

# Spatio-temporal variability of snow accumulation on the Biafo and Hispar glaciers in the central Karakoram

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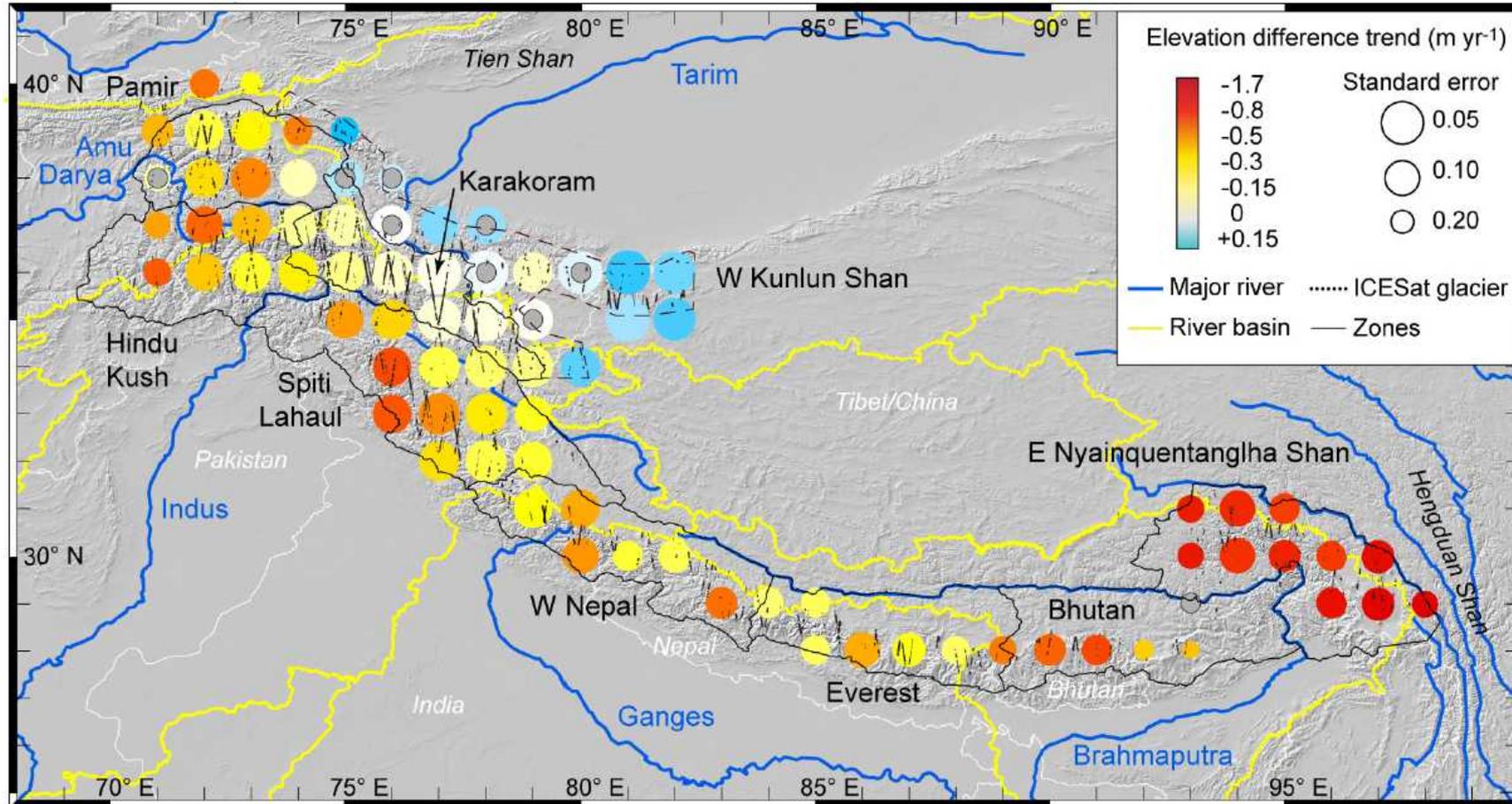
**vEGU 2021**

