6.4 Scandinavia

The majority of the ice on the Scandinavian Peninsula is located in southern Norway. Some glaciers and ice caps are also found in northern Norway and the Swedish Kebnekaise mountains. Scandinavia is one of the regions with the most and longest reported observation series.

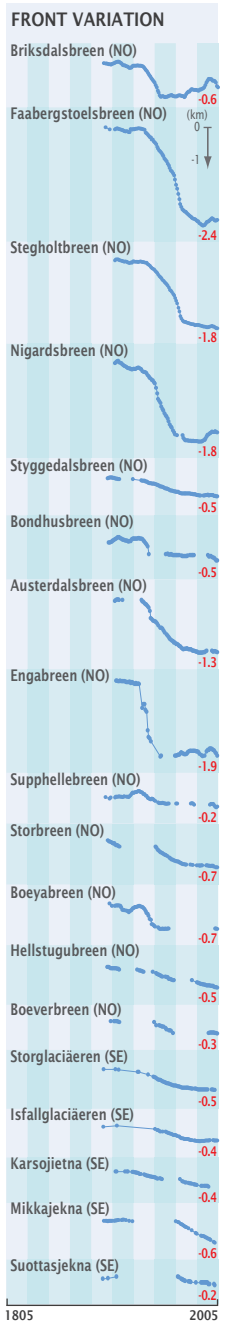
Ice covered area (km²): 2 940

Front variation

number of series:	65
average number of observations:	30
average time length (years):	53

Mass balance

number of series:	39
average number of observations:	16



The Scandinavian Peninsula is located between 60° and 71° north. Galdehøpiggen (2469 m asl) in southern Norway is the highest peak on the Peninsula, and Kebnekaise (2104 m asl) is the highest summit in northern Sweden. Due to the combination of high latitude and the moisture from the North Atlantic, many glaciers and ice caps developed, mainly in Norway, all within 180 km of the west coast (Grove 2004). The greater part of the ice cover is concentrated in southern Norway, namely in Folgefonna, Hardangerjøkulen, Breeheimen, Jotunheimen, and Jostedalsbreen, which is the largest ice cap of mainland Europe (Østrem et al. 1988, 1993). In northern Norway there are the Okstindan and Svartisen ice caps, glaciers in Lyngen and Skjomen (Østrem et al. 1973), as well as in the adjacent Kebnekaise region in Sweden (Holmlund and Jansson 2005). The relevance of glaciers and their changes to the lives of the Scandinavian people is reflected in the extensive observation record. Farms and farmland buried by ice, resettlements and reduced taxes due to the Little Ice Age glacier advances are reported in historical documents (Grove 2004). In today's Norway, 15 per cent of the used runoff comes from glacierised basins and 98 per cent of the electricity is generated by hydropower production (Andreassen et al. 2005).

After having probably disappeared in the early/mid Holocene (Nesje et al. 2008), most of the Scandinavian glaciers and ice caps reached their maximum extent in the mid-18th century (Grove 2004). Blomsterskardsbreen, the southern outlet glacier of Folgefonna, is one of the exceptions, reaching its maximum extent at the beginning of the 20th century (Grove 2004). Annual front variation measurements began in Norway and Sweden at the turn to the 19th century. Several glaciers have been observed on a regular basis for more than a century. A total of over 60 Scandinavian front variation series are available. Storglaciären in Sweden provides the longest existing mass balance record for an entire glacier with continuous seasonal measurements since 1946. Mass balance measurements in Norway started at Storbreen (Jotunheimen) in 1949. Overall mass balance measurements have been reported from 39 glaciers, with 8 continuous series since 1970.


Fig. 6.4.1 Nigardsbreen

After their enlarged state in the 18th century and the minor retreat trend with small frontal oscillations up until the late 19th century, Scandinavian glaciers experienced a general recession during the 20th century with intermittent periods of re-advances around 1910 and 1930, in the second half of the 1970s, and around 1990; the last advance stopped at the beginning of the 21st century (Grove 2004, Andreassen et al. 2005). Local precipitation variances superimposed on these generally coherent patterns, cause variations to occur on individual glaciers. The maritime glaciers (e.g. Hardangerjøkulen, Nigardsbreen, Ålfotbreen, Engabreen) with large annual mass turnover started to gain mass after the early 1960s, whereas the more continental glaciers (e.g. Storglaciären, Gråsubreen, Hellstugubreen, Storbreen) continued their ice loss. Since 2001 all monitored glaciers have experienced a distinct mass deficit (Andreassen et al. 2005).

