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Cryosphere and related hazards in High Mountain Asia in a changing climate

1–4 November 2022 | Almaty, Kazakhstan

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University of Kashmir

Date: 3 November 2022

Permafrost dynamics and its risk to downstream infrastructure over north-western Himalayas

INSERB INDIA

DST@50 1971-2021

DEPARTMENT OF SCIENCE & TECHNOLOGY

UNIVERSITY OF KASHMIR

Presentation Outline

- Knowledge Background-Study area

KNOWN

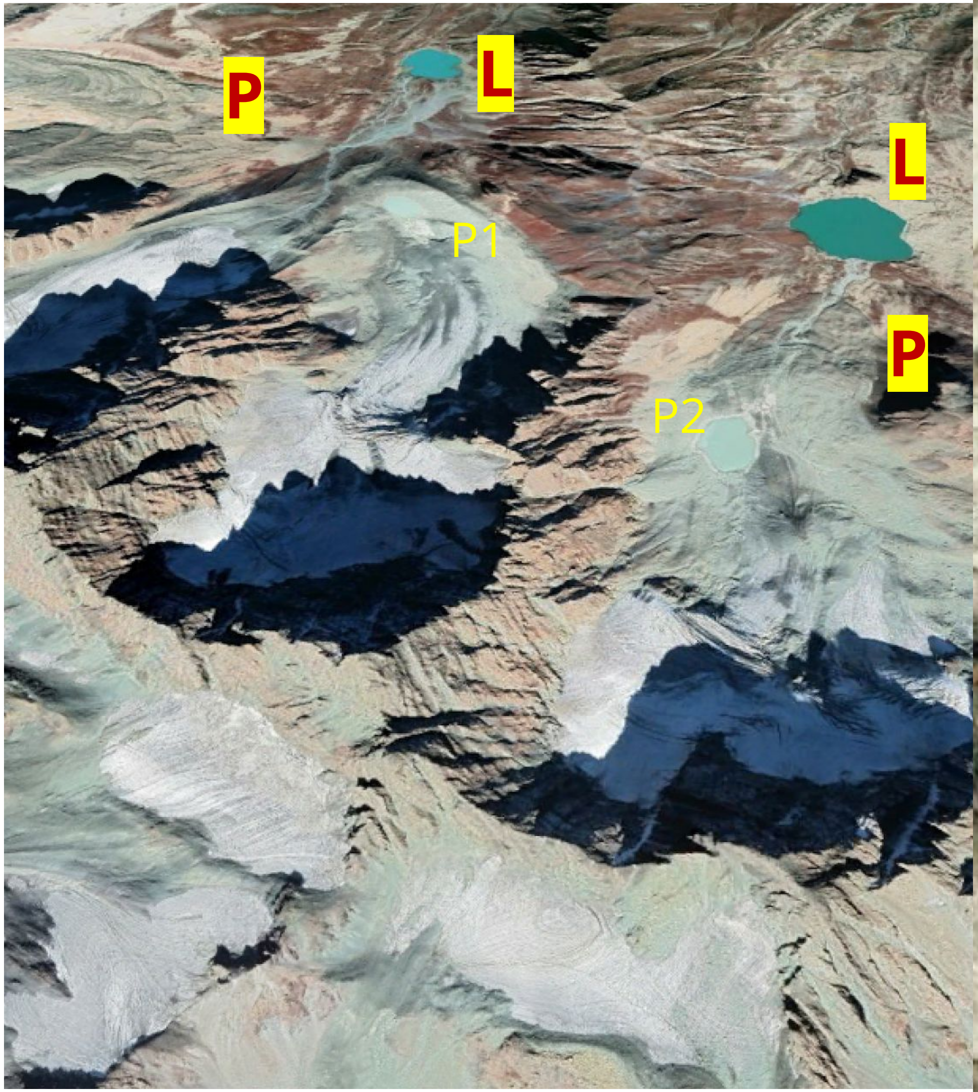
- LST variations and Rock Glaciers
- In situ observations
- Vulnerable glacial lakes and settlements

