Capabilites of satellite data for regularly updated inventories of glacier parameters

Pasterze, Goldbergkees, Kleinfleißkees, Wurtenkees (Hohe Tauern) and Freya Glacier (NE- Greenland)

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Principles of integrated glacier monitoring

combination of

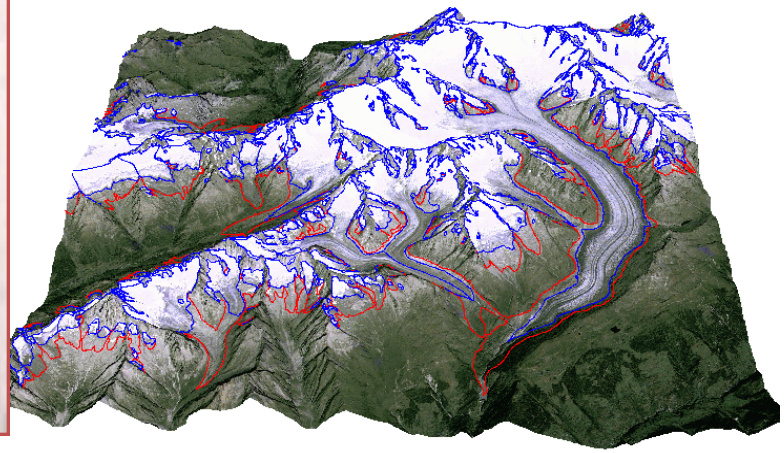
in-situ measurements remote sensing and numerical modelling

annual time series
few glaciers covered
- glacier frontal variations
- mass balance

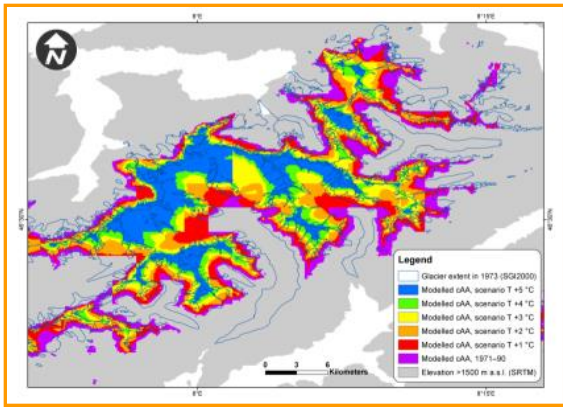
biased towards small glaciers
WGMS

„snapshots“ in time
more glaciers covered
- glacier area
- DEM

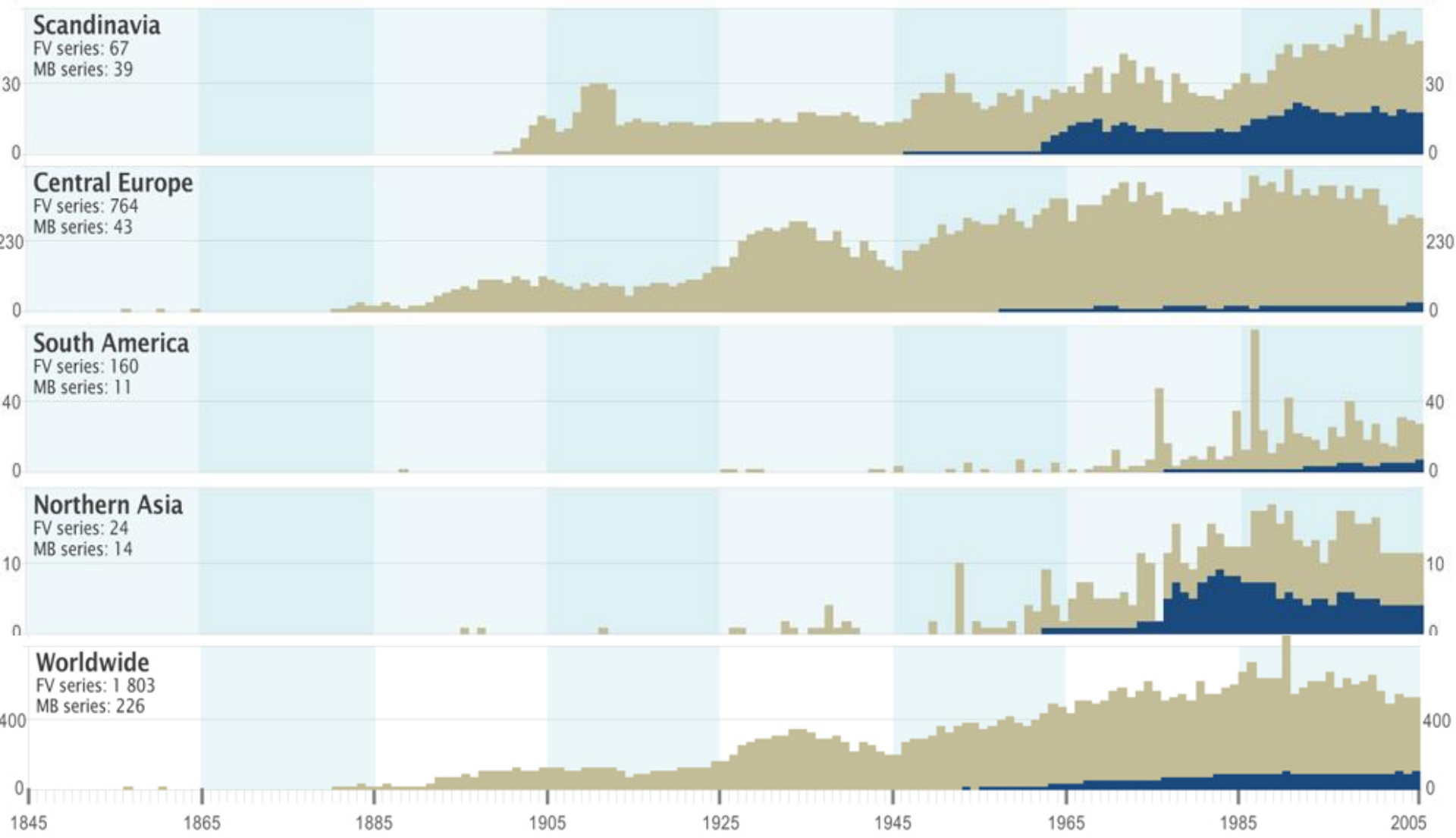
inventories/projects
WGI, GLIMS
GLOBSNOW, CRYOLAND



link between in-situ meas remote sensing
based on process understanding
single studies,
in future operational

