BOG X-ECV Karakoram Anomaly

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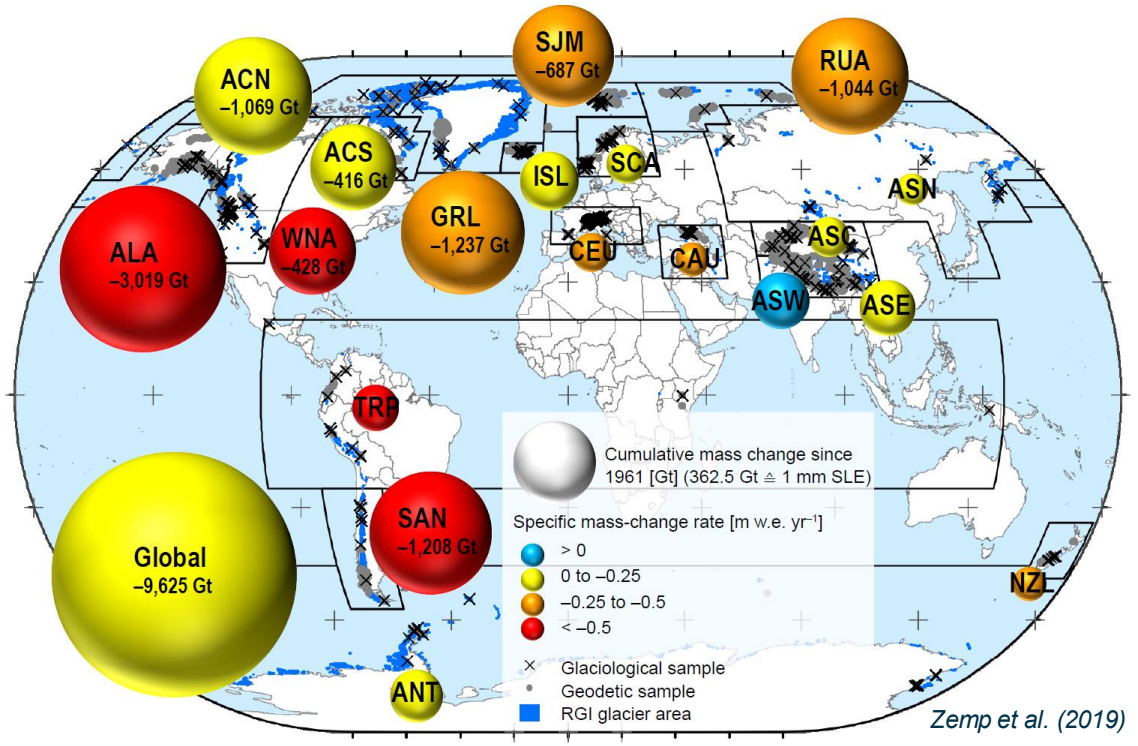
Objectives of the X-ECV Karakoram Anomaly Project

