X-ECV Karakoram Anomaly

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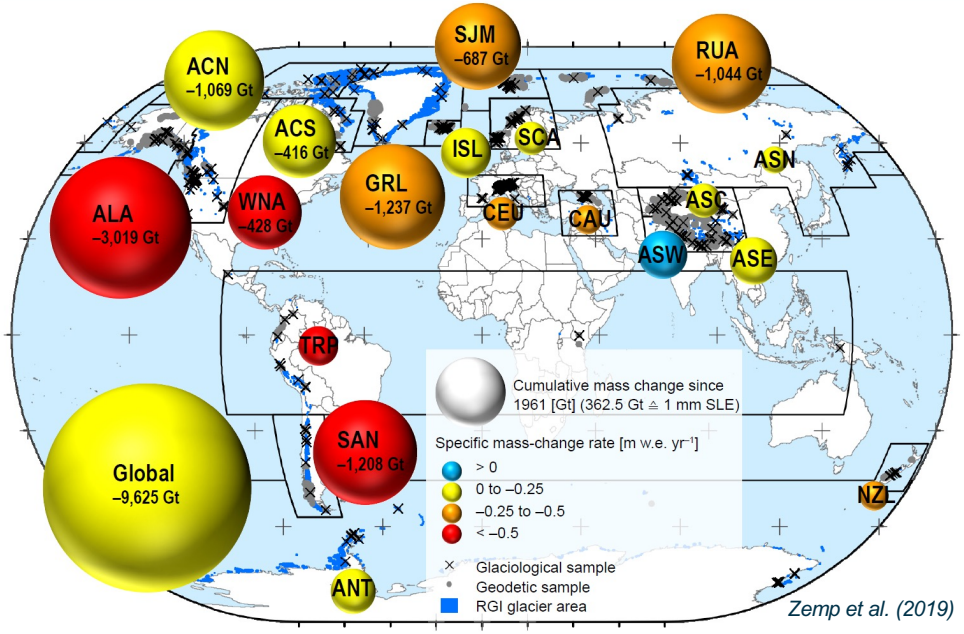
17/02/2026

