



Mapping and analysis of the glacier area during the Little Ice Age-maximum in Jotunheimen, Norway

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Glaciers are very sensitive to climate changes and can, therefore, be used as climate indicators. Additionally, glaciers represent an important factor in power generation. In Norway, 98% of the domestic electricity is generated by hydropower and 15% of the runoff originates from glaciated river basins. The study area of Jotunheimen is located in central South Norway (61.5° N, 8.3° E). The recent glaciers range from 1,270 to 2,300 m a.s.l. Glaciers in Norway are generally exposed to a maritime influence. However, there is a strong West-East-gradient and glaciers become more continental eastwards. Thus, Jotunheimen lies in a transitional zone between maritime and continental glaciological regime. It represents the most continental glaciated area in Norway.

The aim of this study is the mapping of the glacier area during the Little Ice Age (LIA)-maximum not only at several glaciers, but on a regional scale for an implementation of the results into the Norwegian glacier inventory. The method for mapping is remote sensing, using aerial pictures and a satellite image. The mapping has been based on a digital topographical map and the glacier outlines from the 1980s. In the aerial pictures, moraines determine the maximum LIA-extent. Regarding the satellite image (Landsat 5 TM), bands 5–4–3 and 4–3–2 composites have been used to detect the glacier foreland with bare rock or only sparse vegetation cover. These areas were digitized manually applying a GIS-software. Additionally, geochronological maps, made for several glaciers by field-work using lichenometry, served for adjust-

ment and verification of the mapping. Finally, one single outline for each glacier has been derived.

LIA-dating in Jotunheimen has been done by lichenometric studies on the moraines. Due to a spatial regional pattern, the area was divided in two parts. West and Central Jotunheimen experienced the LIA-maximum around AD 1750, East Jotunheimen some decades later. Because of the rather similar extent of these two advances, the different dates can be merged to 1750 to avoid any further differentiation. To verify the fit of the results, an error analysis has been implemented on the areas for the three different sources (aerial pictures – satellite image – geochronological maps). A sample of 18 glaciers has been analyzed and all areas fell within the 95%-confidence interval. Hence, the resulting areas should have a quite sufficient quality.

At the LIA-maximum, there have been 377 glaciers in Jotunheimen with an entire area of 399 km². Supplementary studies have been investigated only on 95 glaciers due to variations in hydrological basins and identification codes of the glaciers at different times. Since 1750, the area of these glaciers has declined from 241 km² to 174 km² in the 1980s and to 163 km² in 2003. This means an areal reduction of 27% from 1750 to the 1980s and of 32% from 1750 to 2003. There are no significant differences in areal change between the maritime and continental parts of Jotunheimen.

Assessing the inventory data (length, maximum and minimum altitude), based on LIA-glacier areas and a DEM, will be the next step in the project. These results will be used as input data in a parameterisation to estimate further glaciologically relevant parameters, e.g. flow velocity. The generation of glacier outlines will be extended to other glaciated areas in Norway.