



Glacier changes in the Glocknergruppe, Austria between 1969 and 1998

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Characteristic changes in glaciation of the mountain range “Glocknergruppe” for the last 30 years of the 20th century are documented and investigated using the recently completed Austrian glacier inventory. In 1969 the Glocknergruppe comprised 79 glaciers covering an area of 69 km². For the new inventory aerial photographs of this region were taken in 1998. A semi-automatic method (Würländer and Eder, 1998) was used for the photogrammetric analysis of these data, generating digital elevation models and digital orthoimages. The elevation maps from 1969 were digitised in order to enable a fully digital analysis using modern GIS technology.

The elevation models and the orthorectified aerial photographs formed the basis for mapping the glacier boundaries. In some areas extensive debris cover required a careful classification of the glacier boundaries using additional information, e.g. from old photographs. The largest glacier of Austria, the Pasterzen Kees with a size of more than 15 km², is situated in the Glocknergruppe. The individual area of all other glaciers in this mountain range is less than 5 km², while 80% of the glaciers showed less than 1 km² in area already in 1969. The geographic distribution of glacier sizes did not change during the 29 years between the observations, indicating a rather uniform glacier evolution for the entire region. One of the glaciers, however, disappeared during this time span. The total glaciated area decreased by 13 %, which is similar to observations in the Stubai Alps. Compared to changes in glacier size, volume change is an even more significant indicator of the climatic impact on glacier reactions. Glacier volume changes could be calculated from the differences of the digital elevation models of 1969 and 1998. The results have been analysed in the context of aspect and mean elevation of the single glaciers. The loss of glacier volume for the Pasterzen Kees (48% of the total loss in the region) is about the same than the loss for all other glaciers together (52%). The relative change in glacier size of –8 % for

the Pasterzen Kees, however, is rather small compared to most of the other glaciers. Variations of the change in glacier size increase with decreasing glacier size. Especially glaciers smaller than 1 km^2 show variations of almost 100%. Tongue elevations of glaciers exposed to southerly directions are about 200 m higher than for glaciers exposed in northerly directions. Between glaciers oriented directly South and North this difference is almost 400 m. Mean elevation changes are larger for glaciers facing from Northwest to Southwest with a maximum in the SW direction (-10 m), whereas the lowest elevation changes are observed for glaciers directed to the East.