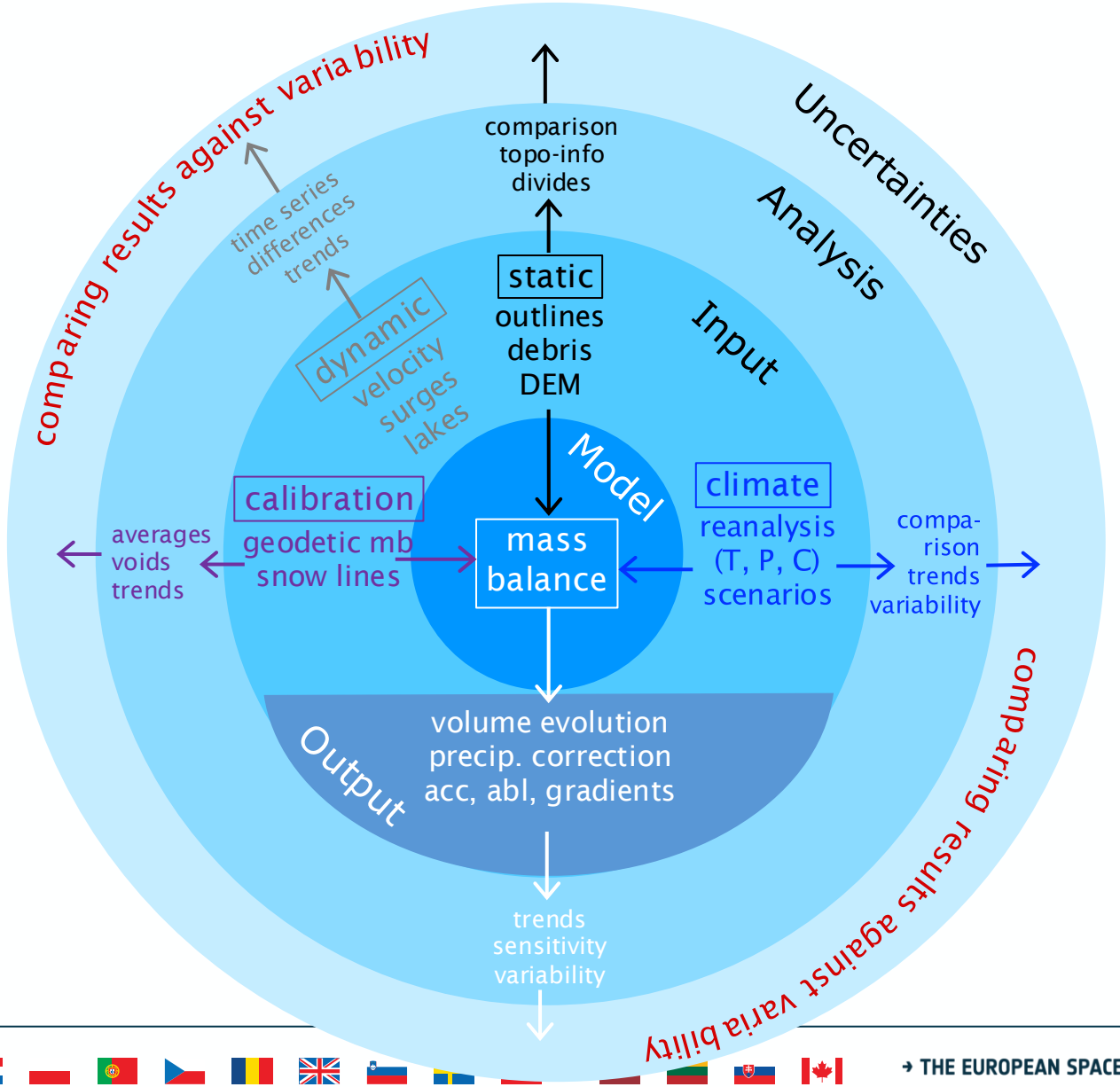
- **Framework:** Climate-Space Theme II: X-ECV Activities, <500 k, 3y duration (10/2024 – 9/2027)
- **Goal:** Improve understanding of the Karakoram Anomaly by combining EO with climate data and mb modelling
- **Connections:** Missing understanding of observed changes is a major research gap (literature,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

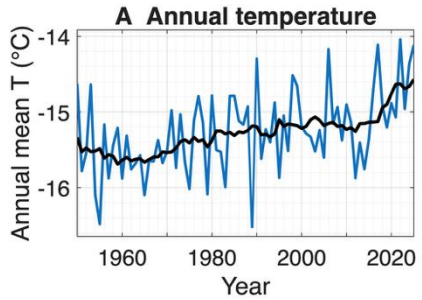
- Observations of snow cover and geodetic mb have uncertainties, but modelled climate data can be unrealistic
- By calibrating a model with observed EO data, also the climatic input data (T/P gradients) can be adjusted

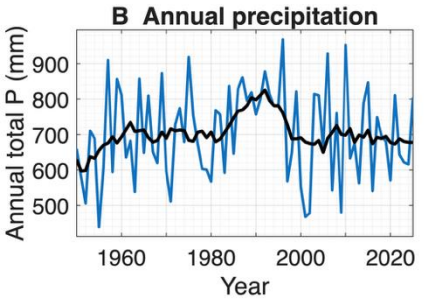
- Surge-type glaciers can only be analysed when they are disconnected from a main glacier (revised inventory)
- We only look at what happens at the surface, equally important are basal properties & ice temperatures