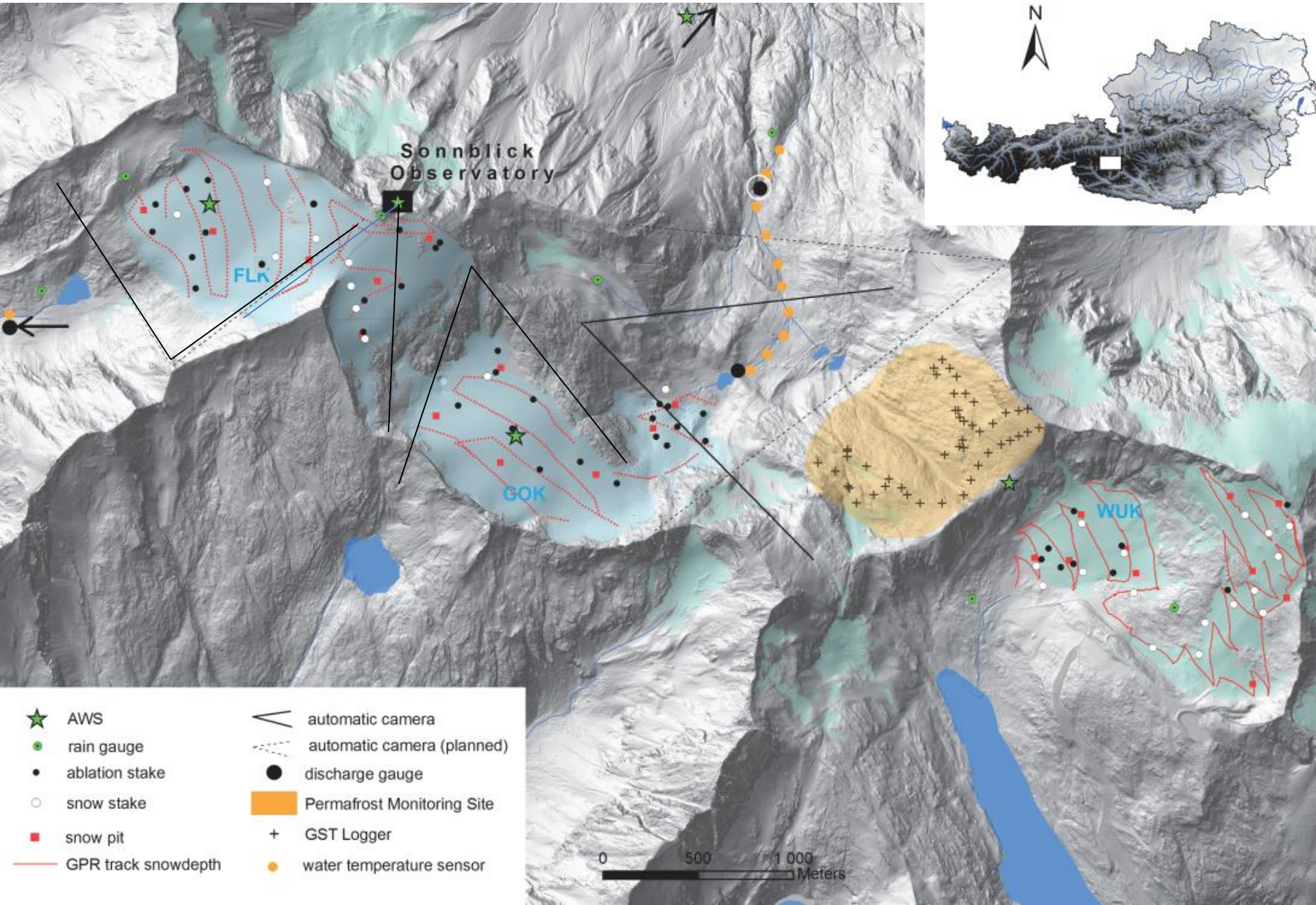


Global Glacier Changes: facts and figures



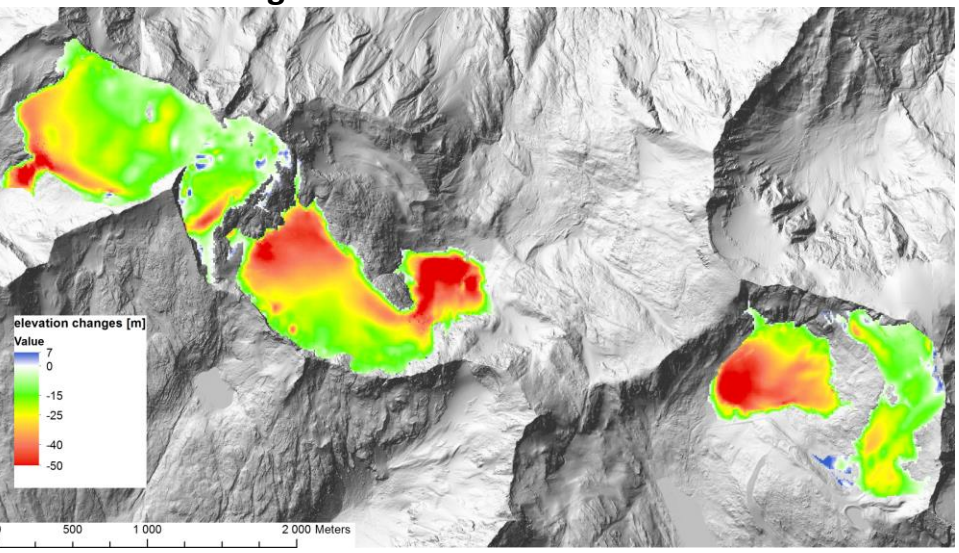
Worldwide mass balance measurements.