Monday 26<sup>th</sup> April 2021

Snow Lake, 4900 m, 29<sup>th</sup> June 2019

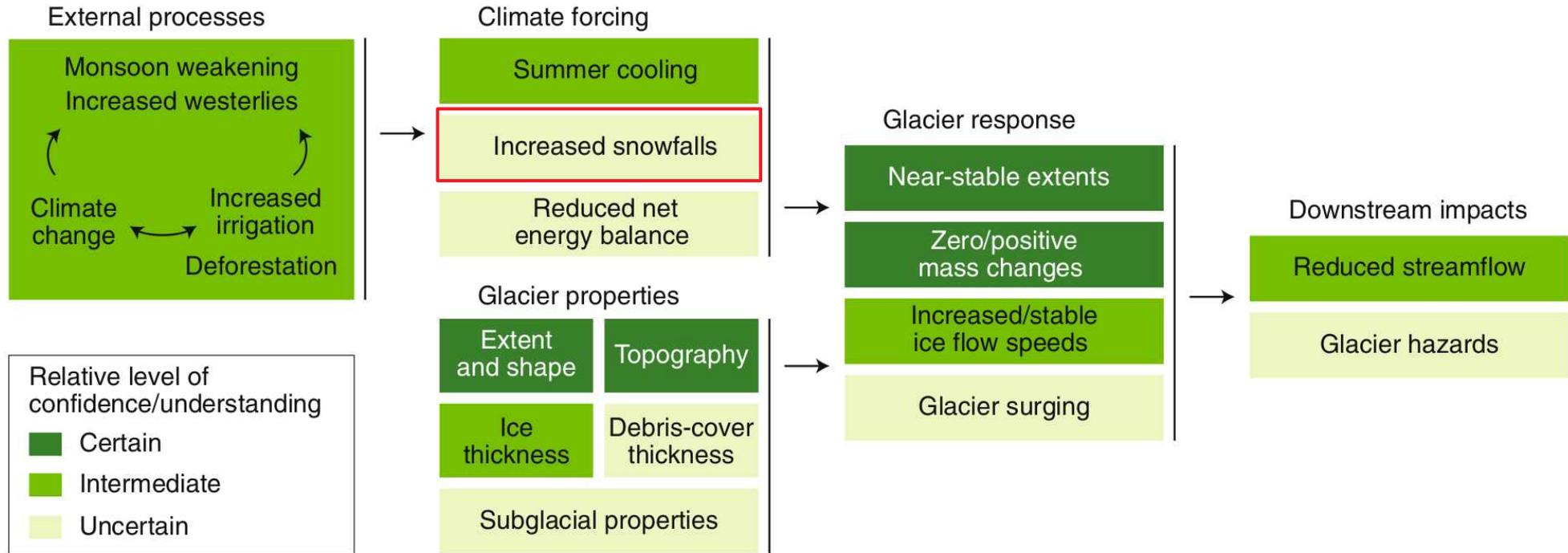


## The Karakoram Anomaly – Glacier Surface Lowering (2003-2008)



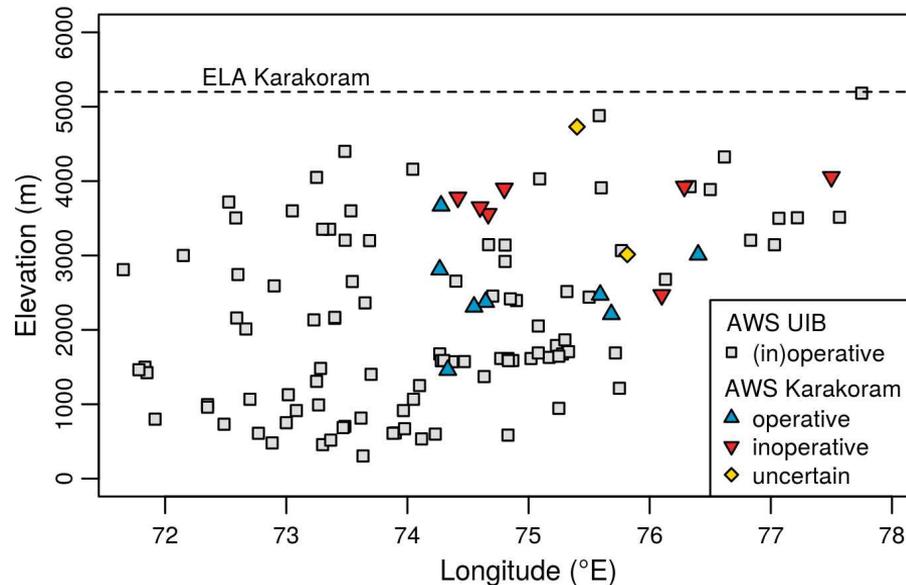