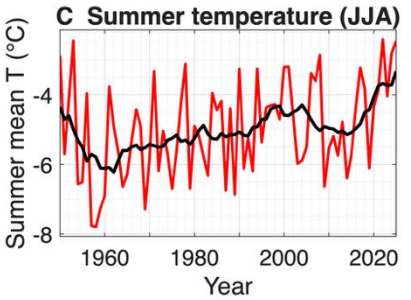
- Improvements: Field measurements of T/P and mass balance gradients would be most important (=> Pakistan)
- Development of techniques to interpolate ECV data gaps created by clouds (e.g. snow cover)

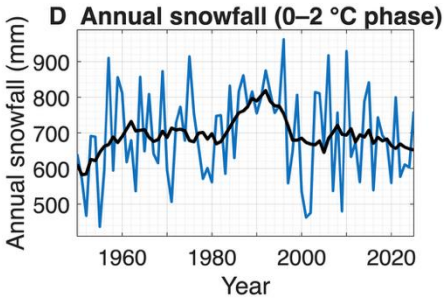
Results & relevance to the CCI community

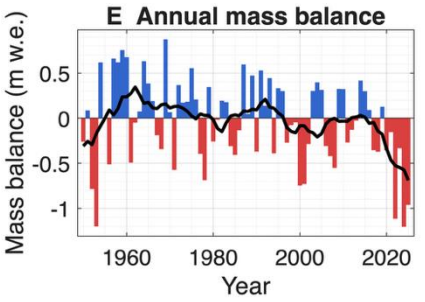
- We have sorted out what we would like to do science-wise with all the datasets :)
- We have first results of the mass balance model for our test region and the first two publications (see poster)

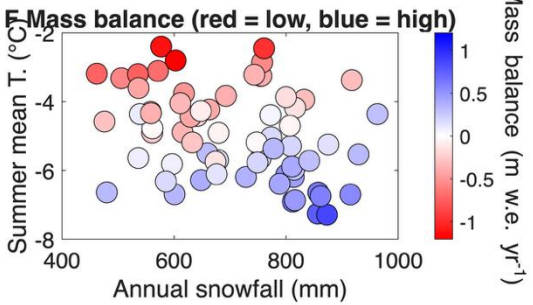


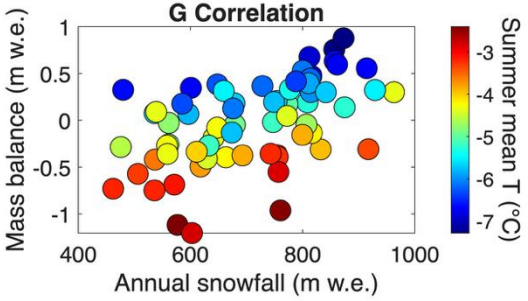


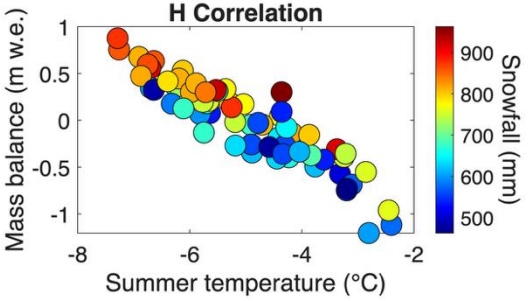


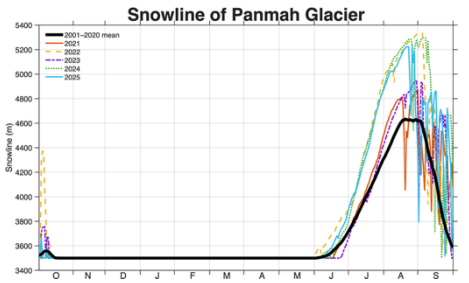












nature reviews earth & environment
https://doi.org/10.1038/s43017-025-00757-9
Review article
Check for updates

Glacier surging and surge-related hazards in a changing climate

Harold Lovell[1], Douglas I. Benn[2], Hester Jiskoot[3], Chris R. Stokes[4], Gwenn E. Flowers[5], Gregoire Guillet[6], Erik Schytt Mannerfelt[6,7], Daniel Falaschi[8], Andreas Kääb[6], Owen King[9], Ívar Örn Benediktsson[10], Rakesh Bhambri[11], Mingyang Lv[12,13], Sher Muhammad[14] & Adrian Luckman[15]

=> Everything we know about glacier surges

communications earth & environment
Article
A Nature Portfolio journal
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[1], Juditha Aga[1], Désirée Treichler[1], Luc Girod[1] & Wei-An Chao[2,3]

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