Small glaciers near Sonnblick observatory

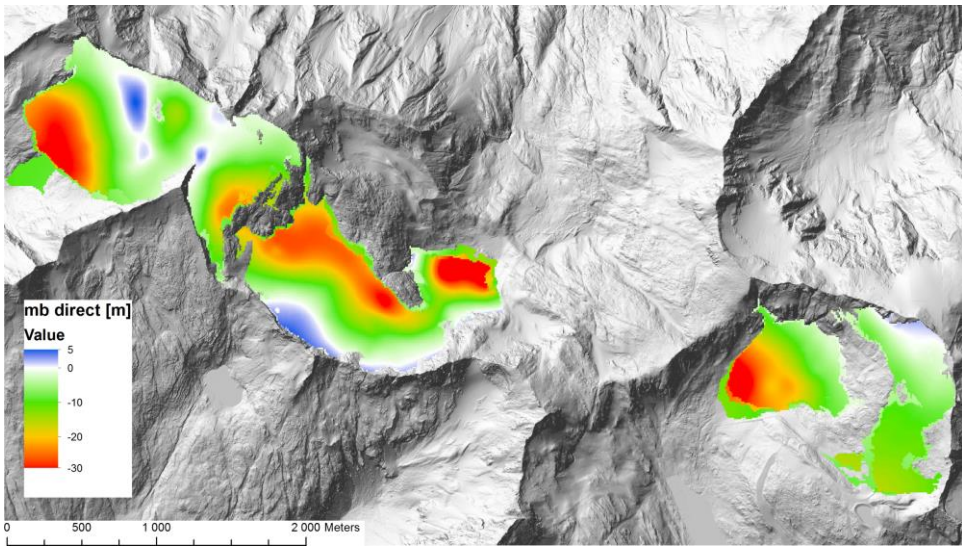


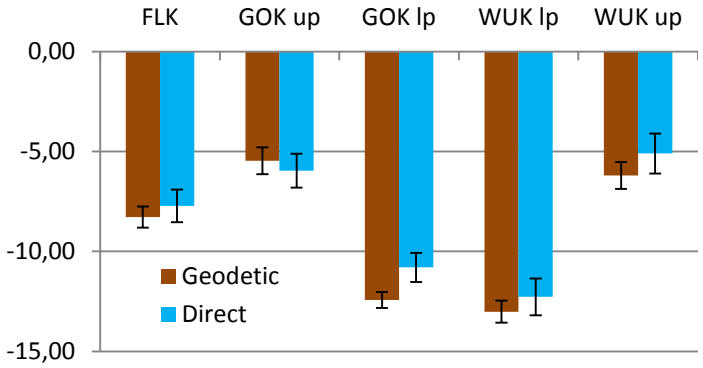
CALIIBRATION OF MASS BALANCE TIME SERIES USING GEODETIC MASS BALANCE

Elevation Changes

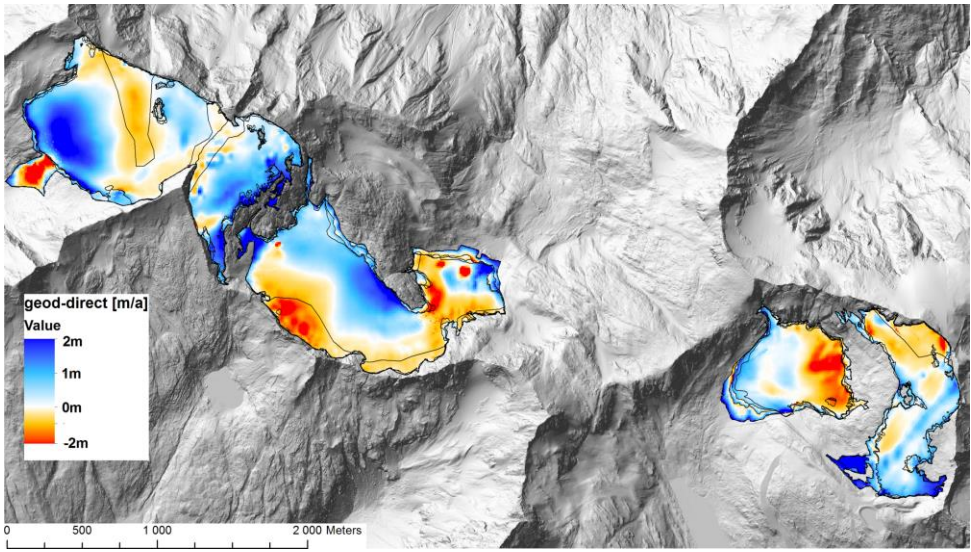


Surface Mass Balance



