem to be used in "4 Methods" or other chapters, and the authors should make a clear statement as to whether or not this data is used, and how it is used.
AC: Thank you very much for the heads up. In our work, this imagery along with Wayback imagery provided by ESRI was used to aid in the verification of the accuracy of our HT dataset, and we have added a note in the "3 Data Sources" section of the new manuscript: "...and Jilin-1 satellite imagery (0.75 m) provided free of charge by China Commercial Satellite Corporation to aid in the identification." and in the "4 Methods" section, the information on the Jilin-1 satellite in Table 1 were updated.

Please carefully check the format of article, for example line 358 “HTwas”, line 414 “mid- and upstream”.
AC: Thanks, we've fixed those formatting issues.

In lines 261-262 of the manuscript, the authors state that 90% of the RTSs tend to be distributed in the altitude range of 3200-4000 m. Is this statement accurate? In context, it would be more standardized to use "90% of HTs" instead of "90% of RTSs".
AC: Thank you very much for catching that the statement in the original manuscript was indeed inaccurate, and we have changed "90% of RTSs" to "90% of HTs" on line 270 of the new manuscript.

In the study, there are several river basins, but it does not appear in the figures, please added it.
AC: Thank you—we have ensured that all of the basins mentioned in the manuscript are shown in Figures 1, 4, and 5; for example, in Figure 1(a), the different basins are labeled on the map with their corresponding names.

About the potential influence factors, it is simple for the impacting factor earthquake, which could be more detail for explaining. For example, it can be seen that there are some fissures after earthquake, which could be the important factors controlling the HTs development.

AC: Thank you for your specific feedback. Due to the lack of specific initiation times for HTs, analyzing the temporal correlation between earthquakes and HT initiation has proven to be challenging for us. As a result, in Figure 7, we are only showing the positions of seismic epicenters in relation to HTs. Regarding the impact of earthquakes causing surface fissures and subsequently exposing substantial ground ice, this is elaborated on lines 335-338 of the manuscript: "During our field investigations, we found a nearly 3 km long and 2 m deep slope fracture caused by a 6.9-magnitude earthquake in 2022, resulting in a massive exposure of subsurface ice…"

We have added further detailed descriptions to the new manuscript based on your suggestions:

L339-349:The occurrence of an earthquake can result in an instantaneous increase in pore water pressure and sliding forces that reduce slope stability and potentially leads to a massive exposure of subsurface ice (Niu et al., 2016; Xia et al., 2022), sediment liquefaction (Dadfar et al., 2017), and permafrost warming due to the seismic vibrations. These vibrations lead to cracking and deformation of the ice layers within the permafrost, releasing moisture and heat, consequently resulting in a temperature rise of the permafrost. Additionally, earthquakes can induce the flow of pore water within the permafrost, further influencing its temperature (Che et al., 2014), creating the ideal setting for active-layer detachment slides.

Line 120, the word tabulate is not suitable.

AC: Thanks, we changed it to "calculate" in the new manuscript.

Line 190, what is ‘al’?

AC: Sorry, it was a spelling mistake and we have corrected it to "a."

In the discussion, the climate factors does not show detail in the methods.

AC: Thank you for catching this. We have made revisions as follows:

L242-245: "To explore the effects of climate on HT, we acquired monthly mean air temperature and precipitation data at 2 meters above ground level from ERA5 for the period 2000–2020. Subsequently, we computed their annual spatial means and standard deviations (Figure 6)."