Inventory of Norwegian Glaciers

Liss M. Andreassen and Solveig H. Winsvold (Eds.)

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Cover photo: Hellstugubrean (Hellstugubreen). Photographer Klaus Thymann took this photo when he joined the editors/authors Liss Andreassen and Solveig Winsvold on summer field work in Jotunheimen in August 2011. Project Pressure documents the world's changing glaciers.

Back cover: Rundvassbreen from Blåmannsisen, September 2005. Part of Rembesdalskåka from Hardangerjøkulen, October 2007. Photos: Miriam Jackson and Hallgeir Elvehøy, NVE. Illustrations: Section of Landsat scene of Jostedalsbreen showing Nigardsbreen in the middle. Section of inventory map.

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Abstract: This inventory gives an updated overview of glaciers in mainland Norway. Satellite images from the Landsat sensors from the period 1999-2006 were used to identify and map the present extent of the glaciers.

Key words: Glaciers, inventory, orthophoto, Landsat, satellite

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Preface

This inventory of Norwegian glaciers in book form is a result of a joint effort over several years. The work has been conducted piece by piece, and on and off, along with other projects and tasks. Finally we have a complete inventory available in the form of this book and as digital outlines in NVE's online map service NVE Atlas. The digital glacier outlines also form a contribution to the international Global Land Ice Measurements from Space (GLIMS) database, which is designed to hold outlines and inventory information of all glaciers in the world primarily using data from optical satellites.

Several persons have been involved in the project leading to this inventory book. Liss M. Andreassen and Solveig H. Winsvold, NVE, have been editors of the book as well as producing the text, figures, tables and maps and selecting the photos. Rune Stubrud, NVE, has made a huge effort producing the layout and design of the book and managed numerous updates from the editors. Jon Endre Hausberg, formerly at NVE, selected Landsat imagery and orthorectified many of them. Astrid Voksø, NVE, designed ArcGIS datamodels used for this new inventory. Astrid and others at the Section for Geoinformation at NVE gave general advice on the GIS work. The glacier mapping is a joint effort by Liss M. Andreassen, Solveig H. Winsvold, Jon Endre Hausberg and Frank Paul, University of Zürich, whom produced outlines for the different regions. Frank Paul has been involved in many parts of the work, from commenting on Landsat imagery at the start of the project to contributions to the text to the final inventory book; all the time generously sharing his scientific know-how. NVE-colleagues Hallgeir Elvehøy, Bjarne Kjøllmoen, Miriam Jackson, Kjetil Melvold and Sindre Engh are thanked for their helpful contribution with comments on names, text and tables. John Brittain, NVE, kindly looked through and corrected the English. We also want to thank Hans Olav Hygen, Norwegian Meteorological Institute, and Bruce Raup from the National Snow and Ice Data Center for their assistance with figures and to Samuel Nussbaumer, University of Zurich, for providing information on historical photos and paintings. Special thanks also go to the many photographers who contributed. Atle Nesje, University of Bergen, Jon Ove Hagen, University of Oslo, Rianne Giesen, University of Utrecht and Al Rasmussen, University of Washington, are all thanked for comments on subsections of the text. Moreover, we thank Andreas Kääb, University of Oslo, for valuable advice in the initial phase of the inventory work.

The work leading to the inventory has been supported by the CryoClim project sponsored by the Norwegian Space Centre and the European Space Agency (ESA). The contributions of Frank Paul were also made possible through funding from the ESA projects GlobGlacier and Glaciers_cci. The CryoClim project, the Norwegian Space Centre and the Norwegian Glacier Museum & Ulltveit-Moe climate centre provided financial support to cover part of the publication costs of this inventory.

Oslo, October, 2012

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Sammendrag

Dette atlaset over breer i Norge består av to deler: en tekstdel med bakgrunn om norske breer, beskrivelse av metoder og resultater, og en kart- og tabelldel som viser breene.

Breene er kartlagt ved hjelp av satellittbilder fra Landsat-sensoren i perioden 1999-2006. En semi-automatisk metode ble benyttet. Den utnytter forskjellene i de spektrale egenskapene av bre og snø sammenlignet med annet overflatemateriale. I et pilotstudie av breer i Jotunheimen ble metoden testet ut og validert, før metoden ble benyttet til å kartlegge alle breer i Norge. Alle kartlagte snø- og ismasser ble sjekket visuelt ved å bruke Landsat-bildene og digitale topografiske kart i bakgrunn, samt ortofoto fra norgeibilder.no hvor disse var tilgjengelig. De kartlagte polygonene ble manuelt klassifisert som 'bre', 'mulig snøfelt' eller 'snø'. Manuelle korreksjoner for å inkludere morenedekket bre, redigere bort sjøer som var klassifisert som bre og breer dekket av skyer eller i skygge ble foretatt hvor det var nødvendig. Alle breer som skulle være med i det nye atlaset fikk en unik ID. Sammensatte breer ble delt inn i breenheter ved å bruke hydrologiske vannskiller. Mange mindre polygoner som ble klassifisert som 'mulig snøfelt' pga. form, størrelse eller usikkerhet vedrørende isinnhold fikk ikke ID og er derfor ikke tatt med i dette breatlaset. Brenavn ble tilordnet både breenheter og sammensatte breer. For å være konsistente brukte vi stavemåte fra digitale topografiske kart fra Statens kartverk selv om disse i noen tilfeller avviker i forhold til tidligere breatlas.

Totalt er 2534 breer (3143 breenheter) tatt med i dette breatlaset. Av disse er 1252 breer (1575 breenheter) i Sør-Norge og 1282 breer (1568 breenheter) i Nord-Norge. Det totale brearealet er 2692 km^2 ± 81 km^2 (anslår ± 3% som usikkerhet). Den største delen, 1523 km^2 (57%), er lokalisert i Sør-Norge, og 1169 km^2 (43%) i Nord-Norge. I tillegg utgjør ca. 400 polygoner klassifisert som 'mulig snøfelt' og uten ID 24 km^2. Det totale brearealet inkludert disse enhetene er 2716 km^2. Breer og flerårige snø- og ismasser utgjør dermed ca. 0,7% av landarealet i Norge.

Antall breer tatt med i dette breatlaset er over 50% høyere enn de 1627 breene som ble inkludert i de to foregående atlasene (Atlas88 og Atlas73). Denne økningen skyldes hovedsakelig at flere små enheter er tatt med sammenlignet med tidligere atlas. Økningen i antall breer kan forklares ved endring i metoden for å kartlegge breer. I de foregående atlasene ble alle breer manuelt inntegnet, mens i dette atlaset er nesten all snø og is automatisk kartlagt, med unntak av noen breer i skygge eller som var dekket av skyer. Noen av de minste enhetene som er inkludert er flerårige ismasser, eller det kan også bare være snø i tilfeller hvor det var mye gjenværende snø i satellittbildet. Særlig noen av bildene brukt for Nord-Norge har en del snø, og kan derfor overdrive breutbredelsen noe.

Nykartleggingen av Norges breer er blitt brukt til å beregne endringer i breutbredelse ved å sammenligne med topografiske kart i enkelte områder. Resultatene viser en stor variabilitet i endring av breareal. I Svartisen-området har breenes areal blitt redusert med 1%, mens arealet av fem platåbreer i Finnmark er redusert med 28% fra 1960-tallet til den nye kartleggingen.

Summary

This inventory of the glaciers in mainland Norway in book form consists of two parts: a text section with background information, description of the methods used and main results, and a map and table section that includes all identified glaciers.

To derive this new inventory satellite images from the Landsat sensors from the period 1999-2006 were analysed. The suitability of a semi-automatic band-ratio method was first applied to map glaciers in a test region in Jotunheimen, before the method was applied to map all glaciers in Norway. All automatically mapped snow and ice polygons were visually inspected using composites of satellite image bands, digital topographic maps and orthophotos where available. The polygons were manually classified as 'glaciers', 'possible snowfields' or 'snow'. Manual corrections for debris cover, glacier-lake interfaces, clouds or cast shadow were made where necessary. All polygons to be included in this new inventory were assigned a unique ID. Glacier complexes were divided into glacier units using drainage divides. Many smaller polygons which had been classified as possible snowfields due to size, shape or due to uncertainty regarding ice content were not assigned IDs and were therefore not included in this inventory book. Glacier names were assigned both to individual glacier units and to glacier complexes. To be consistent we used the spelling from the digital N50 topographic maps produced by the Norwegian Mapping Authority, although in some cases these are different to those used in the previous inventories.

In total 2534 glaciers (3143 glacier units) were defined in the new inventory. Of these 1252 glaciers (1575 glacier units) were in southern Norway and 1282 (1568 glacier units) were in northern Norway. The total glacier area is 2692 km^2 ± 81 km^2 (using ± 3% as uncertainty), the larger part, 1523 km^2 (57%), is located in southern Norway, and 1169 km^2 (43%) in northern Norway. In addition, about 400 polygons classified as 'possible snowfield', and without glacier ID, amount to 24 km^2. The total glacier area including these polygons is 2716 km^2. Glaciers and perennial snowfields in Norway thus cover about 0.7% of the land area in mainland Norway.

The number of glaciers included in this inventory is nearly 57% larger compared to the 1627 glaciers reported in the previous inventories of Norway (Atlas 88 and Atlas 73). The increase in number of glaciers is mainly due to inclusion of many small entities that were not included in the old inventories. The difference in numbers can be explained by the change in the methods applied to map glaciers. In the old inventories glaciers were manually drawn, whereas in this Landsat-derived inventory almost all snow and ice was automatically mapped, except debris covered parts and bodies in cast shadow. Some of the smaller entities we included in this new inventory are perennial ice masses, and some may even be seasonal snow where snow conditions were adverse for mapping. In particular some of the scenes used for northern Norway have more seasonal snow and may thus overestimate glacier extents.

The new digital glacier outlines of Norway have been used to assess glaciers changes by comparison with topographic maps in selected regions. Results show a large variability in the regions studied so far, ranging from −1% in the Svartisen region to −28% for the five northernmost ice caps.

The Norwegian Space Centre, the CryoClim project and the Norwegian Glacier Museum & Ulltveit-Moe climate centre provided financial support to cover part of the publication costs of this inventory.

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Part 1 Background and methods

Glaciers cover 0.7% of the total land area of mainland Norway. They have importance for hydropower production, climate research, local life and tourism, but are also a source of natural hazards. Monitoring of Norwegian glaciers includes field measurements of glacier mass balance and length changes as well as overall surveys from aerial and space-borne imagery. In this inventory the glacier extent has been mapped using imagery from the Landsat sensor acquired over a 7-year period (1999-2006). Part 1 of the inventory consists of four chapters giving background information on previous inventories and on glaciers in Norway, a description of the methods used for producing this new inventory and a presentation of the main results.

Storbrean (Storbreen) in Jotunheimen, August 2011.
Photo: Klaus Thymann, Project Pressure.

Introduction

Motivation

Glaciers in Norway are of interest for several reasons including hydropower production, climate research and tourism. Tourists may come to admire glaciers from a distance or decide to take a hike on the glacier itself, and climbers can encounter a glacier during a climbing expedition. Glaciers can be dangerous either due to the danger of falling into a crevasse or because of natural hazards such as glacier lake outburst floods or ice avalanches. Another important aspect of glaciers is their role as sensitive climate change indicators. The advances and retreats of mountain glaciers are one of the most visible signs of the effects of climate change (Lemke and others, 2007). Many glaciers in Norway are in regions with considerable hydropower potential. Glacier influence on river discharge and hydropower production has thus resulted in an extensive glacier measurement record. A detailed survey of the total glacierized area in Norway has not been performed since the previous glacier inventories were compiled in the mid 1980s for southern Norway (Østrem and others, 1988) and the early 1970s for northern Norway (Østrem and others, 1973). Hence, an updated survey of Norwegian ice masses is required in order to get an overview of the present extent of the glaciers and their changes. Use of satellite images enables semi-automated mapping of glacier outlines, so in this inventory the glacier extent has been mapped using imagery from the Landsat sensors acquired over a 7-year period (1999-2006). The new inventory also contributes to the Global Land Ice Measurements from Space (GLIMS) initiative which is designed to survey the world's glaciers using data primarily from optical satellite instruments (www.glims.org, Raup and others, 2007).

Previous inventories

The first detailed list of the numbers and areas of glaciers in Norway was made by Olav Liestøl in 1958. His list was first printed as a small booklet, but later included in the publication "Glaciers and Snowfields in Norway" (Liestøl, 1962). The list was based on topographic maps from the Norwegian Geographical Survey (Norsk Geografisk Oppmåling) at a scale of 1:100,000 and aerial photographs from the 1940s and 1950s for some regions. According to this assessment the total area of glacier and snowfields in Norway was estimated to be about 3900 km^2 and the number of glaciers about 1750. Unfortunately, some of the topographic maps used were old and inaccurate, and did not differentiate between glaciers and snowfields. In many cases the glaciers were drawn too large (Østrem, 1960; Østrem and Haakensen, 1993).

Glacier hiking in Smørstabbrean, Jotunheimen. View looking west with the Hurrungane mountain massif and Fannaråkbreen in the background. Photo: Peter Zachrisson. Left: Part of Søndre Folgefonna, October 2011. Photo: Solveig H. Winsvold, NVE.

There may be high water discharge from glaciers. A sudden outburst flood from lake Øvre Messingmalm in August 2005 drained Rundvassbreen, part of Blåmannisen. The photo is taken the day after the flood. Photo: Hans Martin Hjemaas.

The first detailed glacier inventory of southern Norway was published in 1969 (Atlas69; Østrem and Ziegler, 1969). Identification of the glaciers was based on photographs from the period 1965–1968 as well as on topographic maps at scales of 1:50 000 and 1:100 000. Glacier area was calculated by mechanically planimetering the surface. A revised and extended glacier inventory for southern Norway was completed in the late 1980s based on aerial photography for the period 1969–1981 (Atlas88; Østrem and others, 1988). The first inventory of northern Scandinavia was compiled in the early 1970s as a joint inventory of glaciers in northern Norway and Sweden (Atlas73; Østrem and others, 1973). The inventory was based on maps and aerial photographs from the 1950s and 1960s. All three inventories consist of tabular data and sketch maps displaying all identified glaciers. The inventories divided the composite glaciers and ice caps into glacier units by following the water divides so that glaciers that drained into different rivers were divided into separate units. Each glacier unit was given a running number, a glacier number (glac no) between 1 and 110 within each hydrological basin. Sketch maps at a scale of 1:250 000 displayed all the identified glaciers. The water system number together with the glacier number gave a unique identification (ID). Basic inventory data such as glacier name (if known), length, area, and minimum and maximum elevations were given in the tables. The Atlas73 and Atlas88 also contained the mean aspect direction of the accumulation and ablation areas and information on glacier types and morphology following the UNESCO guidelines (UNESCO, 1970). The work was based on existing maps at a scale of 1:50 000. Between the first and the second inventories of southern Norway, maps were updated for most regions and the drainage divides were updated. Both the division of glaciers complexes into units and the location of drainage divides therefore differ between these two inventories.

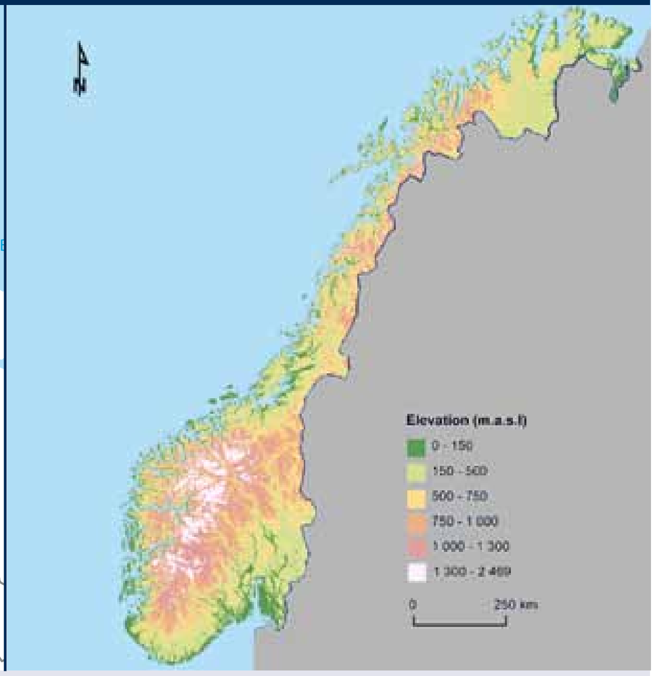
Ice climbing on Nigardsbreen.
Photo: Hallgeir Elvehøy, NVE.

The Atlas69 and Atlas73 inventories revealed a total glacier area in Norway of 2634 km^2, of this 1617 km^2 (61%) in southern Norway and 1017 km^2 (39%) in northern Norway. The total number of glaciers and glacier units was 1627 and 2053 respectively. The second glacier inventory of southern Norway (Atlas88) revealed a glacier area of 1592 km^2, slightly smaller than the first inventory.

Outline of this inventory

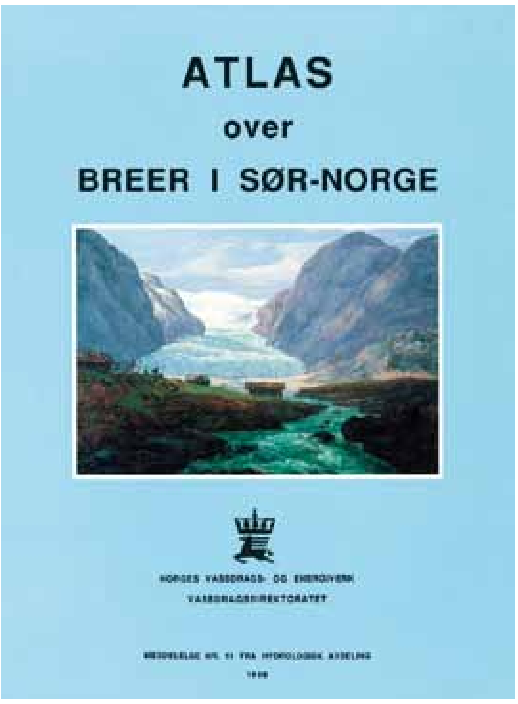
This new inventory is divided into a text section and an inventory map and table section. In the next chapter we provide background information on climate and glaciers in Norway. In the methods chapter we describe the methods used for producing the new inventory and in the results chapter we give an overview of the glacier statistics. Some examples of glacier change analyses are also provided. In the maps and table section all glaciers are included. The Appendices provide further information on glacier names and particular investigations.

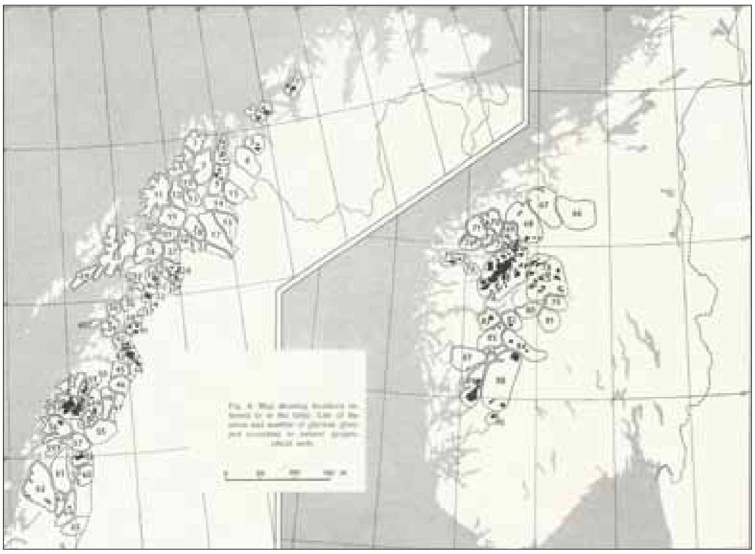
About Norway

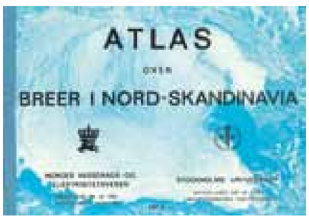


Norway is located in northern Europe on the western and northern part of the Scandinavian Peninsula, bordering the North Sea in the southwest, the Norwegian Sea (North Atlantic Ocean) in the west and the Barents Sea to the northeast. Norway shares a border with Sweden to the east, Finland in the northeast and Russia in the far northeast. Mainland Norway has an area of 385,199 km^2. Norway also includes Svalbard and Jan Mayen in the Arctic. When we refer to Norway in the rest of the book we refer to mainland Norway only. Norway has a long and rugged coastline and spans 13 degrees of latitude (from ca. 58 to 71°N). Areas above the Arctic Circle (67°N) have periods with midnight sun in summer and periods with no sunlight in winter. The highest peak is Galdhøpiggen 2469 m.a.s.l. The mean elevation of the country is about 460 m.a.s.l.

Previous inventories







The first list of number and areas of glaciers in Norway as published in Liestøl (1962) and subsequently by the inventories Atlas69, Atlas73 and Atlas88.

Background

Climate in Norway

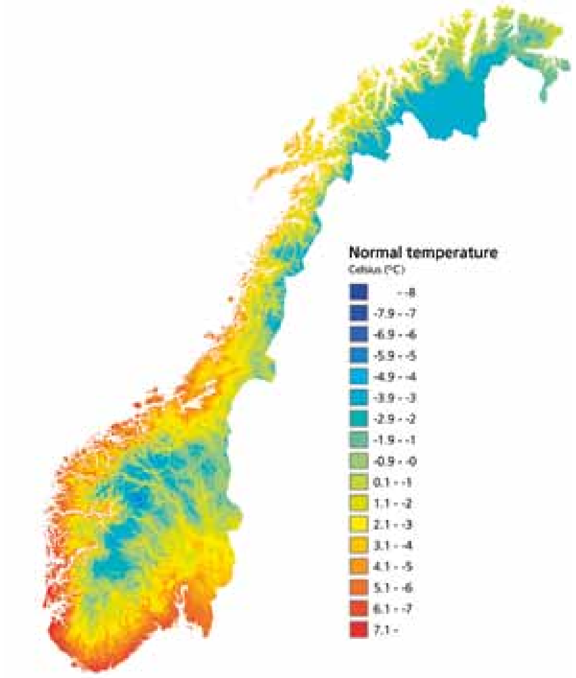
Norway's long coastline and its rugged topography have a strong influence on climate. Climate conditions vary greatly within the country, from a wet maritime climate along the coast towards drier conditions in the interior. Due to the Gulf Stream and the prevailing westerly winds, Norway's coast remains ice free in winter and generally the climate is warmer than the latitude would otherwise imply.

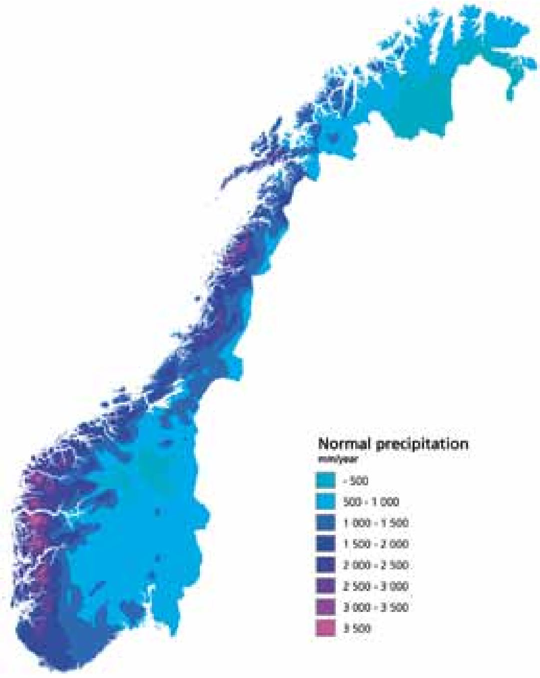
The mean annual temperature for Norway is approximately +1 °C. The highest annual temperatures can be found in the coastal areas of the southern and western part of Norway and mean annual temperatures vary from +6 °C along the western coast to below −4 °C in high mountain regions or in the northern interior (Hanssen-Bauer and others, 2009). Temperatures also decrease from south to north due to increasing latitude. Along the coast the maritime climate results in smaller temperature variations over the year than in the interior parts.

The mean annual precipitation in Norway is about 1500 mm. Most of the precipitation in Norway falls as frontal precipitation where warm air rises above cold air, cools and releases precipitation. The polar front results in humid air masses over Norway in all seasons of the year, but the cyclone activity is greatest in autumn and

The NAO-index

Norway's climate is strongly influenced by large-scale circulation patterns and westerly winds are dominant. Much of the variation in weather from year to year, in particular the winter precipitation, may be attributed to variations in circulation and wind patterns in the North Atlantic Ocean. The North Atlantic Oscillation (NAO) index is widely used to describe the variation in the oscillation. Definitions vary, but it may be defined as the anomaly in sea level pressure difference between the Icelandic low pressure system and the Azores high pressure system in the Atlantic Ocean. When the NAO is positive, the coast of Norway experiences warm and wet winters resulting in high winter precipitation on the glaciers. When the NAO is negative, the winters are colder and drier with less precipitation on the glaciers (Hanssen-Bauer and Førland, 1998; Nesje and others, 2000).





Mean annual temperature and precipitation in Norway for 1961-1990. Figure provided by Hans Olav Hygen, met.no.
Left: Glacier ice. Photo: Bjørn Lytskjold, NVE.

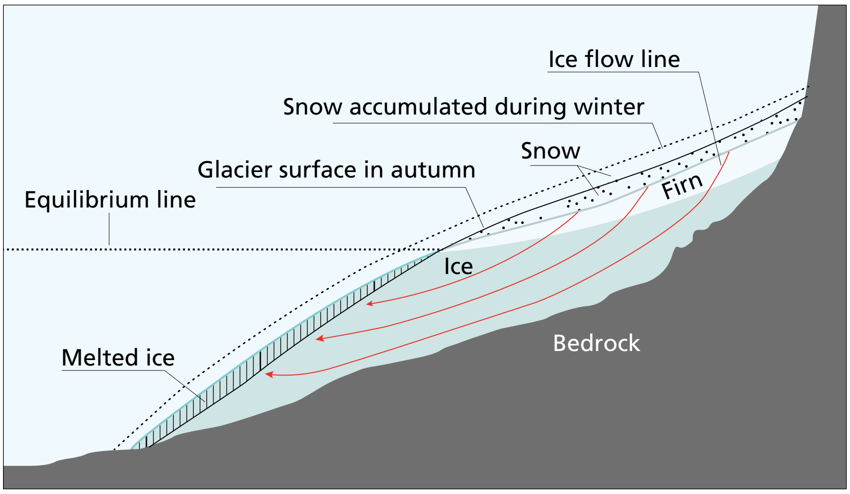
winter. Other common precipitation types are orographic and showery precipitation. Orographic precipitation occurs when moist air masses meet the coast of Norway and are uplifted. As the air rises and cools, orographic clouds form and release precipitation. Showery precipitation is typical in summer when surface heating is strongest, with unstable air giving vertical currents. The rising air cools and precipitation is released.

There are large spatial differences in the annual precipitation in Norway. Precipitation amounts decrease from west to east due to the shading effect of the coastal mountains. The precipitation also decreases towards the north; mainly due to lower air temperatures. The largest amounts are found ~50 km inland from the coast of western Norway. In these areas the frontal and orographic precipitation dominates, and most of the precipitation occurs during autumn and winter. Showery precipitation occurs most frequently in the interior. Here summer is the wettest part of the year, and winter and spring are the driest (sources: met.no/English/Climate_in_Norway/; Hanssen and Bauer, 2009).

The large spatial variation in precipitation regime is also found at the glaciers, there is a strong gradient in winter precipitation from west to east in southern Norway. At Ålfotbreen in the wet western parts, snow amounts of up to 8-10 m are not unusual, whereas Gråsubrean, 200 km to the east and one of the most easterly located glaciers, snow amounts are on average only one fifth of those of Ålfotbreen.

What is a glacier?

A glacier is most simply defined as a mass of perennial ice on land that shows evidence of glacier flow (Post and Lachapelle, 2000). By including movement in the definition, perennial snowpatches are thus excluded. A glacier is formed when fresh snow accumulates year after year on snow that did not melt during the previous summer. Glaciers are thus created where summer temperatures are not high enough to melt all the winter snowfall or where accumulation exceeds melt (and other mass loss). The



Schematic illustration of cross-section of a typical valley glacier. Before the melting season starts snow covers the whole glacier. The glacier consists of ice in the lowermost parts and ice and firn and snow from previous winters in the uppermost parts. In autumn the ablation area has lost all winter snow and some ice, whereas in the accumulation area there is some remaining snow. Ice flows from the upper to the lower parts to compensate for the melting. The boundary between the accumulation and accumulation areas is the equilibrium line. Graphics: Rune Stubrud, NVE.

snowpack grows thicker, snow transforms to firn and gradually into ice. Under its own weight the ice starts to deform and begins to flow towards lower elevations where it melts due to higher temperatures. The annual mass balance of a glacier is the sum of accumulation and ablation, or the winter and summer balance. Accumulation is all processes that add to the mass of the glacier, snowfall being the main process. Ablation is all processes that reduce the mass of the glacier, the main processes being melting and calving. Calving may be a substantial part of the ablation on glaciers terminating in lakes or the sea. When the annual balance averaged over the glacier is positive the glacier grows, and when the annual balance is negative the glacier shrinks. For a glacier to be in balance, the mass surplus in the uppermost area (called the accumulation area) is balanced by the mass deficit in the lowermost areas of the glacier (called the ablation area). The equilibrium line separates the accumulation and ablation areas, and defines the points where the mass balance is zero. The equilibrium line

Glacier terms

Glacier: A glacier is a perennial mass of ice, and usually firn and snow, originating on the land surface by the recrystallisation of snow or other forms of solid precipitation and showing evidence of past or present flow.

Ice: Water in the solid phase.

Firn: Snow that has survived at least one ablation season, but has not been transformed into glacier ice.

Superimposed ice: Ice accumulated on the current summer surface by refreezing of ice or water.

Glaciated: Covered by glacier ice in the past, but not at present.

Glacierized: Containing glaciers or covered by glacier ice today.

Glaciation level: The average of the elevations of the highest unglacierized peak and the lowest glacierized peak.

Source: Mass balance glossary by Cogley and others (2011).

Aerial photo of Trollbergdalsbreen and Hanspolsabreen, northeast of Svartisen. In the ablation area all previous winter snow has melted and bare ice is exposed. In the accumulation area snow from the previous winter still remains. The boundary between the two marks the transient snowline which moves upwards throughout the ablation season. The end-of-summer snowline defines the annual equilibrium line when there is no superimposed ice.
Photo: Fjellanger Widerøe AS, 1998.

Crevasses are typical features of glaciers and may be up to 30 metres deep on Norwegian glaciers. The picture shows part of Nigardsbreen.
Photo: Ole Magnus Tønsberg, NVE.

altitude (ELA) varies from year to year depending on the amount of accumulation and ablation each year. Snow accumulation is highly variable on a glacier, also within the same altitude. Ablation may also vary due to local topography. The ELA does not usually strictly follow an elevation contour line, but may have a patchy appearance.

Crevasses are a characteristic feature of glaciers and their pattern can be chaotic. Crevasses are deep cracks caused by stretch tension. Tensional fractures in the ice occur when ice flow changes due to narrowing, expanding or curving. The direction of the crevasses is dependent on the velocity of the ice, changes in velocity and the direction of flow. Due to the

Glacier melt

Whereas the winter accumulation (and balance) on glaciers in Norway is mainly a result of snow precipitation and redistribution of snow, glacier ablation is more complex. The amount of ablation depends on the total energy available for melt. The energy balance at the glacier surface is the sum of incoming and reflected solar (shortwave) radiation, of incoming and outgoing longwave radiation and the turbulent (sensible and latent) heat fluxes. In addition, other terms as subsurface heat flux and rain flux will contribute, but are found to be small for Norwegian glaciers (Giesen and others, 2009). Energy-balance studies in southern Norway reveal that the relative importance of the net solar radiation for surface melt is largest in the drier interior and decreases towards the west coast where the turbulent heat fluxes are more important (Messel, 1985). Analysis of measurements from an automatic weather station operating on Storbrean in southern Norway shows that variations in temperature and reflected shortwave radiation (surface albedo) can explain most of the inter-annual variation in melt (Andreassen and others, 2008b).

pressure within the ice, crevasses will close at a certain depth depending on the plasticity of the ice mass which is again dependent on temperature. Glacier crevasses in Norway are seldom more than 25-30 m deep.

Glacier types

Glaciers can be classified in different ways depending on their shape, size and location. The glacier size and form is mainly determined by the topography and to which extent the region is covered by glacier ice. Some common glacier types are defined below (definitions are based on Cogley and others, 2011).

Ice body may be used for any object that is made mainly of ice and may or may not be a glacier.

Glacier complexes are glaciers that may be divisible into more than one glacier.

Ice sheets are ice bodies that cover areas of continental size, generally more than 50 000 km^2. Today there are only two ice sheets, the Antarctic Ice Sheet and the Greenland Ice Sheet. The ice thickness can be several thousand metres thick. There are no ice sheets in Norway today, but during the last ice age, the Scandinavian ice sheet covered Norway.

Ice caps or plateau glaciers can have any size, but cover a smaller area than ice sheets. They are a dome-shaped ice body covering the underlying surface topography and with radial flow. Hardangerjøkulen and Folgefonna are typical Norwegian examples.

Outlet glaciers drain an ice cap, often of valley glacier type, but the accumulation area may be difficult to define. The name of the outlet usually refers to the more defined lower part of the glacier. Briksdalsbreen and Nigardsbreen are well-known outlet glaciers from Jostedalsbreen, the largest ice cap in Norway.

Cirque glaciers are located in a cirque, which is created by glacial erosion producing a basin shaped depression in the mountain with steep sides and back wall.

Small ice body outside the Hardangerjøkulen ice cap in southern Norway, August 2011. The ice is probably remnant ice from the ice cap and shows several accumulation layers. Photo: Liss M. Andreassen, NVE.

Valley glaciers follow a valley and may originate from one or more cirque glaciers.

Mountain apron glaciers are small glaciers of irregular shape covering a slope in mountainous terrain or a valley side or part of one without marked deepening in the terrain as in cirque and valley glaciers.

Glacierets are very small glaciers, typically less than 0.25 km^2 in extent, with no marked flow pattern visible at the surface. Glacierets can be of any shape, and usually occupy sheltered parts of the landscape. Windborne snow and avalanches can be dominant contributors to the accumulation of glacierets.

Hanging glaciers are glaciers, typically small, that cling to a steep slope.

Regenerated glaciers are glaciers fed by ice-avalanches from a glacier above a rock cliff. The best-known regenerated glaciers in Norway are at Bøyabreen, Suphellebreen (both fed by Jostedalsbreen) and Nerisen (fed by Øksfjordjøkelen).

Mountain glaciers are glaciers that are confined by surrounding mountain terrain, also called **alpine glaciers.** The term mountain glacier is often used to describe glaciers in general (and to separate them from the ice caps and ice sheets).

All glacier types are found in Norway except ice sheets. Many glaciers are not easily classified and can be a combination of different types. The shape of a glacier will also change through time as the glacier grows or shrinks. For example a cirque glacier may grow into a valley glacier or shrink to a glacieret.

Snowfields are more or less extensive and persistent masses of snow.

Snowpatches are masses of snow of restricted extent and may persist through most or all of the ablation season. Snowpatches are less extensive than snowfields, but the distinction is not clear.

Perennial snowfields and **snowpatches** (persisting for longer than one year) may be difficult to distinguish from glaciers and glacierets.

Typical glacier types in Norway. 1) Valley glacier: Storbrean (left) and Veslebrean in Jotunheimen are short valley glaciers. The two glacier tongues of Storbrean became separated in the 1990s. The neighbouring valley glacier Veslebrean to the right has a narrower accumulation area, but has stronger topographic shading and enhanced snow accumulation from the steep valley walls. Distinct end moraines show the maximum Little Ice Age position. 2) Outlet glacier: Austerdalsbreen, Jostedalsbreen. 3) Glacieret: Juvfonne, Jotunheimen. 4) Regenerated glacier created from avalanches from Flatbreen/Suphellebreen, Jostedalsbreen. 5) Cirque glacier in the Hurrungane. 6) Ice cap: Hardangerjøkulen is a typical ice cap with a flat accumulation area covering a plateau and several outlet glaciers. Photos/Copyright:
1) Sabine Baumann, 2) Laila P. Høvik, NVE,
3) Liss M. Andreassen, NVE,
4) Torunn Bøe, 5) Bjørn Lyskjold, NVE,
6) Petter Bjorstad/Arne Flatmo.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Small steep cirque glaciers at Steindalsnosi in western Jotunheimen that also can be characterised as hanging glaciers. The glaciers (ID 2649 and 2647 in region 28) have mean slopes of 31 and 32 degrees respectively. Investigations on the glacier to the right (ID 2647 in this inventory, also called Nedre Steindalsbre) suggested it to be polythermal (Urdal, 2005). Photo: Liss M. Andreassen, NVE.

Glaciers can also be classified based on their temperature. They can be temperate, polythermal or cold. A temperate glacier consists of ice that is at its pressure-melting point (so-called wet ice) except for a surface layer of about 10-15 m thickness which may experience seasonal cooling. For a glacier to be temperate the previous winter's cold wave must be eliminated by the end of the summer (Paterson, 1994). A cold glacier is a glacier whose ice is below the melting point. Thus, there is no liquid water within the glacier or at its bed. Such a glacier is often called a cold-based glacier. A polythermal glacier contains both cold and temperate parts.

In Norway most glaciers are considered to be temperate, although measurements are available for only a few glaciers. Measurements below 150 m thick ice at Bondhusbreen (Hagen and others, 1993) and under 210 m thick ice at Engabreen (Cohen and others, 2000; Iverson and others 2003) revealed temperate ice at the base of Norwegian glaciers. Temperature measurements at Midtdalsbreen, an outlet of Hardangerjøkulen, suggest that the lowermost parts are cold

Glacier names

The Norwegian language has two official forms, Bokmål (based on Danish) and Nynorsk (new Norwegian). Although the language forms are similar with many identical words, many words are differently spelt and some words are completely different in the two forms. As an example east/eastern is øst/østre in bokmål and aust/austre in nynorsk.

The Norwegian language has several words meaning glacier: 'bre', 'fonn', 'jøkul', 'skavl' and 'is'.
Each word may be pronounced and spelled differently in various regions, and with or without the definitive ending. 'bre' is 'glacier' and 'breen' is 'the glacier'. Bre is the most common ending of a glacier name, and may be written bre, brea, breen, brean, bræ, bred or breden depending on local pronunciation and spelling, e.g Storbreen, Storbrean, Storbreden, Hellstugubrean, Bondhusbrea. In northernmost Norway names from the Sami language are also used for glaciers. Jiehkki means glacier or ice cap in Sami.

Some of the most common words used in Norwegian glacier names are:

Glaciers and snow: bre = glacier, breen/brean/brea = the glacier, jøkul = glacier/ice cap,
fonn = glacier/snowpatch, skavl= glacier/snowpatch, is = ice, snø = snow

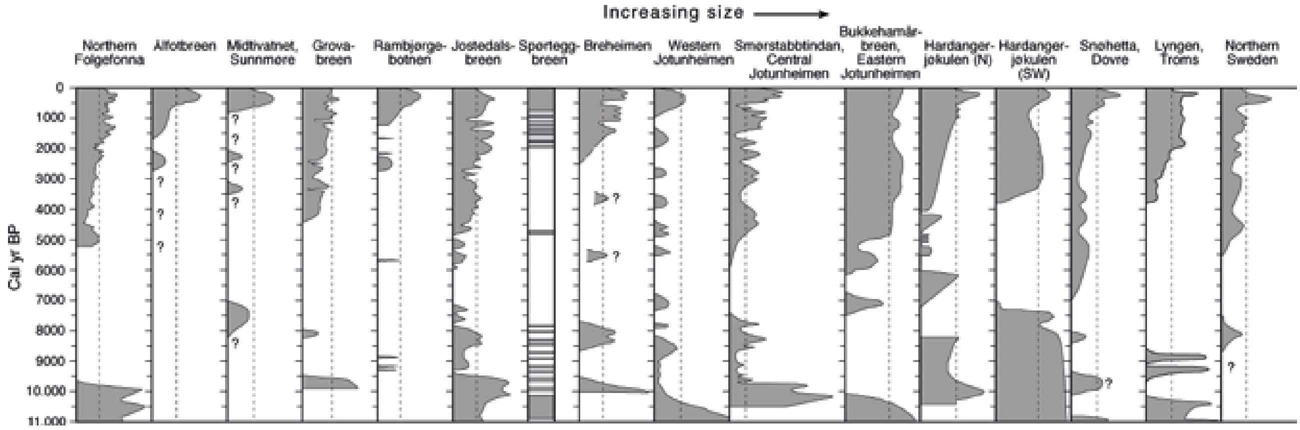
Colours: blå = blue, svart = black, grå = grey, hvit/kvit = white

Size/shape: dal = valley, lang = long, botn = cirque, liten/vesle/vetle = small, rund = round

Directions: sør/søndre(søre) = south/southern, vest/vestre = west/western,
øst(aust)/østre(austre) = east/eastern, nord/nordre = north/northern

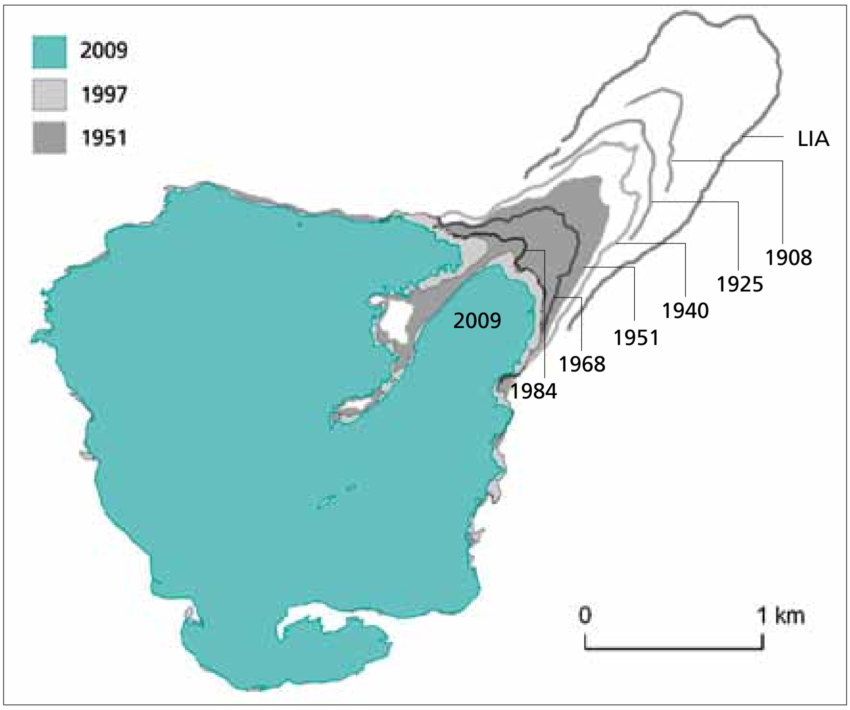
Other: troll = troll/brute, vann/vass/vatn = lake

The spelling of many glacier names also changes from time to time. Nowadays many names are spelt based on local pronunciation. As an example in Jotunheimen (region 28 and 29) the glacier names now end with –an instead of the –en ending used previously, e.g. Storbrean is now used on official maps instead of Storbreen, as used in the scientific literature and on previous maps. In the Folgefonna region (region 36) glaciers on the western side now have –a ending, e.g. Bondhusbrea instead of Bondhusbreen used previously.
In Appendix C we give both historic names used by NVE and the official names used by the Norwegian Mapping Authority.



Holocene glacier variations in different parts of Scandinavia (the horizontal scale is schematic, not to scale). Figure from Nesje (2009) with updates.

throughout the year (Hagen, 1978; Konnestad, 1996). It is not unlikely that many glaciers may have cold zones in the frontal parts that are not eliminated during winter, especially the continental glaciers in the eastern parts of southern Norway, with little snow in winter and with the lowermost parts of the glacier above the mountain permafrost altitude (Etzelmüller and Hagen, 2005). The glacieret Juvfonne in Jotunheimen is an example of a cold-based glacier, with borehole measurements showing an ice temperature of approximately -2°C at 10 m depth (Ødegård and others, 2011).



The retreat of Storbrean in Jotunheimen since the Little Ice Age (LIA) maximum position based on end moraine ridges, observations and maps. Maps of the glacier are available for 1940, 1951, 1968, 1984, 1997 and 2009 (sources: Liestøl 1967; Andreassen 1999; NVE). No historical source are available for exact dating of the LIA maximum extent, but the maximum probably occurred early in the second half of the 18th century (Matthews, 2005).

Holocene glacier variations

Norway was covered by an extensive ice sheet during the last ice age. The ice sheet originated in the Scandinavian mountain chain and spread to larger parts of northern Europe. The Scandinavian Ice Sheet reached Great Britain, northern Germany, Poland and almost to Moscow. Its maximum extent was about 20,000 years BP (Before Present (BP) refers to number of years before 1950 AD and are not the same as calendar years). Periods of glacier retreat and advance then followed. The last major re-advance was the Younger Dryas (YD) event about 11,000-10,000 yr BP (12,800-11,700 calendar years BP). At this time most of Norway was covered by ice, except for the coastal areas that had been deglaciated. During the YD many small glaciers (cirque and local ice caps) were formed beyond the margin of the Scandinavian ice sheet, both in northern Norway and in western Norway (e.g. Andersen, 1968; Sollid and Sørbel, 1979; Nesje, 2009), one of the largest being the ice cap over the Ålfoten area (Sønstergaard and others, 1999). After this advance, both the Scandinavian Ice Sheet and the small glaciers retreated rapidly. Sediment cores from proglacial lakes and moraine sequences have been used to reconstruct the glacier variations during the past 11,700 years – a geological period called the Holocene. Studies have been conducted in many present glacier regions in Norway and results reveal that most glaciers in Norway melted away completely at least once during the early/mid-Holocene (Nesje, 2009). The period when most glaciers were smallest or absent was between 6600 and 6300 calendar years BP. Several periods with re-advances have been reconstructed, but the timing varies from region to region in Norway.

The Little Ice Age (LIA) was the latest cold period during the Holocene. The duration of the LIA period varies; in Norway this period may be defined from AD1400–1850 or even up to 1920 (Grove, 2004; Nesje and others, 2007).

Most Norwegian glaciers reached their maximum extent during the mid 18th century, although the timing of the LIA maximum glacier extent varies considerably for individual glaciers from early to mid 18th century to late 19th century (Grove, 2004). Blomstølskardsbreen, a southern outlet glacier of Folgefonna, is one of the known exceptions in southern Norway, reaching its maximum extent in the early/mid 20th century (Tvede and Liestøl, 1977). In Lyngen in northern Norway the LIA glacier maximum is suggested to be about 1900–1910 (Ballantyne, 1990; Bakke and others, 2005).

Studies suggest that the rapid glacier advance in the early 18th century in southern Norway was not only due to lower summer temperatures, but also mild, wet winters as a result of a positive NAO index in the first half of the 18th century (Nesje and Dahl, 2003; Nesje and others, 2007; Rasmussen and others, 2010).

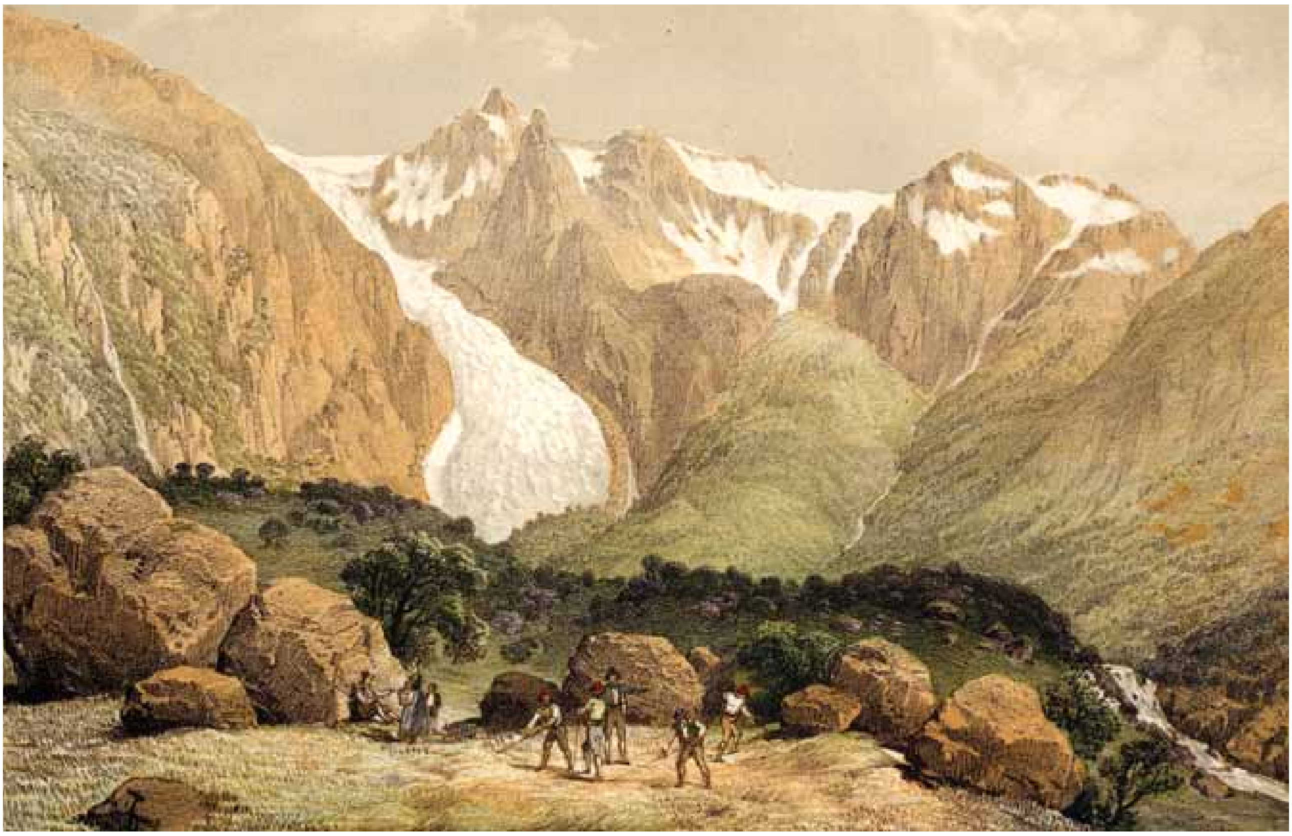
Early observations

Norwegian glaciers tend to be remote, thus the amount of historical data is much less than elsewhere, such as the European Alps (Nussbaumer and others, 2011). No direct evidence has yet been found for advances of Norwegian glaciers before the 17th century. The earliest reliable evidence of advancing ice causing damage to farmland dates from 1684 in the Jostedalsbreen region where two farmers in Krundalen (where the glaciers Bergsetbreen, Tuftebreen and Tverrbreen are situated) could not pay tax because "their high pastures had been covered by advancing ice" (Grove, 2004, p 68). The advance of Brenndalsbreen devastated the farm Tungøyane in 1743. The advance of Nigardsbreen is also well documented. In 1735 the glacier was very close to the nearest farm, and in 1743 the glacier advanced into the farm and completely destroyed the farm buildings (Eide, 1955). In northern Norway, historical documents show that Engabreen destroyed the farm Storstenoren in 1723. Works by Hoel and Werenskold (1962), Theakstone (1988), Grove (2004) and Nussbaumer and others (2011) give a good overview of the early historical documents available and further references. Sketches, drawings and paintings of

Frontal view of Lodalsbreen (left), Stigaholtbreen (right), and Lodalskåpa (background) in 1822 by Wilhelm Maximilian Carpelan, after Carl Friedrich Naumann ("Lodalskåpa"; watercolour, pen and pencil; 11.0 x 19.0 cm; Plansjeverk 2218-nr. 13; Nasjonalbiblioteket, Oslo, Håndskriftsamlingen; photograph by Samuel U. Nussbaumer).

Snow investigations in the first mass balance measurements at Storbrean in 1949. Photo: Olav Liestøl.

Tent camp in front of Nigardsbreen at the start up at the mass balance investigations in spring 1962. Photo: Wibjørn Karlen.



Icefall of Bondhusbrea, as observed in 1851 by James David Forbes. ("Glacier of Bondhuus"; lithograph; 13.5 x 20.7 cm; Forbes, 1853: Plate VI;). Reproduction by Samuel U. Nussbaumer and Heinz J. Zumbühl.

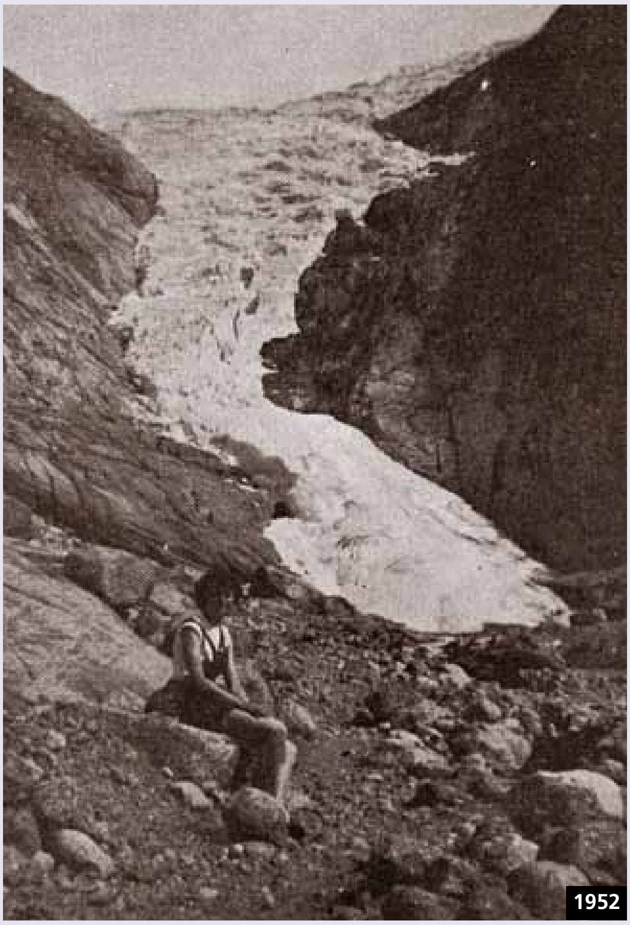
selected glaciers were made by visitors from the 19th century onwards. The oldest pictorial document of a Norwegian glacier is of Bondhusebrea in 1801 (Fig. 13A in Østrem and Haakensen, 1993). A drawing by Carpelan, assumed to be based on travel sketches from Naumann who visited Jostedalen in 1822, show the steep fronts of Lodalsbreen and Stegholtbreen (Messel, 2008). Many observations are also available from Folgefonna. In this region historical documents show a later LIA maximum extent; for Bondhusbrea and Buerbren it was in the 1870s (Nussbaumer and others, 2011).

Photos of Norwegian glaciers are available from the 1860s onwards. For example the first photograph of Briksdalsbreen was taken in 1869 by Christen de Seue (de Seue, 1870). A thorough reassessment of pictorial and written evidence has been made to reconstruct glacier fluctuations of Jostedalsbreen and Folgefonna by Nussbaumer and others (2011).

Glacier monitoring

Systematic observations of Norwegian glaciers started around 1900, when glacier length change measurements were initiated on a number of glaciers (e.g. Rekstad, 1902; Øyen, 1906) following similar studies that had started in the European alps (Forel, 1895). Some of these series are continuous to the present. In 1927 the 'Norges Svalbard og Ishavsundersøkelser' (Norway's Svalbard and Arctic Ocean Investigations) was established in Oslo by the government. In addition to field work in Svalbard and other arctic regions, selected investigations were also carried out in mainland Norway from 1927 onwards. In Jotunheimen investigations included repeated photogrammetric surveys on several glaciers as well as hydrology, velocity and ablation studies of Hellstugubrean. Hoel and Werenskiold (1962) give a thorough overview of these early investigations. In 1948 the Norwegian Polar Institute (NPI) was established in Oslo and took over all routine glacier investigations in Norway. Olav Liestøl was appointed glaciologist and decided to examine one glacier closely, selecting Storbrean in Jotunheimen for this purpose. Storbrean was selected due to its moderate size and easy accessibility from the road. A well-defined glacier and drainage area was also an advantage, but the uneven surface complicating the mass balance measurements was considered an 'unfavourable aspect' (Liestøl, 1967). The first mass balance investigations in Norway began in spring 1949 and mass balance has been measured every year since. Later other investigations were also undertaken including surface ice velocities, as well as meteorological measurements, and runoff and sediment investigations in the river from the glacier (Liestøl, 1967). Throughout the 1950s investigations were concentrated mainly on this glacier, but mass balance measurements were also carried out at Glombreen and Kjølbreen in the Svartisen region in 1954-1956. In the 1960s, planning of hydropower production instigated a need to investigate the contribution of glaciers to runoff for more glaciers. A glacier division, called 'Brekontoret' (the Glacier Office) was established at the Norwegian Water Resources and Energy Directorate (NVE) in Oslo, and Gunnar Østrem was appointed to lead the work. Systematic mass balance studies began on other glaciers from 1962 onwards.

Briksdalsbreen is an outlet glacier of Jostedalsbreen. The glacier is relatively short and steep. It reacts quickly to changes in its mass and has had many periods of advance and recession. The glacier had minor advances culminating in 1910, 1929, 1961, 1969, 1980 and 1996. From 1929 to 1951 the glacier retreated 800 m and revealed a lake. The glacier advanced 200 meters between 1973 and 1980, and after a period of minor changes the glacier advanced a further 300 m from 1987 to 1996 and covered the lake completely. Between 1999 and 2011 the glacier retreated 500 m and revealed the lake again. Late in 2010 the lower part of the terminus was detached from the upper part.



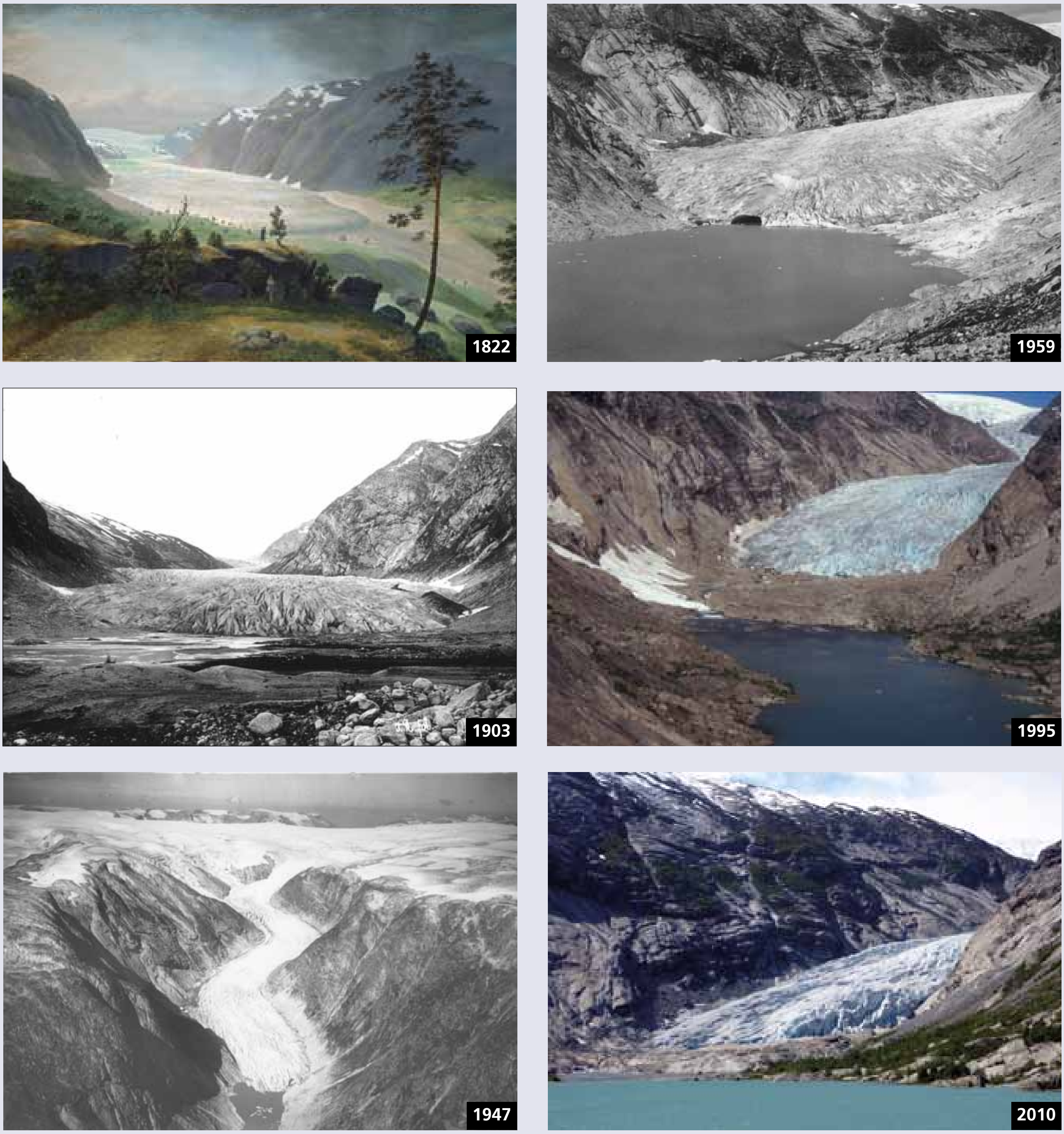
Photos: 1890: Knud Knudsen, 1952: Unknown, 1980: Erik Roland, NVE, 2000: Stefan Winkler, 2010: Miriam Jackson, NVE.

Engabreen is an outlet glacier of Vestre Svartisen. Around 1890 Engabrevatnet was a small lake in front of the glacier (the fjord Holandsfjorden in the foreground, Engabrevatnet between moraines and the glacier). The glacier advanced until 1910 and covered the lake, then retreated slowly until 1931. In the 1930s the glacier retreated rapidly when the glacier was calving into deeper water in Engabrevatnet. The glacier retreated more than 2 km between 1931 and 1965. Since then the glacier has had minor advances culminating in 1971, 1984 and 1998, the last advance nearly reaching the lake shore. From 1999 to 2009 Engabreen retreated nearly 300 m.

Photos: 1890: Library of Congress, 1973: Nils Haakensen, NVE, 1987: Ole Petter Røvik, 1998, 2004, 2011: Hallgeir Elvehøy, NVE.

Nigardsbreen

Nigardsbreen is an outlet glacier of Jostedalsbreen. The glacier is longer and has a gentler slope than Briksdalsbreen, and subsequently a longer response time to changes in its mass. The painting by J. Flintoe shows the glacier in 1822. The glacier had retreated approximately 700 meters from its 1743 LIA maximum extent, and the barren land is clearly visible. From 1930 to 1975 the glacier retreated 2.3 km, the retreat speeded up in the 1940s when the glacier calved into lake Nigardsvatn. In 1959 the glacier was almost out of the lake. After a period of only small changes the glacier advanced 250 meters in the 1990s, culminating in 2000. Since then the glacier has retreated, and between 2004 and 2011 it retreated 136 m.



Paintings/photos: 1822: Flintoe (Messel, 2008), 1903: J. Rekstad, 1947: Fjellanger Widerøe, 1959: Olav Liestøl, 1995: Hallgeir Elvehøy, NVE, 2010: Miriam Jackson, NVE.

Briksdalsbreen, Engabreen and Nigardsbreen are part of the Norwegian glacier length change monitoring programme.

Measurements on Nigardsbreen, Hellstugubrean and Gråsubrean began in 1962 and on Rembesdalskåka and Ålfotbreen in 1963, all of which are still part of today's monitoring programme. Through legislation, glacier mass balance programmes have been included in the licensing terms for hydropower production in glacierized basins. Since measurements started at Storbrean in 1949, mass balance has been measured on 43 glaciers, producing 628 observation years up to and including 2011. Length change data have been measured at 68 glaciers and produced 2434 observation years from 1900 to 2011. An overview of glaciers with mass balance and length change investigations are given in Appendix C.

The mass balance and length change measurements, as well as other glaciological investigations, have been published in annual or biannual reports by NVE since 1963 (e.g. Kjøllmoen and others, 2011). The data are also reported to the World Glacier Monitoring Service (WGMS) and published in their series Fluctuations of Glaciers (e.g. WGMS, 2008) and Glacier Mass Balance Bulletin (e.g. WGMS, 2011).

Stakes are used for measuring the summer balance on the glaciers. Due to melting, stakes need to be drilled deeper into the ice in summer before they melt out. The picture shows drilling on Hellstugubrean in Jotunheimen. Svellnosbrean and Norway's highest peak Galdhøpiggen (2469 m.a.s.l.) are in the background. Photo: Julia Helgesen.

In addition to the mass balance and length change monitoring programme, many other glaciological investigations have taken place in Norway. Studies include measurements of ice thickness, glacier hydrology (e.g. Willis and others, 2011), investigations in two unique subglacial laboratories at Bondhusbrea (e.g. Hagen and others 1993) and Engabreen (e.g. Lappegard and others, 2005) and studies of ice

A unique place to study glaciers

Svartisen Subglacial Laboratory is located under 200 metres of glacier ice under Engabreen in Nordland county, northern Norway. It is a unique facility where researchers have direct access to the glacier-rock interface. Norwegian and international research groups have used this resource to perform pioneering glaciology. Research includes experiments to improve the models used to simulate glacier behaviour, studying the evolution of glacier drainage over a melt season, understanding the effects of climate change on ice sheets (such as Greenland and Antartica) and developing technology that can be used in the search for life on other planets.

Above: A tunnel can be melted out at the base of the glacier using hot water. However, the weight of the glacier above gradually closes the tunnel and after 24 hours it is only half the size. A chainsaw is used to take samples of the basal ice.
Left: Water pockets, elliptically-shaped 'holes' in the ice that are partially filled with water, are found in the basal ice.
Photos: Halfdan Benjaminsen and Miriam Jackson, NVE.

dynamics (e.g. Jackson and others 2005). The studies have been conducted by NVE or by other institutions and individuals. They may be part of master or doctoral theses, international research projects, or contract work for hydropower companies.

Aerial photography and photogrammetric methods have long been popular ways of monitoring glaciers. The first commercial aerial photographs showing a Norwegian glacier were taken in 1937 and show part of the Folgefonni ice cap. Since then, most glacial areas in Norway have been photographed several times. The photographs have been used for detailed mapping of many glaciers. Repeated, detailed glacier mapping has been performed to calculate changes in glacier elevation, area, volume and mass. At the glaciers studied for mass balance, volume changes have been compared with cumulative mass balance results to evaluate the latter (Andreassen and others, 2002). Poor optical contrast of snow-covered parts of the glacier surfaces cause larger uncertainties in derived elevations. Data derived from laser scanned (LIDAR) data are very accurate on snow covered surfaces with low roughness. The first laser scanning campaigns of Norwegian glaciers were conducted in 2001-2003 when Engabreen were mapped repeatedly (Geist and others, 2005). Since 2007 annual LIDAR campaigns have been conducted on a selection of glaciers in Norway including all current mass balance glaciers. The new results are now compared with older maps and are used to correct and revise the direct measurements where necessary. A list of some of the surveyed glaciers are found in appendix C.

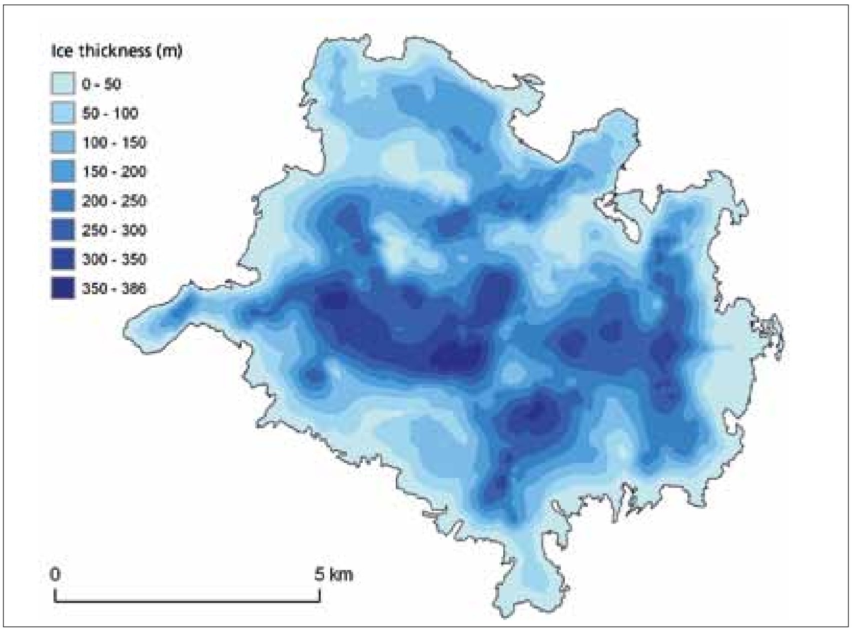
Ice thickness

Ice thickness measurements have been carried out on many glaciers in Norway, often as part of contract work for hydropower companies. The first measurements were carried out on selected glaciers in the 1960s using hot water drilling and seismic soundings, e.g. on Rembedalskåka/Hardangerjøkulen (Sellevold and Kloster, 1964; Elvehøy and others, 2002) and Folgefonna (NGU, 1964). From the 1980s ground penetrating radar has been the preferred method and is still used today. Ice thickness studies of Jostedalsbreen revealed ice thicknesses of nearly 600 m (Sætrang and Wold, 1986) and at Vestre Svartisen, parts of Storglombreen are more than 600 m thick (Sætrang, 1986). As it is difficult to access heavily crevassed outlets, radio-echo measurements have also been conducted from helicopter (Kennett and others, 1993). Ice thickness measurements of Hardangerjøkulen show that the relatively smooth surface covers undulating bed topography (Melvold and others, 2011). The mean thickness of the ice cap is about 150 metres and the thickest parts of the ice are more than 380 metres.

Radio-echo sounding measurements on Hardangerjøkulen in 2008. The equipment consists of a receiver and sender, each mounted on a sledge. Photo: Hallgeir Elvehøy, NVE.

Recent changes of glaciers in Norway

Throughout the 20th century the glaciers in mainland Norway have generally retreated, although several periods of advance have also occurred. Many outlets had advances culminating around 1910 and 1930. During the 1930s a pronounced retreat of Norwegian glaciers started, and is attributed to the Early 20th Century Warming (Hanssen-Bauer and Nordli, 1998). The most recent glacier advance in Norway started in the late 1980s and culminated at the turn of the 20th century. This advance was attributed to a period of transient mass surplus (Andreassen and others, 2005; Nesje and others, 2008). Whilst several maritime glaciers experienced mass surplus from 1962–2000, resulting in re-advances in the 1990s, con-

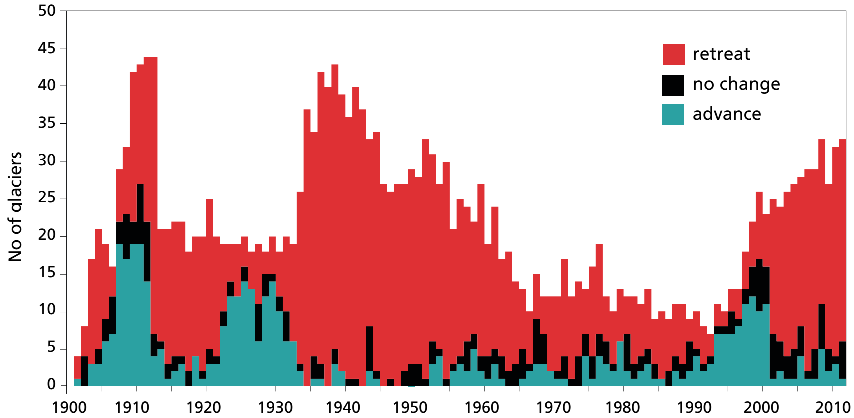


Ice thickness map of Hardangerjøkulen. The glacier outline is from 2010. The ice thickness map is interpolated from various ice thickness measurements collected through several campaigns in the period 1963-2010. The thickest parts of the glacier have nearly 400 metres of ice. Dataset provided by Kjetil Melvold, NVE.

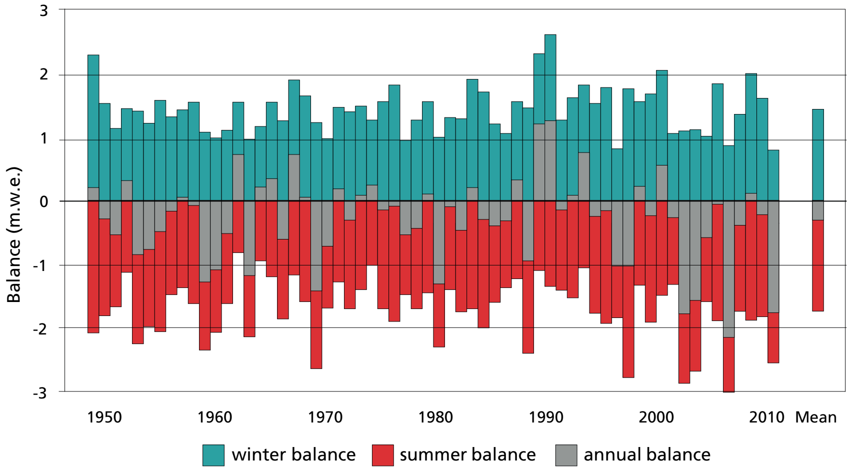
Snow density is measured in snow pits. The picture shows a snow density pit on Nigardsbreen in 1976, when it was not unusual pits to dig 6-7 m deep pits. Nowadays pits are dug to 1.5 m and coring is used for the rest of the winter snow pack. Photo: Nils Haakensen, NVE.

tinental glaciers with small summer and winter balances had a mass deficit and a steady frontal retreat. Since 2000 most glaciers have experienced mass deficit and frontal retreat, although years with positive balances still occur such as in 2005 and 2007 for several maritime glaciers (e.g. Kjøllmoen and others, 2008).

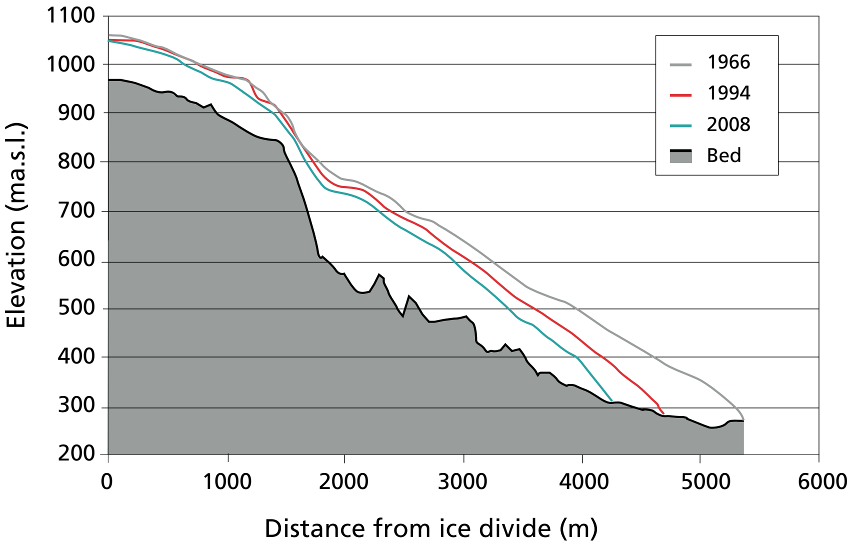
Langfjordjøkelen, the northernmost glacier in the monitoring programme, has experienced the strongest shrinkage of all observed glaciers in Norway (Andreassen and others, 2012). A comparison of maps over two periods, 1966-1994 and 1994-2008 shows a distinct thinning. Storbrean in Jotunheimen is another glacier that has shrunk rapidly, with no major readvances, over the past 100 years, although its mass deficit is smaller than for Langfjordjøkelen. Annual measurements for 1949-2010 show that in 42 out of 62 observation years the mass balance has been negative. The most negative balances have been measured since 2000.



Stacked histogram showing the number of Norwegian glaciers measured every year between 1900 and 2004. Red indicates part of total that retreated (more than 2 m), black indicates no change (+/- 2m), and green part of total that advanced (more than 2 m). Major advances occurred around 1910, 1930 and in the 1990s. The monitoring programme was revitalised in the 1990s after the latest advance of the Norwegian glaciers. Data: NVE



The mass balance series of Storbrean is the longest observation series of mass balance in Norway. Winter, summer and annual balance have been measured since 1949. Data: NVE



Profile along the central flowline of the east-facing part of Langfjordjøkelen, showing the bed profile and the surfaces of 1966, 1994 and 2008. The thinning per year nearly doubled from 1966–94 to 1994–2008. The volume loss of the glacier during the period 1966–2008 is estimated to be 46%. (Andreassen and others, 2012).