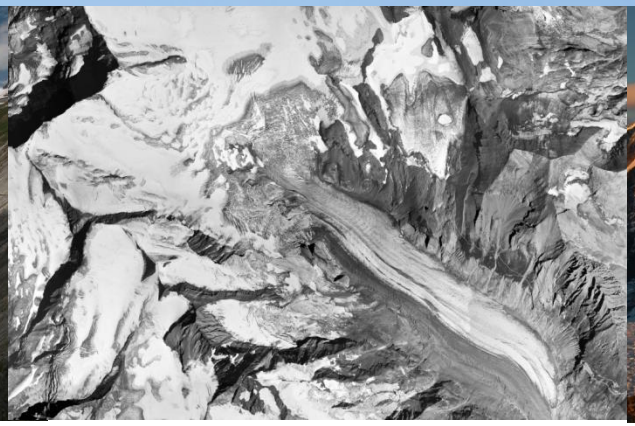


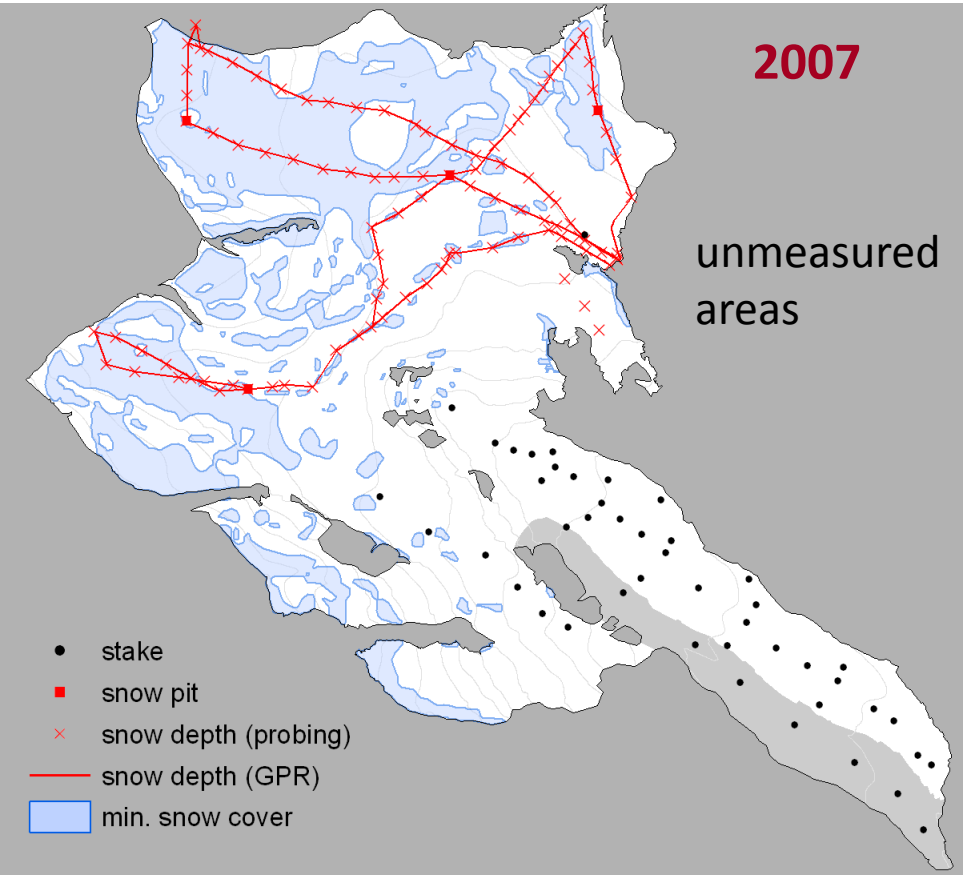
Elevation Changes – Surface Mass Balance

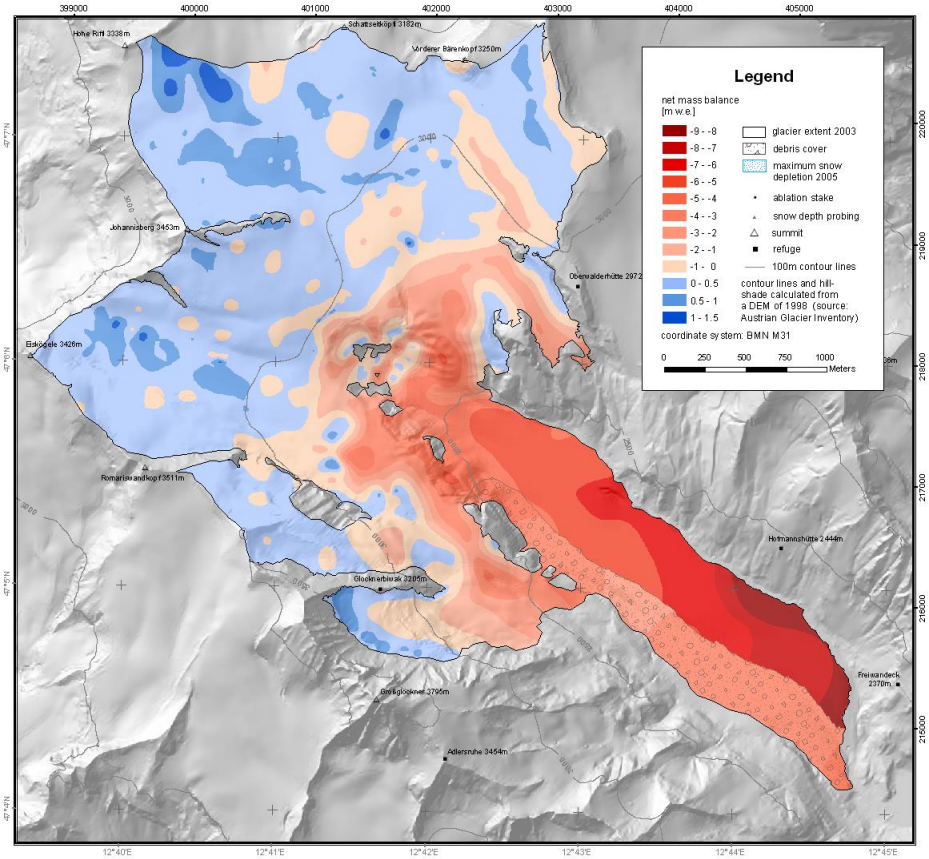


- **BIAS in direct measurements?**
- **Information on ice dynamics**
- **Basal mass balance**
- **Internal mass balance (refreezing, Arctic)**