UNKNOWN

- Preliminary findings/Conclusions

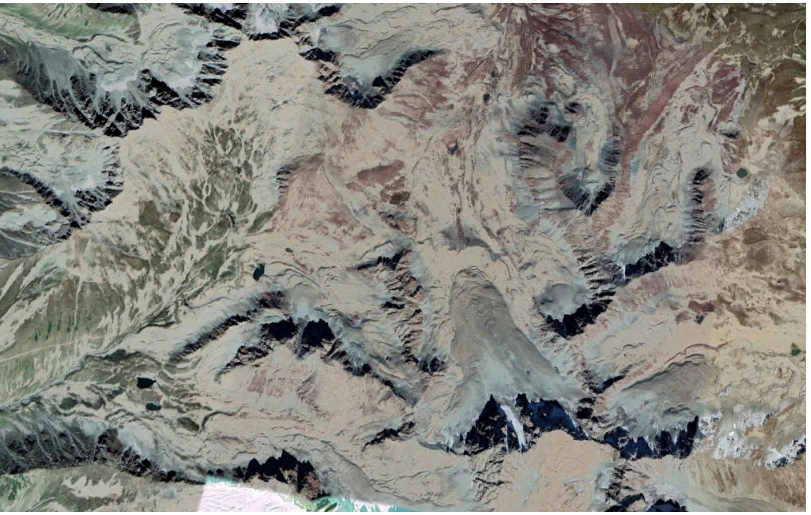
Existing knowledge

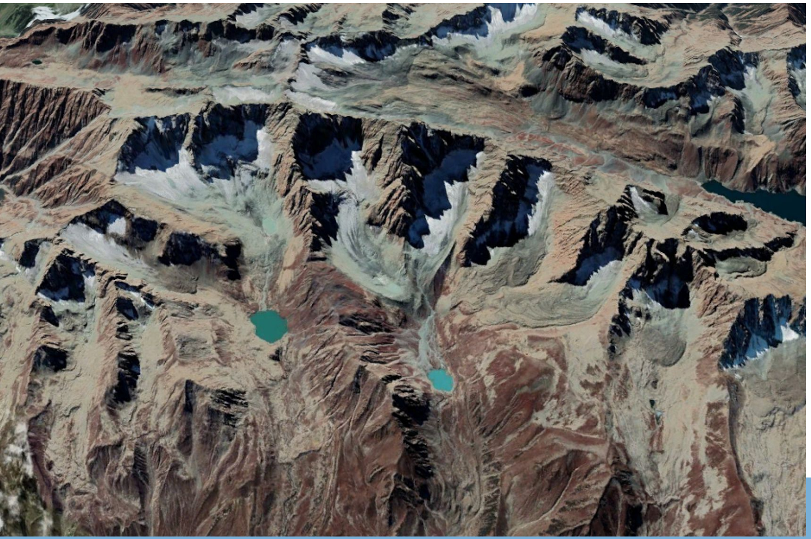
- ✔ **Landscapes that remain frozen for at least two consecutive years.**
- ✔ Least researched component of Himalayan cryosphere (especially contribution to stream flows).
- ✔ Remote sensing, modeling and in situ observations
- ✔ Destabilization can lead to potential hazards:
  - Rock ice avalanches
  - Debris/Mud flows
  - Associated cascading hazards