A combination of little snow during the winter and a warm summer and fall led to a major decrease in all Norwegian glaciers in 2006. Many of the glaciers saw the greatest mass deficit ever recorded. Gråsubrean and Grotbrean in eastern Jotunheimen, August 2006. Photo: Ivar Helleberg.

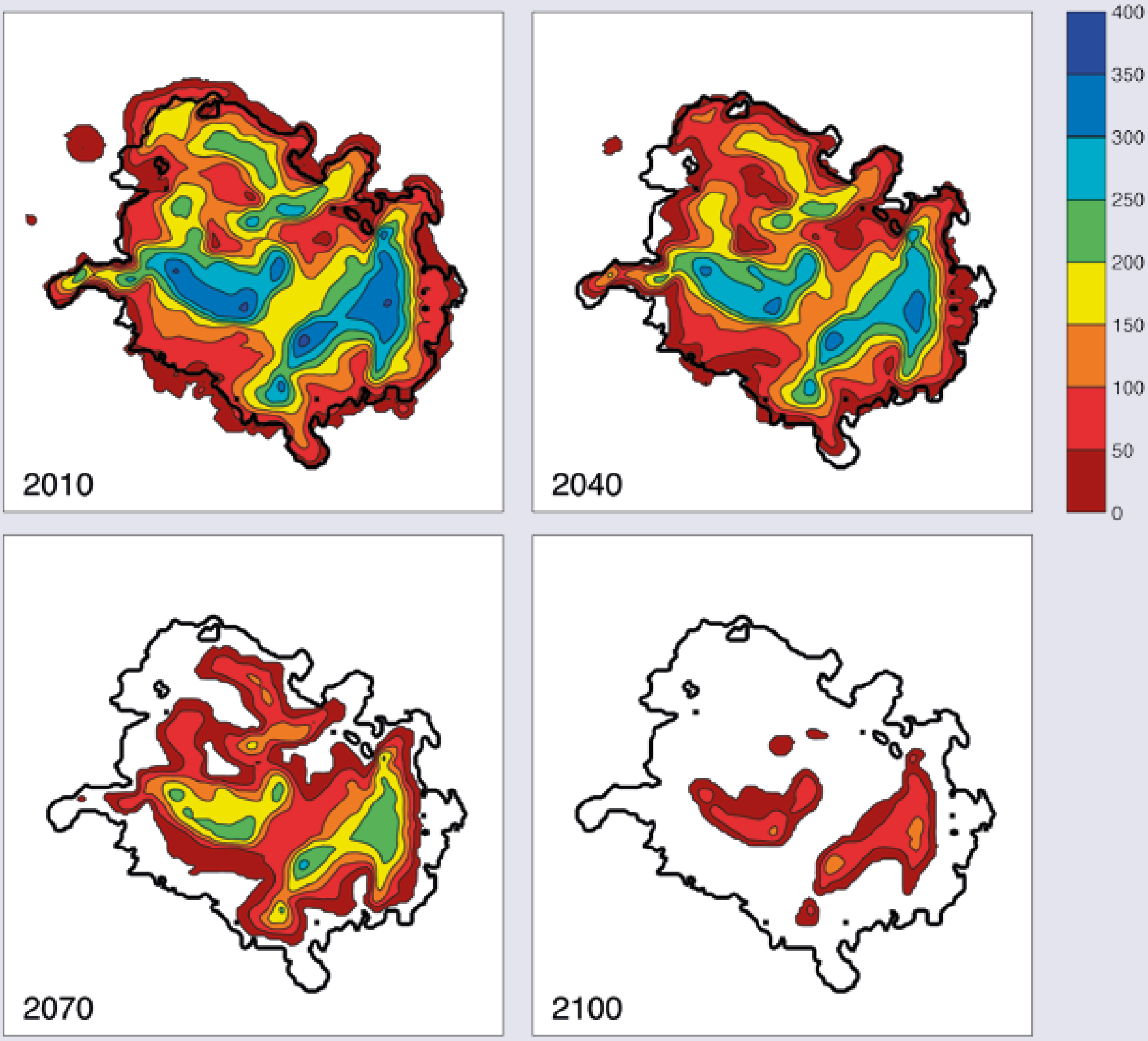
The future of Norwegian glaciers

The global retreat of mountain glaciers in the last century, also in Norway, has been interpreted as a result of global warming (Oerlemans, 2005; Lemke and others, 2007). Variations in a glacier's mass balance are the combined effect of changes in ablation and accumulation. For example, the increase in winter accumulation and transient mass surplus of Norwegian glaciers over 1989-1995 has been closely linked to the positive North Atlantic Oscillation (NAO) index in this period (Hanssen-Bauer and Førland, 1998; Rasmussen and others, 2007). Recent climate projections for the 21st century suggest an accelerated increase in temperature, and also increased precipitation (Hanssen-Bauer and others, 2009). Such a warming will have a significant impact on Norwegian glaciers and many glaciers are projected to disappear or greatly reduce in volume over the next 100 years (Nesje and others, 2008).

The future of Norwegian glaciers depends not only on temperature and other variables related to melt, but also on changes in large-scale circulation patterns and the resulting amount and distribution of precipitation. In addition, the fraction of annual precipitation that falls as snow will decrease in a warmer climate and increase the duration of the melt season (e.g. Andreassen and Oerlemans, 2009). Glaciers that span a small elevation interval, such as Gråsubreen and Ålfotbreen, are more sensitive to future climate change than glaciers that have accumulation areas far above the current equilibrium line. How quickly glaciers will disappear also depends on their ice thickness. Glacier modelling is used to predict the response of a glacier to climate change.

Model simulations for Hardangerjøkulen that take into account the dynamic response of the ice cap, show that for a linear temperature increase of 3°C from the reference period 1961–1990 to the scenario period 2071–2100, the net mass balance soon becomes negative at all altitudes and Hardangerjøkulen will disappear around the year 2100 despite a 10% increase in precipitation.

Modelled ice thickness for Hardangerjøkulen in 2010, 2040, 2070 and 2100, for a climate projection with linear increases in temperature of +3°C and in precipitation of +10%. The thick black line indicates the 1988 ice cap margin. Figure from Giesen and Oerlemans (2010).



2010
2040
2070
2100
400
350
300
250
200
150
100
50
0

Landsat image from 13 September 2002 of the Folgefonna ice cap. Folgefonna consists of three parts, Søndre (southern), Midtre (central) and Nordre (northern). Søndre Folgefonna is the 3rd largest contiguous ice mass in Norway.

Methods

Background

Satellite data have long been used for glaciological applications. Landsat 1 was launched in 1972 as the Earth Resources Technology Satellite (ERTS) with the expressed intent of studying and monitoring the earth's land masses. It included the Multispectral Scanner (MSS) sensor with four spectral bands and had a spatial resolution of 68 x 83 m. The first satellite images of glaciers in Scandinavia were acquired by MSS in the same year. The images were suitable for mapping of the transient snow line (TSL), and the TSL at the end of the melt season was used as an approximation for net glacier mass balance (Østrem, 1975; Østrem and Haakensen, 1993). Another early glaciological study focused on mapping glacier flow velocities (Krimmel and Meier, 1975). However, the coarse resolution of the sensor and the limited spectral range was a major bottleneck towards more operational applications. The Landsat 4 and 5 satellites launched in 1982 and 1984, respectively, contained the new Thematic Mapper (TM) instrument with an improved spectral and spatial resolution (30 m). The new satellites could distinguish a wider (and more scientifically-tailored) portion of the electromagnetic spectrum and register radiation from the ground in greater detail. Each scene covered an area of about 180 x 185 km on the ground resolved into 5760 x 6100 pixels. To give a modern equivalent, this is the same amount of data as captured by a 35 megapixel digital camera today. From the very beginning, Landsat TM data were used to study the spectral reflectance characteristics of glaciers, snow and ice (e.g. Hall and others, 1987; 1989) and it was proposed to use them to create glacier inventories (Howarth and Ommanney, 1986). In 1999 Landsat 7 was launched with the Enhanced Thematic Mapper Plus (ETM+) on-board. This sensor replicated the capabilities of the highly successful TM instruments, and additionally included a panchromatic band with 15 m spatial resolution and a thermal infrared band with 60 m spatial resolution.

Today several optical satellite sensors are used for glacier mapping, e.g. Landsat TM/ETM+, Terra ASTER and SPOT HRV (Kargel and others, 2005). The spatial resolution, region covered (swath width), spectral resolution (number of spectral bands) and the data costs vary between the sensors. Previous studies have shown that the Landsat TM/ETM+ sensors are well suited for mapping glacier extent and monitoring changes even for small alpine glaciers (e.g. Paul and others, 2002; Bishop and others, 2004; Racoviteanu and others, 2009). Landsat has a much larger swath width (185 km) compared to the Terra ASTER or SPOT sensors (60 km) and is thus in many cases considered to be the first choice for glacier mapping due to lower efforts in orthorectification of satellite scenes (Paul and Hendriks, 2010). NVE therefore chose to use Landsat imagery for the new glacier inventory. In the following text we give a short overview on the methods used for creating the new inventory of Norway.

TM band	TM	ETM+
1 (blue)	0.45 - 0.52	0.45 - 0.52
2 (green)	0.52 - 0.60	0.53 - 0.61
3 (red)	0.63 - 0.69	0.63 - 0.69
4 (NIR)	0.76 - 0.90	0.75 - 0.90
5 (SWIR)	1.55 - 1.75	1.55 - 1.75
6 (TIR)	10.40 - 12.50	10.40 - 12.50
7 (SWIR)	2.08 - 2.35	2.09 - 2.35

Spectral band widths of the reflective bands from Landsat TM/ETM+. (NIR= near infrared, TIR= thermal infrared, SWIR= shortwave infrared (NASA, 2009). All values are in micrometers (µm).

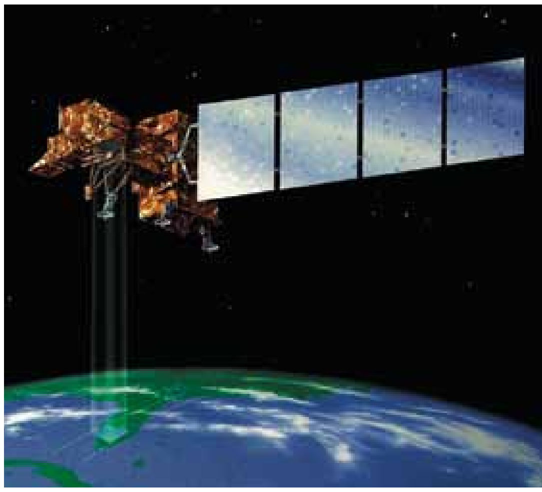


Illustration of the Landsat 5 sensor. Figure from NASA.

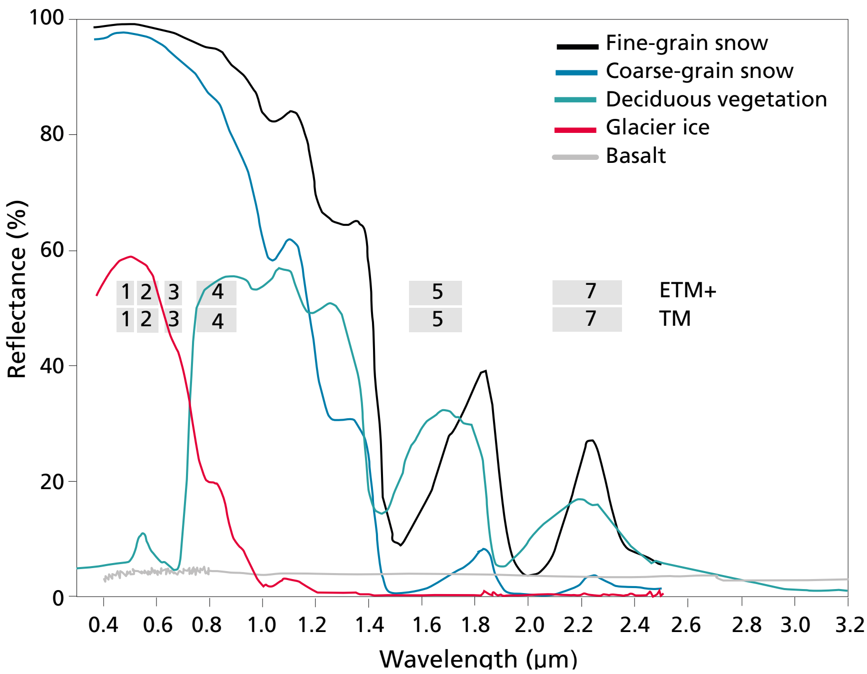
Spectral properties of glaciers

Glacier surfaces are composed of snow, firn, ice, water and debris. Each surface material will reflect, absorb or transmit the energy it receives depending on its spectral characteristics. A graph showing the spectral reflectance of an object as a function of wavelength is called a spectral reflectance curve and the shape of the reflectance curve is the materials spectral signature. (Lillesand and Kiefer, 1987; Kääb, 2005). One advantage of using satellite data for glacier mapping is the possibility to automatically classify regions covered by ice and snow from the multispectral bands of optical sensors. Whereas the human eye is only sensitive in the so-called visible part of the spectrum (VIS), optical remote sensing sensors can also record radiation in the infrared part. Typically, the infrared radiation is subdivided into a near (NIR), shortwave (SWIR) and thermal (TIR) infrared part. Whereas the radiation in the TIR results from surface radiation that is emitted according to its temperature, the radiation in the NIR and SWIR is reflected from the surface. The reflectance characteristics of different surface materials can be illustrated by plotting their spectral reflectance curves. Both fine-grained and coarse-grained snow has a high reflectance in the VIS, which is why sunglasses are required when walking through a snow-covered landscape in sunlight. However, this high reflection is strongly reduced in the NIR and becomes close to zero in the SWIR. In the NIR and SWIR the reflection of snow also depends on grain size, the smaller the grains the higher their reflection. Clean glacier ice has a much lower reflectance in the VIS (it is much darker), and appears nearly black in the SWIR. Most rock types have a comparably low reflectance in all parts of the spectrum, making it nearly impossible to discriminate spectrally between debris cover on a glacier and rock, moraines, or forefield surrounding a glacier.

Mapping glaciers with the band ratio method

Many different methods have been tested for glacier mapping in the past (Albert, 2002; Racoviteanu and others, 2009). One of the most popular and widely used is the band ratio method where thresholded multispectral band ratios are used (e.g. Bayr and others, 1994; Jacobs and others, 1997; Sidjak and Wheate, 1999; Paul and Kääb, 2005). The band ratio method is based on division of the digital numbers (DNs) or grey values in band TM3 (red) (or TM4, NIR) by those of TM5 (SWIR). The resulting ratio image gets comparably high values over ice and snow, but very low ones over other surfaces. With a simple threshold the image can be segmented into a class

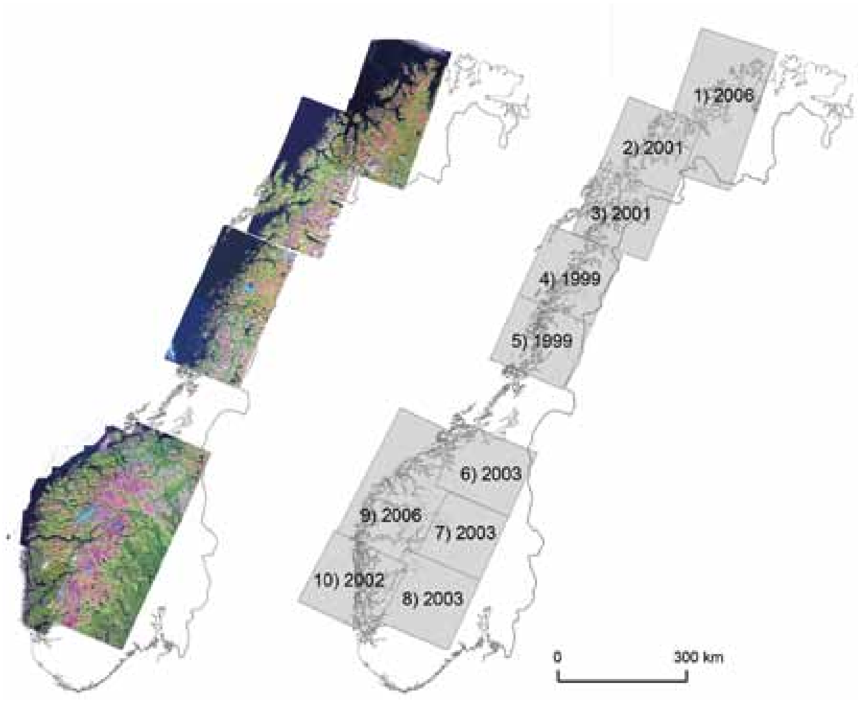
Lodalsbreen, outlet from Jostedalsbreen, with a characteristic medial moraine. The glacier surface is composed of snow, ice and debris. Photo: Hallgeir Elvehøy, NVE, August 2008.



Spectral reflectance curves of typical materials encountered in satellite imagery of glacierized terrain, and pass bands of the Landsat TM and ETM+ sensors in the visible and near-infrared (VNIR), and short-wave infrared (SWIR) parts of the spectrum. Figure provided by Bruce Raup.

‘glacier’ and a class ‘other’. For example if this threshold is 2.0 all pixels that have two times higher DNs in band 3 compared to band 5 are classified as glaciers.

The band ratio method is found to be robust and accurate for glacier outline extraction for debris-free glaciers in previous studies (e.g. Albert, 2002; Paul and others, 2003). In two pilot studies in the Jotunheimen and Svartisen regions in Norway, the band ratio method was tested using Landsat imagery (Andreassen and others, 2008a; Paul and Andreassen, 1999). Results demonstrated that glacier mapping using Landsat imagery was straightforward and accurate in regions with sparse debris cover on the glaciers. The band-ratio method was therefore chosen for mapping all glaciers in Norway. This choice is also in agreement with recent guidelines and recommendations (Paul and others, 2009; Racoviteanu and others, 2009) and compliant with the tiered strategy of glacier monitoring developed by the Global Terrestrial Network for Glaciers (GTN-G), that recommended the use of satellite data for glacier mapping along with cost-saving methods of data compilation and analysis (e.g. Haeberli, 2004).



Overview of Landsat scenes and the respective years used for deriving the new glacier inventory of Norway.

Landsat scenes

Selecting Landsat scenes

When selecting the Landsat scenes used for the new inventory, it was important that the imagery were cloud free and acquired at the end of the ablation season when little seasonal snow remained. Due to the frequent cloud cover along the west coast of Norway in early autumn this proved to be a challenge. Furthermore, remaining seasonal snow considerably reduced the number of appropriate satellite scenes covering glaciers in Norway. A total of 12 Landsat TM/ETM+ scenes covering the period 1999 to 2006 two of which are mosaicked scenes, were selected for the glacier mapping. The scenes covering southern Norway have overall little seasonal snow and few clouds where the glaciers are located, while ceertain scenes for northern Norway have generally more seasonal snow and partly also more clouds.

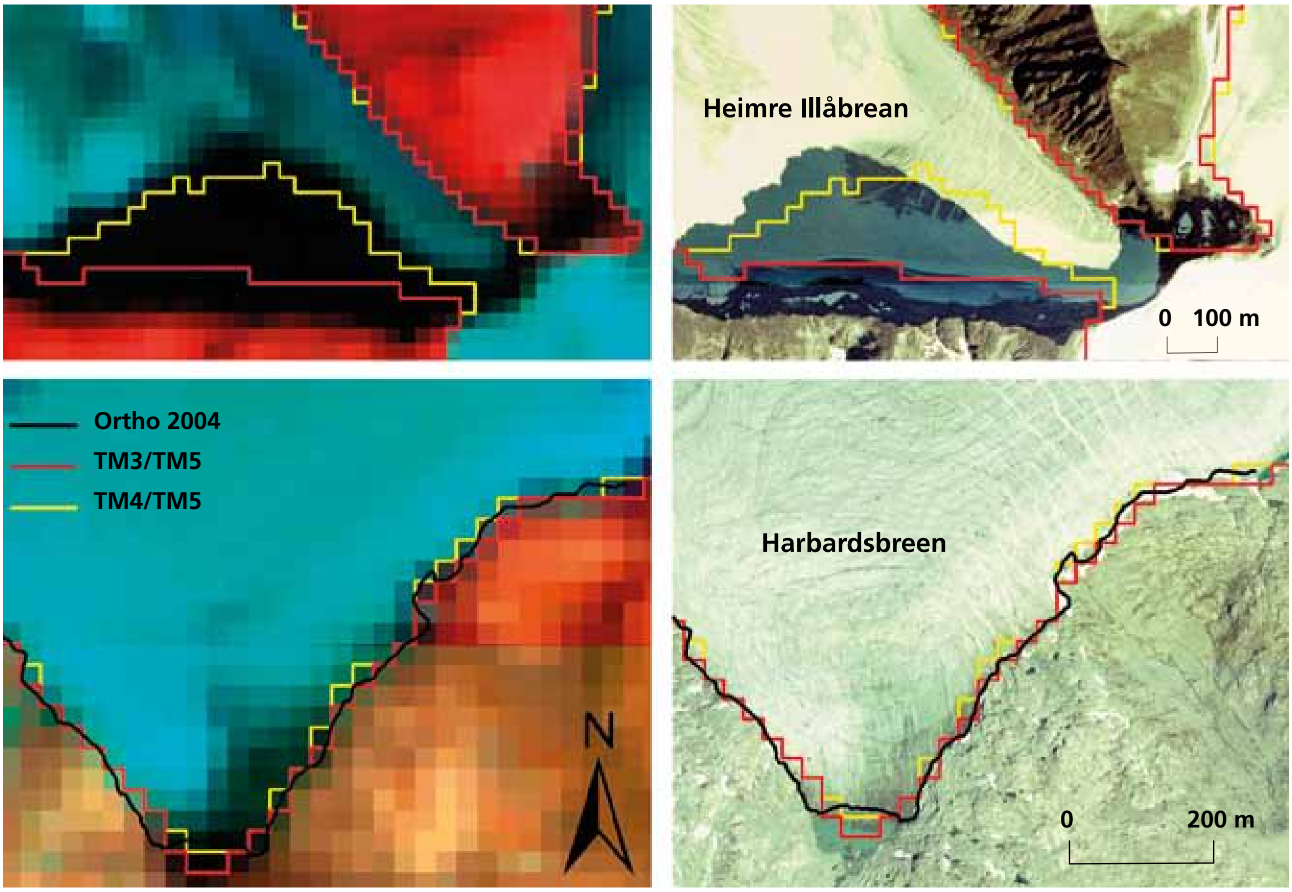
Processing of scenes

Accurate orthorectification of the scenes is needed before they can be combined with other geocoded datasets (e.g. a digital terrain model, DTM). The orthorectification processing and quality check was carried out with the OrthoEngineTM software (©PCI Geomatica).

Five of the 12 scenes were ordered raw from the United States Geological Survey (USGS) and were orthorectified by NVE using ground-control points. Typical control points used were lake edges or islands in lakes. The other scenes were already orthorectified and provided by Norsk Satelittdataarkiv at the center for GIS and Earth

No.	Region	Path/Row	Date	Sensor	Source	Ortho	Cloud (%)	CP	rmse XY
1	Seiland/Øksfjord	196/10 & 11	28-Aug-2006	L5 TM	USGS	NVE	30	5	0.94
2	Lyngen	198/11	20-Aug-2001	L7 ETM+	USGS	CGEO	4	5	0.47
3	Frostisen	198/12	20-Aug-2001	L7 ETM+	USGS	USGS	6	7	0.49
4	Svartisen	199/13	7-Sep-1999	L7 ETM+	USGS	CGEO	0	13	0.5
5	Okstindbreen	199/14	7-Sep-1999	L7 ETM+	USGS	USGS	1	7	0.4
6	Dovre	199/16	9-Aug-2003	L5 TM	USGS	CGEO	0	NA	0.53
7	Jotunheimen	199/17	9-Aug-2003	L5 TM	USGS	CGEO	0	14	0.64
8	Hardangerjøkulen	199/18	9-Aug-2003	L5 TM	USGS	CGEO	0	5	0.2
9	Jostedalsbreen	201/16 & 17	16-Sep-2006	L5 TM	USGS	NVE	0/10	7	0.59
10	Folgefonna	201/18	13-Sep-2002	L7 ETM+	USGS	NVE	47	7	0.59

A list of the Landsat scenes used for glacier mapping. Orthorectification (Ortho.) were done by NVE - Norwegian Water and Energy Directorate, CGEO - The center for GIS and Earth Observation (Arendal) or USGS - United States Geological Survey. CP – number of control points. rmse XY – root mean square error in horizontal direction (in pixels). NA - not available



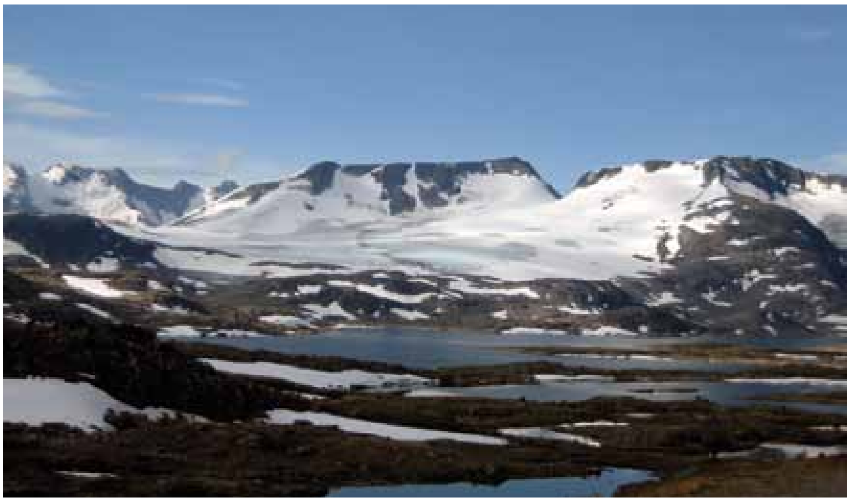
Performance of the automatic mapping method using thresholded band ratios TM3/TM5 and TM4/TM5 in a region with cast shadow (Heimre Illåbrean) and the terminus of Harbardsbreen. To the left the outlines with the Landsat scene as background, to the right the orthophotos in the background. Figure from Andreassen and others (2008a).

Observation (Arendal) or from the USGS. The quality of the orthorectification was tested against 5-14 check points. For all scenes the horizontal positional accuracy (root mean square error, rmse) was less than one pixel (better than 30 m), which was considered to be satisfactory. After the orthorectification or quality control the individual channels band1, band3, band4 and band5 used in the band ratio method were exported to an ArcGIS (© ESRI) readable format (GeoTIFF) where further GIS-based processing was carried out.

Glacier delineation

To assess which of the ratios, TM3/TM5 or TM4/TM5, was better suited for mapping the glaciers for the new inventory, we derived both ratios for several regions and compared them with a validation dataset. In a pilot study in the Jotunheimen region the two ratios TM3/TM5 and TM4/TM5 were calculated from a Landsat image from 2003 and results compared with the digital orthophotos from 2004 (Andreassen and others, 2008a). In general, both ratios gave good results, and by adjusting the threshold value the glacier outlines could have been derived from either. However, the TM3/TM5 ratio showed better performance for ice situated in shadow and for dirty and debris covered ice. We therefore decided to prefer the TM3/TM5 ratio over the TM4/TM5 ratio for the glacier delineation both in Jotunheimen and for the other regions in Norway. In the following we describe the processing to delineate the glaciers.

As a first step, ratio images were computed from the raw digital numbers for bands TM3/TM5 for each scene and converted to a binary image (only black and white) using different thres-



In Norway remaining seasonal snow or perennial snow may cover the terminus, the sides and higher parts, also in late summer, The picture shows Fannaråkbreen in Jotunheimen on 7 August 2009. Photo: Liss M. Andreassen, NVE.

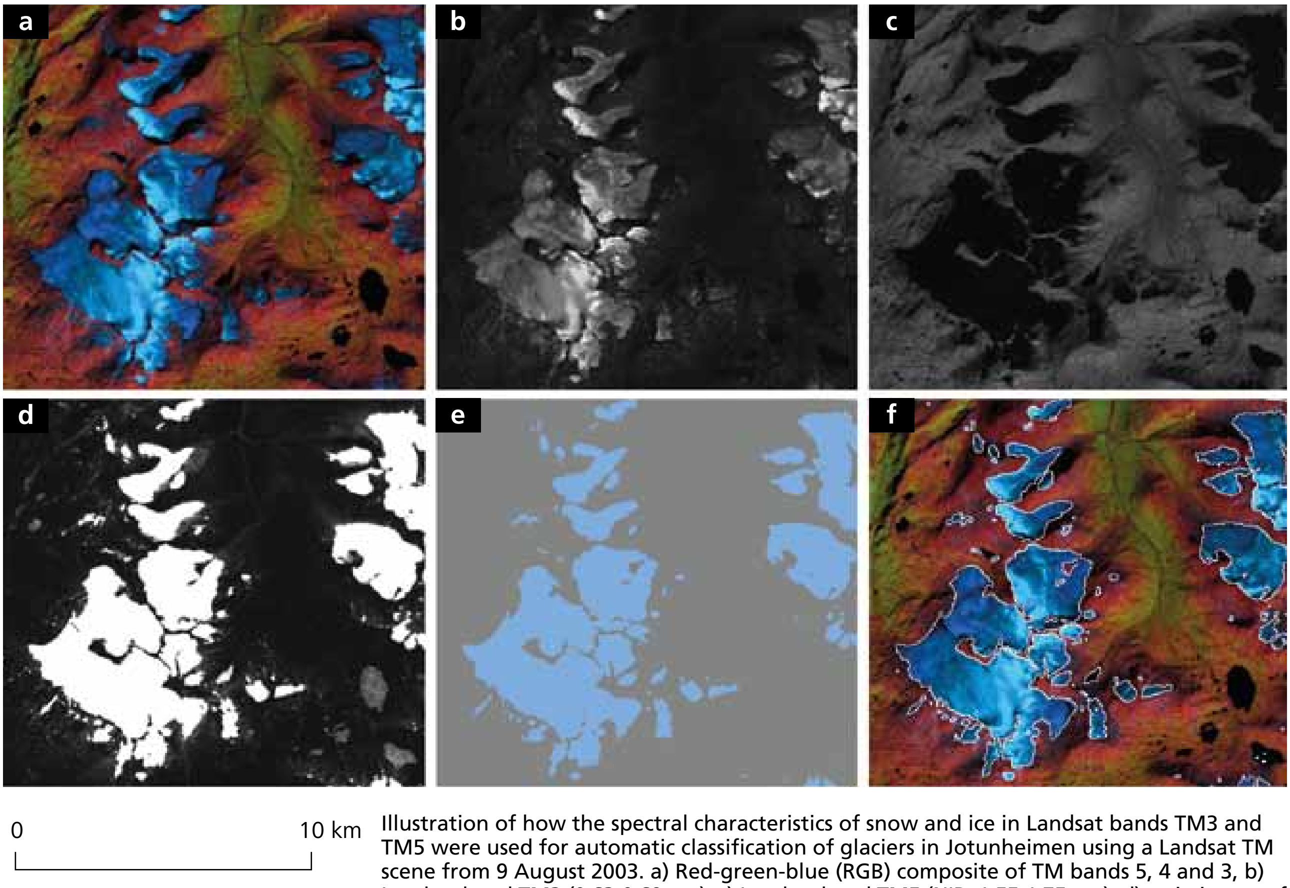


Illustration of how the spectral characteristics of snow and ice in Landsat bands TM3 and TM5 were used for automatic classification of glaciers in Jotunheimen using a Landsat TM scene from 9 August 2003. a) Red-green-blue (RGB) composite of TM bands 5, 4 and 3, b) Landsat band TM3 (0.63-0.69 µm), c) Landsat band TM5 (NIR: 1.55-1.75 µm), d) ratio image of TM3/TM5, e) thresholded image of TM3/TM5 >2.0 and a median filter (3*3 kernel) applied, and f) as a) with outlines (in white) derived from raster to vector conversion of e).

hold values. The resulting glacier maps for each scene were compared with a false color composite (bands 5, 4, and 3 as RGB) of the Landsat image to find the most suitable threshold value. To improve the outlines in parts in shadow a threshold in the TM1 Landsat band was also applied where appropriate (Paul and Kääb, 2005; Paul and Andreassen, 2009). An optimal threshold value was chosen and pixels were finally classified as ice or snow. The thresholds varied between 2.0 and 2.6. As a next step, a median filter (3 by 3 kernel) was applied to the classified binary image to reduce noise in shadow regions and remove isolated pixels outside the glaciers (usually snowpatches). This filter also closes small voids in the mapped glacier areas (e.g. due to rock outcrops or debris) and reduces the size of very small glaciers to some extent. The median-filtered glacier map was converted to outlines using a raster-to-vector conversion tool within ArcGIS and glacier polygons were obtained.

Polygons with a size of 9 pixels (8100 m^2) or smaller were excluded from the further editing and identification process. Then, all mapped snow and ice polygons were visually inspected using composites of satellite image bands as background, typically shifting between combination 543, 432 and 321. All glacier outlines were also inspected using digital topographic main map series of Norway 1:50 000 (herafter called N50) by the Norwegian Mapping Authoritiy in the background. Orthophotos from www.norgeibilder.no were used where available. The polygons were manually classified as 'glaciers', 'possible snowfields' or 'snow'. For some of the larger polygons snow ridges attached to the glacier were cut and classified as snow. This re-classification was of course difficult in many cases. If a glacier has a patchy appearance it might be due to snow ridges, but it may also be due to disintegrating glaciers.

Furthermore, manual corrections for debris cover, glacier-lake interfaces, clouds or cast shadow were made where necessary. Rocky material on

No.	Region	TM3/TM5*	TM 1*
1	Seiland/Øksfjord	2.4	35
2	Lyngen	2.4	60
3	Frostisen	2.6	60
4	Svartisen	2.6	59
5	Okstindbreen	2.6	60
6	Dovre	2.0	-
7	Jotunheimen	2.0	-
8	Hardangerjøkulen	2.0	-
9	Jostedalsbreen	2.0	35
10	Folgefonna	2.0	35

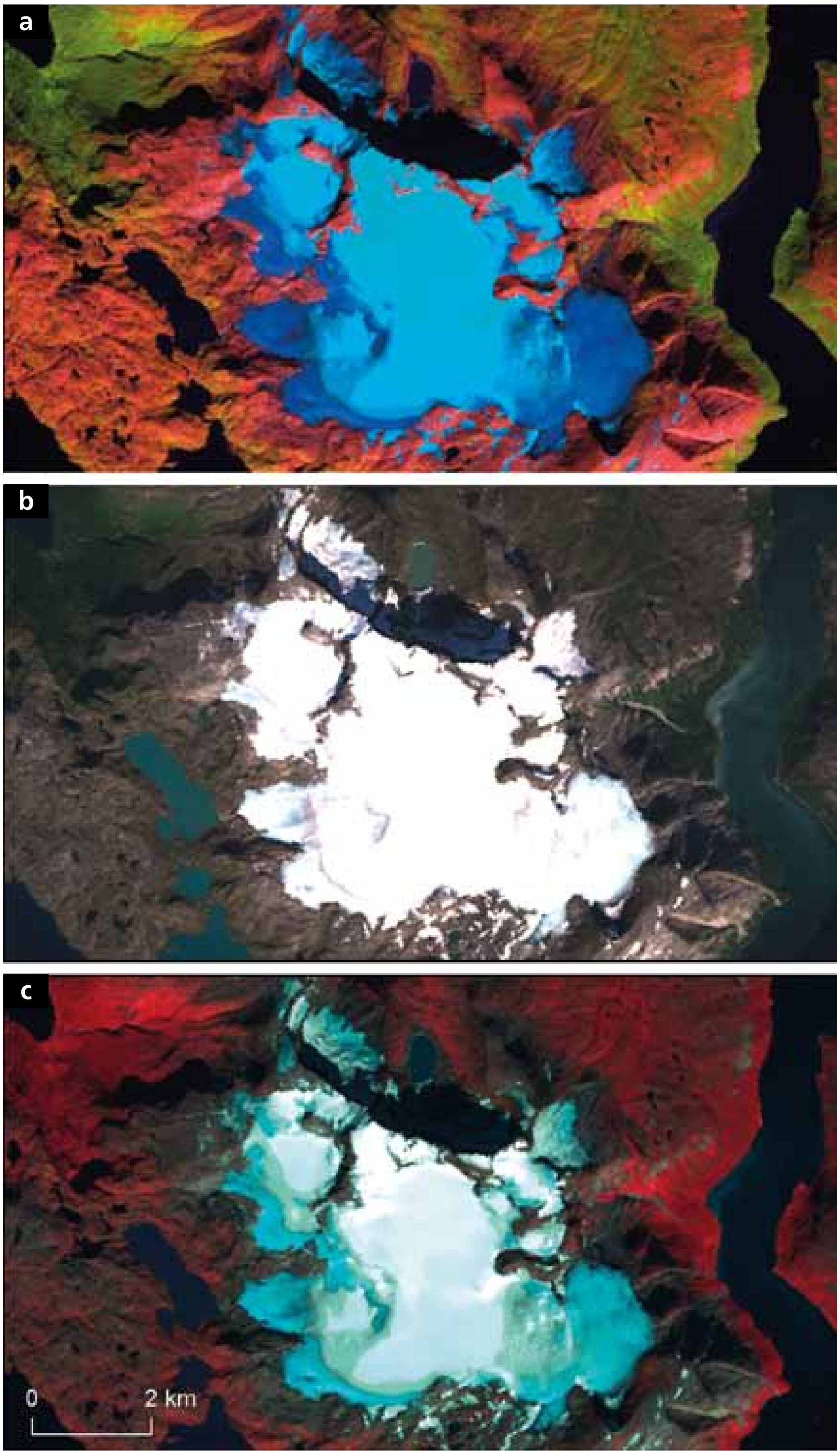
Thresholds used for band-ratio method to map the glaciers in the inventory. See table on page 37 for more information on the scenes.

* Values larger than or equal to the given threshold.

a debris-covered glacier tongue has in general the same spectral characteristics as the terrain surrounding the glacier and had in some cases to be manually digitized. However, only very few glacier outlines had to be corrected for debris cover since the glaciers in Norway are mostly debris free. A much larger manual effort was required for detaching lakes that were wrongly classified as glaciers, as the TM3/TM5 algorithm tends to classify water surfaces as a glacier, a well-known problem when applying TM3/TM5 ratios instead of TM4/TM5 ratios for ice and snow mapping (Paul and Kääb, 2005; Raup and others, 2007). The scenes were also checked for snow and ice bodies in shadow (with the 321 composite in the background). If ice bodies in shadow were not accurately mapped with the band ratio, outlines were manually digitized based on orthophotos (where available) or the Landsat image. Some of the Landsat images included clouds that covered parts of a glacier, for instance the glacier complex Sulitjelmaisen. In these cases N50 glacier outlines were used to complete outlines. However, only a few glaciers had to be corrected for clouds.

Glacier identification

In the previous inventories, perennial snowfields were omitted due to the difficulty in determining the outlines of such snowfields (Østrem and Ziegler, 1969; Østem and others, 1988) and only glaciers and glacierets were included. Thereby the criterion for a glacier was that the ice mass showed clear signs of movement. However, it was found challenging to determine whether an object was glacier or snowfield and the decision on what to include or exclude was somewhat subjective (Østrem and others, 1973). A clear sign of movement has not been a criterion in the new Landsat-derived inventory as the resolution is much coarser and identifying signs of ice flow or separating seasonal snow from perennial snow and perennial snow from glaciers or ice remnants is generally very difficult (e.g. Bolch and others, 2010). Following the GLIMS definition (see box) we included both glaciers and perennial snowfields in the new inventory, also as it can be



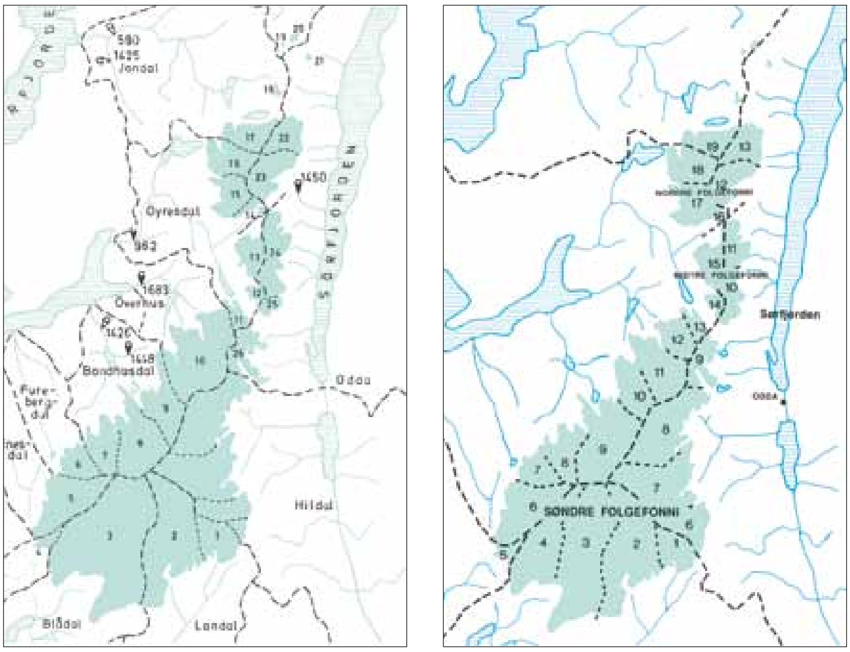
Part of Frostisen shown as red-green-blue (RGB) composites of a) TM bands 5, 4 and 3, b) TM bands 3, 2 and 1 and c). TM bands 4, 3 and 2. The northern outlets of Frostisen are in shadow due to step terrain and are better seen in b).

The GLIMS definition of a 'glacier', tailored to remote sensing and compliant with the World Glacier Monitoring Service (WGMS) standards, states that: 'A glacier or perennial snow mass, identified by a single GLIMS glacier ID, consists of a body of ice and snow that is observed at the end of the melt season, or, in the case of tropical glaciers, after transient snow melts. This includes, at a minimum, all tributaries and connected feeders that contribute ice to the main glacier, plus all debris-covered parts of it. Excluded is all exposed ground, including nunataks. (Raup and Khalsa, 2007; Racoviteanu and others, 2009).

In contrast to many other glacierized regions in the world where debris cover can be a significant problem when using the band-ratio method, glaciers in Norway have in general little or thin debris cover. Only very few glacier outlines had to be corrected for debris cover. Photo shows debris on Storbrean, Jotunheimen. Photo: Liss M. Andreassen, NVE.

difficult to differentiate between them, but excluded polygons classified as snow. All polygons to be included in the new inventory were assigned a unique ID by manually digitising points and basins around them. Glacier complexes were divided into glacier units following drainage divides (see next chapter) before IDs were assigned to each unit. Many smaller polygons which had been classified as possible snowfields due to size, shape or due to uncertainty regarding ice content were not assigned IDs and were therefore not included in this inventory book.

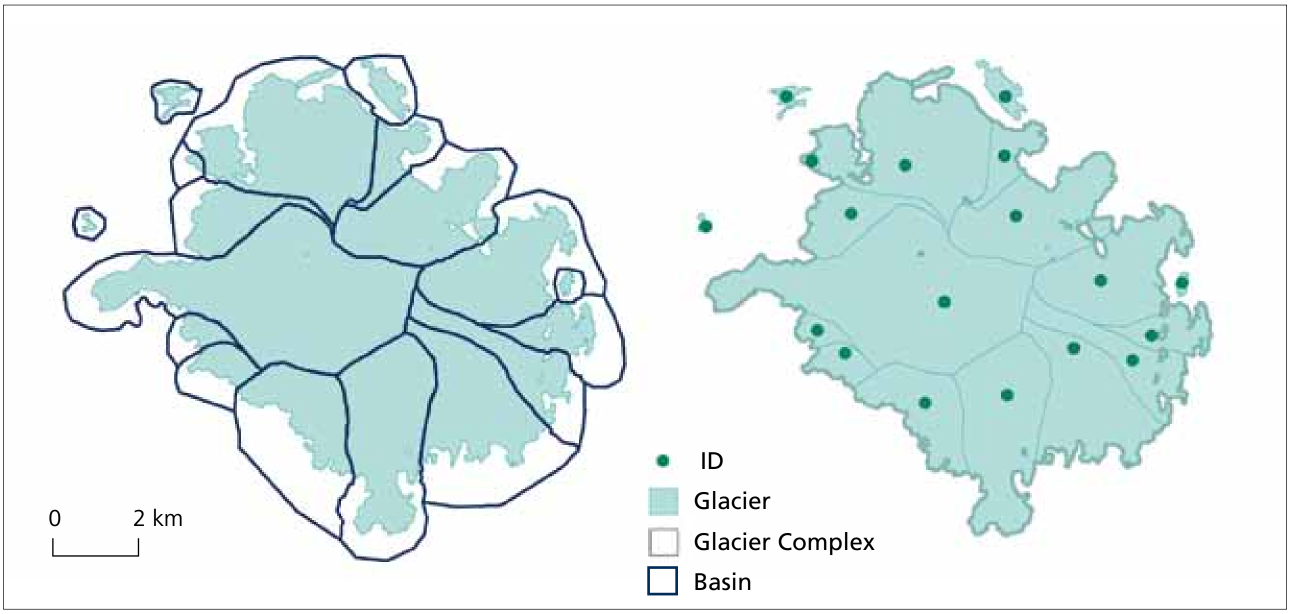
Ideally, we would wish to link this new inventory to the previous ones, both for glacier change assessments and for coupling the inventory properties such as name and others to the new glacier outlines. This was not straightforward, however, for several reasons. The previous inventories exist only digitally as tabular data, the outlines itself are not available in digital form. The coordinates in the tables are too coarse to be used as a unique identifier, especially in southern Norway. Another challenge in southern Norway is that the glacier numbers and basins used are not identical in the two previous inventories. A few of the smaller glaciers can be found in one inventory but not in the other, most probably due to difficulties in judging whether it was a glacier or a perennial snowfield. For many glacier complexes the ice divides or catchment basins were shifted between the two inventories. In some cases glaciers were separated into two or more parts or merged between the pre-existing inventories or between the old inventories and this new one. Such challenges made a consistent and sound identification of individual glaciers from the previous inventories difficult or impossible. As a consequence we have not included a link to the previous inventories in the inventory tables in part 2 of this book.



Drainage divides and glacier numbering differ between the two previous inventories in South Norway. Example shows division of Folgefonna in Atlas69 and Atlas88. Note that both the placement of divides and the numbering varies.

Ice divides

To create an inventory of individual units we divided the glacier complexes into glacier units using drainage divides. For the separation we used NVE's discharge basins (called Regine) and a flow accumulation map made by NVE based on a national 25 metres DTM and the river network of Norway (Voksø and others, 2008). We also used the digital



Each glacier unit has a defined basin and a unique ID. Glacier complexes, such as Hardangerjøkulen, were divided into glacier units by digitising drainage divides. The grey thick line shows the parts identified as the glacier complex Hardangerjøkulen. The small glaciers (or ice bodies) outside the ice cap are not part of the glacier complex.

N50 maps with glacier name information and 20 m contours, and when available also orthophotos, to decide whether and how a glacier should be divided. Although we followed the hydrological basins, in some cases we did not separate a glacier or glacier unit into two parts if only a small part was to be separated.

In recent years new DTMs have been made based on highly accurate laser scanning. For the ice caps Folgefonna and Hardangerjøkulen, which were completely mapped in 2007 and 2010 respectively, we used these new laser DTMs to define the position of the ice divides.

As a general rule we tried to follow the main division made in the previous inventories. It was however, an impossible task to reconstruct the divides as the old inventory divides were not digitally available and the sketch maps are coarse. Furthermore, the hydrological basins have been recalculated and updated and water divides are changed since the previous inventory in many regions. Change assessments for individual glacier units belonging to a larger ice mass based on the tables from the previous inventories is therefore not advisable, as possible changes may be attributed to changes of divides rather than actual glacier changes. The area of individual outlets and the number of glacier units are therefore only to be used in glaciological applications after careful analysis.

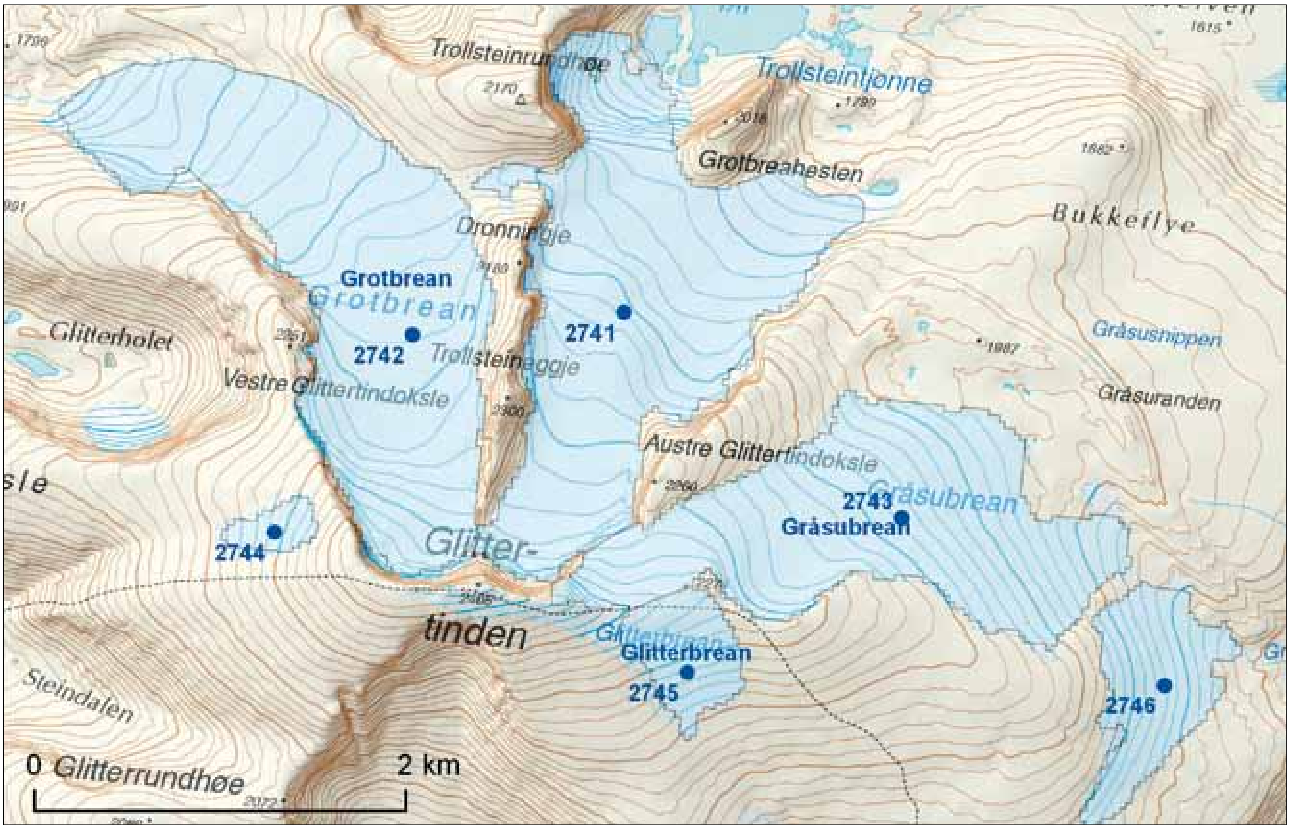
We have used hydrological basins defined by the surface topography of the glaciers. Where the glacier bottom topography is known, the hydrological drainage divides could also be defined by calculating the basins based on ice thickness and bed topography information as water may drain differently than the surface topography alone suggests. We have not recalculated the basins based on ice thickness measurements as this is only available for selected glaciers and we prefer to apply consistent methods. It should be noted that the basins may differ substantially dependent on how they are calculated. The glaciological drainage divide, or ice-flow perimeter, defines the area draining ice to glacier outlets and can deviate considerably from the hydrological drainage divide, as previously shown for Blåmannsisen (Kennett, 1990) and Svartisen (Kennett and others, 1997; Elvehøy and others, 2009).

Identifying glacier complexes

Glacier complexes were assigned a glacier complex code to be able to count both glaciers complexes and glacier units separately (see appendix A). Due to the 30 m resolution of Landsat some glaciers were connected and thus formed glacier complexes, even if they may not be connected in reality. To avoid this we manually checked all glaciers with orthopohotos from norgeibilder.no where available and assigned only glacier complex codes to those that appeared to be connected. In some cases it was difficult to decide due to seasonal snow in either the orthophotos or the Landsat imagery or both. Furthermore, the orthophotos were seldom from the same year, thus some of the defined glacier complexes may be individual detached glaciers and vice versa.

Glacier names

Glacier names were assigned both to individual glacier units and to glacier complexes. As a general rule we have adopted names on glacier units where they existed on the latest digital glacier maps from the Norwegian Mapping Authoritiy. In a few cases we have also added glacier names that were not on the map, but are used in the glacier literature. As an example Svartdalsbrean (the glacier in Svartdalen) was not on the map, but since this name is found in the glacier literature, due to previous length change measurements, we added the name using the new ending, brean (as now also used for the neighbouring glaciers Langedalsbrean and Slettmarkbrean). Another example is Hansebreen, an outlet of Ålfotbreen where mass balance measurements have been



Map showing glacier IDs and glacier names for a subset in region 29. As a general rule glaciers with names on the digital N50 topographic maps have been named in the inventory. Thus, glacier IDs 2742, 2743 and 2745 have been named, whereas 2744, 2741 and 2746 have not been named. Note also that the spelling of Gråsubrean is now with –an ending on the maps instead of Gråsubreen with –en ending as in previous inventories and as used by NVE in other reports. The small snowpatch northwest of 2744 has not been included in the inventory. Glacier IDs 2742, 2741, 2743 and 2745 are also part of a glacier complex and this is named Gråsubrean/Grotbrean/Glitterbrean (GGG) in the IDs inventory (see Appendix A).

carried out since 1986. This name is not a given name on the maps, but has been a working name at NVE and we choose to include it in the inventory as this name is used in reporting from NVE.

Glacier names on maps may be written on one or more units, and in some cases it was difficult to know which glacier unit the glacier name belonged to or if the name was the name of the glacier complex or individual units. If an outlet glacier of a complex glacier consisted of two parts, e.g. Bøyabreen (Jostedalsbreen) and Austre Okstindbreen (Okstindbreen), we added the name to the largest part.

If a glacier consisted of two units of equal size the name was assigned to the glacier complex and the glacier units were not assigned names. In some cases glacier names covered several individual, not connected, parts. These parts may have been connected before, such as Omnsbreen and Vargebreen. In these cases names were assigned to all individual parts, or to the largest part, or to parts based on best judgement.

As a general rule we used the spelling from the digital N50 topographic maps, by the Norwegian Mapping Authority. Spelling of many glacier names has changed since the previous inventories as many names are now spelt according to local pronunciation. Generally we have used the Norwegian name if both the Norwegian and Sami name is on the map. In total, 98 glacier complexes and 357 glacier units have glacier names in the new inventory (Appendix A-B). While 14 glaciers have a name starting with Blå (blue) e.g. Blåbrean, Blåbreen, Blåfonna, Blåisen, Blåskavlen, five have Troll in their name.

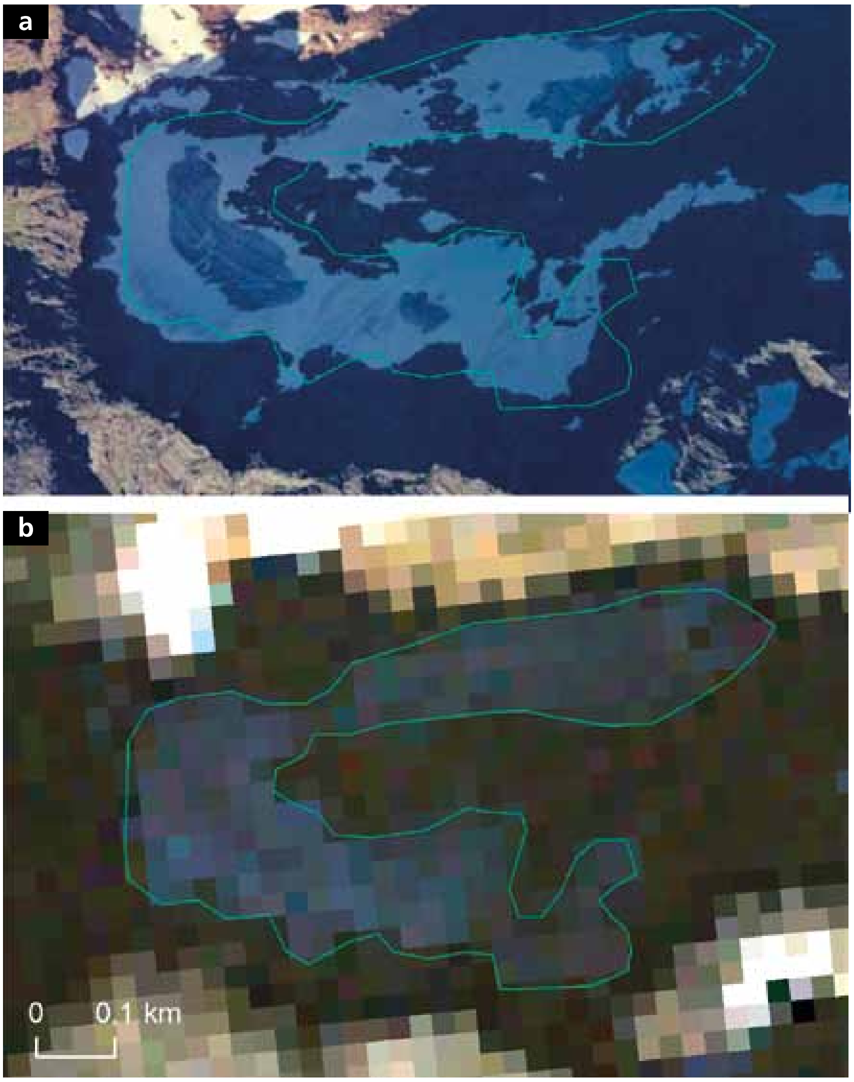
Glacier length

Glacier length is considered the most demanding parameter regarding additional manual work and uncertainty in currently available glacier inventories (Paul and others, 2009). For an ideal glacier a central flowline is digitised from the lowest point to the highest point and length is defined as the horizontal projection of the length, in metres or kilometres. In reality, however, many glaciers are irregular in shape and a central flowline is difficult to define. It is particular challenging to define glacier flowlines for wide and at the same time small glaciers or for glacier complexes. To be able to do glacier length change assessments one may need to define flowlines according to position of former outlines (Baumann and others, 2009). In the previous Norwegian glacier inventories length was reported for all glaciers. The length was defined as the length in km along a centre-line of the glacier, measured on the topographic maps (Østrem and others, 1973, 1988). In the new inventory we have not included glacier length. However, flowlines may subsequently be derived for all glaciers using manually digitising or automatic techniques (Le Bris and Paul, subm.).

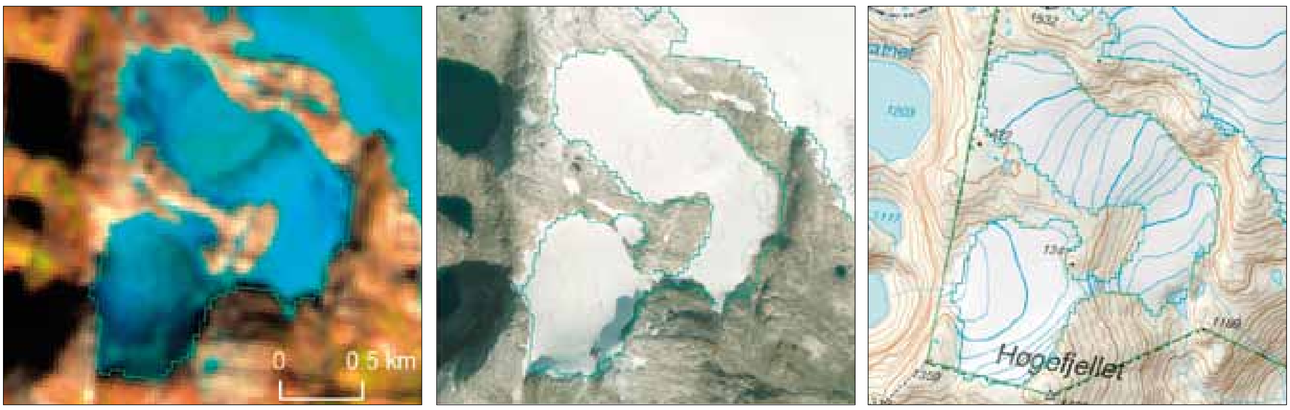
Uncertainties in glacier mapping

The identification of glaciers, the division of glaciers into units, and the modifications of outlines are all prone to errors. The results are dependent on the suitability of the Landsat imagery used and human interpretation. If the snow conditions are poor, results will seldom be good, whether the methods are based on aerial photography, satellite imagery or field investigations. When the images are selected and processed, several decisions by the operator will influence the resulting area: the operator must decide on which thresholds are most suitable for the automated mapping, which mapped bodies to exclude or include and which of the selected polygons to correct. There are many choices: where to draw the line between a glacier front and a lake, what to include as perennial snow or to exclude as seasonal snow, which parts of a glacier are debris covered or in cast shadow and how to draw the ice divides. The selection process on what to recognize as a glacier is thus somewhat subjective and will influence the values derived. These uncertainties in the glacier mapping need to be taken into account when assessing glacier changes from the data.

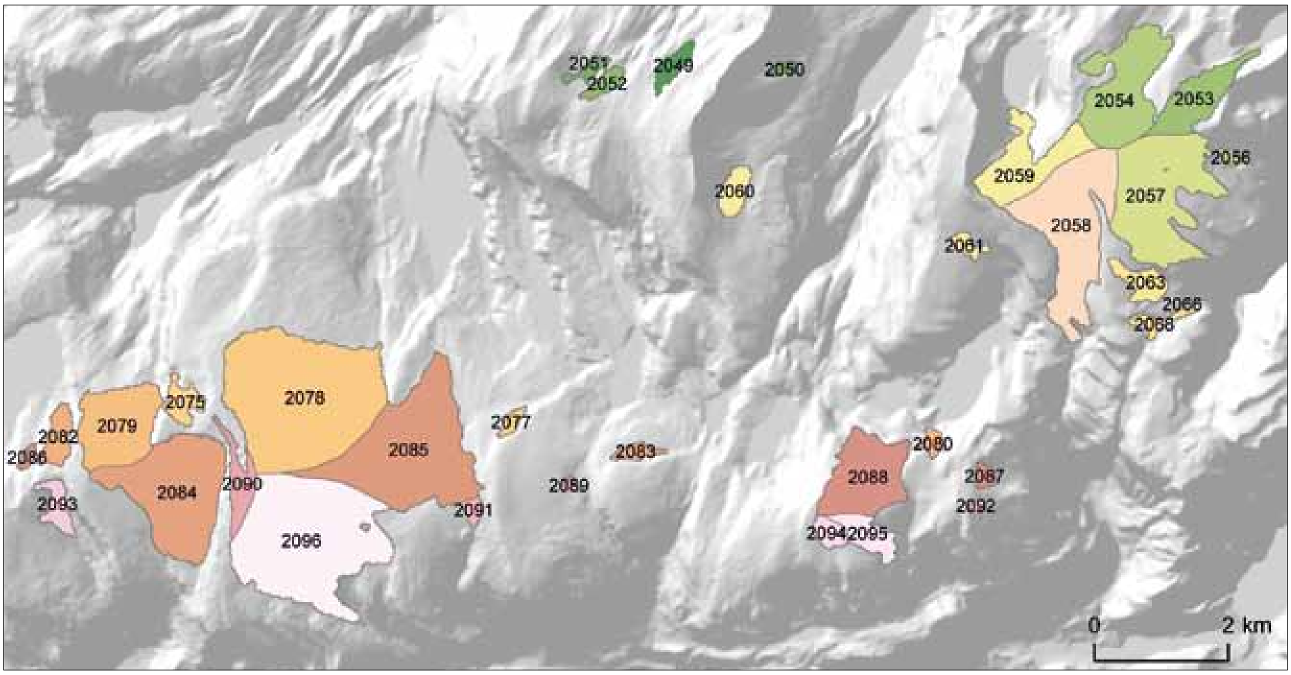
Few quantitative glacier change assessments have been done due to lack of validation data. Paul and others (2002) compared glacier outlines derived from Landsat TM with a SPOT satellite scene (10 m resolution) using a selection of 32 glaciers in the Swiss Alps. In their study the Landsat-derived area was 2.3% smaller than the SPOT-based validation data. Similar differences are found in other studies, including a recently conducted glacier delineation comparison (Paul and others, subm.). This study revealed that it is not really possible to determine the accuracy of outlines, as appropriate reference datasets are seldom available, that the analysis precision can be determined from a multiple digitizing experiment, and that the spatial resolution of the dataset used has limited influence on the quality of the outlines. In general, the accuracy (or precision) was found



Example of glacier ice in the orthophoto (a) which was not automatically classified by the band ratio (TM3/TM5) in the Landsat image (b) due to shadow. The glacier outline (green line) was therefore manually digitized based on both the orthophoto (2008) and Landsat image (2006). The example is from the westernmost glacier in Lofoten, northern Norway (glacier ID 839), northeast of Svolvær.



Validation of results from automatic mapping using thresholded band ratios with TM3/TM5 Landsat (2003), orthophotos (2010) and the 1:50 000 map (glacier ID 2127 and 2124). The green line is the glacier outline.



Zones used for calculating topographic parameters in the Ålfotbreen region. Each zone (shown in colours) represents one glacier with unique glacier ID. For calculation the national digital terrain model of 20 m resolution (DTM20) was used (here represented as hillshade).

to be a few percent, but much larger differences occur for debris-covered glaciers. We compared the Landsat outlines from 2003 with digital glacier outlines derived from 2004 aerial photographs for 16 glaciers (counting each composite glacier or ice cap as one). This revealed a difference in total area of -1.5 km^2 or -2.4% (Andreassen and others, 2008a), i.e. the 2004 map gave less area than the Landsat scene from 2003 for this selection of glaciers. Some of the area differences between the areas in 2003 and 2004 could be explained by actual glacier retreat, especially in calving zones and along the terminus. Compared with the 30 m resolution of Landsat we found the agreement satisfactory. For the other regions we only made qualitative assessments using Landsat imagery and orthophotos were available. Based on this and earlier studies we estimate that the accuracy of the mapped glacier areas in regions that do not require manual correction is better than 3%.

Deriving topographic parameters

Topographic parameters for the new inventory were derived from the national digital terrain model with 20 metres resolution (DTM20) that covers all of Norway and was released in 2011 by the Norwegian Mapping Authority (Statens kartverk, 2011). The DTM20 is put together from contour lines and elevation points from N50). The reported vertical rmse of the DTM20 is ±2-6 m, but the accuracy and the mapping year varies from region to region. Over recent years the maps that the DTM are based on have gradually been updated with data from new aerial photos from the 2000s, but mapping years are not always so easy to define, as the map sheet may consist of several photo series from different years, and may be partly or fully updated with new maps.

The inventory tabular data were derived for each glacier ID using a function in ArcGIS called 'zonal statistics' with each glacier unit as a zone. In this way minimum, maximum, mean and median elevation was derived for each glacier unit directly from the DTM20. The mean slope for each glacier was calculated from the slope grid derived from the DTM20, and mean aspect from a converted aspect grid derived from the DTM20 following a procedure in Paul (2007). All topographic parameters were calculated automatically using a python geoprocessing script in ArcGIS which was programmed for the new inventory.

For minimum elevation it is important to note that the DTM20 are based on glacier extent and surface topography from different years and not necessarily close in time to the Landsat imagery used for the glacier mapping. The mapping date varies from region to region. For the Jotunheimen scene the image and DTM20 are only one year apart, in other regions the difference may be much more. For glaciers that have substantially changed geometry since the mapping used for DTM20 and the date of image acquisition for this inventory, the lowest point of a current glacier might be located on the former surface of the glacier in case of retreat. The calculated minimum elevation is thus in most cases an upper bound, the correct value may be lower. However, the difference between the date of the DTM20 and the image acquisition is likely to have only a small effect on the other topographic parameters, although is difficult to quantify.

The final step in the data processing workflow was a consistency control of the data to check if all glaciers have values, if they were in the correct range, if there where outliers and if all names were correctly spelled.

Bondhusbrea, outlet glacier of Søndre Folgefonna, September 2011.
Photo: Solveig H. Winsvold, NVE.

Results

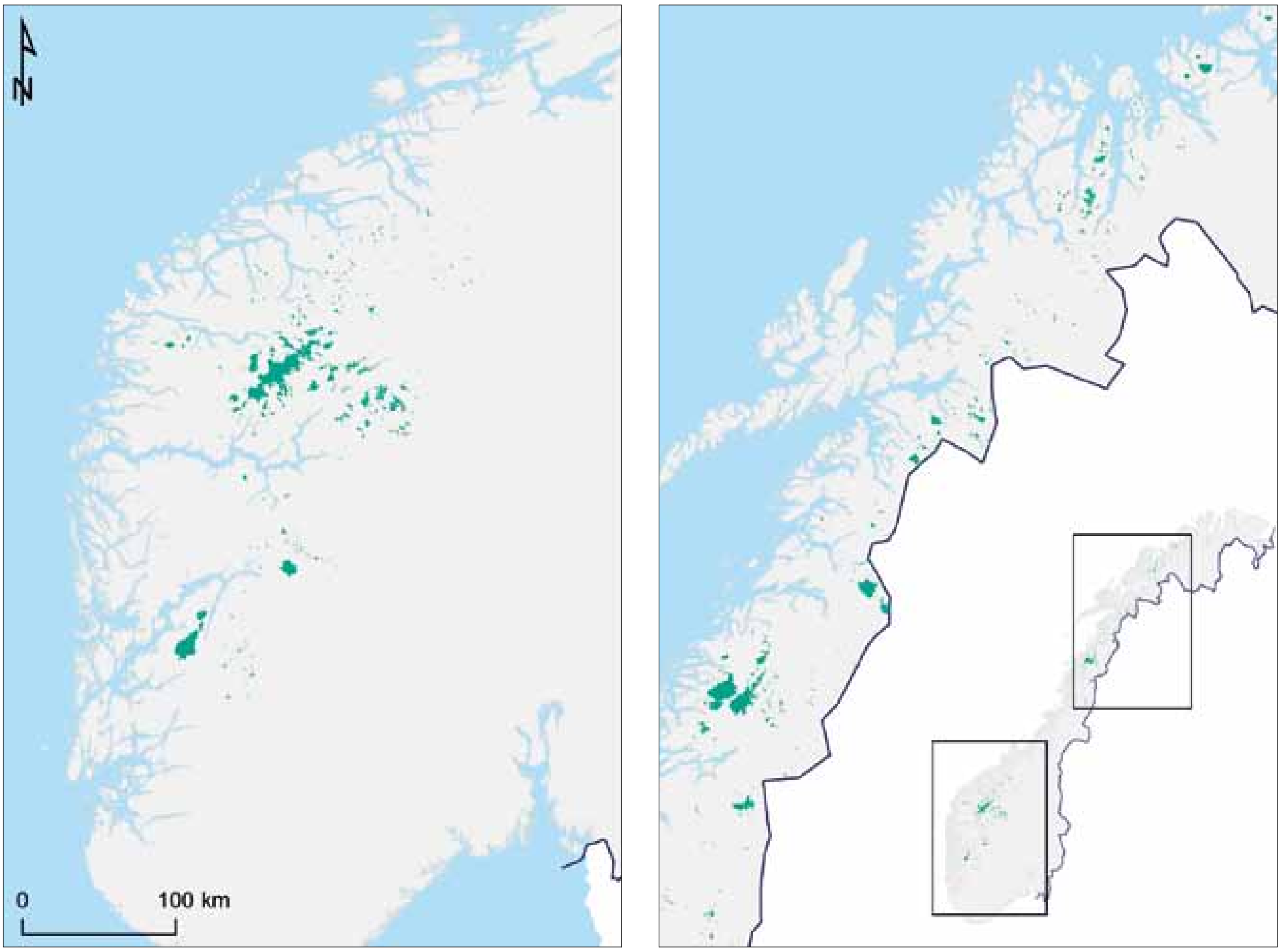
All mapped glaciers in Norway are displayed in tables and maps in part 2. In this chapter we present summary results and statistics based on these data. For explanation of the glacier and region numbering see page 69 of this glacier inventory.

Number and area of glaciers

In total 2534 glaciers (3143 glacier units) were defined for the new inventory. Of these 1252 glaciers (1575 glacier

	New inventories			Previous inventories		
	southern	northern	total	southern	northern	total
Number of glaciers	1252	1282	2534	714	913	1627
Number of glacier units	1575	1568	3143	991	1122	2113
Glacier area (km²)	1522.5	1169.3	2691.8	1592	1017	2609
Glacier area (%)	56.6	43.4	100.0	61.0	39.0	100.0

The number of glaciers, glacier units and total glacier area in southern, northern and total for Norway in the new and the previous inventories Atlas73 and Atlas88.



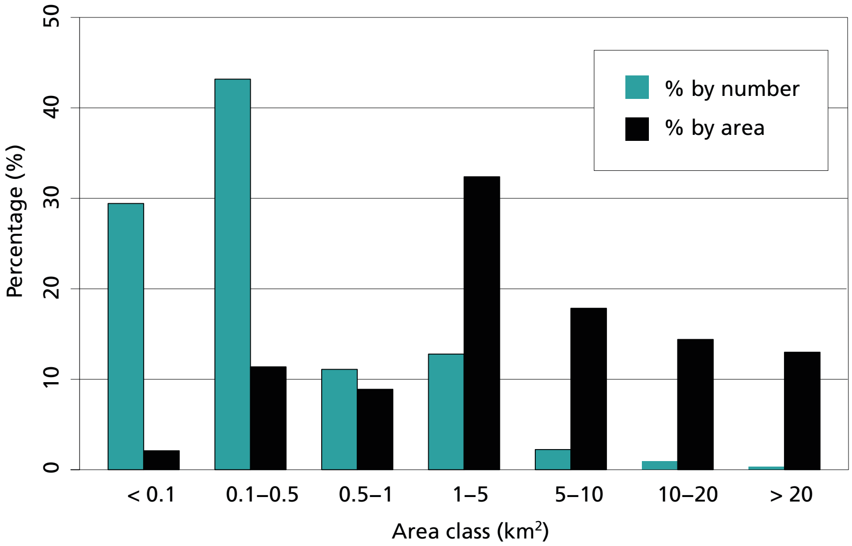
Location of glaciers in Norway, divided into southern and northern Norway. The glaciers are shaded in green to separate them from water bodies in this inventory.

units) were in southern Norway and 1282 (1568 glacier units) were in northern Norway. The total glacier area is 2692 km² ± 81 km² (using ± 3% as uncertainty), the larger part, 1523 km² (57%), is located in southern Norway, and 1169 km² (43%) in northern Norway.

The average glacier size in Norway, based on the glacier units, is 0.86 km² (0.97 km² in southern Norway and 0.75 km² in northern Norway). The data set is dominated by glaciers in the size class 1 – 5 km² which contribute 32% of the total area, but only 13% of the total number. The majority of the glaciers are smaller than 0.5 km² (73%, 2284 units), and contribute 14% to the total area. Glaciers larger than 10 km² contribute 30% to the total area, but only account for 1.3% in number. When glaciers smaller than 1 km² are summarized in one class, they cover 22% of the total area. Glaciers in the 0.5 – 1 km² size class are distributed almost evenly in percentage by number (11%) and area (9%). However, it should be noted that the selection of what to include as a glacier entity is somewhat subjective for the smallest glaciers, and this will influence the number and percentages to a certain degree. If all glaciers less than 0.2 (0.5) km² were left out of the inventory the glacier area would shrink to 2534 (2329) km² and number of glacier units to 1504 (859).

About 400 polygons classified as 'possible snowfield', and without assigned glacier ID, were not included in this inventory and are not displayed in the map section. They amount to 24 km². Their average size is 0.06 km², the largest being 0.33 km², but most are smaller than 0.1 km². Although they are not displayed in this inventory book or included in the statistics, they are stored in NVEs databases (and available at the digital map service 'NVE Atlas') and can be used for change assessments and other analyses. The total glacier area including these polygons is 2716 km². Glaciers and perennial snowfields thus cover about 0.7% of the land area in Norway.

The smallest glacier unit in the inventory is glacier 627, which has an area of 0.0097 km². Totally 278 glacier units were smaller than 0.05 km² (8.8%). The largest glacier unit is



Bar graphs showing percentages of glacier area and number per size class.

Size class km²	Count		Area	
	No.	%	km²	%
< 0.1	930	29.6	57	2.1
0.1 - 0.5	1354	43.1	306	11.4
0.5 - 1	349	11.1	240	8.9
1 - 5	400	12.7	871	32.3
5 - 10	70	2.2	481	17.8
10 - 20	29	0.9	388	17.4
> 20	11	0.4	350	13.0
Total	143	100	2692	100

Percentages of glacier area and number per size class.