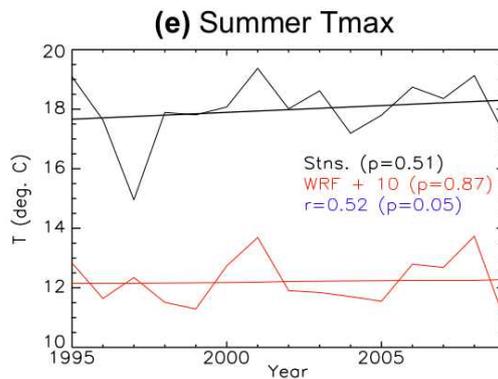
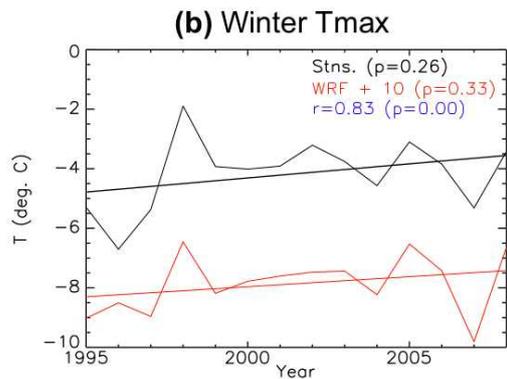
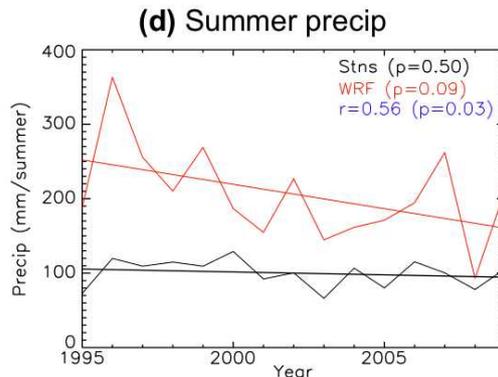
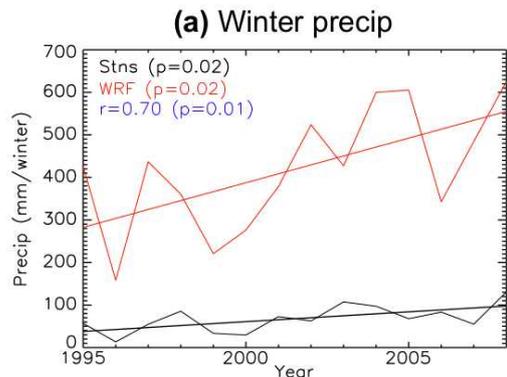
Kääb et al. 2015, The Cryosphere