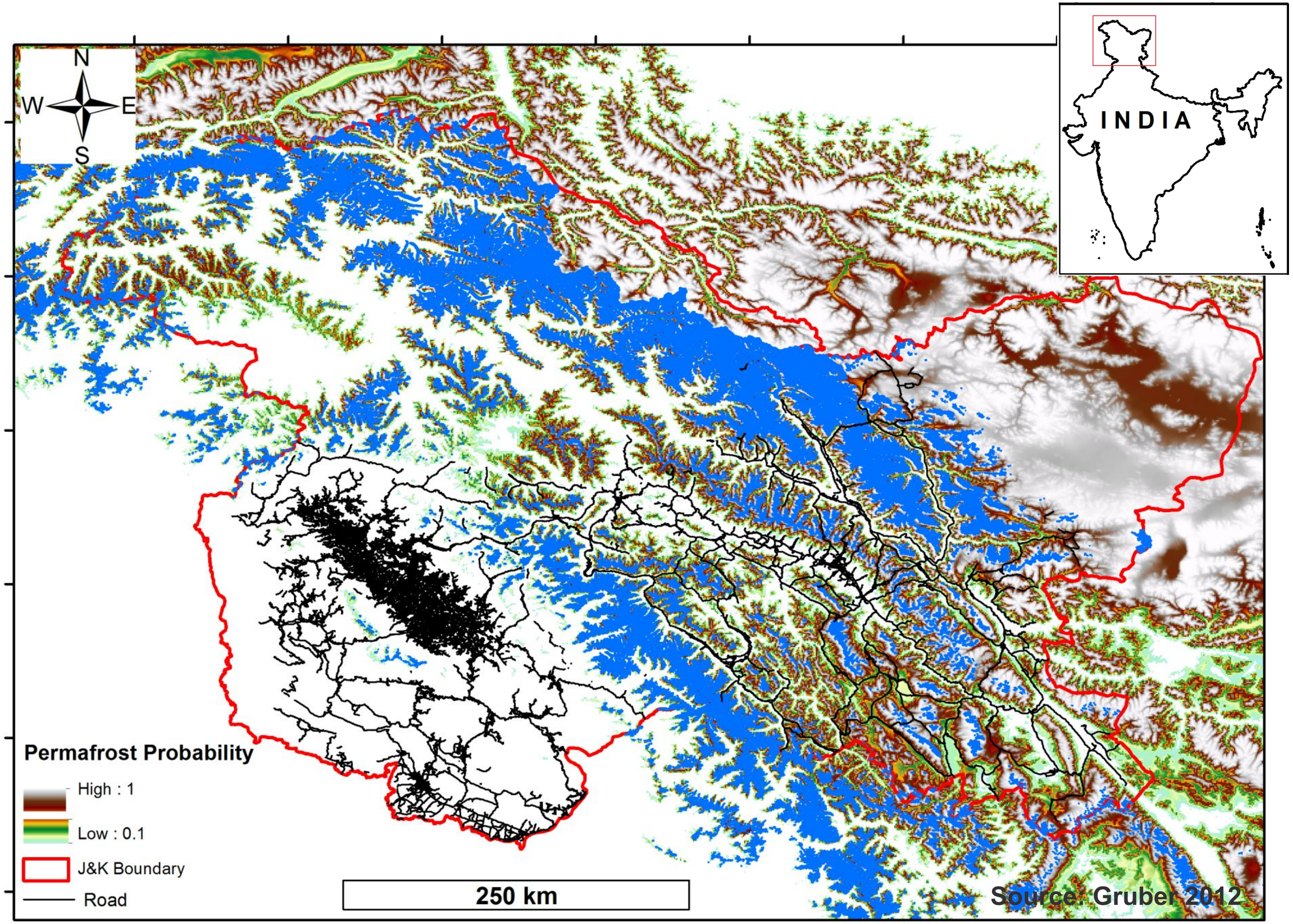


Glacier-Proglacial lake/Rock glacier

Study area

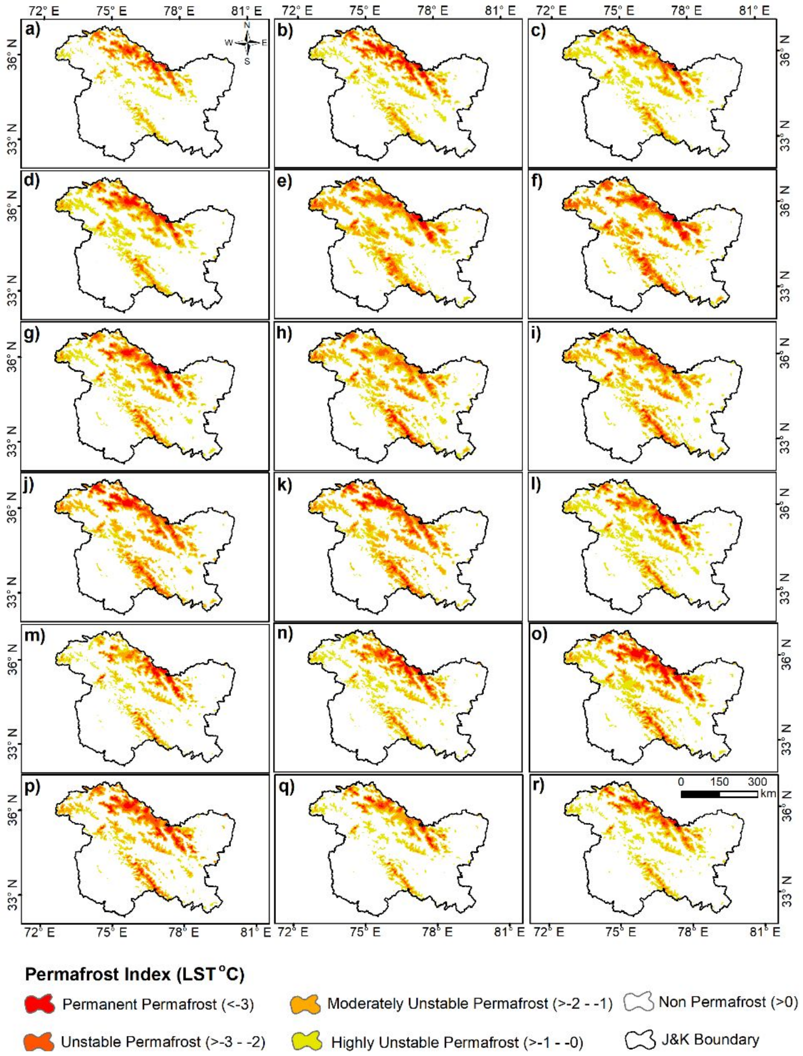


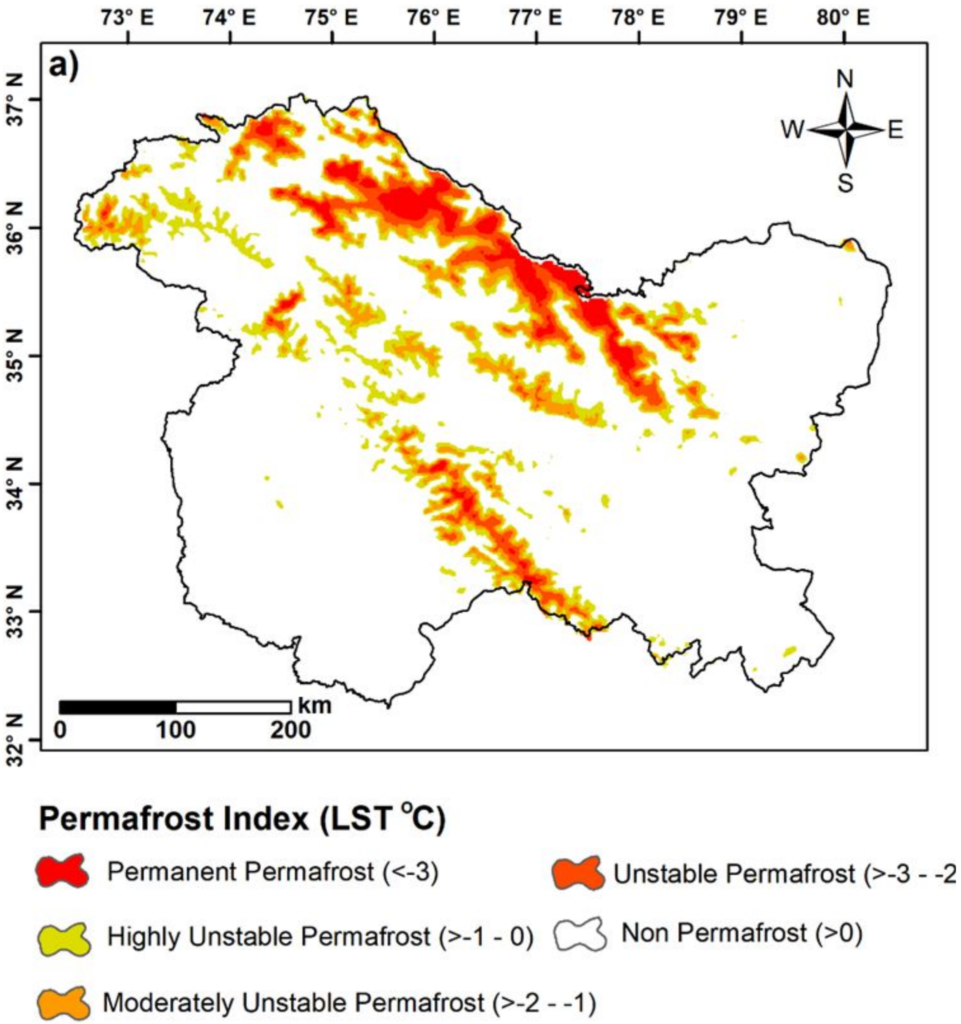




