Name of research institute or organization:

Laboratory of Radiochemistry and Environmental Chemistry, Paul Scherrer Institute

Title of project:

Test of equipment for ice core drilling on high-alpine glaciers

Part of this programme:

International Partnership for Ice Core Sciences (IPICS)
National Science Foundation (NSF) project "1,000-year climatological history of the South American summer monsoon (SASM)" of the University at Albany (PI M. Vuille)

Project leader and team:

Prof. Margit Schwikowski, project leader
Dr. Theo Jenk, Dr. Chiara Uglietti, Johannes Schindler, Anna Dal Farra
Dieter Stampfli, Felix Stampfli (FS INVENTOR)

Project description:

The Quelccaya Ice Cap is the largest tropical ice cap on Earth. Although reduced by 30% over the last 35 years, the glacier covered area is still around 39 km^2 today. Located in the Cordillera Vilcanota between the high Andean Altiplano extending to the west and the Amazon Basin to the east it is situated in a climatically sensitive region. The glacier has been studied for more than 40 years and ice cores were drilled to bedrock in 1983 and 2003. Since 2003, an automated weather station (AWS) is operated on the summit, running in parallel with a snow sampling program to investigate depositional and post-depositional effects on the stable isotope composition of snow accumulation (e.g. mass redistribution). Snowfall at this site is highly associated with the South American summer monsoon (SASM) which is of great socioeconomic relevance to sub-tropical South America. Increased understanding of past SASM variations and the response to natural and anthropogenic disturbances is the focus of an ongoing NSF project (PI M. Vuille). Based on highly resolved ice-core proxy data combined with long-term climatologic and glaciological onsite monitoring/calibration programs, it aims at a comprehensive climatological history of the SASM for the last 1000 years. In this context our goal was to extend the 2003 ice core record to the present to obtain overlapping time periods with the dataset from the AWS and related instrumental/remote sensing data. This would allow a detailed investigation on how climatic signals are archived in the Quelccaya ice leading to most reliable paleo reconstructions and interpretation. Furthermore the ice core should allow to accurately determining the currently not well defined accumulation rates for this period.

For updating the Quelccaya record from 2003 to the present we modified our small version of the Fast Electromechanical Lightweight Ice Coring System (FELICS small). FELICS small is composed of a 90 cm long core barrel (60 mm inner diameter), chip barrel and drive unit attached to an electric cable connected to a control box and the battery pack. No winch is used; the drill system is manually lifted out of the borehole by pulling on the electric cable. The modification included extending the cable to 30 m length. The system was tested at the Jungfraufirn near the research station in April 2014 and worked well. At the same time, we tried the drill with a light-weight winch (Fig. 1). After successful testing at Jungfraujoch, the drill was employed during an expedition to Quelccaya glacier (13.93°S, 70.82°W, 5660 m a.s.l.) in October 2014. Drilling went smoothly even under difficult circumstances. We were able to establish a new depth record for our lightweight drill, recovering 21 m of good quality cores. Drilling was stopped soon after solid ice was reached (around 20 m) and core breaking by manual pull started to become almost impossible with a high risk of losing the drill.

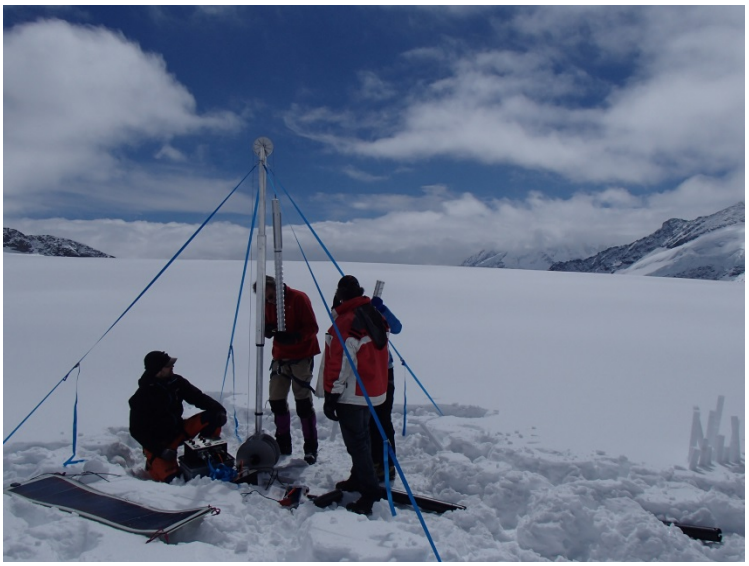

Figure 1. Test of the shallow firn drill FELICS small equipped with a light-weight winch at the Jungfraufirn.

Key words:

High-altitude glaciers, firn core drilling

Internet data bases:

http://www.psi.ch/lch/analytical-chemistry
http://quelccaya.blogspot.ch/

Collaborating partners/networks:

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Mathias Vuille, University at Albany, Department of Atmospheric and Environmental Sciences, Albany, NY 12222, USA

Scientific publications and public outreach 2014:

Refereed journal articles and their internet access

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