Objectives of the X-ECV Karakoram Anomaly Project

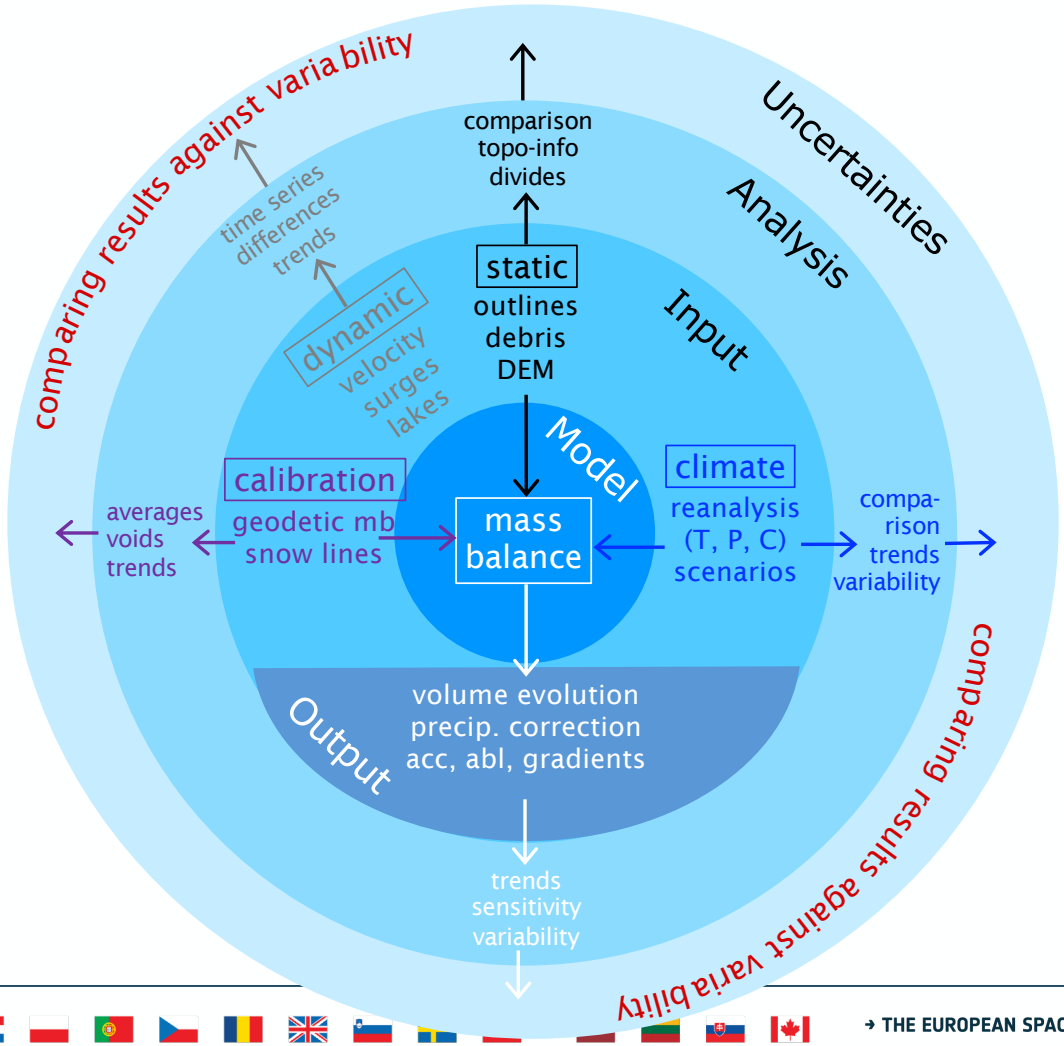
- **Framework:** Climate-Space Theme II: X-ECV Activities, <500 k, 3y duration (10/2024 – 9/2027)
- **Goal:** Improve understanding of the Karakoram Anomaly by combining EO with climate data and mb modelling
- **Connections:** Missing understanding of observed changes is a major research gap (literature, IPCC), quasi-periodic hazards due to GLOFs caused by surges, unknown precipitation and unsure future glacier evolution
- **Policy:** Glaciers feed Indus, good to know how glaciers will develop, but we miss baseline data (T/P, mb)



Zemp et al. (2019)

Skeleton overview of the approach

- We use climate and EO data to feed and calibrate a glacier mass balance model
- The model will inform us about unknowns (precip., acc./abl., mb gradients)
- The input data will also be analysed statistically (variability/trends) and used to determine sensitivities & uncertainties
- Modelled future glacier volume evolution will be compared to previous studies
- Differences to surge-type glaciers will be analysed (mb, snow cover)
- The latter requires their separation from trunk glaciers in current inventories



ECVs being used

- We use products created by Glaciers_cci to inform (glacier extent) and calibrate (elevation change & snow cover) a mass balance model that is forced by daily means of T / P from reanalysis data (ERA-5, ERA5-L)
- ECVs include: glaciers, snow cover, cloud cover and lakes as well as T / P, topography being key aux. data