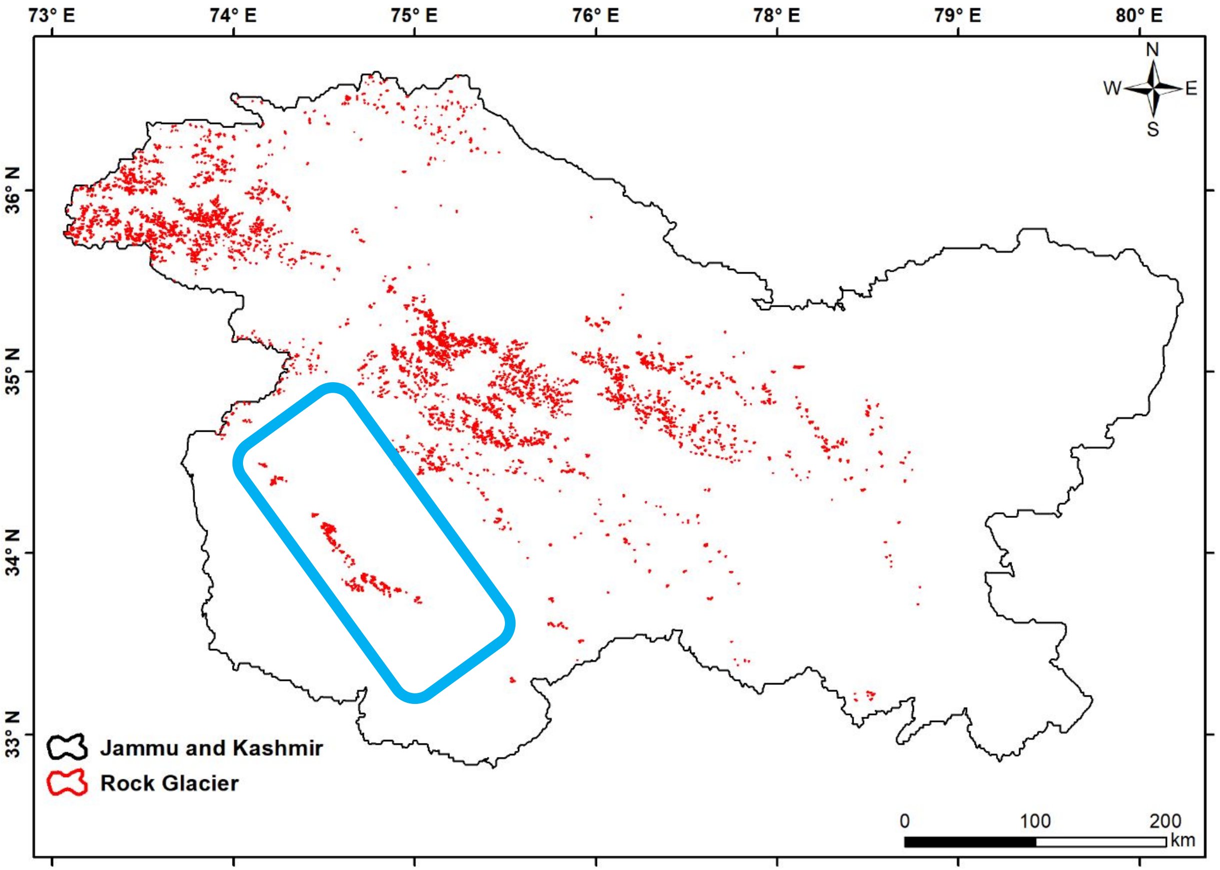
Rock glacier and rock glacier complexes (Left)
Permafrost+Road infrastructure in Jammu and Kashmir (Right)

