

Name of research institute or organization:

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**Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie (VAW),  
ETH Zürich**

Title of project:

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Glaciological investigations on the Grosser Aletschgletscher

Project leader and team:

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Dr. Andreas Bauder, project leader

Dr. Matthias Huss, 2-4 field assistants and support by the custodians

Project description:

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Long-term glacier observations have been carried out to document glacier variations of Grosser Aletschgletscher and include annual length change measurements since 1880, accumulation and mass balance measurements starting in 1918, repeated map or arial photograph surveys, complemented by stream runoff in the Massa river since 1922 by BAFU, respectively.

In an ongoing project the length, area, volume, and mass changes are continuously observed applying modern remote sensing techniques as well as direct field measurements. The research activities are focused on long term trends and seasonal fluctuations. Net volume changes are calculated by comparison of digital elevation models (DEM) derived from the existing maps and photogrammetrical analysis. Mass balance components with firn accumulation and ablation are measured in detail at Jungfraufirn.

The almost 100-year long time-series of annual accumulation and glacier melt have been analysed with the aim of better understanding the climatic forcing on glaciers. Multidecadal changes are linked to both variations in air temperature and solar radiation.

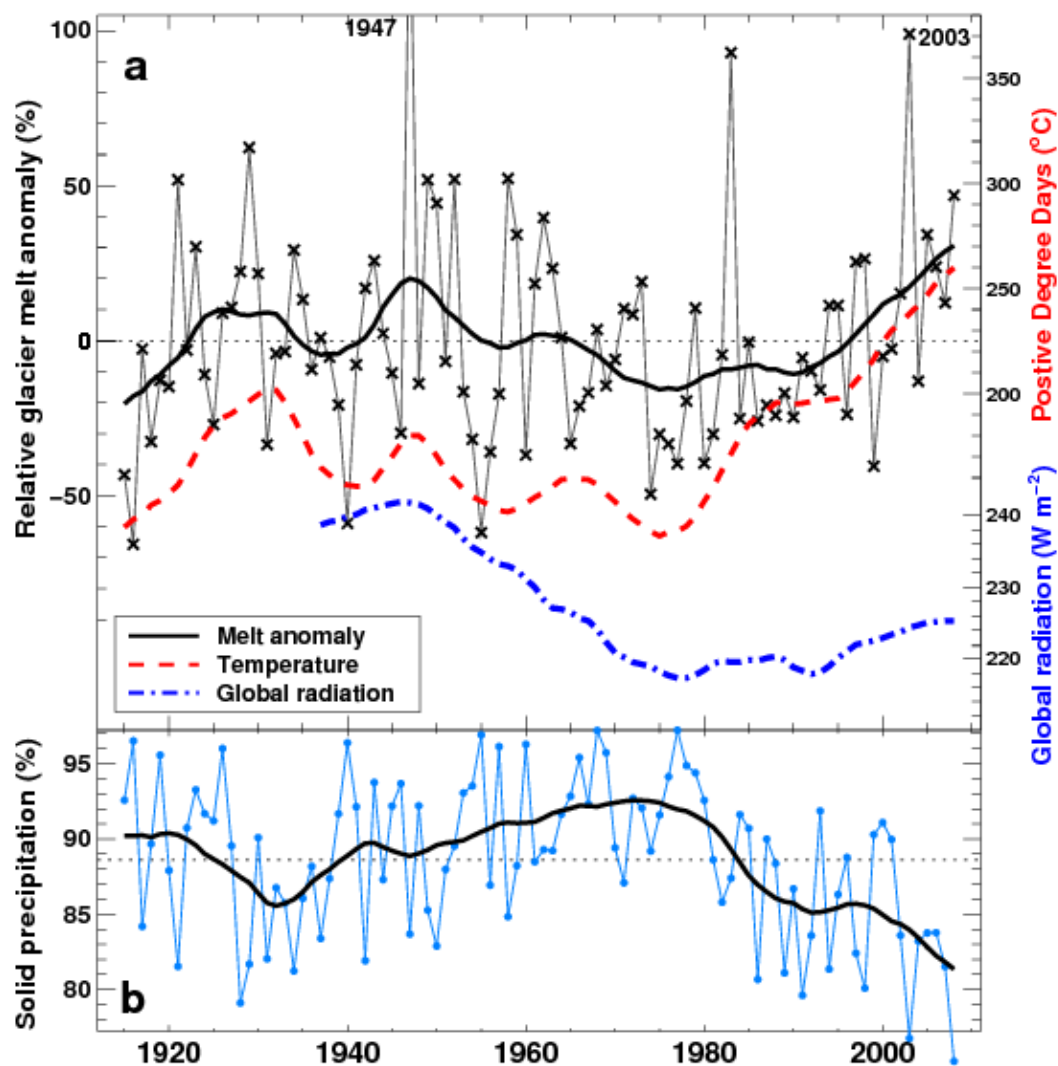


Figure: (a) Annual melt anomaly at the measurement site P3 on Jungfraufirn (black), sum of daily air temperatures above 0°C (red) summer (JJA) in measured global radiation in Davos (blue), (b) calculated annual fraction of solid precipitation. All time series are low-pass filtered using 11-year running means (thick lines).

Key words:

Glacier measurements, firn accumulation, ice melt, volume change, mass balance

Internet data bases:

[http://www.vaw.ethz.ch/research/glaciology/glacier\\_change/gz\\_variations\\_gr\\_aletsch\\_gretscher](http://www.vaw.ethz.ch/research/glaciology/glacier_change/gz_variations_gr_aletsch_gretscher)

Collaborating partners/networks:

Swiss Glacier Monitoring Network, Federal Office for the Environment (BAFU)