Austerdalsisen (ID 1361), an outlet of Østre Svartisen with an area of 55.4 km². Austerdalsisen thus contributes to 2% of the total glacier area in Norway. As this is an outlet glacier, the glacier area will be sensitive to the location of the defined drainage divides. The data set includes 169 glacier complexes (representing totally 778 glacier units). The smallest has an area of 0.167 km² (a nameless glacier complex in glacier region 7) and the largest glacier complex is Jostedalsbreen with an area of 474 km².

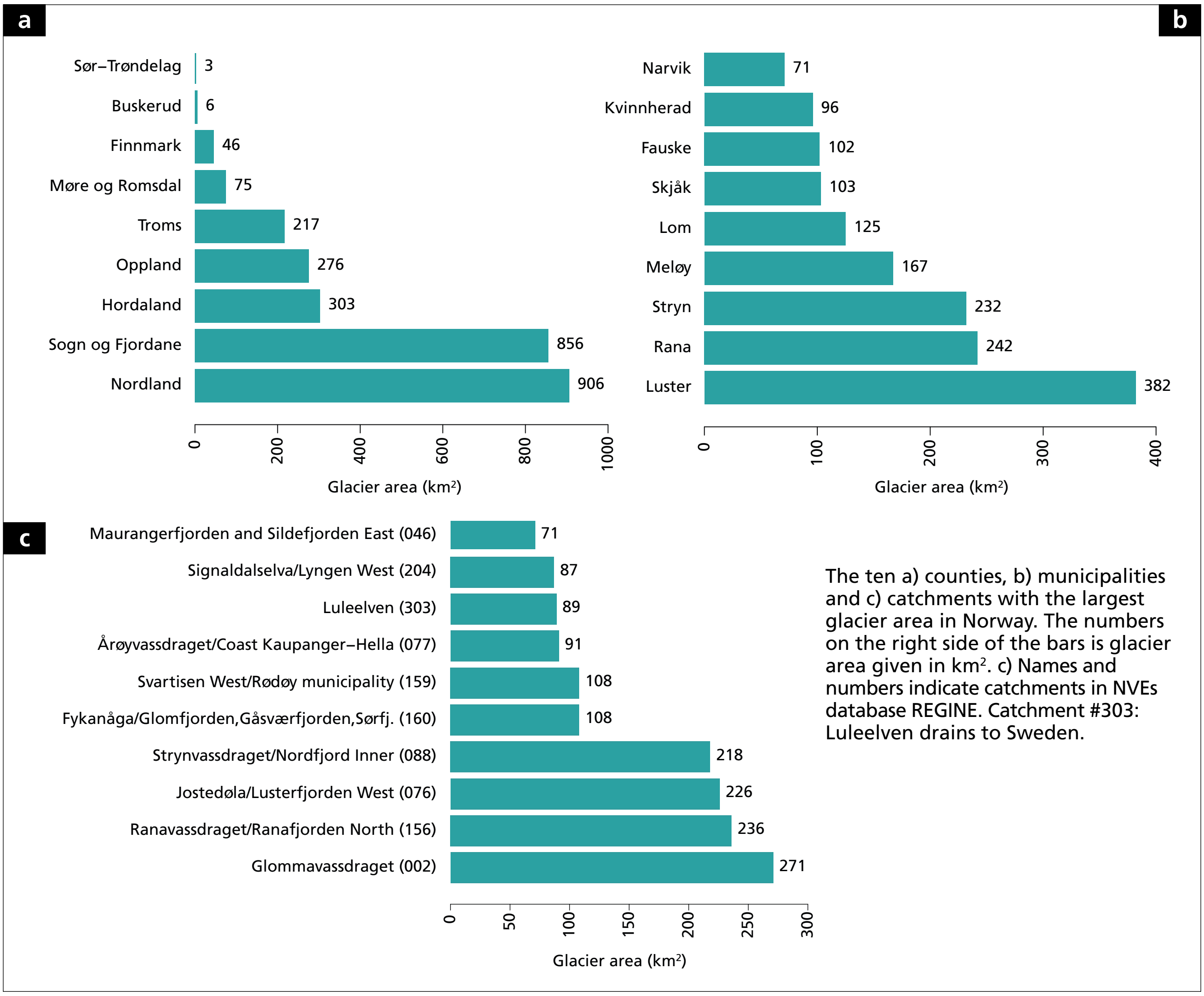
The westernmost glacier is ID 2076 (region 24) and the westernmost glacier complex is Blåbreen (BLB) located west of Ålfotbreen. The southernmost glacier is ID 3109 (region 35) and glacier complex Nupsfonn (NUP). The easternmost glacier is ID 11 (region 1) which is part of the glacier complex Seilandsjøkelen (SEJ). In southern Norway the easternmost glacier is ID 2737 (region 29) and glacier complex Gråsubrean/Grotbrean/Glitterbrean (GGG). The northernmost glacier is ID 3 (region 1) and glacier complex Nordmannsjøkelen (NOJ).

The number of glaciers in this inventory is nearly 57% larger compared to the 1627 glaciers reported in the previous inventory based on Atlas88 and Atlas73. The increase in number of glaciers is mainly due to inclusion of many small entities that were not included in the old inventories. Moreover, many smaller glaciers have disintegrated and now constitute of smaller, disconnected parts. The difference can be explained by the change in the methods applied to map glaciers. In the old inventories glaciers were manually drawn and seasonal snow was excluded. Some glaciers may have not been included if they were covered

Austerdalsisen (ID 1361), an outlet glacier of Østre Svartisen, is the largest glacier unit in the new inventory. Photo: Niels Giroud, October 2008.

by snow or not visible on the maps. In this Landsat-derived inventory almost all snow and ice were automatically mapped, except debris covered parts and bodies in cast shadow. Some of the new small glaciers included in the new inventory were not included on the topographic maps and may therefore have been overlooked in the past inventories. On the other hand, many of the smaller entities we included in the new inventory are perennial ice masses, and some may be seasonal snow where snow conditions were adverse for the mapping. In particular some of the scenes used for northern Norway (scenes no. 2, 3, 4 and 5, see p 37) have more seasonal snowfields and may thus overestimate glacier extents.

Norway is administratively divided into 19 counties and 429 municipalities (per 1 June 2012). According to the new inventory 11 of 19 counties, and



The ten a) counties, b) municipalities and c) catchments with the largest glacier area in Norway. The numbers on the right side of the bars is glacier area given in km². c) Names and numbers indicate catchments in NVEs database REGINE. Catchment #303: Luleelven drains to Sweden.

Glittertind (2464 m a.s.l. in 2004) in the background is the second highest peak in Norway. Its elevation varies due to the snowpatch on its summit, which is not included in the inventory. The glaciers in Jotunheimen - East (region 29) are the highest situated glaciers in Norway. Gråsubrean (ID 2743) in the foreground. Photo: Liss M. Andreassen, NVE, September 2012.

98 of 429 municipalities have glaciers within their boundaries. The counties Nordland (906 km^2, 34% of total glacier area), Sogn og Fjordane (856 km^2, 32%) and Hordaland (303 km^2, 11%) counties have the largest glacier area. The three municipalities Luster (382 km^2, 14% of total glacier area), Rana (242 km^2, 9%) and Stryn (232 km^2, 9%) have the largest glacier area.

Norway is divided into 262 water catchments in the national database called REGINE, which is maintained by NVE. The three catchments in Norway with the largest glacier area are Glommavassdraget (catchment #002), Ranavassdraget/Ranafjorden North (#156) and Jostedøla/Lusterfjorden West (#076). The glacier area covered in each drainage basin is 271 km^2 (10% of total glacier area), 236 km^2 (9%) and 226 km^2 (8%) respectively.

A total of 15 glacier units in the new inventory are located on the boarder to Sweden. Two glaciers have larger parts located in Sweden: Rivgojiekna (ID 714, region 9) and Sulitjelmaisen (ID 978, region 12). These two were therefore divided by the Swedish border and only the Norwegian parts were included in the tabular data. Thus inventory data for these two units only represents the Norwegian part. Another 13 glaciers were located on the border (in regions 7, 8, 9, 10, 11 and 12), but with only small parts located in Sweden. Since their Swedish parts were so small, their entire outlines were included in the tabular data displayed in part 2, but the Swedish parts (totally 1.3 km^2) were excluded from the total glacier area of Norway. The glaciers located on the border to Sweden count for an area of 19.4 km^2 in Norway. Water from 132 Norwegian glacier units (about 115 km^2) drains to Sweden.

Of all the 3143 glacier units in Norway, 1595 of them drain to catchments regulated for hydropower. The glaciers draining to regulated catchments represent a glacier area of 1610 km^2, 60% of the total glacier area in Norway.

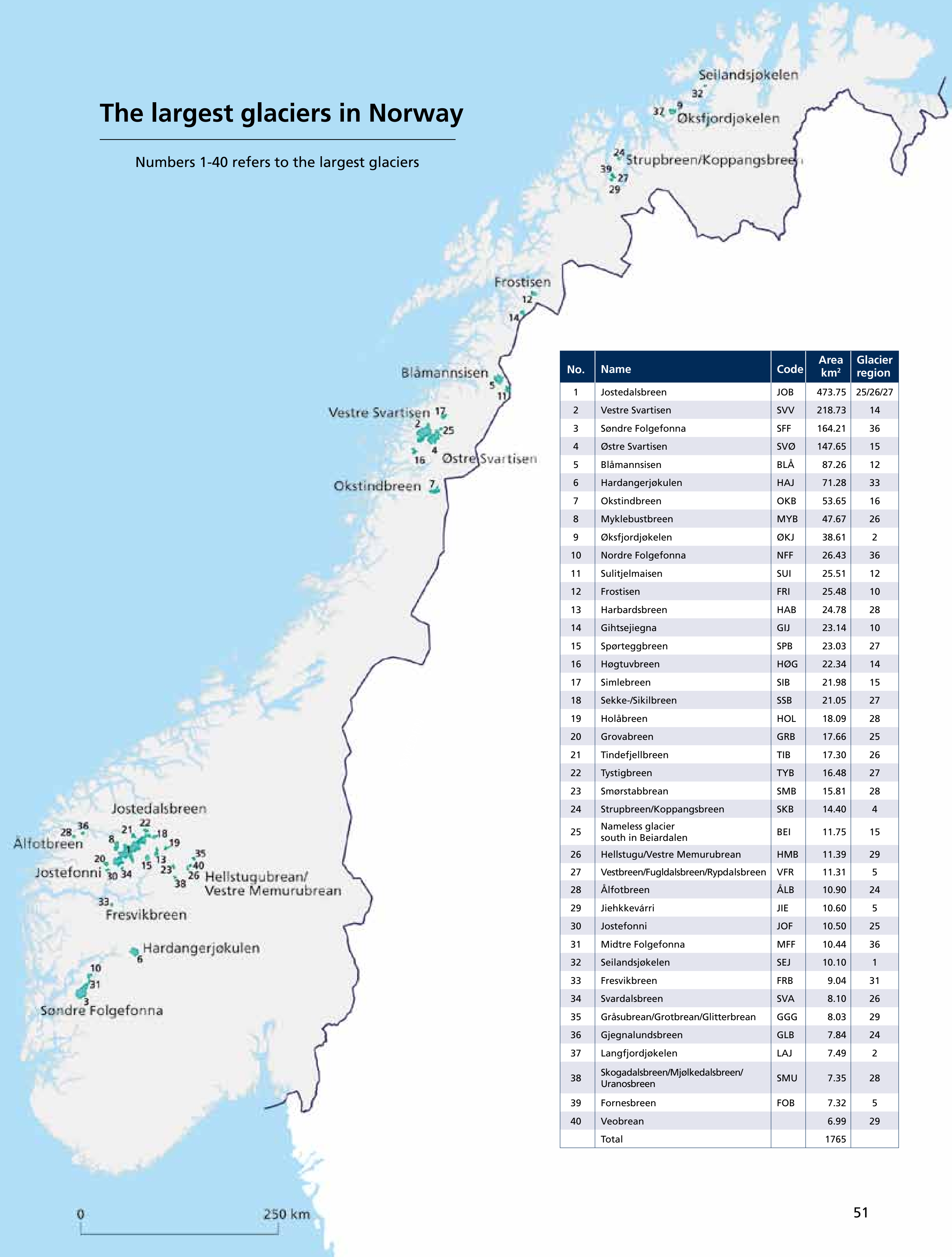
May glaciers exist in other parts not shown in this inventory? As mentioned the polygons classified as 'possible snowfield' without assigned glacier IDs were not included in this inventory and are not displayed in the map section. Two small polygons in the Rondane Mountains, a continental part of southern Norway east of Jotunheimen, with sizes of 0.035 km^2 and 0.019 km^2 are in this category. They may be ice remnants of cirque glaciers. We have not included glaciers in Sylane as most of the glacier area belongs to Sweden and only a very small part (0.15 km) of one glacier is in Norway. The Sylane and Rondane regions were not included in the previous inventories of South Norway either. In addition to this amount of 'possible snowfields' which may contain glacier ice, but were not assigned IDs in this inventory, there may also be small bodies that were missed, either that they are misclassified (e.g. hidden in shadow or clouds) or outside the imagery used for this inventory.

The largest glaciers in Norway

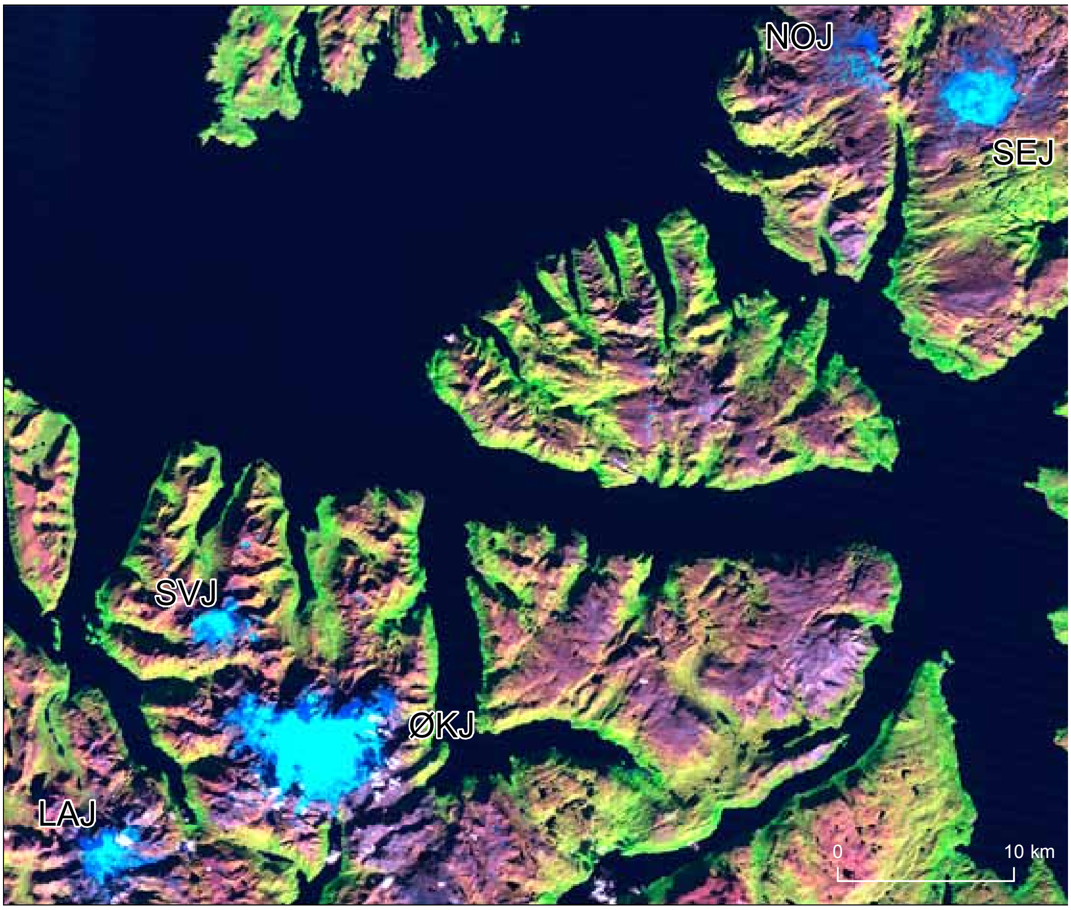
The 40 largest glaciers in Norway cover 1765 km^2 or 65.5% of the total glacier area. The largest glacier is Jostedalsbreen and it is divided into 82 units in this new inventory. The four largest glacier complexes are Jostedalsbreen (474 km^2), Vestre Svartisen (219 km^2), Søndre Folgefonna (164 km^2) and Østre Svartisen (148 km^2). They comprise 37% (1004 km^2) of the total glacierized area.

The largest glaciers in Norway

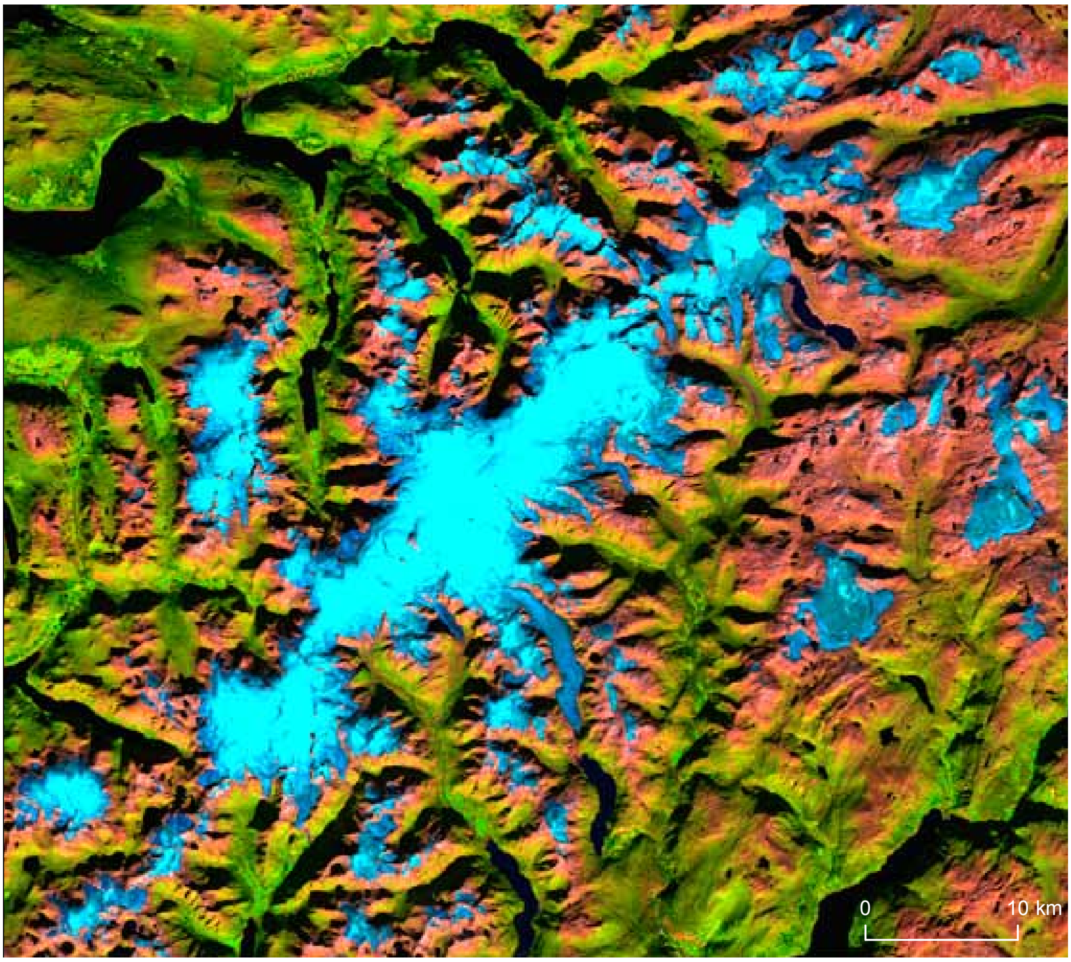
Numbers 1-40 refers to the largest glaciers



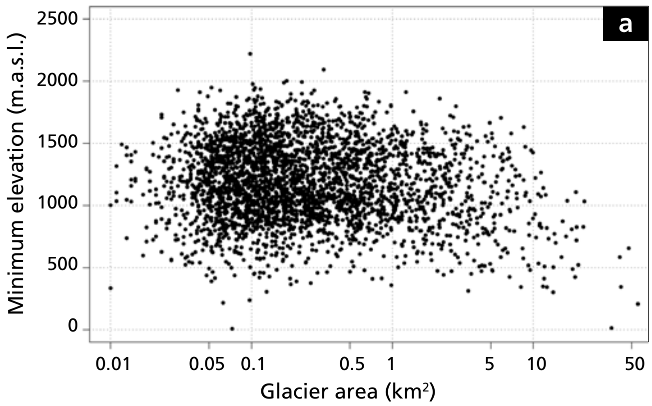
No.	Name	Code	Area km²	Glacier region
1	Jostedalsbreen	JOB	473.75	25/26/27
2	Vestre Svartisen	SVV	218.73	14
3	Søndre Folgefonna	SFF	164.21	36
4	Østre Svartisen	SVØ	147.65	15
5	Blåmannsisen	BLÅ	87.26	12
6	Hardangerjøkulen	HAJ	71.28	33
7	Okstindbreen	OKB	53.65	16
8	Myklebustbreen	MYB	47.67	26
9	Øksfjordjøkelen	ØKJ	38.61	2
10	Nordre Folgefonna	NFF	26.43	36
11	Sulitjelmaisen	SUI	25.51	12
12	Frostisen	FRI	25.48	10
13	Harbardsbreen	HAB	24.78	28
14	Gihtsejiegna	GIJ	23.14	10
15	Spørteggbreen	SPB	23.03	27
16	Høgtuvbreen	HØG	22.34	14
17	Simlebreen	SIB	21.98	15
18	Sekke-/Sikilbreen	SSB	21.05	27
19	Holåbreen	HOL	18.09	28
20	Grovabreen	GRB	17.66	25
21	Tindefjellbreen	TIB	17.30	26
22	Tystigbreen	TYB	16.48	27
23	Smørstabbrean	SMB	15.81	28
24	Strupbreen/Koppangsbreen	SKB	14.40	4
25	Nameless glacier south in Beiardalen	BEI	11.75	15
26	Hellstugu/Vestre Memurubrean	HMB	11.39	29
27	Vestbreen/Fugldalsbreen/Rypdalsbreen	VFR	11.31	5
28	Ålfotbreen	ÅLB	10.90	24
29	Jiehkkevárri	JIE	10.60	5
30	Jostefonni	JOF	10.50	25
31	Midtre Folgefonna	MFF	10.44	36
32	Seilandsjøkelen	SEJ	10.10	1
33	Fresvikbreen	FRB	9.04	31
34	Svardalsbreen	SVA	8.10	26
35	Gråsubrean/Grotbrean/Glitterbrean	GGG	8.03	29
36	Gjegnalundsbreen	GLB	7.84	24
37	Langfjordjøkelen	LAJ	7.49	2
38	Skogadalsbreen/Mjølkedalsbreen/ Uranosbreen	SMU	7.35	28
39	Fornesbreen	FOB	7.32	5
40	Veobrean		6.99	29
	Total		1765	

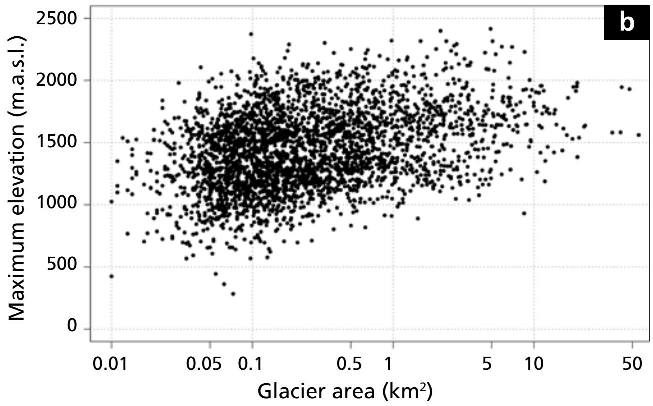


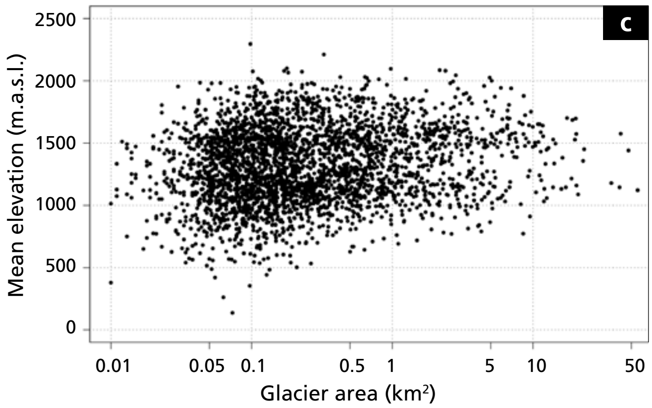
Landsat image from 28 August 2006 showing the northernmost glaciers in mainland Norway, five small ice caps in Finnmark. LAJ – Langfjordjøkelen, ØKJ-Øksfjordjøkelen, SVJ-Svartfjelljøkelen, SEJ-Seilandsjøkelen and NOJ-Nordmannsjøkelen. The glaciers have shrunk in the 20th century, and Nordmannsjøkelen has disintegrated into several smaller parts.



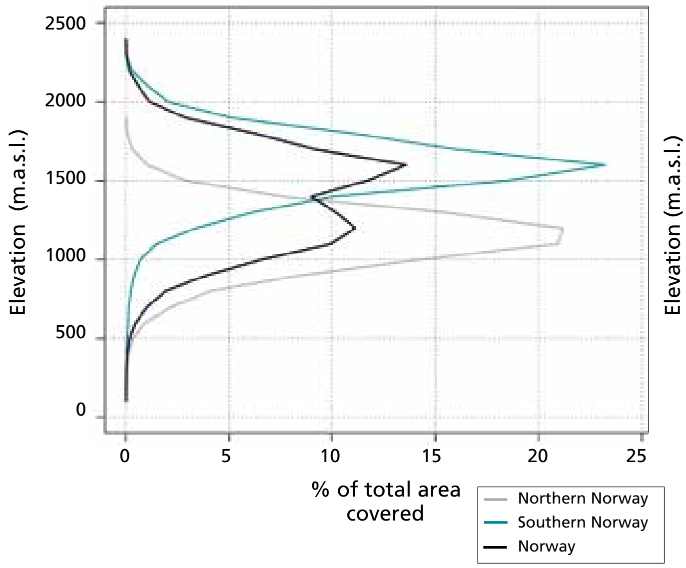
Landsat image from 16 September 2006 showing Jostedalsbreen, the largest contiguous ice mass in Norway with a total area of 474 km^2.

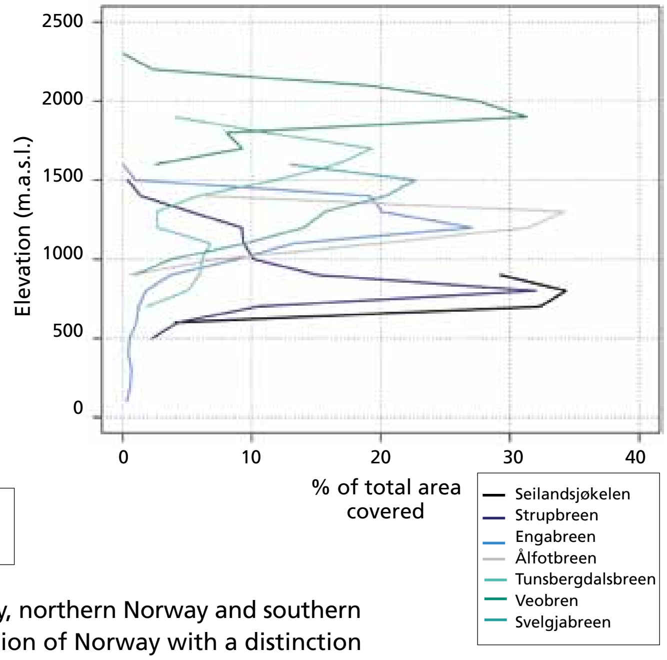




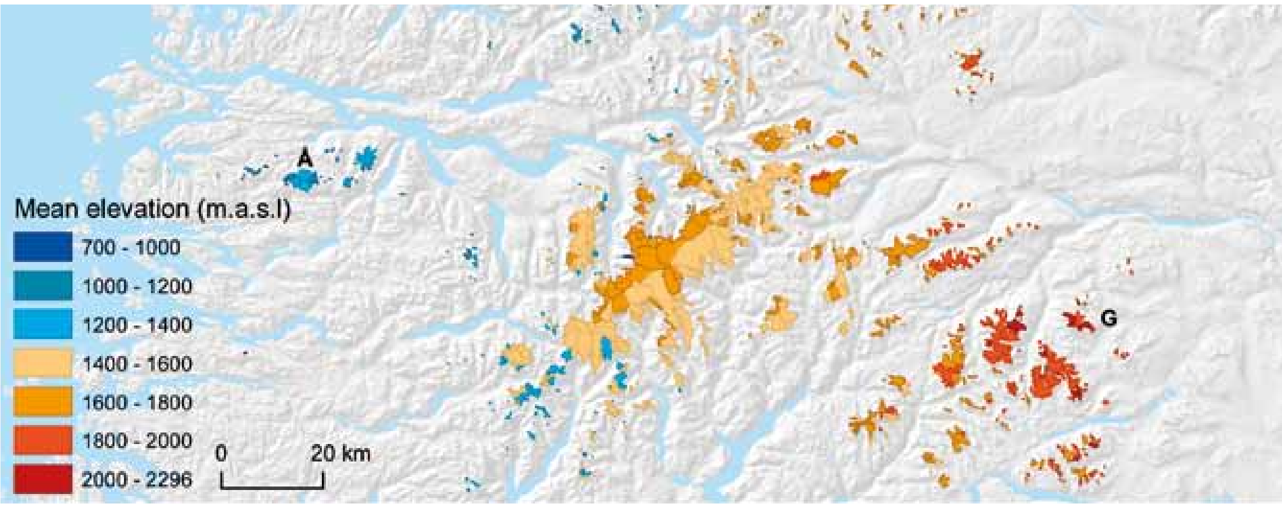


Glacier area (km²) is plotted against a) minimum elevation, b) maximum elevation and c) mean elevation. Small glaciers are located at all elevations. The two glaciers with lowest minimum elevation are Nerisen (ID 48) and Engabreen (ID 1094) which can be recognized by the two dots with minimum elevation of 8 m and 14 m.a.s.l. With regard to minimum, maximum and mean elevation, glaciers can be located everywhere independent of their size. There is a weak tendency for a higher maximum elevation for larger glaciers, although glaciers smaller than 10 km² have the highest elevations.

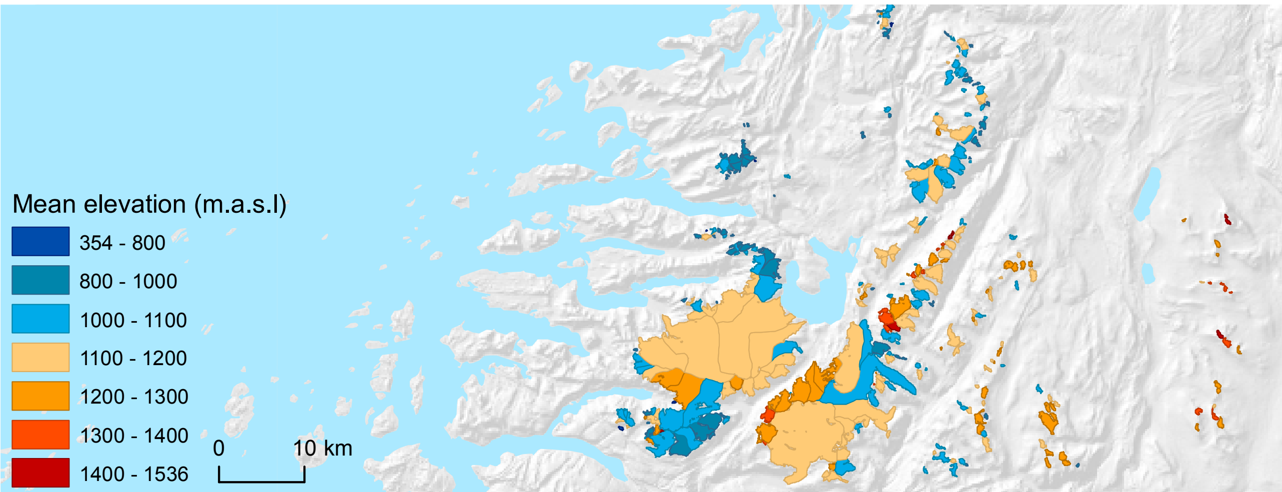




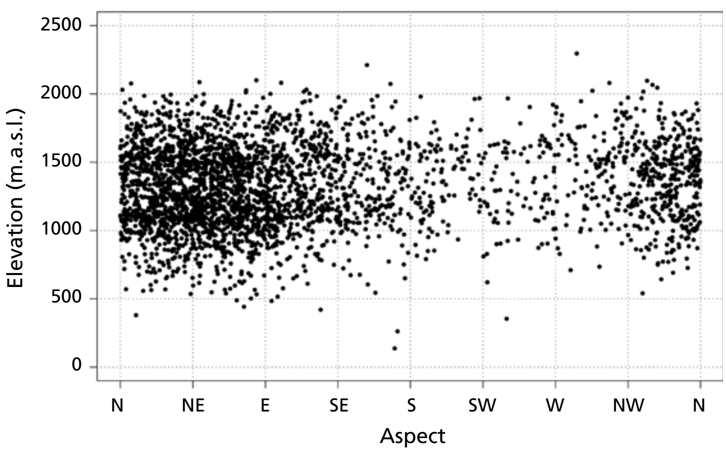
Left: The area-elevation distribution of glaciers in Norway, northern Norway and southern Norway in 100 m intervals. The clearly bi-modal distribution of Norway with a distinction between 1000 – 1300 m and 1400 – 1600 m illustrates the predominant location of glaciers in northern and southern Norway, respectively.
Right: The area-elevation distribution of seven glaciers in Norway in 100 m intervals. The glaciers are ranged from north to south in the legend. Glaciers in southern Norway (Ålfotbreen, Tunsbergdalsbreen, Veobrean, Svelgjabreen) are generally located at higher elevations than glaciers in the north (Seilandsjøkelen, Strupbreen, Engabreen). Ice caps (Seilandsjøkelen, Ålfotbreen) usually have the majority of their area in a limited elevation interval near their maximum elevation, whereas mountain and valley glaciers (Strupbreen, Veobrean) have a more even distribution and the largest area around their mean elevation (e.g. Manley, 2008; Paul and Svoboda, 2009). Engabreen from Vestre Svartisen has a huge accumulation area and a narrow tongue reaching far down. It has the typical hypsography of an outlet glacier from an ice cap.



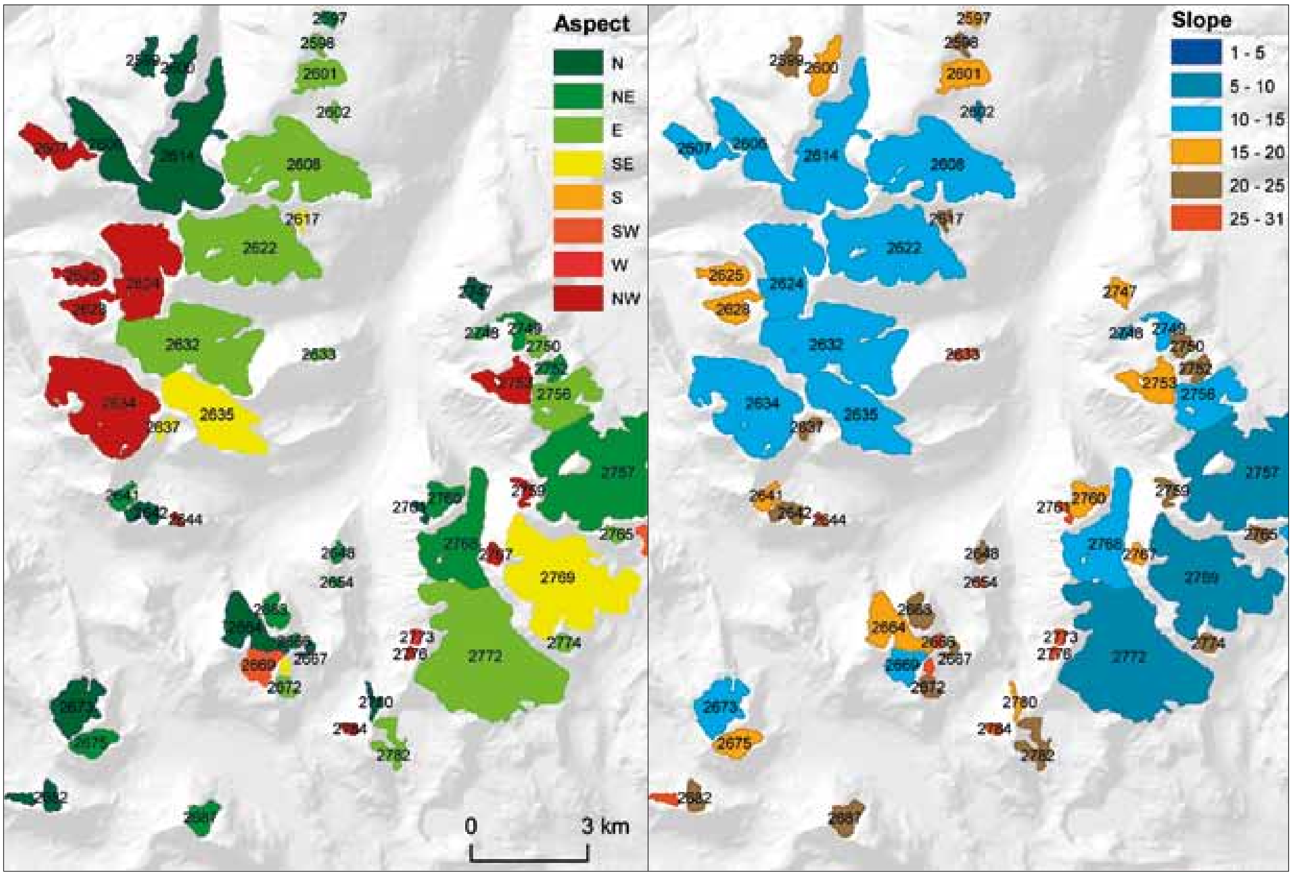
Colour coded visualization of mean elevation for a west (coast) – east (interior) transect in southern Norway. The glacier mean elevation gradually increases from low elevations on the west coast, towards higher elevations in the more continental and drier regions in the east. No glaciers are located farther east than the Jotunheimen regions. The increase in mean elevation from west to east reflects the strong precipitation gradient in this region. Location of long-term mass balance glaciers Ålfotbreen (Å, ID 2078) in the west and Gråsubrean (G, ID 2743) in the east are shown for reference.



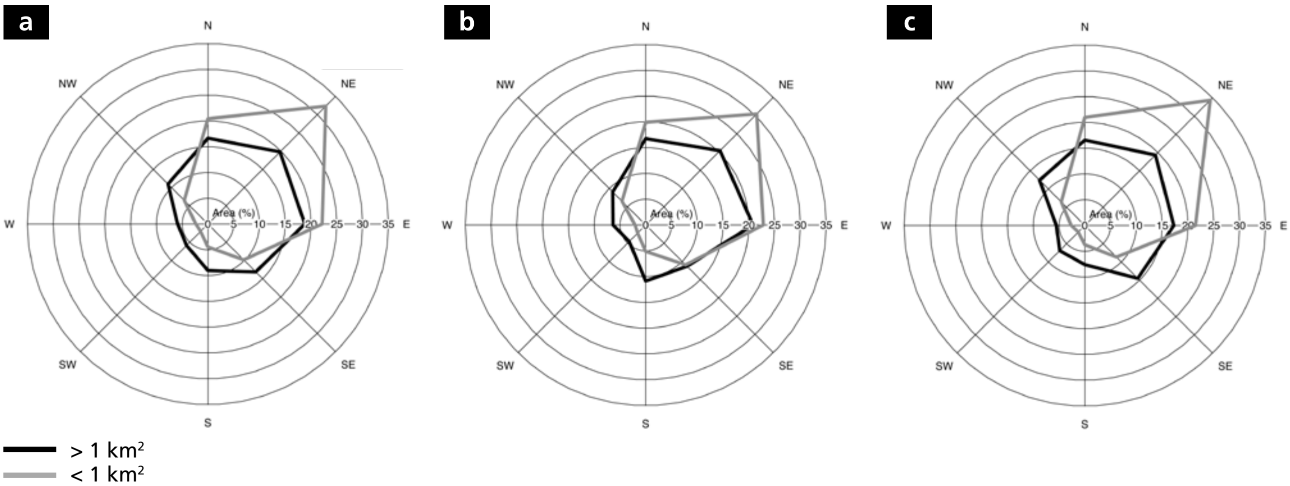
Colour coded visualization of mean elevation for a west (coast) – east (interior) transect in the Svartisen regions, northern Norway. Note that the scale and elevation range differ from the transect of southern Norway. The glacier mean elevation increases from the west coast towards the east, but the pattern is not so clear as in southern Norway. The mean elevation of the glaciers is generally lower in northern Norway.



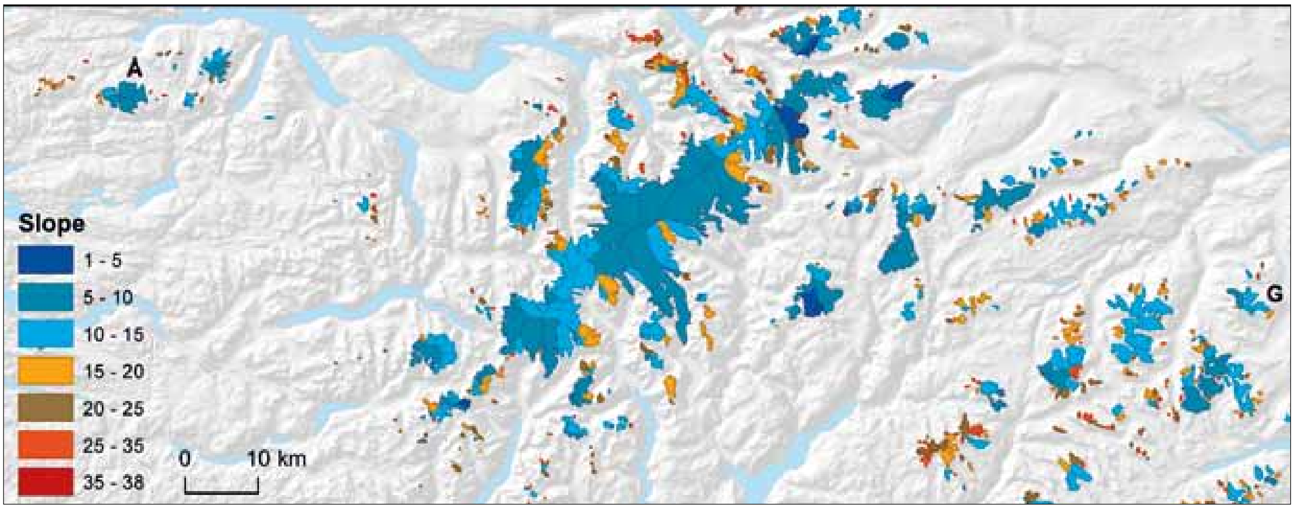
Mean elevation plotted against aspect for all glaciers in Norway. Glaciers in Norway are oriented in all directions, but glaciers facing to the north and east dominate.



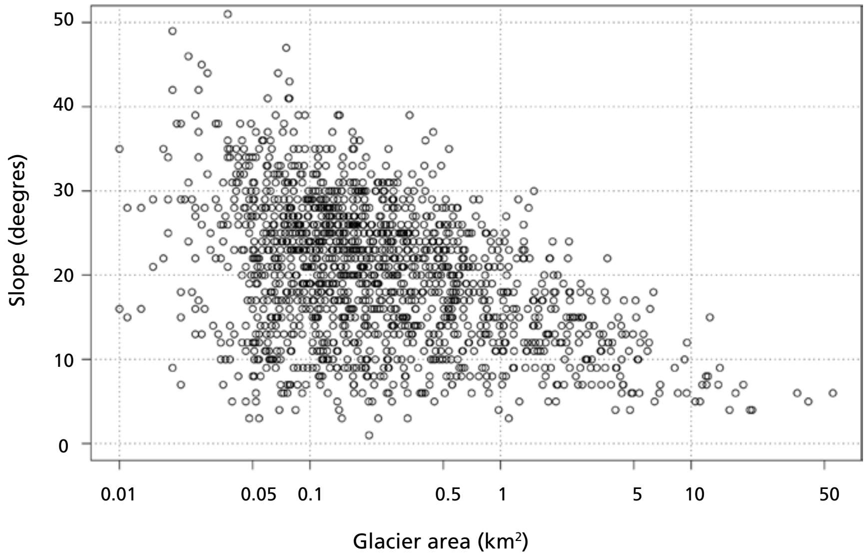
A colour-coded illustration of mean aspect (left) and slope (right) for selected glaciers in central Jotunheimen. The numbers are glacier IDs. The larger mountain glaciers have gentler slopes than the smaller glaciers. N, NE and E are the dominant aspects. None of the glaciers are facing south or have mean slope in the class 1-5 degrees in this section.

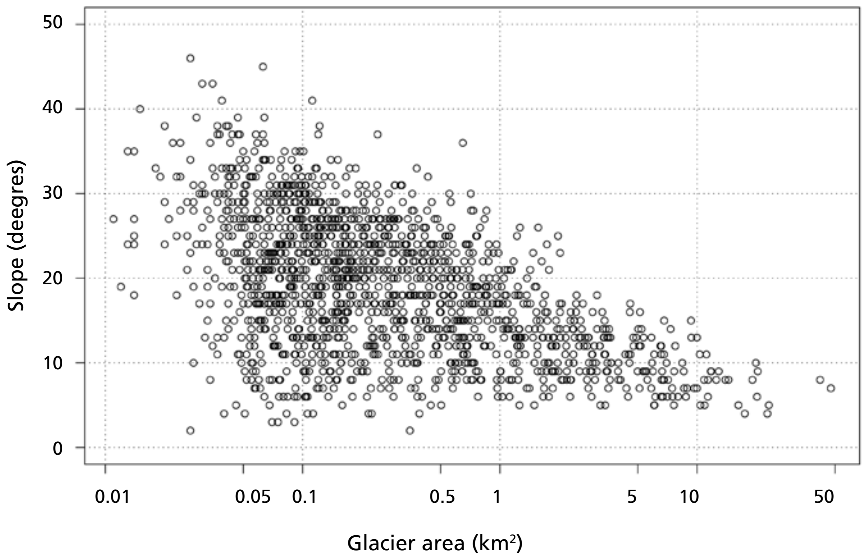


Aspect illustrated in radial charts for a) Norway, b) northern Norway and c) southern Norway. Overall, 55% of the glaciers > 1 km^2 face towards the three sectors N, NE, and E, while only 21% face towards the opposite quadrant S, SW and W. Larger glaciers are somewhat more evenly distributed compared to the smaller ones. This distribution is found in both northern and southern Norway. The high number of glaciers facing toward the NE can be explained by the reduced solar radiation on north facing slopes. Most likely, also the prevailing SW wind direction leads to the accumulation of drifting snow on these north-east facing mountain slopes.



A colour-coded visualization showing mean slope in degrees for for a west (coast) – east (interior) transect in southern Norway. Larger glaciers and glaciers belonging to ice caps/glacier complexes have generally lower mean slopes than smaller glaciers and individual cirque and mountain glaciers. Location of long-term mass balance glaciers Ålfotbreen (Å, ID 2078) in the west and Gråsubrean (G, ID 2743) in the east are shown for reference.





A plot showing the slope for each glacier unit in northern Norway (upper) and southern Norway (lower). Larger glaciers tend to have smaller mean slopes, while smaller glaciers can have any slope. Glaciers in northern Norway have higher mean slope values on some glaciers, especially small ones (< 0.1 km^2), compared to southern Norway.

Glaciers related to ice caps or glacier complexes usually have lower mean slope values compared to cirque and mountain glaciers which have higher mean slope values (Paul and others, 2011). In total 778 glaciers in northern Norway have a mean slope greater than 20 degrees (24.7%), and 676 glaciers in southern Norway (21.5%). 154 glaciers in northern Norway have a mean slope greater than 30 degrees (4.9%), and 121 glaciers in southern Norway (3.8%).

Glacier changes

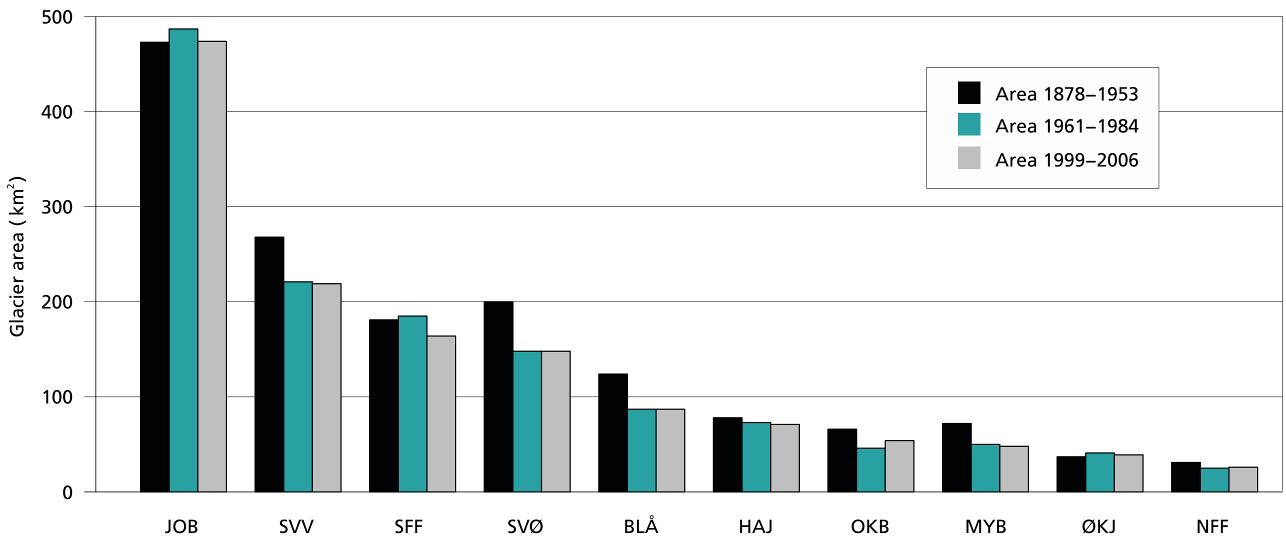
Analysing glacier changes for individual units in the new glacier inventory with the previous inventories is not straightforward. As already mentioned the previous inventories existed only as tabular data with glacier extents printed on sketch maps. For many of the smallest glaciers it is often uncertain to which glacier the point information stored in the glacier inventories belongs to. Furthermore, glacier basins are impossible to reconstruct precisely from the sketch maps. Comparisons with tabular data from the previous inventories should only be done for single glaciers or for complete glacier complexes, not for individual units belonging to complexes.

Looking at the largest glacier complexes a comparison of the glacier area can be made from the estimates in the previous inventories. According to the list of glaciers by Liestøl (1962) the ten largest glaciers had a total area of 1529 km². The mapping dates vary greatly for this early survey, from around 1900 for some to 1950s for others. It is also uncertain which entities were included in each glacier complex as no detailed maps from this survey were published. In Atlas88/Atlas73 the mapping years varied from 1962 to 1984 for this selection, the total area of the 10 largest was 1363 km². In this present inventory mapping years range from 1999 to 2006, and the total area was 1329 km², a reduction of 200 km² (13%) since the first estimate in 1962. However, note that the glacier area of Jostedalsbreen is nearly the same from the earliest to the present estimate and larger in 1984, and that Øksfjordjøkelen was smallest in the first estimate. Both complexes clearly shrunk between the first and subsequent estimates, so this reveals differences in what was included in the complex or other errors, rather than glacier changes. Results from assessments from tabular data should therefore be interpreted with care.

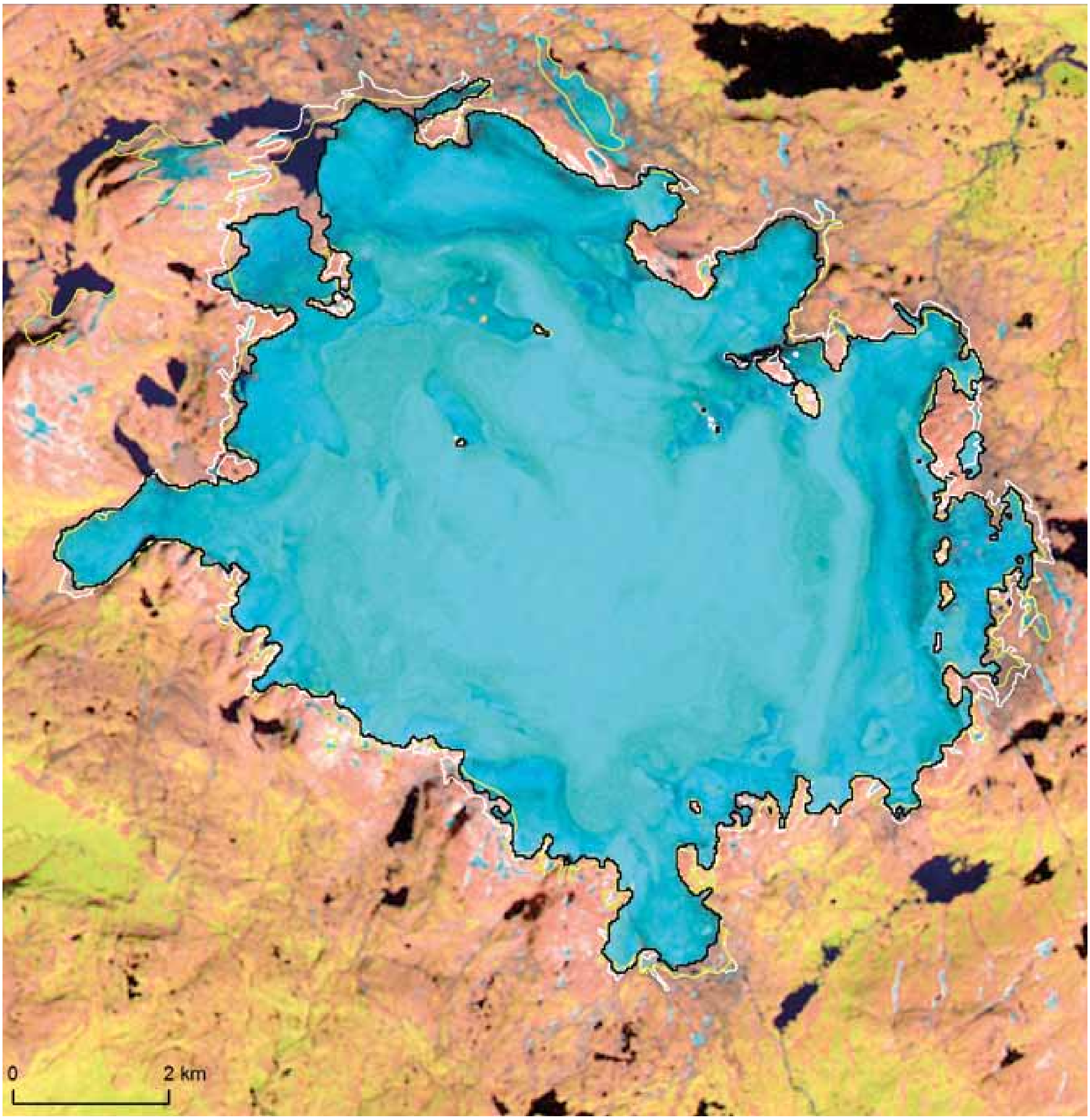
In a case study in the Jotunheimen region, which comprise many individual valley and cirque glaciers (mountain glaciers) and only a few ice caps/glacier complexes, a sample of 161 glacier units have been compared with the

		New inventory 1999-2006		Atlas 73/ Atlas88		Liestøl 1962	
No.	Name	Year	Area (km²)	Year	Area (km²)	Year	Area (km²)
1	Jostedalsbreen	2006	474	1984	487	1945	473
2	Vestre Svartisen	1999	219	1968	221	1894-1905	268
3	Søndre Folgefonna	2002	164	1981	185	1927-1953	181
4	Østre Svartisen	1999	148	1968	148	1894-1905	200
5	Blåmannsisen	1999	87	1961	87	1904-1907	124
6	Hardangerjøkulen	2003	71	1983	73	1936	78
7	Okstindbreen	1999	54	1962	46	1885-1894	66
8	Myklebustbreen	2006	48	1984	50	1945	72
9	Øksfjordjøkelen	2006	39	1966	41	1878-1945	37
10	Nordre Folgefonna	2002	26	1981	25	1927-1953	31
	Sum		1329		1363		1529

Comparison of area of the 10 largest glaciers in Norway based on three assessments: this inventory 1999-2006, the previous inventory Atlas73-Atlas88 and the list of glaciers by Liestøl (1962). Note that mapping year varies greatly.



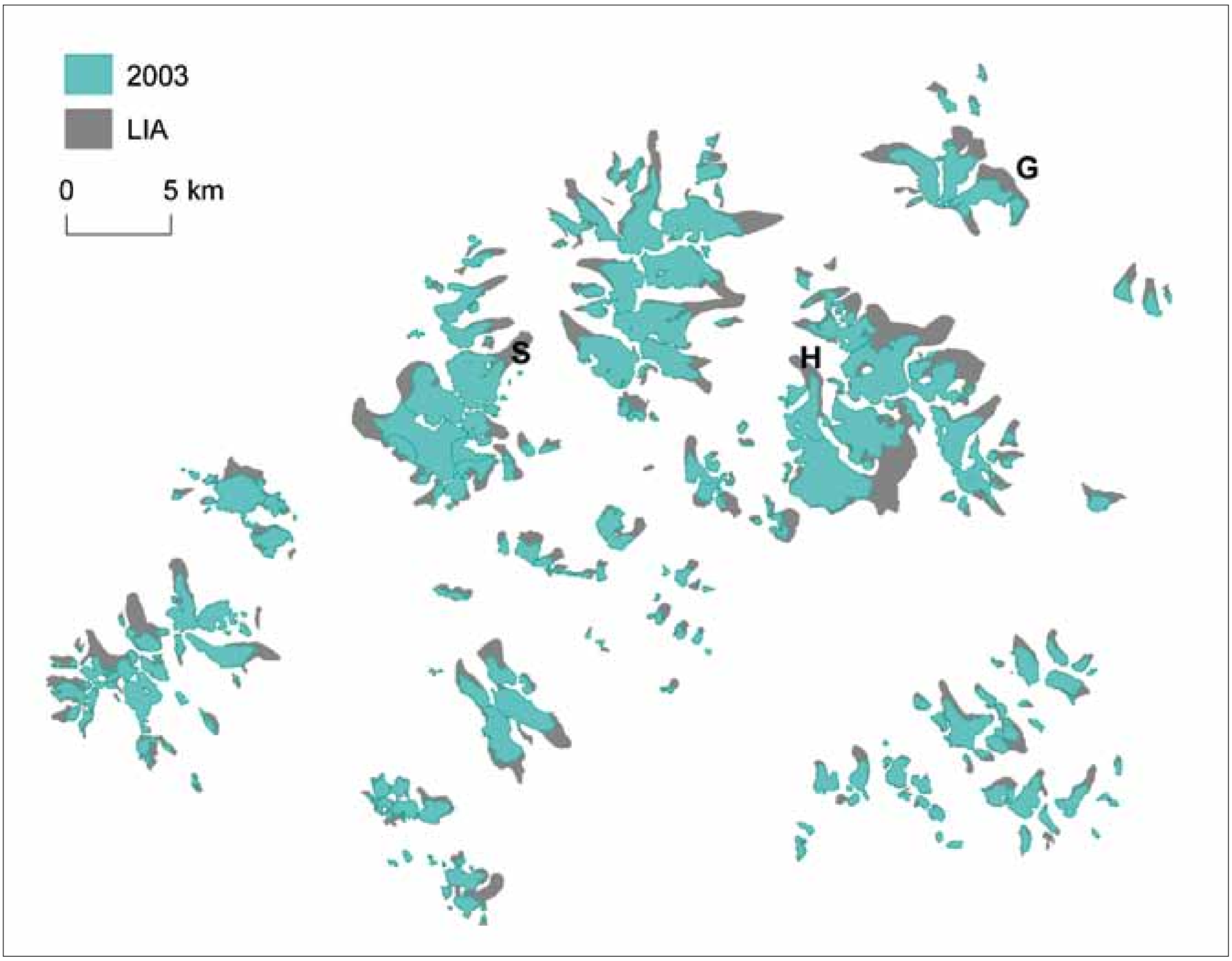
Comparison of area of the 10 largest glaciers in Norway based on three assessments. See the above table for more information on mapping years for individual glaciers. JOB=Jostedalsbreen, SVV=Vestre Svartisen, SFF=Søndre Folgefonna, SVØ= Østre Svartisen, BLÅ=Blåmannsisen, HAJ=Hardangerjøkulen, OKS=Okstindbreen, MYB=Myklebustbreen. ØKJ=Øksfjordjøkelen and NFF=Nordre Folgefonna.



Landsat image of Hardangerjøkulen from 9 August 2003 with the 2003 outline shown in black. The outlines from 1973 (yellow) and 1961 (white) show glacier extent digitized from maps of the glacier.

two previous inventories Atlas 69 and Atlas88 (Andreassen and others, 2008a). Most of the smallest glaciers (<0.1 km²) and some of the largest glacier units (belonging to glacier complexes) were excluded from the comparison to avoid uncertainties related to identification and ice divides. The comparison showed that the total area of the 161 glaciers was reduced from 229.5 km² in 1965/1966 (Atlas69) to 213.6 km² in ~1980 (Atlas88) and 201.0 km² in 2003 (the new inventory). The total reduction was 28.5 km² or 12% for the 38 year period. The change in area grouped into size classes showed that the reduction in glacier area was mainly caused by shrinkage of the mountain glaciers (size class 1–5 km²). The study revealed that an inventory comparison can be done in regions with many individual glaciers like Jotunheimen, but it is not recommended for individual units belonging to ice caps/glacier complexes.

Glacier change analysis can also be done by comparing the Landsat-derived outlines for this inventory with glacier outlines from the N50-maps. This has so far been done in some regions in Norway: in Jotunheimen (Andreassen and others, 2008a), Svartisen (Paul and Andreassen, 2009), Jostedalsbreen (Paul and others, 2011) and Seiland and Øksfjord (Winsvold and Andreassen, 2010). In the Svartisen study the N50-outlines were mainly from 1968, in Jotunheimen 1966-1983, for Jostedalsbreen outlines were mainly from 1966, and in Seiland and Øksjord the outlines were from 1966. In Jotunheimen (sample of 355 glacier units) the glaciers have generally decreased, the total reduction was 10% from 1966-1983 to 2003. In Svartisen (sample of 300 glacier units) there was virtually no change in glacier size (−1.1% or −0.35% per deca-



Glacier changes in a section of Jotunheimen from their Little Ice Age (LIA) maximum extent to their 2003 extent. Location of long-term mass balance glaciers Storbrean (S, ID 2636), Hellstugubrean (H, ID 2768) and Gråsubrean (G, ID 2743) are shown for reference. Data from Baumann and others (2009) and Andreassen and others (2008a).

de) from 1968 to 1999. In Jostedalsbreen (sample of 297 glacier units) the area reduction was 9% from 1966 to 2006. In Seiland and Øksjord the area reduction of five ice caps was 28% from 1966 to 2006. The scatter of individual changes was large in all four study regions and strongly increased towards smaller glaciers. Although the periods are different so the results are not directly comparable, results clearly point to regional differences in glacier area development.

The new outlines can also be compared with maps made especially for a glacier. Maps of Hardangerjøkulen reveal a glacier area of 76.9 km^2 in 1961, 74.4 km^2 in 1971, whereas the Landsat image from 2003 used for this inventory reveal an area of 71.3 km^2. The reduction in area was thus 7% from 1961 to 2003.

Landsat images can also be used to map previous glacier extent. In a study from a section in Jotunheimen the Landsat image from 2003, which was used to map the glaciers in Jotunheimen for this inventory, was used together with aerial photos and other information to map the LIA maximum extent and create a LIA inventory (Baumann and others, 2009). Results revealed that between the LIA maximum extent and 2003 the glaciers shrank by 35% of their area and 34% of their length. The timing of the LIA maximum in Jotunheimen is roughly between AD1750 and 1800, earliest in West and Central Jotunheimen, whereas in East Jotunheimen it is closer to AD1800 (Winkler, 2002; Matthews, 2005).

It should be noted that there will be several uncertainties in the area change assessments since one compares glacier areas derived from different sources (Landsat, topographic maps or tabular data), often with different snow conditions. Each method has its specific uncertainties, so calculated area changes may partly be due to differences in methods, snow conditions or human interpretation rather than real glacier changes.

References

Albert, T. 2002. *Evaluation of remote sensing techniques for ice-area classification applied to the tropical Quelccaya ice cap, Peru.* Polar Geography, 26, 210–226.

Andersen, B.G. 1968. *Glacial geology of western Troms, North Norway.* Norges geologiske undersøkelse, 256, 1–160.

Andreassen, L.M. 1999. *Comparing traditional mass balance measurements with long-term volume change extracted from topographical maps: a case study of Storbreen glacier in Jotunheimen, Norway, in the period 1940 - 1997.* Geografiska Annaler, 81 A (4), 467-476.

Andreassen, L.M. and J. Oerlemans. 2009. *Modelling long-term summer and winter balances and the climate sensitivity of Storbreen, Norway.* Geografiska Annaler, 91 A (4), 233–251.

Andreassen, L.M. (ed.), B. Kjøllmoen, N.T. Knudsen, W.B. Whalley and J. Fjellanger. 2000. *Regional change of glaciers in northern Norway.* NVE Report, 1.

Andreassen, L.M., H. Elvehøy and B. Kjøllmoen. 2002. *Using aerial photography to study glacier changes in Norway.* Annals of Glaciology, 34, 343–348.

Andreassen, L.M., H. Elvehøy, B. Kjøllmoen, R.V. Engeset and N. Haakensen. 2005. *Glacier mass balance and length variations in Norway.* Annals of Glaciology, 42, 317–325.

Andreassen, L.M., F. Paul, A. Kääb and J.E. Hausberg. 2008a. *Landsat-derived glacier inventory for Jotunheimen, Norway, and deduced glacier changes since the 1930s.* The Cryosphere, 2, 131–145.

Andreassen, L.M., M.R. van den Broeke, R.H. Giesen and J. Oerlemans. 2008b. *A five-year record of surface energy and mass balance from the ablation zone of Storbreen, Norway.* Journal of Glaciology, 54 (185), 245–258.

Andreassen, L.M., B. Kjøllmoen, A. Rasmussen, K. Melvold and Ø. Nordli. 2012. *Langfjordjøkelen, a rapidly shrinking glacier in northern Norway.* Journal of Glaciology, 58 (209), 581–593.

Bakke, J., S.O. Dahl, Ø. Paasche and A. Nesje. 2005. *Glacier fluctuations, equilibrium-line altitudes and palaeoclimate in Lyngen, northern Norway during the Lateglacial and Holocene.* Holocene, 15 (4), 518–540.

Ballantyne, C.K. 1990. *The Holocene glacial history of Lyngshalvøya, northern Norway: chronology and climate implications.* Boreas, 19 (2), 93–117.

Baumann, S., S. Winkler and L.M. Andreassen. 2009. *Mapping glaciers in Jotunheimen, South-Norway, during the 'Little Ice Age' maximum.* The Cryosphere, 3, 231–243.

Bayr, K.J., D.K. Hall and W.M. Kovalick. 1994. *Observations on glaciers in the Eastern Austrian Alps using satellite data.* International Journal of Remote Sensing, 15, 1733–1742.

Bishop, M.P., R.G. Barry, A.B.G. Bush, L. Copeland, J.L. Dwyer, A.G. Fountain, W. Haeberli, D.K. Hall, A. Kääb, J.S. Kargel, B.F. Molnia, J.A. Olsenholler, F. Paul, B.H. Raup, J.F. Shroder, D.C. Trabant and R. Wessels. 2004. *Global Land Ice Measurements from Space (GLIMS): Remote sensing and GIS investigations of the Earth's cryosphere.* Geocarto International, 19 (2), 57–85.

Bolch, T., B. Menounos and R. Wheate. 2010. *Landsat-based inventory of glaciers in Western Canada, 1985–2005.* Remote Sensing of Environment, 114, 127–137.

Cohen, D. 2000. *Rheology of ice at the bed of Engabreen, Norway.* Journal of Glaciology, 46 (155), 611–621.

Cogley, J.G., R. Hock, L.A. Rasmussen, A.A. Arendt, A. Bauder, R.J. Braithwaite, P. Jansson, G. Kaser, M. Möller, L. Nicholson and M. Zemp. 2011. *Glossary of Glacier Mass Balance and Related Terms.* IHP-VII Technical Documents in Hydrology No. 86, IACS Contribution No. 2, UNESCO-IHP, Paris.

de Seue, C. 1870. *Le névé de Justedal et ses glaciers.* Christiania, Jensen.

Eide, T.O. 1955. *Breden og bygda*. Norveg, 5, 1–42.

Elvehøy, H., R. Engeset, L.M. Andreassen, J. Kohler, Y. Gjessing and H. Björnsson. 2002. *Assessment of possible jökulhlaups from Lake Demmevatnet in Norway.* IAHS Publication, 271, 31–36.

Elvehøy, H., M. Jackson and L.M. Andreassen. 2009. *The influence of drainage boundaries on specific mass balance results, a case study of Engabreen, Norway.* Annals of Glaciology, 50, 135–140.

Etzelmüller, B. and J.O. Hagen. 2005. *Glacier permafrost interaction in arctic and alpine environments –examples from southern Norway and Svalbard.* British Geological Society, Special Publication, 242, 11–27.

Forel, F.A. 1895. *Les variations périodiques des glaciers. Discours préliminaire.* Extrait des Archives des Sciences physiques et naturelles XXXIV, 209–229.

Geist, T., H. Elvehøy, M. Jackson and J. Stötter. 2005. *Investigations on intra-annual elevation changes using multi-temporal airborne laser scanning data: Case study Engabreen, Norway.* Annals of Glaciology, 42, 195–201.

Giesen, R.H. and J. Oerlemans. 2010. *Response of the ice cap Hardangerjøkulen in southern Norway to the 20th and 21st century climates.* The Cryosphere, 4, 191–213.

Giesen, R.H., L.M. Andreassen, M.R. van den Broeke and J. Oerlemans. 2009. *Comparison of meteorology and surface energy balance at Storbreen, and Midtdalsbreen, two glaciers in southern Norway.* The Cryosphere, 3, 57–74.

Grove, J.M. 2004. *'Little Ice Ages'– ancient and modern.* Volume I, Routledge, London.

Haeberli, W. 2004. *Glaciers and ice caps: historical background and strategies of worldwide monitoring.* In J.L Bamber and A.J. Payne, eds. Mass balance of the cryosphere. Cambridge, Cambridge University Press, 559–578.

Hagen, J.O. 1978. *Brefrontprosesser ved Hardangerjøkulen.* Hovedfagsoppgave i naturgeografi. Geografisk institutt, Universitetet i Oslo.

Hagen, J.O., O. Liestøl, J.L. Sollid, B. Wold and G. Østrem. 1993. *Subglacial investigations at Bondhusbreen, Folgefonni, Norway.* Norsk Geografisk Tidsskrift, 47, 117–162.

Hall, D.K., J.P. Ormsby, R.A. Bindschadler and H. Siddalingaiah. 1987. *Characterization of snow and ice zones on glaciers using Landsat Thematic Mapper data.* Annals of Glaciology, 9, 104–108.

Hall, D.K., A.T.C. Chang, J.L. Foster, C.S. Benson and W.M. Kovalick. 1989. *Comparison of in situ and Landsat derived reflectances of Alaskan glaciers.* Remote Sensing of Environment, 28, 493–504.

Hanssen-Bauer, I. and E.J. Førland. 1998. *Annual and seas-onal precipitation trends in Norway 1896–1997.* DNMI Report, 27/98.

Hanssen-Bauer, I. and Ø. Nordli. 1998. *Annual and seasonal temperature variations in Norway 1876–1997.* Klima, 25/98.

Hanssen-Bauer, I., H. Drange, E.J. Førland, L.A. Roald, K.Y. Børsheim, H. Hisdal, D. Lawrence, A. Nesje, S. Sandven, A. Sorteberg, S. Sundby, K. Vasskog and B. Ådlandsvik. 2009. *Klima i Norge 2100. Bakgrunnsmateriale til NOU Klimatilpassing.* Norsk klimasenter, september 2009.

Hoel, A. and W. Werenskiold, eds. 1962. *Glaciers and snowfields in Norway.* Norsk Polarinstitutt Skrifter, 114.

Howarth, P. and C.S. Ommanney. 1986. *The use of Landsat digital data for glacier inventories*, Annals of Glaciology, 8, 90–92.

Iverson, N.R., D. Cohen, T.S. Hooyer, U.H. Fischer, M. Jackson, P.L. Moore, G. Lappegard and J. Kohler. 2003. *Effects of basal debris on glacier flow.* Science, 301, 81–83.

Jackson, M., I. Brown and H. Elvehøy. 2005. *Velocity measurements on Engabreen.* Annals of Glaciology, 42, 29–34.

Jacobs, J.D., E.L. Simms and A. Simms. 1997. *Recession of the southern part of Barnes Ice Cap, Baffin Island, Canada, between 1961 and 1993, determined from digital mapping of Landsat TM.* Journal of Glaciology, 43 (143), 98–102.

Kääb, A. 2005. *Remote sensing of mountain glaciers and permafrost creep.* Geographisches Institut der Universität Zürich, Schriftenrehe Physische Geographie, 46.

Kargel, J.S., M.J. Abrams, M.P. Bishop, A. Bush, G. Hamilton, H. Jiskoot, A. Kääb, H.H. Kieffer, E.M. Lee, F. Paul, F. Rau, B. Raup, J.F. Shroder, D. Soltesz, L. Stearns, R. Wessels and the GLIMS Consortium. 2005. *Multispectral imaging contributions to Global Land Ice Measurements from Space.* Remote Sensing of Environment, 99 (1/2), 187–219.

Kennett. M. 1990. *Kartlegging av istykkelse og feltavgrensning på Blåmannsisen 1990*. NVE Rapport, 8.

Kennett, M., C. Rolstad, H. Elvehøy and E. Ruud. 1997. *Calculation of drainage divides beneath the Svartisen ice-cap using GIS hydrologic tools.* Norsk Geografisk Tidsskrift, 51(1), 23–28.

Kjøllmoen, B. (ed.), L.M. Andreassen, H. Elvehøy, M. Jackson, A.M. Tvede, T. Laumann and R.H. Giesen. 2007. *Glaciological investigations in Norway in 2006*. NVE Report, 1.

Kjøllmoen, B. (ed.), L.M. Andreassen, H. Elvehøy, M. Jackson, R.H. Giesen and S. Winkler. 2008. *Glaciological investigations in Norway in 2007.* NVE Report, 3.

Kjøllmoen, B. (ed.), L.M. Andreassen, H. Elvehøy, M. Jackson and R.H. Giesen. 2011. *Glaciological investigations in Norway in 2010.* NVE Report, 3.

Konnestad, H. 1996. *Moreneformer i fronten av Midtdalsbreen – en glasiologisk og geomorfologisk undersøkelse av dannelsesprosessene.* Hovedfagsoppgave, Geografisk institutt, Universitetet i Oslo.

Krimmel, R.M. and M.F. Meier. 1975. *Glacier applications of ERTS - 1 images*. Journal of Glaciology, 15 (73), 391–402.

Lappegard, G., J. Kohler, J.O. Hagen and M. Jackson. 2005. *Long time series with subglacial load cell data at Engabreen, Norway.* Journal of Glaciology, 52 (136), 137–148.

Le Bris, R. and F. Paul. in revison. *An automatic method to create glacier flow lines: A pilot study with Alaskan glaciers.* Computers and Geosciences.

Lemke, P., J. Ren, R.B. Alley, I. Allison, J. Carrasco, G. Flato, Y. Fujii, G. Kaser, P. Mote, R.H. Thomas and T. Zhang. 2007. *Observations: Changes in Snow, Ice and Frozen Ground. In Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller, eds.]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Liestøl, O. 1962. *List of the area and number of glaciers.* In A. Hoel and W. Werenskiold, eds. Glaciers and snowfields in Norway, Norsk Polarinstitutt Skrifter, 114.

Liestøl, O. 1967. *Storbreen glacier in Jotunheimen, Norway.* Norsk Polarinstitutt Skrifter, 141.

Lilleøren, K.S. 2007. *Omnsbreen - utbredelse og dynamikk under "Den lille istid" og gjennom det 20. århundre.* Masteroppgave i geofag, Naturgeografi, Institutt for geofag, Universitetet i Oslo.