## The Karakoram Anomaly – Characteristics and Mechanisms



Farinotti et al. 2020, Nature Geoscience

## The Karakoram Anomaly – Temperature and Precipitation Trends



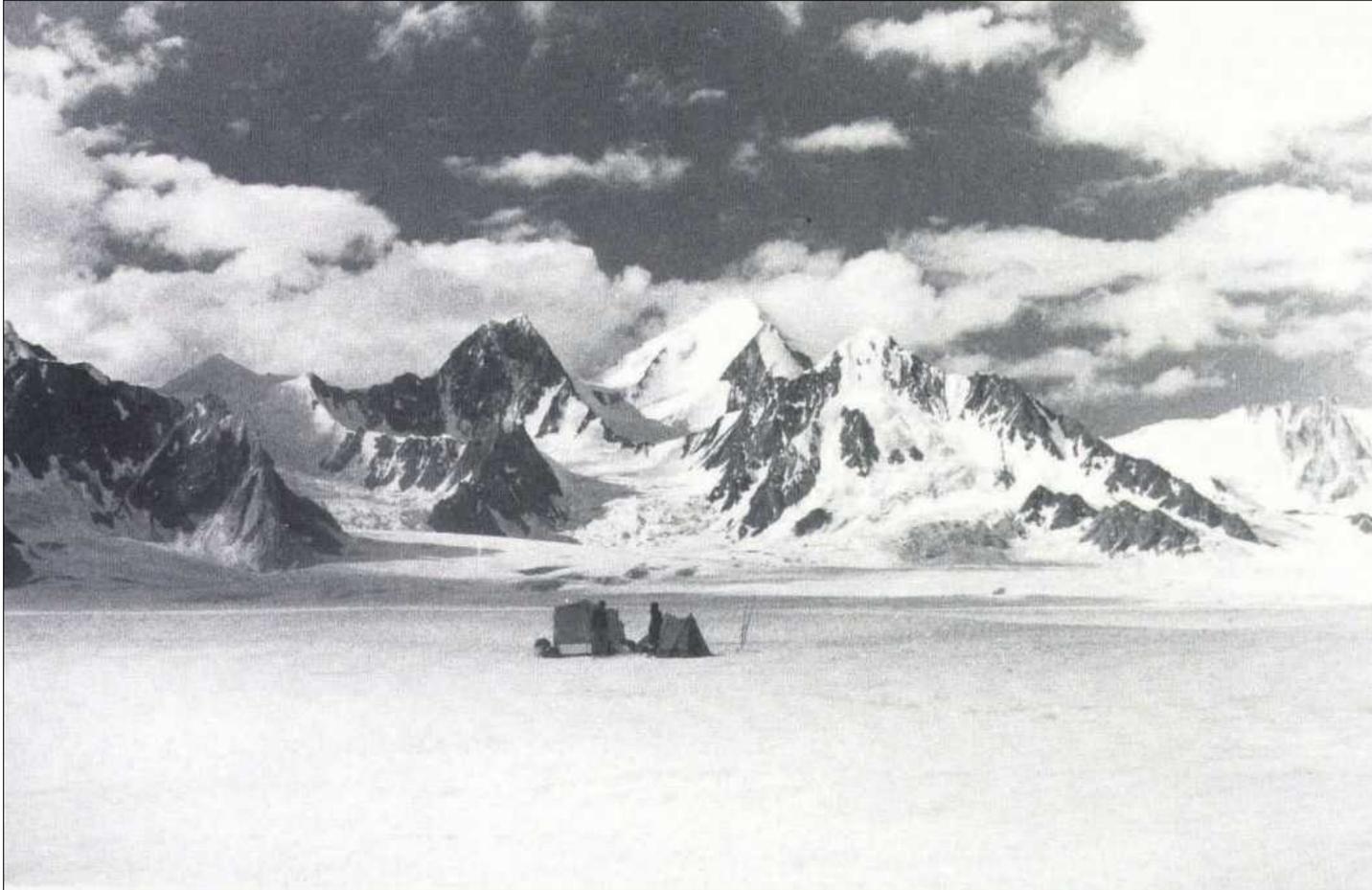
Data basis: Dahri et al. 2016, Sci. Total Environ.