Land surface temperature variations

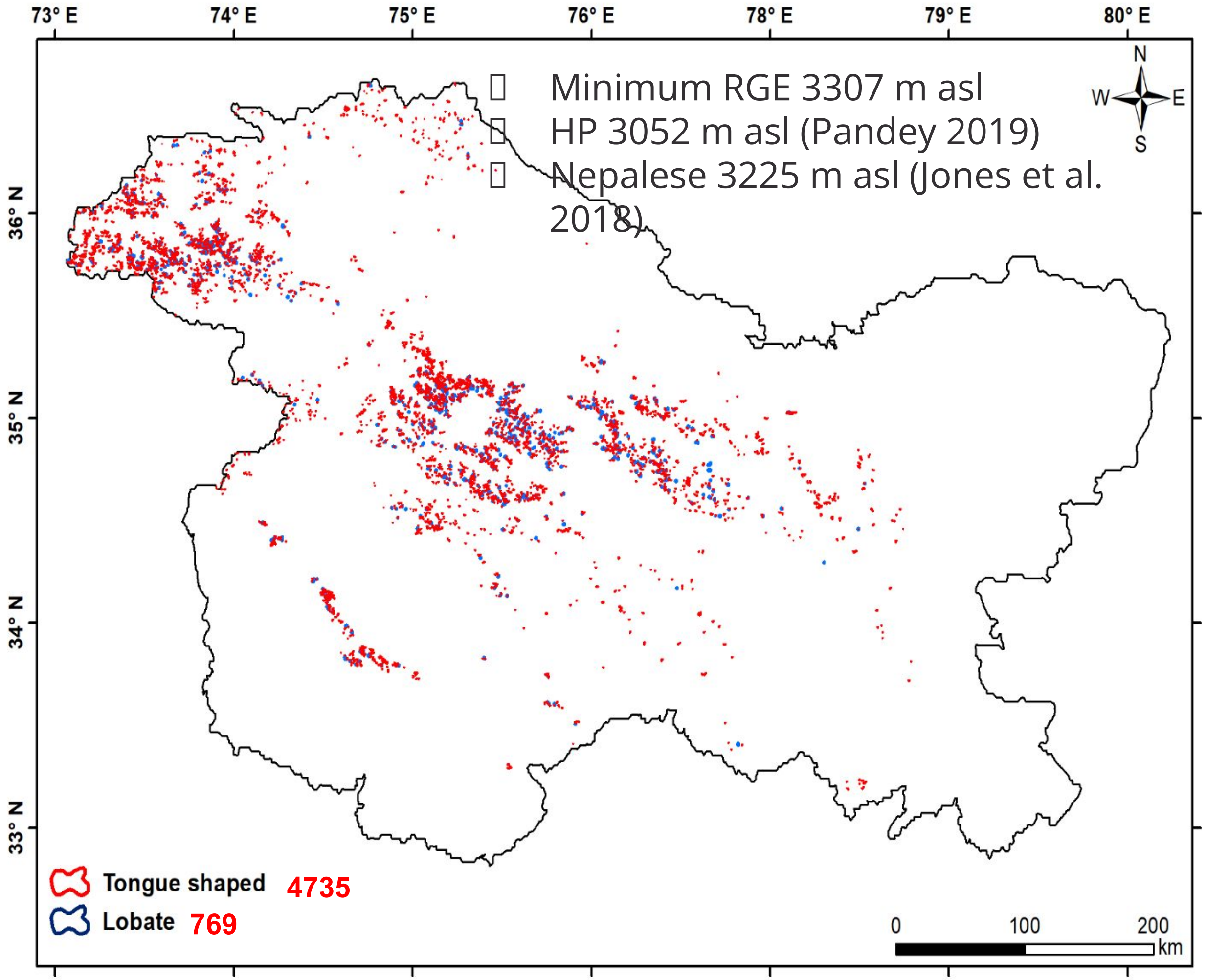




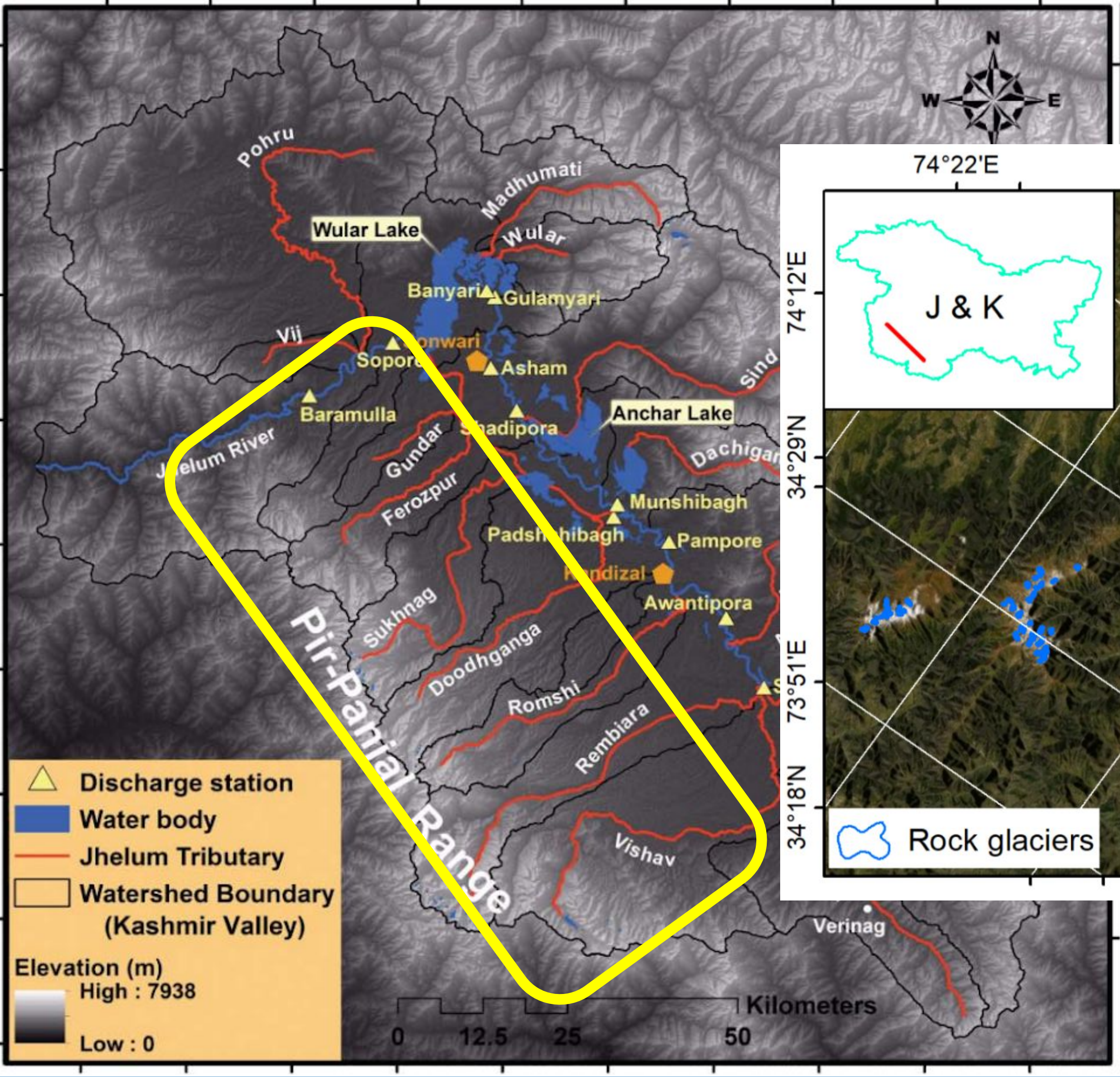
Rock glacier mapping

