Dear Reviewer,

We sincerely thank you for your comprehensive and detailed review of our manuscript. Your comments have been invaluable in helping us to refine our work, we will carefully address the issues you raised.

My main concern with this manuscript is that the authors claim they develop a "novel method for estimating annual discharge" of supraglacial channels which is not supported by work presented in the manuscript. Specifically,

1.The authors calculation of annual glacial discharge (which per the title is the pivotal contribution of this work) relies on data from two weather stations and nine ablation stakes. These 9 ablation stakes are used to calculate mass balance (constraining MB in equ 1) at a 5 cm resolution. There is a brief discussion of some errors in the discussion but they cite errors from other studies and not an error analysis for this work. Moreover, the manuscript lacks details on the methodology for ablation stake measurements (what dates and at what frequency were ablation stakes measured?, what is the associated error?) And the data itself is not presented in the manuscript.

Reply: Thank you for your insightful review and constructive feedback. For glacier runoff:

1. Glacier runoff models based on coarse-resolution meteorological data are commonly used, but the uncertainty remains significant. Generally, the algebraic sum of mass balance derived from ablation stakes and precipitation provides more reliable results. We have now added a detailed description of the ablation stake measurements to Section 2.4 (including measurement dates and frequency).

2. The detailed data have been added to Appendix 2 (Table A2), including stake ID, elevation, and mass balance records.

3. As you point out, the uncertainties of stake-based mass balance can be classified into three groups: (1) errors in field observations; (2) errors related to spatial extrapolation over the entire glacier; and (3) error due to unaccounted interannual changes in glacier area (Dyurgerov et al., 2002). Among these, class (1) is very small (centimeter scale) and negligible at the annual scale, and (3) typically arises only in multi-year studies. Since this study focuses solely on Qiyi Glacier's 2023 data, it is also excluded. Therefore, the primary error is spatial extrapolation from ablation stakes, which typically requires higher resolution DEMs (e.g., obtained by TLS laser scanning (Xue et al., 2024)) for assessment. Due to the absence of the UAV-derived high resolution DEMs for Qiyi Glacier during 2022 and 2023, we cannot provide a site-specific error estimate. However, given the geographic proximity, similar glacier types, and comparable elevation range covered by stakes, we used the error assessment from Urumqi Glacier No.1 reported by Xu et al. (2019) (±0.12 m w.e.) as a reference. Calculations showed their interpolation errors within 17%, so we set the maximum uncertainty range at ±20% in our discussion (Section 4.2) based on this result. From these results we conclude that, although spatial extrapolation uncertainties are the dominant error source, they do not affect our finding that channel geometry can be used to estimate glacier runoff.

Table A2. Ablation stake measurements record

Stake ID	Latitude (°)	Longitude (°)	Elevation (m)	MB (mm w.e.)
3-1	39.249607	97.753264	4320	-1894.8
4-2	39.247748	97.753548	4350	-1540.2
5-1	39.246667	97.754925	4380	-1280.7
6-5	39.244167	97.753611	4430	-935.7
7-1	39.243494	97.755908	4480	-1236.9
8-1	39.241767	97.758044	4550	-1249.5
9-1	39.240086	97.759672	4610	-945.6
10-4	39.237303	97.764169	4700	-919.2
12-mountain pass	39.234425	97.768039	4800	-594.3

2.Estimating annual discharge into a supraglacial stream is not a novel method, and even if it were, it would need to be validated on actual discharge measurements. Intuitively, streams with larger catchment areas should convey a greater proportion of annual discharge (e.g., Yang and Smith 2016), however, this isn't specifically described and therefore makes it seem like that is a novel finding of this work. I recommend revising the manuscript to take care to properly cite and describe known physical relationships and by potentially adding a section to the discussion which distinguishes between new findings (stream morphology relationships with discharge) vs. findings that align with previous studies.

