

Review on the manuscript entitled

“Rock glaciers in the Daxue Shan, southeastern Tibetan Plateau: an inventory, their distribution, and their environmental controls”

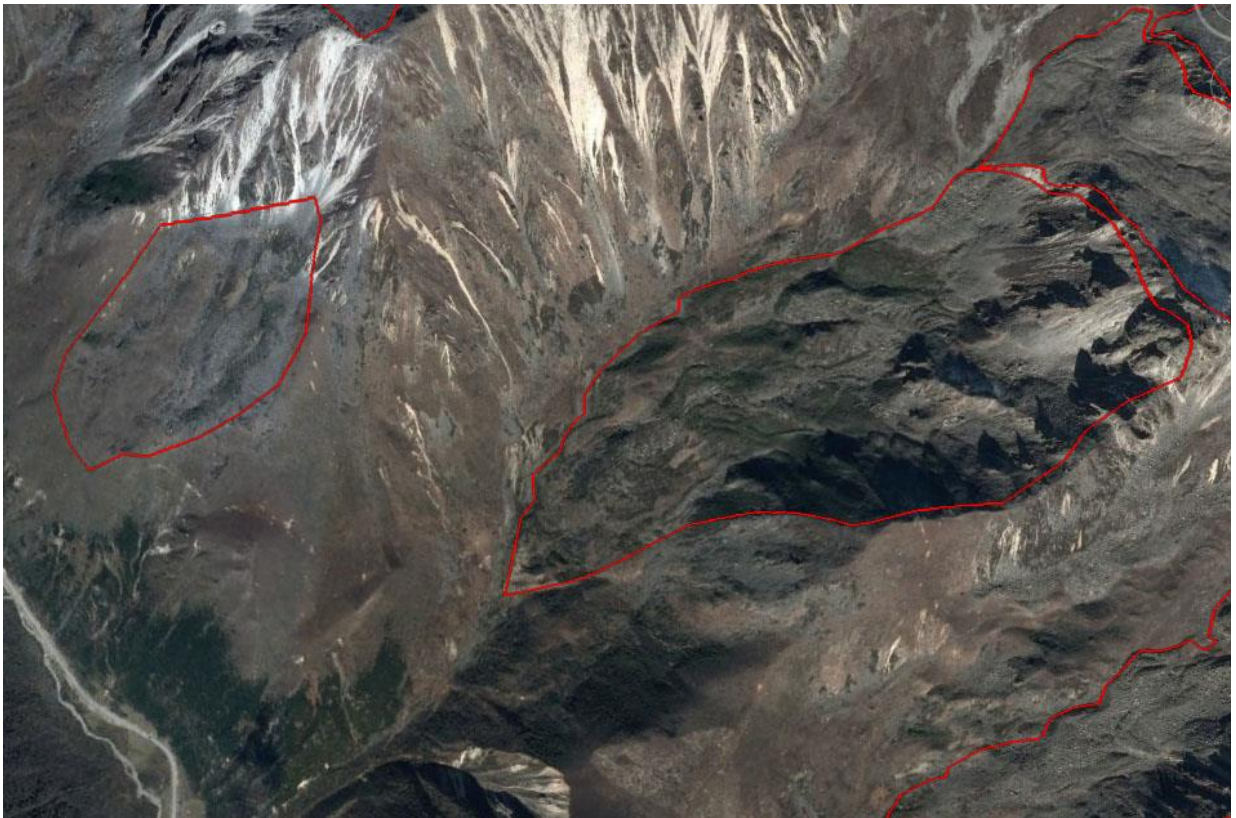
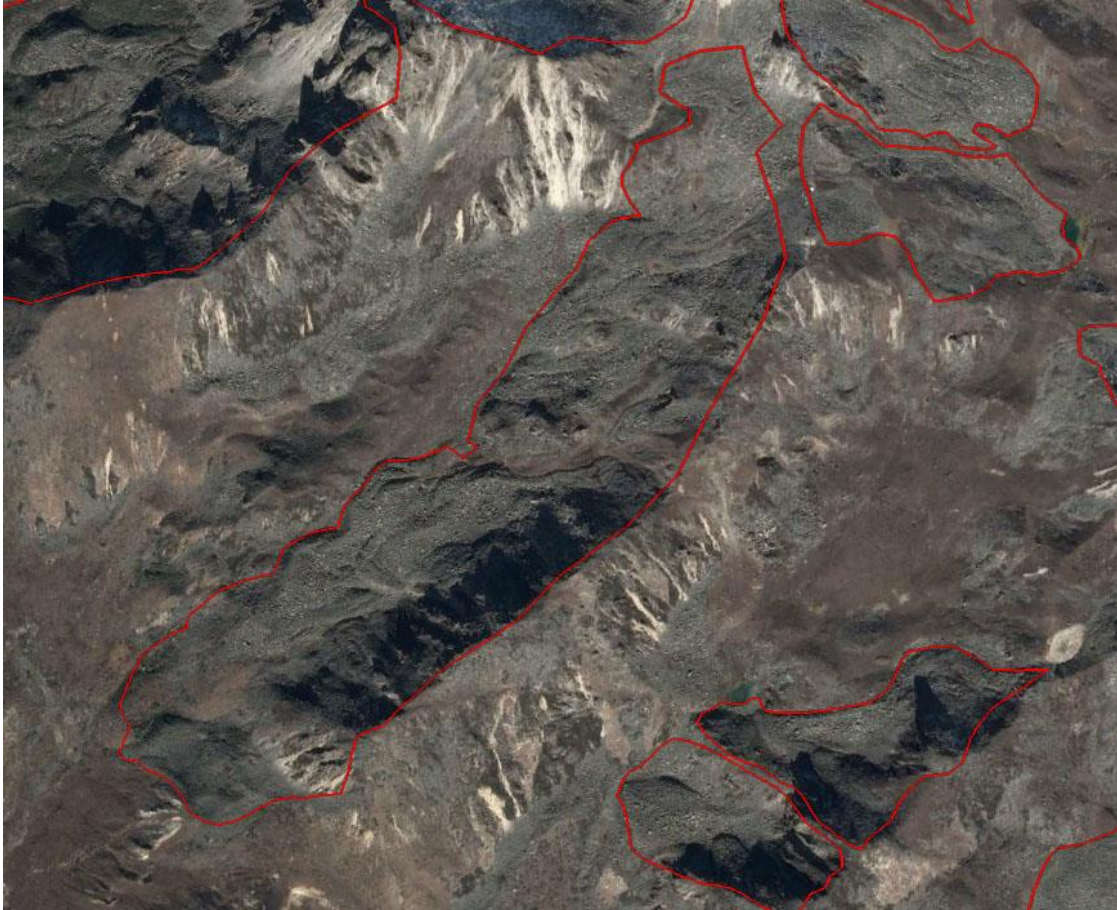
by Zeze Ran and Gengnian Liu