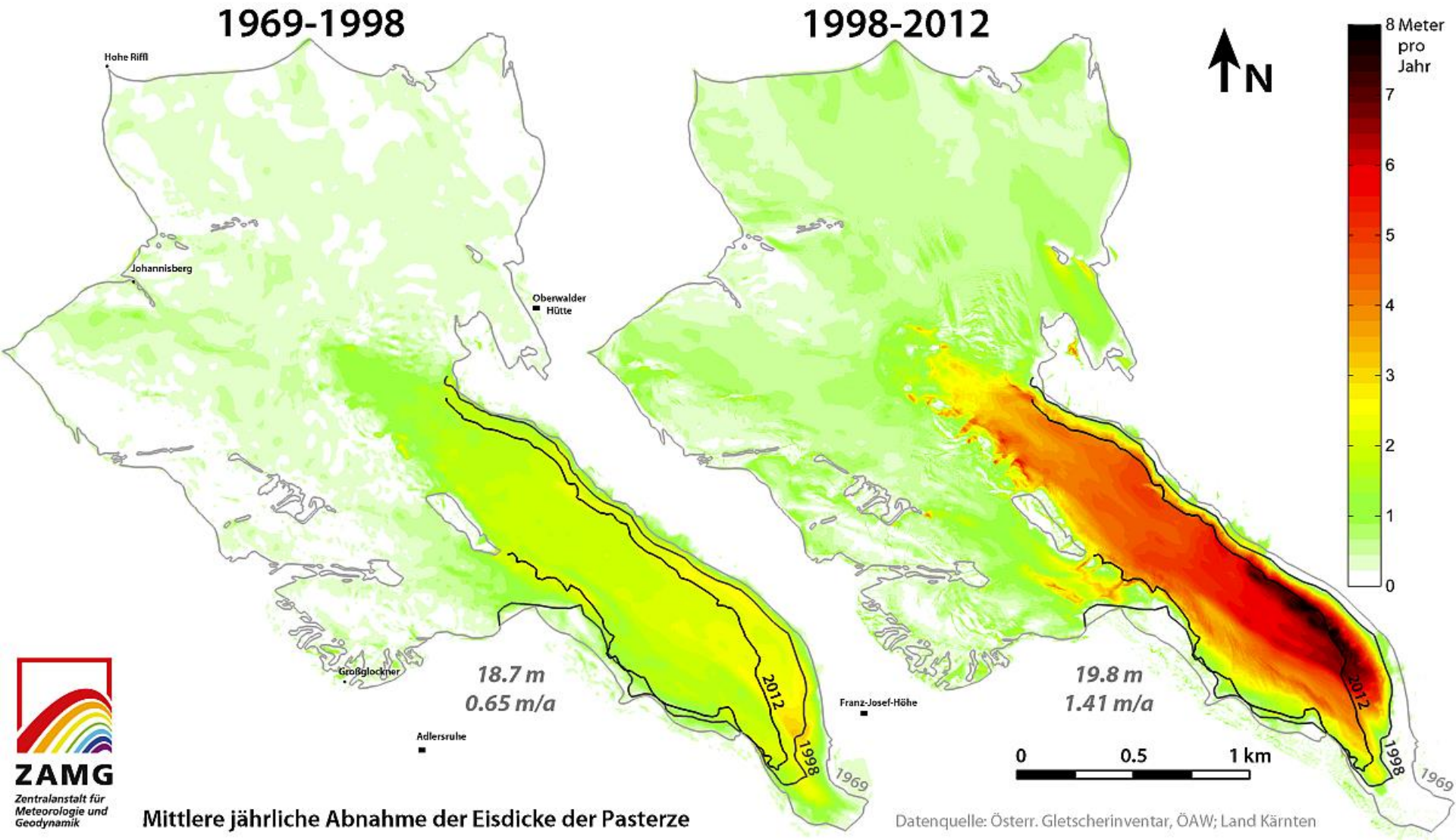
Direct measurements on Pasterze 16km²







ELEVATION CHANGES OF PASTERZE BETWEEN THE LAST INVENTORIES



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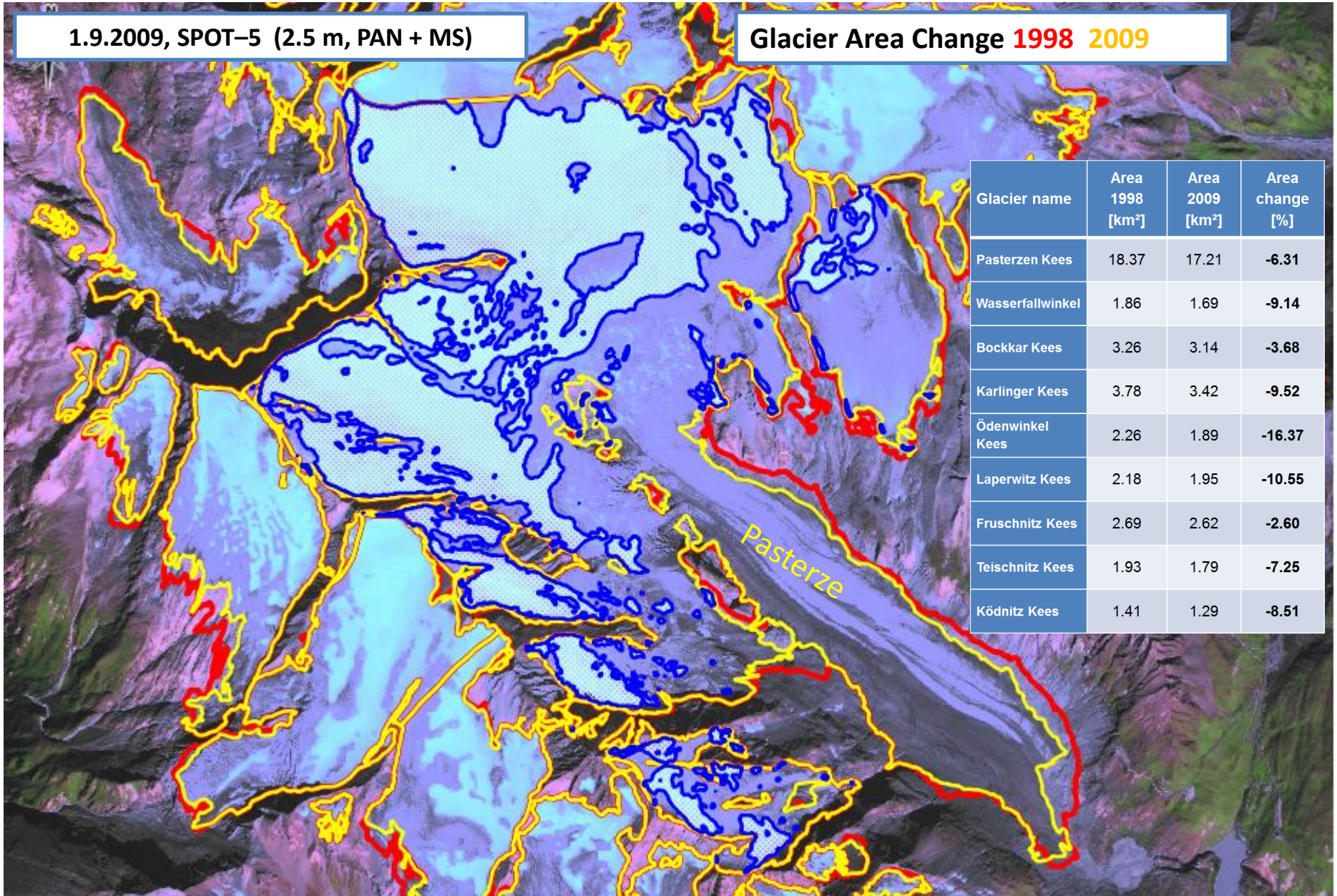
Mittlere jährliche Abnahme der Eisdicke der Pasterze

