

Name of research institute or organization:

Labor für Radio- und Umweltchemie der Universität Bern und des Paul Scherrer Instituts

Title of project:

VITA Varves, Ice cores, and Tree rings – Archives with annual resolution

Project leader and team

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Project description:

The 'Varves, Ice cores, and Tree rings – Archives with annual resolution (VITA)' subprogram of the National Centre of Competence in Research on Climate (NCCR Climate) aims to compare proxy climate records from trees, lakes, peat bogs and glaciers within a small region of Switzerland.

To obtain the VITA ice core archive, the Fiescherhorn glacier, Berner Oberland, was selected as suitable site. In December 2002, a 150 m ice core was retrieved from this glacier (46°33'N, 8°4'E, 3900 m asl). In order to establish proxy records, glaciochemical data from the same glacier, but from a 77 m long core previously drilled in 1989 (Schotterer et al., 1998; Schwikowski et al., 1999), were investigated along with meteorological data from stations in the vicinity.

Annual layers in the ice core were defined by minima in the $\delta^{18}\text{O}$ record that correspond to mid-winter (i.e. ~January on a monthly basis). For the calibration of the ice core proxy records, temperature and precipitation data from several meteorological stations (Meiringen, Jungfrauoch, Interlaken, Graechen, Grand St Bernard, Adelboden, Weissfluhjoch, Zermatt, Grimsel, Sion, and Lugano) were used. These data were compared with the $\delta^{18}\text{O}$ and accumulation ice core records for two time periods (1946-1988, 1959-1988).

Correlation analysis revealed that the summer $\delta^{18}\text{O}$ record can be used as a proxy for summer temperatures while the annual $\delta^{18}\text{O}$ record may only be used as a temperature proxy for the Jungfrauoch (or high-elevation stations, see Fig. 1). Annual accumulation at Fiescherhorn may be used as a proxy for precipitation, at least on a long-term basis.

Currently the top 108 m of the new ice core has been sampled at a resolution of 4 to 5 cm, with the sample length decreasing with increasing depth. Some 2500 samples have been cut and subsequently analysed for major ions (Na^+ , NH_4^+ , K^+ , Mg^{2+} , Ca^{2+} , F^- , CHOO^- , CH_3COO^- , CH_3SO_3^- , Cl^- , NO_3^- , SO_4^{2-}) using established ion chromatography techniques.

Preliminary dating of the ice core record has been done using the ammonium and calcium records. These species vary seasonally, with elevated concentrations observed during spring and summer. These records were also compared with existing data from two other ice cores spanning the periods 1989-2000 and 1946-1988. Thus

the top 108 m of this ice core is thought to cover the time period 1943-2002 with an uncertainty of ± 5 years. The mean annual accumulation rate during this period is 1.8 m water equivalent (m w.e. y^{-1}). This value is greater than other published accumulation rates for this site (1.4 and 1.5 m w.e. y^{-1}).

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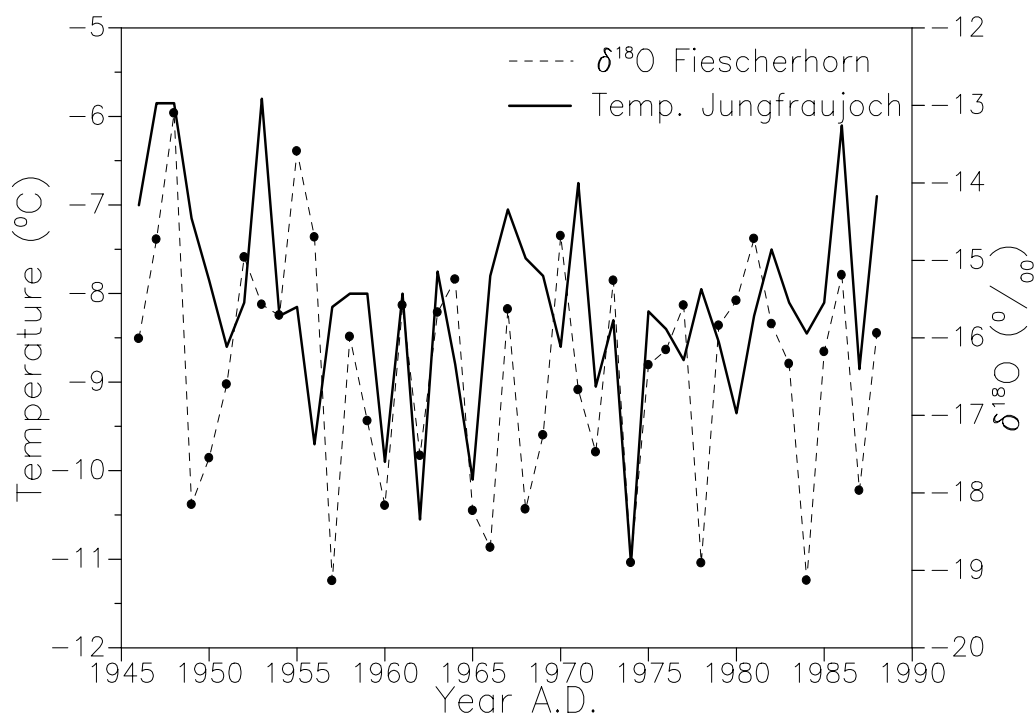


Fig. 1: Annual median temperatures at Jungfrauoch (solid line) and annual median $\delta^{18}\text{O}$ from the Fiescherhorn ice core (dashed line) ($r=0.36$, 99% confidence limit).

Key words:

Climate reconstruction, high-alpine

Internet data bases:

<http://lch.web.psi.ch/>

<http://www.nccr-climate.unibe.ch/>

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Scientific publications and public outreach 2003:

Refereed journal articles

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