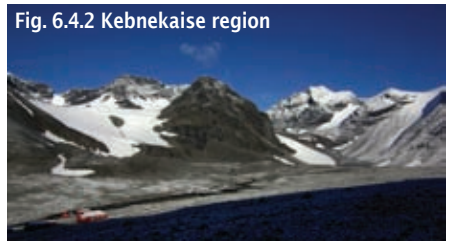
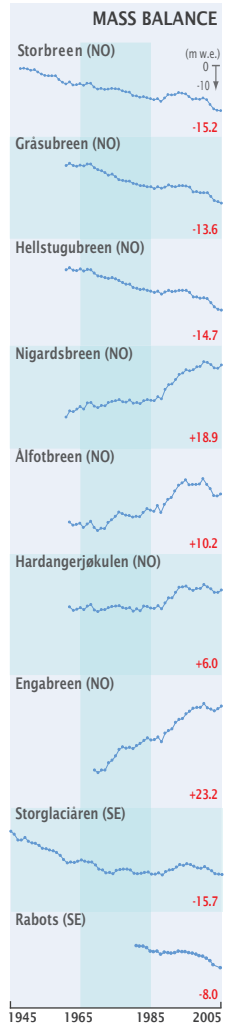


Fig. 6.4.2 Kebnekaise region



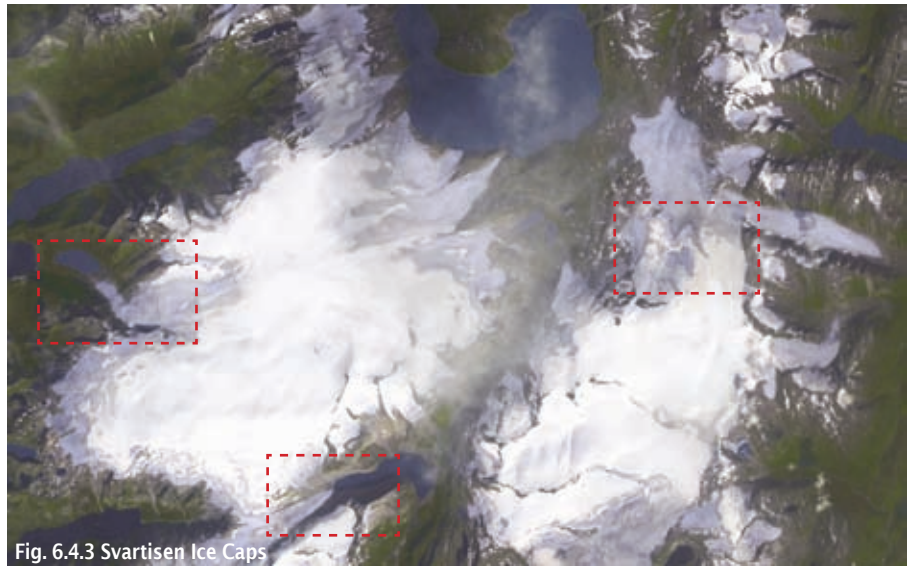


Fig. 6.4.3 Svartisen Ice Caps


Fig. 6.4.3a

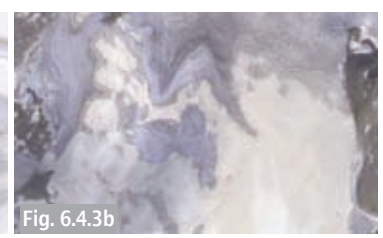


Fig. 6.4.3b


Fig. 6.4.3c

Fig. 6.4.1 View toward the proglacial lake and the tongue of Nigardsbreen, Norway, Jostedalsbreen Ice Cap in the background (photograph taken in July 2005). Source: I. Roer, *University of Zurich*, Switzerland.

Fig. 6.4.2 Tarfala research station in the Kebnekaise region (Sweden), with Isfallsglaciären in the background (photograph taken in August 2007). Source: P. Jansson, *University of Stockholm*, Sweden.

Fig. 6.4.3 Svartisen Ice Caps, Norway, with Engabreen outlet glacier to the middle left. Source: ASTER satellite image (35x21 km) and close-ups, 11 August 2006.