Lillesand, T.M. and R.W. Kiefer. 1987. *Remote sensing and image interpretation. John Wiley and Sons, New York.*

Manley, W.F. 2008. *Geospatial inventory and analysis of glaciers: a case study for eastern Alaska range.* In R.S. Williams and J.G. Ferrigno, eds. Satellite image atlas of glaciers of the world. US Geological Survey, Professional Paper, K424–K439.

Matthews, J.A. 2005. *'Little Ice Age' glacier variations in Jotunheimen, southern Norway: a study in regionally-controlled lichenometric dating of recessional moraines with implications for climate and lichen growth rates.* The Holocene, 15, 1–19.

Melvold, K., T. Laumann and A. Nesje. 2011. *Kupert landskap under Hardangerjøkulen.* GEO, 36–37.

Messel, N. 2008. *Oppdagelsen av fjellet/The Discovery of the Mountains. Katalog. Utstilling/exhibition Nasjonalmuseet – Kunst (Nasjonalgalleriet), 31 January–11 May 2008.* Nasjonalmuseet for kunst, arkitektur og design, Oslo.

Messel, S. 1985. *Energibalanseundersøkelser på breer i Norge 1954–1981.* In E. Roland, E. and N. Haakensen, eds. Glasiologiske undersøkelser i Norge 1982. NVE Rapport, 01, 45–59.

NASA. 2009. *Landsat 7 – Science Data user handbook.* Date retrived: 26 March 2010. URL: http://landsathandbook.gsfc.nasa.gov/handbook.html

Nesje, A. 2009. *Latest Pleistocene and Holocene alpine glacier fluctuations in Scandinavia.* Quaternary Science Reviews, 28, 2119–2136

Nesje, A. and S.O. Dahl. 2003. *The 'Little Ice Age' – only temperature?* The Holocene, 13 (1), 139–145.

Nesje, A., Ø. Lie and S.O. Dahl. 2000. *Is the North Atlantic Oscillation reflected in Scandinavian glacier mass balance records?* Journal of Quaternary Science, 15, 587–601.

Nesje, A., S. Dahl, T. Thun and Ø. Nordli. 2007. *The 'Little Ice Age' glacial expansion in western Scandinavia: summer temperature or winter precipitation?* Climate Dynamics, 30, 789–801.

Nesje, A., J. Bakke, S.O. Dahl, Ø. Lie and J.A. Matthews. 2008. *Norwegian mountain glaciers in the past, present and future.* Global and Planetary Change, 60, 10–27.

NGU (Norges geologiske undersøkelse). 1964. *Seismiske undersøkelser på Folgefonni, 27. april – 3. juni.* NGU rapport, 545.

Nussbaumer, S.U., A. Nesje and H.J. Zumbühl. 2011. *Historical glacier fluctuations of Jostedalsbreen and Folgefonna (southern Norway) reassessed by new pictorial and written evidence.* The Holocene, 21 (3), 455–471.

Oerlemans, J. 2005. *Extracting a climate signal from 169 glacier records.* Science, 308, 675–77.

Paul, F. 2007. *The New Swiss Glacier Inventory 2000 - Application of Remote Sensing and GIS.* Geographisches Institut der Universität Zürich, Schriftenreihe Physische Geographie, 52.

Paul, F. and L.M. Andreassen. 2009. *A new glacier inventory for the Svartisen region (Norway) from Landsat ETM+ data: Challenges and change assessment.* Journal of Glaciology, 55 (192), 607–618.

Paul, F. and J. Hendriks. 2010. *Optical remote sensing of glacier extent.* In Pellikka, P. and W.G. Rees, eds. Remote Sensing of Glaciers – Techniques for Topographic, Spatial and Thematic Mapping of Glaciers. CRC Press, Taylor and Francis Group, Leiden, 137–152.

Paul, F. and A. Kääb. 2005. *Perspectives on the production of a glacier inventory from multispectral satellite data in the Canadian Arctic: Cumberland Peninsula, Baffin Island.* Annals of Glaciology, 42, 59–66.

Paul, F. and F. Svoboda. 2010. *A new glacier inventory on southern Baffin Island, Canada, from ASTER data: II. Data analysis, glacier change and applications.* Annals of Glaciology, 50 (53), 22–31.

Paul, F., A. Kääb, M. Maisch, T.W. Kellenberger and W. Haeberli. 2002. *The new remote sensing-derived Swiss glacier inventory: I. Methods.* Annals of Glaciology, 34, 355–361.

Paul, F., C. Huggel, A. Kääb and T. Kellenberger. 2003. *Comparison of TM-derived glacier areas with higher resolution data sets.* EARSeL Workshop on Remote Sensing of Land Ice and Snow, Bern, 11.-13.3.2002, EARSeL eProceedings, 2, 15–21.

Paul, F., R. Barry, G. Cogley, H. Frey, W. Haeberli, A. Ohmura, S. Ommanney, B. Raup, A. Rivera and M. Zemp. 2009. *Recommendations for the compilation of glacier inventory data from digital sources.* Annals of Glaciology, 50, 119–126.

Paul, F., L.M. Andreassen and S.H. Winsvold. 2011. *A new glacier inventory for the Jostedalsbreen region, Norway, from Landsat TM scenes of 2006 and changes since 1966.* Annals of Glaciology, 52 (59), 153–162.

Paul, F., N. Barrand, E. Berthier, T. Bolch, K. Casey, H. Frey, S.P. Joshi, V. Konovalov, R. Le Bris, N. Mölg, G. Nosenko, C. Nuth, A. Pope, A. Racoviteanu, P. Rastner, B. Raup, K. Scharrer, S. Steffen and S. Winsvold. in press. *On the accuracy of glacier outlines derived from remote sensing data.* Annals of Glaciology, 54 (63).

Paterson, W.S.B. 1994. *The physics of glaciers.* 3rd edition. Oxford.

Post, A. and E.R. Lachapelle. 2000. *Glacier Ice.* Revised ed. Seattle, University of Washington Press, copublished with the International Glaciological Society.

Racoviteanu, A.E., F. Paul, B. Raup, S.J.S. Khalsa and R. Armstrong. 2009. *Challenges and recommendations in mapping of glacier parameters from space: results of the 2008 Global Land Ice Measurements from Space (GLIMS) workshop, Boulder, Colorado, USA.* Annals of Glaciology, 50 (53).

Rasmussen, L.A., L.M. Andreassen and H. Conway. 2007. *Reconstruction of mass balance of glaciers in southern Norway back to 1948.* Annals of Glaciology, 46, 255–260.

Rasmussen, L.A., L.M. Andreassen, S. Baumann and H. Conway. 2010. *Little Ice Age precipitation in Jotunheimen, southern Norway.* The Holocene, 20 (7), 1039–1045.

Raup, B. and S.J.S. Khalsa. 2007. *GLIMS Analysis Tutorial. Digital Media.* Online at: http://www.glims.org/MapsAndDocs/assets/GLIMS_Analysis_Tutorial_a4.pdf.

Raup, B.H., A. Kääb, J.S. Kargel, M.P. Bishop, G. Hamilton, E. Lee, F. Paul, F. Rau, D. Soltesz, S.J.S. Khalsa, M. Beedle and C. Helm. 2007. *Remote Sensing and GIS technology in the Global Land Ice Measurements from Space (GLIMS) Project.* Computers and Geosciences, 33, 104–125.

Rekstad, J. 1902. *Iakttagelser fra bræer i Sogn og Nordfjord.* Norges geologiske undersøkelse, Aarbog 1902 (3), 1–48.

Sellevold, M.A. and K. Kloster. 1964. *Seismic measurements on the glacier Hardangerjøkulen, Western Norway.* Norsk Polarinstitutt Årbok, 1964, 87–91.

Sidjak, R.W. and R.D. Wheate. 1999. *Glacier mapping of the Illecillewaet icefield, British Columbia, Canada, using Landsat TM and digital elevation data.* International Journal of Remote Sensing, 20, 273–284.

Sollid, J.L and L. Sørbel. 1979. *Deglaciation of western central Norway.* Boreas, 8, 233–239.

Statens Kartverk. 2011. *http://www.statkart.no/filestore/Landdivisjonen_ny/Kart_og_produkter/hTerrengmodell/*Produktark-Terrengmodell_10m-og-20m_20110204.pdf.

Sætrang, A.C. 1988. *Kartlegging av istykkelse på Vestre Svartisen 1986.* NVE Oppdragsrapport, 3–88.

Sætrang, A.C. and B. Wold. 1986. *Results from the radio echo-sounding on parts of the Jostedalsbreen ice cap, Norway.* Annals of Glaciology, 8, 156–158.

Sønstegaard, E., A.R. Aa and O. Klakegg. 1999. *Younger Dryas glaciation in the Ålfotbreen area, western Norway; evidence from lake sediments and marginal moraines.* Norsk Geologisk Tidsskrift, 79, 33–45.

Theakstone, W.H. 1988. *Svartisen glacier atlas (three volumes).* Department of Geography, University of Manchester.

Tvede, A.M. and T. Laumann. 2007. *Aurland Mountains.* In Kjøllmoen, B., ed. Glaciological investigations in Norway in 2006. NVE Report, 1, 49–54.

Tvede, A.M. and O. Liestøl. 1977. *Blomsterskardbreen, Folgefonni, mass balance and recent fluctuations.* Norsk Polarinstitutt Årbok, 1976, 225–234.

UNESCO. 1970. *Perennial ice and snow masses – a guide for compilation and assemblage of data for the World Glacier Inventory.* Technical Papers in Hydrology No. 1.

Urdal, H. 2005. *Temperaturregime og stabilitet med henblikk på isskred fra hengebreer - eksempel fra Steindalsnosi, Sognefjellet, Vest Norge.* Masteroppgave i geofag, Naturgeografi, Institutt for geofag, Universitetet i Oslo.

Voksø, A., N.K. Orthe, H. Hisdal and K. Engeland. 2008. *Low flow index map for Norway – interaction using GIS-software and analysis.* XXV Nordic Hydrologic Conference, NHP Report, 50, 154–159.

WGMS. 2008. *Fluctuations of Glaciers 2000–2005, Volume IX.* W. Haeberli, M. Zemp, A. Kääb, F. Paul and M. Hoelzle, eds. ICSU(FAGS)/IUGG(IACS)/UNEP/UNESCO/WMO, World Glacier Monitoring Service, Zurich, Switzerland.

WGMS. 2011. *Glacier Mass Balance Bulletin No. 11 (2008–2009).* M. Zemp, S.U. Nussbaumer, I. Gärtner-Roer, M. Hoelzle, F. Paul and W. Haeberli, eds. ICSU(WDS)/IUGG(IACS)/UNEP/UNESCO/WMO, World Glacier Monitoring Service, Zurich, Switzerland.

Willis, I.C., C. Fitzsimmons, K. Melvold, L.M. Andreassen and R.H. Giesen. 2012. *Structure, morphology and water flux of a subglacial drainage system, Midtdalsbreen, Norway.* Hydrological Processes, doi:10.1002/hyp8431.

Winkler, S. 2002. *Von der "Kleinen Eiszeit" zum "globalen Gletscherrückzug. Eignen sich Gletscher als Klimazeugen?* Colloquia Academia, Abhandlungen der Mathematisch-naturwissenschaftlichen Klasse 2002 Nr. 3, Akademie der Wissenschaften und der Literatur Mainz/Franz Steiner Verlag Stuttgart.

Winsvold, S.H. and L.M. Andreassen. 2010. *Glacier area changes in western Finnmark, Northern Norway – Change detection based on maps and Landsat imagery.* IPY Oslo Science Conference, 8-12 June, 2010. Abstract.

Ødegård, R.S., A. Nesje, K. Isaksen and T. Eiken. 2011. *Perennial ice patch studies – preliminary results from a case study in Jotunheimen, southern Norway.* Geophysical Research Abstracts, 13, EGU2011-12027.

Østrem, G. 1960. *Breer og morener i Jotunheimen.* Norsk Geografisk Tidsskrift, 17 (1959–60), 210–243.

Østrem, G. 1975. *ERTS data in glaciology – An effort to monitor glacier mass balance from satellite imagery.* Journal of Glaciology, 15 (73), 403–415.

Østrem, G. and N. Haakensen. 1993. *Glaciers of Norway.* In R.S. Williams and J.G. Ferrigno, eds. Satellite image atlas of glaciers of the world. US Geological Survey, Professional Paper, E63-E109.

Østrem, G. and T. Ziegler. 1969. *Atlas over breer i Sør-Norge.* Meddelelse, 20, Hydrologisk avdeling, Norges vassdrags- og elektrisitetsvesen, Oslo, Norway.

Østrem, G., N. Haakensen and O. Melander. 1973. *Atlas over breer i Nord-Skandinavia.* Meddelelse, 22, Hydrologisk avdeling, Norges vassdrags- og energiverk, Oslo, Norway.

Østrem, G., K. Dale Selvig and K. Tandberg. 1988. *Atlas over breer i Sør-Norge.* Meddelelse, 61, Hydrologisk avdeling, Norges vassdrags- og elektrisitetsvesen, Oslo, Norway.

Øyen, P.A. 1906. *Klima und Gletscherschwankungen in Norwegen.* Zeitschrift für Gletscherkunde, 1, 46–61.

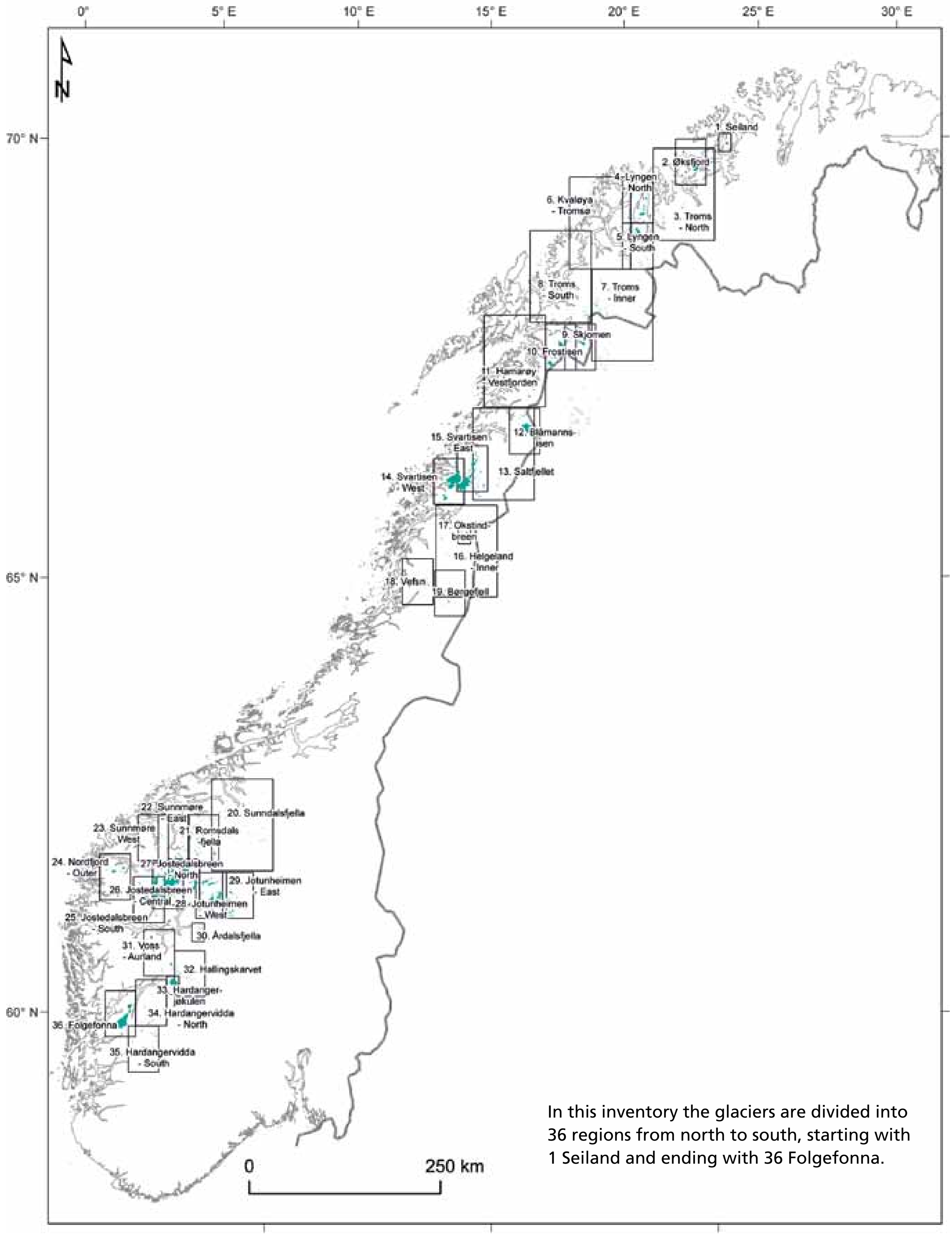

Bøverbrean, July 2010. Photo: Ragnar Ekker, NVE.


View from Store Veotinden towards Austre Memurutinden, August 2006. Photo: Ivar Helleberg.

Part 2 Maps and tables

In part 2 all the glaciers identified for the inventory are compiled in tables and displayed in maps. The glaciers have been divided into 36 regions going from north to south. Many photos and aerial photographs are included to illustrate the glaciers.
The Appendices provide further information on glacier names, particular investigations and abbreviations used.

Glacier ID 2760, August 2011.
Photo: Klaus Thymann, Project Pressure.



In this inventory the glaciers are divided into 36 regions from north to south, starting with 1 Seiland and ending with 36 Folgefonna.

Introduction to maps and tables

In the previous inventories the glaciers were divided into hydrological basins. In this inventory we have chosen to divide the glaciers into 36 regions from north to south, starting with 1 Seiland and ending with 36 Folgefonna. The regional numbering is shown in three maps for Northern Norway North, Northern Norway South, and Southern Norway. Glacier IDs have been assigned automatically within each region from north to south based on latitude. Region 1 contains glacier IDs 1-15, region 2 glacier IDs 16-50 etc., ending with region 36 Folgefonna with IDs 3110-3143, with some regions overlapping. Each map shows which glacier IDs belong to each region. Some larger ice caps, such as Blåmannsisen, Okstindbreen, Hardangerjøkulen and Folgefonna, are shown separately. The largest ice caps, Svartisen and Jostedalsbreen, are divided into two regions. The scale differs from region to region.

Glaciers are shown in green as in previous inventories to differentiate them from lakes and fjords. Some geographical names such as mountain peaks, cities, islands, river, lakes and fjords are shown in order to help orientate the reader themself. Shaded relief of the topography (hillshade) is used in the maps.

A selection of glacier names is shown on the maps. Names of glacier complexes are in capital letters to differentiate them from glacier units. Glaciers belonging to a glacier complex have a three letter code in capital letters in the table. A list of named complex glaciers and their codes are given in Appendix A. All glacier units with names in this inventory are listed in Appendix B. The inventory tables include glacier ID, glacier name, code for glacier complex, date (YYYYMMDD), area, minimum and maximum elevation, slope (in degrees) and aspect. The topographic parameters have been calculated as described in the methods section. Appendix C gives an overview of glaciers where mass balance or other scientific investigations have been performed. Appendix D lists abbreviations used in the inventory book.

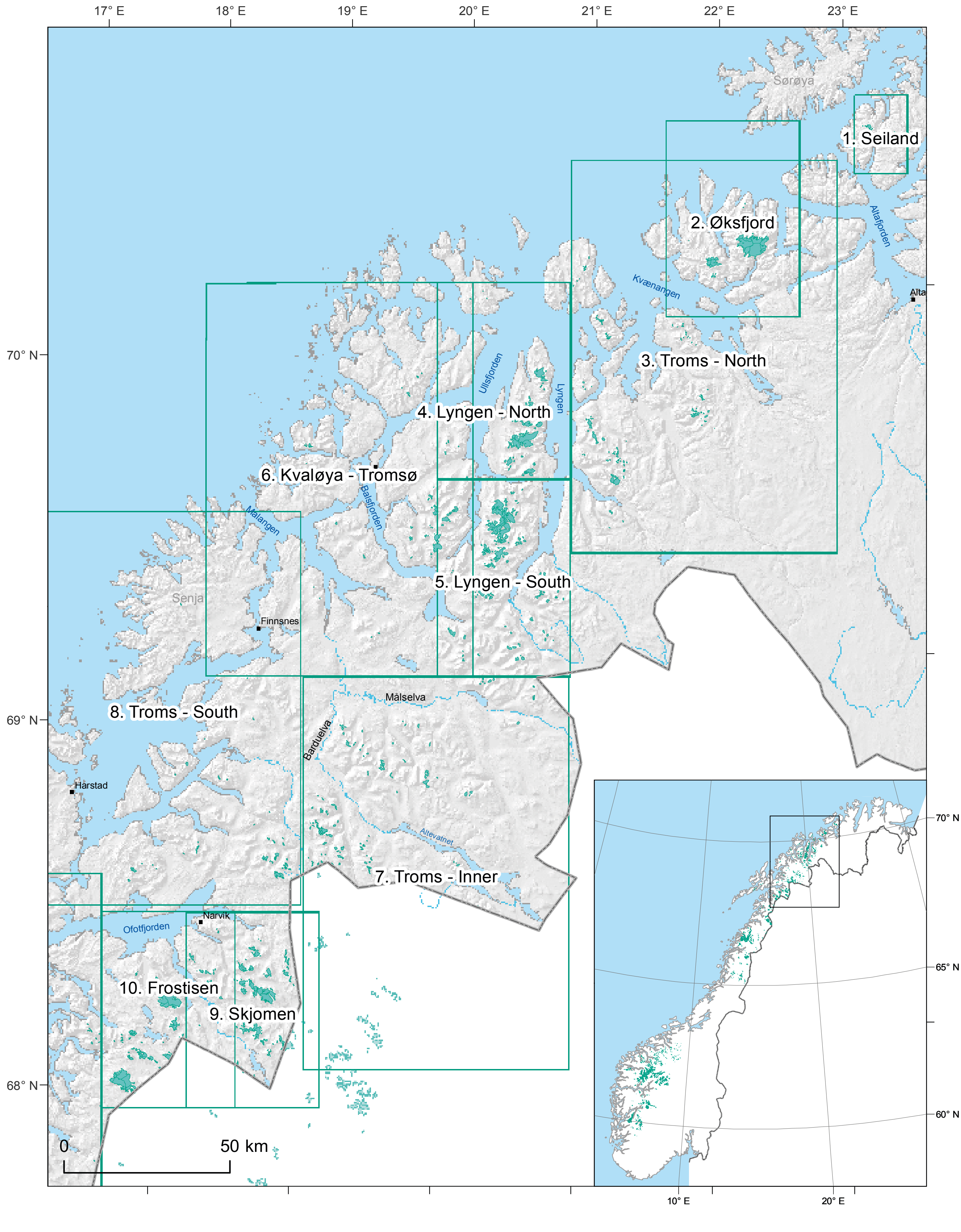
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
3110	Brottefonn		20020913	0.27	1301	1486	22	NE
3111			20020913	0.17	1323	1479	20	NE
3112			20020913	0.21	1214	1401	23	NE
3113		NFF	20020913	5.44	1189	1644	9	NW
3114		NFF	20020913	4.53	1186	1642	10	E
3115	Juklavassbrea	NFF	20020913	5.59	1095	1643	8	NW
3116	Dettebrea	NFF	20020913	5.87	925	1642	13	SE
3117	Botnabrea	NFF	20020913	5.00	1066	1634	9	W
3118			20020913	0.16	1180	1333	19	S
3119		MFF	20020913	3.11	1010	1569	14	NE
3120		MFF	20020913	2.87	1234	1572	9	NW
3121		MFF	20020913	3.66	1205	1573	10	SE
3122		MFF	20020913	0.80	1298	1446	8	N
3123			20020913	0.17	1309	1393	12	N

This table shows a selection of data from region 36 Folgefonna. For all glacier units the table lists glacier ID, name, glacier complex code, date of Landsat image, area in km², minimum and maximum elevation, slope (in degrees) and aspect.

Section of region map 36 Folgefonna showing glaciers complexes Nordre Folgefonna (NFF) and Midtre Folgefonna (MFF) with selected names of individual glaciers.

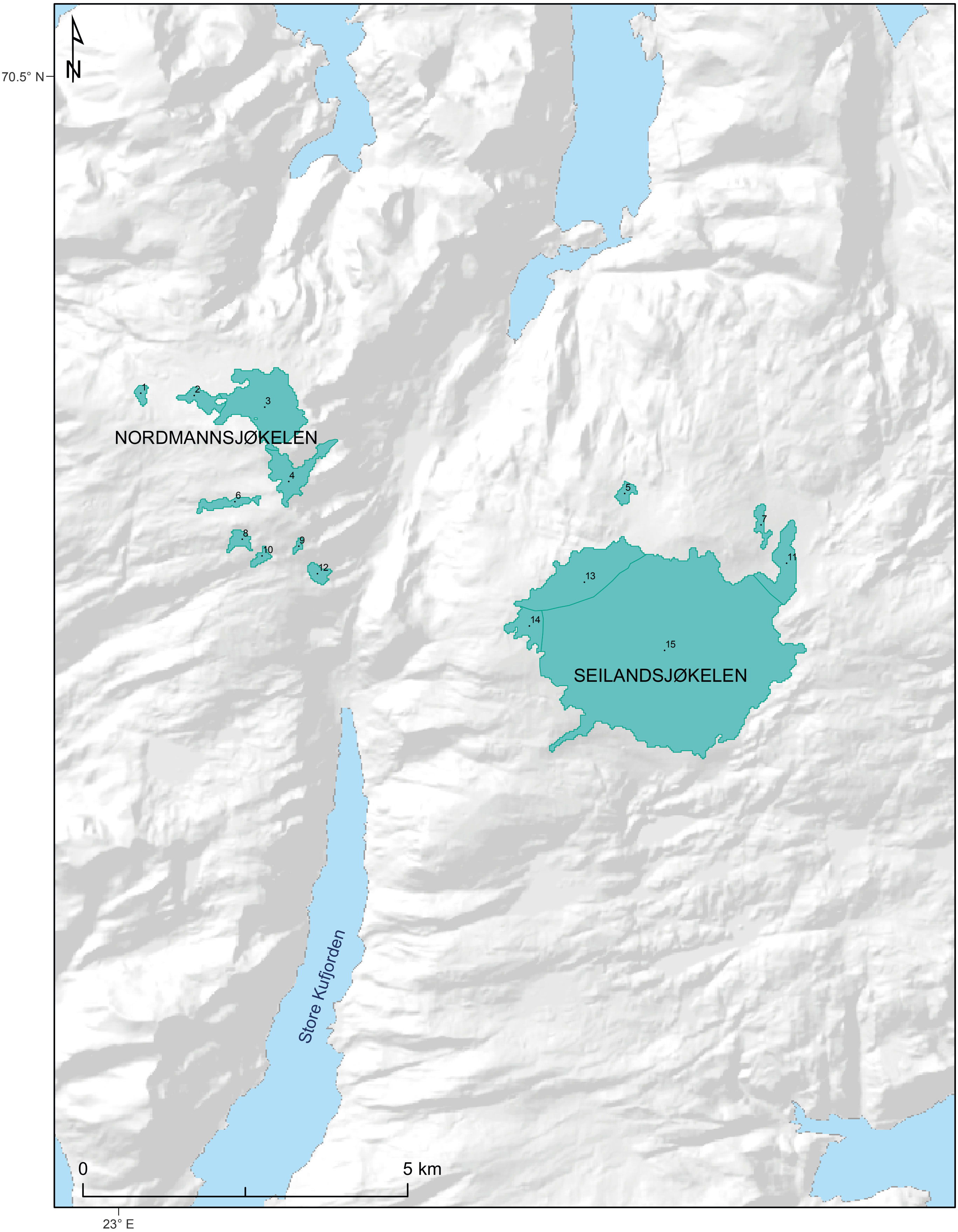
View from Langfjordjøkelen northeast towards Øksfjordjøkelen, September 2011. Photo: Solveig H. Winsvold, NVE.

Northern Norway North



1. **Seiland**

Glacier ID 1 - 15

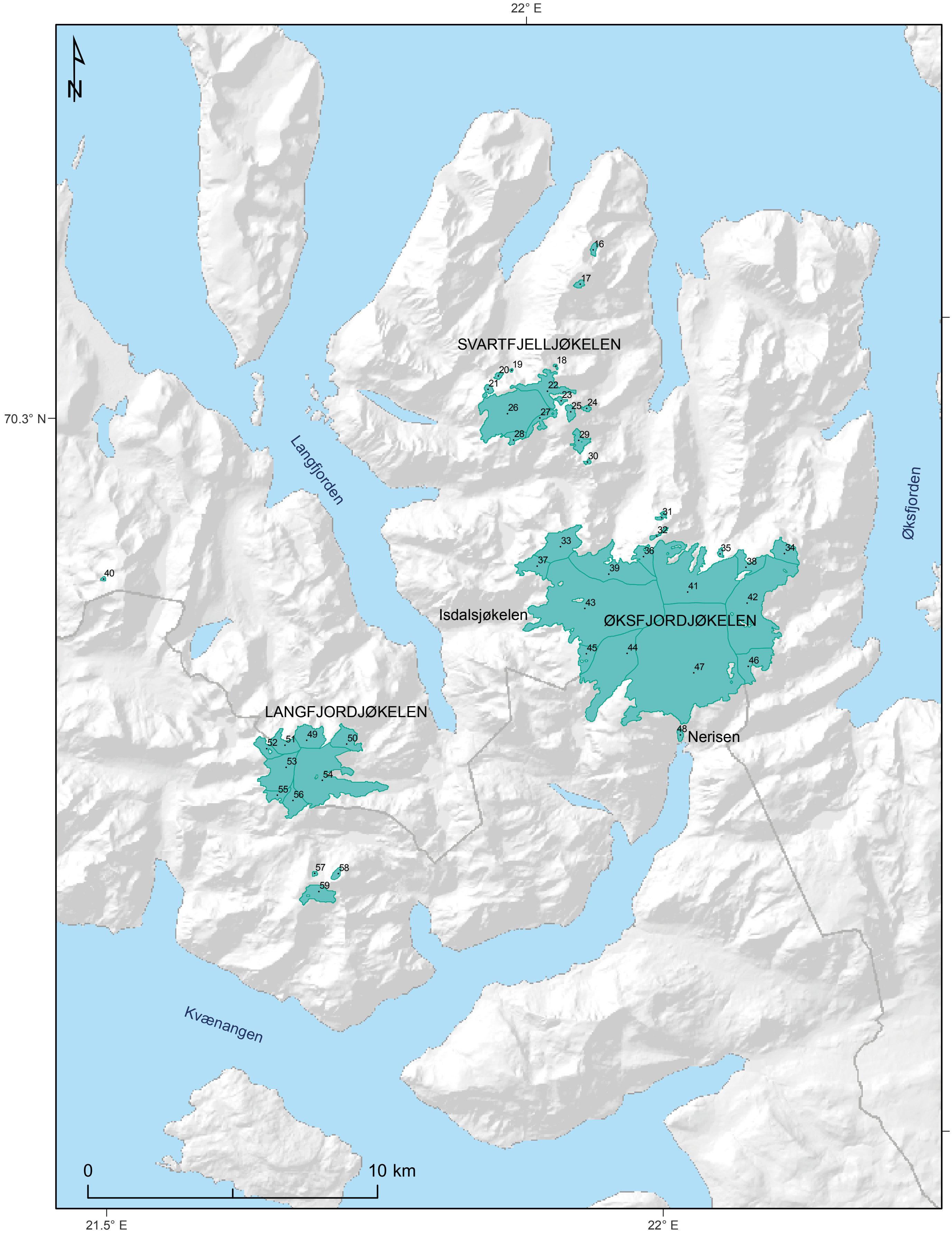


Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1			20060828	0.04	796	862	12	N
2		NOJ	20060828	0.14	856	948	9	NW
3		NOJ	20060828	0.98	803	1050	12	N
4		NOJ	20060828	0.36	512	1051	20	E
5			20060828	0.07	817	871	9	NE
6			20060828	0.12	830	1001	11	SW
7			20060828	0.08	723	809	15	NE
8			20060828	0.08	781	891	16	S
9			20060828	0.02	862	933	18	S
10			20060828	0.05	734	855	21	S
11		SEJ	20060828	0.38	673	803	6	NE
12			20060828	0.08	626	790	23	E
13		SEJ	20060828	0.98	820	910	4	NW
14		SEJ	20060828	0.23	864	903	3	S
15		SEJ	20060828	8.51	575	931	6	S

Section of Landsat image from 2006 showing Nordmannsjøkelen (left) and Seilandsjøkelen (right).

2. **Øksfjord**

Glacier ID 16 - 59



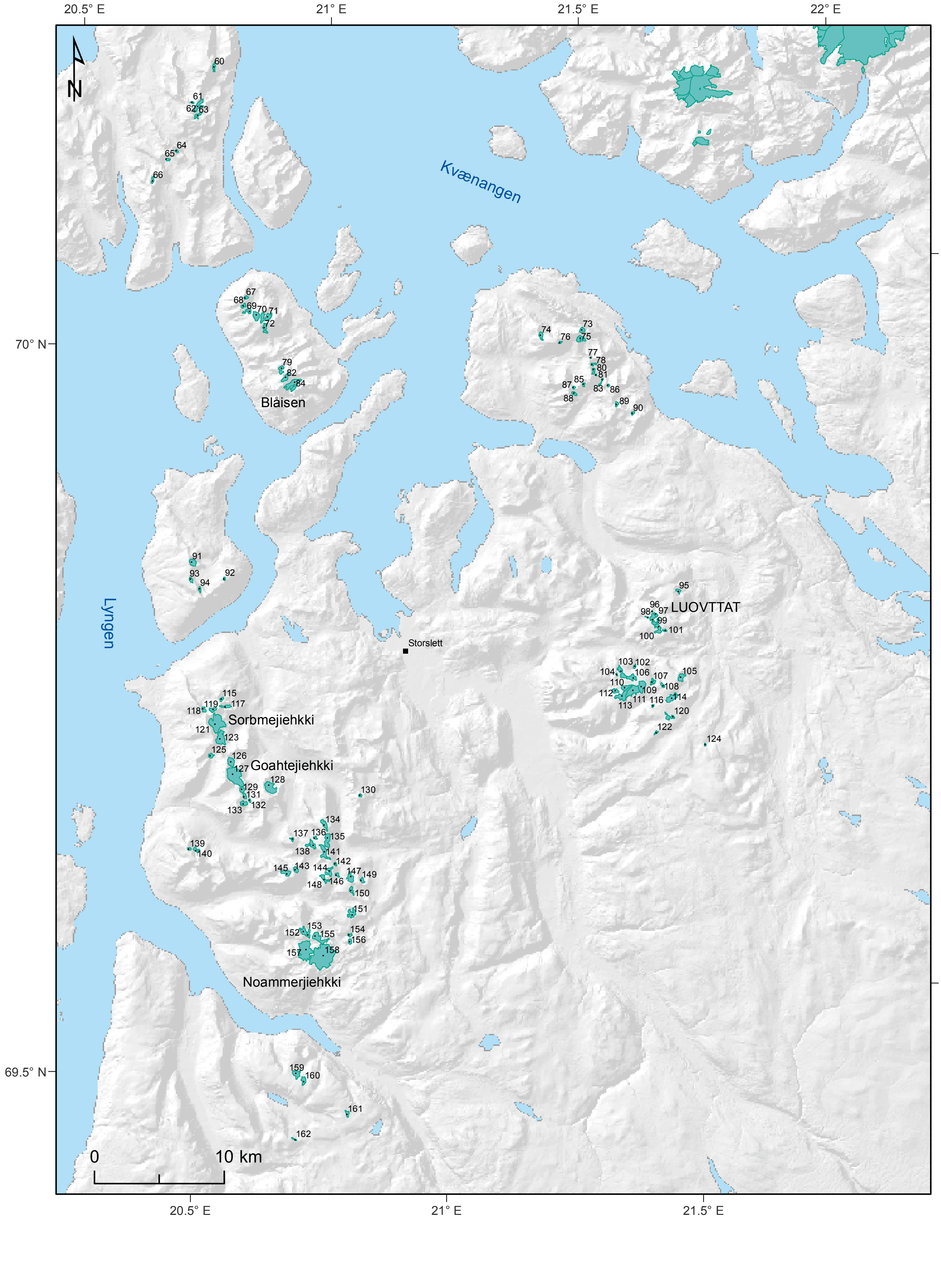
Isfjordjøkelen (47) and Nerisen (48), Øksfjordjøkelen, July 2008. Nerisen is a regenerated glacier fed by ice avalanches from Isfjordjøkelen, a part of Øksfjordjøkelen. Ice from the glacier was used by fishermen and fish merchants until 1949 when a refrigeration plant was built (Hoel and Werenskiold, 1962). Photo: Bjørnulf Håkenrud.

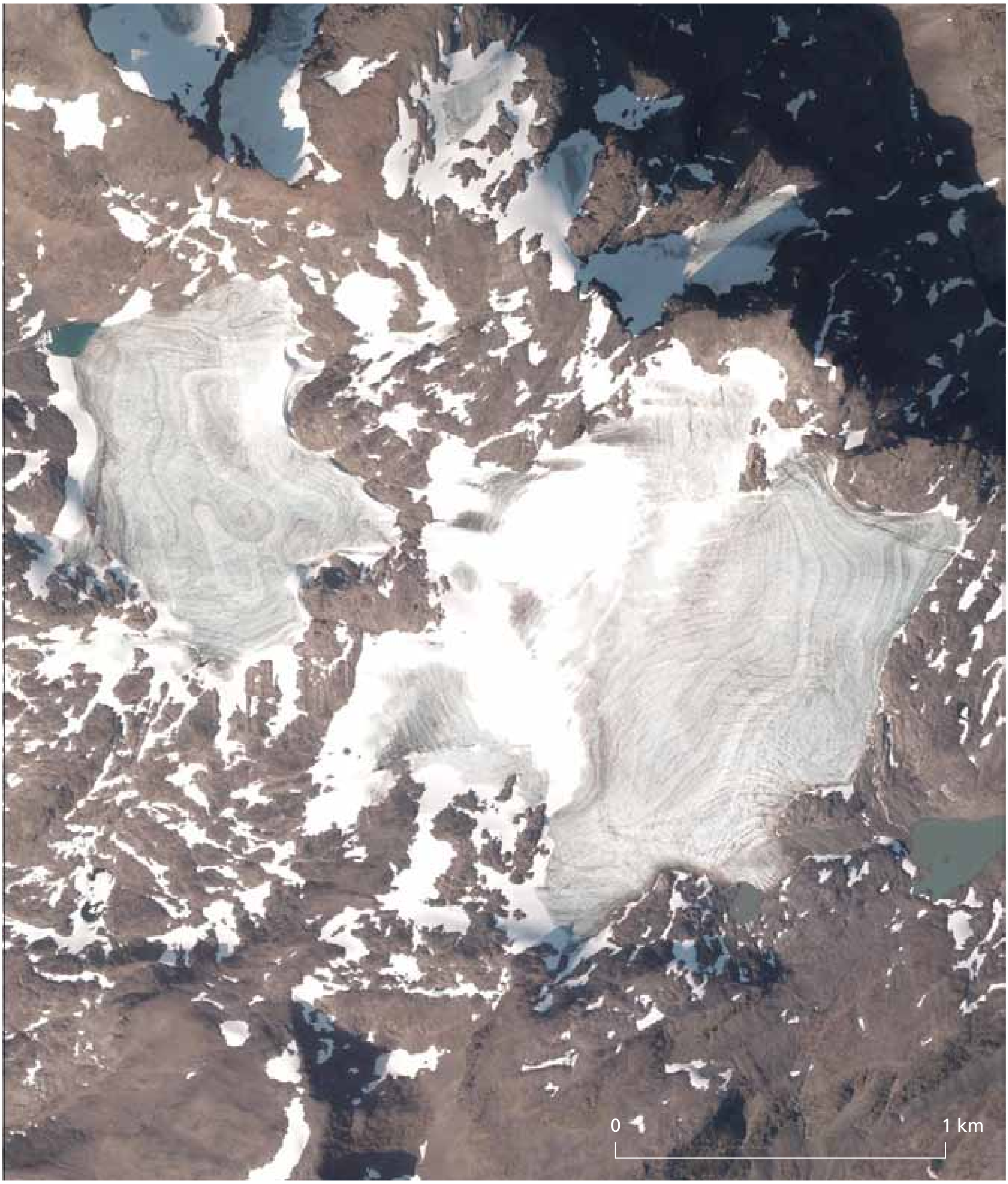
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
16			20060828	0.08	437	641	28	NE
17			20060828	0.07	652	806	33	SE
18			20060828	0.02	598	704	35	NE
19			20060828	0.01	335	425	35	N
20			20060828	0.05	494	658	34	N
21			20060828	0.09	772	952	24	N
22		SVJ	20060828	0.84	414	1062	19	NE
23			20060828	0.06	882	1065	33	N
24			20060828	0.05	437	655	33	E
25			20060828	0.14	1045	1166	23	NE
26		SVJ	20060828	2.79	606	1048	10	SW
27		SVJ	20060828	0.30	790	1082	18	S
28		SVJ	20060828	0.20	825	987	13	W
29			20060828	0.26	376	712	24	E
30			20060828	0.03	723	858	32	NE
31			20060828	0.06	677	898	36	N
32			20060828	0.06	948	1138	14	NE
33		ØKJ	20060828	1.17	688	1048	13	N
34		ØKJ	20060828	0.53	916	1123	16	NE
35			20060828	0.05	691	912	34	N
36		ØKJ	20060828	0.44	1029	1203	10	NW
37		ØKJ	20060828	0.54	818	1031	11	W
38		ØKJ	20060828	0.48	897	1151	12	NW
39		ØKJ	20060828	2.09	474	1204	12	NW
40			20060828	0.02	724	892	38	N
41		ØKJ	20060828	4.53	514	1204	13	N
42		ØKJ	20060828	4.33	518	1164	13	E
43	Isdaljøkelen	ØKJ	20060828	8.19	344	1204	9	W
44		ØKJ	20060828	3.01	537	1164	10	S
45		ØKJ	20060828	0.42	1010	1119	7	SW
46		ØKJ	20060828	0.92	770	1106	15	SE
47	Isfjordjøkelen	ØKJ	20060828	11.95	412	1189	8	S
48	Nerisen		20060828	0.07	8	284	29	S
49		LAJ	20060828	0.68	818	1045	12	NE
50		LAJ	20060828	0.58	699	1020	18	E
51		LAJ	20060828	0.50	728	1028	10	NW
52		LAJ	20060828	0.33	782	1010	14	NW
53		LAJ	20060828	1.18	675	1017	11	SW
54		LAJ	20060828	3.46	313	1039	13	SE
55		LAJ	20060828	0.25	839	927	6	W
56		LAJ	20060828	0.52	760	939	10	S
57			20060828	0.03	815	919	27	NE
58			20060828	0.09	798	993	33	N
59			20060828	0.53	741	1039	17	SE

East-facing outlet of Langfjordjøkelen (54), August 2010. Mass balance measurements began on this outlet in 1989 to increase knowledge of glaciers in northern Norway. Photo: Bjarne Kjøllmoen, NVE.

3. Troms - North

Glacier ID 60 - 162





Orthophoto of Noammerjiehkki (158) and surrounding glaciers in 2011. Source: www.norgeibilder.no.

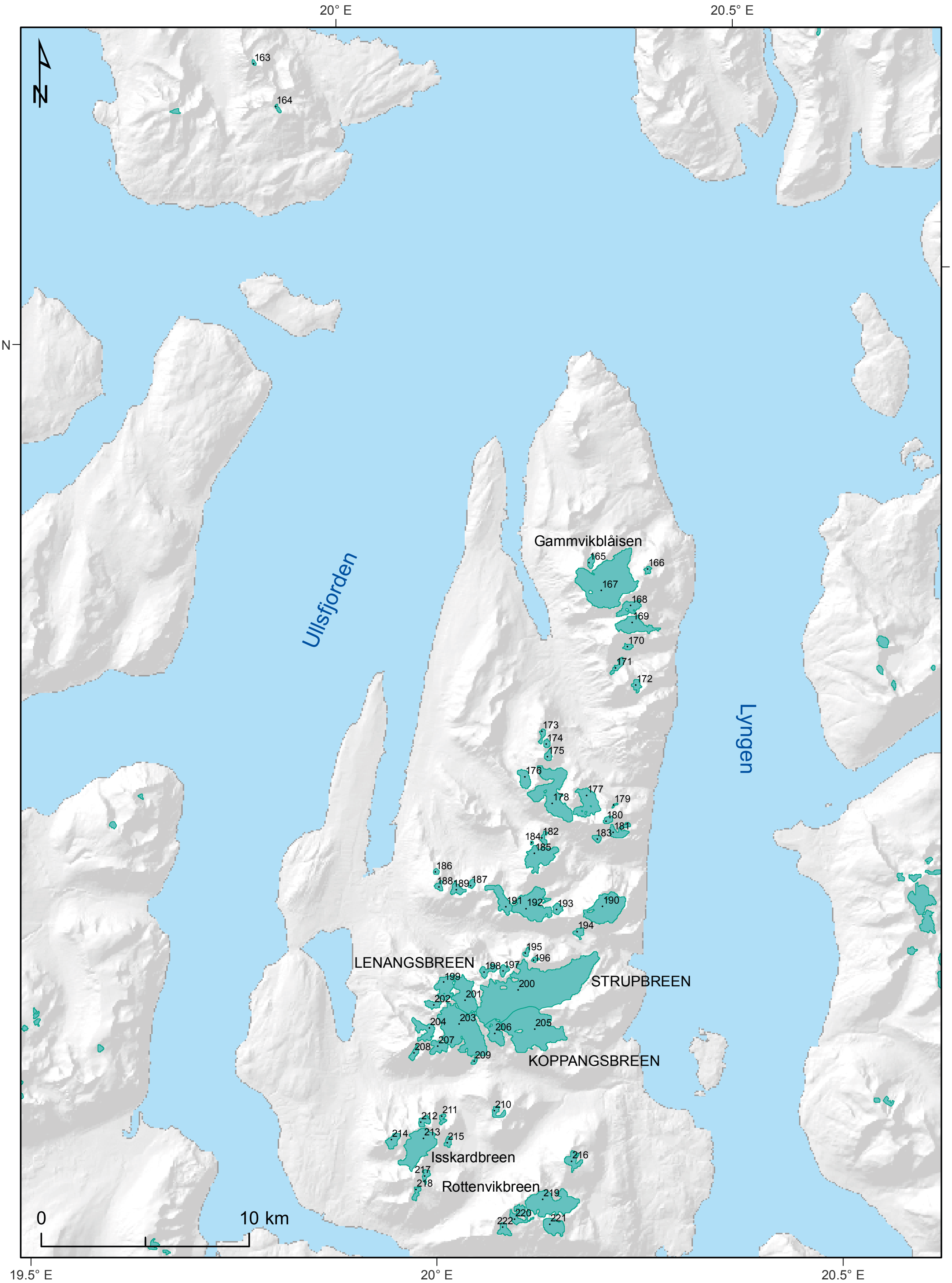
Glacier ID	Name	Code	Date	Area km^2	Elevation Min.	Elevation Max.	Slope	Aspect
60			20060828	0.10	504	696	27	SE
61			20060828	0.03	692	777	28	N
62			20060828	0.29	458	912	25	NE
63			20060828	0.12	461	848	29	E
64			20010820	0.04	590	697	26	E
65			20010820	0.05	416	445	8	SE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
66			20010820	0.07	530	658	16	NE
67			20010820	0.07	499	658	27	E
68			20010820	0.08	611	795	25	E
69			20010820	0.15	483	803	27	N
70			20010820	0.27	642	1047	29	N
71			20010820	0.34	464	1094	32	NE
72			20010820	0.17	552	1104	37	SE
73			20010820	0.13	778	990	26	E
74			20010820	0.14	758	994	23	NE
75			20010820	0.19	514	829	27	E
76			20010820	0.04	763	892	34	SE
77			20010820	0.01	737	768	16	NW
78			20010820	0.07	547	690	19	E
79			20010820	0.17	613	882	24	NE
80			20010820	0.08	668	886	28	E
81			20010820	0.02	710	771	29	NE
82			20010820	0.19	740	1036	23	NE
83			20010820	0.05	465	708	21	N
84	Blåisen		20010820	0.53	510	981	16	NE
85			20010820	0.05	681	806	19	S
86			20010820	0.03	523	568	12	NW
87			20010820	0.04	707	844	29	NW
88			20010820	0.08	638	742	18	E
89			20010820	0.06	757	958	26	N
90			20010820	0.04	719	878	31	NE
91			20010820	0.23	738	983	21	NE
92			20010820	0.03	898	926	10	NE
93			20010820	0.09	735	945	39	NE
94			20010820	0.06	767	903	33	E
95			20060828	0.08	746	926	27	NE
96			20060828	0.01	1035	1099	28	NE
97		LUO	20060828	0.06	1022	1128	18	N
98			20060828	0.02	1084	1105	7	N
99		LUO	20060828	0.27	1078	1183	7	N
100		LUO	20060828	0.22	1101	1174	7	SE
101			20060828	0.04	1092	1119	10	N
102			20060828	0.04	798	989	32	N
103			20060828	0.26	1056	1169	9	N
104			20060828	0.02	1118	1138	9	E
105			20060828	0.21	932	1065	16	E
106			20060828	0.22	1135	1201	8	N
107			20060828	0.11	1021	1191	22	N
108			20060828	0.07	998	1238	33	N
109			20060828	0.37	1075	1212	9	S
110			20060828	0.20	1118	1192	5	SW
111			20060828	0.55	991	1195	8	S
112			20060828	0.12	1030	1119	12	NW
113			20060828	0.42	980	1187	12	SE
114			20060828	0.35	908	1168	20	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
115			20010820	0.06	740	907	25	NE
116			20060828	0.03	1051	1100	13	N
117			20010820	0.14	671	1071	29	E
118			20010820	0.09	837	989	25	NE
119			20010820	0.13	846	1029	23	NW
120			20060828	0.17	1007	1118	9	NE
121	Sorbmejiehkki		20010820	1.07	586	986	18	E
122			20060828	0.04	1057	1141	13	E
123			20010820	0.52	548	995	23	E
124			20060828	0.03	861	920	17	NE
125			20010820	0.11	642	725	13	SE
126			20010820	0.27	686	868	18	NE
127	Goahtejiehkki		20010820	1.21	714	1087	16	NE
128			20010820	0.55	723	951	15	NE
129			20010820	0.13	914	1069	25	E
130			20010820	0.04	1062	1129	14	NE
131			20010820	0.09	931	1130	26	NE
132			20010820	0.04	878	1004	23	N
133			20010820	0.16	836	953	16	SE
134			20010820	0.22	1124	1208	10	NE
135			20010820	0.32	1033	1281	25	E
136			20010820	0.05	1041	1185	27	N
137			20010820	0.05	1115	1167	12	N
138			20010820	0.24	1129	1225	9	NW
139			20010820	0.06	1009	1171	28	NE
140			20010820	0.11	575	758	32	NE
141			20010820	0.35	1061	1275	12	S
142			20010820	0.05	810	956	30	NE
143			20010820	0.11	929	1177	33	E
144			20010820	0.19	1084	1182	9	NE
145			20010820	0.21	890	1134	20	W
146			20010820	0.07	835	978	22	NE
147			20010820	0.25	872	1101	20	N
148			20010820	0.17	1021	1161	15	N
149			20010820	0.09	781	926	26	NE
150			20010820	0.12	908	1162	28	SE
151			20010820	0.26	889	1253	20	NE
152			20010820	0.21	1038	1268	26	NE
153			20010820	0.13	869	1182	28	N
154			20010820	0.06	916	1044	26	NE
155			20010820	0.42	959	1253	19	NE
156			20010820	0.08	1047	1168	22	NE
157			20010820	1.18	915	1114	9	NW
158	Noammerjiehkki		20010820	2.48	934	1231	8	SE
159			20010820	0.24	943	1294	29	NE
160			20010820	0.16	1072	1340	26	NE
161			20010820	0.09	1104	1191	17	E
162			20010820	0.04	1045	1131	28	NE

4. **Lyngen - North**

Glacier ID 163 - 222




Koppangsbreen (205), September 2001.
Photo: Miriam Jackson, NVE.


Fresh snow on Strupbreen (200), early October, 2002.
Photo: Bjarne Kjøllmoen, NVE.

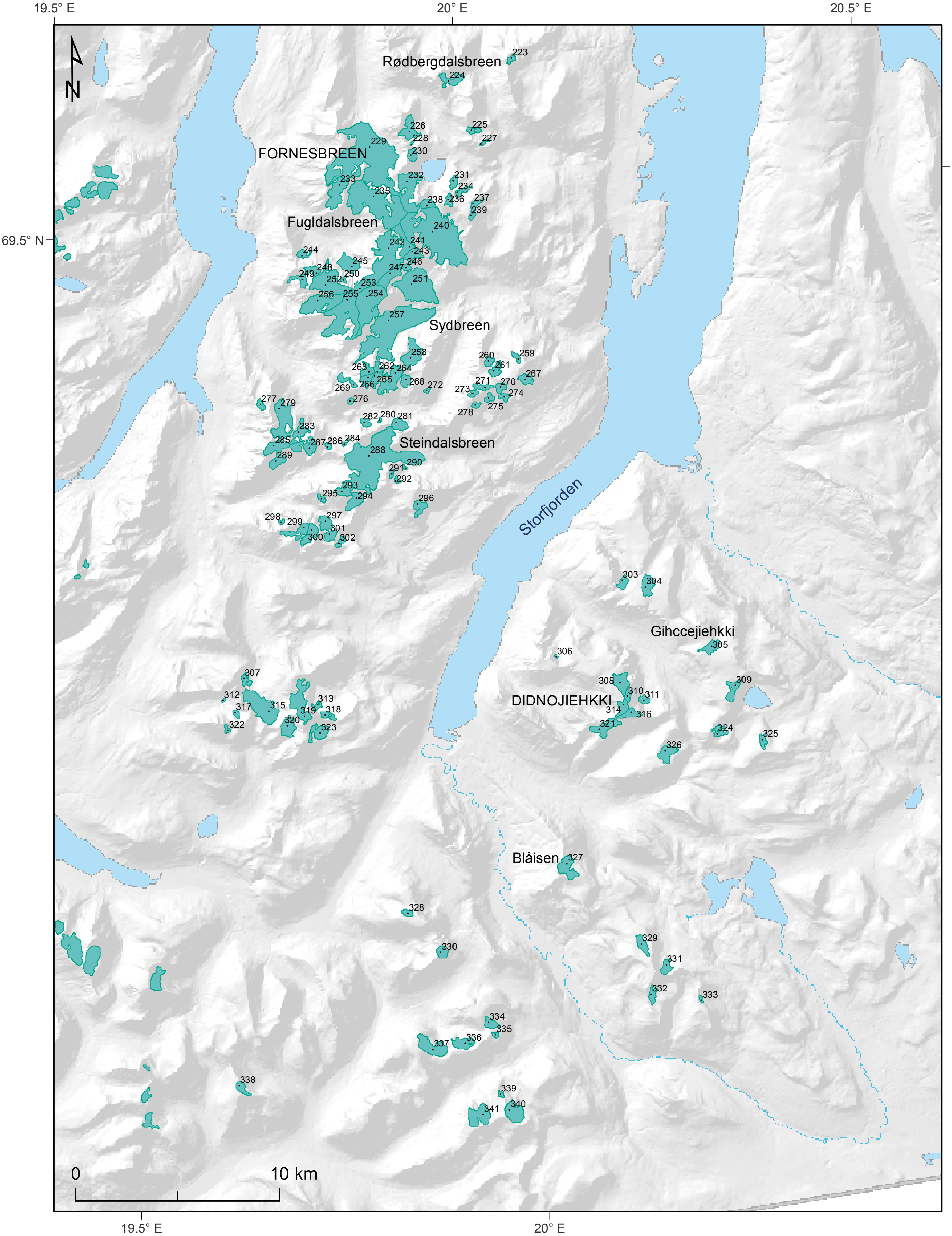
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
163			20010820	0.04	607	763	35	N
164	Fonnisen		20010820	0.06	603	846	36	NE
165			20010820	0.15	619	945	32	NE
166			20010820	0.09	763	1020	32	NE
167	Gammvikblåisen		20010820	4.95	530	1213	13	NE
168			20010820	0.50	467	833	23	E
169			20010820	0.98	359	1162	22	E
170			20010820	0.10	448	735	32	S
171			20010820	0.19	366	836	28	NE
172			20010820	0.18	593	852	26	NE
173			20010820	0.12	575	852	28	NE
174			20010820	0.10	649	834	24	NE
175			20010820	0.14	602	966	30	NE
176	Stefjellblåisen		20010820	0.40	609	976	23	N
177	Austre Vaggasblåisen		20010820	1.10	503	1010	21	N
178	Vestre Vaggasblåisen		20010820	2.63	472	1136	19	NE
179			20010820	0.03	558	730	26	NE
180			20010820	0.12	1114	1383	26	NE
181			20010820	0.41	591	1242	27	E
182			20010820	0.12	577	959	35	NE
183			20010820	0.12	567	783	27	S
184			20010820	0.02	824	931	34	NW
185	Reindalsblåisen		20010820	1.22	536	1278	22	NE
186			20010820	0.06	673	832	32	N
187			20010820	0.10	700	935	29	N
188			20010820	0.13	746	985	28	NE
189			20010820	0.25	575	913	28	N
190	Støvelbreen		20010820	1.94	824	1344	18	NE
191			20010820	0.70	646	1150	25	N
192			20010820	1.90	560	1188	20	N
193			20010820	0.18	674	979	30	N
194			20010820	0.17	566	706	20	SE
195			20010820	0.09	779	1006	29	NE
196			20010820	0.05	955	1128	30	NE
197			20010820	0.17	901	1284	35	N
198			20010820	0.26	773	1344	35	NE
199		LEB	20010820	0.77	718	1446	29	NE
200	Strupbreen	SKB	20010820	9.51	481	1509	12	E
201	Lenangsbreen	LEB	20010820	1.42	664	1374	22	N
202	Trollbreen		20010820	0.22	817	1211	30	NW
203		LEB	20010820	3.63	450	1483	22	SE
204	Forholtbreen		20010820	0.59	609	1348	28	N
205	Koppangsbreen	SKB	20010820	4.14	509	1203	15	E
206		SKB	20010820	0.74	706	1385	27	S
207			20010820	0.40	745	1288	33	SW
208			20010820	0.17	656	1108	33	S
209			20010820	0.06	217	362	21	S
210			20010820	0.20	691	954	28	NE
211			20010820	0.11	421	706	28	NE

Aerial photo of Strupbreen (200) and Koppangsbreen (205), August 1985. Photo: Fjellanger Widerøe AS.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
212			20010820	0.20	809	1170	30	N
213	Isskardbreen		20010820	1.92	692	1147	13	SW
214			20010820	0.32	978	1336	28	S
215			20010820	0.13	428	622	30	E
216			20010820	0.41	884	1263	25	E
217			20010820	0.15	599	884	27	NE
218			20010820	0.15	680	874	23	SE
219	Rottenvikbreen		20010820	2.14	688	1437	19	E
220			20010820	0.54	731	1395	35	S
221	Kjosbreen		20010820	0.64	898	1294	22	E
222			20010820	0.24	546	909	29	SE

5. **Lyngen - South**

Glacier ID 223 - 341



Sydbreen (257) and Midtbreen (251), September 2001.
Photo: Miriam Jackson, NVE.

Steindalsbreen (288), August 2010.
Photo: Frode Hansen.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
223			20010820	0.11	1008	1168	24	E
224	Rødbergdalsbreen		20010820	0.43	649	1281	27	E
225			20010820	0.17	893	1188	26	E
226			20010820	0.60	822	1256	26	E
227			20010820	0.07	953	1253	31	NE
228			20010820	0.03	1058	1288	39	NE
229		FOB	20010820	6.34	654	1684	18	N
230			20010820	0.23	946	1263	31	SE
231			20010820	0.19	955	1276	23	NE
232	Rypdalsbreen	VFR	20010820	1.40	707	1681	28	NE
233		FOB	20010820	0.98	1070	1686	24	S
234			20010820	0.19	839	1294	31	NE
235	Fugldalsbreen	VFR	20010820	3.52	846	1681	18	W
236			20010820	0.17	1333	1403	6	W
237			20010820	0.17	956	1474	36	E
238		VFR	20010820	0.27	982	1395	23	E
239			20010820	0.08	1202	1481	41	E
240	Vestbreen	VFR	20010820	5.11	481	1734	17	E
241		VFR	20010820	0.60	1444	1743	20	W
242		JIE	20010820	2.28	889	1831	24	NW
243		VFR	20010820	0.40	1232	1746	36	S
244			20010820	0.19	655	893	26	NE
245			20010820	0.63	479	818	21	NW
246			20010820	0.13	972	1308	35	SE
247		JIE	20010820	0.56	1358	1829	27	E
248		JIE	20010820	0.25	1238	1536	26	N
249			20010820	0.29	891	1523	32	W
250			20010820	0.07	993	1336	44	NE
251	Midtbreen		20010820	2.31	442	1312	15	SE
252		JIE	20010820	1.49	615	1737	30	N
253		JIE	20010820	0.44	1272	1832	29	NW
254		JIE	20010820	2.00	1009	1834	20	S
255		JIE	20010820	2.26	679	1733	22	SW
256	Blåisen	JIE	20010820	1.32	874	1722	24	W
257	Sydbreen		20010820	4.29	472	1277	14	E
258			20010820	0.86	751	1302	21	NE
259			20010820	0.13	1216	1489	27	N
260			20010820	0.17	891	1143	27	NE
261			20010820	0.27	935	1295	22	NE
262			20010820	0.18	1182	1629	30	N
263			20010820	0.28	1299	1621	22	NW
264			20010820	0.84	879	1412	25	SE
265			20010820	0.28	1275	1629	31	SE
266			20010820	0.28	1354	1622	16	SW
267			20010820	0.27	1016	1418	26	E
268			20010820	0.25	884	1105	22	SW
269			20010820	0.24	819	1355	30	N
270			20010820	0.20	1086	1425	34	SE
271			20010820	0.23	1285	1485	19	NW

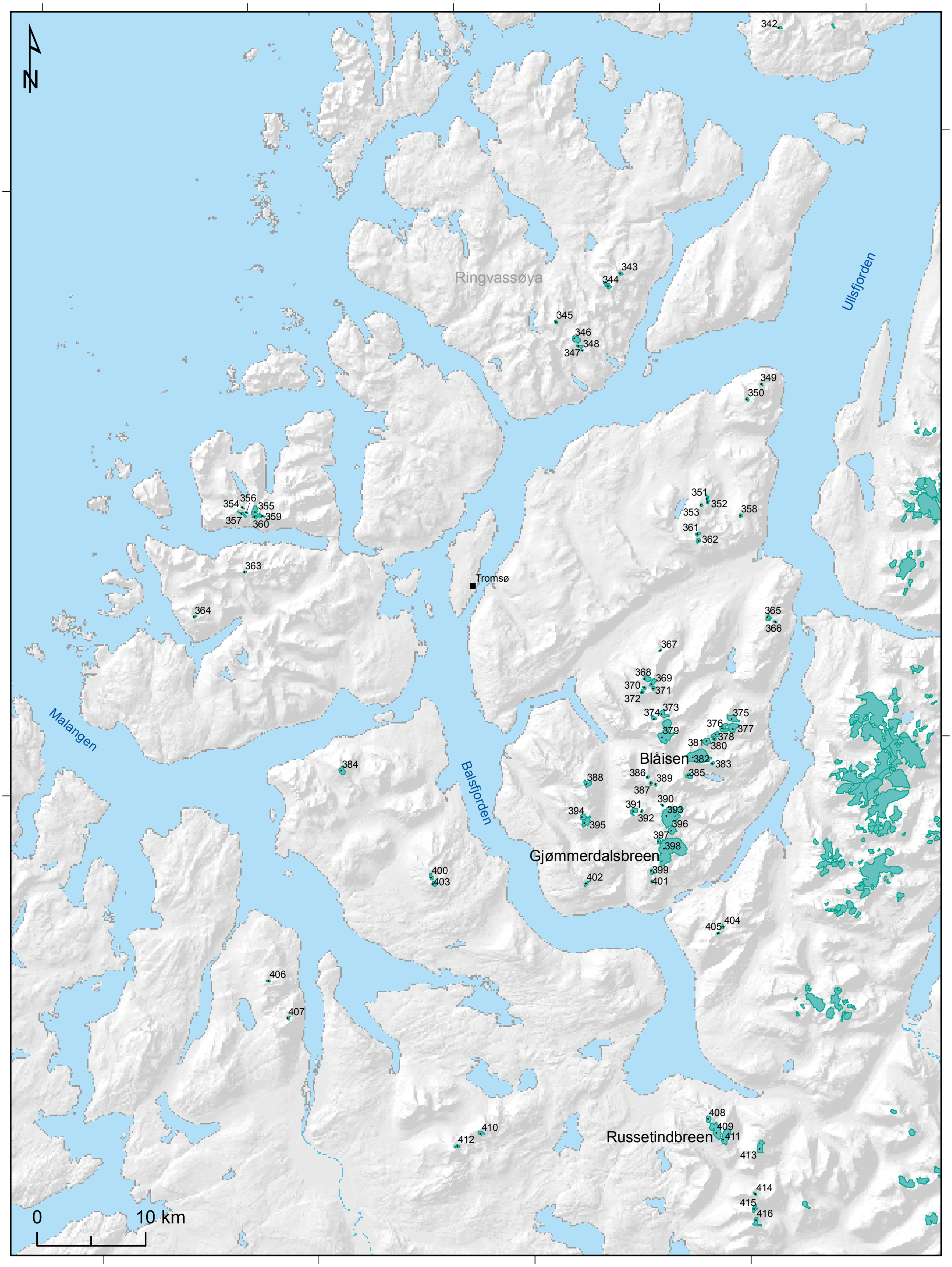
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
272			20010820	0.06	808	1000	30	E
273			20010820	0.11	1382	1445	8	SW
274			20010820	0.15	918	1194	23	SE
275			20010820	0.15	1006	1262	31	S
276			20010820	0.08	976	1183	34	SE
277			20010820	0.15	887	1124	24	N
278			20010820	0.11	924	1186	35	SE
279			20010820	1.24	595	1485	29	NE
280			20010820	0.03	974	1234	44	NE
281			20010820	0.36	861	1224	26	N
282			20010820	0.16	777	1026	31	N
283			20010820	0.44	700	1471	32	NE
284			20010820	0.06	741	975	25	W
285			20010820	0.53	1085	1544	26	SE
286			20010820	0.08	857	974	20	E
287			20010820	0.59	814	1383	28	SE
288	Steindalsbreen		20010820	5.14	474	1504	15	E
289			20010820	0.35	768	1134	30	SE
290			20010820	0.04	538	593	12	N
291			20010820	0.08	917	1160	37	E
292			20010820	0.07	842	1037	37	NE
293			20010820	0.40	1300	1503	11	SW
294			20010820	0.47	967	1322	23	SE
295			20010820	0.09	978	1233	26	SE
296			20010820	0.33	843	1330	39	SE
297			20010820	0.36	859	1319	26	N
298			20010820	0.06	692	885	36	NW
299			20010820	0.46	970	1576	28	SW
300			20010820	0.48	1047	1542	26	S
301			20010820	0.27	1021	1283	24	SE
302			20010820	0.14	775	1065	28	NE
303			20010820	0.22	814	1071	19	N
304			20010820	0.49	1060	1383	19	N
305	Gihccejiehkki		20010820	0.37	1055	1407	22	NE
306	Riehppejiehkki		20010820	0.03	883	982	34	NE
307			20010820	0.21	390	696	32	E
308		DID	20010820	0.57	1203	1541	13	NE
309			20010820	0.39	1141	1443	17	NE
310		DID	20010820	0.15	1289	1524	34	E
311			20010820	0.17	701	896	20	NE
312			20010820	0.03	578	689	22	SW
313			20010820	0.13	619	877	28	N
314		DID	20010820	0.31	1422	1562	18	NW
315			20010820	1.50	547	890	17	N
316		DID	20010820	0.29	1301	1557	23	NE
317			20010820	0.09	815	959	17	NW
318			20010820	0.19	802	1036	21	N
319			20010820	1.10	909	1495	21	NE
320			20010820	0.52	841	1273	25	S

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
321			20010820	0.62	1098	1349	25	SE
322			20010820	0.08	939	1352	43	E
323			20010820	0.50	693	1123	22	E
324			20010820	0.25	958	1323	26	NE
325			20010820	0.19	935	1265	29	E
326			20010820	0.51	861	1318	26	NE
327	Blåisen		20010820	0.66	1103	1441	19	N
328			20010820	0.16	1206	1408	22	N
329			20010820	0.33	1242	1455	13	SE
330			20010820	0.25	958	1299	31	N
331			20010820	0.27	941	1270	22	E
332			20010820	0.23	945	1203	26	E
333			20010820	0.05	1151	1279	35	E
334			20010820	0.27	960	1269	24	NE
335			20010820	0.07	1129	1322	27	N
336			20010820	0.46	1094	1444	20	NE
337			20010820	0.89	929	1409	24	E
338			20010820	0.24	1093	1382	31	NE
339			20010820	0.07	1116	1325	39	NE
340			20010820	0.72	976	1467	29	N
341			20010820	0.83	1005	1411	20	N

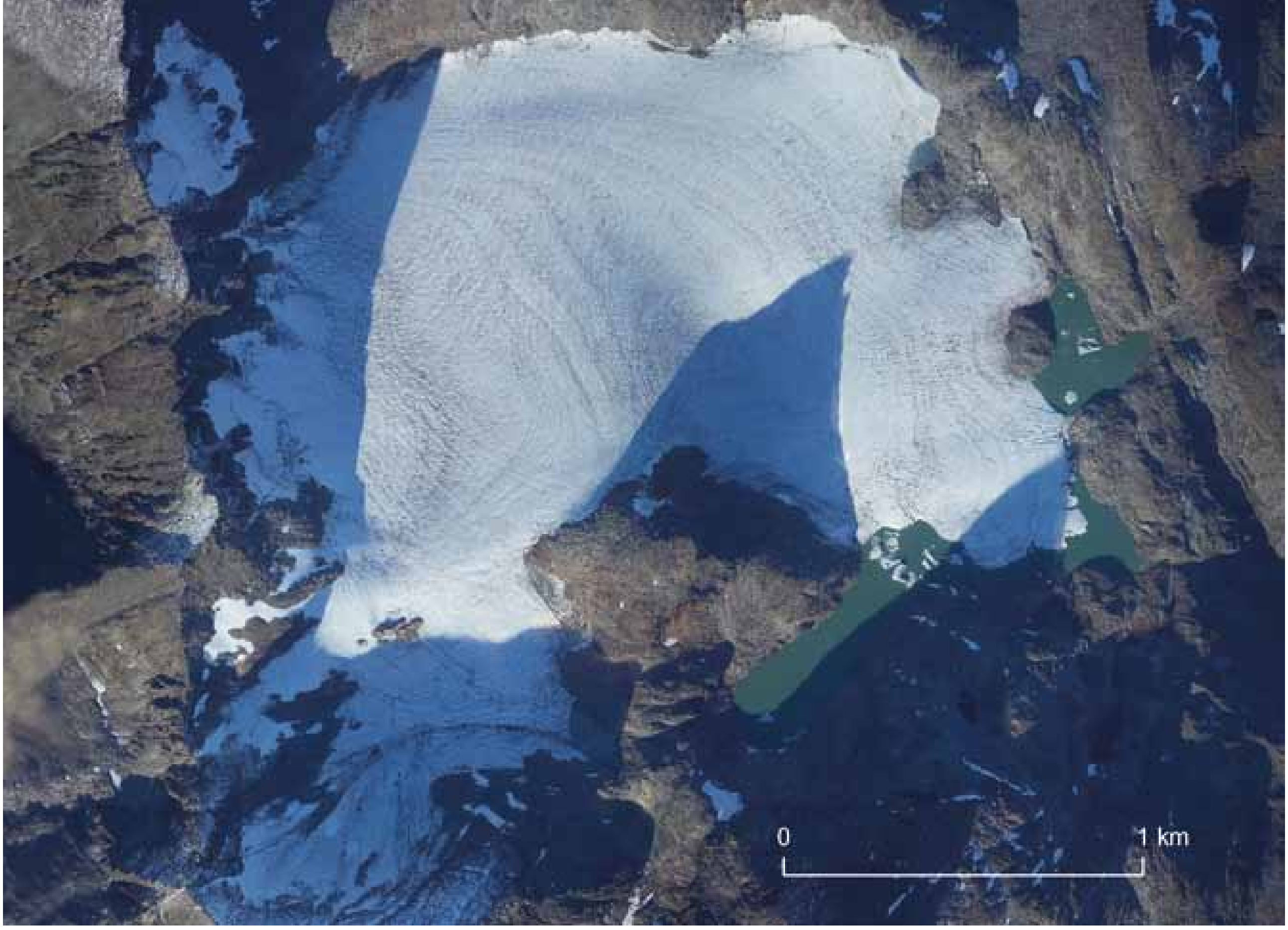
Midtbreen (251), September 2001.
Photo: Miriam Jackson, NVE.

6. **Kvaløya - Tromsø**

Glacier ID 342 - 416



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
342			20010820	0.08	627	938	41	NE
343			20010820	0.09	562	722	23	E
344			20010820	0.22	671	977	30	N
345			20010820	0.07	737	925	32	E
346			20010820	0.35	627	952	24	E
347			20010820	0.12	458	695	27	NE
348			20010820	0.02	627	724	31	NE
349			20010820	0.04	547	673	27	E
350			20010820	0.08	616	824	31	N
351			20010820	0.09	792	937	23	E
352			20010820	0.06	789	940	22	NE
353			20010820	0.05	902	957	12	SE
354			20010820	0.03	566	747	45	N
355			20010820	0.43	642	926	21	NE
356			20010820	0.03	847	903	14	W
357			20010820	0.13	681	865	18	NW
358			20010820	0.07	769	909	21	SE
359			20010820	0.05	666	892	34	N
360			20010820	0.08	726	905	25	SW
361			20010820	0.11	697	891	25	E
362			20010820	0.11	642	859	28	NE
363			20010820	0.05	807	935	26	N
364			20010820	0.04	540	705	32	NE
365			20010820	0.15	711	962	28	NE
366			20010820	0.05	640	794	23	E
367			20010820	0.03	808	961	26	N
368			20010820	0.29	932	1222	28	N
369			20010820	0.23	827	1208	31	E
370			20010820	0.06	869	953	15	NW
371			20010820	0.08	1079	1344	35	NE
372			20010820	0.08	977	1241	33	N
373			20010820	0.35	720	1112	27	NE
374			20010820	0.13	666	835	19	N
375			20010820	0.47	754	1086	26	NE
376			20010820	0.39	1069	1378	22	SE
377			20010820	0.56	1030	1311	15	SE
378			20010820	0.26	1024	1358	25	E
379			20010820	1.65	619	1287	19	NE
380			20010820	0.07	1072	1270	28	SE
381			20010820	0.32	940	1186	24	SE
382	Blåisen		20010820	1.93	779	1130	12	NE
383			20010820	0.08	921	1095	31	N
384			20010820	0.31	802	1018	21	E
385			20010820	0.22	621	847	20	E
386			20010820	0.05	767	899	27	E
387			20010820	0.06	817	1012	34	NE
388			20010820	0.25	752	1227	33	NE
389			20010820	0.05	623	722	19	NE
390			20010820	0.04	826	919	26	NE

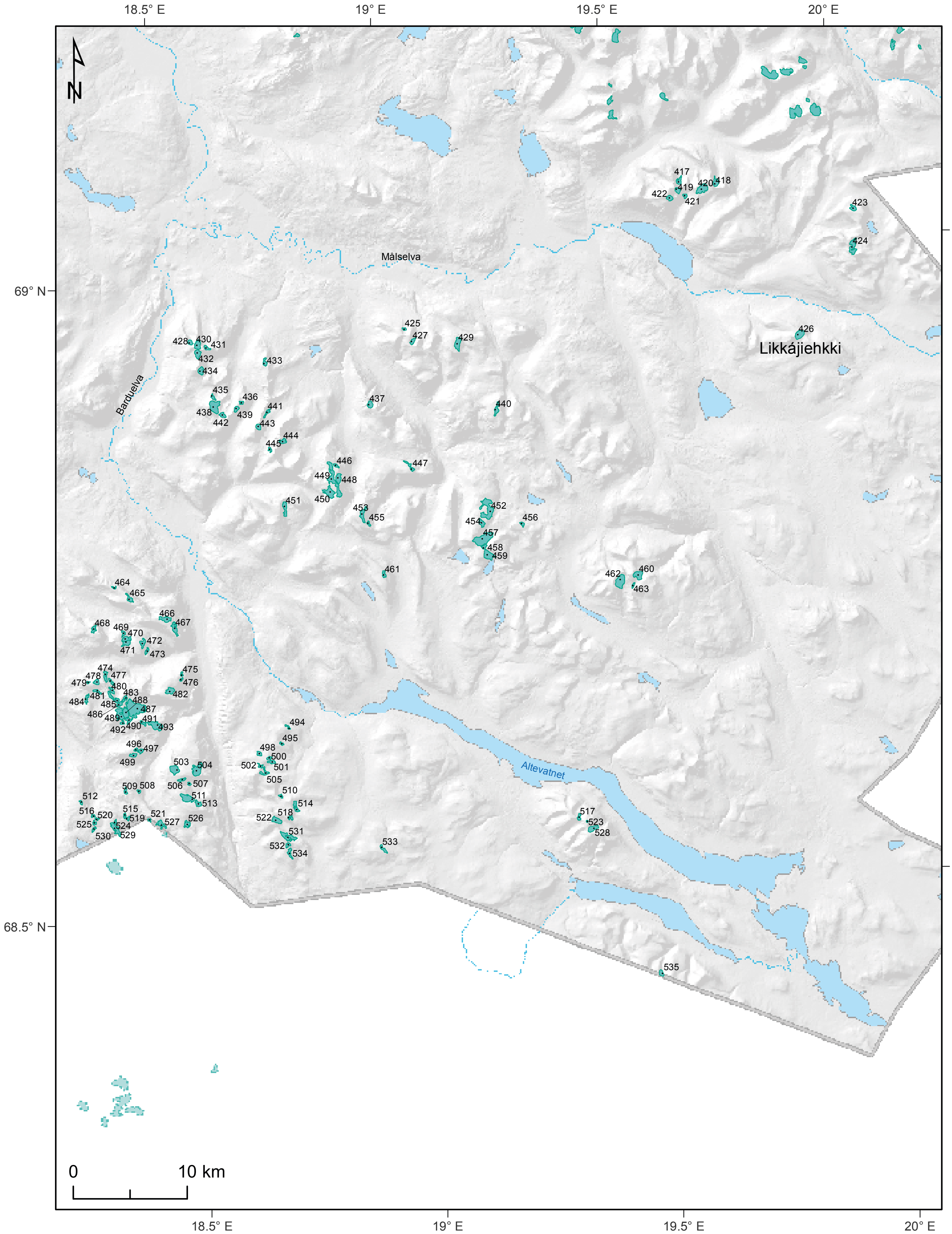


Orthophoto of Gjømmerdalsbreen (398), October 2010. Source: NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
391			20010820	0.25	837	1186	23	NE
392			20010820	0.05	919	1051	29	N
393			20010820	2.23	650	1148	13	NE
394			20010820	0.24	934	1284	31	NE
395			20010820	0.40	736	1185	30	E
396			20010820	0.38	773	1126	24	E
397			20010820	0.11	906	1098	29	NE
398	Gjømmerdalsbreen		20010820	4.07	690	1077	9	E
399			20010820	0.13	516	646	19	E
400			20010820	0.15	756	925	28	NE
401			20010820	0.04	826	907	26	E
402			20010820	0.11	720	850	23	SE
403			20010820	0.17	775	974	26	NE
404			20010820	0.06	643	813	25	NE
405			20010820	0.05	1020	1202	33	SE
406			20010820	0.05	708	877	34	NE
407			20010820	0.06	719	900	28	NE
408			20010820	0.23	1037	1278	21	N
409	Russetindbreen		20010820	1.00	922	1343	21	NE
410			20010820	0.14	899	1184	27	E
411			20010820	0.79	927	1291	19	E
412			20010820	0.09	832	1090	27	E
413			20010820	0.49	837	1375	33	E
414			20010820	0.04	935	1107	38	NE
415			20010820	0.18	949	1285	36	E
416			20010820	0.27	905	1240	30	E

7. Troms - Inner

Glacier ID 417 - 535



Cirque glacier (528) near Altevatn near Rohkunborri peak (1659 m.a.s.l.), August 2009. Photo: Arve Tvede.