General comments:

The study presents the first comprehensive rock glacier inventory of a specific mountain range in the southeastern Tibetan Plateau. Moreover different controls of their occurrence are analysed and described. Currently only little is known about rock glacier occurrence in Tibet and no comprehensive study exists. The topic of the study is therefore relevant and suitable for The Cryosphere. The text is, however, quite descriptive and needs moreover some structural and language improvements. I appreciate very much that the generated inventory is provided as supplementary material to this article. The major shortcoming is that the generated rock glacier inventory contains many errors and needs to be completely revised. Moreover, an analysis or a discussion of uncertainty is entirely missing. More details are provided below.

Most critical issue:

The authors delineate rock glaciers manually by on screen digitising based on high resolution satellite images available on Google Earth. General characteristics of rock glaciers are described based on the literature which the authors took as the basis for their delineation. However, from figures 2, 3, and 7 and from the provided vector data it is obvious that many rock glaciers are not correctly delineated. Especially the upper boundary of the rock glaciers is often wrong. Moreover, several complex landforms are delineated as rock glaciers which could also be landslide deposits or relict rock glaciers. I provide below two examples below: In both complex landforms are combined into one large rock glacier, but parts of the area are very probably not part of creeping permafrost bodies. Moreover, steep headwalls are also classified as rock glaciers which deliver debris, but are certainly not part of rock glaciers. In addition, some of the delineated features may not be rock glaciers. I am aware that it is partly impossible to clearly identify rock glaciers based on optical imagery alone. However, more effort is needed to correctly classify rock glaciers and hence, the rock glacier inventory needs to be completely revised at best using additional data sources. The newly available High Mountain Asia DEM, information providing information about the surface displacement (e.g. SAR coherence images) and the occurrence of permafrost (e.g. based on the Permafrost Zonation Index (Gruber, 2012, TC) or Chinese permafrost maps) will be important additional data sources. I am aware that this requires huge additional effort, but it is important that the inventory is as accurate as possible in order not to provide a wrong example about how to delineate rock glaciers and in order to not provide wrong numbers. Alternatively the authors may also revise their inventory using at least some additional data, only include intact (active and inactive rock glaciers) into the inventory, and classify them according to the certainty.



Figures: Random examples of “rock glacier” outlines based on the kml-file provided by the authors.

Further major comments:

1. The description of the methodology and the criteria for identification rock glaciers needs to be much more explicitly mentioned and described considering the relevant literature. In addition, an analysis and discussion about the uncertainty and possible sources of errors needs to be included.
2. The lower altitude of rock glaciers may provide information about the lower boundary the area where permafrost is probable. However, there are many exceptions. Hence, this concept needs to be applied with more caution. In addition, a comparison with existing information about permafrost occurrence (e.g. Gruber, 2012, Chinese maps of permafrost occurrence) should be provided.
3. The results section is too descriptive. Highlight the most important findings and refer to tables for the detailed information.
4. The results should be put much better into context of existing literature and not only to the few existing ones from Chinese Tien Shan. I would help in this respect to separate the results and discussion into own sections.
5. The authors use partly improper terminology, e.g. “marine-type periglacial environment”, “fossilized glacier-derived features”

Specific comments (I highlight the most important issues only, there are many more minor technical issues which I would address after careful revision and resubmission):

P. 2 L12f. Provide more details and a reference. What are the phenomena observed in ice margins?

L. 18ff. Do not cite so many references in a row (max. 5-6). Be more specific and selective.

P. 3 L5f: Be more specific. Shukla et al. (2010) address debris-covered glaciers, not rock glaciers.

L. 22: Include the info about elevation.

L. 23: Delete “famous”. I and probably the vast majority of the readers have never heard about this mountain. Include the elevation.

P. 4, L. 1ff: Include more references to prove the statements.

P. 5, L. 12. The scale of the geological map is rough. Isn't there a better scale available?

L. 23-25. These details are not needed as obvious; just write vs. aspect.

P. 6, L. 12. I think there are much more talus-derived rock glaciers. Provide a clear definition and proof the number better.

P. 8, L. 15ff: Consider more recent literature which perform similar analysis, but also older other literature and do not refrain only to Chinese researchers. The northern Tien Shan stretches from Kyrgyzstan in the west to Xinjiang in the east. Hence either write “Northern Tien (or Tian) Shan” in China or (which is preferred) consider also the other parts of northern Tien Shan (e.g. the work authored and co-authors by A. Gorbunov).

P. 9, L. 15ff: Move the methodological description to the methods section.

P. 11, L. 2ff: The general info about the climate would fit much better in the section about the study area.

L. 12, section 4.3. This section is not a proper own section: It contains methodological information (e.g. about ground truthing and the used DEM) and also information about the

limitations. The respective parts should therefore be moved to the methods and discussion section.

References:

The formatting of the references should be carefully checked so that all meet the journal specifications.