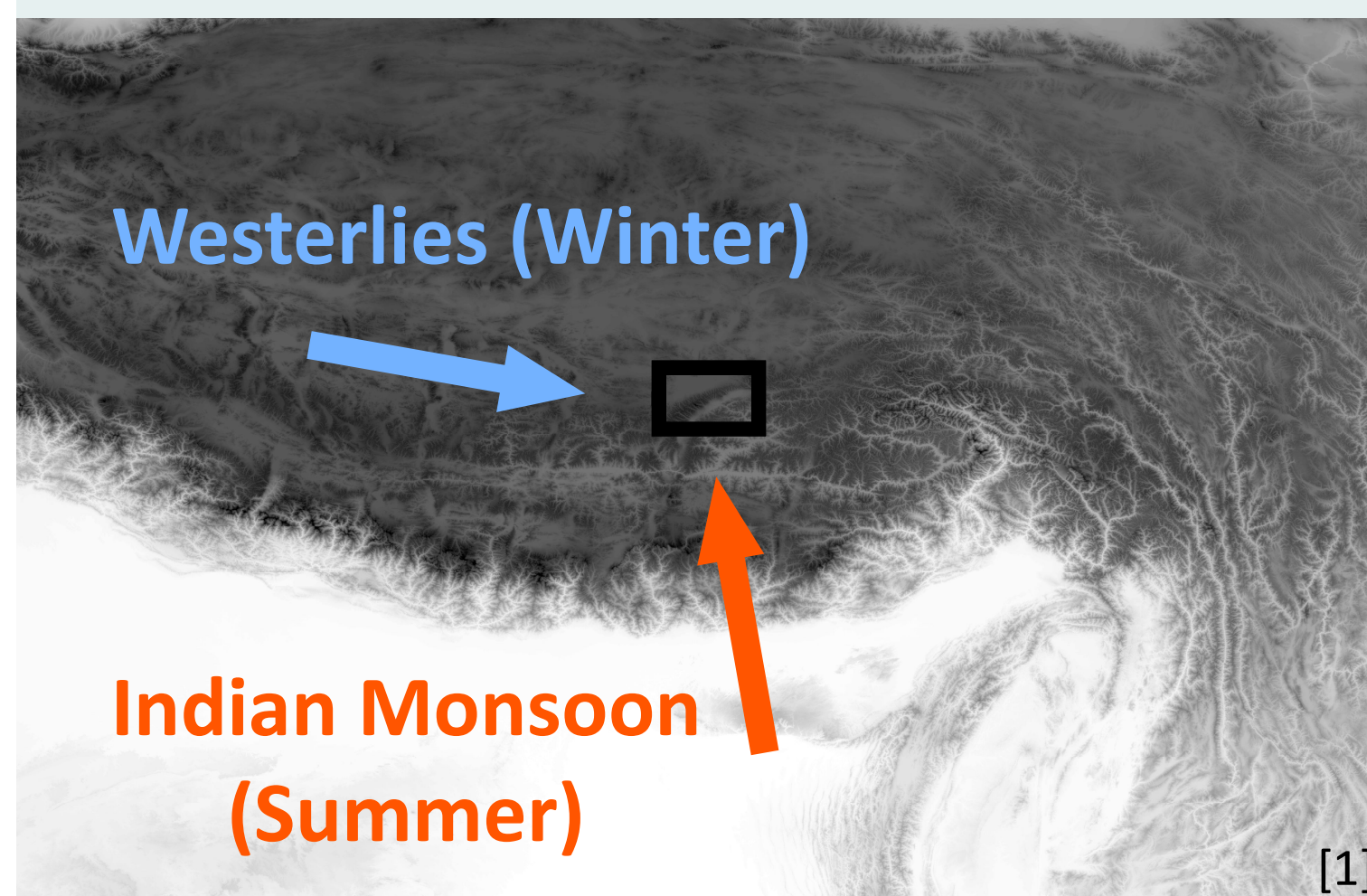


Introduction

The western Nyainqêntanglha Range on the Tibetan Plateau reaches an elevation of 7162 m and is characterized by an extensive, yet understudied periglacial environment.

The Indian Monsoon delivers high moisture from the south during the summer months. The Westerlies lead to a dry winter climate (see below).^[1]

Here we present the first rock glacier inventory of this region, containing 1433 actively moving landforms.



Methods

To ensure both a high reliability and comparability of our inventory, we combined manual outlining with a semi-automatic classification. Both approaches are based on optical satellite images, NDVI, 12 m DEM data and InSAR surface velocity.

The manual approach was performed by three analysts according to the IPA guidelines.^[2] Rock glaciers were classified according to their activity based on their median surface velocity of 2016 to 2019.