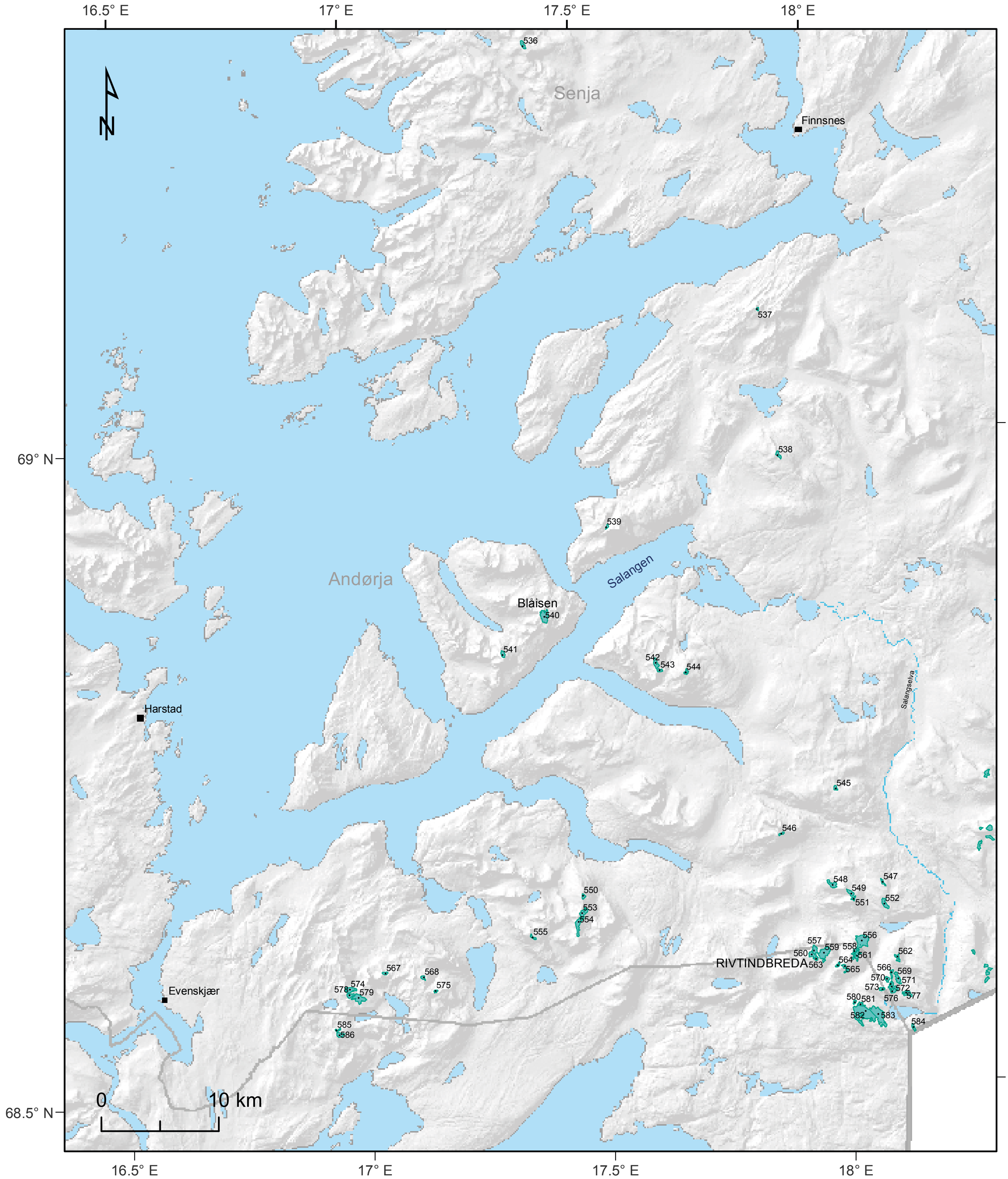
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
417			20010820	0.20	767	1025	21	NE
418			20010820	0.28	922	1187	25	NE
419			20010820	0.17	1009	1346	35	E
420			20010820	0.56	971	1269	18	SE
421			20010820	0.11	624	738	15	SE
422			20010820	0.20	1031	1300	28	SE
423			20010820	0.20	1267	1437	19	N
424			20010820	0.53	1028	1298	14	NE
425			20010820	0.06	951	1087	32	N
426	Likkájiehkki		20010820	0.46	967	1293	19	E
427			20010820	0.16	1030	1324	26	NE
428			20010820	0.14	939	1139	25	N
429			20010820	0.43	1127	1375	23	E
430			20010820	0.32	1026	1357	23	NE
431			20010820	0.14	940	1183	27	N
432			20010820	0.31	1026	1342	29	SE
433			20010820	0.16	1133	1343	23	NE
434			20010820	0.24	860	1134	31	E
435			20010820	0.11	959	1151	32	NE
436			20010820	0.08	1097	1227	23	N
437			20010820	0.23	1041	1267	25	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
438			20010820	0.72	1073	1378	18	E
439			20010820	0.15	1015	1214	30	SE
440			20010820	0.26	1382	1487	9	SE
441			20010820	0.13	810	921	10	E
442			20010820	0.17	1039	1159	16	N
443			20010820	0.17	1039	1233	23	E
444			20010820	0.19	1056	1467	33	E
445			20010820	0.09	1057	1229	21	NW
446			20010820	0.09	1183	1265	16	NE
447			20010820	0.19	994	1238	30	NE
448			20010820	0.31	941	1347	25	NE
449			20010820	1.02	1267	1534	13	NE
450			20010820	0.57	1147	1437	17	SW
451			20010820	0.31	917	1078	15	E
452			20010820	1.08	1071	1504	20	E
453			20010820	0.33	1251	1470	18	E
454			20010820	0.23	1431	1592	18	E
455			20010820	0.08	1034	1170	26	E
456			20010820	0.10	1115	1229	23	NE
457			20010820	1.17	1189	1565	14	NE
458			20010820	0.12	1429	1590	24	N
459			20010820	0.50	1040	1508	21	SE
460			20010820	0.44	1123	1516	24	NE
461			20010820	0.13	1062	1210	24	E
462			20010820	0.71	1013	1435	21	SE
463			20010820	0.07	1314	1439	17	S
464			20010820	0.06	1110	1282	25	N
465			20010820	0.20	1207	1341	15	NE
466			20010820	0.34	1167	1370	13	NE
467			20010820	0.34	1041	1289	28	E
468			20010820	0.18	949	1376	29	N
469			20010820	0.11	1356	1460	23	E
470			20010820	0.25	1082	1278	15	E
471			20010820	0.27	1068	1280	14	SE
472			20010820	0.24	1268	1442	17	E
473			20010820	0.11	876	949	9	SE
474			20010820	0.21	916	1151	32	E
475			20010820	0.06	997	1195	29	NE
476			20010820	0.06	1126	1291	28	E
477			20010820	0.11	766	874	18	NE
478			20010820	0.17	1410	1484	12	N
479			20010820	0.04	1254	1390	35	N
480			20010820	0.15	951	1145	30	NE
481			20010820	0.13	946	1027	14	S
482			20010820	0.33	1069	1361	23	SE
483			20010820	0.12	1032	1234	19	E
484			20010820	0.16	953	1039	12	E
485			20010820	0.27	1208	1426	29	NE
486			20010820	0.16	1320	1407	13	S

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
487			20010820	1.60	797	1156	12	E
488			20010820	0.38	1080	1405	31	E
489			20010820	0.52	1221	1437	15	NW
490			20010820	0.18	1133	1284	12	N
491			20010820	0.13	1272	1338	9	S
492			20010820	0.08	1133	1243	15	S
493			20010820	0.61	850	1334	20	SE
494			20010820	0.07	972	1102	26	NE
495			20010820	0.07	1053	1200	29	NE
496			20010820	0.06	1278	1392	18	E
497			20010820	0.13	996	1269	25	NE
498			20010820	0.13	1117	1296	27	N
499			20010820	0.16	1195	1360	18	SE
500			20010820	0.08	1111	1302	23	E
501			20010820	0.15	1058	1294	20	NE
502			20010820	0.10	1257	1397	19	NE
503			20010820	0.47	1160	1404	18	N
504			20010820	0.63	975	1301	22	E
505			20010820	0.20	1143	1455	25	NE
506			20010820	0.13	1157	1378	25	SE
507			20010820	0.06	857	922	14	SE
508			20010820	0.06	1016	1173	26	E
509			20010820	0.11	1156	1230	8	SE
510			20010820	0.07	1110	1222	20	N
511			20010820	0.56	1285	1400	7	NE
512			20010820	0.06	1224	1338	24	NE
513			20010820	0.19	1195	1332	16	E
514			20010820	0.23	1115	1238	17	NE
515			20010820	0.06	1126	1190	11	NE
516			20010820	0.06	1135	1295	29	N
517			20010820	0.12	1258	1529	26	N
518			20010820	0.10	1198	1411	23	SE
519			20010820	0.11	1016	1186	15	SE
520			20010820	0.05	1186	1258	10	E
521			20010820	0.05	1173	1198	8	S
522			20010820	0.32	1128	1502	24	E
523			20010820	0.03	1538	1649	28	NE
524			20010820	0.07	1012	1109	15	SE
525			20010820	0.08	1186	1262	11	SE
526			20010820	0.22	954	1203	25	E
527	Fonna		20010820	0.27	1104	1220	11	NE
528			20010820	0.33	1097	1491	25	NE
529			20010820	0.43	971	1193	20	NE
530			20010820	0.09	1080	1154	13	SE
531			20010820	0.51	1060	1453	23	NE
532			20010820	0.12	1237	1309	12	SE
533			20010820	0.17	1098	1266	24	NE
534			20010820	0.18	1097	1257	22	E
535			20010820	0.17	1034	1252	27	NE

8. Troms - South

Glacier ID 536 - 586

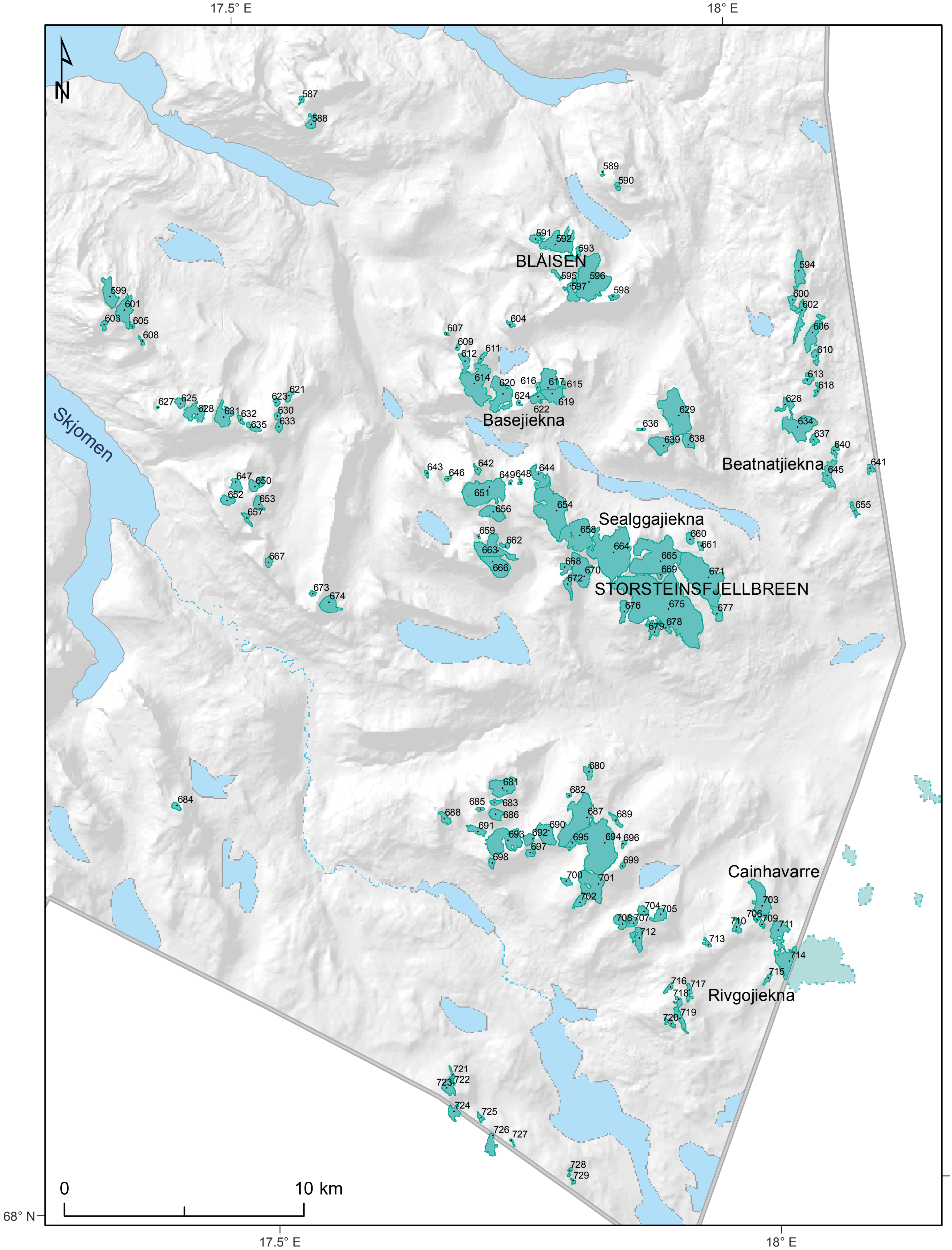


Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
536			20010820	0.16	658	840	27	NE
537			20010820	0.06	881	1037	27	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
538			20010820	0.13	901	1089	19	NE
539			20010820	0.06	711	993	41	NW
540	Blåisen		20010820	0.56	799	1182	20	NE
541			20010820	0.14	835	1057	26	NE
542			20010820	0.24	986	1208	27	E
543			20010820	0.10	964	1171	29	NE
544			20010820	0.10	968	1141	21	E
545			20010820	0.09	941	1074	19	N
546			20010820	0.07	1185	1254	15	S
547			20010820	0.09	911	1036	24	NE
548			20010820	0.27	957	1199	27	NE
549			20010820	0.18	1106	1265	23	NE
550			20010820	0.09	916	1067	26	E
551			20010820	0.08	1095	1313	29	NE
552			20010820	0.26	947	1112	17	E
553			20010820	0.29	899	1182	21	NE
554			20010820	0.41	847	1162	27	SE
555			20010820	0.08	940	1123	23	E
556			20010820	0.87	938	1356	21	E
557		RIB	20010820	0.24	1095	1160	8	W
558			20010820	0.11	1124	1311	28	SE
559			20010820	0.68	1016	1291	12	S
560		RIB	20010820	0.21	1095	1160	5	N
561			20010820	0.25	920	1270	30	E
562			20010820	0.14	977	1172	24	NE
563		RIB	20010820	0.08	1111	1161	7	SE
564			20010820	0.08	1020	1125	20	NW
565			20010820	0.15	1005	1220	14	SE
566			20010820	0.12	1026	1263	30	NE
567			20010820	0.09	895	1070	33	N
568			20010820	0.09	915	1051	21	NE
569			20010820	0.26	754	918	18	NE
570			20010820	0.12	1240	1334	10	N
571			20010820	0.05	1330	1422	12	NE
572			20010820	0.17	1100	1392	24	E
573			20010820	0.09	1277	1394	18	NW
574			20010820	0.30	917	1178	25	N
575			20010820	0.06	874	987	24	N
576			20010820	0.20	1206	1418	17	SE
577			20010820	0.23	1069	1156	8	NE
578			20010820	0.16	1038	1235	20	E
579			20010820	0.52	888	1115	8	E
580			20010820	0.06	1152	1349	30	N
581			20010820	0.11	1161	1333	20	NE
582			20010820	1.69	953	1331	11	SE
583			20010820	1.06	889	1216	12	E
584			20010820	0.11	919	1024	18	NE
585			20010820	0.06	922	1065	23	NE
586			20010820	0.18	907	1068	13	E

9. **Skjomen**

Glacier ID 587 - 729



Storsteinsfjellbreen (675) in September 2006. Mass balance investigations were carried out on the glacier in two periods: 1964-1968 and 1991-1995. Length change measurements were initiated on the glacier in 2006. Photo: Hallgeir Elvehøy, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
587			20010820	0.05	1243	1302	12	NW
588			20010820	0.17	1013	1374	30	E
589			20010820	0.02	1019	1188	38	N
590			20010820	0.06	1141	1278	24	SE
591			20010820	0.16	1178	1382	23	NE
592	Blåisen		20010820	0.95	1037	1475	15	NE
593			20010820	0.08	1253	1465	28	NE
594			20010820	0.48	1190	1391	24	E
595			20010820	0.08	1120	1189	13	NW
596		BLI	20010820	1.80	896	1239	13	E
597		BLI	20010820	0.26	1169	1423	31	E
598			20010820	0.07	1230	1352	25	N
599			20010820	0.51	953	1482	23	NE
600			20010820	0.15	1192	1321	15	E
601			20010820	0.59	917	1327	17	NE
602			20010820	0.35	1098	1381	14	NE
603			20010820	0.08	1082	1284	29	S
604			20010820	0.06	1260	1446	37	N
605			20010820	0.04	1122	1308	34	NE
606			20010820	0.54	1074	1364	15	E
607			20010820	0.02	1233	1307	29	N
608			20010820	0.04	1034	1181	31	NE
609			20010820	0.04	1099	1242	31	N
610			20010820	0.13	1183	1278	15	E
611			20010820	0.08	1102	1362	27	NE
612			20010820	0.21	1284	1610	22	NW
613			20010820	0.14	1128	1275	17	NE
614			20010820	1.31	1037	1610	22	E
615			20010820	0.04	1276	1382	33	E

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
616			20010820	0.07	1448	1524	7	N
617			20010820	0.58	1159	1463	17	NE
618			20010820	0.06	1104	1235	28	E
619			20010820	0.42	1226	1464	13	E
620	Basejiekna		20010820	0.87	986	1330	13	N
621			20010820	0.10	1159	1326	22	NE
622			20010820	0.20	1358	1547	15	SE
623			20010820	0.07	1264	1326	11	N
624			20010820	0.04	1265	1467	31	NW
625			20010820	0.14	1175	1342	24	N
626			20010820	0.20	1236	1377	10	NE
627			20010820	0.01	1003	1026	16	N
628			20010820	0.45	1042	1484	25	N
629			20010820	1.59	1211	1571	15	N
630			20010820	0.07	1106	1282	32	E
631			20010820	0.49	1096	1378	20	NE
632			20010820	0.06	1081	1219	30	NE
633			20010820	0.10	1021	1193	29	E
634			20010820	0.94	1146	1414	11	E
635			20010820	0.12	1135	1308	33	N
636			20010820	0.04	1248	1460	51	N
637			20010820	0.10	1226	1376	19	N
638			20010820	0.21	1235	1519	24	SE
639			20010820	0.50	1298	1560	17	SE
640			20010820	0.10	1161	1329	19	NE
641			20010820	0.09	1197	1291	17	NE
642			20010820	0.07	1228	1382	31	NE
643			20010820	0.04	904	1083	30	N
644			20010820	0.40	1259	1592	23	NE
645	Beatnatjiekna		20010820	0.38	1282	1403	14	E
646			20010820	0.05	999	1065	17	N
647			20010820	0.20	1018	1229	19	N
648			20010820	0.04	1285	1455	36	NW
649			20010820	0.03	1105	1235	37	NW
650			20010820	0.25	976	1239	21	NE
651			20010820	1.51	1036	1566	18	NE
652			20010820	0.19	1298	1361	6	NW
653			20010820	0.18	1069	1241	17	E
654			20010820	1.90	1147	1605	18	E
655			20010820	0.09	1192	1261	18	NE
656			20010820	0.45	1103	1448	21	E
657			20010820	0.11	1119	1290	23	E
658			20010820	1.30	1096	1692	23	N
659			20010820	0.02	1271	1413	42	N
660			20010820	0.12	1182	1338	26	NE
661			20010820	0.07	1175	1298	23	N
662			20010820	0.07	1063	1209	22	NE
663			20010820	0.83	1221	1701	22	E
664	Sealggajiekna		20010820	2.63	1152	1841	18	N

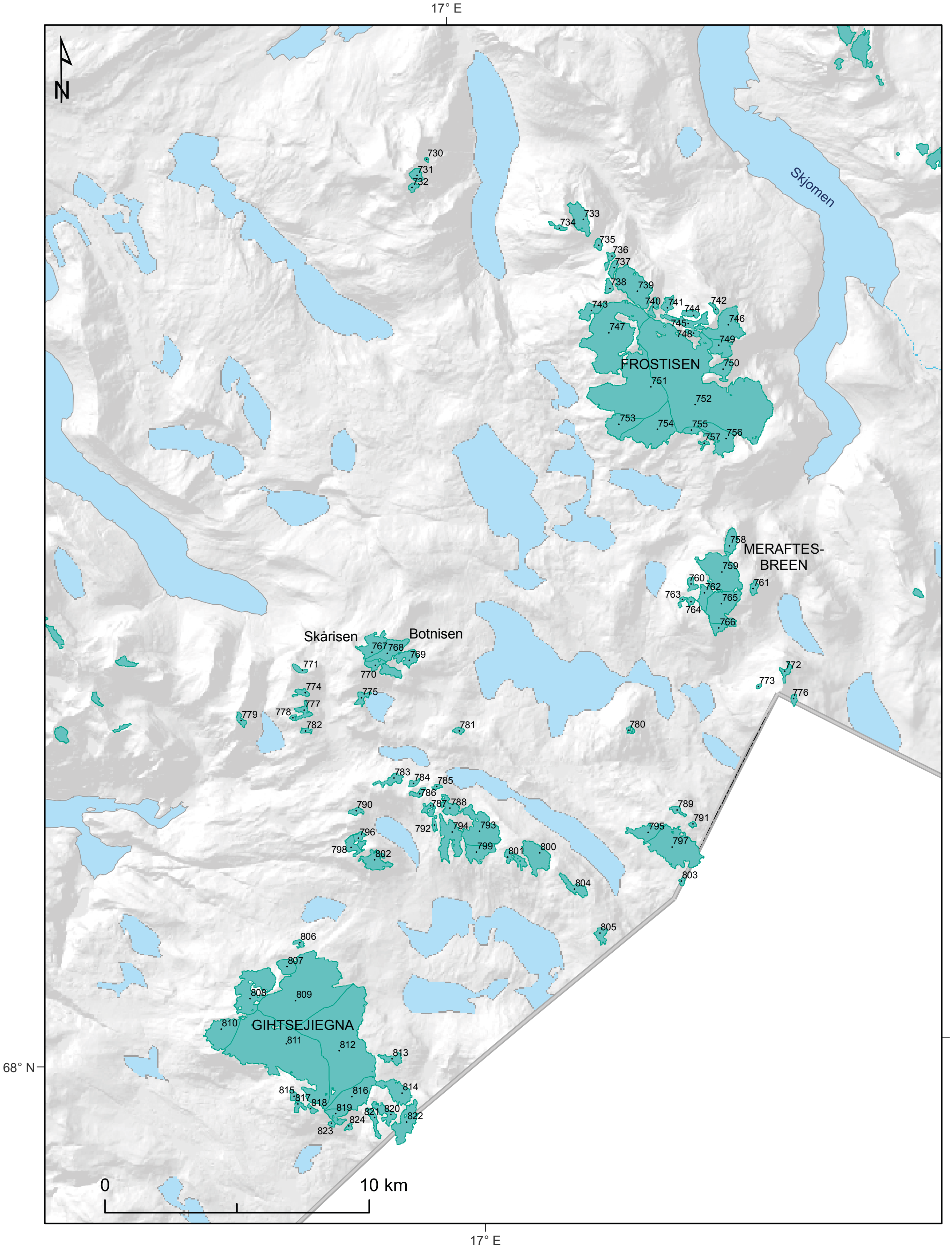
Orthophoto of Storsteinsfjellbreen (675), August 2010. The glacier has retreated 1 km from its maximum extent. Distinct end moraine ridges mark the previous extent. Source: www.norgeibilder.no.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
665			20010820	2.38	1221	1844	15	NE
666			20010820	0.68	1053	1583	21	E
667			20010820	0.10	1136	1305	22	NE
668			20010820	0.16	1229	1416	20	NW
669			20010820	0.06	1465	1574	20	E
670			20010820	0.86	1145	1484	15	S
671			20010820	2.22	1146	1482	12	NE
672			20010820	0.19	1205	1508	27	E
673			20010820	0.05	1257	1398	29	NW
674			20010820	0.42	1023	1269	20	NE
675		STB	20010820	6.01	1017	1862	12	SE
676			20010820	0.25	1405	1527	13	W
677			20010820	0.20	1266	1370	10	E
678		STB	20010820	0.08	1311	1509	18	SE
679		STB	20010820	0.18	1295	1582	23	S
680			20010820	0.15	1170	1295	17	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
681			20010820	0.64	1167	1512	17	E
682			20010820	0.04	1309	1346	10	NW
683			20010820	0.08	1574	1701	20	NE
684			20010820	0.09	1255	1441	25	N
685			20010820	0.05	1355	1516	38	NW
686			20010820	0.22	1282	1534	23	SE
687			20010820	1.52	1241	1527	9	NE
688			20010820	0.14	1278	1499	17	SE
689			20010820	0.11	1043	1194	30	NE
690			20010820	0.51	1311	1560	15	NW
691			20010820	0.20	1222	1351	14	N
692			20010820	0.17	1295	1487	24	NW
693			20010820	1.09	1146	1532	18	N
694			20010820	2.57	1216	1652	12	NE
695			20010820	0.12	1379	1485	11	S
696			20010820	0.05	1256	1322	11	NE
697			20010820	0.13	1220	1373	22	SE
698			20010820	0.08	1315	1502	26	SE
699			20010820	0.05	1358	1529	32	E
700			20010820	0.10	1295	1518	21	NW
701			20010820	0.90	1246	1640	19	SE
702			20010820	0.19	1347	1512	21	SE
703	Cainhavarre		20010820	0.80	1232	1557	17	NE
704			20010820	0.14	1197	1414	28	N
705			20010820	0.24	1321	1553	24	N
706			20010820	0.05	1556	1572	3	N
707			20010820	0.20	1338	1503	18	N
708			20010820	0.20	1297	1560	23	N
709			20010820	0.05	1509	1565	10	SE
710			20010820	0.16	1440	1521	9	NW
711			20010820	0.54	1170	1436	16	NE
712			20010820	0.31	1263	1465	17	SE
713			20010820	0.07	1238	1398	24	N
714	Rivgojiekna		20010820	0.64	1404	1459	2	S
715			20010820	0.08	1304	1405	11	S
716			20010820	0.07	1202	1283	11	NE
717			20010820	0.12	1142	1308	21	E
718			20010820	0.12	1308	1444	21	E
719			20010820	0.18	1233	1399	20	E
720			20010820	0.09	1308	1429	14	E
721			20010820	0.07	1199	1258	15	E
722			20010820	0.02	1196	1244	21	NE
723			20010820	0.23	1245	1378	16	NE
724			20010820	0.22	1103	1299	20	E
725			20010820	0.06	1064	1202	28	NE
726			20010820	0.28	1189	1440	22	E
727			20010820	0.03	1193	1237	16	NE
728			20010820	0.04	1107	1246	30	E
729			20010820	0.03	1156	1244	25	NE

10. **Frostisen**

Glacier ID 730 - 824

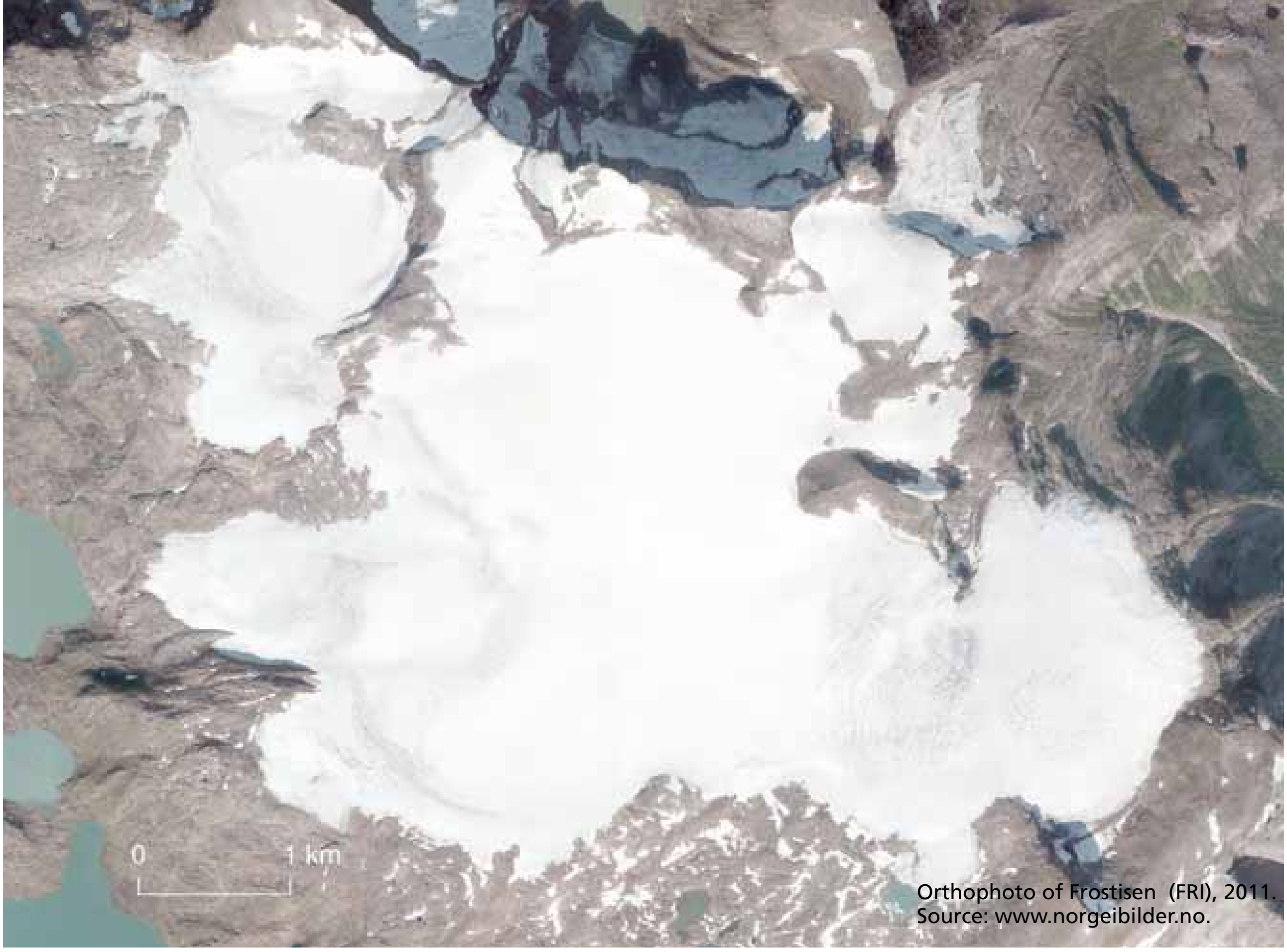


10. **Frostisen** | Northern Norway North

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
730			20010820	0.02	876	957	29	NE
731			20010820	0.18	847	1039	21	E
732			20010820	0.09	831	1093	31	E
733			20010820	0.60	839	1265	21	N
734			20010820	0.09	1075	1306	19	NW
735			20010820	0.10	890	1073	24	NE
736			20010820	0.11	1083	1274	15	NE
737			20010820	0.14	1050	1296	26	E
738			20010820	0.12	1346	1502	16	NW
739			20010820	1.33	898	1540	23	NE

Snow depth sounding on Langfjordjøkelen, May 2010. Photo: Ragnar Ekker, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
740			20010820	0.14	963	1552	39	NE
741			20010820	0.19	768	946	15	NE
742			20010820	0.07	1335	1500	21	NW
743		FRI	20010820	0.34	1144	1377	17	NW
744			20010820	0.14	1012	1194	21	NW
745	Reintindbreen		20010820	0.44	1011	1625	37	N
746		FRI	20010820	1.11	865	1585	23	NE
747		FRI	20010820	3.79	973	1729	11	SW
748		FRI	20010820	0.10	1551	1667	26	S
749		FRI	20010820	0.45	1030	1429	18	E



Orthophoto of Frostisen (FRI), 2011.
Source: www.norgeibilder.no.

10. **Frostisen** | Northern Norway North

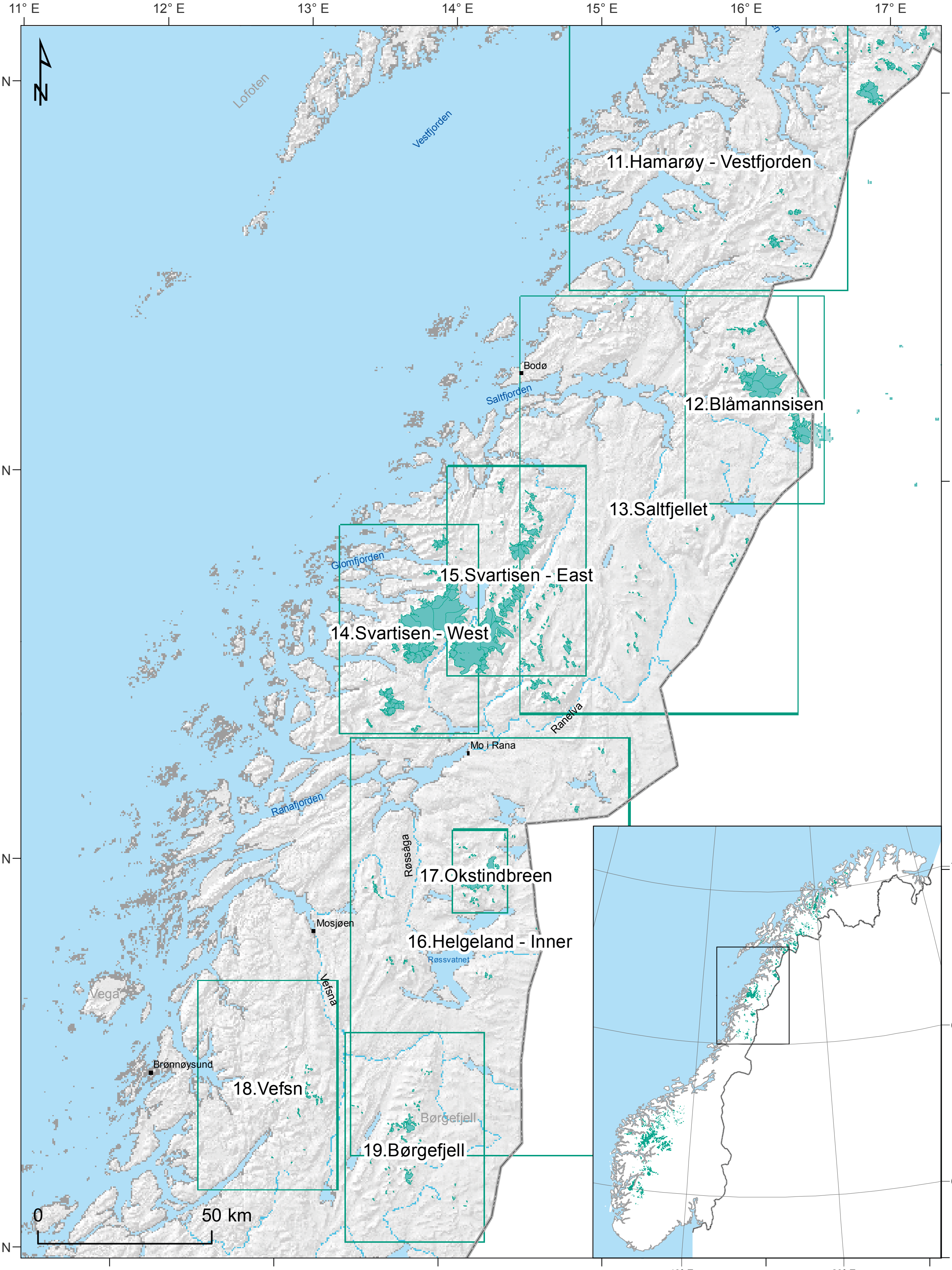
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
750		FRI	20010820	0.39	1089	1295	18	E
751		FRI	20010820	4.25	912	1510	8	W
752		FRI	20010820	11.43	822	1733	7	SE
753		FRI	20010820	0.77	1020	1197	8	SW
754		FRI	20010820	1.78	1020	1267	5	SW
755		FRI	20010820	0.23	1090	1258	13	SE
756		FRI	20010820	0.85	1032	1201	7	SE
757			20010820	0.06	1034	1114	10	S
758	Nordre Meraftesbreen		20010820	0.34	966	1282	18	NE
759	Meraftesbreen		20010820	1.62	1028	1399	11	NW
760			20010820	0.13	1266	1384	12	N
761			20010820	0.13	1148	1307	27	E
762		MER	20010820	0.32	1377	1439	3	N
763			20010820	0.06	1257	1343	20	NW
764			20010820	0.07	1339	1400	10	W
765		MER	20010820	1.25	1015	1437	15	E
766		MER	20010820	0.17	1136	1381	24	E
767	Skårisen	SBO	20010820	0.61	1054	1424	18	N
768	Botnisen	SBO	20010820	0.64	911	1420	15	NE
769		SBO	20010820	0.36	923	1197	17	NE
770		SBO	20010820	0.45	1106	1421	13	SE
771			20010820	0.10	997	1114	29	N
772			20010820	0.13	1161	1340	19	E
773			20010820	0.03	1093	1226	42	NW
774			20010820	0.11	998	1166	16	E

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
775			20010820	0.15	845	996	21	E
776			20010820	0.08	1006	1158	23	E
777			20010820	0.19	979	1118	14	E
778			20010820	0.04	1092	1120	5	NW
779			20010820	0.10	1021	1214	30	E
780			20010820	0.05	1199	1257	12	NE
781			20010820	0.08	858	1007	24	NE
782			20010820	0.07	892	1005	14	NE
783			20010820	0.23	947	1252	27	N
784			20010820	0.07	906	1179	38	N
785			20010820	0.05	1054	1214	31	N
786			20010820	0.11	1141	1277	13	NE
787			20010820	0.15	1201	1338	14	W
788			20010820	0.33	960	1370	30	NE
789			20010820	0.10	1239	1299	12	NE
790			20010820	0.11	872	996	15	NE
791			20010820	0.05	1185	1246	14	E
792			20010820	0.08	1190	1341	18	SW
793			20010820	1.36	871	1291	11	N
794			20010820	0.91	1053	1397	12	S
795			20010820	0.51	1160	1251	6	NW
796			20010820	0.18	946	1299	20	N
797			20010820	1.99	986	1263	7	SE
798			20010820	0.24	1080	1301	16	NW
799			20010820	0.55	1021	1202	10	SE
800			20010820	0.83	1087	1336	9	SE
801			20010820	0.26	1144	1262	10	S
802			20010820	0.50	985	1293	16	SE
803			20010820	0.05	1186	1233	8	NE
804			20010820	0.32	1079	1277	15	NE
805			20010820	0.19	1037	1120	10	E
806			20010820	0.08	924	1056	24	N
807		GIJ	20010820	0.34	1071	1218	10	N
808		GIJ	20010820	1.57	991	1364	14	N
809		GIJ	20010820	5.35	925	1349	6	E
810		GIJ	20010820	1.07	1132	1350	8	W
811		GIJ	20010820	6.88	951	1473	7	S
812		GIJ	20010820	6.42	819	1489	5	NE
813			20010820	0.20	1073	1162	8	NE
814			20010820	0.66	1012	1306	19	NE
815			20010820	0.12	1242	1327	10	W
816		GIJ	20010820	1.16	1115	1490	9	NE
817			20010820	0.11	1238	1382	14	SW
818			20010820	0.07	1373	1442	15	SW
819		GIJ	20010820	0.31	1155	1487	19	E
820			20010820	0.31	1252	1369	8	W
821			20010820	0.20	1199	1286	10	NW
822			20010820	0.78	1117	1377	13	SE
823		GIJ	20010820	0.05	1218	1293	17	SE
824			20010820	0.05	979	1079	16	E

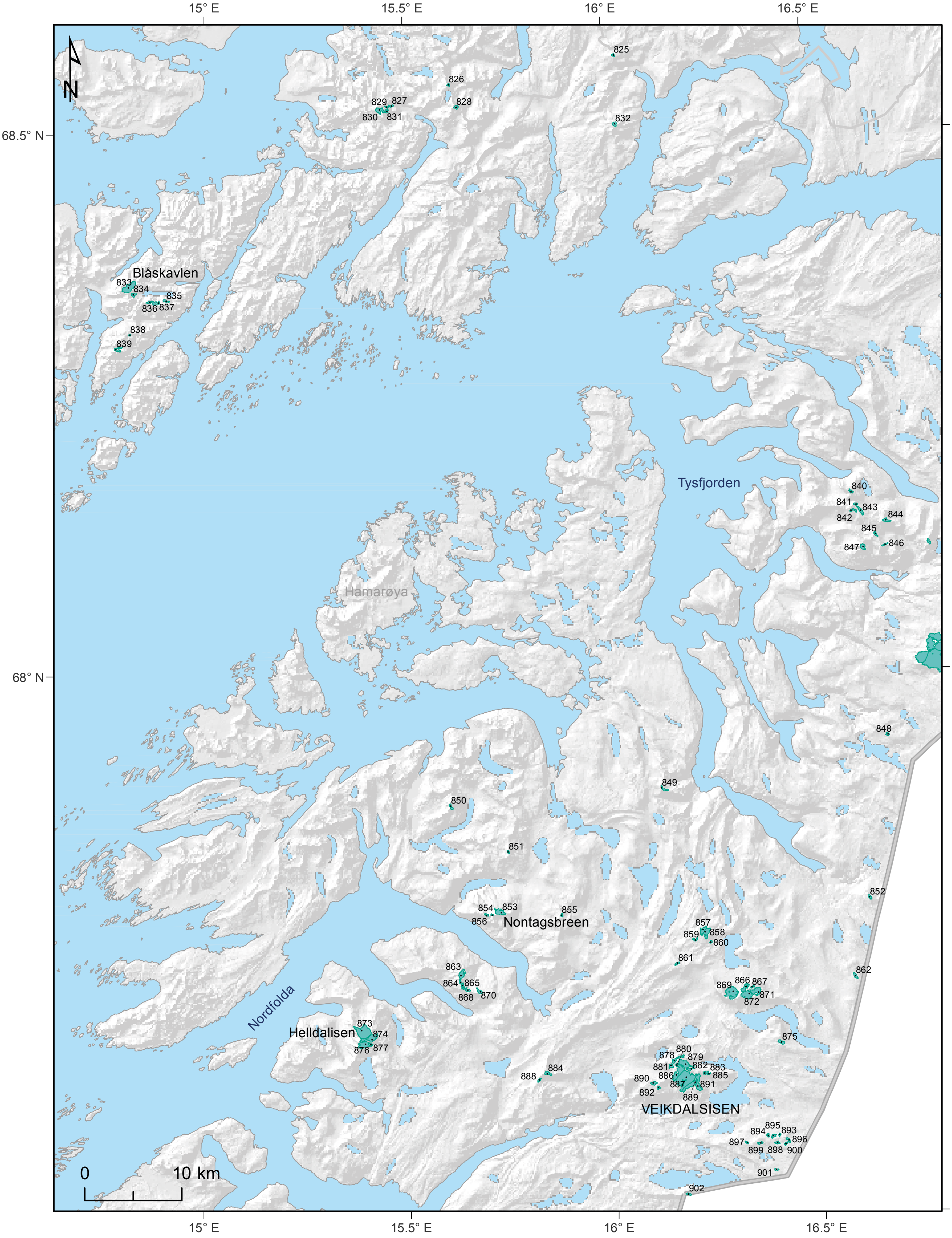
Engabreen (1094), a northern outlet of Vestre Svartisen,
August 2010. Photo: Hallgeir Elvehøy, NVE.

Fonndalsbreen (1097), August 2011.
Photo: Hallgeir Elvehøy, NVE.

Northern Norway South



11. **Hamarøy - Vestfjorden** Glacier ID 825 - 902



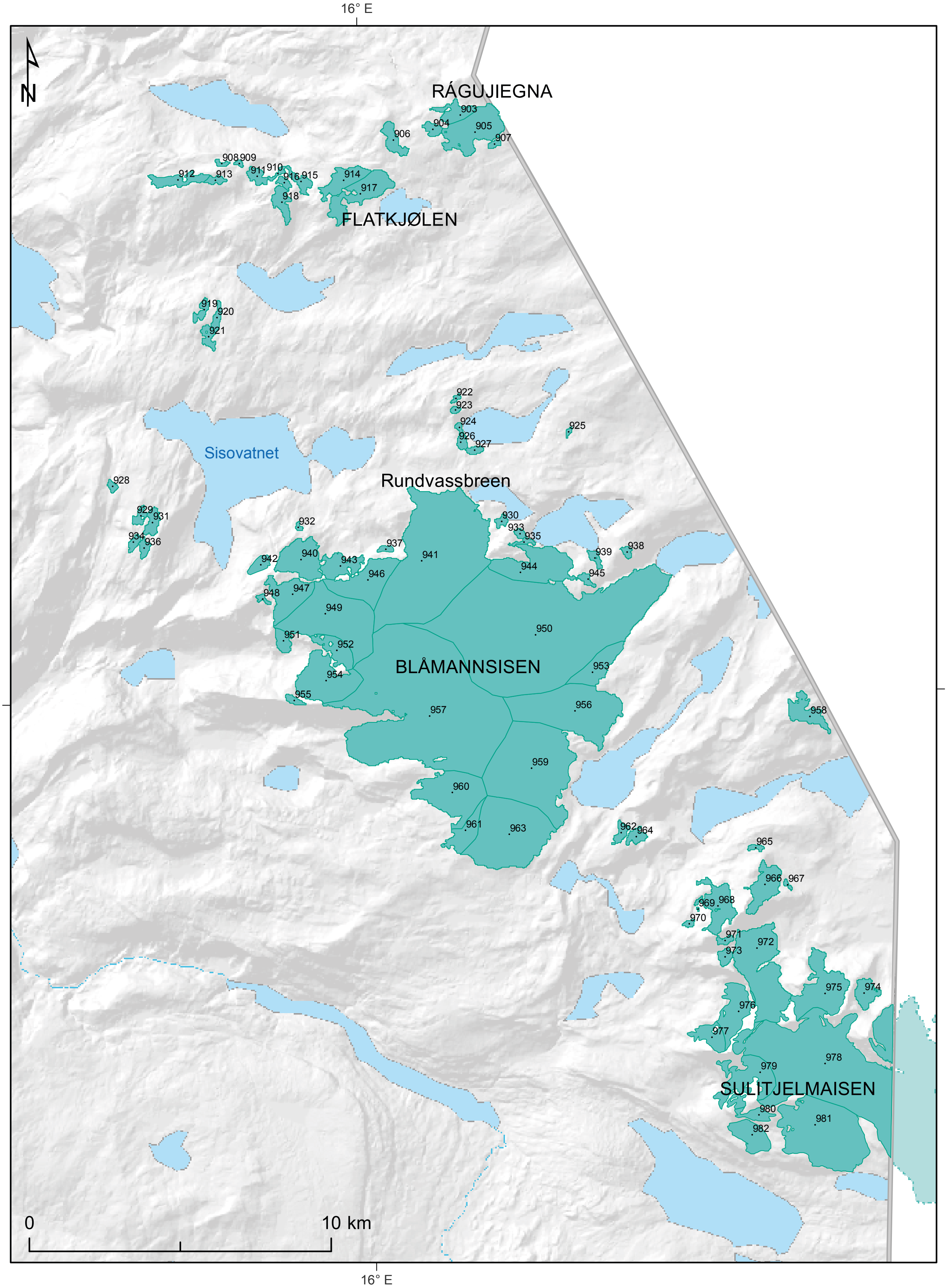
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
825			20010820	0.06	854	948	18	NE
826			20010820	0.06	867	963	20	W
827			20010820	0.05	391	607	27	E
828			20010820	0.12	687	867	19	E
829			20010820	0.05	636	991	37	E
830			20010820	0.35	728	1057	22	SW
831			20010820	0.08	844	1095	30	SE
832			20010820	0.14	830	1035	26	N
833	Blåskavlen		20010820	0.87	593	915	15	N
834			20010820	0.13	306	577	28	E
835			20010820	0.11	454	735	26	E
836			20010820	0.24	539	911	22	NE
837			20010820	0.04	625	769	28	N
838			20010820	0.03	610	697	22	E
839			20010820	0.19	412	803	30	NE
840			20010820	0.10	862	1016	24	NE
841			20010820	0.07	848	1011	22	NE
842			20010820	0.11	894	1018	19	S
843			20010820	0.21	878	1062	22	NE
844			20010820	0.17	936	1182	27	NE
845			20010820	0.11	812	993	26	E
846			20010820	0.07	831	1180	47	N
847			20010820	0.23	884	1086	22	E
848			20010820	0.08	1040	1145	18	N
849	Goasstejiegna		20010820	0.11	821	992	30	NE
850			20010820	0.12	874	1112	29	E
851			20010820	0.05	914	1048	26	E
852			20010820	0.11	1219	1333	24	NE
853	Nontagsbreen		20010820	0.44	883	1194	24	NE
854			20010820	0.03	1077	1202	28	NW
855			20010820	0.05	875	971	19	NE
856			20010820	0.06	969	1147	30	N
857			20010820	0.29	1044	1215	10	NE
858			20010820	0.43	1040	1211	10	NE
859			20010820	0.08	1123	1167	4	SW
860			20010820	0.06	944	988	11	E
861			20010820	0.08	962	1118	18	N
862			20010820	0.15	1108	1252	25	NE
863			20010820	0.36	779	1103	23	NE
864			20010820	0.06	980	1090	28	E
865	Reinvikisen		20010820	0.13	885	1099	25	NE
866			20010820	0.31	1058	1433	25	N
867			20010820	0.07	1119	1219	13	E
868	Reinvikisen		20010820	0.11	848	1063	34	N
869			20010820	1.13	889	1255	15	N
870			20010820	0.17	784	1054	26	N
871			20010820	0.53	1032	1391	21	NE
872			20010820	0.67	1146	1414	14	S
873	Helldalisen		20010820	1.48	874	1348	17	N

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
874			20010820	0.52	722	1153	21	E
875			20010820	0.17	898	1088	23	NE
876			20010820	0.76	842	1324	21	SE
877			20010820	0.09	750	902	19	E
878			20010820	0.26	867	1401	26	N
879			20010820	0.65	729	1374	23	E
880			20010820	0.05	1306	1393	15	S
881			20010820	0.13	1043	1221	22	S
882			20010820	0.14	863	1238	31	NE
883			20010820	0.11	963	1192	24	NE
884			20010820	0.16	885	1128	27	NE
885			20010820	0.05	1059	1162	27	N
886		VEI	20010820	0.80	1047	1359	9	SW
887		VEI	20010820	2.17	875	1274	10	S
888			20010820	0.08	849	1027	28	E
889		VEI	20010820	0.59	881	1050	8	S
890			20010820	0.15	900	1130	27	NE
891		VEI	20010820	0.60	867	1189	23	E
892			20010820	0.06	1051	1149	17	E
893			20010820	0.05	991	1140	22	N
894			20010820	0.06	1097	1185	16	NE
895			20010820	0.12	1060	1196	19	N
896			20010820	0.10	1011	1104	16	NE
897			20010820	0.04	1121	1249	35	N
898			20010820	0.09	1137	1178	9	NE
899			20010820	0.09	1093	1128	7	SE
900			20010820	0.06	1096	1142	10	N
901			20010820	0.06	1008	1079	13	NE
902			20010820	0.07	1219	1302	18	NE

Crevasses. Photo: Solveig H. Winsvold, NVE.

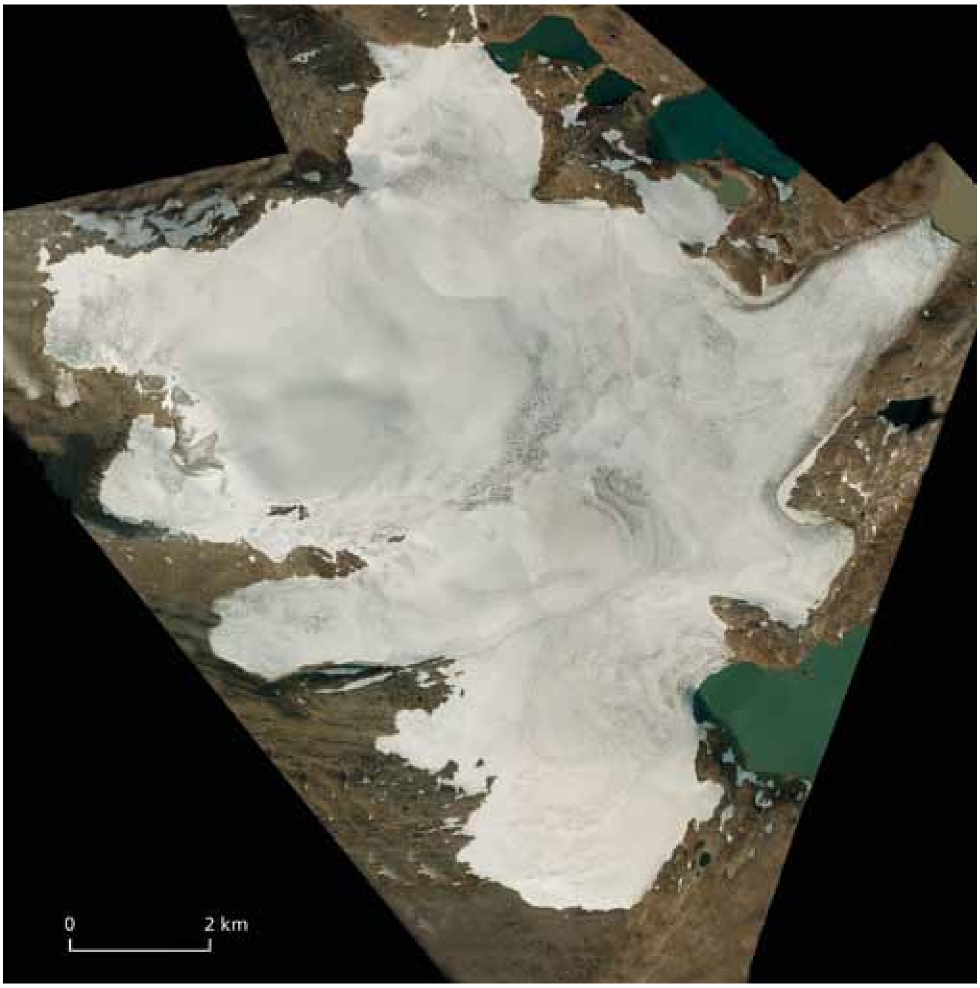
12. **Blåmannsisen**

Glacier ID 903 - 982



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
903		RAG	19990907	0.56	1040	1157	7	N
904		RAG	19990907	0.20	1134	1147	1	N
905		RAG	19990907	1.97	962	1162	7	SE
906			19990907	0.46	1056	1182	11	E
907			19990907	0.08	939	1000	9	E
908			19990907	0.07	1011	1093	19	N
909			19990907	0.05	1015	1062	14	N
910		SKI	19990907	0.09	930	1105	25	N
911			19990907	0.26	937	1103	17	NE
912			19990907	0.56	924	1141	18	N
913			19990907	0.14	1069	1115	4	NE
914		FLA	19990907	0.85	971	1209	8	NE
915		SKI	19990907	0.29	930	1116	15	N
916			19990907	0.12	1061	1129	10	N
917		FLA	19990907	1.50	902	1180	11	SE
918			19990907	0.45	956	1148	10	E
919			19990907	0.20	927	1108	14	NE
920		SIJ	19990907	0.20	886	1017	8	NE
921		SIJ	19990907	0.26	979	1059	6	S
922			19990907	0.05	1053	1109	11	E
923			19990907	0.06	1039	1096	10	E
924			19990907	0.06	944	1037	21	E
925			19990907	0.04	990	1025	8	E
926			19990907	0.15	944	1059	15	NE
927			19990907	0.12	953	1055	17	N
928			19990907	0.09	895	995	16	N
929			19990907	0.17	1059	1118	9	NE
930			19990907	0.12	1051	1175	17	NE
931			19990907	0.32	1026	1122	8	NE
932			19990907	0.05	961	1127	30	N
933		BLÅ	19990907	0.09	1081	1247	25	E
934			19990907	0.14	1059	1099	5	W
935		BLÅ	19990907	0.11	1009	1421	35	NE
936			19990907	0.17	1077	1128	7	W
937			19990907	0.09	1032	1250	35	N
938			19990907	0.10	1070	1233	21	SE
939			19990907	0.15	1009	1103	15	NE
940		BLÅ	19990907	1.50	1042	1385	14	NE
941	Rundvassbreen	BLÅ	19990907	11.11	838	1419	5	N
942			19990907	0.28	984	1144	20	NW
943		BLÅ	19990907	0.79	941	1326	26	N
944		BLÅ	19990907	2.30	1020	1364	9	NE
945			19990907	0.14	1037	1163	11	NE
946		BLÅ	19990907	1.95	1249	1399	5	NW
947		BLÅ	19990907	1.35	1079	1388	9	SW
948			19990907	0.08	1120	1227	17	S
949		BLÅ	19990907	4.32	973	1524	6	NW
950		BLÅ	19990907	20.35	826	1384	4	E
951		BLÅ	19990907	0.32	711	1037	22	S

Rundvassbreen (941), part of Blåmannsisen, September 2010. Photo: Hans Martin Hjemaas.



Orthophoto of Blåmannsisen in 2011. Blåmannsisen is the 5th largest ice cap in Norway and has an area of 87 km^2. Source: NVE.

12. **Blåmannsisen** | Northern Norway South

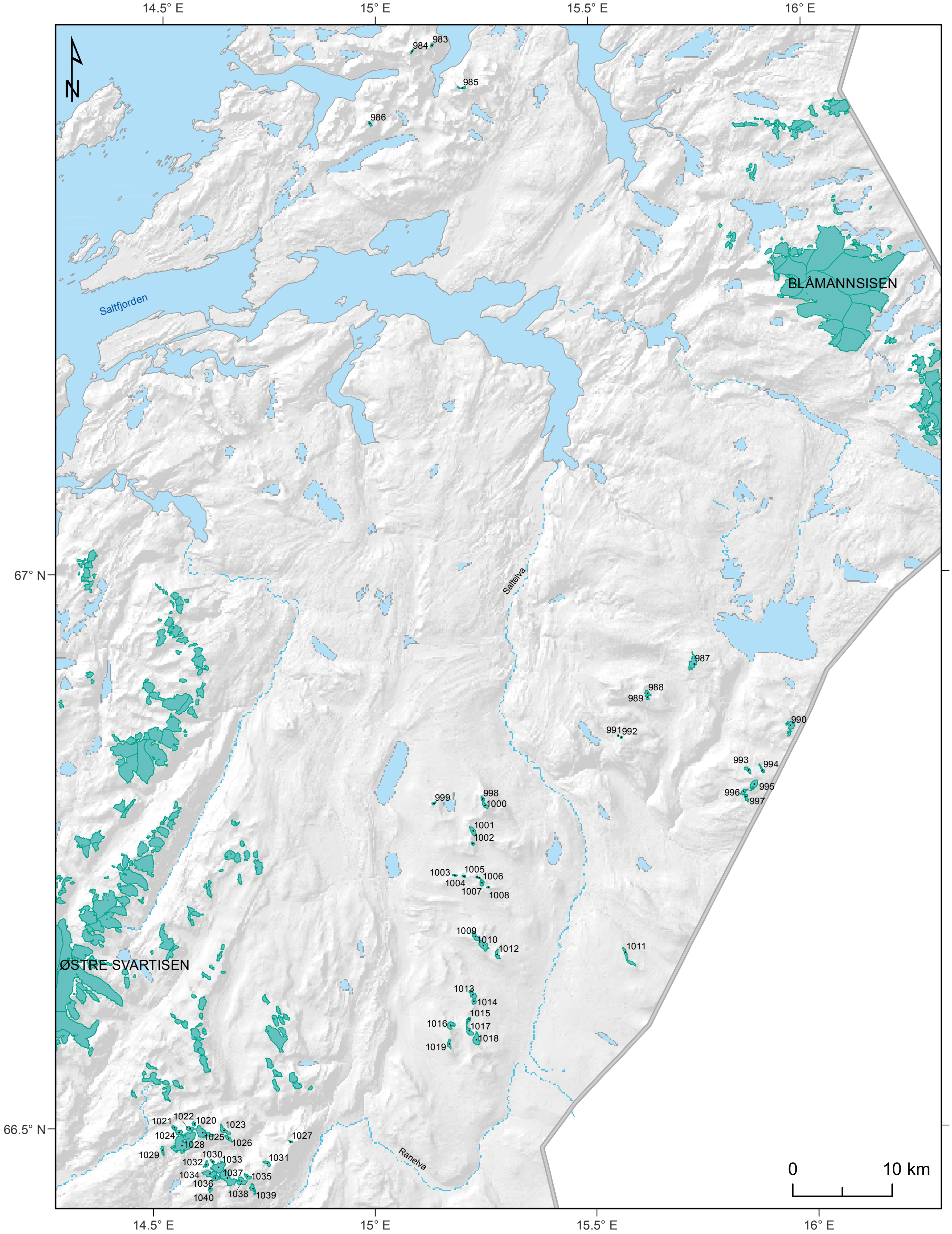
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
952		BLÅ	19990907	0.78	1241	1538	14	W
953		BLÅ	19990907	1.10	1039	1128	3	E
954		BLÅ	19990907	2.30	1044	1529	14	W
955			19990907	0.13	1151	1282	27	NE
956		BLÅ	19990907	4.77	987	1163	4	E
957		BLÅ	19990907	18.79	809	1530	7	S
958			19990907	0.79	1033	1380	12	E
959		BLÅ	19990907	6.81	966	1283	6	E
960		BLÅ	19990907	2.69	945	1283	7	W
961		BLÅ	19990907	0.87	1060	1282	6	SW
962			19990907	0.22	1012	1229	19	N
963		BLÅ	19990907	4.94	1015	1283	6	S
964			19990907	0.24	972	1221	21	N
965			19990907	0.09	1022	1122	18	NE
966			19990907	1.05	1002	1638	24	NE
967			19990907	0.05	1040	1173	34	NE
968			19990907	1.22	1050	1662	19	NW
969			19990907	0.01	1317	1351	15	NW
970			19990907	0.07	1236	1375	24	NW
971			19990907	0.12	1361	1595	25	SE
972		SUI	19990907	3.69	1047	1611	12	NE

Rundvassbreen (941) calves into Øvre Messingmalmvatn. Several jøkulhlaups, or Glacier Lake Outburst Floods (GLOFs), have occurred from this glacier. The first known event occurred in September 2001. Five more events have been registered since then: August 2005, August 2007, September 2009, September 2010 and September 2011. During the Jøkulhlaups the water drains from the lake and under the glacier to the hydropower reservoir Sisovatnet. The jøkulhlaups are a direct consequence of climate change that has caused the glacier to thin so that it is no longer such an effective dam. Photo: Hans Martin Hjemaas, May 2012.

Glacier ID	Name	Code	Date	Area km^2	Elevation Min.	Elevation Max.	Slope	Aspect
973		SUI	19990907	0.21	1319	1431	11	NE
974			19990907	0.55	1216	1481	18	NE
975		SUI	19990907	2.22	1069	1740	15	N
976			19990907	1.39	1046	1674	16	N
977			19990907	0.64	1192	1693	23	NW
978		SUI	19990907	12.27	1085	1751	8	SE
979		SUI	19990907	1.90	1075	1683	17	W
980			19990907	0.35	1311	1531	22	S
981		SUI	19990907	5.23	909	1546	10	SE
982			19990907	0.95	1119	1338	11	SE

13. Saltfjellet

Glacier ID 983 - 1040



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
983			19990907	0.06	829	983	35	E
984			19990907	0.05	794	864	23	SE
985			19990907	0.09	843	1090	39	N
986			19990907	0.09	867	988	23	E
987			19990907	0.69	1226	1371	8	SE
988			19990907	0.17	1091	1281	20	NE
989			19990907	0.15	1171	1296	20	E
990			19990907	0.57	1149	1381	19	SE
991			19990907	0.03	1187	1228	13	NE
992			19990907	0.04	1179	1259	24	N
993			19990907	0.22	1279	1492	24	NE
994			19990907	0.14	1160	1318	25	NE
995			19990907	0.47	1259	1422	13	SE
996			19990907	0.22	1242	1372	14	E
997			19990907	0.16	1157	1278	16	E
998			19990907	0.12	1478	1596	21	NE
999			19990907	0.08	1184	1313	28	N
1000			19990907	0.21	1420	1636	26	NE
1001			19990907	0.33	1207	1397	14	E
1002			19990907	0.08	1164	1314	27	E
1003			19990907	0.07	1098	1182	17	N
1004			19990907	0.06	1253	1381	23	N
1005			19990907	0.03	1352	1409	16	NE
1006			19990907	0.04	1318	1400	21	NE
1007			19990907	0.19	1256	1422	20	E
1008			19990907	0.04	1260	1396	36	N
1009			19990907	0.36	1296	1513	16	N
1010			19990907	0.56	1207	1436	20	NE
1011			19990907	0.44	1169	1340	24	NE
1012			19990907	0.21	1197	1339	24	E
1013			19990907	0.37	1176	1307	14	NE
1014			19990907	0.20	1129	1311	22	E
1015			19990907	0.11	1127	1252	17	E
1016			19990907	0.38	1185	1448	20	NE
1017			19990907	0.39	1176	1462	29	NE
1018			19990907	0.54	1115	1427	25	E
1019			19990907	0.20	1214	1351	23	E
1020			19990907	0.11	872	1104	31	NE
1021			19990907	0.15	877	1066	21	N
1022			19990907	0.25	1044	1296	25	N
1023			19990907	0.40	917	1120	21	NE
1024			19990907	0.25	1045	1279	26	N
1025			19990907	0.97	896	1260	23	NE
1026			19990907	0.20	957	1078	9	E
1027			19990907	0.06	1124	1236	29	N
1028			19990907	2.83	975	1286	10	SE
1029			19990907	0.19	1048	1232	17	E
1030			19990907	0.10	888	1142	29	N
1031			19990907	0.21	1107	1280	18	N

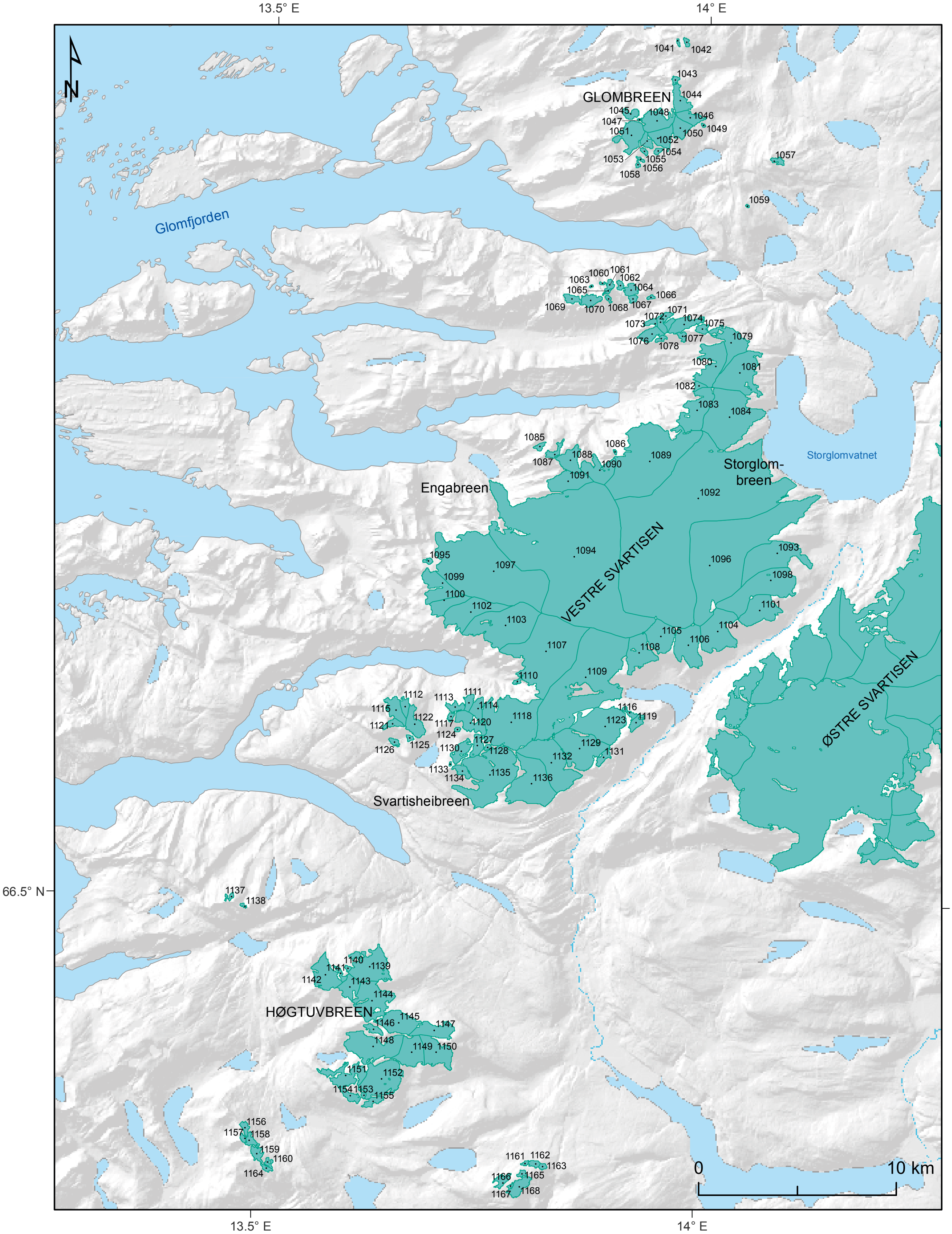
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1032			19990907	0.18	975	1251	23	N
1033			19990907	1.00	908	1375	18	NE
1034			19990907	0.64	1201	1328	9	SW
1035			19990907	0.21	1188	1395	25	NE
1036			19990907	0.25	1189	1303	11	S
1037			19990907	1.33	876	1319	23	NE
1038			19990907	0.52	1015	1382	24	N
1039			19990907	0.30	877	1201	22	E
1040			19990907	0.16	1072	1305	27	NE

Above: Tåkeheimen, cabin at Litlbreen (1091), Vestre Svartisen, March 2010. Photo: Ragnar Ekker, NVE.

Right: Engabreen (1094), Vestre Svartisen, March 2010. Photo: Ragnar Ekker, NVE.

14. **Svartisen - West**

Glacier ID 1041 - 1168




Northern part of Vestre Svartisen.
Photo: Hallgeir Elvehøy,
September 2005.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1041			19990907	0.05	849	866	5	NW
1042			19990907	0.10	945	1045	19	E
1043		GLO	19990907	0.10	835	979	18	NE
1044		GLO	19990907	0.78	781	1046	18	NE
1045			19990907	0.30	705	987	25	N
1046		GLO	19990907	0.63	688	1020	11	E
1047			19990907	0.02	1008	1133	49	N
1048		GLO	19990907	1.33	802	1112	12	NE
1049			19990907	0.03	727	811	23	E
1050		GLO	19990907	0.73	806	1015	11	SE
1051		GLO	19990907	1.39	800	1157	12	S
1052		GLO	19990907	0.90	839	1063	8	SE
1053		GLO	19990907	0.32	879	1073	12	S
1054			19990907	0.10	796	861	11	SE
1055			19990907	0.09	833	958	15	SE
1056			19990907	0.05	799	883	14	NE
1057			19990907	0.17	979	1158	16	E
1058			19990907	0.06	867	917	11	E
1059			19990907	0.02	891	961	24	NE
1060			19990907	0.03	961	1092	38	N
1061			19990907	0.18	888	1206	25	N
1062			19990907	0.13	865	1113	30	NE
1063			19990907	0.02	751	786	15	NW
1064			19990907	0.34	873	1138	21	NE
1065			19990907	0.05	1095	1219	20	E
1066			19990907	0.06	798	976	26	NE
1067			19990907	0.13	960	1107	17	SE
1068			19990907	0.08	823	1074	31	E
1069			19990907	0.30	799	1181	26	N
1070			19990907	0.47	935	1263	24	N
1071			19990907	0.34	863	1129	13	N
1072			19990907	0.28	917	1149	13	NW
1073			19990907	0.17	902	1018	16	N

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1074			19990907	0.81	776	1158	15	NE
1075			19990907	0.24	941	1180	25	N
1076			19990907	0.57	849	1168	13	W
1077			19990907	0.17	876	1152	23	SE
1078			19990907	0.12	991	1150	25	S
1079		SVV	19990907	1.72	761	1207	12	NE
1080		SVV	19990907	2.17	823	1243	10	NW
1081		SVV	19990907	3.34	773	1245	11	NE
1082			19990907	0.18	1111	1229	11	W
1083	Botntindbreen	SVV	19990907	2.29	890	1273	11	NW
1084	Tretten-null-to-breen	SVV	19990907	5.89	585	1245	11	E
1085			19990907	0.14	711	1139	39	N
1086			19990907	0.03	747	970	38	N
1087	Botløyrabreen		19990907	0.29	637	1430	31	NE
1088		SVV	19990907	1.04	703	1293	18	NE
1089	Frukosttindbreen	SVV	19990907	10.50	742	1264	5	N
1090	Dimdalsbreen	SVV	19990907	1.51	629	1203	15	N
1091	Litlbreen	SVV	19990907	1.66	895	1202	7	W
1092	Storglombreen nord	SVV	19990907	41.20	585	1583	5	NE
1093	Kjølbreen	SVV	19990907	3.80	742	1243	7	E
1094	Engabreen	SVV	19990907	36.02	14	1581	6	NW
1095			19990907	0.10	789	912	21	N
1096	Storglombreen sør	SVV	19990907	15.90	585	1437	4	NE
1097	Fonndalsbreen	SVV	19990907	13.87	302	1421	7	NW
1098		SVV	19990907	4.41	937	1381	7	NE
1099	Memorgebreen	SVV	19990907	1.84	821	1179	9	NW
1100		SVV	19990907	1.03	944	1219	8	W
1101		SVV	19990907	2.09	768	1346	14	E
1102		SVV	19990907	2.62	635	1341	9	W
1103	Nordfjordbreen	SVV	19990907	5.40	714	1423	12	SW
1104		SVV	19990907	2.92	583	1388	18	SE
1105		SVV	19990907	1.80	797	1581	22	S
1106		SVV	19990907	2.31	706	1447	17	S
1107		SVV	19990907	9.23	518	1467	10	SW
1108		SVV	19990907	1.87	612	1470	24	SE
1109	Flatisen	SVV	19990907	12.53	343	1466	15	SE
1110		SVV	19990907	0.10	238	569	27	SW
1111		SVV	19990907	0.31	806	1173	21	NE
1112			19990907	0.32	884	1175	15	N
1113		SVV	19990907	0.33	781	1205	29	NW
1114		SVV	19990907	0.54	786	1333	20	N
1115			19990907	0.82	864	1302	17	N
1116			19990907	0.17	733	1143	31	N
1117		SVV	19990907	0.11	1094	1296	28	N
1118		SVV	19990907	6.08	640	1484	16	N
1119			19990907	0.35	912	1186	21	E
1120		SVV	19990907	0.99	1018	1380	14	SW
1121			19990907	0.29	1087	1304	13	NW
1122			19990907	0.90	888	1305	23	NE

Svartisheibreen (1135) in August 2001. Photo: Miriam Jackson, NVE.