Norris et al. 2018, Climate Dynamics

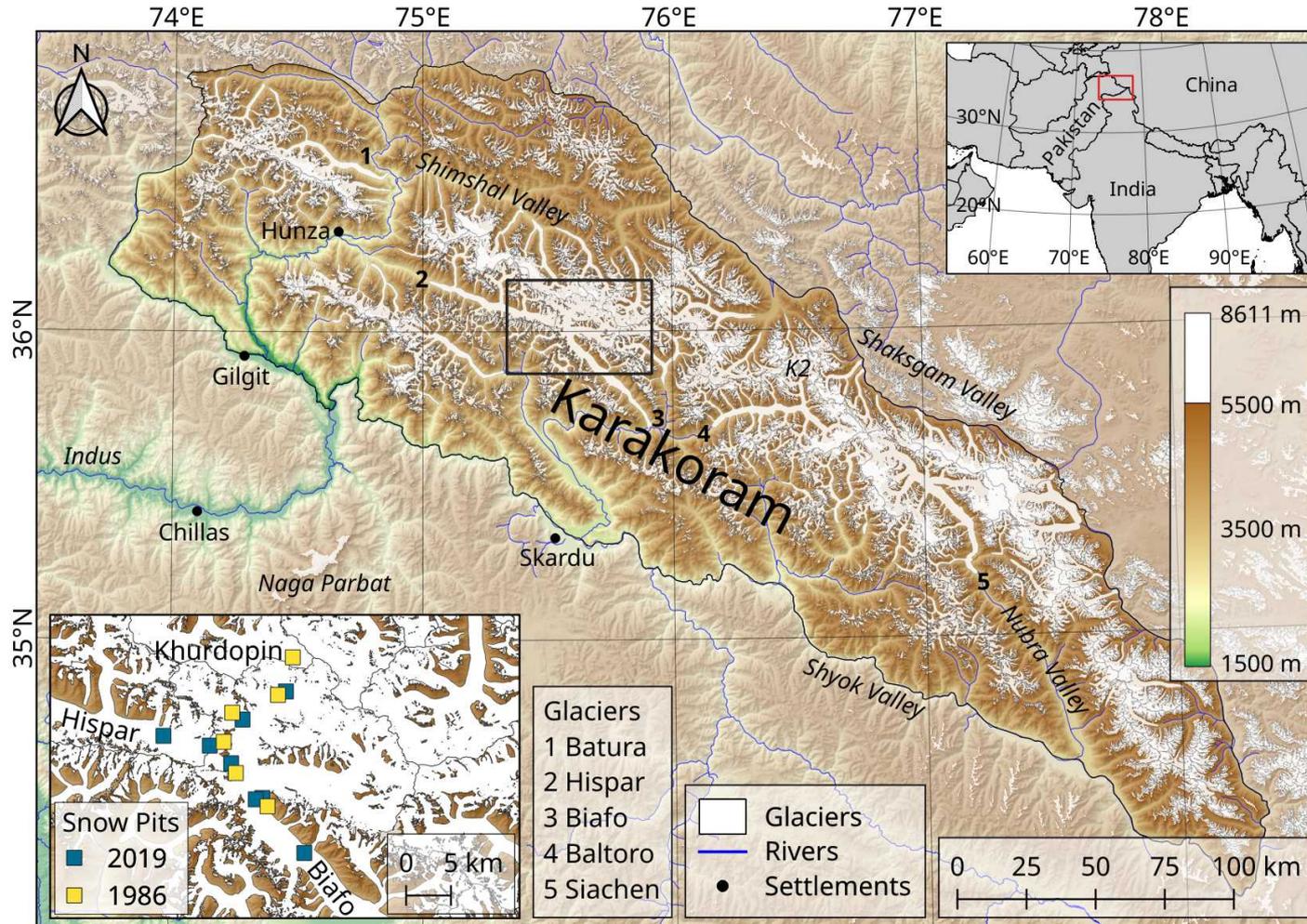
Research questions: How variable is the snow accumulation spatially and temporally at high elevations in the central Karakoram? What is the source of the precipitation? Has the snowfall increased over time?



