**Studying the subglacial hydrological system in West-Antarctica – Opportunities and challenges**

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Chemical and isotopical signature of subglacial water has extensively been used to reveal subglacial hydrological processes. In glacial systems, where surface melt can reach the bed, oxygen rich surface melt mixes with basal water enriched in solutes and weathering products from its interaction with the glacier bed. Changes in the englacial and subglacial hydrological system throughout the annual cycle are reflected in the chemical and isotopical composition of run-off, englacial and subglacial water. At many alpine glaciers glacier run-off is routinely monitored and samples for chemical analyzes taken. More challenging is the access of the glacial bed through boreholes, which however is regularly done on alpine glaciers.

In the case of the West-Antarctic Ice Sheet rare surface melt refreezes within short time close to the surface in the firn layer. Subglacial water is therefore the result of basal melt caused by geothermal and frictional heat trapped at the base of the ice sheet. Basal melting delivers like a conveyor belt dust particles and oxygen from the air trapped in the ice from the ice surface to the subglacial system. Over a long timescale of possibly hundreds to thousands of years basal melt water interacts with the glacial bed. In this process the subglacial water enriches in solutes from mineral dissolution, chemical weathering and microbial activity. In areas of basal melting fresh basal melt dilutes solute enriched basal water, while in areas of basal freezing solute concentrations increase as solutes are expelled from the ice during the freeze-on process. Differences in solute concentrations and the portion of different chemical elements from one sample location to the other, as seen at the UpC Sticky Spot (Vogel and others, unpublished data), therefore reflect the history of the basal water and the catchment area it originated from. In addition the accretion of basal ice in areas of basal freezing also bears valuable information about the subglacial environment. The presence of accretion ice itself contains information about the freeze-on history while isotopical and chemical composition of the ice reflect the water source.

Studying the subglacial regime of polar ice sheets however bears large logistical and technological challenges. Geophysical investigation can generally distinguish between a frozen and unfrozen or wet bed. However they are yet unable to identify characteristics of the hydrological system or to detect smaller features like subglacial cavities. Shielded by 1000 m and more ice, direct observations and sample collection are only possible through boreholes. Due to the great ice thickness and the remoteness drilling in WAIS bears more technological and logistical problems then drilling on alpine and arctic glaciers. Water pressures at the bottom of the boreholes are similar to the deep-sea environment. Instruments, sampling and insitu analyzing systems, routinely used in other areas, have therefore to be modified or specially designed to withstand and operate in this environment or to fit through the narrow shaft of a borehole. For long-term monitoring of the basal water or the glacial bed sensors and analyzing systems have to be placed to or close to the bed and data transmitted to the surface.

Similar challenging for future drilling operations is to avoid contamination of the subglacial environment, in particular through drilling fluids, which might be possible through a combination of different drilling technologies (hot-water, coiled tubing, rotary or cryobot) dependent on the individual scientific question.