STUBACHER SONNBLICK KEES 2003 AND 2004, AUSTRIA (1:10000)

(Colour Orthophoto Map 2003 and Thematic-Topographic Map 2004)

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Within the framework of the long-term glaciological and glacial-hydrological measurement programme carried out on the glacier Stubacher Sonnblick Kees, situated in the Granatspitz Group (Hohe Tauern, Eastern Alps), new maps were produced primarily for mass balance calculation purposes but also to document area changes in the glacier, due to rapid mass loss caused by global warming. The project was carried out by the Department of Geography and Geology at the University of Salzburg in cooperation with the Hydrological Service of Salzburg.

In view of the extraordinary hot summer of 2003 in Central Europe, which resulted in a record mass loss in Alpine glaciers, an aerial photogrammetric survey was initiated just at the right time. It covered the area of the Pasterze, the largest glacier in the Austrian as well as the Eastern Alps, and the surrounding glaciers including the Stubacher Sonnblick Kees (note: this glacier is not to be confused with the famous meteorological observatory on the Hoher Sonnblick, which is situated 30 km to the east). The aerial photographs were taken on August 13, 2003, by Luftbild Fischer, Klagenfurt, and are of excellent quality. The scale of the images is, on average, 1:12000 due to a flight elevation of approx. 4800 m above the Adriatic Sea. In 2004, an ortho-photo using the DTM of the Bundesamt für Eich- und Vermessungswesen, Vienna was produced by students, supervised by B. Zagel and G. Griesebner, Salzburg, of the Department of Geography (now the Department of Geography and Geology).

The map from 2003, with a scale 1:10000, covers the Stubacher Sonnblick Glacier and the catchment area of the Lake Weißsee, which is used as a reservoir for the hydro power plant of the Austrian Federal Railways. It shows the situation of the accumulation area, which is reduced to a few snow patches; by the end of the mass balance year, September 11, 2003, almost no accumulation was left. Therefore, the mean ELA at 3080 m a.s.l. was above the highest point of the glacier and the AAR was only 0.006. Firn layers dating back to the 1960s have melted away since 1982, which was the beginning of an almost continuous mass loss up to the present. The mean specific mass balance was -2.870 m ($B = - 4.024 \times 10^6$ m³). In 2003, the glacier showed the highest yearly mass loss since the beginning of mass balance records in 1964 and probably even exceeded the most extreme year up until now, which was 1947. At the terminus of the glacier, situated at an altitude of 2500 m a.s.l. a proglacial lake developed. On July 27, 2006, the lake drained and the surface level was lowered by 6 m, stabilising at a final elevation of 2499 m a.s.l. according to the outflow situation. After the complete melting of the glaciated basin, the final length of the lake named Unterer Eisboden See, which means the Lower Glacier Basin Lake, will be approx. 400 m.

The basis for producing the 2004 map 1:10000 was elaborated by R. Braunshier in his thesis (2005). A calibrated conventional camera was used to take photos of the Sonnblickkees from different positions by H. Slupetzky in September 2004. The photos were evaluated by applying the photogrammetric PhotoModeler software, which led then to a DTM. Initially, W. Gruber (2002) used this software, which had originally been developed for architectural purposes, on the Cathedral Massif Glacier, B.C., Canada, and proved it to be an adequate method with satisfactory accuracy. Using the 2003 ortho-photo, the glacier edge was defined and outlined, showing that old snow was covering the ice border at higher altitudes and therefore not yet part to the glacier. The new contour lines were derived from the DTM, the accumulation / ablation patterns and the ELA were determined photogrammetrically.

The map of 2004 shows the areas of old snow, firn and ice and rock islands, which have been melting out more and more in recent years and thus adding considerably to the downwasting of the glacier. The ortho-photo of 2003 was used for the map background. A semi-direct method, derived from a function between the specific mass balance and the AAR, was used to calculate the mass balance for 2004 at the end of the natural balance year (September 9). A net mass budget of $+0.011 \times 10^6$ m³ was estimated. The ELA was calculated to be at 2755 m a.s.l. Therefore, on small glaciers with a surface area of only a few km², it is possible to use amateur photos, apply the PhotoModeler software to them and thus create, with reasonable accuracy, good results for the basic elements needed to produce new glacier maps.