



## **Creating a new Norwegian glacier inventory using Landsat imagery – methods, challenges and results**

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Glaciers cover nearly 1% of the land area in mainland Norway. A detailed survey of the total glacier area has not been performed since the compilation of glacier inventories in the mid 1980s for southern Norway and the early 1970s for northern Norway. Here we report on a new glacier inventory derived from Landsat imagery.

One of the major challenges was to find suitable Landsat scenes as few good scenes were available due to frequent seasonal snow and clouds. After careful inspection 12 Landsat scenes over the period 1999-2006 were selected for deriving the new inventory. Glacier outlines were mapped using well established image segmentation methods for all scenes. Orthophotos were used for training and validation in test regions. Comparison with validation data showed that glacier mapping with Landsat data was straightforward and accurate.

Manual corrections for debris cover, glacier-lake interfaces, clouds or cast shadow were done when necessary. Only very few glacier outlines had to be corrected for debris cover since many glaciers in mainland Norway originate from ice caps. A much larger manual effort was required for excluding lakes that were wrongly classified as glaciers. Another challenge was the presence of seasonal or perennial snow fields in the satellite scenes. This was solved by manually classifying snow patches and excluding them from the inventory. Drainage divides and topographic inventory parameters were derived from a 25 m national digital elevation model for all glaciers.

The new glacier outlines were linked to previous inventories and outlines available from historic topographic maps to derive changes in area in several regions. The calculated changes reveal a large variation. While in the Svartisen region the overall area change from 1968 to 1999 was close to zero, the area change in the northernmost region, Finnmark, was -28% from 1966 to 2006. Calculation of area changes were in many cases challenging and uncertain, as different sources had to be compared (imagery, maps, inventories) and due to adverse snow conditions.