## Canadian Research Expedition to the Snow Lake in 1986



Wake 1989, *Annals of Glaciology*  
Hewitt et al. 1989, *Annals of Glaciology*

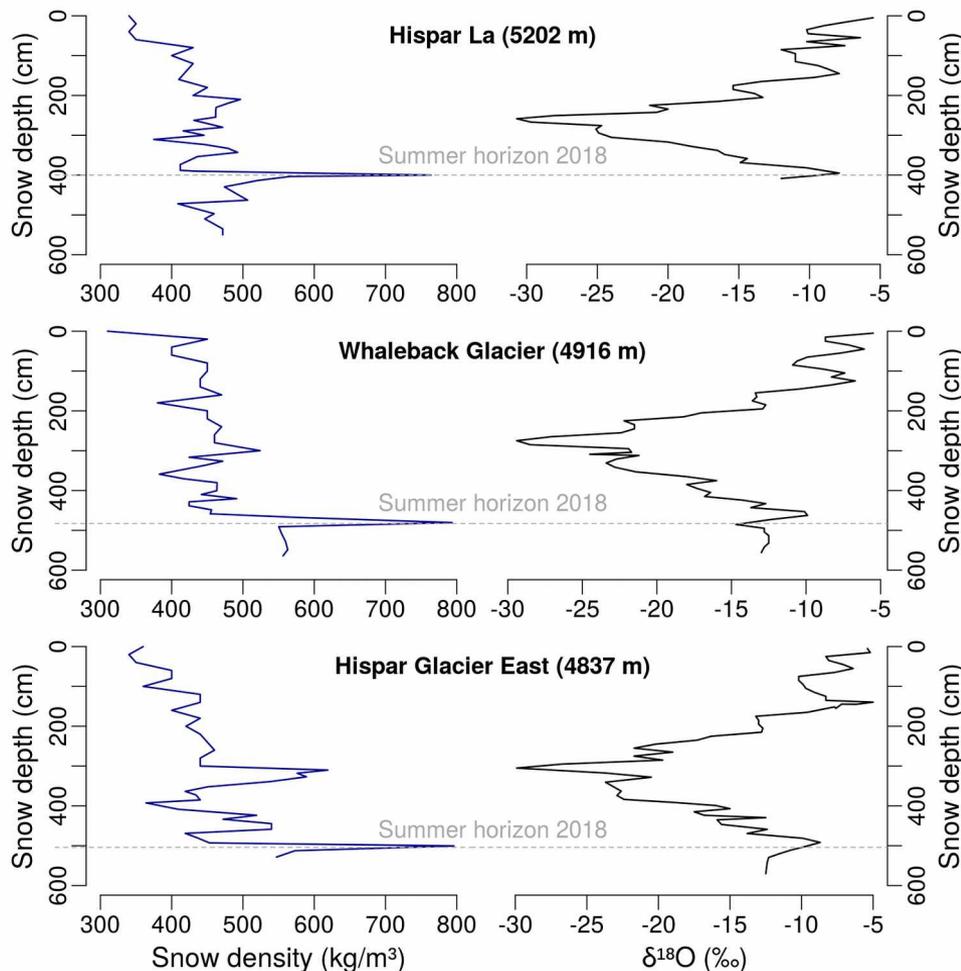


Analysis of 8 snow pits and 4 firn cores between 4400 and 5200 m

- Snow density measurements (on site)
- Stable isotope ratios of 176 samples from three profiles (Picarro, PSI)
- Elemental analysis of 34 samples from one profile (ICP-MS, University of Bern)

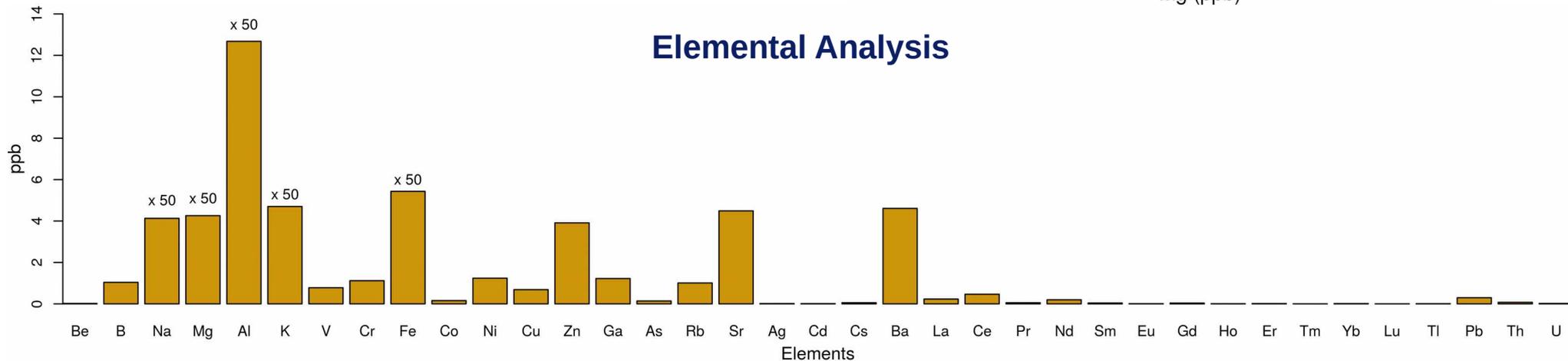
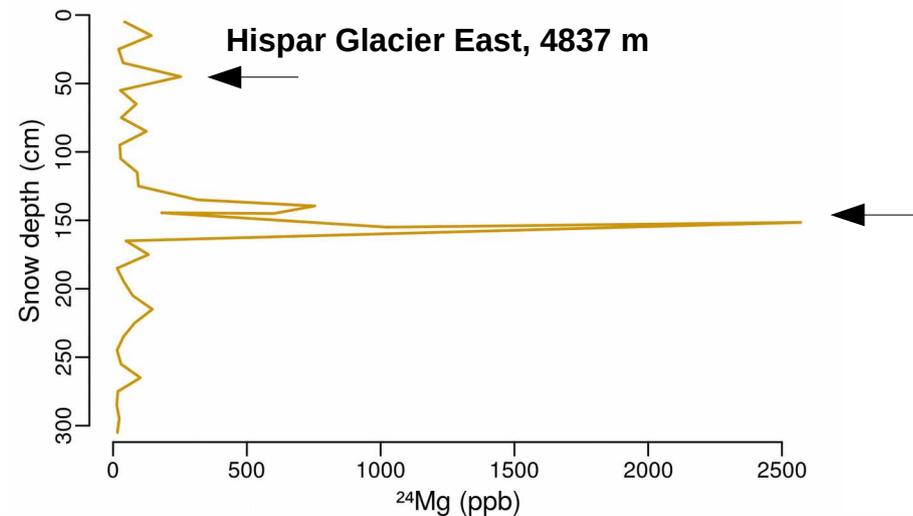
## Snow Density