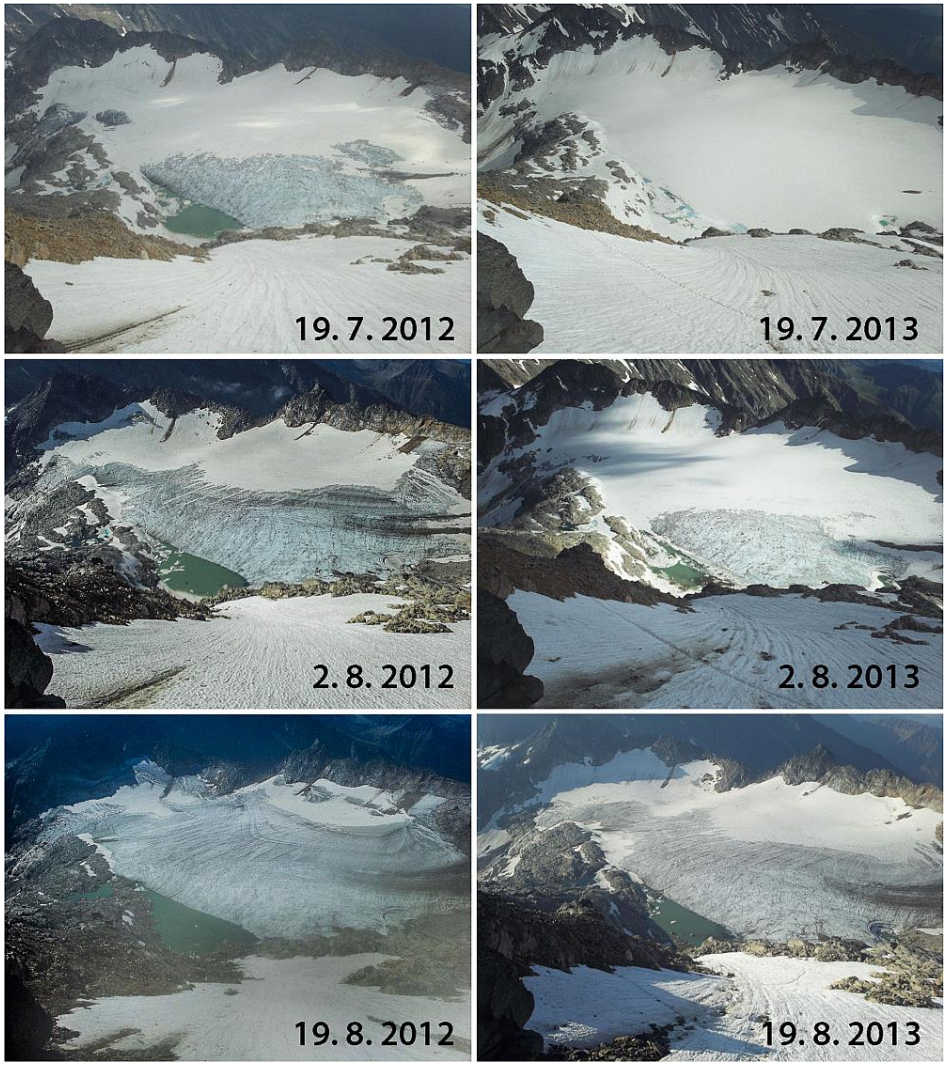
Datenquelle: Österr. Gletscherinventar, ÖAW; Land Kärnten

SNOW – ICE DELINEATION ON GLACIERS (=> SURFACE MASS BALANCE = 0)



Glacier name	Area 1998 [km²]	Area 2009 [km²]	Area change [%]
Pasterzen Kees	18.37	17.21	**-6.31**
Wasserfallwinkel	1.86	1.69	**-9.14**
Bockkar Kees	3.26	3.14	**-3.68**
Karlinger Kees	3.78	3.42	**-9.52**
Ödenwinkel Kees	2.26	1.89	**-16.37**
Laperwitz Kees	2.18	1.95	**-10.55**
Fruschnitz Kees	2.69	2.62	**-2.60**
Teischnitz Kees	1.93	1.79	**-7.25**
Ködnitz Kees	1.41	1.29	**-8.51**