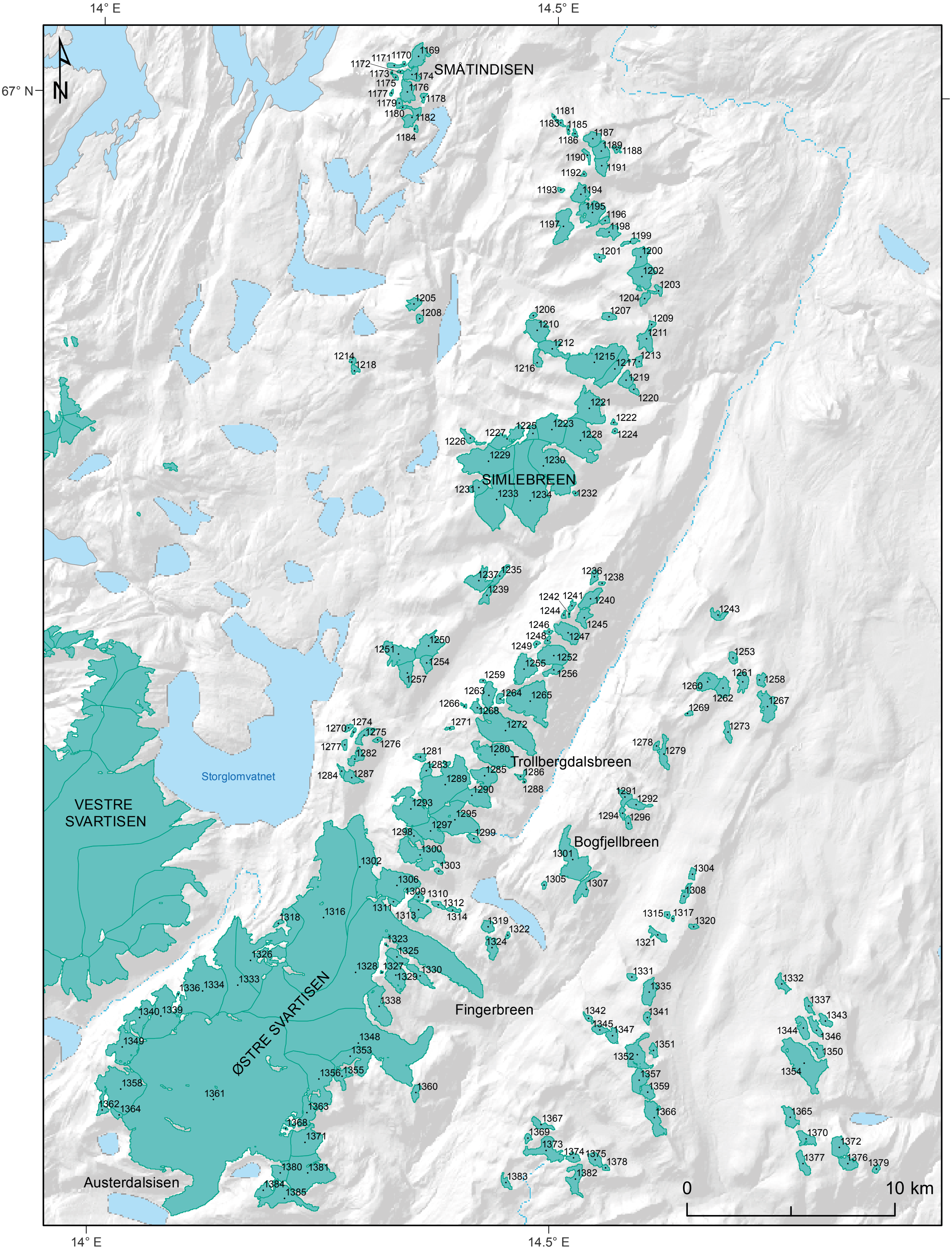
Tretten-null-to-breen (1084) in September 2005. Photo: Miriam Jackson, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1123		SVV	19990907	3.41	612	1191	12	N
1124			19990907	0.06	887	994	18	SW
1125			19990907	0.09	1060	1255	26	W
1126			19990907	0.15	762	790	3	N
1127		SVV	19990907	0.50	1090	1469	28	NW
1128		SVV	19990907	0.08	1393	1523	25	SE
1129		SVV	19990907	3.31	718	1415	13	S
1130			19990907	0.67	824	1335	25	NW
1131		SVV	19990907	0.30	867	989	10	SE
1132		SVV	19990907	3.81	557	1446	14	SE
1133			19990907	0.02	986	1154	46	NW
1134		SVV	19990907	0.36	1058	1355	25	S
1135	Svartisheibreen	SVV	19990907	5.62	686	1427	13	S
1136		SVV	19990907	4.03	760	1443	9	SE
1137			19990907	0.09	908	1125	23	N
1138			19990907	0.05	868	1002	25	N
1139		HØG	19990907	2.57	757	1211	12	NE
1140		HØG	19990907	0.07	1120	1222	15	N
1141		HØG	19990907	0.17	954	1186	12	NW
1142		HØG	19990907	1.57	796	1240	16	N
1143		HØG	19990907	0.84	932	1213	14	S
1144		HØG	19990907	2.57	687	1225	15	E
1145		HØG	19990907	1.71	874	1282	18	N
1146			19990907	0.28	1044	1243	16	SW
1147		HØG	19990907	1.25	952	1251	15	N
1148		HØG	19990907	2.97	825	1184	9	W
1149		HØG	19990907	1.72	889	1190	8	S
1150		HØG	19990907	1.74	721	1162	13	SE
1151		HØG	19990907	1.48	820	1226	14	N
1152		HØG	19990907	2.92	745	1223	14	E
1153		HØG	19990907	0.06	1068	1120	9	S
1154		HØG	19990907	0.39	1026	1103	6	S
1155		HØG	19990907	0.31	910	1052	14	SE
1156			19990907	0.20	874	1071	28	NE
1157			19990907	0.10	1001	1202	30	E
1158			19990907	0.26	783	1043	24	NE
1159			19990907	0.33	810	1142	26	NE
1160			19990907	0.12	811	980	22	NE
1161			19990907	0.07	958	1041	19	N
1162			19990907	0.16	950	1056	17	N
1163			19990907	0.10	895	1038	19	NE
1164			19990907	0.12	931	1104	25	NE
1165			19990907	0.11	1087	1147	10	N
1166			19990907	0.31	983	1184	19	N
1167			19990907	0.05	1143	1172	6	E
1168			19990907	0.64	925	1163	21	SE

Flatisen (1109), August 2001. Photo: Bjarne Kjøllmoen, NVE.

15. **Svartisen - East**

Glacier ID 1169 - 1385



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1169		SMÅ	19990907	0.68	793	1183	18	E
1170			19990907	0.03	938	1078	31	N
1171			19990907	0.13	845	1058	30	N
1172			19990907	0.04	1157	1288	23	W
1173			19990907	0.02	1087	1164	22	S
1174			19990907	0.40	898	1285	26	E
1175			19990907	0.05	986	1092	29	SW
1176		SMÅ	19990907	0.56	922	1284	24	E
1177			19990907	0.04	849	939	26	NW
1178			19990907	0.08	663	838	20	N
1179			19990907	0.11	1098	1278	24	SE
1180			19990907	0.05	1050	1108	12	SE
1181			19990907	0.04	858	992	34	NE
1182			19990907	0.48	791	1056	14	E
1183			19990907	0.08	921	1076	30	N
1184			19990907	0.05	770	838	17	E
1185			19990907	0.04	955	1079	27	NE
1186			19990907	0.07	945	1155	24	N
1187		HØB	19990907	0.44	975	1331	24	NE
1188			19990907	0.10	806	987	28	NE
1189		HØB	19990907	0.48	1013	1252	14	E
1190			19990907	0.11	1015	1158	19	W
1191		HØB	19990907	0.44	994	1177	16	E
1192			19990907	0.04	1086	1171	20	SE
1193			19990907	0.06	1109	1236	31	N
1194			19990907	0.55	911	1275	23	NE
1195			19990907	1.03	896	1201	15	E
1196			19990907	0.13	871	1097	25	E
1197			19990907	1.02	964	1178	11	SW
1198			19990907	0.47	792	1088	20	NE
1199			19990907	0.15	895	1035	18	N
1200		GRF	19990907	0.57	945	1204	14	NE
1201			19990907	0.15	904	1151	33	N
1202		GRF	19990907	1.04	1064	1334	11	E
1203			19990907	0.17	844	1138	26	E
1204			19990907	0.23	931	1229	31	SE
1205			19990907	0.30	983	1169	14	NE
1206			19990907	0.07	930	1145	30	NE
1207			19990907	0.21	959	1241	26	NE
1208			19990907	0.12	885	1046	24	E
1209		RØF	19990907	0.10	939	1050	17	E
1210			19990907	0.93	875	1319	21	NE
1211		RØF	19990907	0.55	855	1110	17	E
1212			19990907	0.69	856	1340	25	NE
1213			19990907	0.15	886	985	17	E
1214			19990907	0.08	817	989	26	NE
1215		HAF	19990907	2.85	923	1284	10	N
1216			19990907	0.27	1086	1331	18	SE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1217		HAF	19990907	1.02	993	1263	7	E
1218			19990907	0.13	890	999	18	NE
1219		AFF	19990907	0.40	871	1137	19	E
1220		AFF	19990907	0.15	793	980	24	E
1221	Simlefonna	SIB	19990907	1.69	691	1240	20	E
1222			19990907	0.05	892	1010	22	NE
1223		SIB	19990907	1.56	971	1313	11	N
1224			19990907	0.05	999	1045	10	NE
1225		SIB	19990907	0.31	1122	1268	9	NW
1226			19990907	0.27	925	1170	29	NE
1227	Tverrådalsfonna	SIB	19990907	0.88	964	1222	17	NW
1228	Jervåfonna	SIB	19990907	2.44	758	1310	15	E
1229	Reinkalvfonna	SIB	19990907	3.00	911	1227	7	W
1230	Skjellåfonna	SIB	19990907	3.38	799	1306	11	SE
1231		SIB	19990907	0.50	972	1117	10	W
1232			19990907	0.04	776	941	35	NE
1233	Leirbreen	SIB	19990907	3.37	872	1191	7	S
1234	Hengfonna	SIB	19990907	4.85	765	1265	6	S
1235			19990907	0.28	898	1198	14	N
1236			19990907	0.18	1003	1291	24	E
1237	Vegdalsisen		19990907	0.79	960	1223	12	N
1238			19990907	0.05	982	1104	22	NE
1239			19990907	0.30	1063	1212	15	SE
1240			19990907	0.58	1019	1375	19	E
1241			19990907	0.10	1327	1502	17	N
1242			19990907	0.02	1388	1477	13	S
1243			19990907	0.26	928	1172	21	NE
1244			19990907	0.06	1380	1456	11	S
1245			19990907	0.41	1001	1304	23	E
1246			19990907	0.07	1345	1420	13	N
1247	Leiråbre		19990907	0.82	951	1388	18	E
1248			19990907	0.07	1213	1404	31	SE
1249			19990907	0.06	1282	1356	15	N
1250			19990907	1.05	962	1265	12	N
1251			19990907	1.16	914	1295	16	N
1252			19990907	1.17	941	1439	18	E
1253			19990907	0.19	1054	1292	26	NE
1254			19990907	0.36	1079	1263	14	SE
1255			19990907	1.04	1172	1545	14	NW
1256			19990907	0.30	1091	1400	21	E
1257			19990907	0.59	1058	1291	10	SE
1258			19990907	0.22	1214	1326	13	E
1259			19990907	0.05	1035	1126	23	N
1260			19990907	0.70	1236	1301	6	N
1261			19990907	0.39	1217	1325	6	S
1262			19990907	0.48	1130	1291	10	SE
1263			19990907	0.60	1111	1517	19	N
1264			19990907	0.14	1309	1476	21	N
1265	Skjelåtindbreen		19990907	2.70	932	1437	15	SE

Østre Svartisen in August 2001. Photo: Hallgeir Elvehøy, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1266			19990907	0.04	1147	1306	26	NW
1267			19990907	0.84	973	1266	16	E
1268			19990907	0.25	1299	1504	18	NW
1269			19990907	0.07	1147	1172	4	SE
1270			19990907	0.10	1033	1158	23	N
1271			19990907	0.06	1078	1141	12	NW
1272	Hanspolsabreen		19990907	3.09	860	1604	14	E
1273			19990907	0.25	1005	1089	10	E
1274			19990907	0.05	1145	1239	22	NW
1275			19990907	0.31	915	1314	24	NE
1276			19990907	0.07	868	1099	27	NE
1277			19990907	0.11	1161	1258	11	NW
1278			19990907	0.10	1219	1267	9	E
1279			19990907	0.44	1016	1287	25	E
1280	Trollbergdalsbreen		19990907	1.71	936	1277	9	SE
1281			19990907	0.17	886	1139	31	N
1282			19990907	0.33	1079	1281	17	E
1283		BEI	19990907	0.30	1063	1504	25	NE
1284			19990907	0.12	1141	1234	8	N
1285		BEI	19990907	0.83	906	1196	13	E
1286			19990907	0.11	824	1050	22	E
1287			19990907	0.35	919	1235	18	E
1288			19990907	0.03	855	925	22	E

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1289		BEI	19990907	3.66	970	1562	12	NE
1290		BEI	19990907	1.17	886	1356	16	E
1291			19990907	0.28	1012	1236	20	NE
1292			19990907	0.35	900	1222	24	NE
1293		BEI	19990907	2.05	1099	1550	12	NW
1294			19990907	0.12	1188	1238	6	E
1295		BEI	19990907	2.32	885	1553	18	E
1296			19990907	0.15	1000	1189	22	SE
1297		BEI	19990907	1.03	1093	1547	17	S
1298		BEI	19990907	0.39	1189	1510	18	S
1299			19990907	0.17	988	1201	28	NE
1300			19990907	1.84	803	1378	16	E
1301	Bogfjellbreen		19990907	1.94	961	1327	16	NE
1302		SVØ	19990907	4.00	857	1140	4	N
1303			19990907	0.08	953	1154	33	NE
1304			19990907	0.14	1062	1159	11	N
1305			19990907	0.07	1199	1224	6	W
1306		SVØ	19990907	2.15	847	1108	7	NE
1307			19990907	0.59	1033	1252	13	SE
1308			19990907	0.27	1172	1259	5	N
1309			19990907	0.15	937	1189	29	NE
1310			19990907	0.01	1046	1117	28	NE
1311		SVØ	19990907	0.14	1035	1113	8	SW
1312			19990907	0.15	897	1084	31	NE
1313			19990907	0.70	1009	1232	13	SE
1314			19990907	0.12	909	1061	28	N
1315			19990907	0.08	1156	1199	7	NW
1316		SVØ	19990907	17.10	751	1561	6	NE
1317			19990907	0.04	1199	1229	7	NW
1318			19990907	0.09	1224	1268	7	S
1319			19990907	0.27	940	1219	28	NE
1320			19990907	0.09	960	1217	28	E
1321			19990907	0.27	1038	1240	14	N
1322			19990907	0.05	982	1122	24	N
1323			19990907	0.02	1216	1266	29	NE
1324			19990907	0.43	1013	1237	18	E
1325			19990907	0.46	962	1266	28	NE
1326		SVØ	19990907	5.29	857	1558	10	NW
1327			19990907	0.02	1290	1352	25	N
1328	Fingerbreen	SVØ	19990907	20.90	522	1540	4	E
1329			19990907	1.07	1001	1377	16	E
1330			19990907	0.52	948	1205	28	NE
1331			19990907	0.14	1049	1206	22	N
1332			19990907	0.30	1012	1158	19	NE
1333		SVØ	19990907	4.37	818	1451	7	N
1334		SVØ	19990907	4.71	790	1454	11	NW
1335			19990907	0.67	999	1351	21	E
1336			19990907	0.02	1021	1090	29	NW
1337			19990907	0.21	1001	1225	24	NE

Lappbreen (1348) in August 2001. Photo: Miriam Jackson, NVE.

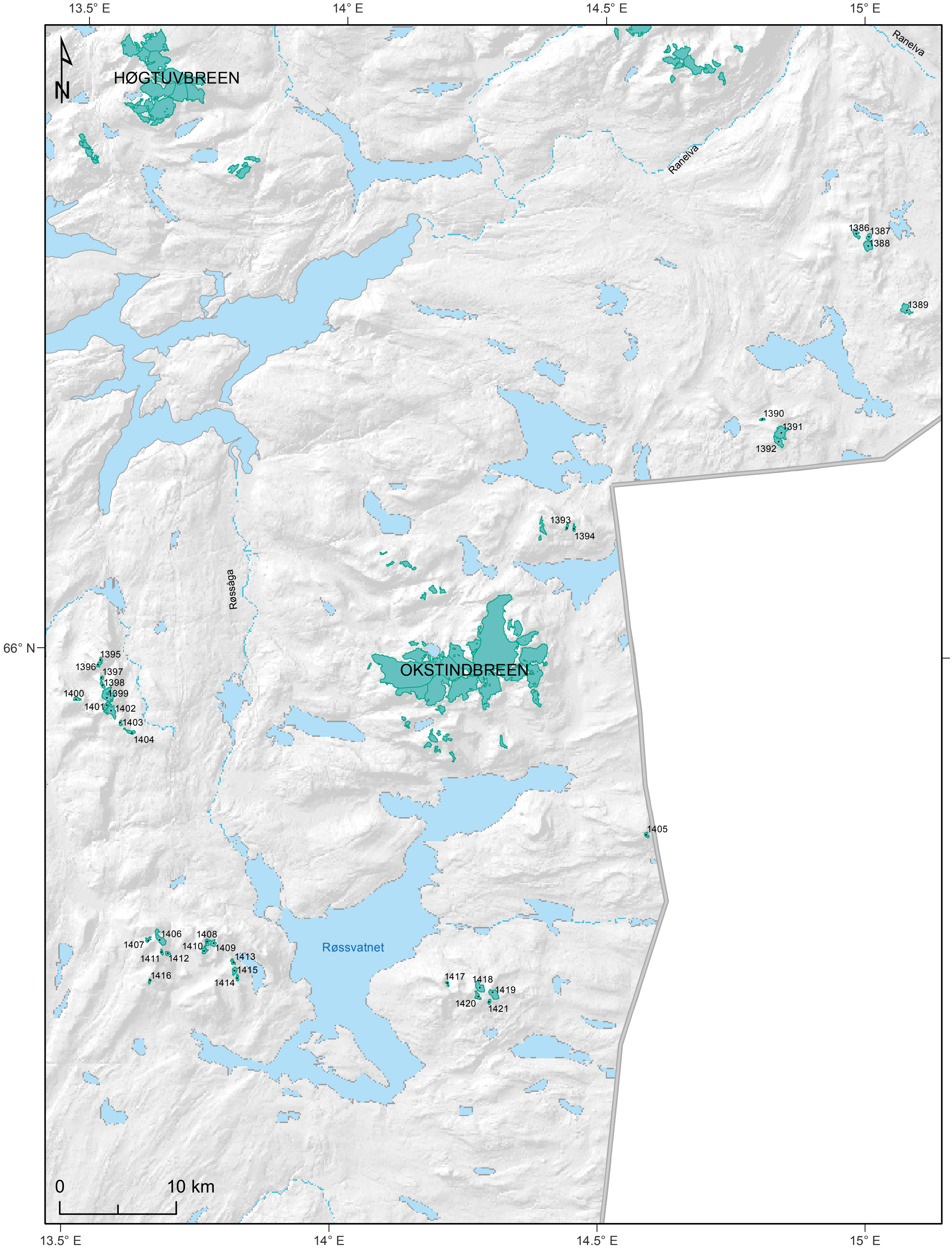
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1338		SVØ	19990907	1.32	820	1283	26	E
1339		SVØ	19990907	2.69	850	1571	15	N
1340		SVØ	19990907	1.33	983	1545	22	N
1341			19990907	0.15	1040	1227	26	E
1342			19990907	0.12	982	1109	23	NE
1343			19990907	0.24	1022	1301	25	N
1344			19990907	0.45	1251	1321	5	NE
1345			19990907	0.24	998	1179	23	N
1346			19990907	0.31	1210	1293	7	N
1347			19990907	0.32	1018	1356	24	N
1348	Lappbreen	SVØ	19990907	12.04	509	1353	7	E
1349		SVØ	19990907	1.65	987	1520	17	W
1350			19990907	0.33	1195	1279	6	SE
1351			19990907	0.19	815	877	9	E
1352			19990907	1.07	1015	1480	27	E
1353		SVØ	19990907	1.46	917	1272	12	SE
1354			19990907	2.55	1060	1311	7	SE
1355		SVØ	19990907	0.49	852	1193	21	E
1356		SVØ	19990907	3.20	823	1352	9	SE
1357			19990907	0.63	1045	1421	26	SE
1358	Kampliisen	SVØ	19990907	3.40	783	1420	12	NW
1359			19990907	0.36	950	1137	16	E
1360			19990907	0.25	999	1216	26	E

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1361	Austerdalsisen	SVØ	19990907	55.41	208	1562	6	S
1362			19990907	0.19	1155	1348	20	NW
1363		SVØ	19990907	0.72	951	1260	19	E
1364		SVØ	19990907	0.17	1313	1391	8	SW
1365			19990907	0.47	945	1291	22	E
1366			19990907	0.92	928	1301	25	NE
1367			19990907	0.30	979	1152	22	NE
1368			19990907	0.02	1156	1231	18	NW
1369			19990907	0.11	1116	1159	7	NE
1370			19990907	0.40	1064	1321	22	N
1371		SVØ	19990907	1.67	731	1302	17	NE
1372			19990907	0.63	1144	1302	9	NE
1373			19990907	1.03	987	1187	14	NE
1374			19990907	0.22	1091	1227	16	N
1375			19990907	0.33	916	1199	25	NE
1376			19990907	0.42	1178	1283	8	SE
1377			19990907	0.40	1190	1284	6	S
1378			19990907	0.08	904	1045	27	NE
1379			19990907	0.10	859	955	15	E
1380		SVØ	19990907	0.61	1137	1298	9	W
1381		SVØ	19990907	2.84	844	1302	13	E
1382			19990907	0.68	936	1210	18	E
1383			19990907	0.19	1014	1146	21	NE
1384			19990907	0.49	1088	1254	11	NW
1385			19990907	1.38	954	1260	11	S


Photo: Miriam Jackson, NVE.

16. **Helgeland - Inner**

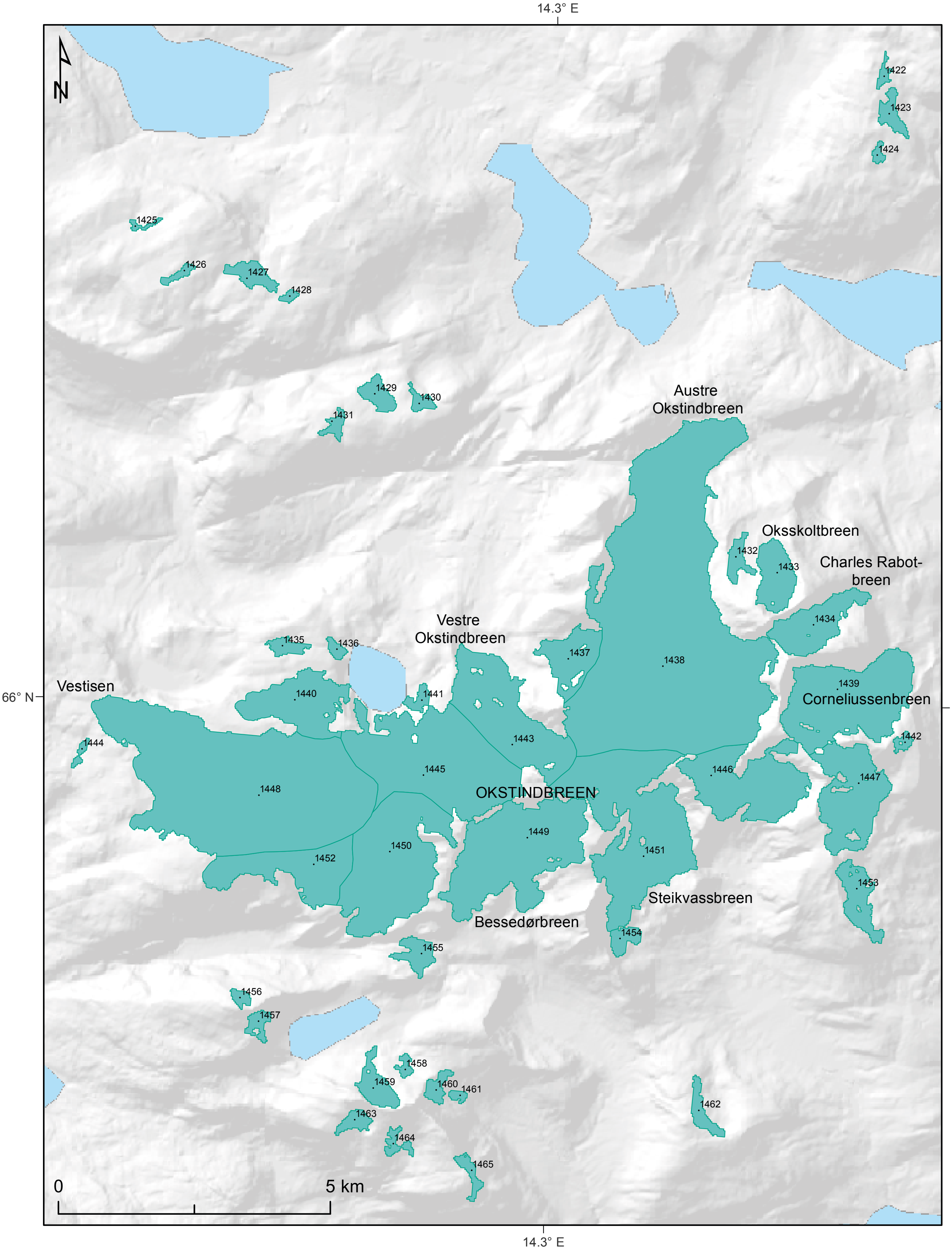
Glacier ID 1386 - 1421



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1386			19990907	0.27	1056	1199	16	NE
1387			19990907	0.17	914	1181	27	NE
1388			19990907	0.51	1027	1303	21	NE
1389			19990907	0.51	1228	1427	12	NE
1390			19990907	0.06	1016	1135	25	N
1391			19990907	0.84	1114	1364	13	E
1392			19990907	0.41	1115	1345	15	E
1393			19990907	0.08	1205	1305	20	SE
1394			19990907	0.10	1087	1155	17	E
1395			19990907	0.06	934	1057	27	E
1396			19990907	0.12	1000	1190	28	E
1397			19990907	0.07	975	1137	26	E
1398			19990907	0.13	1103	1252	26	NE
1399			19990907	0.83	818	1303	25	E
1400			19990907	0.13	971	1095	21	N
1401			19990907	0.19	983	1168	25	SE
1402			19990907	0.57	829	1152	17	E
1403			19990907	0.08	948	1097	27	E
1404			19990907	0.19	814	1059	30	NE
1405			19990907	0.11	1077	1281	25	E
1406	Brovresenspeatnoe		19990907	0.52	994	1341	29	NE
1407			19990907	0.12	1141	1270	21	N
1408			19990907	0.16	1120	1474	30	E
1409			19990907	0.19	1037	1230	21	NE
1410			19990907	0.17	1167	1388	26	SE
1411			19990907	0.08	1120	1298	33	E
1412			19990907	0.11	824	947	16	E
1413			19990907	0.10	963	1157	28	NE
1414			19990907	0.18	1041	1177	19	SE
1415			19990907	0.08	901	1003	23	E
1416			19990907	0.06	946	1076	23	SE
1417			19990907	0.07	1006	1101	17	NE
1418			19990907	0.47	1096	1346	23	NE
1419			19990907	0.48	1048	1347	22	E
1420			19990907	0.20	1200	1338	14	SW
1421			19990907	0.08	1149	1281	19	S

17. **Okstindbreen**

Glacier ID 1422 - 1465



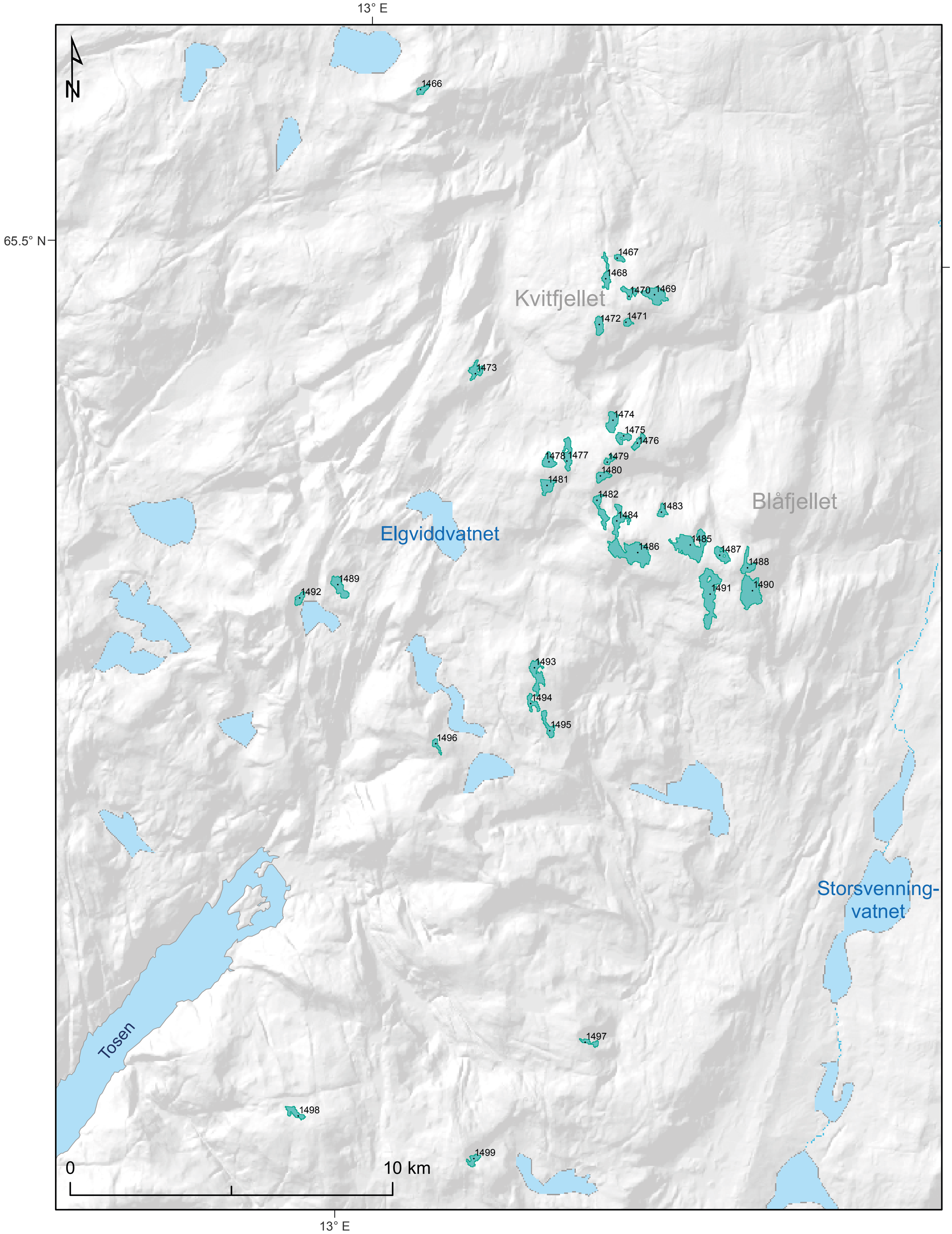
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1422			19990907	0.08	1168	1217	7	E
1423			19990907	0.23	1108	1238	19	E
1424			19990907	0.06	1174	1226	10	SE
1425			19990907	0.05	1032	1102	20	N
1426			19990907	0.09	1205	1250	6	NW
1427			19990907	0.29	980	1176	20	NE
1428			19990907	0.05	1075	1134	13	NE
1429			19990907	0.26	907	1200	23	N
1430			19990907	0.12	937	1170	30	N
1431			19990907	0.13	1147	1260	10	SE
1432			19990907	0.22	1234	1490	16	NE
1433	Oksskoltbreen		19990907	0.72	1272	1784	22	N
1434	Charles Rabot-breen		19990907	1.06	1034	1798	25	NE
1435			19990907	0.17	1125	1180	7	N
1436			19990907	0.09	1033	1147	23	NE
1437		OKB	19990907	0.85	1289	1742	16	NW
1438	Austre Okstindbreen	OKB	19990907	14.14	772	1764	9	N
1439	Corneliussenbreen	OKB	19990907	2.99	925	1771	17	NE
1440		OKB	19990907	1.52	1021	1356	12	N
1441		OKB	19990907	0.13	1026	1241	28	NW
1442			19990907	0.08	1232	1390	24	E
1443	Vestre Okstindbreen	OKB	19990907	2.58	1048	1789	13	NW
1444			19990907	0.06	984	1036	13	W
1445		OKB	19990907	4.32	1021	1678	10	NW
1446	Vestre Svartfjellbreen	OKB	19990907	2.29	1002	1677	18	S
1447	Austre Svartfjellbreen	OKB	19990907	1.82	1100	1742	22	E
1448	Vestisen	OKB	19990907	9.47	1035	1520	6	NW
1449	Bessedørbreen	OKB	19990907	3.59	888	1662	17	S
1450	Oksfjellbreen	OKB	19990907	3.54	977	1557	9	S
1451	Steikvassbreen	OKB	19990907	4.44	777	1754	17	E
1452		OKB	19990907	1.77	1112	1510	13	S
1453			19990907	0.60	1080	1467	24	E
1454		OKB	19990907	0.20	886	1060	17	E
1455			19990907	0.31	929	1110	15	NE
1456			19990907	0.09	1265	1473	35	N
1457			19990907	0.15	1149	1381	25	SE
1458			19990907	0.08	1021	1195	21	N
1459			19990907	0.40	982	1484	24	N
1460			19990907	0.17	1018	1252	29	E
1461			19990907	0.06	849	977	21	E
1462			19990907	0.24	926	1176	25	NE
1463			19990907	0.17	1222	1401	25	S
1464			19990907	0.13	1098	1322	21	S
1465			19990907	0.15	1076	1282	25	E


Austre Okstindbreen (1438), September 2011.
Photo: Kjell-Harald Nesengmo.


Corneliussenbreen (1439), September 2010.
Photo: Kjell-Harald Nesengmo.

18. **Vefsn**

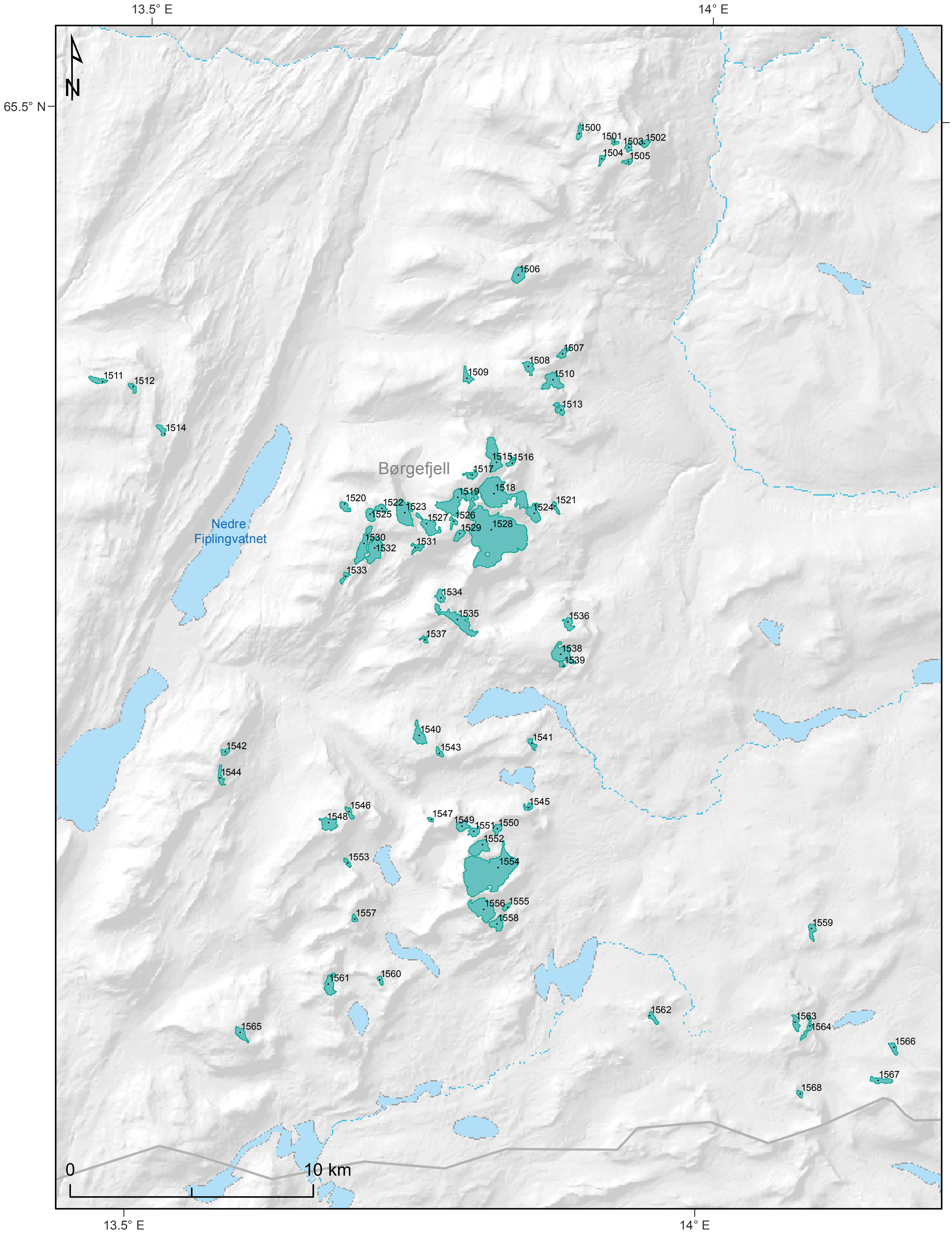
Glacier ID 1466 - 1499



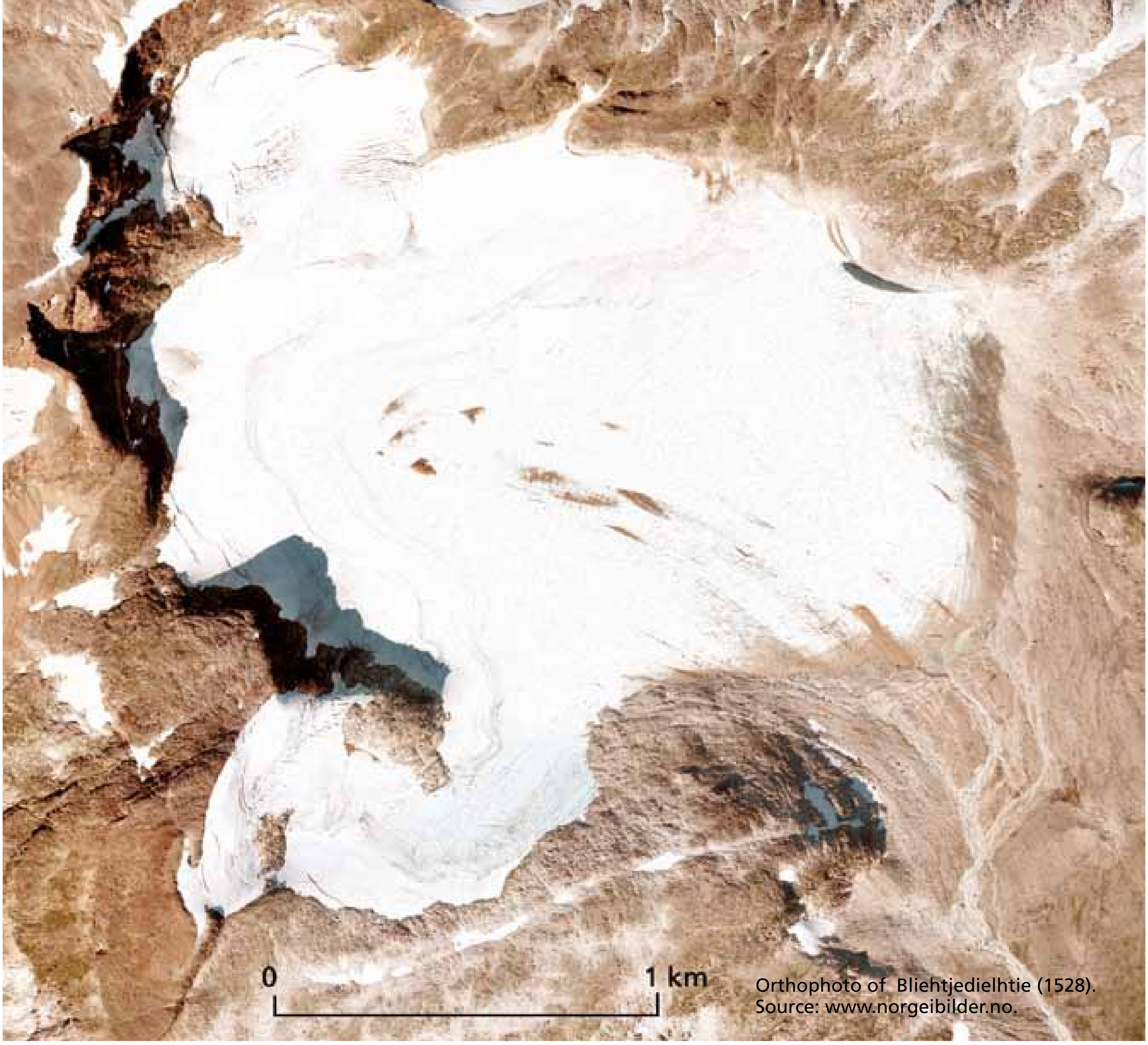
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1466			19990907	0.07	1053	1087	6	SE
1467			19990907	0.05	776	857	23	NE
1468			19990907	0.15	856	1118	15	N
1469			19990907	0.27	847	1089	24	NE
1470			19990907	0.10	1045	1189	19	N
1471			19990907	0.05	1002	1150	31	SE
1472			19990907	0.12	1021	1133	13	S
1473			19990907	0.13	879	1011	16	NE
1474			19990907	0.17	843	1075	22	N
1475			19990907	0.11	1077	1179	18	N
1476			19990907	0.09	1070	1151	9	NE
1477			19990907	0.19	891	1122	14	N
1478			19990907	0.13	983	1161	23	N
1479			19990907	0.05	1121	1216	22	SE
1480			19990907	0.10	957	1177	29	SE
1481			19990907	0.15	1021	1126	13	SE
1482			19990907	0.19	874	1223	27	NE
1483			19990907	0.07	815	977	25	NE
1484			19990907	0.23	825	1179	25	NE
1485			19990907	0.55	900	1207	16	NE
1486			19990907	0.63	1019	1179	11	SE
1487			19990907	0.14	1020	1181	20	N
1488			19990907	0.15	1008	1179	20	E
1489			19990907	0.19	811	946	19	NE
1490			19990907	0.49	872	1134	21	E
1491			19990907	0.62	958	1151	8	SE
1492			19990907	0.08	764	819	14	SE
1493			19990907	0.25	918	1013	12	E
1494			19990907	0.10	944	997	9	E
1495			19990907	0.13	872	956	12	E
1496			19990907	0.05	837	931	13	E
1497			19990907	0.06	772	957	23	NE
1498			19990907	0.11	890	1013	19	N
1499			19990907	0.09	786	1007	27	NE

19. **Børgefjell**

Glacier ID 1500 - 1568



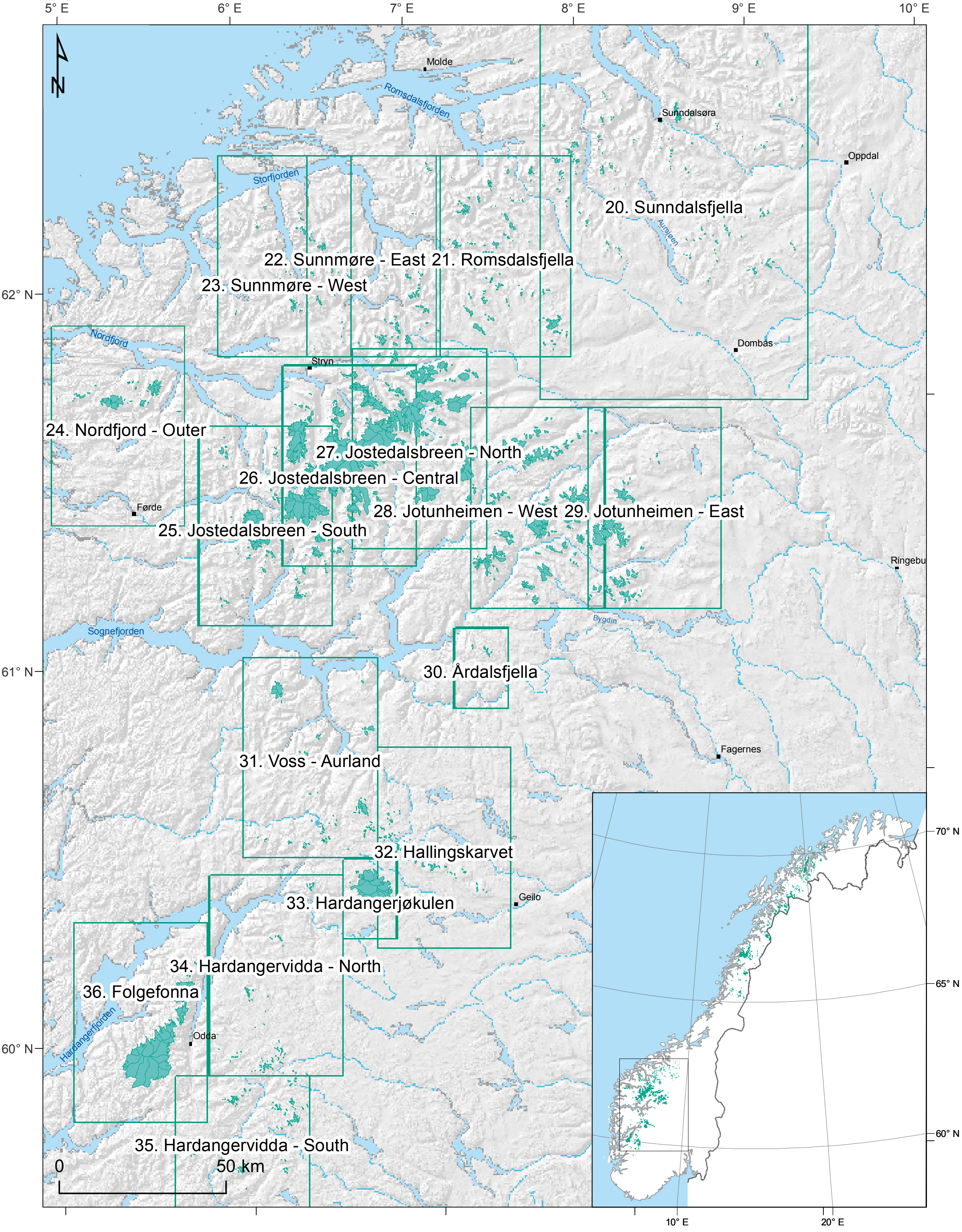
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1500			19990907	0.09	1197	1256	14	NE
1501			19990907	0.05	1276	1292	5	E
1502			19990907	0.10	1009	1237	29	NE
1503			19990907	0.08	1258	1285	6	SE
1504			19990907	0.07	1220	1290	10	N
1505			19990907	0.06	1144	1265	20	SE
1506			19990907	0.28	1075	1302	18	NE
1507			19990907	0.12	1142	1224	12	E
1508			19990907	0.15	1167	1238	9	N
1509			19990907	0.15	1022	1235	19	N
1510			19990907	0.37	909	1216	22	E
1511			19990907	0.13	916	1077	29	N
1512			19990907	0.08	1023	1104	17	E
1513			19990907	0.14	1018	1267	24	E
1514			19990907	0.09	991	1098	24	NE
1515			19990907	0.56	1047	1471	26	NE
1516			19990907	0.08	1160	1259	13	NE
1517			19990907	0.12	1452	1569	20	N
1518			19990907	1.65	988	1660	17	NE
1519			19990907	0.64	1328	1638	16	NW
1520			19990907	0.12	995	1236	29	N
1521			19990907	0.07	988	1051	14	NE
1522			19990907	0.12	1080	1259	25	N
1523			19990907	0.55	985	1492	28	NE
1524			19990907	0.28	1021	1195	16	E
1525			19990907	0.16	1220	1359	15	NE
1526			19990907	0.08	1605	1657	7	NW
1527			19990907	0.36	1089	1562	25	N
1528	Bliehtjedielhtie		19990907	3.85	960	1502	12	E
1529			19990907	0.13	1350	1629	37	SE
1530			19990907	0.43	1200	1342	12	SE
1531			19990907	0.11	1240	1355	11	SW
1532			19990907	0.49	1052	1269	14	E
1533			19990907	0.08	1095	1170	12	S
1534			19990907	0.14	1029	1203	19	NE
1535			19990907	0.59	941	1398	28	NE
1536			19990907	0.15	1095	1258	18	N
1537			19990907	0.05	1145	1161	3	NE
1538			19990907	0.47	1074	1380	22	E
1539			19990907	0.05	1115	1285	28	SE
1540			19990907	0.28	913	1261	28	NE
1541			19990907	0.08	971	1063	19	NE
1542			19990907	0.07	1135	1275	21	E
1543			19990907	0.07	1123	1265	32	NE
1544			19990907	0.12	1054	1248	31	E
1545			19990907	0.08	951	1172	31	NE
1546			19990907	0.09	1166	1360	32	NE
1547			19990907	0.03	1195	1289	29	NE
1548			19990907	0.28	1259	1379	15	N



19. **Børgefjell** | Northern Norway South

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1549			19990907	0.16	1184	1268	10	NE
1550			19990907	0.11	1190	1313	20	SE
1551			19990907	0.13	1197	1350	20	NW
1552			19990907	0.36	1186	1553	27	E
1553			19990907	0.06	936	1007	17	NE
1554			19990907	2.66	1110	1618	15	E
1555			19990907	0.06	975	1081	18	E
1556			19990907	0.69	1159	1539	17	E
1557			19990907	0.05	1127	1221	23	E
1558			19990907	0.22	1030	1292	23	E
1559			19990907	0.13	1085	1228	17	NE
1560			19990907	0.05	1062	1167	28	E
1561			19990907	0.27	1030	1219	20	NE
1562			19990907	0.09	1039	1131	22	NE
1563			19990907	0.14	1245	1333	9	NE
1564			19990907	0.13	1113	1319	23	E
1565			19990907	0.16	1105	1256	22	E
1566			19990907	0.10	990	1109	25	NE
1567			19990907	0.17	1127	1285	30	N
1568			19990907	0.05	1071	1150	20	NE

Southern Norway

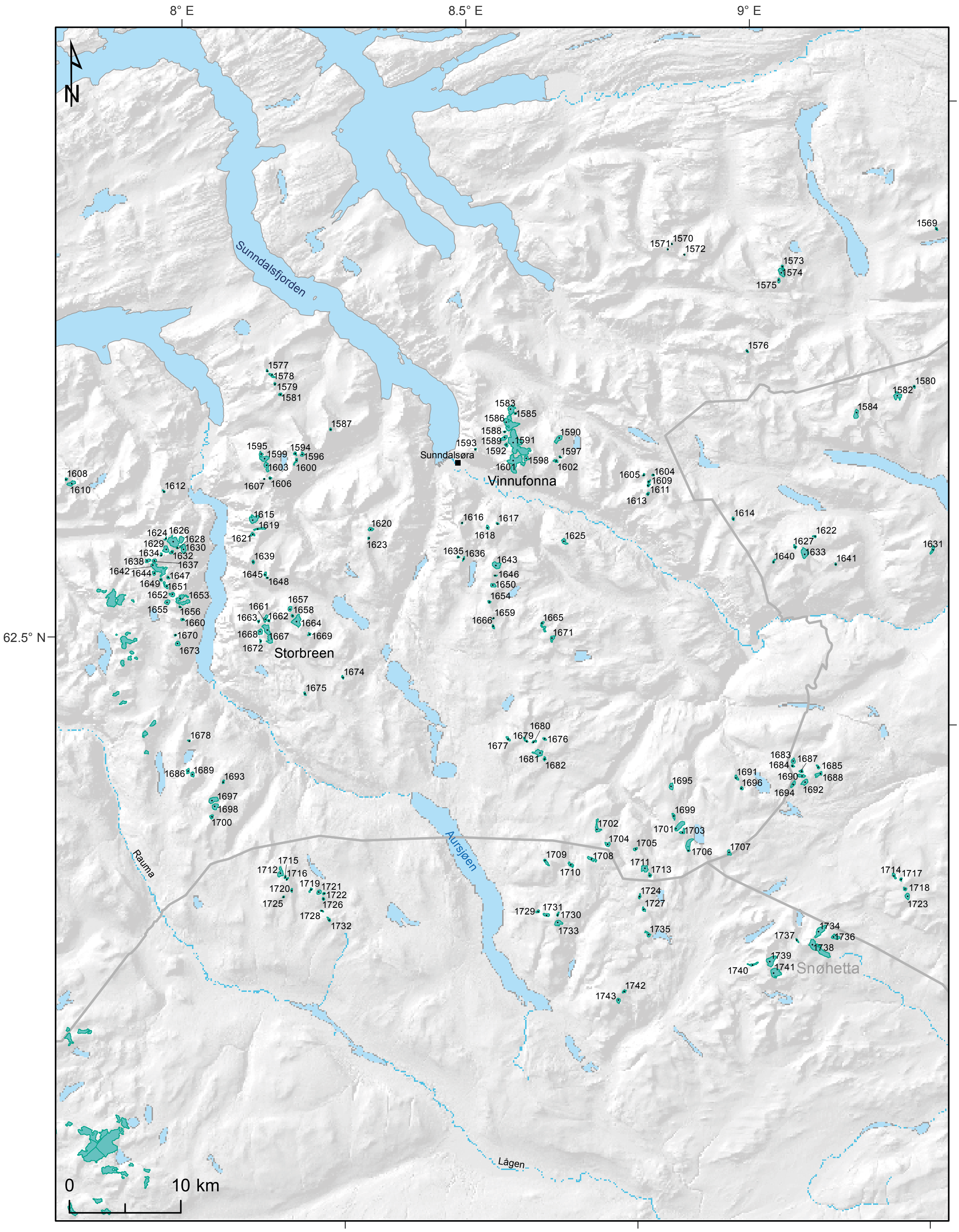


Jostedalsbreen
Syrdalsbreen
Blåskavlen
Storskavlen
Vargebreen
Hardangerjøkulen

Glaciers in southern Norway. Looking north with Hardangerjøkulen in the foreground and Jostedalsbreen in the background. Aerial photo from September 2010. Photo/Copyright: Petter Bjorstad/Arne Flatmo.

20. **Sunndalsfjella**

Glacier ID 1569 - 1743



Orthophoto of Vinnufonna (1601) in 2010. Source: www. norgeibilder.no.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1569	Dukfonna		20030809	0.04	1219	1312	27	E
1570			20030809	0.01	1208	1297	35	NE
1571			20030809	0.01	1157	1213	24	SE
1572			20030809	0.01	1104	1153	27	NE
1573			20030809	0.06	1360	1438	21	E
1574			20030809	0.25	1242	1563	23	E
1575			20030809	0.07	1276	1443	23	SE
1576			20030809	0.04	1351	1493	43	NE
1577			20030809	0.03	1051	1187	34	NE
1578			20030809	0.09	1089	1252	29	NE
1579			20030809	0.03	1230	1315	26	E
1580			20030809	0.04	1308	1387	19	E
1581			20030809	0.06	1197	1273	15	NE
1582			20030809	0.28	1384	1583	17	NE
1583			20030809	0.35	1225	1598	25	NE
1584			20030809	0.25	1402	1548	17	E
1585			20030809	0.03	1235	1374	30	E
1586			20030809	0.87	1073	1672	23	E
1587			20030809	0.04	1210	1359	36	NE
1588			20030809	0.03	1652	1697	10	W
1589			20030809	0.17	1519	1721	28	NW
1590			20030809	0.24	1413	1604	27	SE
1591			20030809	1.97	1154	1824	25	NE
1592			20030809	0.07	1374	1486	25	SW
1593			20030809	0.02	1356	1497	32	NE
1594			20030809	0.05	1250	1411	30	N
1595			20030809	0.09	1267	1476	33	NE
1596			20030809	0.08	1260	1416	26	NE
1597	Trollbotnbre		20030809	0.03	1305	1446	46	NE

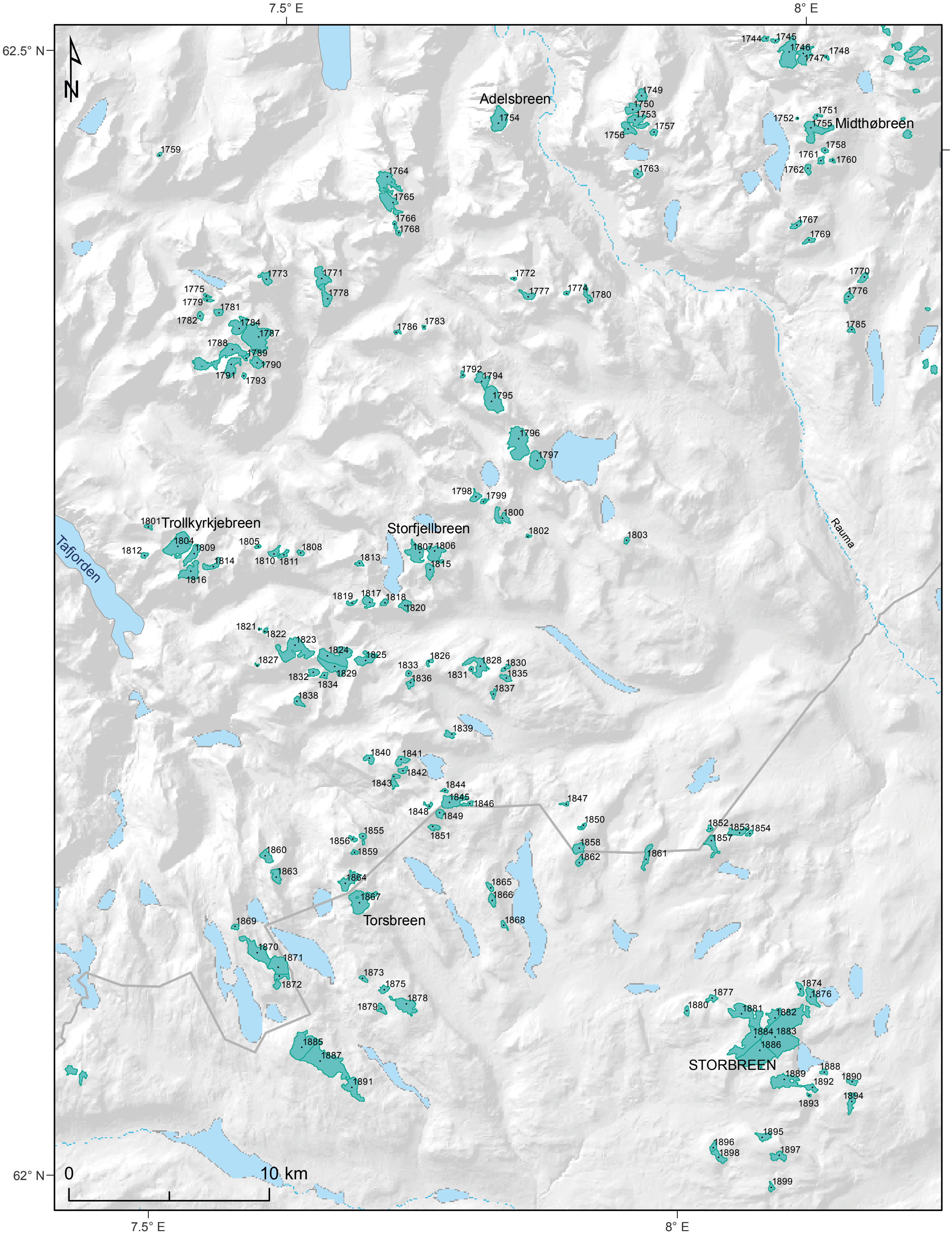
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1598	Kaldfonna		20030809	0.14	1361	1624	26	SE
1599			20030809	0.27	1187	1562	26	NE
1600			20030809	0.08	1142	1309	24	E
1601	Vinnufonna		20030809	1.16	1169	1690	16	S
1602			20030809	0.07	1449	1590	29	S
1603			20030809	0.22	1200	1352	18	E
1604			20030809	0.03	1109	1200	19	E
1605			20030809	0.03	1587	1701	30	S
1606			20030809	0.04	1227	1393	37	N
1607			20030809	0.01	1354	1400	25	N
1608			20060916	0.04	1340	1478	29	E
1609			20030809	0.04	1364	1562	33	NE
1610			20060916	0.21	1132	1385	20	NE
1611			20030809	0.04	1467	1654	33	NE
1612			20060916	0.03	1073	1141	24	NE
1613			20030809	0.05	1489	1613	27	SE
1614			20030809	0.05	1293	1436	33	NE
1615			20030809	0.41	1311	1699	24	NE
1616			20030809	0.02	1300	1416	33	NE
1617			20030809	0.03	1442	1617	43	NE
1618			20030809	0.08	1558	1679	20	N
1619			20030809	0.14	1215	1382	14	E
1620			20030809	0.10	1311	1446	17	E
1621			20030809	0.08	1273	1311	9	E
1622			20030809	0.05	1382	1500	28	NE
1623			20030809	0.03	1394	1461	25	E
1624			20030809	0.04	1149	1365	33	N
1625			20030809	0.15	1313	1532	31	NE
1626			20030809	0.88	1202	1592	22	N
1627			20030809	0.06	1491	1592	17	N
1628			20030809	0.02	1391	1516	36	S
1629			20030809	0.22	1137	1280	14	W
1630	Blikskårbreen		20030809	0.29	1352	1705	27	SE
1631			20030809	0.13	1418	1496	18	E
1632			20030809	0.07	1221	1338	23	SE
1633			20030809	0.42	1413	1619	17	E
1634			20030809	0.03	1193	1266	19	NW
1635			20030809	0.03	1516	1556	13	NE
1636			20030809	0.04	1479	1559	22	E
1637			20030809	0.09	1363	1533	21	NE
1638			20030809	0.11	1288	1446	22	N
1639			20030809	0.05	1312	1453	33	E
1640			20030809	0.04	1487	1594	21	SE
1641			20030809	0.03	1373	1456	28	E
1642	Hoemsbreen		20030809	0.70	1081	1587	23	NE
1643			20030809	0.34	1410	1767	27	NE
1644			20030809	0.08	1503	1603	17	S
1645			20030809	0.07	1346	1547	30	N
1646			20030809	0.03	1478	1602	21	E

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1647			20030809	0.05	1175	1321	29	NE
1648			20030809	0.02	1504	1603	29	NE
1649			20030809	0.05	1374	1439	12	S
1650			20030809	0.13	1385	1603	27	NE
1651			20030809	0.12	1390	1569	17	NW
1652			20030809	0.13	1254	1495	26	NE
1653			20030809	0.53	1045	1650	25	E
1654			20030809	0.05	1500	1605	23	NE
1655			20030809	0.14	1344	1422	11	S
1656			20030809	0.03	1372	1494	31	E
1657			20030809	0.12	1529	1780	29	N
1658			20030809	0.04	1468	1579	29	E
1659			20030809	0.01	1491	1538	19	SE
1660			20030809	0.05	1321	1509	34	NE
1661			20030809	0.15	1297	1568	22	N
1662			20030809	0.04	1463	1701	41	N
1663			20030809	0.04	1572	1605	11	NW
1664			20030809	0.52	1235	1615	18	NE
1665			20030809	0.17	1518	1709	24	NE
1666			20030809	0.05	1430	1492	19	E
1667	Storbreen		20030809	0.66	1377	1596	13	SE
1668			20030809	0.15	1422	1530	9	NW
1669			20030809	0.06	1454	1681	35	NE
1670			20030809	0.03	1295	1405	29	NE
1671			20030809	0.14	1613	1750	22	SE
1672			20030809	0.04	1505	1567	13	N
1673	Evelsfonn		20030809	0.14	1279	1497	27	E
1674			20030809	0.04	1429	1529	22	NE
1675			20030809	0.04	1475	1561	26	E
1676			20030809	0.05	1439	1523	22	NE
1677			20030809	0.07	1556	1655	22	NE
1678			20030809	0.03	1366	1462	30	NE
1679			20030809	0.06	1531	1642	25	NE
1680			20030809	0.05	1562	1658	20	N
1681			20030809	0.32	1588	1781	18	NE
1682			20030809	0.06	1558	1658	20	E
1683			20030809	0.12	1568	1725	24	E
1684			20030809	0.05	1660	1714	15	NE
1685			20030809	0.06	1688	1738	15	NE
1686			20030809	0.09	1497	1705	27	N
1687			20030809	0.06	1616	1727	21	NE
1688			20030809	0.16	1656	1753	15	SE
1689			20030809	0.11	1680	1781	14	N
1690			20030809	0.15	1699	1809	16	NE
1691			20030809	0.09	1543	1670	31	NE
1692			20030809	0.20	1633	1766	17	SE
1693			20030809	0.05	1698	1839	29	E
1694			20030809	0.12	1655	1798	19	SE
1695			20030809	0.16	1488	1676	20	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1696			20030809	0.06	1593	1719	28	NE
1697			20030809	0.32	1503	1832	23	E
1698			20030809	0.22	1505	1762	24	NE
1699			20030809	0.10	1638	1751	26	E
1700			20030809	0.09	1563	1726	27	E
1701			20030809	0.39	1473	1803	18	NE
1702			20030809	0.23	1555	1693	21	E
1703			20030809	0.12	1600	1885	29	NE
1704			20030809	0.12	1665	1897	25	N
1705			20030809	0.07	1610	1739	18	NE
1706			20030809	0.37	1553	1856	18	NE
1707			20030809	0.12	1677	1819	19	E
1708			20030809	0.17	1645	1739	17	NE
1709			20030809	0.12	1697	1847	18	N
1710			20030809	0.12	1624	1742	22	NE
1711			20030809	0.27	1648	1833	16	NE
1712			20030809	0.27	1599	1783	17	NE
1713			20030809	0.07	1583	1729	26	NE
1714			20030809	0.10	1591	1740	26	NE
1715			20030809	0.03	1750	1829	15	N
1716			20030809	0.02	1732	1839	18	NE
1717			20030809	0.04	1613	1744	25	NE
1718			20030809	0.07	1746	1816	12	E
1719			20030809	0.05	1670	1736	11	NE
1720			20030809	0.04	1715	1780	23	E
1721			20030809	0.12	1536	1705	23	NE
1722			20030809	0.04	1474	1614	30	NE
1723	Storbrean		20030809	0.15	1725	1849	19	E
1724			20030809	0.06	1713	1768	14	E
1725			20030809	0.02	1707	1779	25	SE
1726			20030809	0.04	1555	1658	26	E
1727			20030809	0.08	1591	1688	21	NE
1728			20030809	0.03	1487	1593	36	N
1729			20030809	0.06	1473	1703	39	N
1730			20030809	0.04	1774	1864	17	E
1731			20030809	0.12	1632	1826	37	N
1732			20030809	0.06	1713	1803	21	E
1733			20030809	0.24	1598	1830	23	SE
1734			20030809	0.50	1706	2253	23	NE
1735			20030809	0.11	1549	1755	25	E
1736			20030809	0.20	1660	2006	26	E
1737			20030809	0.04	1696	1849	38	NE
1738			20030809	1.03	1638	2083	17	E
1739			20030809	0.50	1594	1892	16	NE
1740			20030809	0.12	1692	1877	29	NW
1741			20030809	0.55	1592	1816	14	NE
1742			20030809	0.06	1671	1774	20	E
1743			20030809	0.11	1649	1814	29	E

21. **Romsdalsfjella**

Glacier ID 1744 - 1899



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1744			20060916	0.07	1222	1402	29	NE
1745			20060916	0.07	1241	1302	12	N
1746			20060916	0.96	1123	1519	15	NE
1747			20060916	0.47	1207	1303	7	E
1748			20030809	0.04	1197	1255	20	NE
1749			20060916	0.25	1216	1541	26	NE
1750			20060916	0.29	1351	1702	27	E
1751			20030809	0.07	1303	1425	16	NE
1752			20030809	0.01	1407	1447	18	N
1753			20060916	0.43	1101	1634	32	NE
1754	Adelsbreen		20060916	0.75	1198	1622	19	NE
1755	Midthøbreen		20030809	0.70	1271	1524	13	E
1756			20060916	0.29	1368	1700	27	S
1757			20060916	0.09	1185	1387	32	N
1758			20030809	0.07	1199	1300	18	NE
1759			20060916	0.04	1013	1266	37	N
1760			20030809	0.04	1255	1399	28	NE
1761			20030809	0.09	1378	1482	13	NE
1762			20030809	0.13	1442	1608	24	E
1763			20060916	0.15	1549	1766	29	N
1764			20060916	0.71	1124	1783	30	E
1765			20060916	0.58	1199	1716	24	E
1766			20060916	0.06	1428	1569	35	NE
1767			20030809	0.13	1402	1729	27	NE
1768			20060916	0.05	1504	1632	25	NE
1769			20030809	0.12	1390	1507	22	N
1770			20030809	0.15	1475	1622	22	NW
1771			20060916	0.46	1380	1647	20	NE
1772			20060916	0.04	1401	1540	38	N
1773			20060916	0.25	1278	1599	29	E
1774			20060916	0.05	1365	1513	37	N
1775			20060916	0.04	1271	1475	31	NE
1776			20030809	0.15	1432	1614	23	E
1777			20060916	0.19	1324	1656	30	NE
1778			20060916	0.36	1298	1640	26	E
1779			20060916	0.06	1365	1597	45	NE
1780			20060916	0.18	1412	1640	25	E
1781			20060916	0.13	1309	1556	28	NE
1782			20060916	0.10	1193	1241	9	S
1783			20060916	0.03	1290	1394	24	N
1784			20060916	0.52	1306	1656	22	N
1785			20030809	0.08	1429	1646	31	E
1786			20060916	0.06	1305	1439	27	NE
1787			20060916	1.43	1180	1720	21	E
1788			20060916	1.08	1045	1624	18	NW
1789			20060916	0.07	1543	1643	17	S
1790			20060916	0.27	1166	1527	26	E
1791			20060916	0.45	1305	1579	24	SE
1792			20060916	0.05	1322	1469	24	N

Trollkyrkjebreen (1804) in September 2008. Photo: Tore Klokk.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1793			20060916	0.05	1166	1238	17	SW
1794			20060916	0.34	1301	1576	20	E
1795			20060916	0.89	1352	1640	16	NE
1796	Storbreen		20060916	1.26	1326	1722	13	NW
1797			20060916	0.53	1338	1682	22	E
1798			20060916	0.18	1363	1632	27	NE
1799			20060916	0.07	1404	1621	31	NE
1800			20060916	0.34	1313	1636	23	E
1801			20060916	0.07	1394	1545	28	NE
1802			20060916	0.04	1419	1589	32	NE
1803			20030809	0.07	1552	1662	21	E
1804	Trollkyrkjebreen		20060916	1.04	1218	1572	14	NE
1805			20060916	0.04	1172	1298	32	N
1806	Storfjellbreen		20060916	0.51	1360	1747	22	NE
1807	Storfjellbreen		20060916	0.58	1418	1726	14	NW
1808			20060916	0.07	1293	1447	30	NE
1809			20060916	0.38	1337	1648	20	N
1810			20060916	0.17	1268	1577	26	NE
1811			20060916	0.11	1351	1611	32	N
1812			20060916	0.08	1358	1535	28	N
1813			20060916	0.08	1485	1526	6	SW
1814			20060916	0.23	1244	1624	25	NE
1815			20060916	0.26	1431	1728	25	SE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1816	Nakkebreen		20060916	0.56	1377	1709	20	SE
1817			20060916	0.25	1308	1600	23	N
1818			20060916	0.09	1649	1720	18	E
1819			20060916	0.08	1413	1637	32	N
1820			20060916	0.22	1445	1649	21	E
1821			20060916	0.02	1432	1525	40	N
1822			20060916	0.04	1420	1566	28	NE
1823	Storbreen		20060916	1.14	1331	1763	21	N
1824		ILL	20060916	0.98	1290	1861	17	NE
1825			20060916	0.43	1338	1791	28	N
1826			20060916	0.07	1517	1637	18	NE
1827			20060916	0.02	1407	1520	38	NE
1828			20060916	0.52	1431	1730	18	NE
1829		ILL	20060916	0.57	1374	1861	17	SE
1830			20060916	0.08	1547	1752	23	E
1831			20060916	0.04	1617	1754	27	NE
1832			20060916	0.17	1404	1580	21	W
1833			20060916	0.07	1546	1714	28	E
1834			20060916	0.09	1561	1631	13	SE
1835			20060916	0.14	1560	1859	34	NE
1836			20060916	0.13	1463	1661	25	E
1837			20060916	0.09	1551	1690	20	SE
1838			20060916	0.15	1435	1684	24	E
1839			20060916	0.14	1423	1633	29	NE
1840			20060916	0.17	1581	1802	28	N
1841			20060916	0.22	1512	1893	27	E
1842			20060916	0.11	1578	1884	32	NE
1843			20060916	0.18	1579	1831	21	SE
1844			20060916	0.05	1581	1763	37	NE
1845			20060916	0.55	1447	1965	22	NE
1846			20060916	0.09	1503	1655	17	NE
1847			20030809	0.06	1351	1476	24	N
1848			20060916	0.07	1663	1809	21	NW
1849			20060916	0.14	1665	1895	27	SE
1850			20060916	0.08	1656	1864	35	N
1851			20060916	0.13	1525	1662	15	SE
1852			20030809	0.07	1633	1711	13	NE
1853			20030809	0.26	1493	1741	25	N
1854			20030809	0.07	1528	1657	23	N
1855			20060916	0.11	1548	1751	29	E
1856			20060916	0.07	1512	1748	31	N
1857	Storløypbreen		20030809	0.32	1694	1851	15	NE
1858			20060916	0.25	1684	1946	24	E
1859			20060916	0.06	1589	1717	23	SE
1860			20060916	0.25	1464	1698	23	N
1861			20060916	0.26	1634	1820	27	E
1862			20060916	0.13	1656	1829	21	E
1863			20060916	0.27	1471	1795	30	E
1864	Langfonna		20060916	0.49	1457	1870	21	N
1865			20060916	0.10	1609	1742	29	NE
1866			20060916	0.17	1584	1727	23	E

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1867	Torsbreen		20060916	0.96	1415	1894	20	NE
1868			20060916	0.09	1506	1623	25	NE
1869			20060916	0.09	1542	1730	29	NE
1870			20060916	0.86	1473	1810	19	NE
1871			20060916	0.68	1394	1821	24	NE
1872			20060916	0.28	1605	1835	17	SE
1873			20060916	0.08	1536	1707	31	NE
1874			20060916	0.15	1700	1837	16	NE
1875			20060916	0.13	1479	1726	27	N
1876			20060916	0.36	1517	1763	23	E
1877			20060916	0.13	1551	1714	23	N
1878			20060916	0.61	1439	1735	20	NE
1879			20060916	0.14	1607	1696	11	SE
1880			20060916	0.09	1656	1784	19	NE
1881		STO	20060916	1.09	1590	1884	15	N
1882		STO	20060916	0.39	1839	1884	4	N
1883		STO	20060916	3.04	1524	1885	8	E
1884		STO	20060916	0.98	1798	1947	6	NW
1885			20060916	1.16	1516	1844	14	NE
1886		STO	20060916	1.41	1757	1946	7	SE
1887			20060916	1.93	1466	1782	12	NE
1888			20060916	0.08	1553	1746	31	N
1889			20060916	0.73	1709	1917	10	NE
1890			20060916	0.11	1714	1866	18	NE
1891			20060916	0.56	1511	1704	14	E
1892			20060916	0.16	1800	1909	15	N
1893			20060916	0.03	1928	1980	17	NE
1894			20060916	0.25	1827	1898	8	E
1895			20060916	0.21	1621	1903	26	NE
1896			20060916	0.11	1685	1794	13	NE
1897			20060916	0.26	1766	1903	13	SE
1898			20060916	0.23	1639	1805	18	E
1899			20060916	0.09	1638	1730	16	E

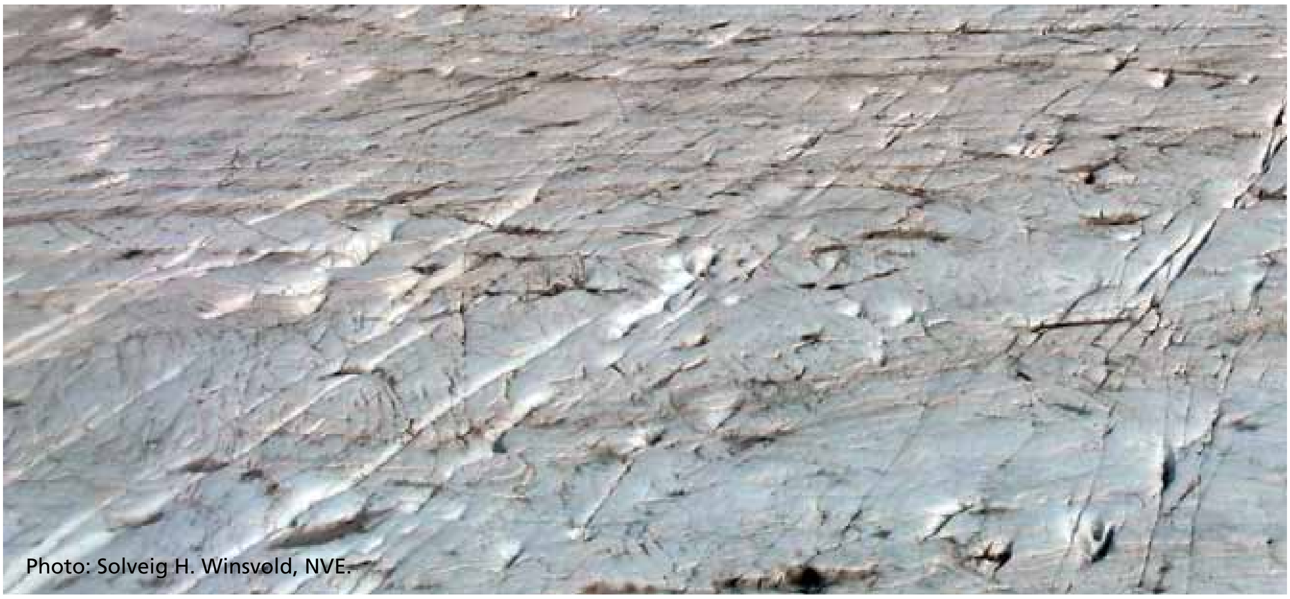
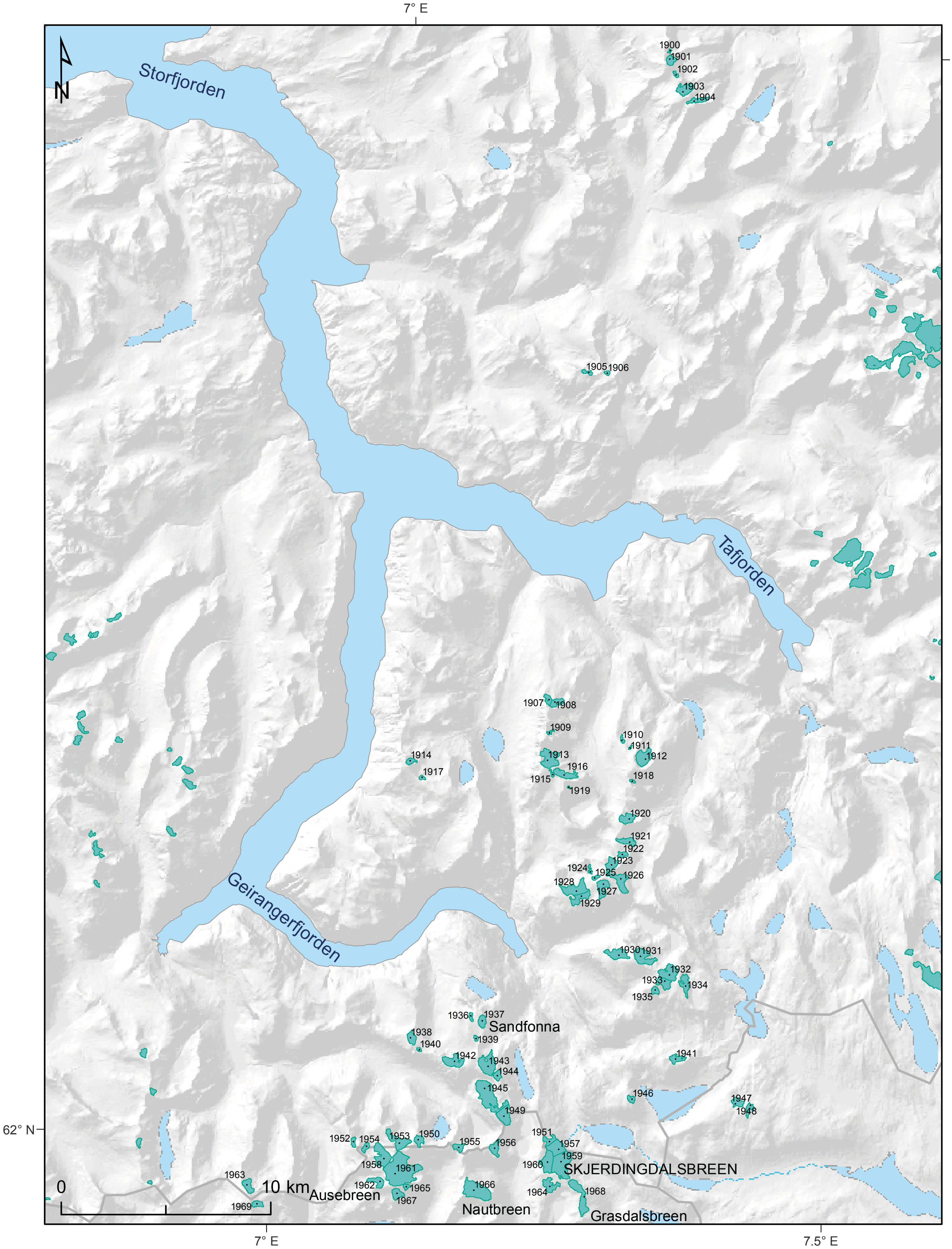


Photo: Solveig H. Winsvold, NVE.