Reply: As you noted, there are indeed existing studies that have calculated supraglacial stream runoff, but these are mostly based on observed discharge or runoff models driven by meteorological data (Muthyala et al., 2022; Yang et al., 2019). Our intention here is to highlight the novelty of using supraglacial channel geometric parameters (e.g., sinuosity and lateral deviation) to estimate runoff, rather than relying solely on hydrological models or in situ discharge measurements.
In addition, we have expanded the discussion to emphasize the topographic differences between the Greenland Ice Sheet (studied by Yang and Smith (2016)) and high elevation mountain glaciers. When catchments originate from high elevation mountain glaciers, steep and complex glacier surfaces may weaken the simple dominant relationship between catchment area and glacier runoff, and supraglacial channel geometry is more strongly influenced by local topography. This is one of the reasons why we keep the gradient variable in our regression equations. Finally, we have carefully implemented your suggestions to explicitly acknowledge the established physical principles you mentioned (contribution of catchment areas to glacier runoff) and to clearly distinguish between previously known findings and the novel results of our study in Section 4.4.

The main contribution of this work seems to be the geometric analysis performed on the very high resolution DEM created for Qiyi Glacier in 2023. By framing the analysis in the context of annual discharge, which has significant yet undiscussed uncertainties, undercuts confidence in the results. I suggest revisiting the annual discharge calculation, including a more robust error analysis and discussion (in addition to increasing the detail in the methods section), and shifting the main findings of the manuscript to what can be confidently argued by your results.

Reply: Thank you for your positive feedback. This study is the first in the Tibetan Plateau to conduct high resolution geometric analysis of supraglacial rivers. We have supplemented the methodology for annual runoff calculations and error analysis in our response to your first question (Section 4.2 and Table A2). We hope these revisions meet your satisfaction.

Methodology on the Automatic determination of supraglacial streams and "manual correction" should be elaborated on. How many streams were originally identified by the algorithm? How many needed to be corrected visually? Only 11 streams are shown in Fig 4a so it is unclear why an automatic method needed to be employed in the first place.

Reply: The reasons we first conducted an automatic extraction method are as follows: the automatic determination algorithm ensures an objective and repeatable identification of the entire supraglacial stream network. Regarding the number of streams: if each tributary and main stem is counted as one stream from its headwater, the DEM-based automated extraction algorithm identifies not only the 11 clearly visible streams shown in Fig. 4a, but also an additional 22 lower-order, smaller, and shorter tributaries that are much less distinct in the figure. As for manual correction, for these smaller tributaries, although stream lines can be delineated based on DEM data, they are not clearly visible when overlaid on orthophotos (with a resolution of 5 cm).Therefore, under the principle that "streams automatically extracted from DEM must be clearly distinguishable on orthophotos to ensure the realism of stream morphology," the purpose of manual correction was to truncate these smaller tributaries and upstream sections where channels are difficult to recognize. We sincerely thank you again for your detailed inquiry.

Section 3.4 belongs in the methods section

Reply: Thank you for your suggestion. After careful consideration, we have decided to retain this section in the Results. In Section 2.5 we briefly introduce the regression model, although the regression model and related contents in Section 3.4 have methodological aspects, the specific coefficients, equations, and errors are one of the core findings of our research. We therefore believe presenting them here may offer readers a more coherent and fluid narrative. To ensure clarity, we have added explicit cross references between Sections 2.5 and 3.4, allowing readers to easily locate the complete model details.

L54: Yes, not every study uses weather station data (as cited in this sentence) but many studies do use weather station data, this sentence is quite misleading in this regard.

Reply: We thank the reviewers for pointing out this overgeneralization. The sentence was intended to emphasize the challenge of lacking field meteorological data in remote areas, but the phrasing was not sufficiently precise. The statement has now been revised: "Estimates of meltwater runoff at basin or larger scales have often relied either on the limited field observations (Gleason et al., 2016; Smith et al., 2017, 2021) or on glacier runoff models driven by coarse-resolution climate data (Beamer et al., 2016; Hock, 2005; Sicart et al., 2008; Wang et al., 2024; Yang et al., 2025). Although in situ meteorological observations from weather stations are used in some glacier studies, such data are often unavailable or sparse for remote glacierized regions, leading to uncertainties in modeled runoff that hinder a robust quantitative analysis of its relationship with supraglacial channel geometry."

Tables, what do the ** mean? I can't find a description for this in the text.

Reply: we sincerely apologize for missing that detail, In the table, the asterisks denote the significance levels of the correlation coefficients (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). We have added an explanation of this in the caption of Fig. 8.

Fig 9. Move to methods

Reply: We appreciate your suggestion. After discussion, we believe it is more appropriate to retain Figure 9 in its current location (Section 3.4). This figure provides an intuitive illustration of the regression model performance and its comparison with the observed values, making it more suitable as a result presentation in Section 3.4.

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