- Strong increase in density in the upper 200 cm of the snow profile
- A very thick ice lens determines the summer horizon of the previous year

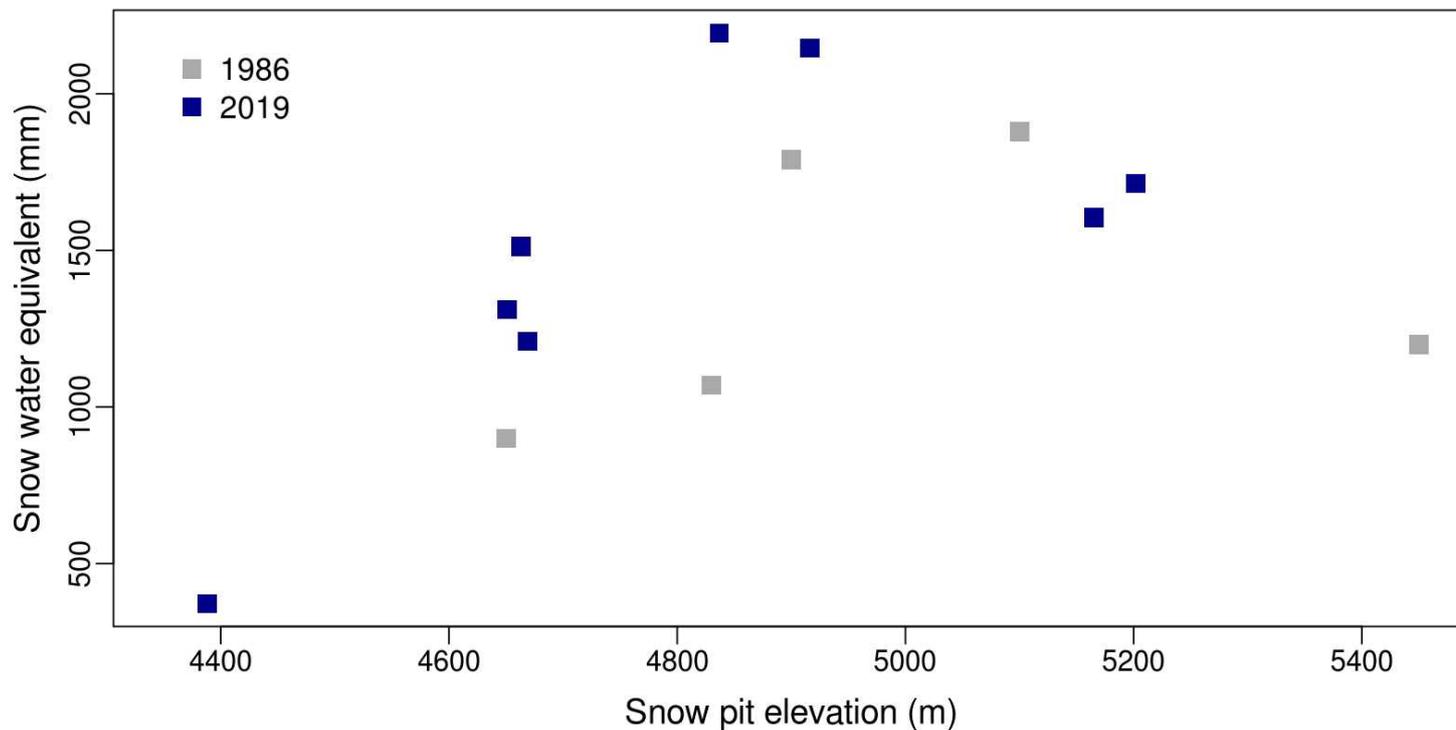


## Stable Isotope Ratios

- Stable isotope ratios were measured at the Paul Scherrer Institute
- Clear seasonal signal
- Snow pack: summer 2018 to summer 2019