Scientific publications and public outreach 2009:

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### **Refereed journal articles**

Huss, M. and Bauder, A. (2009). 20th-century climate change inferred from four long-term point observations of seasonal mass balance. *Annals of Glaciology*, 50(50), 207-214.

<http://www.ingentaconnect.com/content/igsoc/agl/2009/00000050/00000050/art00029>

Farinotti, D., Huss, M., Bauder, A. and Funk, M. (2009). An estimate of the glacier ice volume in the Swiss Alps. *Global and Planetary Change*, 68(3), 225-231, doi:10.1016/j.gloplacha.2009.05.004.

<http://dx.doi.org/10.1016/j.gloplacha.2009.05.004>

Huss, M. Funk, M. and Ohmura, A. (2009). Strong Alpine glacier melt in the 1940s due to enhanced solar radiation. 36(23), *Geophysical Research Letters*, L23501, doi:10.1029/2009GL040789.

<http://dx.doi.org/10.1029/2009GL040789>

### **Conference papers**

Bauder, A., Huss, M., "Gletscherschmelze und Wasserhaushalt in Vergangenheit und Zukunft", Tagung 'Schnee, Eis und Wasser im Alpenraum - aktueller denn je!', Bern, 5-Jun-2009.

Bauder, A. "Reconstuction of Swiss glaciers over the last century", International Conference on Historic maps and imagery for modern scientific applications, Bern, 1-3 Oct 2009.

Farinotti, D., A. Bauder, A., M. Huss, M., Funk, M., "How much ice is stored by the Swiss glaciers". Swiss Geoscience Meeting 2009, Neuchâtel, 22 Nov 2009.

Huss, M., Bauder, A., Funk, M., "Large scatter and multidecadal fluctuations in the 20th century mass loss of 30 Swiss glaciers". Swiss Geoscience Meeting 2009, Neuchâtel, 22 Nov 2009.

### **Book sections**

Bauder, A. (2009). Gletscher, unberechenbare Zeitgenossen?, in Hallers Landschaften und Gletscher, Jubiläumsband zum 300. Geburtstag von Albrecht von Haller. *Mitteilungen der Naturforschende Gesellschaft in Bern, Neue Folge Band 66*, 151-157.

### **Data books and reports**

Bauder, A. and Rüegg, R. eds. *The Swiss Glaciers 2003/04 and 2004/05*. Glaciological Report No. 125/126, Cryospheric Commission of the Swiss Academy of Sciences published by the Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zürich, 117p. 2009.

### **Radio and television**

"Alpine glaciers face the climate heat", Interview with glaciologist Andreas Bauder, ETH Zürich, NDTV, India, November 29, 2009

[http://www.tubaah.com/details.php?video\\_id=116012](http://www.tubaah.com/details.php?video_id=116012)

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