22. **Sunnmøre - East**

Glacier ID 1900 - 1969



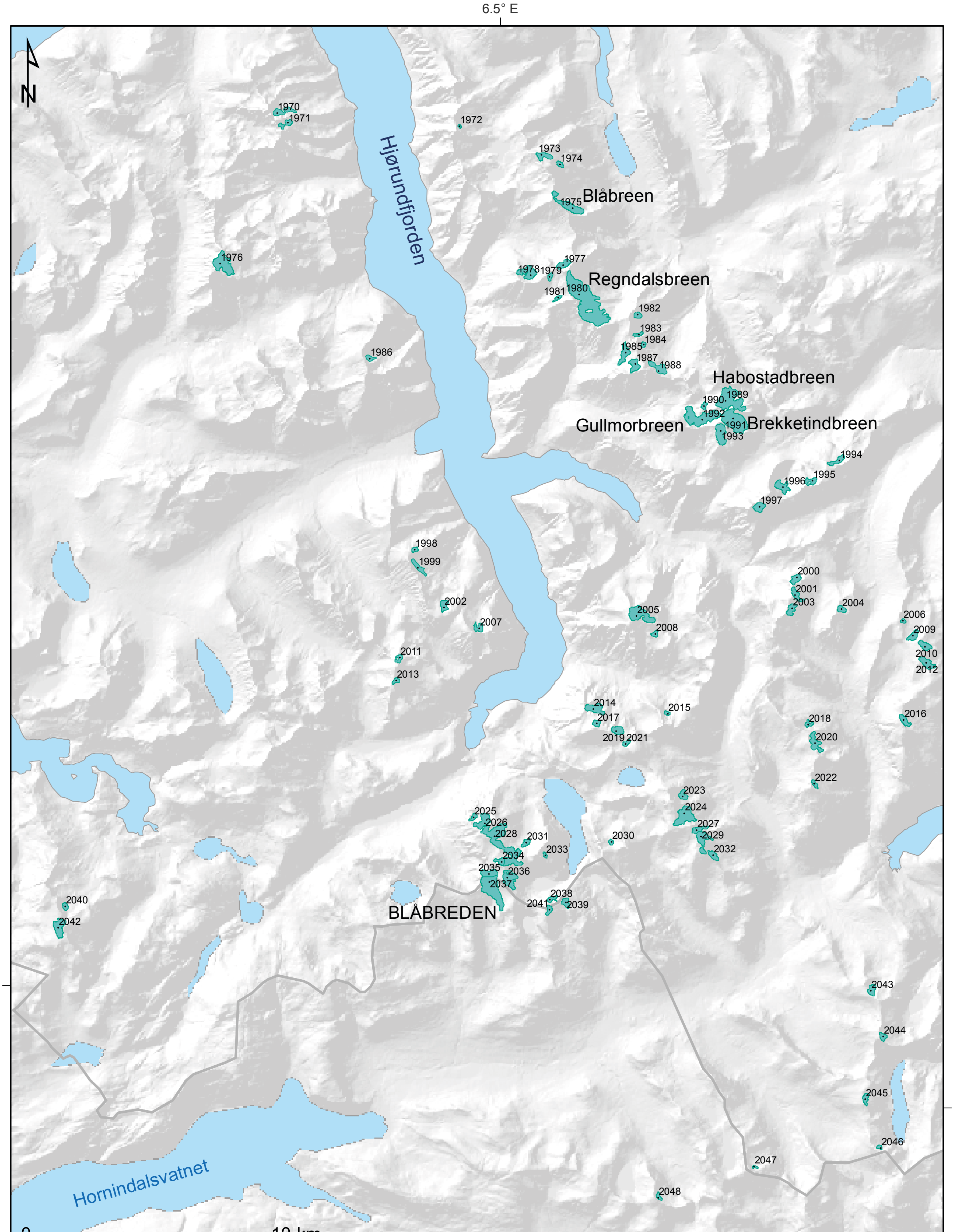
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1900			20060916	0.02	1130	1257	27	NE
1901			20060916	0.16	1050	1280	26	E
1902			20060916	0.05	1104	1233	30	NE
1903			20060916	0.32	1088	1390	21	NE
1904			20060916	0.18	1017	1408	27	NE
1905			20060916	0.08	1162	1301	30	N
1906			20060916	0.05	1232	1375	32	NE
1907			20060916	0.12	1363	1543	26	NE
1908			20060916	0.18	1277	1544	22	NE
1909			20060916	0.04	1390	1634	37	E
1910			20060916	0.05	1336	1499	28	NE
1911			20060916	0.02	1409	1524	24	NE
1912			20060916	0.45	1262	1651	21	NE
1913			20060916	0.56	1211	1747	29	NE
1914			20060916	0.10	1278	1484	25	NE
1915			20060916	0.04	1679	1776	19	E
1916			20060916	0.32	1133	1699	31	NE
1917			20060916	0.05	1190	1292	27	NE
1918			20060916	0.03	1430	1594	27	E
1919			20060916	0.01	1404	1511	35	E
1920			20060916	0.27	1298	1594	24	NE
1921			20060916	0.23	1184	1499	22	E
1922			20060916	0.11	1502	1673	17	W
1923			20060916	0.29	1310	1650	24	N
1924			20060916	0.05	1233	1369	21	NE
1925			20060916	0.06	1471	1633	37	N
1926			20060916	0.41	1336	1647	22	E
1927			20060916	0.34	1433	1693	24	SE
1928			20060916	0.55	1339	1682	17	N
1929			20060916	0.30	1448	1673	15	SE
1930			20060916	0.39	1397	1728	27	N
1931			20060916	0.50	1315	1755	26	E
1932			20060916	0.50	1403	1703	17	N
1933			20060916	0.27	1549	1715	13	SE
1934			20060916	0.29	1444	1640	23	E
1935			20060916	0.11	1556	1719	23	SE
1936			20060916	0.06	1564	1633	10	NW
1937	Sandfonna		20060916	0.18	1478	1646	24	E
1938			20060916	0.19	1394	1550	22	E
1939			20060916	0.05	1532	1555	5	S
1940			20060916	0.04	1422	1522	30	NE
1941			20060916	0.20	1401	1687	29	NE
1942			20060916	0.42	1294	1619	25	N
1943	Flydalsbreen		20060916	0.60	1215	1659	21	NE
1944			20060916	0.14	1395	1612	26	NE
1945		HES	20060916	1.08	1291	1679	14	NW
1946			20060916	0.10	1403	1600	31	NE
1947			20060916	0.18	1399	1566	20	NE
1948			20060916	0.14	1467	1589	14	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1949		HES	20060916	0.40	1391	1685	21	E
1950			20060916	0.17	1368	1577	21	NE
1951		SKE	20060916	0.17	1377	1601	19	NE
1952			20060916	0.08	1435	1681	31	NE
1953			20060916	0.45	1361	1673	29	N
1954			20060916	0.10	1308	1519	24	NE
1955			20060916	0.15	1283	1408	11	NE
1956			20060916	0.23	1371	1602	24	E
1957		SKE	20060916	0.43	1302	1602	18	NE
1958			20060916	0.57	1305	1773	21	NW
1959		SKE	20060916	0.88	1314	1651	19	E
1960		SKE	20060916	0.46	1469	1650	11	NW
1961			20060916	1.73	1074	1828	24	E
1962	Ausebreen		20060916	0.23	1327	1703	24	W
1963			20060916	0.23	1225	1456	24	NE
1964			20060916	0.32	1501	1615	10	S
1965			20060916	0.07	1460	1671	29	SE
1966	Nautbreen		20060916	0.85	1305	1671	18	NE
1967			20060916	0.21	1447	1727	26	SE
1968	Grasdalsbreen		20060916	0.57	1323	1584	26	NE
1969			20060916	0.13	1304	1517	21	E

Orthophoto of Nautbreen (1966) in 2010. Source: www.norgeibilder.no.

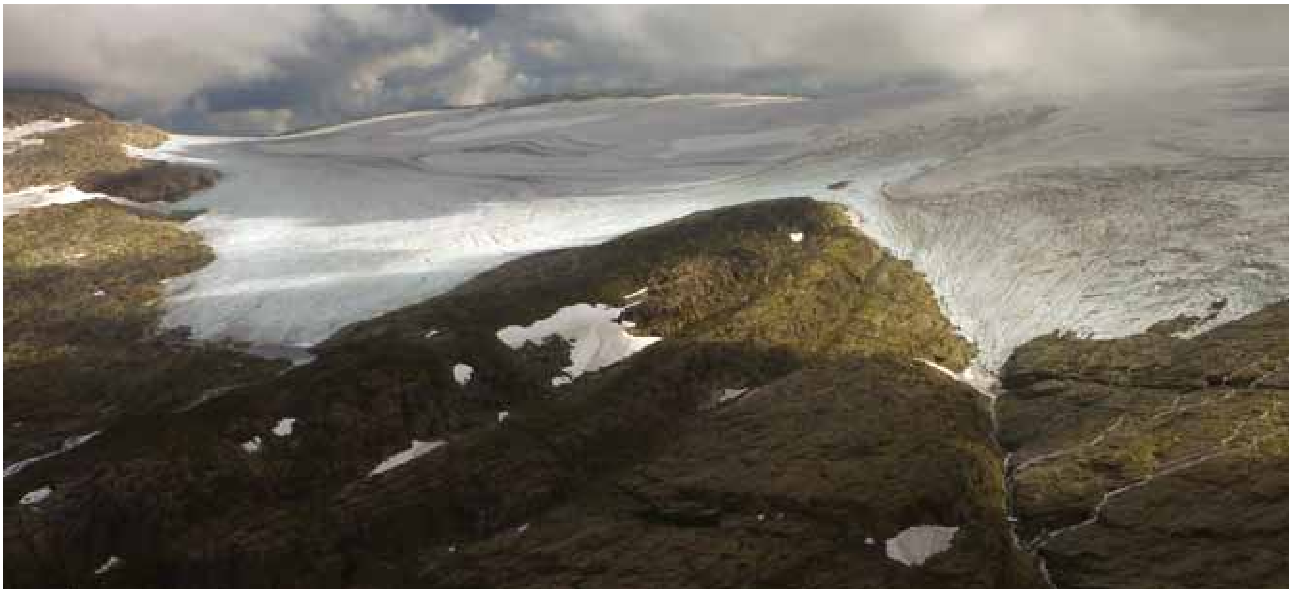
23. Sunnmøre - West

Glacier ID 1970 - 2048



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
1970			20060916	0.15	746	1205	34	NE
1971			20060916	0.09	1026	1302	27	E
1972			20060916	0.01	1031	1085	27	NE
1973	Ljøsabreen		20060916	0.13	1075	1345	27	NE
1974			20060916	0.05	895	1037	26	E
1975	Blåbreen		20060916	0.31	892	1352	27	E
1976			20060916	0.41	1029	1372	23	E
1977			20060916	0.12	1276	1440	30	NW
1978	Blåbreen		20060916	0.24	1036	1325	24	N
1979			20060916	0.04	1143	1349	31	S
1980	Regndalsbreen		20060916	1.47	966	1469	23	NE
1981			20060916	0.04	1100	1222	23	W
1982			20060916	0.06	950	1096	26	E
1983			20060916	0.04	953	1145	27	NE
1984			20060916	0.03	924	984	21	E
1985			20060916	0.18	1068	1199	10	SW
1986			20060916	0.06	899	1116	32	NE
1987			20060916	0.15	1191	1428	26	NW
1988			20060916	0.17	857	1132	33	NE
1989	Habostadbreen		20060916	0.63	1062	1409	16	NE
1990			20060916	0.04	1088	1193	23	N
1991	Brekketindbreen		20060916	0.61	1099	1522	21	E
1992	Gullmorbreen		20060916	0.57	1002	1381	16	NW
1993			20060916	0.26	1192	1515	25	SE
1994			20060916	0.11	1097	1422	30	N
1995			20060916	0.09	1192	1393	33	N
1996			20060916	0.17	872	1049	20	NE
1997			20060916	0.12	1310	1450	20	SE
1998			20060916	0.04	1139	1291	30	NE
1999			20060916	0.11	947	1172	41	NE
2000			20060916	0.11	1158	1368	26	N
2001			20060916	0.12	1204	1469	31	E
2002			20060916	0.10	1038	1274	30	N
2003			20060916	0.12	1337	1482	23	E
2004			20060916	0.07	1237	1341	21	NE
2005			20060916	0.38	1131	1572	24	E
2006			20060916	0.03	1218	1340	29	E
2007			20060916	0.09	1008	1240	29	N
2008			20060916	0.05	1164	1265	16	NE
2009			20060916	0.11	1185	1358	25	NW
2010			20060916	0.12	1292	1445	26	NE
2011			20060916	0.06	1125	1297	27	NE
2012			20060916	0.16	1150	1388	27	NE
2013			20060916	0.05	1213	1325	23	E
2014			20060916	0.20	961	1226	29	NE
2015			20060916	0.03	924	1076	39	N
2016			20060916	0.10	1237	1446	31	E
2017			20060916	0.06	1394	1461	14	N
2018			20060916	0.05	994	1163	29	NE

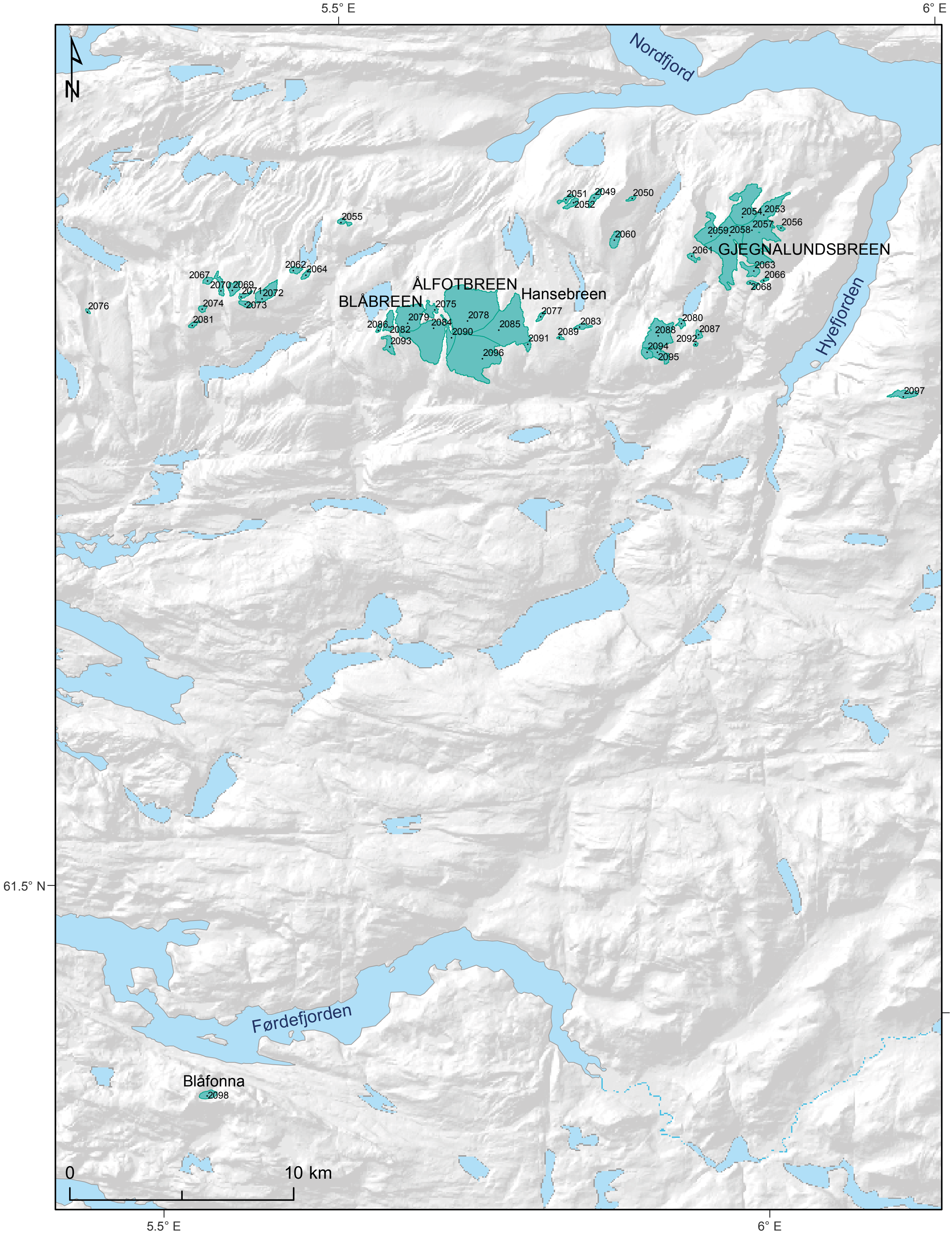
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2019			20060916	0.12	1200	1385	27	NE
2020			20060916	0.19	1177	1432	31	NE
2021			20060916	0.05	1226	1295	17	W
2022			20060916	0.05	1192	1347	39	NE
2023			20060916	0.09	929	1165	34	E
2024			20060916	0.37	1140	1561	28	NE
2025			20060916	0.05	1163	1328	23	NE
2026			20060916	0.21	1180	1478	28	N
2027			20060916	0.10	1074	1455	32	NE
2028			20060916	0.84	1073	1585	27	NE
2029			20060916	0.24	1151	1451	28	E
2030			20060916	0.03	1083	1135	15	N
2031			20060916	0.07	878	1005	23	N
2032			20060916	0.09	1066	1224	24	E
2033			20060916	0.02	1223	1287	28	E
2034			20060916	0.08	1443	1569	16	NW
2035		BBD	20060916	0.15	1207	1336	14	SW
2036			20060916	0.28	1135	1519	27	SE
2037		BBD	20060916	0.60	1101	1310	12	S
2038			20060916	0.06	1184	1340	30	N
2039			20060916	0.09	1166	1299	22	NE
2040			20060916	0.05	1001	1134	26	NE
2041			20060916	0.06	1294	1361	17	SE
2042			20060916	0.23	1260	1451	13	NE
2043			20060916	0.10	1197	1400	25	NE
2044			20060916	0.06	1275	1423	24	E
2045			20060916	0.08	1217	1334	27	E
2046			20060916	0.03	1222	1346	31	NE
2047			20060916	0.02	1195	1274	32	N
2048			20060916	0.04	1152	1233	27	NE



Outlet glaciers of Ålfotbreen (ÅLB), August 2010. Hansebreen (2085) to the left and Ålfotbreen (2078) to the right. The name Hansebreen is not given on official maps. Mass balance has been measured at Hansebreen since 1986 and at Ålfotbreen since 1963. Photo: Hallgeir Elvehøy, NVE.

24. **Nordfjord - Outer**

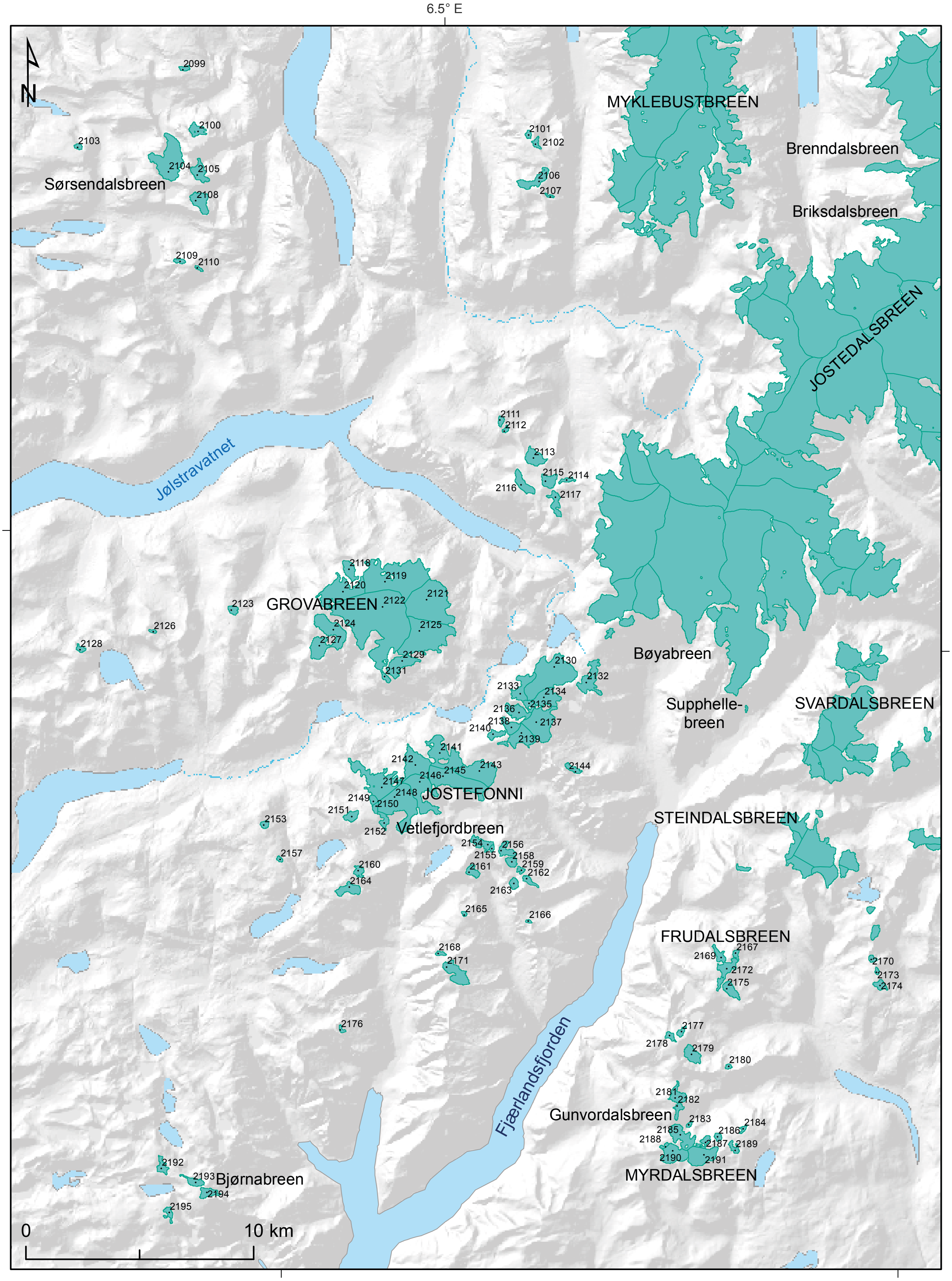
Glacier ID 2049 - 2098



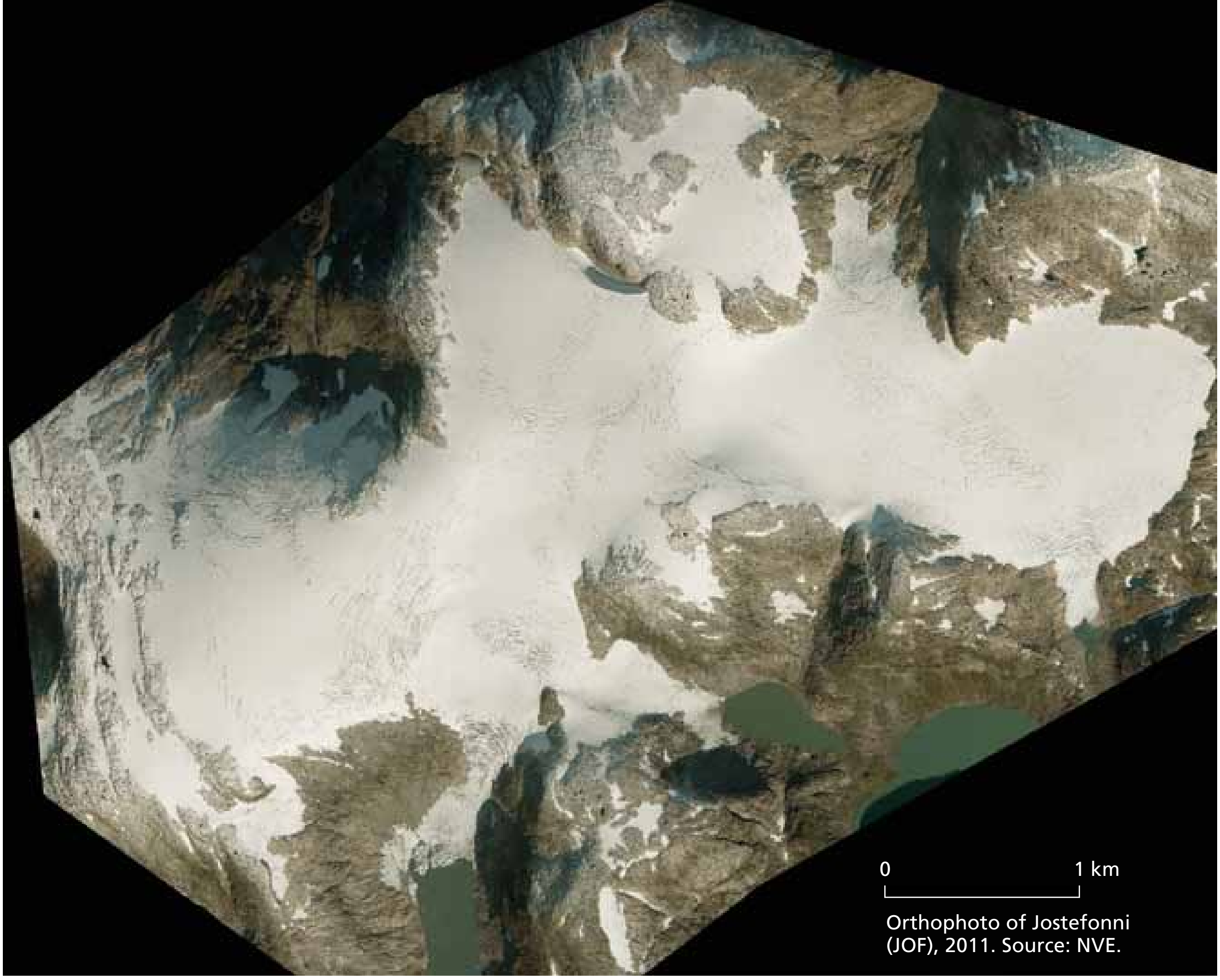
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2049			20060916	0.20	1069	1302	23	N
2050			20060916	0.06	969	1133	22	NE
2051			20060916	0.11	1155	1337	16	NE
2052			20060916	0.14	1140	1319	15	NE
2053		GLB	20060916	0.74	962	1454	14	NE
2054		GLB	20060916	1.55	1070	1466	12	N
2055			20060916	0.10	936	1091	28	NE
2056			20060916	0.06	1017	1173	27	E
2057		GLB	20060916	2.24	1090	1465	10	SE
2058		GLB	20060916	2.25	949	1470	10	S
2059		GLB	20060916	1.05	978	1527	13	N
2060			20060916	0.26	1112	1247	13	E
2061			20060916	0.11	1307	1432	13	SE
2062			20060916	0.12	916	1060	25	N
2063			20060916	0.29	1111	1330	14	E
2064			20060916	0.10	931	1086	23	N
2066			20060916	0.04	1009	1135	24	NE
2067			20060916	0.10	1000	1161	21	NE
2068			20060916	0.10	1141	1226	12	E
2069			20060916	0.23	1050	1262	17	N
2070			20060916	0.19	958	1232	16	NW
2071			20060916	0.09	1126	1281	24	N
2072			20060916	0.52	915	1265	20	N
2073			20060916	0.12	1141	1304	25	S
2074			20060916	0.08	1120	1267	26	SE
2075			20060916	0.26	1134	1319	14	NW
2076			20060916	0.03	762	833	24	NE
2077			20060916	0.08	1027	1180	22	N
2078		ÅLB	20060916	3.99	899	1384	10	NE
2079		BLB	20060916	1.25	1031	1313	11	N
2080			20060916	0.10	958	1138	24	N
2081			20060916	0.08	1007	1158	22	E
2082			20060916	0.29	1038	1285	18	NW
2083			20060916	0.13	980	1152	22	N
2084		BLB	20060916	2.19	1073	1316	8	S
2085	Hansebreen	ÅLB	20060916	2.92	929	1355	9	NE
2086			20060916	0.06	1121	1235	23	NW
2087			20060916	0.09	1065	1182	20	E
2088			20060916	1.21	1049	1400	13	NE
2089			20060916	0.04	1082	1150	13	NE
2090		ÅLB	20060916	0.38	1301	1384	8	W
2091		ÅLB	20060916	0.09	1170	1227	7	S
2092			20060916	0.03	1142	1218	23	E
2093			20060916	0.24	1061	1301	16	S
2094			20060916	0.18	1342	1398	6	SE
2095			20060916	0.37	1126	1392	15	E
2096		ÅLB	20060916	3.51	922	1384	9	SE
2097	Storbreen		20060916	0.30	1201	1328	15	N
2098	Blåfonna		20060916	0.23	789	1021	23	NE

Southern part of Gjegnalunds-
breen, 2058, August 2010.
Photo: Hallgeir Elvehøy, NVE.

25. **Jostedalsbreen - South** Glacier ID 2099 - 2195



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2099			20060916	0.08	1193	1316	18	NE
2100			20060916	0.28	1170	1507	28	N
2101			20060916	0.07	1401	1502	17	NW
2102			20060916	0.10	1321	1524	31	NE
2103			20060916	0.07	1100	1261	34	NE
2104	Sørsendalsbreen		20060916	1.66	969	1416	13	N
2105			20060916	0.42	1075	1477	26	NE
2106			20060916	0.49	1320	1508	19	NW
2107			20060916	0.04	1211	1346	29	NE
2108			20060916	0.50	1085	1417	24	NE
2109			20060916	0.08	1268	1408	28	N
2110			20060916	0.04	1154	1333	32	E
2111			20060916	0.09	1257	1427	25	NE
2112			20060916	0.06	1301	1451	27	NE
2113			20060916	0.46	1266	1539	22	NE
2114			20060916	0.10	1151	1444	30	N
2115			20060916	0.31	1314	1507	14	NE
2116			20060916	0.40	1303	1436	11	N
2117			20060916	0.33	1336	1439	11	E
2118			20060916	0.36	1168	1501	18	N
2119		GRB	20060916	3.38	1101	1622	13	N
2120		GRB	20060916	1.50	1245	1585	10	NW
2121		GRB	20060916	2.82	1162	1632	13	E
2122		GRB	20060916	6.64	1115	1633	9	SW
2123			20060916	0.13	1139	1317	23	NE
2124			20060916	1.01	1132	1454	9	SE
2125		GRB	20060916	2.53	1153	1631	13	SE
2126			20060916	0.04	1165	1291	25	NE
2127			20060916	0.60	1262	1417	10	W
2128			20060916	0.09	1242	1383	25	NE
2129		GRB	20060916	0.69	1100	1508	15	E
2130			20060916	2.37	1106	1563	10	NE
2131		GRB	20060916	0.10	1368	1494	14	SE
2132			20060916	0.73	1144	1497	18	E
2133			20060916	0.59	1368	1563	9	NW
2134			20060916	0.68	1101	1562	18	E
2135			20060916	0.18	1479	1563	8	S
2136			20060916	0.49	1301	1541	14	NW
2137			20060916	1.37	1133	1546	18	E
2138			20060916	0.33	1264	1543	13	NW
2139			20060916	0.78	1278	1543	15	S
2140			20060916	0.21	1291	1513	25	NW
2141		JOF	20060916	1.27	1167	1484	13	NE
2142		JOF	20060916	1.12	1240	1488	6	NW
2143		JOF	20060916	1.26	1166	1340	5	E
2144			20060916	0.15	988	1142	22	NE
2145		JOF	20060916	1.68	1048	1523	10	E
2146		JOF	20060916	1.27	1010	1522	12	S
2147		JOF	20060916	1.53	1119	1613	19	N



Orthophoto of Jostefonni (JOF), 2011. Source: NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2148	Vetlefjordbreen	JOF	20060916	1.96	962	1613	14	SE
2149		JOF	20060916	0.12	1568	1615	7	W
2150		JOF	20060916	0.09	1566	1614	6	SW
2151			20060916	0.22	1380	1479	12	N
2152		JOF	20060916	0.20	1257	1578	25	SE
2153			20060916	0.10	1165	1355	28	NE
2154			20060916	0.32	1224	1437	16	NE
2155			20060916	0.05	1217	1269	13	S
2156			20060916	0.28	1145	1473	21	NE
2157			20060916	0.05	1267	1346	21	NE
2158			20060916	0.17	1202	1411	21	E
2159			20060916	0.07	1135	1243	18	NE
2160			20060916	0.16	1206	1429	24	NE
2161			20060916	0.20	1174	1410	22	E
2162			20060916	0.14	1127	1300	25	NE
2163			20060916	0.15	1211	1329	15	NW
2164			20060916	0.38	1212	1364	10	E
2165			20060916	0.04	1327	1426	24	N
2166			20060916	0.03	1204	1312	31	NE
2167		FRU	20060916	0.09	1310	1471	30	E
2168			20060916	0.07	1307	1384	17	NE
2169		FRU	20060916	0.20	1224	1584	26	N
2170			20060916	0.08	1345	1484	24	NE
2171			20060916	0.65	1107	1483	21	E
2172		FRU	20060916	0.47	1414	1580	12	SE

Vetlefjordbreen (2148) from Jostefonni (JOF), August 2006. Mass balance investigations were carried out in 1996-2000 on this glacier. Photo: Hallgeir Elvehøy, NVE.

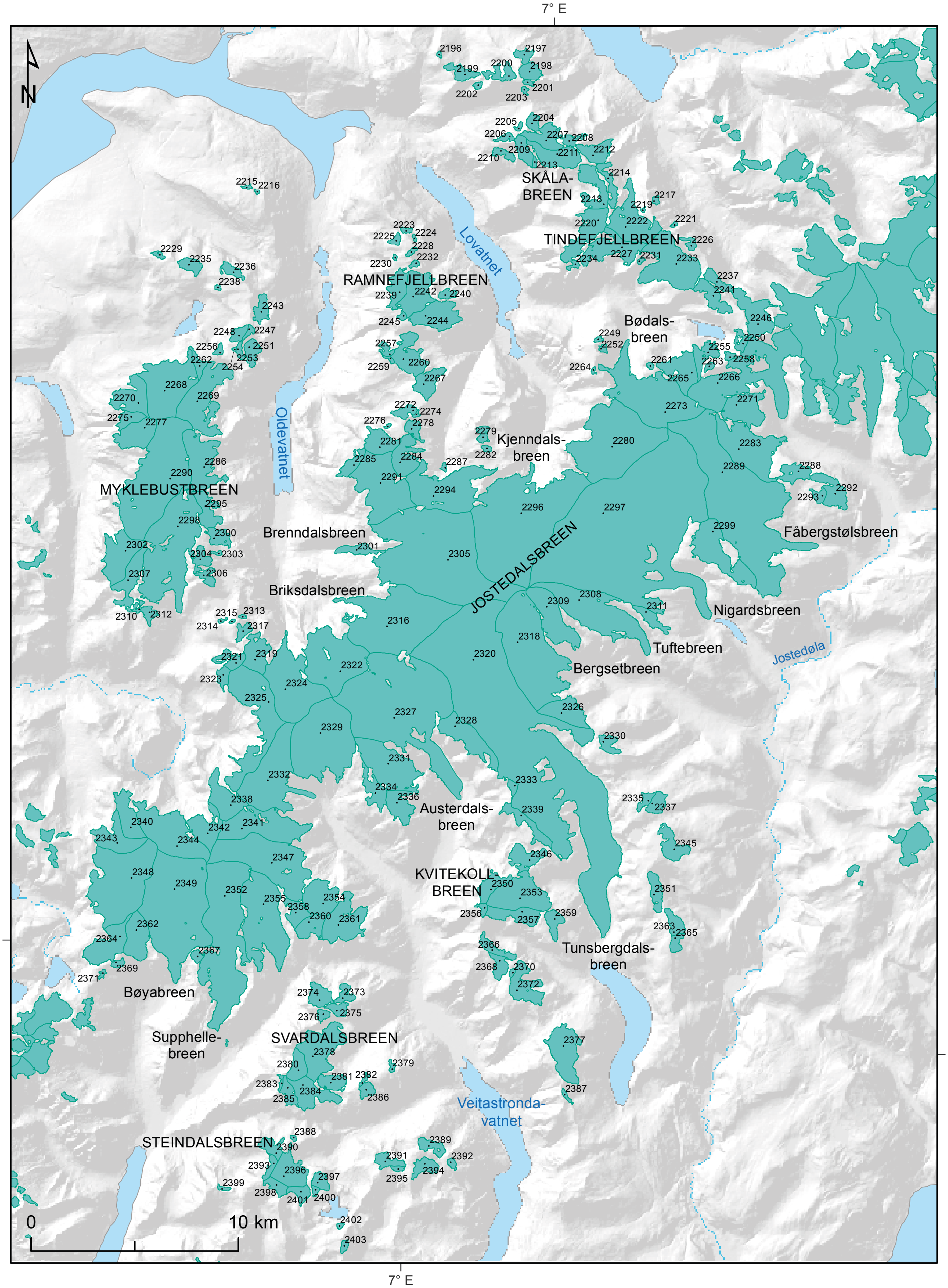
25. **Jostedalsbreen - South** | Southern Norway

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2173			20060916	0.04	1417	1551	30	E
2174	Brattbreen		20060916	0.17	1318	1536	22	E
2175			20060916	0.31	1300	1508	24	NE
2176			20060916	0.05	1097	1276	31	E
2177	Bjåstadbreen		20060916	0.10	1331	1577	29	N
2178	Bjåstadbreen		20060916	0.11	1451	1596	13	N
2179			20060916	0.38	1049	1205	14	E
2180			20060916	0.05	1193	1314	26	NE
2181	Gunvordalsbreen		20060916	0.36	1265	1580	23	NE
2182			20060916	0.15	1325	1516	26	SE
2183			20060916	0.04	1002	1062	14	NE
2184			20060916	0.06	1399	1520	21	N
2185	Gunvordalsbreen	MYR	20060916	0.68	1176	1569	24	NE
2186			20060916	0.09	1289	1408	19	N
2187		MYR	20060916	0.17	1254	1501	19	N
2188		MYR	20060916	0.05	1499	1532	4	SW
2189			20060916	0.13	1399	1468	9	S
2190	Voggebreen	MYR	20060916	0.72	1403	1537	8	SW
2191	Myrdalsbreen	MYR	20060916	0.84	1287	1512	12	SE
2192			20060916	0.21	1281	1361	9	NE
2193			20060916	0.22	1225	1354	16	NE
2194	Bjørnabreen		20060916	0.26	1068	1432	21	E
2195	Langedalsbreen		20060916	0.15	1287	1397	13	E


Part of Nigardsbreen (2297), July 2010. Photo: Markus Engelhardt.


Bergsetbreen (2318), August 2006. The lower tongue became completely separated from the glacier in summer 2006. The new, active terminus is inaccessible for glacier length observations and the measurements are now terminated. Photo: Stefan Winkler.

26. Jostedalsbreen - Central Glacier ID 2196 - 2403



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2196			20060916	0.06	1262	1385	27	E
2197		BRE	20060916	0.42	1174	1593	26	NE
2198	Breidfonna	BRE	20060916	0.73	1238	1706	23	E
2199			20060916	0.72	1093	1495	28	N
2200			20060916	0.73	1199	1783	28	NW
2201			20060916	0.13	1521	1771	28	E
2202			20060916	0.12	1456	1586	18	W
2203			20060916	0.09	1352	1574	27	SE
2204		SKÅ	20060916	0.41	1333	1629	26	E
2205			20060916	0.10	1321	1556	35	NW
2206			20060916	0.24	1370	1786	37	NW
2207		SKÅ	20060916	1.43	1094	1807	17	N
2208			20060916	0.36	1172	1661	28	NE
2209		SKÅ	20060916	0.78	1367	1827	18	SE
2210			20060916	0.37	1373	1670	22	S
2211		SKÅ	20060916	1.96	1421	1718	10	SW
2212		TIB	20060916	1.18	1087	1688	22	NE
2213		SKÅ	20060916	0.10	1343	1459	12	S
2214		TIB	20060916	0.79	1271	1776	26	E
2215			20060916	0.08	1209	1442	33	NE
2216	Håskredskavlen		20060916	0.04	1281	1419	33	N
2217	Skadefonna		20060916	0.12	1297	1564	33	NE
2218		TIB	20060916	1.69	1276	1811	18	W
2219			20060916	0.04	1574	1740	38	NW
2220		TIB	20060916	2.44	1334	1862	17	W
2221			20060916	0.06	1099	1369	36	NE
2222	Tundraskarsbreen	TIB	20060916	3.45	954	1884	14	N
2223			20060916	0.12	1193	1520	38	NE
2224			20060916	0.05	1336	1547	35	NE
2225			20060916	0.20	1391	1634	28	NW
2226			20060916	0.27	1745	1864	18	SW
2227		TIB	20060916	2.57	1343	1884	15	S
2228			20060916	0.12	1597	1692	15	SE
2229			20060916	0.14	1128	1382	25	N
2230			20060916	0.05	1479	1554	18	NW
2231			20060916	0.08	1506	1659	29	SE
2232			20060916	0.12	1353	1581	25	E
2233	Skålebreen	TIB	20060916	5.04	1154	1862	14	SW
2234		TIB	20060916	0.15	1591	1663	11	S
2235			20060916	0.62	1445	1564	10	NE
2236			20060916	0.47	1250	1559	27	N
2237			20060916	0.65	1210	1922	36	NE
2238			20060916	0.06	1477	1516	6	NW
2239		RAM	20060916	1.22	1396	1783	12	NW
2240	Helsetbreen		20060916	0.31	1255	1694	31	NE
2241			20060916	1.25	1599	1923	14	S
2242	Senlenskebreen	RAM	20060916	2.39	1202	1843	13	N
2243	Eidsbreen		20060916	0.70	1146	1636	21	NE
2244		RAM	20060916	2.34	1214	1853	14	E

Bøyabreen (2349) in June 2011. The lower part is now detached from the main part. The flowers in front are Engsoleie (Ranunculus acris) Photo: Gaute Dvergsdal Bøyum. The inset shows Bøyabreen around 1900. Photo from Library of Congress, Washington DC, USA.

26. **Jostedalsbreen - Central** | Southern Norway

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2245		RAM	20060916	0.13	1769	1847	10	NW
2246	Teibreen	JOB	20060916	2.43	1176	1836	16	N
2247			20060916	0.19	1486	1705	26	SE
2248			20060916	0.44	1498	1702	15	NW
2249			20060916	0.08	1474	1663	30	N
2250	Strupebreen	JOB	20060916	0.46	1506	1952	24	NW
2251	Krokebreen		20060916	0.70	1168	1612	19	E
2252			20060916	0.12	1250	1459	26	E
2253			20060916	0.23	1498	1691	20	SE
2254			20060916	0.03	1639	1674	8	W
2255		JOB	20060916	1.05	1245	1753	20	N
2256			20060916	0.17	1344	1552	19	N
2257	Årnesbreen	ÅRV	20060916	0.30	1427	1800	24	N
2258		JOB	20060916	0.17	1679	2008	30	NW
2259		ÅRV	20060916	0.10	1740	1801	6	S
2260	Vesledalsbreen	ÅRV	20060916	2.06	1217	1791	17	E
2261			20060916	0.09	1724	1804	13	W
2262		MYB	20060916	0.49	1296	1642	11	NW
2263			20060916	0.15	1777	1903	18	NW
2264			20060916	0.06	1723	1845	17	NW
2265	Bohrsbreen	JOB	20060916	2.15	1411	1790	11	N
2266	Lodalsbreen	JOB	20060916	9.32	855	2004	15	E
2267		ÅRV	20060916	1.27	1253	1842	18	NE

Tunsbergdalsbreen (2320) is the largest and longest outlet from Jostedalsbreen. Photo: Morgan Gibson, August 2011.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2268		MYB	20060916	5.55	1235	1726	9	N
2269	Instebreen	MYB	20060916	4.56	1021	1736	16	E
2270		MYB	20060916	2.17	1315	1722	14	NW
2271		JOB	20060916	2.45	1306	1972	18	SE
2272			20060916	0.46	1519	1826	22	NW
2273	Bødalsbreen	JOB	20060916	8.41	654	1923	10	NW
2274			20060916	0.07	1714	1807	23	SE
2275		MYB	20060916	0.72	1417	1720	10	W
2276			20060916	0.05	1547	1692	34	NW
2277		MYB	20060916	2.10	1416	1725	8	SW
2278			20060916	0.53	1334	1822	25	E
2279			20060916	0.37	1397	1735	26	E
2280	Krunebreen	JOB	20060916	10.85	1092	1901	8	W
2281	Sundsbreen	JOB	20060916	1.47	1218	1786	13	NW
2282			20060916	0.12	1444	1650	27	NE
2283		JOB	20060916	5.13	789	1968	16	E
2284		JOB	20060916	1.85	1457	1799	12	SE
2285		JOB	20060916	0.77	1515	1704	9	W
2286		MYB	20060916	3.40	1071	1728	15	E
2287			20060916	0.08	846	1072	24	N
2288			20060916	1.02	1274	1730	19	NE
2289	Fåbergstølsbreen	JOB	20060916	20.29	720	1981	9	SE
2290		MYB	20060916	11.80	1141	1789	9	W
2291		JOB	20060916	6.14	1360	1723	6	SW
2292			20060916	1.53	1346	1639	16	E

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2293			20060916	0.35	1582	1622	2	W
2294	Ruteflotbreen	JOB	20060916	6.06	1297	1826	11	N
2295		MYB	20060916	1.37	1172	1709	20	E
2296	Kjenndalsbreen	JOB	20060916	19.07	489	1948	8	N
2297	Nigardsbreen	JOB	20060916	42.02	345	1946	8	SE
2298	Haugabreen	MYB	20060916	9.97	896	1794	13	SE
2299		JOB	20060916	3.97	1346	1689	9	SW
2300	Høgalmebreen	MYB	20060916	0.77	1155	1692	25	NE
2301	Brenndalsbreen	JOB	20060916	0.72	410	1368	17	W
2302		MYB	20060916	2.96	1204	1817	10	W
2303			20060916	0.08	1398	1497	11	E
2304			20060916	0.63	1300	1621	17	SE
2305	Brenndalsbreen	JOB	20060916	20.12	1108	1952	6	W
2306	Flatebreen		20060916	0.46	1229	1542	22	NE
2307		MYB	20060916	1.82	1114	1811	12	SW
2308	Tuftebreen	JOB	20060916	6.79	799	1945	11	SE
2309	Baklibreen	JOB	20060916	3.31	1035	1954	16	SE
2310			20060916	0.21	1357	1581	20	NW
2311		JOB	20060916	0.78	1415	1623	6	SE
2312			20060916	0.41	1218	1517	22	E
2313			20060916	0.06	1104	1298	36	NE
2314			20060916	0.06	1237	1432	30	N
2315			20060916	0.04	1416	1612	37	N
2316	Briksdalsbreen	JOB	20060916	11.73	349	1917	9	NW
2317			20060916	0.40	1265	1619	20	NE
2318	Bergsetbreen	JOB	20060916	11.15	854	1957	11	SE
2319		JOB	20060916	1.74	1204	1689	16	NE
2320	Tunsbergdalsbreen	JOB	20060916	47.64	656	1930	7	SE
2321		JOB	20060916	0.82	1209	1728	22	N
2322	Tjøtabreen	JOB	20060916	6.58	1115	1865	12	NW
2323		JOB	20060916	0.48	1537	1730	12	SW
2324	Melkevollbreen	JOB	20060916	6.58	620	1865	11	NW
2325		JOB	20060916	6.52	1063	1794	12	W
2326	Vetledalsbreen	JOB	20060916	2.03	1154	1633	13	E
2327	Austerdalsbreen	JOB	20060916	19.85	424	1915	10	SE
2328		JOB	20060916	2.77	1368	1744	12	SW
2329	Langedalsbreen	JOB	20060916	9.35	761	1872	13	S
2330	Tverradalsbreen		20060916	0.60	1217	1557	23	NE
2331	Lokebreen	JOB	20060916	4.58	810	1800	17	E
2332	Langedalsbreen	JOB	20060916	6.81	425	1802	15	SE
2333		JOB	20060916	0.25	1589	1659	7	SW
2334		JOB	20060916	1.24	1428	1666	13	SW
2335		RØY	20060916	0.38	1414	1599	10	N
2336		JOB	20060916	1.50	1122	1666	19	E
2337		RØY	20060916	0.69	1392	1604	12	NE
2338		JOB	20060916	2.19	1295	1764	9	NW
2339		JOB	20060916	1.21	1500	1695	10	SW
2340		JOB	20060916	1.85	1215	1654	9	N
2341	Bjørnakyrkjebreen	JOB	20060916	4.74	776	1766	13	E

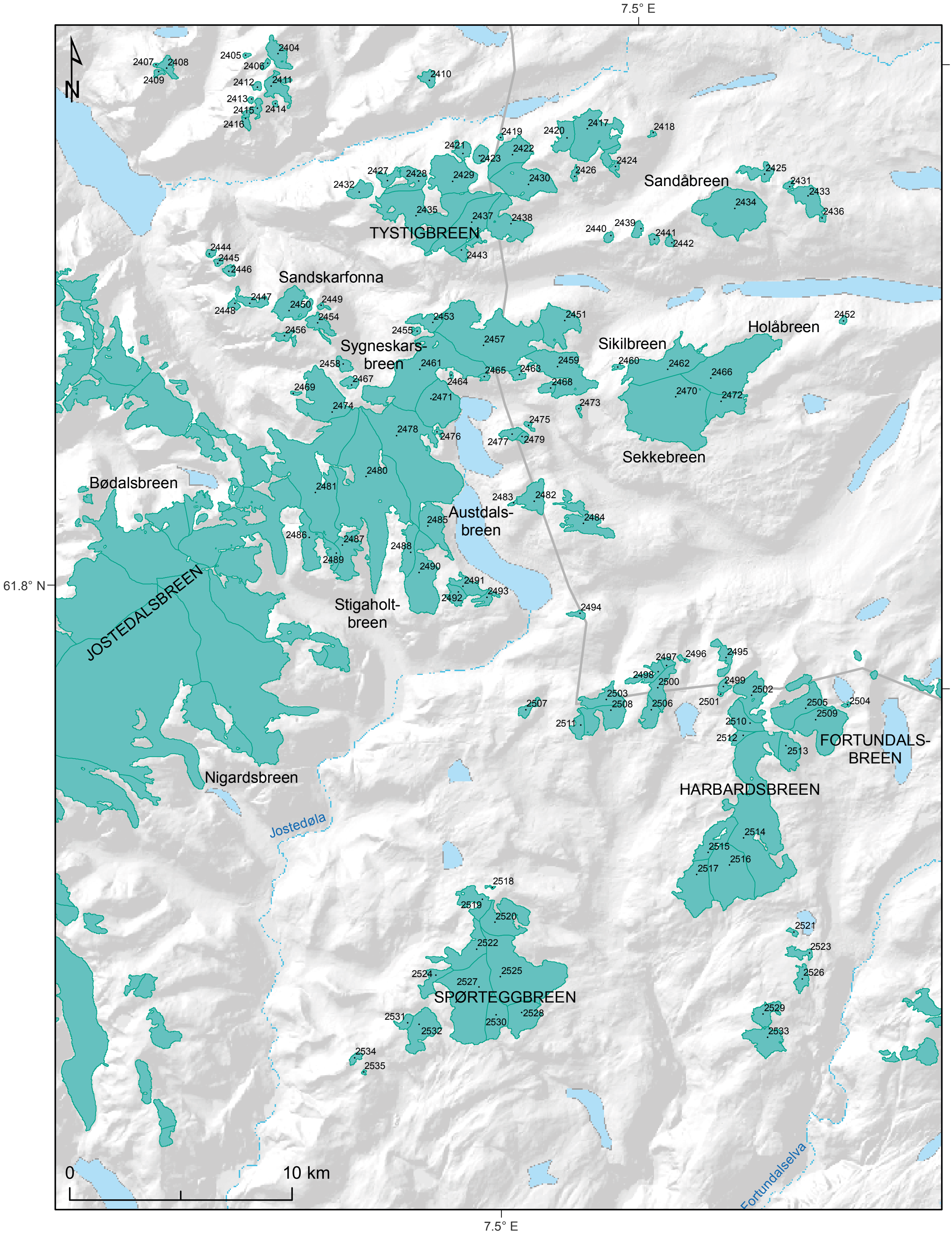
Glacier hiking on Austerdalsbreen (2327) in 2010. The steep ice falls in the background are called Odin (left) and Tor (right) (named after thunder and chief gods in Norse Mythology). Photo: Sven Bjørne-Larsen.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2342		JOB	20060916	1.92	1291	1716	12	NW
2343		JOB	20060916	2.28	1238	1649	8	W
2344		JOB	20060916	5.17	1110	1711	12	N
2345	Liastølbreen		20060916	1.32	1230	1660	17	E
2346			20060916	1.34	1306	1622	11	NW
2347	Opptaksbreen	JOB	20060916	7.75	983	1719	12	NE
2348	Lundabreen	JOB	20060916	8.89	1104	1647	7	W
2349	Bøyabreen	JOB	20060916	13.90	504	1733	8	S
2350		KVI	20060916	1.11	1292	1778	14	N
2351	Vassdalsbreen		20060916	0.89	1385	1641	20	E
2352	Supphellebreen	JOB	20060916	12.87	733	1734	9	S
2353		KVI	20060916	3.64	1079	1778	13	E
2354		JOB	20060916	2.28	1096	1687	16	N
2355	Vetle Supphellebreen	JOB	20060916	7.33	794	1706	14	SE
2356		KVI	20060916	0.21	1676	1779	10	SW
2357		KVI	20060916	1.51	1397	1771	14	S
2358		JOB	20060916	1.01	1400	1628	8	SW
2359			20060916	0.76	1321	1613	19	E
2360		JOB	20060916	1.19	1337	1687	13	SW
2361	Nystølsbreen	JOB	20060916	3.11	953	1687	18	E
2362	Vetlebreen	JOB	20060916	2.15	1089	1648	13	S
2363		VAS	20060916	0.71	1342	1620	20	NE
2364	Marabreen	JOB	20060916	2.53	1183	1620	9	SW
2365		VAS	20060916	0.42	1435	1639	17	E
2366		TVE	20060916	0.70	1333	1609	24	NE
2367		JOB	20060916	0.27	1336	1599	19	W
2368		TVE	20060916	0.69	1360	1584	10	SW
2369		JOB	20060916	0.20	1207	1379	21	SE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2370		SKR	20060916	0.09	1518	1560	6	NW
2371			20060916	0.10	1246	1380	20	SE
2372		SKR	20060916	1.93	1197	1595	15	NE
2373			20060916	0.50	1239	1542	17	N
2374			20060916	0.98	1179	1619	23	NE
2375			20060916	0.49	1370	1586	13	SE
2376			20060916	0.26	1424	1595	16	S
2377	Såta		20060916	2.95	1239	1699	16	NE
2378		SVA	20060916	3.51	1147	1561	10	NE
2379	Eldalsbreen		20060916	0.12	1417	1526	11	N
2380	Stølsbotnbreen	SVA	20060916	0.97	1412	1659	8	N
2381		SVA	20060916	0.86	1196	1552	18	NE
2382		ELD	20060916	0.11	1384	1650	23	N
2383		SVA	20060916	0.12	1576	1659	8	SW
2384	Kvitlabreen	SVA	20060916	1.98	1261	1632	9	SE
2385		SVA	20060916	0.66	1354	1653	10	S
2386		ELD	20060916	0.43	1374	1663	21	SE
2387			20060916	0.13	1263	1437	24	E
2388			20060916	0.07	1247	1355	22	N
2389	Bukkabreen		20060916	0.66	1299	1521	15	NE
2390		STE	20060916	0.72	1278	1518	15	N
2391			20060916	0.65	1333	1600	13	N
2392			20060916	0.17	1320	1534	26	E
2393		STE	20060916	0.38	1467	1585	6	N
2394	Lysebreen		20060916	0.77	1321	1580	13	SE
2395			20060916	0.15	1445	1528	8	SW
2396	Tuftabreen	STE	20060916	2.01	1058	1585	14	NE
2397			20060916	0.53	1316	1543	14	NE
2398		STE	20060916	0.56	1444	1585	10	SW
2399			20060916	0.10	1241	1407	30	NE
2400			20060916	0.14	1438	1535	8	S
2401		STE	20060916	0.57	1369	1542	9	SW
2402			20060916	0.08	1313	1430	23	N
2403			20060916	0.18	1362	1517	22	E

Cotton grass (Latin: *Eriophorum*, Norwegian: Myrull) in front of Nigardsbreen (2297) in June 2010. Photo: Solveig H. Winsvold, NVE.

27. **Jostedalsbreen - North** Glacier ID 2404 - 2535



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2404			20060916	0.88	1236	1640	24	E
2405			20060916	0.06	1303	1478	37	N
2406			20060916	0.12	1507	1583	12	W
2407			20060916	0.03	1583	1615	12	NW
2408			20060916	0.44	1270	1614	24	E
2409			20060916	0.12	1369	1546	27	SE
2410			20060916	0.39	1403	1614	16	N
2411			20060916	0.96	1176	1724	24	NE
2412			20060916	0.13	1441	1645	26	NW
2413			20060916	0.06	1448	1628	34	NW
2414			20060916	0.05	1495	1563	14	S
2415			20060916	0.36	1368	1704	25	SE
2416			20060916	0.16	1356	1665	26	SE
2417		RAU	20060916	3.39	1478	1868	11	NE
2418			20060916	0.07	1432	1628	27	E
2419			20060916	0.06	1339	1524	34	N
2420		RAU	20060916	0.96	1560	1847	11	N
2421			20060916	0.46	1328	1584	20	N
2422		MÅR	20060916	1.86	1425	1883	9	NE
2423			20060916	0.45	1453	1712	18	N
2424		RAU	20060916	0.59	1524	1868	15	E
2425			20060916	0.72	1538	1905	22	NE
2426			20060916	0.16	1556	1766	17	S
2427		TYB	20060916	0.48	1387	1807	27	N
2428		TYB	20060916	1.10	1399	1835	14	N
2429		TYB	20060916	2.77	1461	1795	8	N
2430		MÅR	20060916	3.01	1339	1882	12	E
2431			20060916	0.13	1606	1910	32	NE
2432			20060916	0.67	1346	1737	24	N
2433			20060916	1.26	1600	1916	14	NE
2434	Sandåbreen		20060916	5.11	1541	1920	7	SE
2435		TYB	20060916	5.97	1288	1835	9	S
2436			20060916	0.07	1655	1729	12	E
2437		TYB	20060916	3.24	1417	1735	5	SW
2438	Mårådalsbreen	TYB	20060916	2.36	1306	1731	11	SE
2439			20060916	0.27	1479	1823	25	N
2440			20060916	0.17	1560	1785	23	NE
2441			20060916	0.18	1698	1772	8	SE
2442			20060916	0.16	1469	1683	25	E
2443		TYB	20060916	0.57	1430	1631	10	SE
2444	Svelingsfonna		20060916	0.12	1293	1513	27	NE
2445	Trongurskarfonna		20060916	0.11	1386	1602	27	NE
2446	Halvardsvorfonna		20060916	0.21	1248	1599	30	N
2447	Skipedalsfonna		20060916	0.55	1409	1694	30	N
2448			20060916	0.16	1628	1735	11	N
2449			20060916	0.10	1362	1689	35	NE
2450	Sandskarfonna		20060916	1.69	1355	1884	18	NE
2451		JOB	20060916	2.29	1446	1709	8	E
2452			20060916	0.10	1343	1577	28	N

Austdalsbreen (2478), an eastern outlet of the northern part of Jostedalsbreen. The glacier terminates in lake Austdalsvatnet, which has been part of the hydropower reservoir Styggevatnet since 1988. Glaciological investigations on Austdalsbreen started in 1986 in connection with the construction of the hydropower reservoir. Photo: Miriam Jackson, NVE, October 2006.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2453		JOB	20060916	0.81	1364	1644	17	N
2454			20060916	0.72	1326	1895	22	E
2455			20060916	0.11	1598	1682	11	NE
2456			20060916	0.35	1572	1736	11	S
2457	Sikilbreen	JOB	20060916	8.56	1205	1739	9	N
2458			20060916	0.34	1414	1702	21	E
2459	Tverrbyttnbreen	JOB	20060916	3.58	1373	1787	14	NE
2460			20060916	0.10	1507	1641	22	N
2461	Sygneskarsbreen	JOB	20060916	7.48	1289	1805	7	NW
2462	Sikilbreen	SSB	20060916	3.67	1462	1923	10	N
2463		JOB	20060916	0.28	1670	1739	7	W
2464			20060916	0.04	1634	1650	4	SW
2465	Sygneskarsbreen	JOB	20060916	0.13	1609	1721	15	SE
2466	Holåbreen	SSB	20060916	6.05	1415	1871	5	NE
2467			20060916	0.32	1582	1774	18	N
2468		JOB	20060916	0.30	1653	1774	11	NW
2469			20060916	0.07	1393	1606	34	NE
2470	Sekkebreen	SSB	20060916	9.67	1444	1924	7	S
2471	Sygneskarsbreen	JOB	20060916	3.06	1272	1642	10	E
2472		SSB	20060916	1.66	1615	1763	6	SE
2473			20060916	0.09	1691	1792	21	E
2474	Vesledalsbreen	JOB	20060916	3.43	1221	1757	11	NW
2475			20060916	0.10	1510	1694	27	NE
2476		JOB	20060916	0.09	1526	1690	22	NE

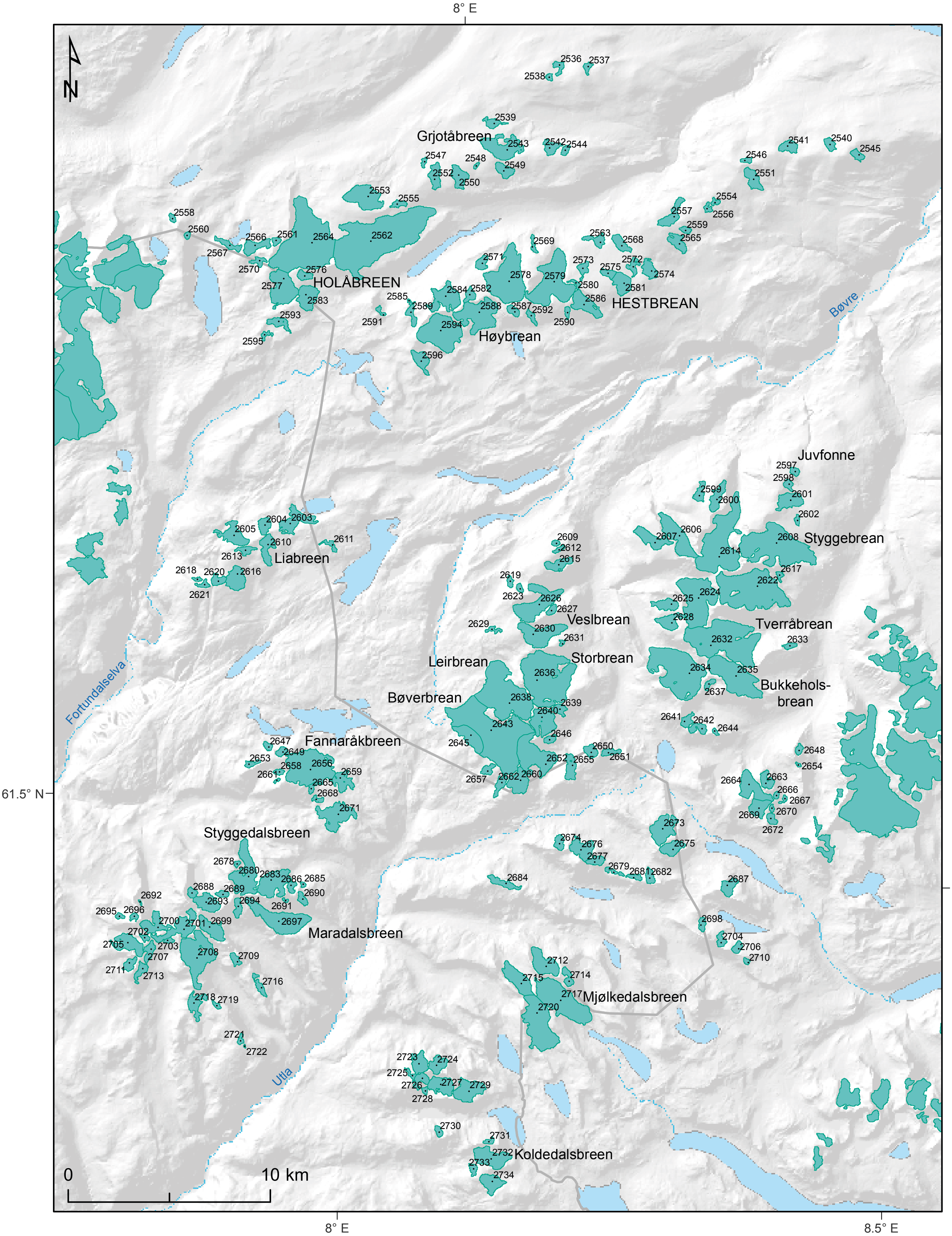
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2477			20060916	0.38	1549	1719	13	NW
2478	Austdalsbreen	JOB	20060916	10.38	1222	1755	5	SE
2479			20060916	0.18	1568	1707	14	SE
2480	Stigaholtbreen	JOB	20060916	12.50	819	1773	8	S
2481	Erdalsbreen	JOB	20060916	10.32	930	1906	11	NW
2482		KUP	20060916	1.20	1364	1741	13	NE
2483		KUP	20060916	0.06	1658	1689	12	N
2484			20060916	2.01	1396	1760	17	NE
2485		JOB	20060916	1.78	1336	1756	21	NE
2486		JOB	20060916	1.53	1451	1904	15	SW
2487		JOB	20060916	1.63	1338	1850	22	SE
2488		JOB	20060916	1.15	1492	1757	8	SW
2489		JOB	20060916	0.59	1658	1884	10	S
2490		JOB	20060916	3.62	1299	1756	8	SE
2491		VIV	20060916	0.77	1353	1681	19	N
2492		VIV	20060916	0.58	1552	1677	7	W
2493		VIV	20060916	0.40	1409	1689	15	NE
2494			20060916	0.19	1488	1638	20	N
2495	Vestre Kollebreen		20060916	0.70	1421	1781	17	NE
2496			20060916	0.09	1387	1516	30	NE
2497		TBB	20060916	0.20	1535	1622	9	N
2498		TBB	20060916	0.73	1540	1826	19	N
2499			20060916	0.23	1658	1760	13	E
2500		TBB	20060916	1.06	1527	1902	21	E
2501			20060916	0.04	1684	1754	15	E
2502	Austre Kollebreen	HAB	20060916	1.86	1393	1934	13	N
2503		GRE	20060916	1.10	1256	1828	11	NE
2504			20060916	0.06	1560	1631	20	N
2505		FOR	20060916	2.68	1487	2012	12	NE
2506		TBB	20060916	0.81	1576	1903	13	S
2507			20060916	0.34	1514	1629	10	N
2508		GRE	20060916	1.72	1456	1801	9	SE
2509		FOR	20060916	3.11	1415	1940	9	SE
2510		HAB	20060916	1.17	1557	1880	10	NW
2511		GRE	20060916	0.50	1672	1803	5	S
2512		HAB	20060916	0.35	1680	1814	7	W
2513		HAB	20060916	1.23	1492	1956	18	SE
2514		HAB	20060916	11.35	1265	1957	8	E
2515		HAB	20060916	1.63	1534	1719	9	NW
2516		HAB	20060916	4.38	1316	1713	7	S
2517		HAB	20060916	2.81	1415	1670	7	S
2518			20060916	0.04	1497	1583	25	N
2519		SPB	20060916	1.23	1468	1747	12	N
2520	Leirbotnbreen	SPB	20060916	2.52	1279	1755	12	NE
2521			20030809	0.10	1353	1455	21	NE
2522		SPB	20060916	2.05	1394	1748	8	W
2523			20030809	0.41	1420	1594	16	N
2524		SPB	20060916	0.81	1451	1662	8	SW
2525		SPB	20060916	7.07	1320	1760	6	E

Western part of Spørteggbreen (SPB). 2527 in the front, 2532 in the middle. Jostedalsbreen in the background, October 2010.
Photo: Hallgeir Elvehøy, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2526			20030809	0.53	1456	1661	15	E
2527		SPB	20060916	6.08	1356	1698	5	S
2528		SPB	20060916	1.77	1459	1616	6	SE
2529		SVB	20030809	0.90	1446	1697	12	NE
2530		SPB	20060916	1.50	1420	1621	5	S
2531			20060916	0.32	1434	1556	13	N
2532			20060916	1.85	1336	1566	7	E
2533	Sveidalsbreen	SVB	20030809	1.55	1367	1683	11	E
2534			20060916	0.18	1551	1683	11	NE
2535			20060916	0.03	1566	1643	17	NE