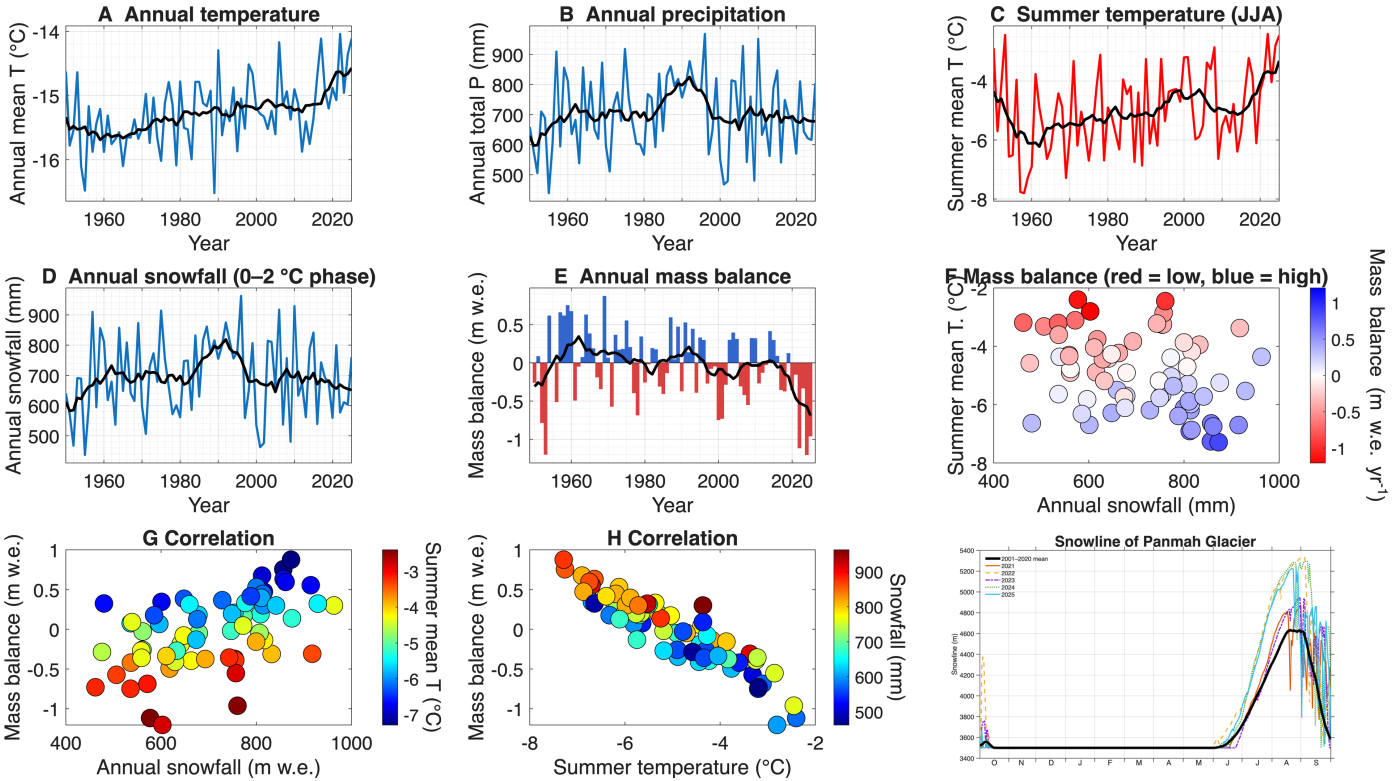
- Observations of snow cover and geodetic mb have uncertainties, but modeled climate data can be unrealistic
- By calibrating a model with observed EO data, also the climatic input data (T/P gradients) can be adjusted

- Surge-type glaciers can only be analysed when they are disconnected from a main glacier (revised inventory)
- We only look at what happens at the surface, equally important are basal properties & ice temperatures

- Improvements: Field measurements of T/P and mass balance gradients would be most important (=> Pakistan)
- Development of techniques to interpolate ECV data gaps created by clouds (e.g. snow cover)

Results & relevance to the CCI community

- We have sorted out what we would like to do science-wise with all the datasets :)
- We have first results of the mass balance model for our test region and the first two publications (see poster)



nature reviews earth & environment
https://doi.org/10.1038/s43017-025-00757-9
Review article
Check for updates

Glacier surging and surge-related hazards in a changing climate

Harold Lovell, Douglas I. Benn, Hester Jiskoot, Chris R. Stokes, Gwenn E. Flowers, Gregoire Guillet, Erik Schytt Mannerfelt, Daniel Falaschi, Andreas Kääb, Owen King, Ívar Örn Benediktsson, Rakesh Bhambri, Mingyang Lv & Adrian Luckman

=> Everything we know about glacier surges

communications earth & environment
A Nature Portfolio journal
Article
https://doi.org/10.1038/s43247-025-03125-z

Recent giant detachment of a glacier on the Tibetan plateau provoked by its frozen tongue

Check for updates

Andreas Kääb, Juditha Aga, Désirée Treichler, Luc Girod & Wei-An Chao

=> Dense time-series of satellite data reveal poly-thermal characteristics of a glacier