For the semi-automatic approach, we use a small number of manual rock glacier outlines to train a pixel-based maximum likelihood algorithm to identify other pixels with similar properties. The algorithm greatly overestimated the actual rock glacier area but helps to ensure no rock glaciers are overlooked.

Inventory of active rock glaciers in the western Nyainqêntanglha Range, Tibetan Plateau

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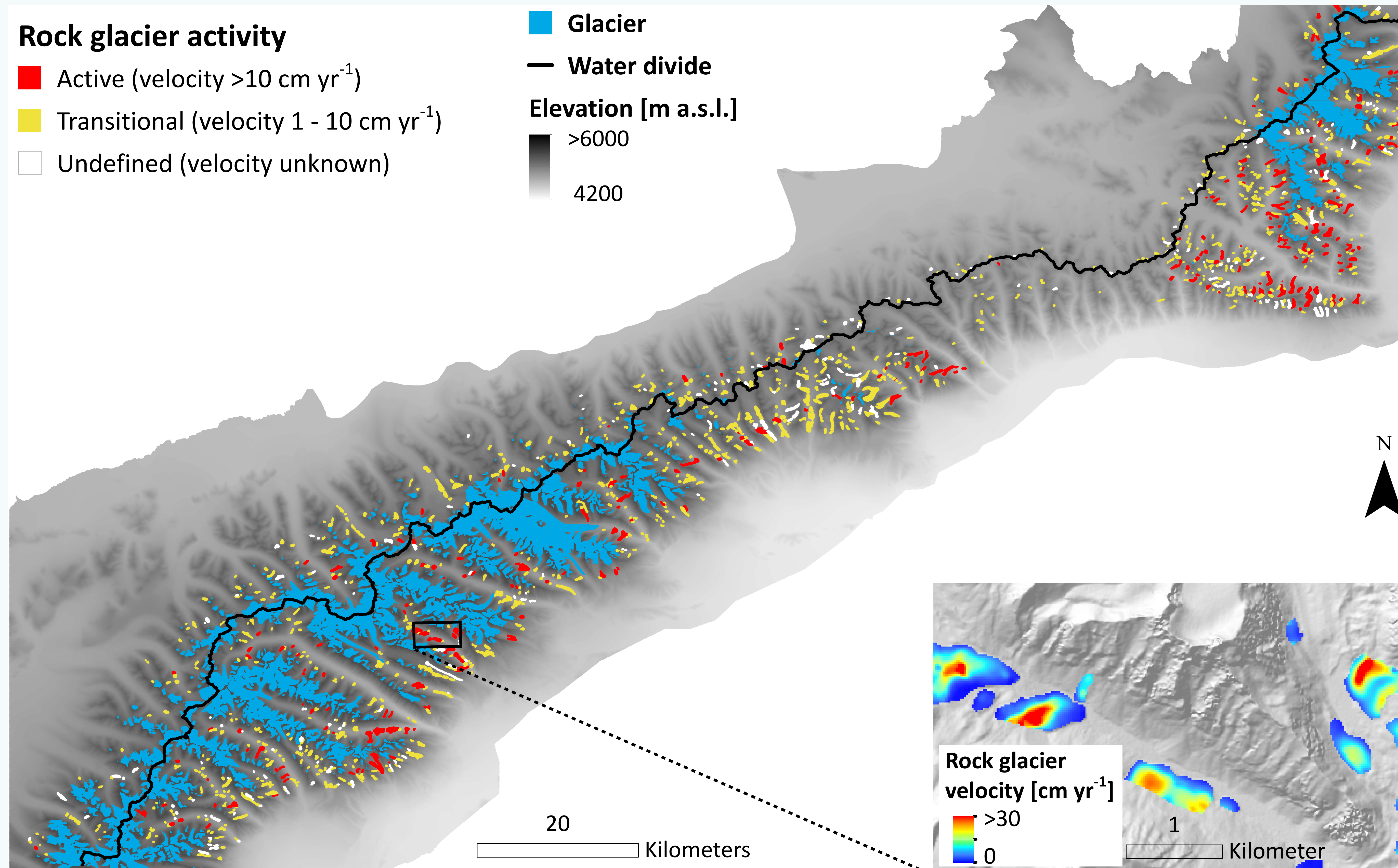
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The inventory will be available shortly at:
<https://doi.org/10.1594/PANGAEA.928971>