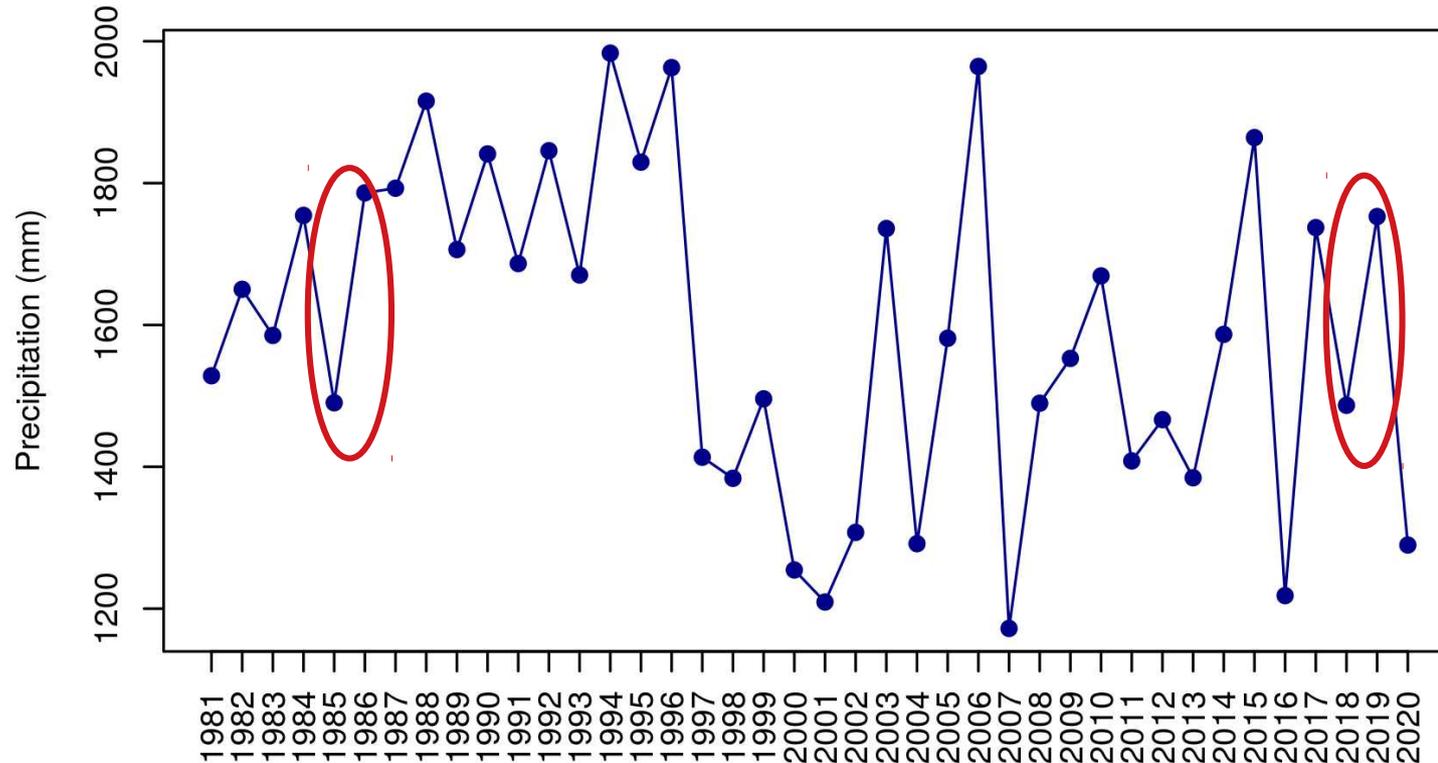


## Vertical Snow Accumulation Gradient



Date basis (1986): Wake 1989, Annals of Glaciology; Hewitt et al. 1989, Annals of Glaciology

## Snow Lake Annual Precipitation Variations (1981-2020)



Data basis: ERA 5 monthly average

### Take home messages

- The distinct summer horizons, dust layers, and isotope signature in the snow profiles make it possible to reconstruct the snowfall chronology and precipitation origin at high elevations
- Studying multi-annual (or decadal) snow accumulation variations with light equipment is limited by high snowfall rates
- Snow accumulation in the central Karakoram varies greatly in space and over time
- Accumulations basins in the central Karakoram are valuable climate archives that bear potential for future ice/firn core studies

Thank you for your attention!