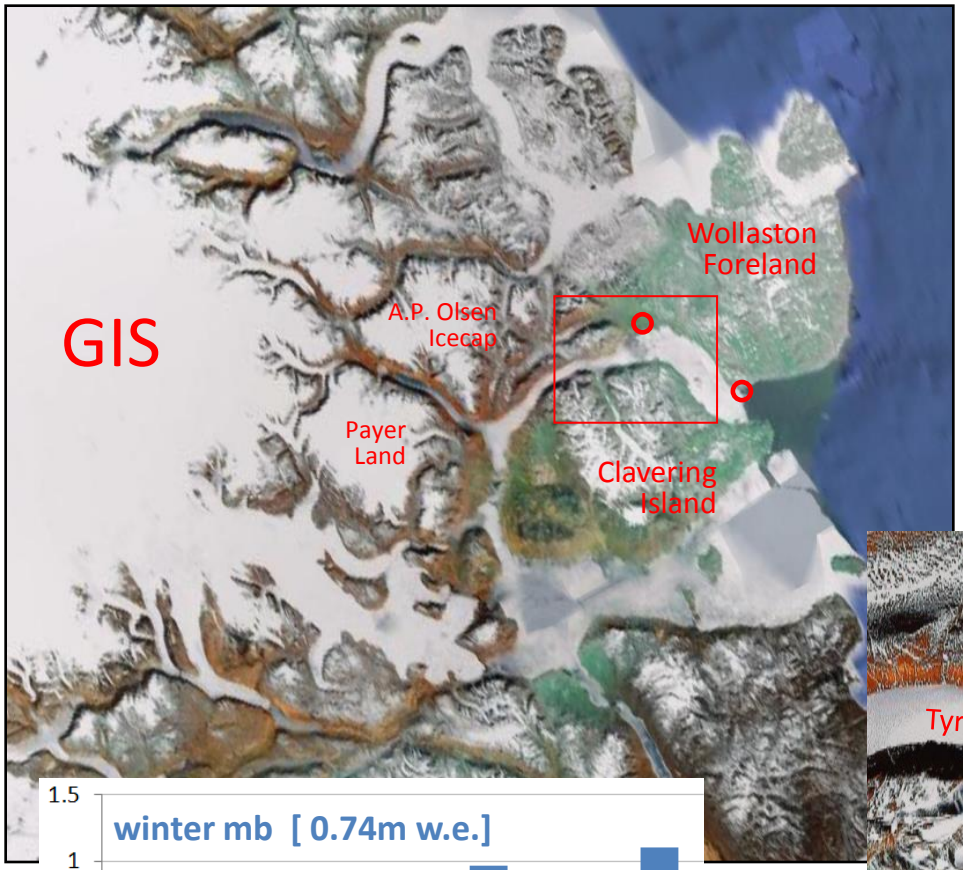
Goldbergkees 2012-2013

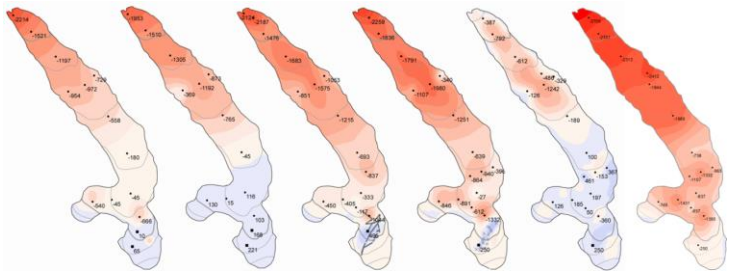


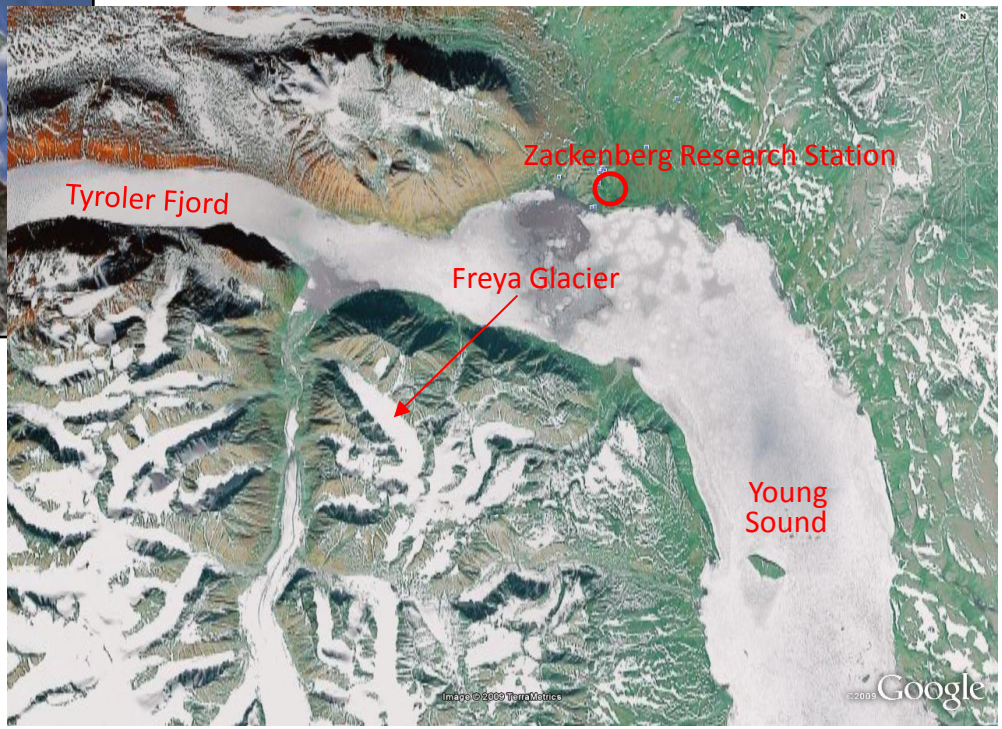
Kleinfleisskees 2012-2013

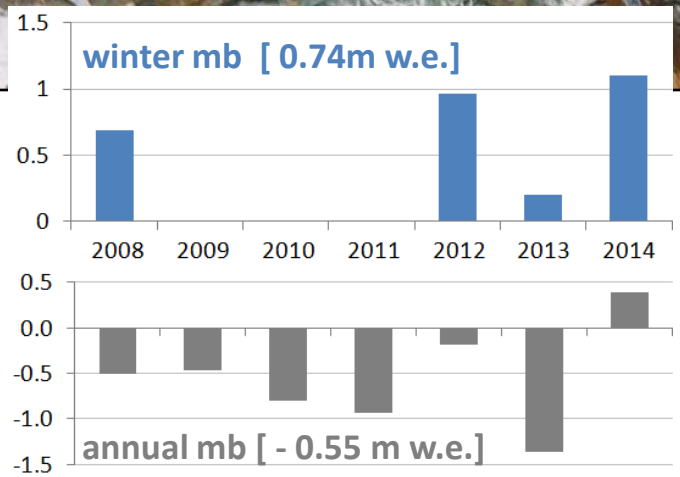
for small and accessible glaciers. → for others use of Satellite Data