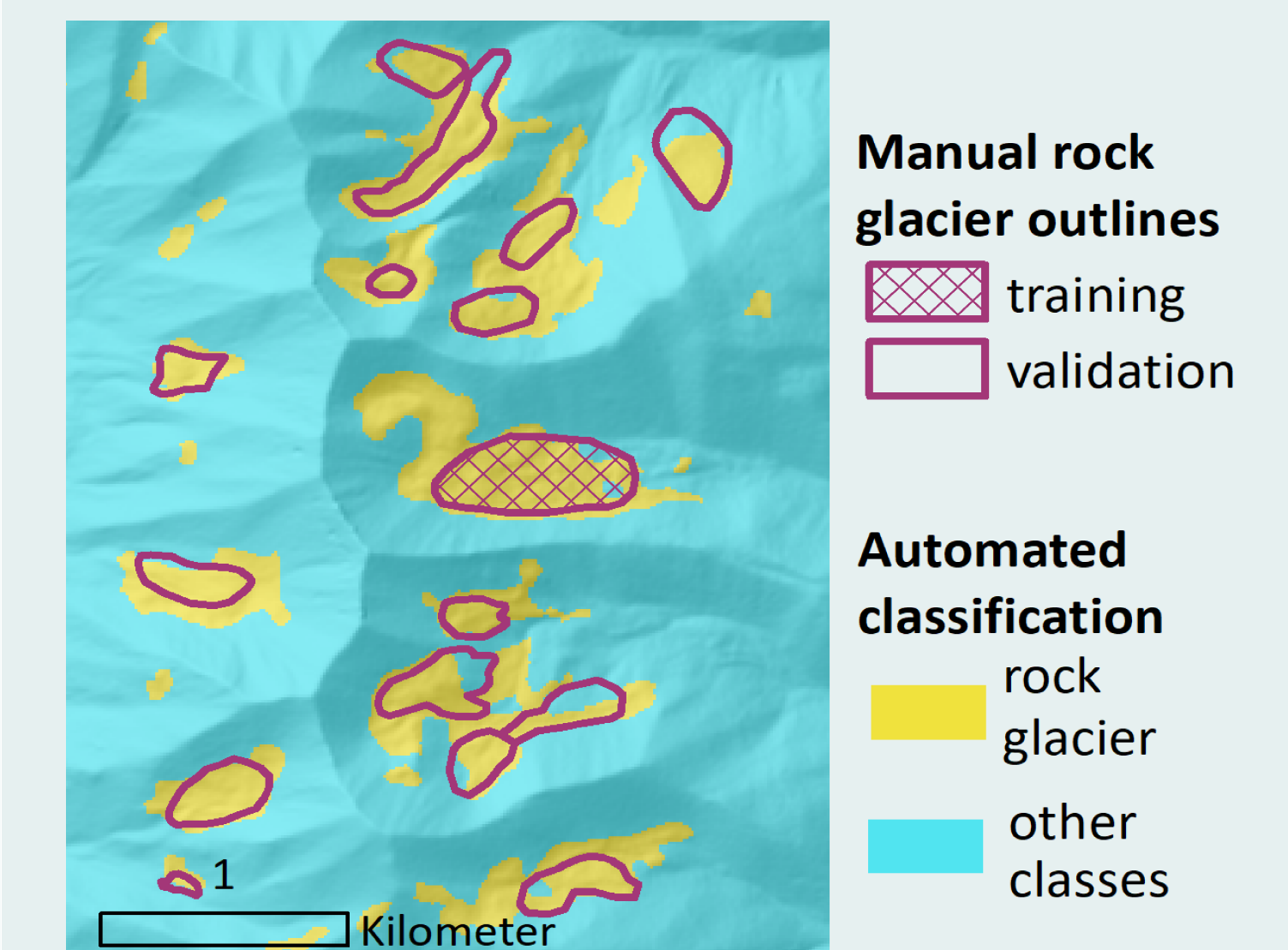
References

- [1] Yao, T., Masson-Delmotte, V., Gao, J., Yu, W., Yang, X., Risi, C., Sturm, C., Werner, M., Zhao, H., He, Y., Ren, W., Tian, L., Shi, C., and Hou, S.: A review of climatic controls on $\delta^{18}O$ in precipitation over the Tibetan Plateau: Observations and simulations. *Reviews of Geophysics*, 51(4), 525-548, 2013.
- [2] Delaloye, R. and Echelard, T.: Towards standard guidelines for inventorying rock glaciers – Baseline concepts (Version 4.1), available at: <https://www3.unifr.ch/geo/geomorphology/en/research/ipa-action-group-rock-glacier/>, 2020.