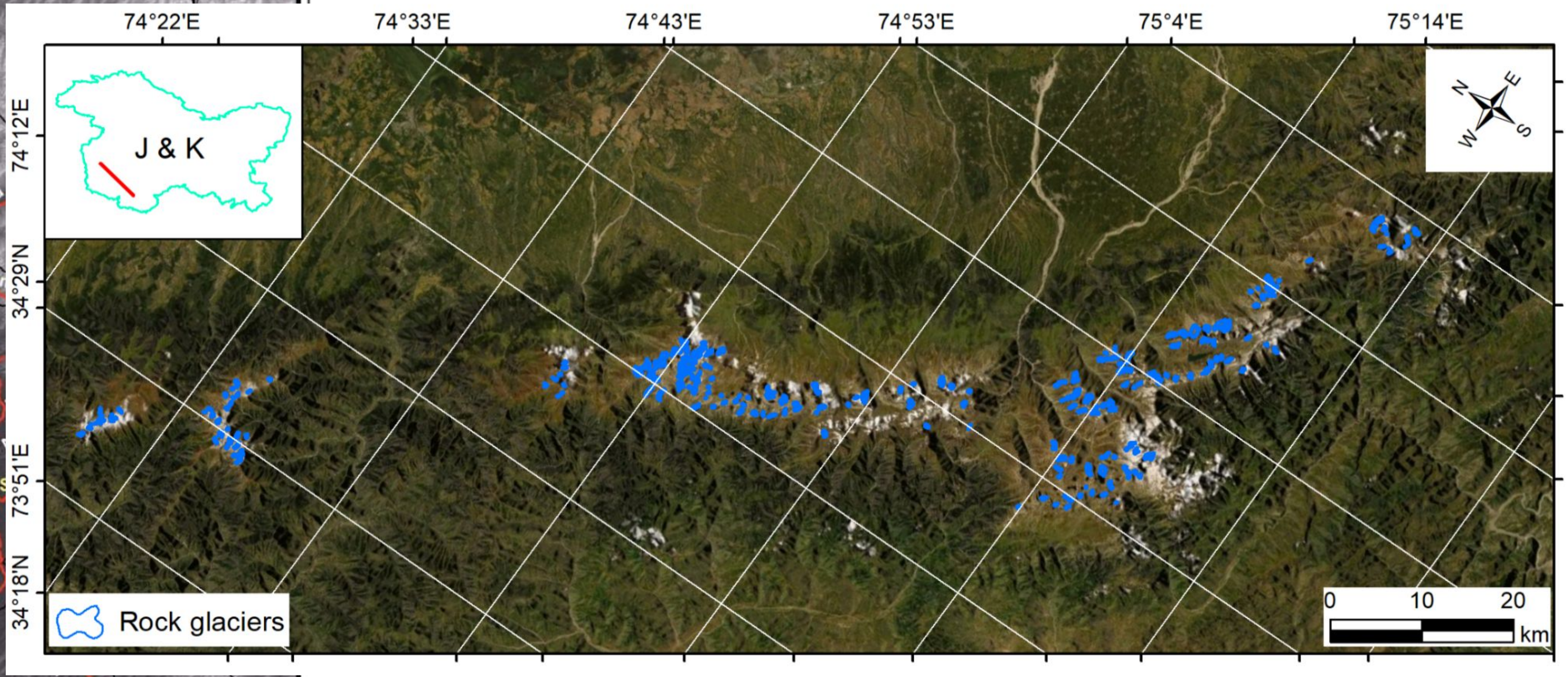


- Minimum RGE 3307 m asl
- HP 3052 m asl (Pandey 2019)
- Nepalese 3225 m asl (Jones et al. 2018)