Zackenberg – Freya Glacier 6 km^2

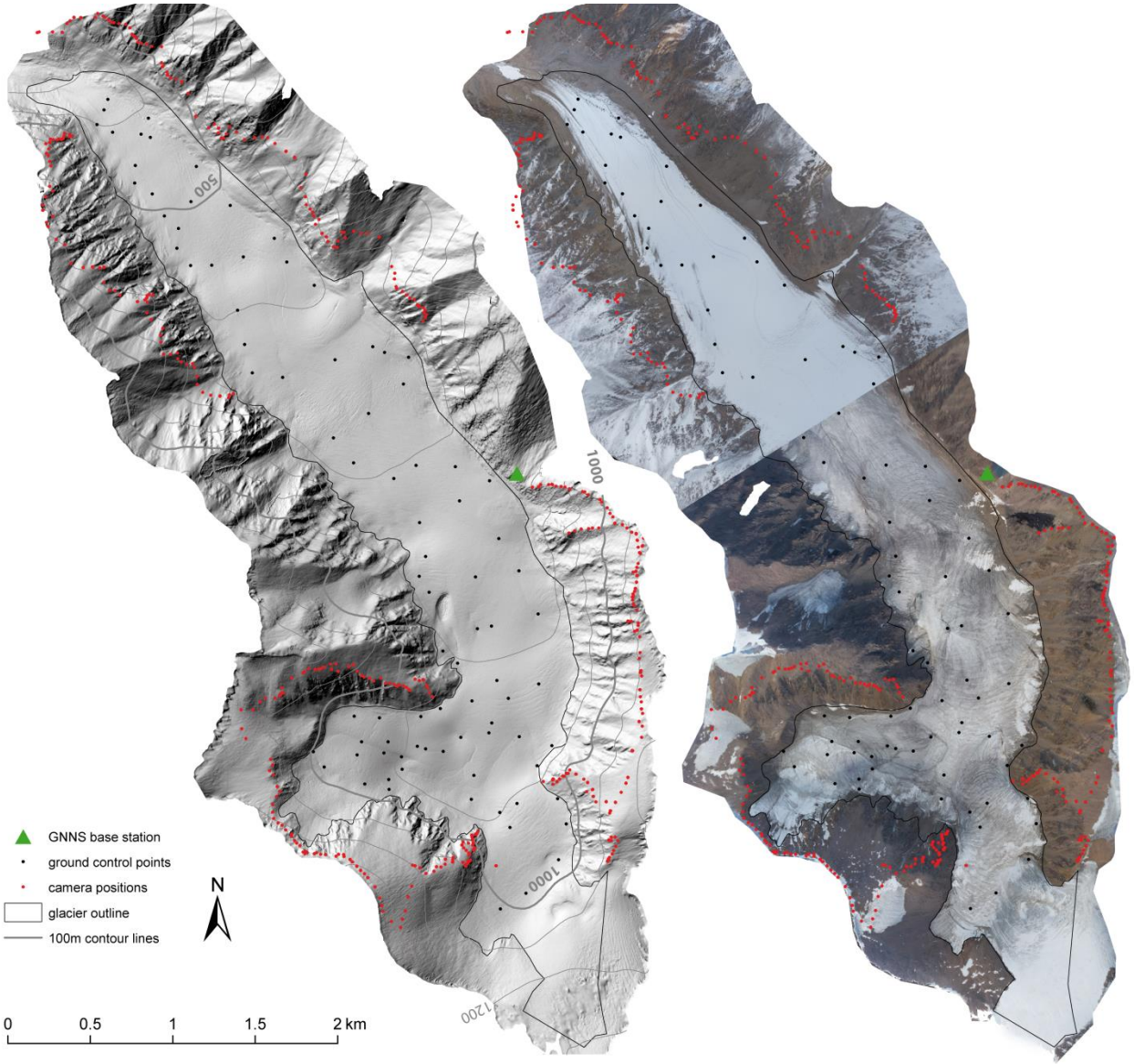




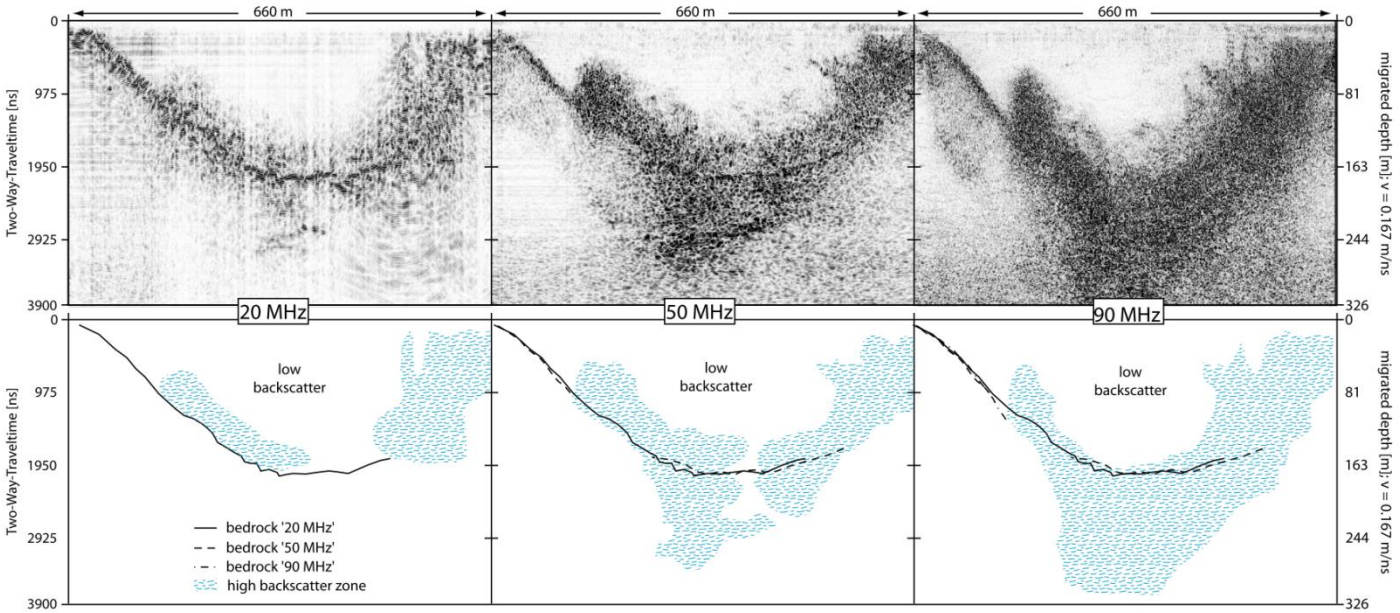




DEM 2013 Terrestrial Structure from Motion Photogrammetry. 1m resolution



Freya Glacier – GPR survey for Ice thickness



What kind of data is of use for glacier research/monitoring

To improve the coverage and/or acuracy of MASS and AREA changes:

- Updated glacier outlines (1 year)
- DEMs of glacier surface (10-50m, 1 -5 years)

To improve process understanding (model input or validation):

- Snow/ice cover extents (daily – weekly, 10-50m)
- Surface temperature/surface melt yes/no (daily)
- Extents of debris cover/melt ponds,lakes (1 year, daily)
- DEM of glacier bed
- Surface velocity data

Conclusion:

„Snapshots“ of remote sensing data are usefull for glacier studies
BUT: there is a strong need of repeating those snapshots with a higher and regular frequency!

Thank you!