- [3] Bolch, T., Yao, T., Kang, S., Buchroithner, M. F., Scherer, D., Maussion, F., Huintjes, E., and Schneider, C.: A glacier inventory for the western Nyainqentanglha Range and the Nam Co Basin, Tibet, and glacier changes 1976–2009, *The Cryosphere*, 4, 419–433, 2010.
- [4] Reinosch, E., Gerke, M., Riedel, B. Schwalb, A., and Buckel, J.: Rock glacier inventory of the western Nyainqêntanglha Range, Tibetan Plateau, supported by InSAR time series and automated classification. submitted to *Permafrost and Periglacial Processes*, 2021 (in review)

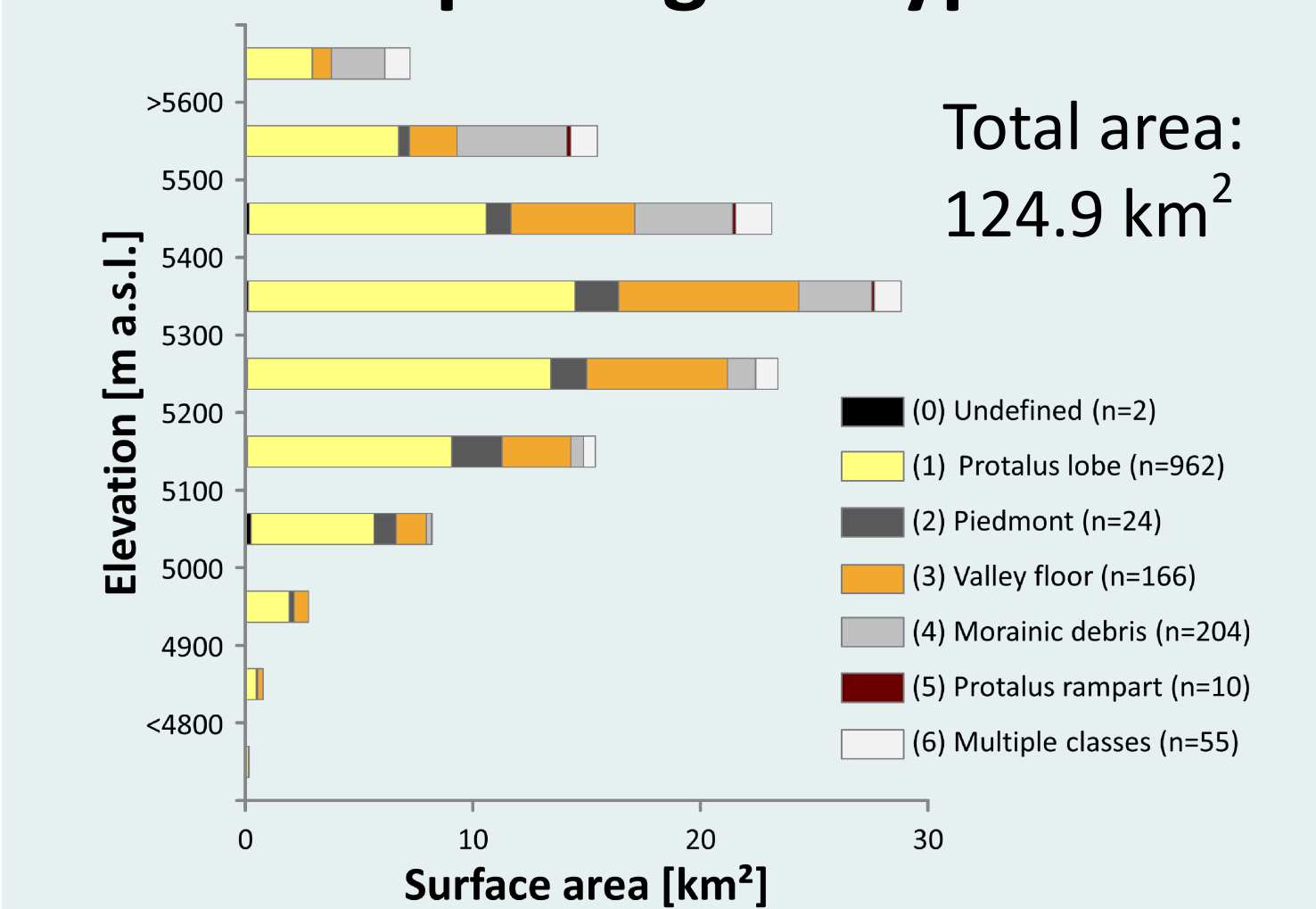
Further results

Pixel-based classification



True positive rate: 69.5 %
Overestimates the rock glacier area by a factor of 3.4.

Altitudinal distribution of morphological types



Largest area: Protalus lobes (64.6 km²)
Most active: Spatulate and tongue-shaped rock glaciers (50 % and 39 % are active, respectively).

Moisture availability controls rock glacier distribution

The southern (windward) side receives more precipitation than the northern (leeward) side of the mountain range during the monsoon period.^[3] This is reflected in the higher number and activity of rock glaciers on the southern side.

The area north of the water divide (see large illustration) contains 300 rock glaciers, only 8 % of which are active. The southern side contains 1133 rock glaciers, 21.4 % of which are active.^[4]