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Glacial changes, water cycle observations and mass balance developments on Stubacher Sonnblickkees, Salzburg, in recent years.

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The Stubacher Sonnblickkees, situated in the Hohe Tauern mountain range of the Austrian Alps, is a small northwest-exposed slope glacier with a surface area of about 1.5 km^2 at an altitude ranging between 3.050 m and 2.500 m above sea level.

Due to rough terrain, the glacier has a complex shape resulting in an irregular interlocking of accumulation and ablation patterns. It has been monitored since 1959 and mass balances, which are a useful tool for a better understanding of the glacier-climate relation, have been calculated by using semi direct (AAR) and direct glaciological methods.

Mass change time series show a mass gain of 11 Mill. m^3 between 1965 and 1981, followed by a continuous mass loss adding up to 26 Mill m^3 in 2004. Whilst 1965 was a very positive year with a mass gain of 3.5 Mill m^3, Stubacher Sonnblickkees lost 3.8 Mill m^3 in the extreme year of 2003 and altogether approx. 25 % of the total ice mass up to now. A hypothetical extrapolation of the last 20 years predicts that the glacier could disappear within the next 50 to 80 years.

Observing the genesis and development of new lakes around the glacier is also an important part of the monitoring programme. In 1990 “Lake Eisrandsee”, a small tarn situated at a sea level of 2500 m between the glacier snout and a rock barrier in the east of the glacier appeared for the first time. In 1994 it was surveyed using conventional geodetic instruments and a length of 80 m as well as a width of 30m was recorded then. Due to constant melting of the glacier, Eisrandsee has continuously grown in size. It is now (2004) 203 m long and 112 m wide with a max depth of approx. 8 m.

Terrestrial laser scanning as well as surveying using differential GPS was carried out in 2004 in order to achieve a detailed map of the lake and the surrounding glacier.

The hydrologic system of the recent lake is very complex and in order to understand the ongoing hydrological processes, Eisrandsee as well as its two (in)direct outlets (Keesbach and Eislbach), situated at different altitude, are monitored. Three automatic gauges with data loggers for water level and water temperature were installed in summer 2002, discharge measurements using current meters and tracer methods were carried out in order to achieve accurate discharge rating curves.

First results show, that in summer, due to high melting rates and low capacity of the sub-glacial flow system, the water level of the lake rises approx. 4 m until it reaches the outlet level of Eislbach, which acts as an overflow for the lake's discharge. In late autumn or early winter as the glacier melting rate is reduced due to lower temperatures, all the water is drained by the sub-glacial flow system towards Keesbach and no discharge is to be observed at Eislbach.

Daily fluctuations of the lake's water level combined with slightly delayed and different discharge reactions in the two brooks were also observed as well as regular temperature fluctuations depending on global radiation.

A special phenomenon was observed in spring 2004, when heavy rainfall on the frozen and snow covered lake as well as surface discharge from the glacier created a slush-water mixture, which caused a sudden rise of the water level lake in Eisrandsee and a small "glacier flood" in Eislbach. The reconstruction of this process was useful for the understanding of a similar event at Obersulzbach, where a bridge was destroyed in Mai 2002.