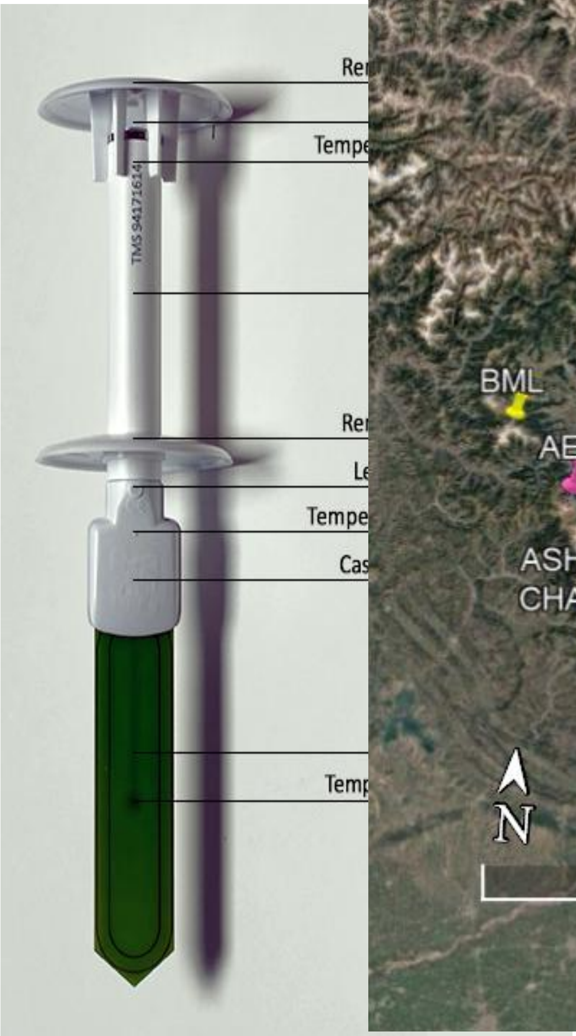


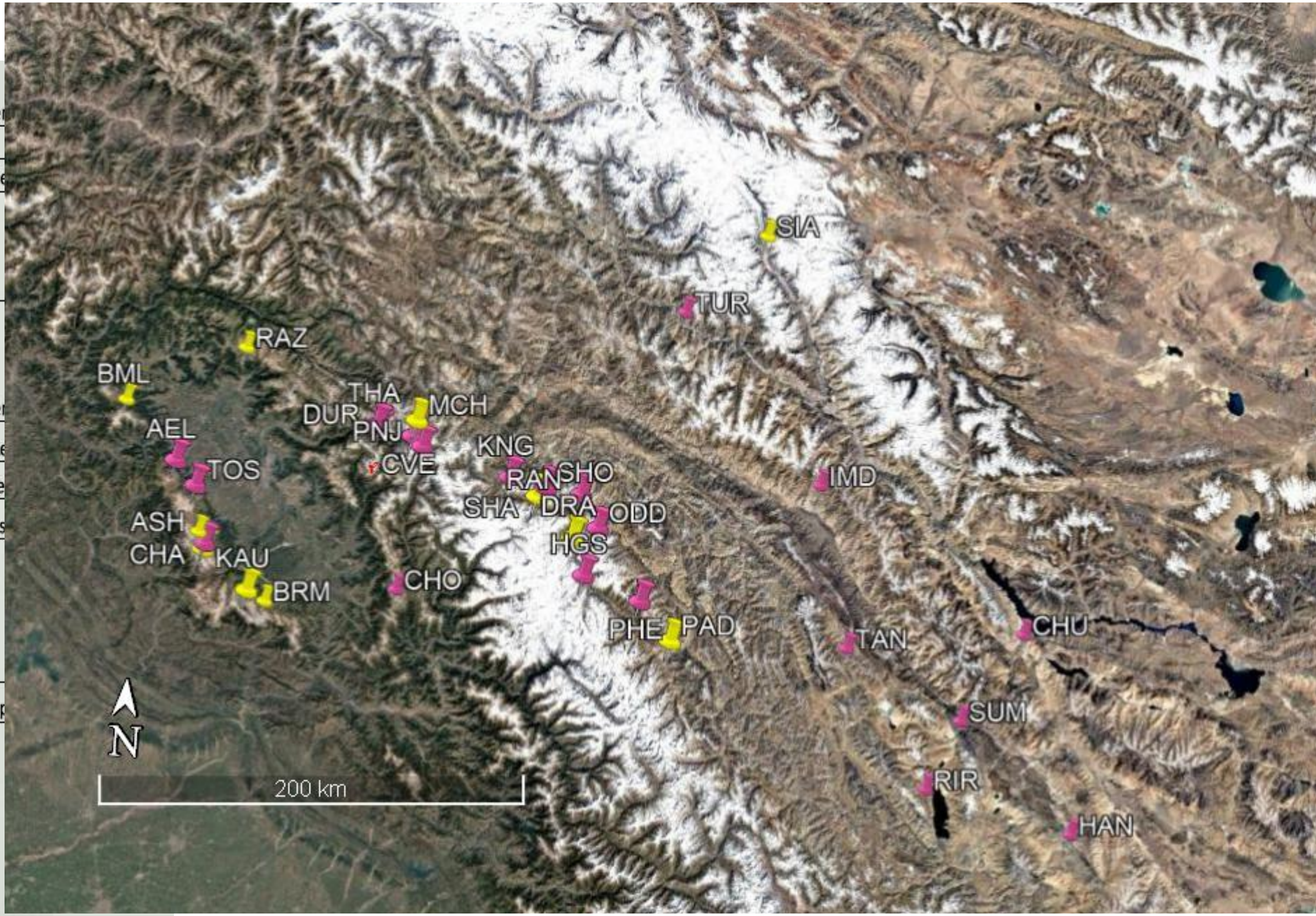
Contribution to streamflows unknown



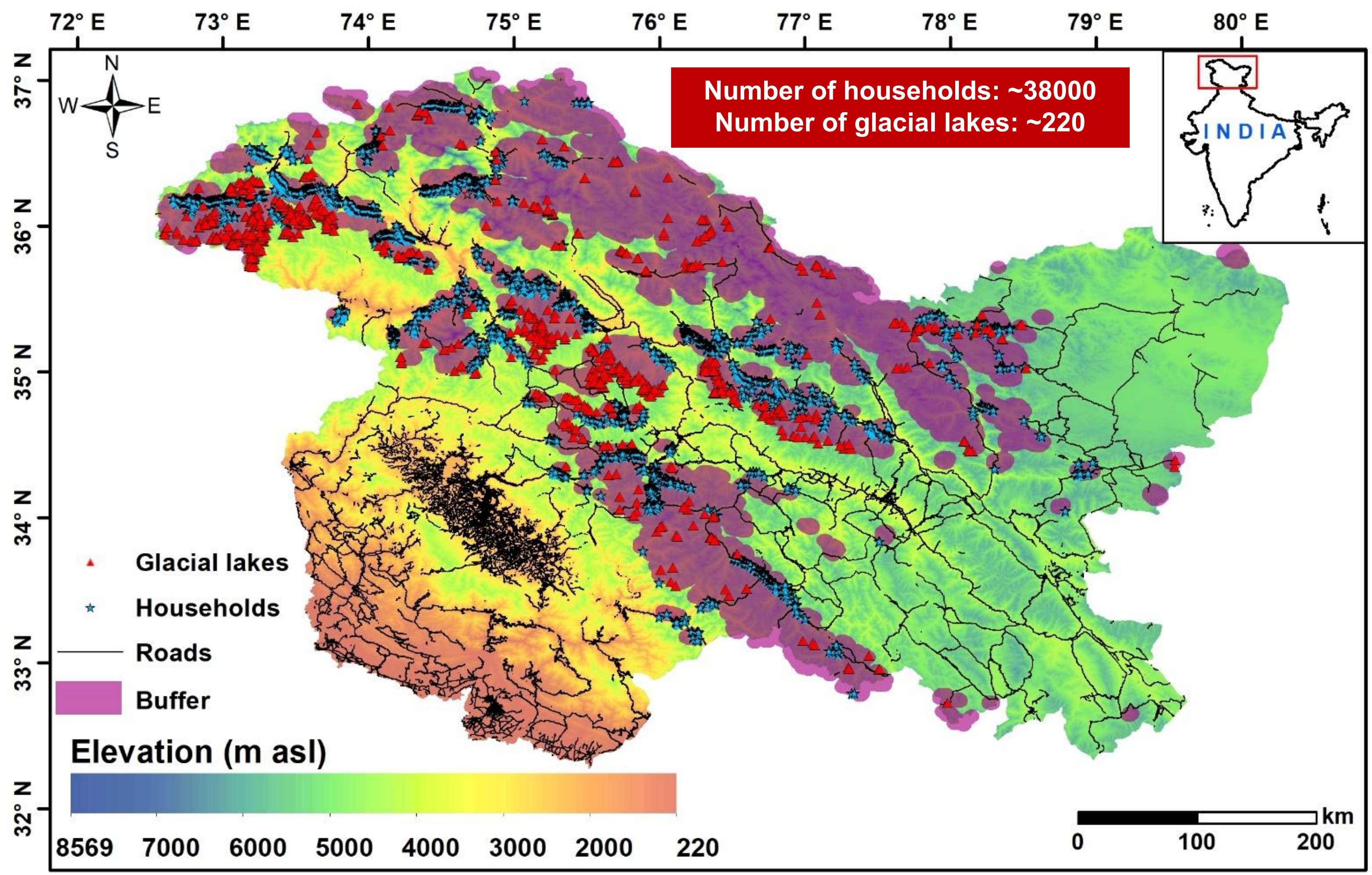


In situ temperature observations





Vulnerable glacial lakes and settlements



Conclusions

- LST data indicates that around 25% of the area is under permafrost, however, satellite derived LST may need bias-corrections to come up with more reliable estimates of permafrost in the region.

- While rock glacier have been comprehensively mapped from high-resolution satellite data more information is needed about understanding their dynamics using other remote sensing techniques like InSAR.

- The ice content is rock glaciers is not known. Glaciohydrological and isotopes based studies can help better understand the contribution of melt waters from rock glaciers.

- Permafrost dynamics and its degradation should be mandatory part of any EIA process in mountain regions to avoid damages to infrastructure and loss of lives.

Thank you

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