28. **Jotunheimen - West**

Glacier ID 2536 - 2734



Surtningsbreen (2655) in August 2007. Distinct lateral moraines mark the LIA extent of this glacier. Photo: Petter Zachrisson.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2536	Kvitingsbreen		20030809	0.21	1683	1839	12	NE
2537			20030809	0.15	1784	1896	13	NE
2538	Kvitingsbreen		20030809	0.09	1847	1908	10	NE
2539			20030809	0.32	1615	1738	13	N
2540	Kluftutefonni		20030809	0.26	1744	1968	20	N
2541	Lendbreen		20030809	0.43	1679	1917	18	NE
2542			20030809	0.41	1648	1939	22	N
2543	Grjotåbreen		20030809	1.60	1669	2046	15	NE
2544			20030809	0.15	1737	1905	19	N
2545			20030809	0.23	1700	1998	22	SE
2546			20030809	0.12	1820	1934	20	N
2547			20030809	0.10	1666	1777	13	N
2548			20030809	0.05	1949	2013	11	S
2549			20030809	0.46	1724	2019	18	SE
2550			20030809	0.63	1697	1925	12	SE
2551	Møyldulbreen		20030809	0.57	1639	1947	18	E
2552	Heimstre Gjelåbreen		20030809	0.56	1788	1912	10	NE
2553	Midtre Gjelåbreen		20030809	1.61	1651	1929	14	NE
2554			20030809	0.11	1749	1818	9	E
2555			20030809	0.20	1722	1843	10	E
2556			20030809	0.13	1782	1880	13	E
2557			20030809	0.68	1686	1998	12	NE
2558			20060916	0.11	1581	1807	26	N
2559			20030809	0.14	1669	1864	22	SE
2560			20060916	0.09	1618	1794	26	NE
2561			20030809	0.14	1729	1937	28	NW
2562	Holåbreen	HOL	20030809	8.79	1472	1929	6	E
2563			20030809	0.36	1544	1762	22	N
2564	Ytre Gjelåbreen	HOL	20030809	6.60	1459	2020	8	N
2565	Sulbrean		20030809	0.51	1577	1926	20	SE
2566			20030809	0.61	1524	1848	20	N
2567			20030809	0.33	1465	1747	24	N
2568	Hestfonni		20030809	0.43	1628	1778	14	N
2569			20030809	0.14	1429	1800	29	NE
2570			20030809	0.22	1680	1869	15	NW
2571			20030809	0.32	1697	1889	15	N
2572	Runningsbrean		20030809	0.29	1720	1802	6	E
2573			20030809	0.28	1802	1936	9	NE
2574	Runningsbrean		20030809	0.50	1550	1760	19	E
2575		HEB	20030809	0.23	1835	1919	11	N
2576			20030809	0.27	1708	1963	21	E
2577	Holåbreen	HOL	20030809	1.75	1599	1959	10	SW
2578	Ytstebreen		20030809	3.56	1566	2145	13	N
2579	Heimaste Hestbreen		20030809	3.36	1577	2120	13	N
2580			20030809	0.11	1946	1974	6	NE
2581	Hestbrean	HEB	20030809	0.76	1752	1922	9	E
2582		HØY	20030809	0.28	1926	2018	8	NW
2583		HOL	20030809	0.96	1498	1788	17	E
2584			20030809	1.38	1570	2109	17	N

Leirbrean (2638), part of Smørstabbrean, September 2007. Length change measurements have been carried out since 1909 on this outlet glacier. Photo: Miriam Jackson, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2585			20030809	0.02	1462	1577	32	N
2586	Heksetebrean		20030809	0.99	1613	2047	15	E
2587			20030809	0.23	1993	2121	11	S
2588	Høybrean	HØY	20030809	2.28	1620	2084	15	SE
2589			20030809	0.32	1537	1778	17	N
2590			20030809	0.12	1720	2054	29	S
2591			20030809	0.10	1442	1618	31	NE
2592			20030809	0.19	1671	2016	20	SE
2593			20030809	0.40	1570	1644	6	SE
2594			20030809	2.73	1598	1978	9	SE
2595			20030809	0.13	1559	1689	14	E
2596			20030809	0.56	1594	1849	19	E
2597	Juvfonne		20030809	0.15	1836	1964	17	NE
2598	Kjelen		20030809	0.18	1835	1984	21	E
2599			20030809	0.35	1610	2007	21	N
2600	Storgrovbrean		20030809	0.63	1640	2172	19	N
2601	Vesljuvbrean		20030809	0.80	1835	2198	16	E
2602			20030809	0.10	1930	1973	8	E
2603	Liabreen		20030809	1.09	1460	1784	17	NE
2604			20030809	0.41	1565	1857	18	N
2605	Liabreen		20030809	0.96	1407	1834	18	N
2606	Heimre Illåbrean		20030809	1.65	1578	2121	13	N
2607	Dumhøbrean		20030809	0.92	1750	2171	14	NW
2608	Styggebrean		20030809	4.92	1665	2415	13	E

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Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2609			20030809	0.10	1731	1887	27	N
2610	Liabreen		20030809	0.67	1459	1840	20	SE
2611			20030809	0.18	1477	1591	11	NE
2612			20030809	0.11	1848	2013	17	NE
2613			20030809	0.27	1717	1823	12	SE
2614	Storjuvbrean		20030809	4.49	1393	2223	11	N
2615	Høgskridubrean		20030809	0.55	1507	2096	25	NE
2616	Liabreen		20030809	0.86	1425	1745	17	E
2617			20030809	0.12	1937	2114	22	SE
2618			20030809	0.08	1472	1584	28	N
2619	Brangsbrean		20030809	0.14	1634	1878	26	N
2620			20030809	0.30	1541	1759	18	NW
2621			20030809	0.15	1547	1726	22	N
2622	Svellnosbrean		20030809	5.08	1580	2316	12	E
2623	Brangsbrean		20030809	0.11	1757	2038	32	N
2624	Nørdre Illåbrean		20030809	3.21	1632	2175	12	NW
2625			20030809	0.55	1715	2024	17	NW
2626	Hurrbrean		20030809	2.02	1400	2045	16	NE
2627			20030809	0.18	1705	1971	28	N
2628			20030809	0.66	1795	2245	17	NW
2629	Nufsfonne		20030809	0.15	1637	1832	20	NW
2630	Veslbrean		20030809	1.66	1424	2053	17	NE
2631	Jervefonne		20030809	0.06	1734	1948	33	E
2632	Tverråbrean		20030809	5.35	1475	2211	13	E

Smørstabbrean (SMB) with outlet glaciers Leirbrean (2638) to the left and Bøverbrean (2643) to the right, August 2007.
Photo: Bjørn Lytskjold, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2633			20030809	0.15	1734	2066	27	E
2634	Søre Illåbreen		20030809	4.60	1558	2093	11	NW
2635	Bukkeholsbrean		20030809	2.93	1590	2132	11	SE
2636	Storbrean		20030809	5.22	1398	2079	14	NE
2637			20030809	0.17	1808	2026	25	SE
2638	Leirbrean	SMB	20030809	4.76	1513	2089	12	NW
2639			20030809	0.28	1639	1986	27	SE
2640	Bjørnbrean		20030809	1.26	1520	2186	26	E
2641			20030809	0.28	1663	1896	20	NE
2642			20030809	0.33	1667	1938	24	N
2643	Bøverbrean	SMB	20030809	6.75	1432	2143	8	NW
2644			20030809	0.07	1820	2074	30	NW
2645		SMB	20030809	1.00	1569	1909	9	NW
2646			20030809	0.19	1493	1806	27	NE
2647			20030809	0.14	1467	1688	32	NE
2648			20030809	0.15	1667	1889	24	NE
2649			20030809	0.21	1589	1942	31	N
2650			20030809	0.32	1625	1888	22	NW
2651			20030809	0.24	1636	1904	21	NE
2652	Sandelvbrean	SMB	20030809	2.36	1393	2141	14	SE
2653			20030809	0.17	1564	1779	32	N
2654			20030809	0.04	1763	1885	30	NE
2655	Surtningsbreen		20030809	0.54	1498	1929	23	NE
2656	Fannaråkbreen	FAB	20030809	3.33	1448	1982	14	NE

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Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2657			20030809	0.24	1727	1999	19	W
2658			20030809	0.12	1688	1828	18	W
2659		FAB	20030809	0.68	1520	1661	8	NE
2660		SMB	20030809	0.93	1550	2033	23	E
2661			20030809	0.04	1808	1897	28	NW
2662			20030809	0.34	1727	1988	23	W
2663			20030809	0.40	1683	2027	23	NE
2664		VIB	20030809	1.23	1467	2050	19	N
2665		FAB	20030809	0.15	1658	1813	21	E
2666			20030809	0.09	1716	1918	31	NE
2667			20030809	0.08	1639	1873	24	N
2668			20030809	0.13	1574	1661	10	SE
2669		VIB	20030809	0.66	1858	2056	11	SW
2670			20030809	0.08	1873	2036	30	SE

Berdalsbreen (2705) with the peak Store Austanbottstind in the background (2204 m.a.s.l.), August 2010. Photo: Bjørn Lytskjold, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2671			20030809	1.55	1391	1697	9	E
2672			20030809	0.21	1719	1978	22	E
2673	Høgvaglbreen		20030809	1.29	1571	1986	13	N
2674			20030809	0.29	1480	1847	26	N
2675	Høgvaglbreen		20030809	0.61	1623	2027	20	NE
2676	Kristenbreen		20030809	0.86	1448	1998	28	NE
2677	Alvbreen		20030809	0.32	1582	1998	25	NE
2678			20030809	0.07	1543	1779	32	NE
2679			20030809	0.16	1594	1712	23	N
2680	Styggedalsbreen		20030809	2.02	1280	2253	23	N
2681			20030809	0.15	1661	1861	27	N
2682			20030809	0.27	1590	1938	25	N
2683	Gjertvassbreen		20030809	1.57	1359	2317	26	NE
2684			20030809	0.45	1534	1825	23	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2685			20030809	0.06	1646	1826	32	N
2686			20030809	0.19	1567	1933	33	N
2687			20030809	0.47	1605	1972	23	NE
2688			20030809	0.19	1488	1743	28	NE
2689			20030809	0.16	1621	1920	24	W
2690			20030809	0.21	1695	1911	19	SE
2691			20030809	0.04	1911	2106	33	S
2692			20030809	0.02	1545	1670	36	NE
2693	Skagastølsbreen		20030809	0.82	1509	1871	20	N
2694	Slingsbybreen		20030809	0.29	1550	2138	31	S
2695			20030809	0.10	1526	1723	28	N
2696			20030809	0.12	1713	2037	33	N
2697	Maradalsbreen		20030809	2.38	1256	2100	15	E
2698			20030809	0.19	1502	1780	24	NE
2699	Midtmaradalsbreen		20030809	0.85	1373	1827	19	E
2700	Ringsbreen		20030809	0.76	1272	1844	25	NE
2701		RIN	20030809	1.22	1487	2059	25	NW
2702			20030809	0.12	1814	2104	29	W
2703		RIN	20030809	0.11	1679	1785	16	S
2704			20030809	0.23	1558	1878	30	NE
2705	Berdalsbreen		20030809	0.99	1523	2063	21	NW
2706			20030809	0.21	1608	1915	24	NE
2707			20030809	0.36	1543	1913	30	SE
2708	Stølsmaradalsbreen		20030809	2.64	1325	1876	17	E
2709			20030809	0.21	1673	1907	21	S
2710			20030809	0.08	1723	1882	23	SE
2711			20030809	0.29	1628	2027	31	W
2712			20030809	1.15	1510	1962	21	N
2713			20030809	0.32	1553	1999	29	SE
2714			20030809	0.30	1702	1965	27	NE
2715	Skogadalsbreen	SMU	20030809	1.19	1473	1964	18	N
2716			20030809	0.28	1436	1701	17	E
2717	Mjølkedalsbreen	SMU	20030809	3.21	1384	1937	12	SE
2718			20030809	0.63	1431	1690	15	E
2719			20030809	0.10	1439	1582	27	NE
2720	Uranosbreen	SMU	20030809	2.95	1531	2003	11	S
2721			20030809	0.11	1507	1580	13	E
2722			20030809	0.01	1467	1510	24	E
2723		SNB	20030809	0.66	1505	1942	22	N
2724			20030809	0.55	1496	1923	25	NE
2725		SNB	20030809	0.13	1766	1925	13	NW
2726		SNB	20030809	0.35	1641	1921	23	SE
2727		SNB	20030809	0.87	1605	1919	15	W
2728			20030809	0.08	1500	1622	15	S
2729	Snøggeken		20030809	1.18	1409	1850	15	NE
2730			20030809	0.15	1413	1764	28	N
2731			20030809	0.11	1528	1757	25	N
2732	Koldedalsbreen		20030809	1.27	1402	1785	12	E
2733			20030809	0.18	1567	1784	20	NW
2734	Koldedalsbreen		20030809	0.75	1484	1806	17	NE

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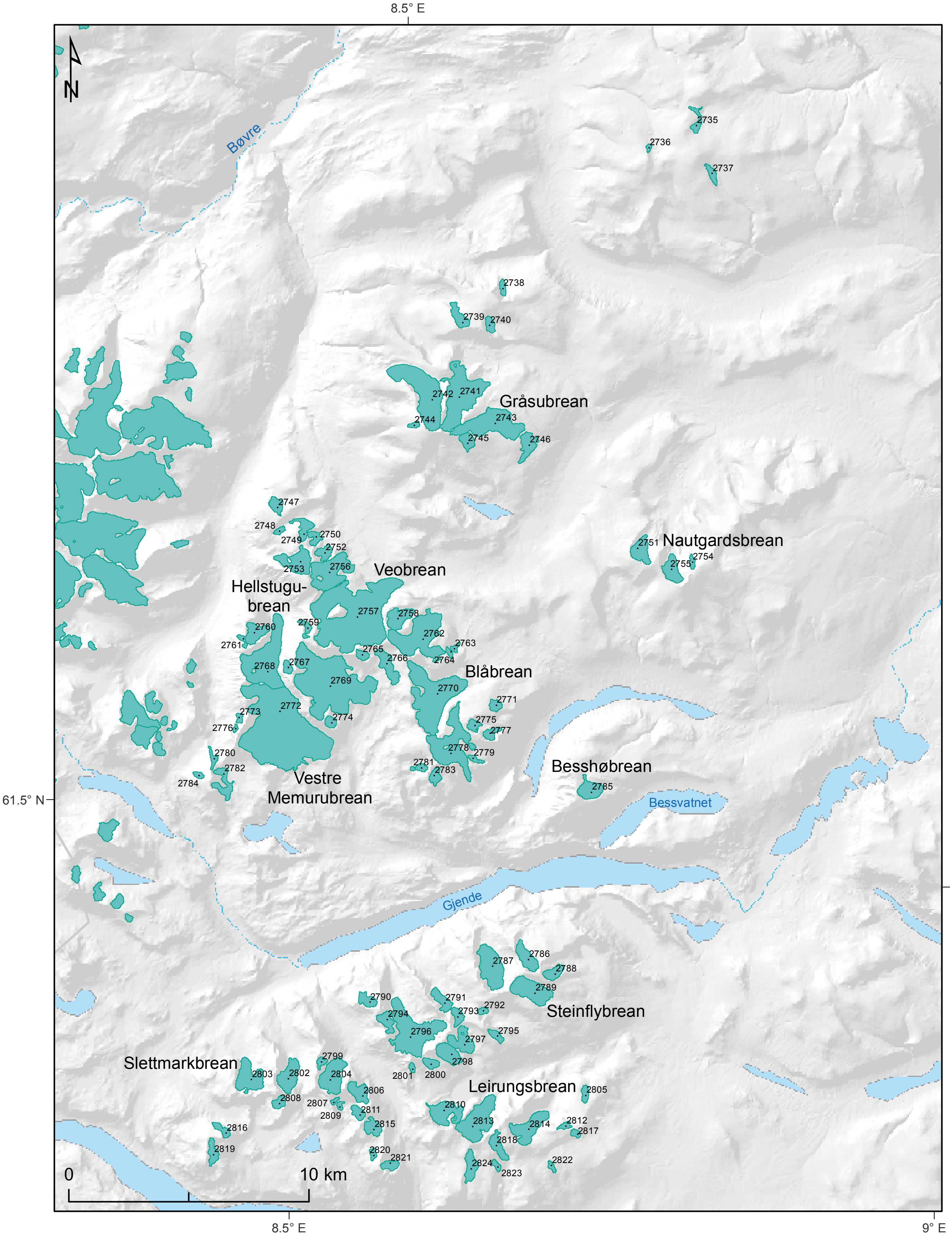
Glacier ID 2735 - 2824



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2735	Handklefonne		20030809	0.25	1640	1968	27	E
2736	Storfonne		20030809	0.06	1769	1945	32	NE
2737			20030809	0.21	1731	1923	18	E
2738			20030809	0.14	1620	1845	21	NE
2739	Smiugjelsbrean		20030809	0.43	1798	2127	14	N
2740			20030809	0.21	1755	2005	26	E
2741		GGG	20030809	2.71	1710	2280	13	NE
2742	Grotbrean	GGG	20030809	2.83	1798	2293	10	NW
2743	Gråsubrean	GGG	20030809	2.17	1860	2399	12	NE
2744			20030809	0.10	2220	2373	17	W
2745	Glitterbrean	GGG	20030809	0.33	2093	2302	15	SE
2746			20030809	0.57	1711	1966	18	E
2747			20030809	0.30	1807	2009	16	N
2748			20030809	0.10	1852	1902	9	NE
2749			20030809	0.42	1793	2045	15	NE
2750			20030809	0.23	1661	1929	24	E
2751	Nautgardsbrean		20030809	0.62	1694	1988	15	NE
2752			20030809	0.30	1658	1940	21	NE
2753			20030809	0.97	1807	2320	19	NW
2754			20030809	0.11	1878	2138	27	NW
2755	Nautgardsbrean		20030809	0.59	1746	1976	13	N
2756			20030809	1.74	1651	2188	15	E
2757	Veobrean		20030809	6.99	1579	2270	10	NE
2758			20030809	0.68	1903	2119	12	NE
2759			20030809	0.18	1838	2290	24	NW
2760			20030809	0.57	1635	2041	20	NE
2761			20030809	0.10	1977	2178	26	N
2762	Styggehøbrean		20030809	2.58	1723	2238	13	NE
2763			20030809	0.09	1582	1773	25	NE
2764			20030809	0.08	1801	1965	34	NE
2765			20030809	0.18	2002	2238	23	E
2766			20030809	0.65	1872	2097	15	SW
2767			20030809	0.17	1988	2182	20	NW
2768	Hellstugubrean	HMB	20030809	2.81	1494	2212	13	NE
2769	Austre Memurubrean		20030809	5.90	1705	2272	10	SE
2770	Blåbrean		20030809	3.49	1639	2121	13	NE
2771			20030809	0.21	1774	1955	18	E
2772	Vestre Memurubrean	HMB	20030809	8.58	1631	2229	7	E
2773			20030809	0.10	1860	2069	30	W
2774			20030809	0.19	1897	2082	21	E
2775			20030809	0.20	1845	2052	20	E
2776			20030809	0.05	1878	1991	26	NW
2777			20030809	0.23	1756	1955	17	NE
2778			20030809	2.38	1584	2316	15	E
2779			20030809	0.11	1740	1939	24	NE
2780			20030809	0.15	1626	1961	19	N
2781			20030809	0.16	1827	2102	20	W
2782	Semelbrean		20030809	0.54	1652	2057	21	E
2783			20030809	0.25	1838	2129	27	SE

Hellstugubrean (2768) in 2011 and 1942 (inset). The glacier has retreated 0.8 km in this period. In 1942 the glacier was connected with the small glacier to the right (2760); the medial moraine shows where the two glaciers merge. The glaciers became detached in the 1960s. Annual mass balance measurements began in 1962. Photos: Liss M. Andreassen, NVE, and unknown.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2784			20030809	0.10	1763	2016	30	NW
2785	Besshøbrean		20030809	0.63	1801	2100	15	NE
2786			20030809	0.61	1742	2108	15	N
2787			20030809	1.40	1589	2035	14	N
2788			20030809	0.34	1824	2071	18	NE
2789	Steinflybrean		20030809	1.25	1912	2166	9	SE
2790			20030809	0.32	1794	2063	22	N
2791	Skarvflybrean		20030809	0.42	1697	2076	20	N
2792			20030809	0.10	1768	1954	25	E
2793			20030809	0.27	1901	2076	13	NE
2794			20030809	0.38	1679	2221	33	NE
2795			20030809	0.19	1858	2036	17	E
2796			20030809	2.60	1527	2104	14	N
2797	Skarvflyløyftbrean	SFB	20030809	0.73	1720	2111	17	E
2798		SFB	20030809	0.64	1912	2218	13	SE
2799			20030809	0.13	1753	2003	31	E
2800			20030809	0.23	1899	1998	12	S

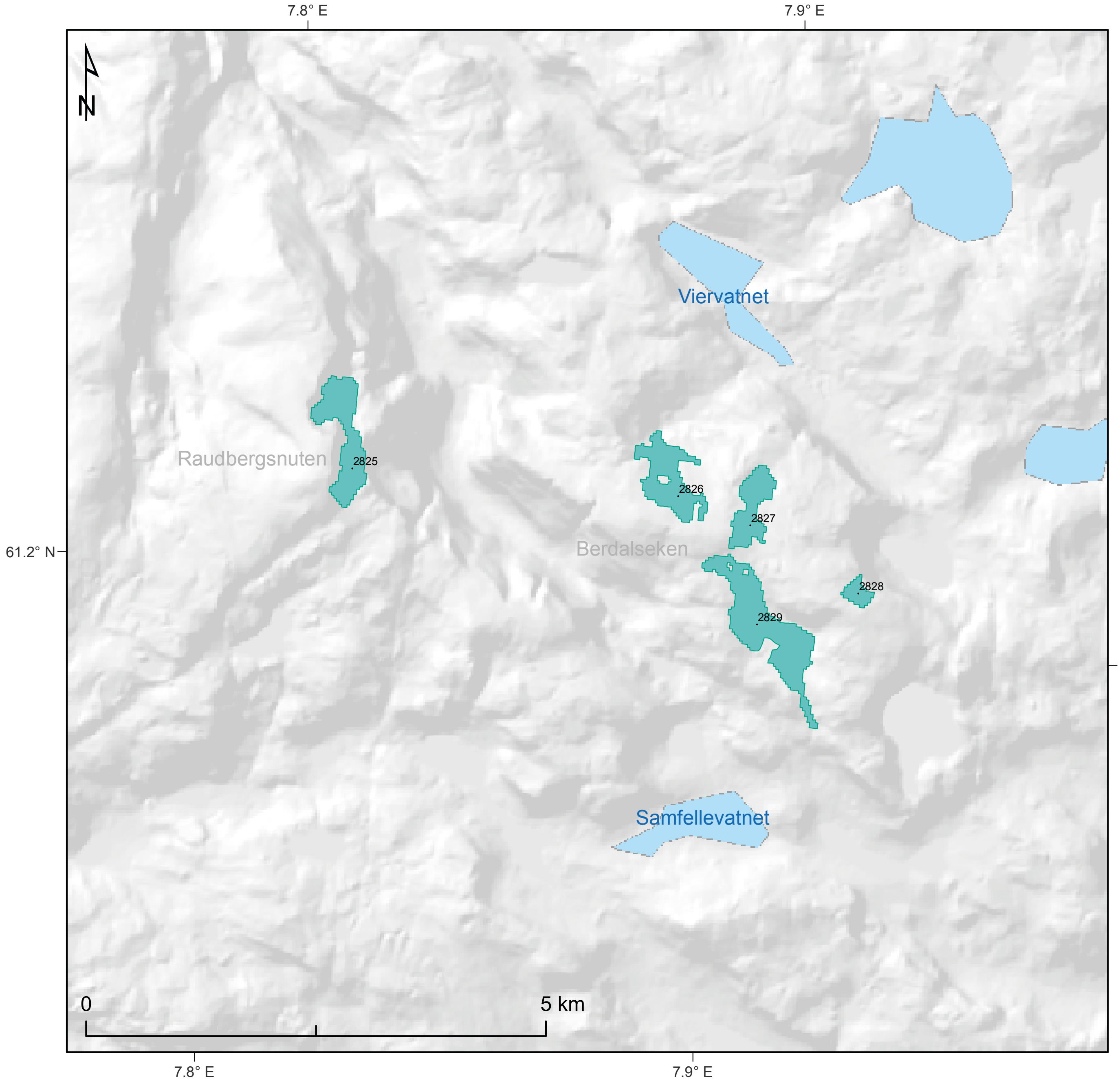
Svartdalsbrean (2804), August 2011. Photo: Petter Zachrisson

29. **Jotunheimen - East** | Southern Norway

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2801			20030809	0.08	1795	2013	29	SE
2802	Langedalsbrean		20030809	0.84	1533	1960	18	NE
2803	Slettmarkbrean		20030809	1.06	1476	2028	18	N
2804	Svartdalsbrean		20030809	1.09	1587	2162	21	NE
2805			20030809	0.18	1671	1873	18	NE
2806			20030809	0.52	1670	2069	24	NE
2807			20030809	0.06	1926	2054	29	SE
2808			20030809	0.23	1819	2132	27	SW
2809			20030809	0.08	1772	1889	20	SE
2810			20030809	0.99	1578	1956	17	N
2811			20030809	0.24	1801	2105	26	W
2812			20030809	0.12	1865	2079	24	N
2813	Leirungsbrean		20030809	1.70	1502	2019	16	N
2814			20030809	1.07	1617	2075	15	NE
2815			20030809	0.40	1857	2058	13	SE
2816			20030809	0.22	1713	1992	27	NE
2817			20030809	0.11	1829	1997	26	SE
2818			20030809	0.44	1742	2124	19	SE
2819			20030809	0.32	1661	1968	21	SE
2820			20030809	0.11	1793	1872	13	NW
2821			20030809	0.24	1553	1954	31	NE
2822			20030809	0.09	1735	1816	11	E
2823			20030809	0.11	1707	1887	29	E
2824	Kalvehøgdbreene		20030809	0.50	1745	2042	16	SE

30. Årdalsfjella

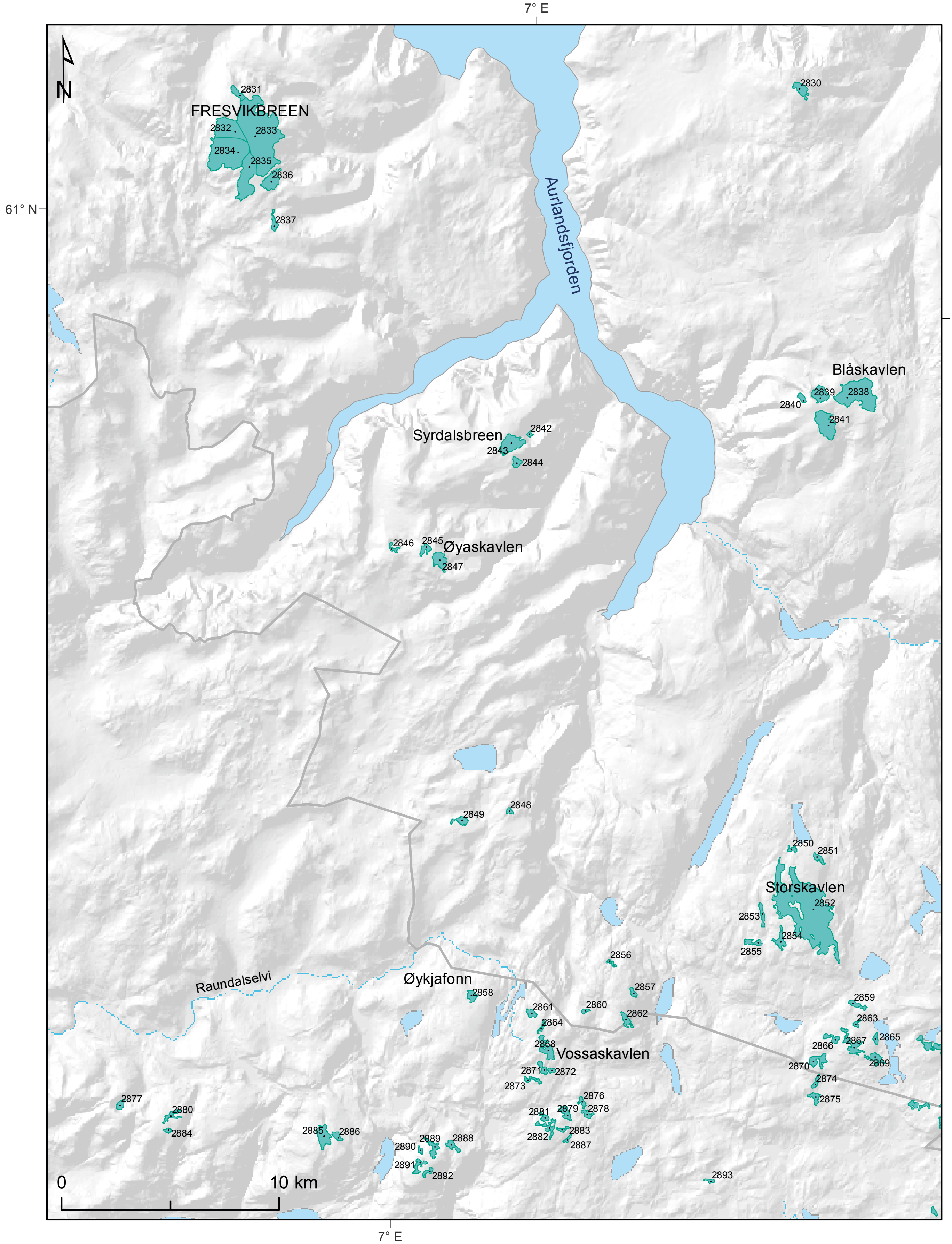
Glacier ID 2825 - 2829



Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2825			20030809	0.39	1419	1757	21	NE
2826			20030809	0.36	1462	1766	19	N
2827			20030809	0.24	1587	1760	11	NE
2828			20030809	0.07	1664	1765	18	NE
2829			20030809	0.64	1569	1744	9	E

31. **Voss - Aurland**

Glacier ID 2830 - 2893



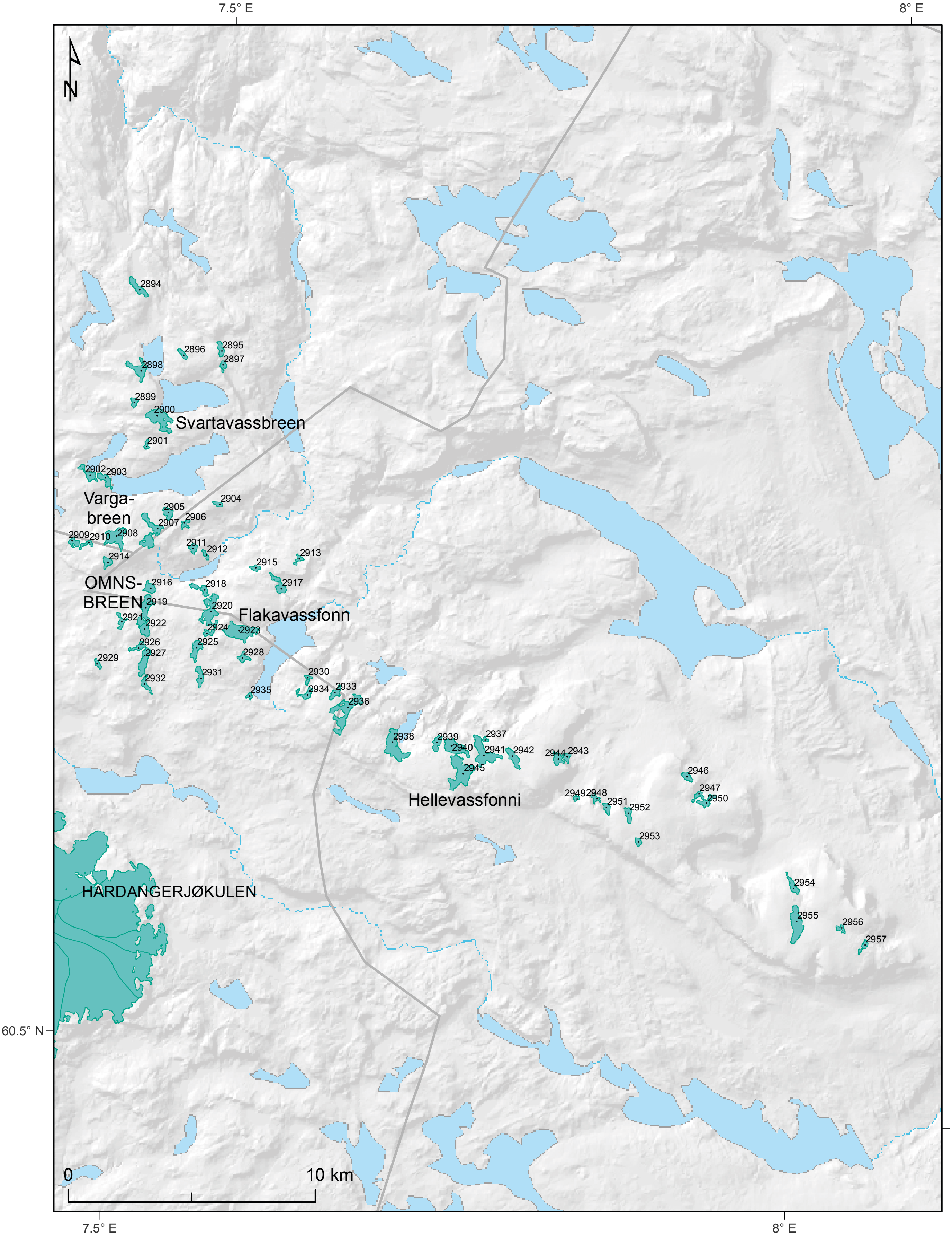
Blåskavlen (2838) and glacier 2841, August 2010. Photo: Hallgeir Elvehøy, NVE.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2830			20060916	0.29	1513	1672	18	NE
2831		FRB	20060916	0.18	1327	1547	27	NE
2832		FRB	20060916	1.03	1458	1630	6	NW
2833		FRB	20060916	4.32	1252	1642	11	NE
2834		FRB	20060916	2.27	1414	1640	6	W
2835		FRB	20060916	1.24	1367	1641	8	S
2836			20060916	0.51	1311	1503	13	E
2837	Gryteskarvbreen		20060916	0.15	1266	1436	16	NE
2838	Blåskavlen		20060916	1.78	1428	1706	10	NE
2839			20060916	0.41	1381	1752	23	N
2840			20060916	0.10	1457	1719	30	NW
2841			20060916	0.83	1453	1752	16	E
2842			20030809	0.05	1195	1259	19	NE
2843	Syrdalsbreen		20030809	0.65	1452	1742	11	E
2844			20030809	0.15	1450	1658	27	E
2845			20030809	0.15	1498	1577	9	N
2846			20030809	0.09	1394	1587	31	NE
2847	Øyaskavlen		20030809	0.37	1369	1584	18	E
2848			20030809	0.06	1348	1443	22	NE
2849			20030809	0.17	1341	1507	22	N
2850			20030809	0.08	1505	1593	17	N
2851			20030809	0.12	1490	1571	11	E
2852	Storskavlen		20030809	5.86	1387	1710	7	NE

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2853			20030809	0.16	1557	1604	10	E
2854			20030809	0.22	1585	1660	4	NW
2855			20030809	0.15	1497	1616	19	N
2856			20030809	0.06	1308	1449	28	NE
2857			20030809	0.08	1353	1478	25	E
2858	Øykjafonn		20030809	0.17	1387	1546	17	N
2859			20030809	0.15	1334	1512	27	N
2860			20030809	0.06	1405	1566	25	NE
2861			20030809	0.12	1336	1472	19	N
2862			20030809	0.17	1382	1554	18	E
2863			20030809	0.06	1515	1552	8	N
2864			20030809	0.08	1473	1515	6	NE
2865			20030809	0.07	1461	1544	18	E
2866	Skomabreen		20030809	0.15	1492	1601	14	N
2867	Skomabreen		20030809	0.37	1513	1652	7	NE
2868	Vossaskavlen		20030809	0.37	1419	1553	12	E
2869			20030809	0.23	1458	1623	12	E
2870	Skomabreen		20030809	0.29	1497	1606	11	N
2871			20030809	0.13	1438	1503	7	E
2872			20030809	0.06	1380	1445	11	NE
2873			20030809	0.10	1405	1468	10	N
2874			20030809	0.10	1487	1582	21	SE
2875			20030809	0.14	1464	1521	7	NE
2876			20030809	0.09	1260	1387	23	NE
2877	Trollabotnen		20030809	0.13	1098	1249	20	NE
2878	Brattskavlen		20030809	0.12	1269	1416	19	NE
2879			20030809	0.19	1264	1460	19	N
2880			20030809	0.17	1349	1553	16	N
2881			20030809	0.10	1288	1426	18	N
2882			20030809	0.22	1378	1475	7	N
2883			20030809	0.07	1399	1458	8	E
2884	Olsskavlen		20030809	0.06	1517	1567	8	E
2885	Såtaskavlen		20030809	0.45	1349	1573	14	NE
2886			20030809	0.12	1367	1483	18	NE
2887			20030809	0.06	1272	1338	10	E
2888			20030809	0.16	1380	1523	17	NE
2889			20030809	0.22	1318	1535	12	N
2890			20030809	0.05	1297	1476	27	N
2891			20030809	0.16	1433	1601	14	N
2892			20030809	0.09	1454	1595	19	E
2893			20030809	0.05	1296	1384	22	N

32. **Hallingskarvet**

Glacier ID 2894 - 2957



Glacier 2898 (Alsnosibreen), September 2006. Storskavlen is seen in the background. Photo: Arve Tvede. The inset shows the glacier in late summer 1941. Photo: Kvistgård. Lake Mellomvatn in the foreground is regulated and the water level was 5 metres lower in 2006 than in 1941. The glacier has changed little in this period. In fact, there are signs of a net thickening in the central part of the glacier where a small rock was visible in 1941, but not in 2006. (Tvede and Laumann, 2006).

32. **Hallingskarvet** | Southern Norway

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2894			20030809	0.21	1516	1602	17	NE
2895			20030809	0.11	1469	1612	26	NE
2896			20030809	0.08	1578	1637	8	N
2897			20030809	0.07	1457	1555	22	E
2898	Alsnosibreen		20030809	0.29	1451	1636	20	NE
2899			20030809	0.08	1656	1680	6	S
2900	Svartavassbreen		20030809	0.54	1442	1663	15	NE
2901			20030809	0.05	1524	1556	9	NE
2902			20030809	0.18	1475	1596	18	NE
2903			20030809	0.16	1432	1562	21	NE
2904			20030809	0.06	1479	1544	18	NE
2905			20030809	0.14	1571	1644	9	NE
2906			20030809	0.08	1521	1657	21	SE
2907	Vargabreen		20030809	0.45	1655	1739	5	NE
2908	Vargabreen		20030809	0.42	1538	1700	15	NW
2909			20030809	0.10	1500	1558	9	NE
2910			20030809	0.07	1527	1576	12	N
2911			20030809	0.09	1504	1578	14	NE
2912			20030809	0.05	1353	1490	23	E

Vargabreen in September 2006. Photo: Arve Tvede. The inset shows the glacier in late summer 1941. Photo: Kvistgård. The lake is regulated, but the water level was approximately the same in both photos. From 1941 to 1969 the glacier has nearly disappeared.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2913			20030809	0.07	1429	1538	18	NE
2914			20030809	0.11	1575	1668	15	SE
2915			20030809	0.07	1464	1576	26	N
2916			20030809	0.15	1384	1535	19	NE
2917	Storfonn		20030809	0.20	1444	1607	21	E
2918			20030809	0.14	1370	1557	20	N
2919		OMN	20030809	0.37	1468	1590	10	E
2920			20030809	0.49	1502	1677	8	NE
2921			20030809	0.10	1519	1577	6	N
2922		OMN	20030809	0.16	1499	1592	13	E
2923	Flakavassfonn		20030809	0.62	1490	1711	13	NE
2924			20030809	0.08	1621	1651	4	S
2925			20030809	0.22	1561	1606	4	SE
2926	Omnsbreen		20030809	0.11	1503	1579	10	NE
2927	Omnsbreen		20030809	0.29	1498	1596	14	E
2928			20030809	0.11	1638	1667	4	E
2929			20030809	0.06	1533	1564	7	NE
2930			20030809	0.06	1528	1573	9	SE
2931			20030809	0.16	1518	1559	5	E

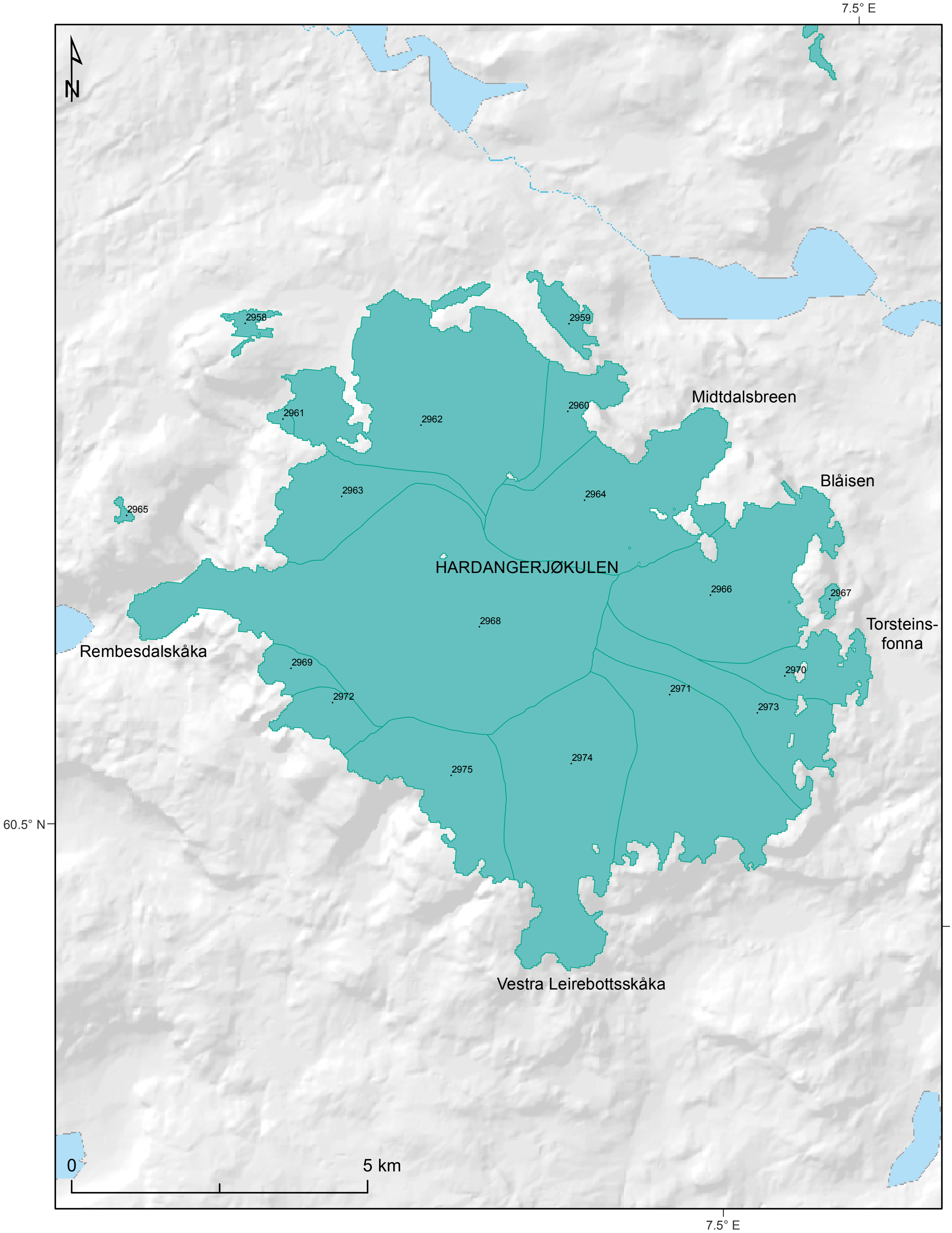
Part of Omnsbreen (2919), August 2006. The glacier covered an area of ~6 km² at its LIA maximum extent, but shrunk greatly in the 20th century. Omnsbreen consists today of several smaller parts and survives due to windblown snow (Lilleøren, 2007). Photo: Karianne Staalesen Lilleøren.

32. **Hallingskarvet** | Southern Norway

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2932			20030809	0.11	1417	1515	19	E
2933			20030809	0.13	1643	1742	12	N
2934			20030809	0.13	1561	1669	13	N
2935			20030809	0.05	1463	1512	11	NE
2936			20030809	0.64	1571	1789	9	NE
2937			20030809	0.03	1541	1675	28	N
2938			20030809	0.58	1516	1741	18	NE
2939			20030809	0.15	1577	1775	18	N
2940			20030809	0.37	1617	1762	15	N
2941			20030809	0.55	1561	1807	12	N
2942			20030809	0.21	1739	1834	6	N
2943			20030809	0.08	1467	1624	30	E
2944			20030809	0.15	1677	1858	21	NE
2945	Hellevassfonni		20030809	0.74	1660	1857	10	E
2946			20030809	0.10	1561	1678	20	NE
2947			20030809	0.09	1496	1738	27	NE
2948			20030809	0.08	1533	1685	24	NE
2949			20030809	0.04	1512	1631	28	N
2950			20030809	0.16	1487	1785	28	N
2951			20030809	0.09	1523	1824	35	N
2952			20030809	0.12	1625	1860	26	NE
2953			20030809	0.07	1821	1861	8	E
2954			20030809	0.15	1498	1684	23	NE
2955			20030809	0.50	1717	1832	9	NE
2956			20030809	0.07	1749	1775	5	E
2957			20030809	0.08	1669	1743	11	E

33. **Hardangerjøkulen**

Glacier ID 2858 - 2975



33. **Hardangerjøkulen** | Southern Norway

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2958			20030809	0.29	1412	1713	23	N
2959			20030809	0.68	1403	1637	18	NE
2960		HAJ	20030809	1.68	1421	1815	7	NE
2961		HAJ	20030809	0.12	1440	1554	12	NW
2962	Ramnabergbreen	HAJ	20030809	9.97	1426	1823	7	NW
2963		HAJ	20030809	2.92	1539	1825	6	W
2964	Midtdalsbreen	HAJ	20030809	6.80	1384	1861	8	NE
2965			20030809	0.07	1595	1620	3	NE
2966	Blåisen	HAJ	20030809	6.56	1372	1861	6	E
2967			20030809	0.13	1500	1653	24	E
2968	Rembesdalskåka	HAJ	20030809	17.44	1038	1860	4	W
2969		HAJ	20030809	0.73	1493	1694	8	W
2970	Torsteinsfonna	HAJ	20030809	1.83	1401	1776	9	E
2971		HAJ	20030809	6.70	1199	1830	6	SE
2972		HAJ	20030809	1.12	1424	1763	8	W
2973		HAJ	20030809	3.42	1469	1845	5	SE
2974	Vestra Leirebottsskåka	HAJ	20030809	8.00	1242	1826	6	S
2975		HAJ	20030809	4.00	1518	1824	8	SW

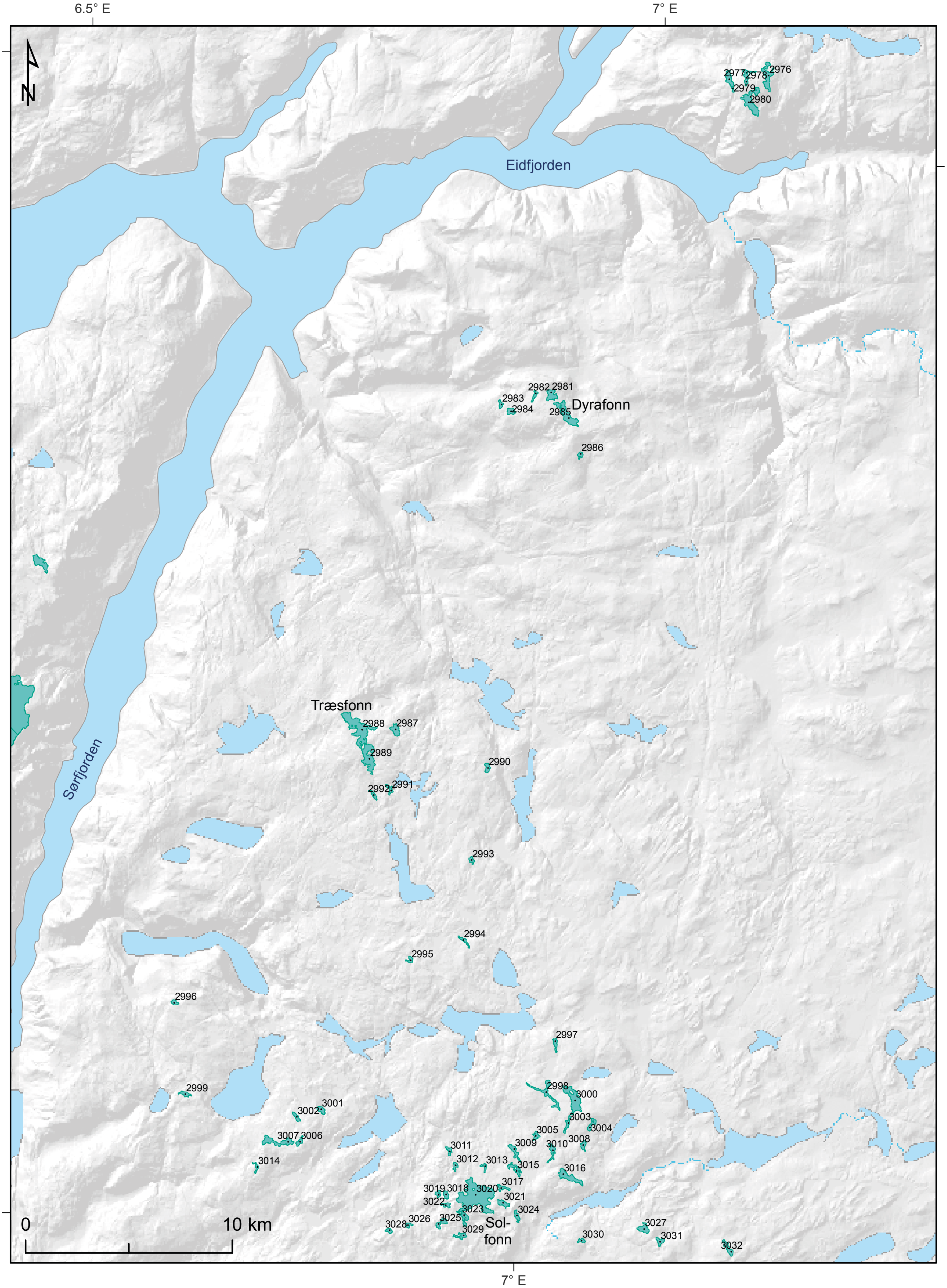
The northern outlets of Hardangerjøkulen in September 2006. From left to right: Blåisen (2966), Midtdalsbreen (2964) and glacier 2960, the latter unofficially called Bukkeskinnsbreen. Photo: Rianne Giesen.

Rembesdalskåka (2968) in October 2003. Mass balance investigations on this outlet glacier have been carried out since 1963. Photo: Hallgeir Elvehøy, NVE.

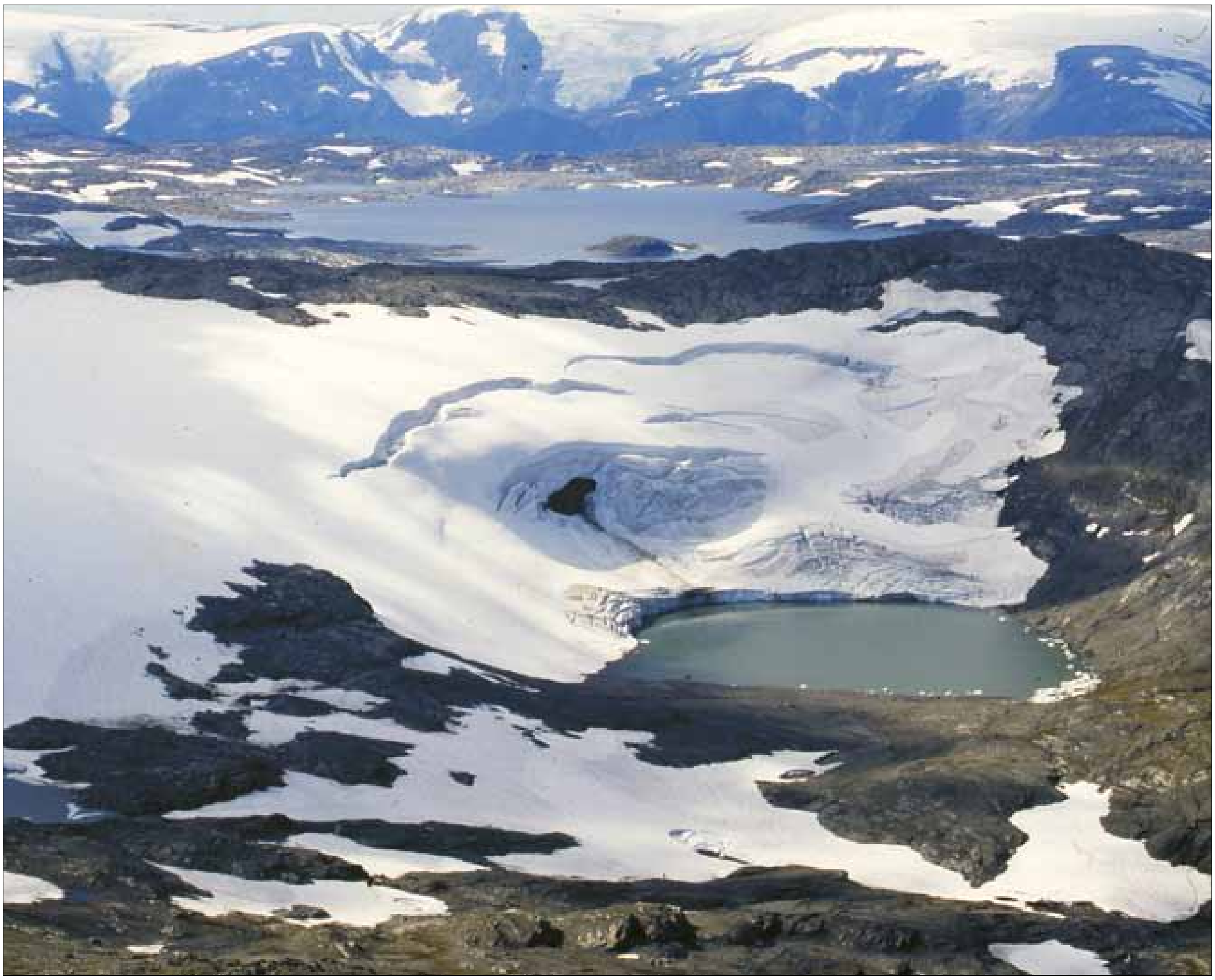
Blåisen (2966) in 1988.
Photo: Jon Ove Hagen.

Ramnabergbreen (2962) on the western
side of Hardangerjøkulen, August 2011.
Photo: Liss M. Andreassen, NVE.

34. **Hardangervidda - North** Glacier ID 2976 - 3032



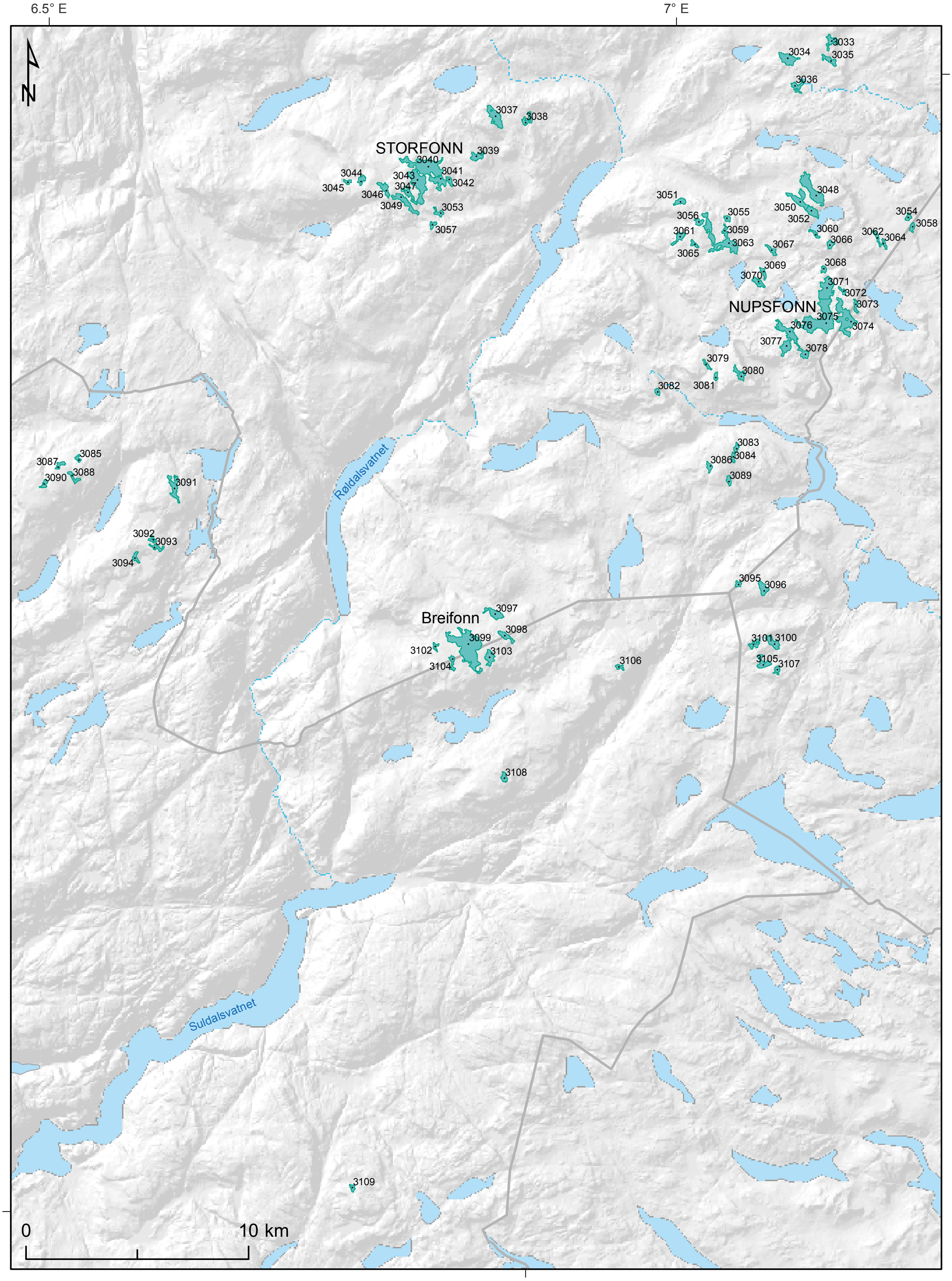
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
2976			20030809	0.33	1434	1568	12	NE
2977			20030809	0.17	1322	1580	20	N
2978			20030809	0.14	1389	1612	20	N
2979			20030809	0.03	1573	1581	2	S
2980			20030809	0.48	1345	1587	14	E
2981			20030809	0.19	1412	1552	16	NE
2982			20030809	0.06	1515	1561	14	NW
2983			20030809	0.05	1380	1502	19	N
2984			20030809	0.09	1449	1529	13	N
2985	Dyrafonn		20030809	0.44	1351	1547	22	NE
2986			20030809	0.06	1353	1442	19	E
2987			20030809	0.17	1420	1544	16	E
2988	Træsfonn		20030809	0.92	1387	1656	17	NE
2989			20030809	0.52	1455	1652	13	E
2990			20030809	0.08	1405	1491	21	E
2991			20030809	0.07	1360	1427	17	NE
2992			20030809	0.06	1396	1451	15	E
2993			20030809	0.06	1398	1486	18	E
2994			20030809	0.07	1342	1441	18	NE
2995			20030809	0.05	1436	1500	13	N
2996			20030809	0.05	1345	1482	32	N
2997			20030809	0.08	1384	1467	18	E
2998			20030809	0.29	1439	1561	8	NE
2999			20030809	0.09	1337	1417	21	N
3000			20030809	0.54	1376	1572	15	NE
3001			20030809	0.09	1338	1432	20	NE
3002			20030809	0.07	1419	1503	14	N
3003			20030809	0.09	1461	1575	11	SE
3004			20030809	0.10	1424	1547	19	SE
3005			20030809	0.08	1422	1482	12	NE
3006			20030809	0.08	1518	1595	17	NW
3007			20030809	0.32	1449	1573	15	N
3008			20030809	0.08	1421	1500	17	E
3009			20030809	0.13	1479	1511	6	NE
3010			20030809	0.13	1429	1514	12	NE
3011			20030809	0.07	1392	1515	22	NE
3012			20030809	0.06	1478	1517	7	NE
3013			20030809	0.06	1439	1480	9	N
3014			20030809	0.05	1451	1521	10	N
3015			20030809	0.14	1453	1504	9	NE
3016			20030809	0.30	1387	1558	20	NE
3017			20030809	0.08	1458	1531	11	NE
3018			20030809	0.07	1480	1598	17	N
3019			20030809	0.06	1456	1550	18	NE
3020	Solfonn		20030809	1.66	1461	1620	8	N
3021			20030809	0.12	1471	1538	13	NE
3022			20030809	0.07	1537	1639	18	NW
3023			20030809	0.13	1477	1605	11	SE
3024			20030809	0.08	1350	1467	21	E



Træsfonn (2988) in 1994. Dettebrea (3116), part of Nordre Folgefonna (NFF), in the background. Photo: Arve Tvede.

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
3025			20030809	0.11	1553	1578	4	SE
3026			20030809	0.05	1436	1530	20	N
3027			20030809	0.16	1399	1557	19	N
3028			20030809	0.05	1450	1542	22	N
3029			20030809	0.10	1427	1534	11	NE
3030			20030809	0.05	1398	1498	20	E
3031			20030809	0.09	1397	1538	21	NE
3032			20030809	0.14	1428	1526	16	NE

35. Hardangervidda - South Glacier ID 3033 - 3109



Glacier (3097) north of Breifonn (3099), one of the southernmost glaciers in Norway, July 2010. Photo: Arnt Flatmo.

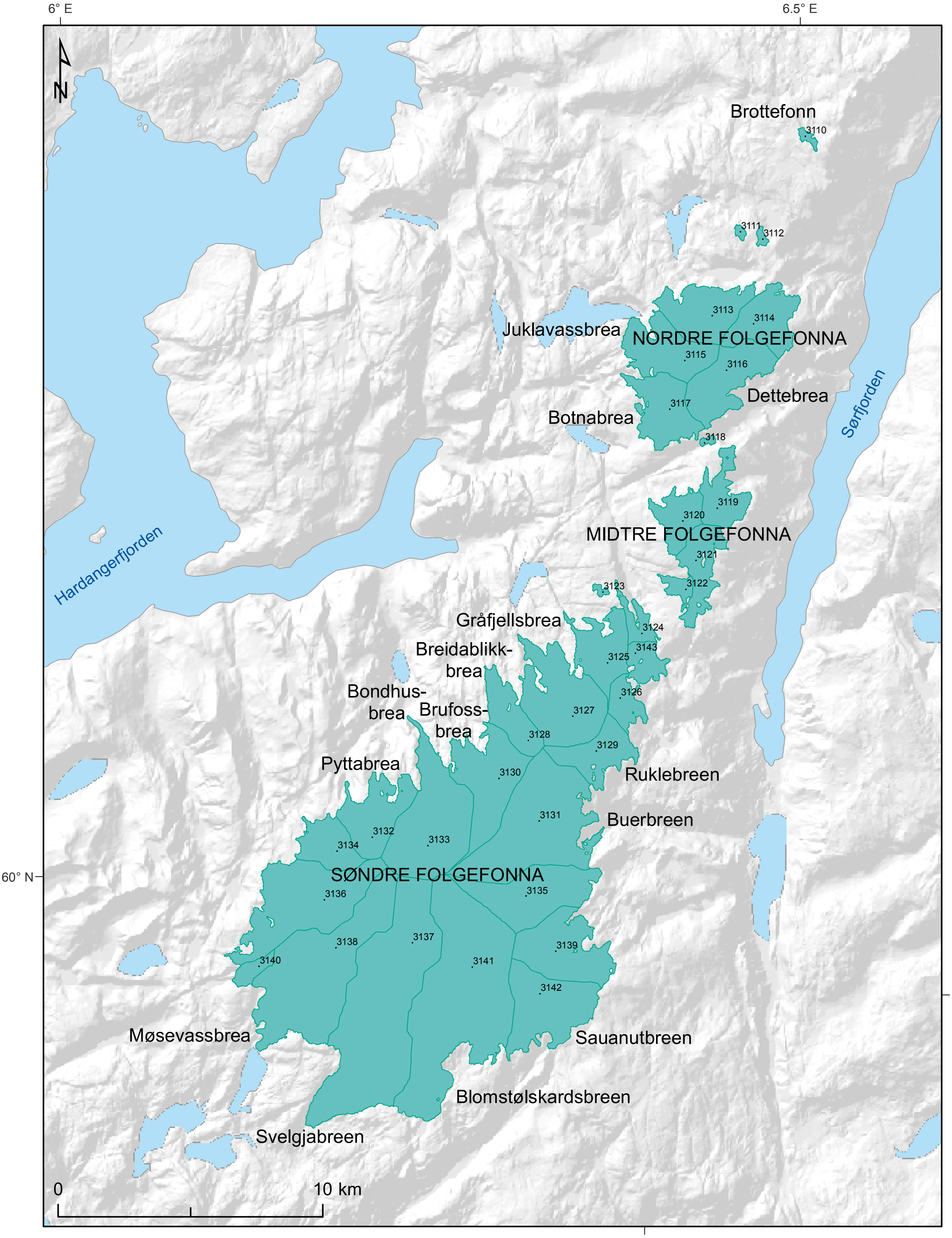
Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
3033			20030809	0.16	1397	1523	15	E
3034			20030809	0.29	1458	1586	15	NE
3035	Søre Skavlen		20030809	0.13	1399	1506	15	NE
3036			20030809	0.15	1474	1536	8	E
3037			20030809	0.35	1459	1591	11	E
3038			20030809	0.12	1400	1509	16	E
3039			20030809	0.15	1356	1549	20	NE
3040		STF	20030809	0.83	1417	1582	12	N
3041		STF	20030809	0.25	1438	1581	14	NE
3042			20030809	0.07	1352	1447	22	E
3043	Reinsnosfonni		20030809	0.60	1418	1619	8	E
3044			20030809	0.10	1382	1505	23	NW
3045			20030809	0.05	1338	1458	31	N
3046			20030809	0.16	1498	1551	10	N
3047			20030809	0.15	1465	1573	8	SE
3048			20030809	0.57	1576	1660	8	NE
3049			20030809	0.27	1358	1531	10	E
3050			20030809	0.31	1525	1666	8	N
3051			20030809	0.11	1334	1508	30	N
3052			20030809	0.17	1527	1675	16	E
3053			20030809	0.08	1246	1392	24	NE
3054			20030809	0.06	1351	1442	19	NE
3055			20030809	0.06	1514	1576	15	NE
3056			20030809	0.09	1527	1616	15	NW
3057			20030809	0.06	1351	1416	17	N
3058			20030809	0.07	1337	1435	21	E
3059			20030809	0.08	1539	1579	8	NE
3060			20030809	0.06	1527	1596	15	N

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
3061			20030809	0.13	1449	1569	19	N
3062			20030809	0.08	1375	1441	15	NE
3063			20030809	0.69	1506	1629	12	NE
3064			20030809	0.05	1357	1408	18	NE
3065			20030809	0.06	1559	1582	7	N
3066			20030809	0.08	1500	1596	14	E
3067			20030809	0.09	1460	1575	21	E
3068			20030809	0.06	1379	1469	21	E
3069			20030809	0.07	1464	1527	16	NE
3070			20030809	0.12	1527	1567	7	NE
3071	Store Nupsfonn	NUP	20030809	0.47	1497	1641	8	NE
3072			20030809	0.06	1584	1626	10	N
3073			20030809	0.08	1551	1635	24	E
3074			20030809	0.68	1465	1620	11	E
3075		NUP	20030809	1.15	1511	1630	8	N
3076			20030809	0.35	1551	1643	11	N
3077			20030809	0.20	1596	1665	9	SE
3078			20030809	0.12	1395	1592	26	E
3079			20030809	0.06	1439	1531	24	NE
3080			20030809	0.15	1489	1618	16	NE
3081			20030809	0.05	1499	1569	15	N
3082			20030809	0.05	1469	1555	24	NE
3083			20030809	0.06	1356	1450	19	E
3084			20030809	0.06	1399	1472	17	E
3085			20030809	0.05	1337	1463	23	N
3086			20030809	0.08	1476	1502	3	N
3087			20030809	0.07	1411	1541	24	N
3088			20030809	0.09	1373	1515	18	E
3089			20030809	0.07	1336	1434	23	E
3090			20030809	0.07	1438	1500	12	N
3091			20030809	0.27	1246	1496	17	NE
3092			20030809	0.05	1382	1462	17	NE
3093			20030809	0.09	1316	1496	19	NE
3094			20030809	0.07	1339	1469	18	SE
3095			20030809	0.06	1544	1616	13	NE
3096			20030809	0.17	1478	1569	16	NE
3097			20030809	0.22	1351	1540	24	N
3098			20030809	0.14	1511	1601	9	NE
3099	Breifonn		20030809	1.37	1417	1601	7	N
3100			20030809	0.19	1359	1567	24	E
3101			20030809	0.11	1538	1622	15	S
3102			20030809	0.05	1519	1563	8	NW
3103			20030809	0.19	1515	1582	9	SE
3104			20030809	0.09	1568	1594	3	NE
3105			20030809	0.18	1382	1555	18	NE
3106			20030809	0.06	1479	1576	17	NE
3107			20030809	0.07	1400	1549	22	NE
3108			20030809	0.09	1425	1512	20	E
3109			20030809	0.05	1345	1450	22	N

Nupsfonn (NUP) in 1996. Photos: Arve Tvede.

36. **Folgefonna**

Glacier ID 3110 - 3143



Møsevassbrea (3138) from Søndre Folgefonna (SFF), September 2011. Photo: Solveig H. Winsvold, NVE.

Glacier ID	Name	Code	Date	Area km^2	Elevation Min.	Elevation Max.	Slope	Aspect
3110	Brottefonn		20020913	0.27	1301	1486	22	NE
3111			20020913	0.17	1323	1479	20	NE
3112			20020913	0.21	1214	1401	23	NE
3113		NFF	20020913	5.44	1189	1644	9	NW
3114		NFF	20020913	4.53	1186	1642	10	E
3115	Juklavassbrea	NFF	20020913	5.59	1095	1643	8	NW
3116	Dettebrea	NFF	20020913	5.87	925	1642	13	SE
3117	Botnabrea	NFF	20020913	5.00	1066	1634	9	W
3118			20020913	0.16	1180	1333	19	S
3119		MFF	20020913	3.11	1010	1569	14	NE
3120		MFF	20020913	2.87	1234	1572	9	NW
3121		MFF	20020913	3.66	1205	1573	10	SE
3122		MFF	20020913	0.80	1298	1446	8	N
3123			20020913	0.17	1309	1393	12	N

Gråfjellsbrea (3127) from Søndre Folgefonna (SFF), October 2006. Photo: Hallgeir Elvehøy, NVE.

36. **Folgefonna** | Southern Norway

Glacier ID	Name	Code	Date	Area km²	Elevation Min.	Elevation Max.	Slope	Aspect
3124		SFF	20020913	1.34	1136	1513	13	NE
3125		SFF	20020913	4.47	1186	1598	6	NW
3126		SFF	20020913	1.88	1128	1596	13	E
3127	Gråfjellsbrea	SFF	20020913	8.77	1078	1645	6	N
3128	Breidablikkbrea	SFF	20020913	3.55	1240	1645	7	NW
3129	Ruklebreen	SFF	20020913	4.10	1228	1645	8	SE
3130	Brufossbrea	SFF	20020913	7.50	1236	1641	6	NW
3131	Buerbreen	SFF	20020913	14.44	700	1645	8	E
3132	Pyttabrea	SFF	20020913	5.31	815	1621	9	N
3133	Bondhusbrea	SFF	20020913	10.91	533	1637	5	N
3134		SFF	20020913	3.46	1062	1608	9	NW
3135		SFF	20020913	7.62	1098	1631	5	NE
3136		SFF	20020913	11.34	1072	1620	6	W
3137	Svelgjabreen	SFF	20020913	22.71	828	1628	4	S
3138	Møsevassbrea	SFF	20020913	16.19	873	1613	5	SW
3139		SFF	20020913	7.13	1162	1602	8	E
3140		SFF	20020913	0.97	1146	1361	7	SW
3141	Blomstølskardsbreen	SFF	20020913	23.11	1033	1638	5	SW
3142	Sauanutbreen	SFF	20020913	7.65	1056	1585	9	SE
3143		SFF	20020913	1.76	1099	1547	13	E

Glacier (3113), part of Nordre Folgefonna (NFF), October 2006. The glacier is used for summer skiing (Folgefonn Sommarskisenter); note the remnants of the big jumps seen in the upper, centre part of the photo. Photo: Hallgeir Elvehøy, NVE.

Appendix A: **List of named glacier complexes**

No	Name	Code	Region	Units
1	Austfjellfonna	AFF	15	2
2	Blåbreden	BBD	23	2
3	Blåbreen	BLB	24	2
4	Blåisen	BLI	9	2
5	Blåmannsisen	BLÅ	12	20
6	Breifonna	BRE	26	2
7	Didnojiehkki	DID	5	4
8	Eldedalsbreen	ELD	26	2
9	Fannaråkbreen	FAB	28	3
10	Flatkjølen	FLA	12	2
11	Fornesbreen	FOB	5	2
12	Fortundalsbreen	FOR	27	2
13	Fresvikbreen	FRB	31	5
14	Frostisen	FRI	10	12
15	Frudalsbreen	FRU	25	3
16	Gihtsejiegna	GIJ	10	9
17	Gjegnalundsbreen	GLB	24	5
18	Glombreen	GLO	14	8
19	Greinbreen	GRE	27	3
20	Grovabreen	GRB	25	7
21	Gråsubrean/Grotbrean/ Glitterbrean	GGG	29	4
22	Gråtåtindfonna	GRF	15	2
23	Hábresfonna	HAF	15	2
24	Harbardsbreen	HAB	27	8
25	Hardangerjøkulen	HAJ	33	14
26	Hellstugu/Vestre Memurubrean	HMB	29	2
27	Hestbrean	HEB	28	2
28	Hestebreen	HES	22	2
29	Holåbreen	HOL	28	4
30	Høgtindbreen	HØB	15	3
31	Høgtuvbreen	HØG	14	16
32	Høybreen	HØY	28	2
33	Illstigbreen	ILL	21	2
34	Jiehkkevárri	JIE	5	8
35	Jostedalsbreen	JOB	25/26/27	82
36	Jostefonni	JOF	25	10
37	Kupbreen	KUP	27	2
38	Kvitekollbreen	KVI	26	4
39	Langfjordjøkelen	LAJ	2	8
40	Lenangsbreen	LEB	4	3
41	Luovttat	LUO	3	3
42	Meraftesbreen	MER	10	3
43	Midtre Folgefonna	MFF	36	4
44	Myklebustbreen	MYB	26	13
45	Myrdalsbreen	MYR	25	5
46	Mårådalsbreen	MÅR	27	2
47	Nameless glacier in Beiardalen	BEI	15	8
48	Nordmannsjøkelen	NOJ	1	3
49	Nordre Folgefonna	NFF	36	5
50	Nupsfonn	NUP	35	2
51	Okstindbreen	OKB	17	15
52	Omnsbreen	OMN	32	2
53	Rágujiekna	RAG	12	3
54	Ramnefjellbreen	RAM	26	4
55	Raudeggbreen	RAU	27	3
56	Ringsbreen	RIN	28	2
57	Rivtindbreda	RIB	8	3
58	Rønnåfonna	RØF	15	2
59	Røykjedalsbreen	RØY	26	2
60	Seilandsjøkelen	SEJ	1	4
61	Sekke-/Sikilbreen	SSB	27	4
62	Sijdasjiegna	SIJ	12	2
63	Simlebreen	SIB	15	10
64	Skarvflyløyftbrean	SFB	29	2
65	Skjerdingdalsbreen	SKE	22	4
66	Skogadalsbreen/Mjølke-dalsbreen/Uranosbreen	SMU	28	3
67	Skruklebreen	SKR	26	2
68	Skråisen	SKI	12	2
69	Skålabreen	SKÅ	26	5
70	Skårisen/Botnisen	SBO	10	4
71	Smørstabbrean	SMB	28	5
72	Småtindisen	SMÅ	15	3
73	Spørteggbreen	SPB	27	8
74	Steindalsbreen	STE	26	5
75	Storbreen	STO	21	5
76	Storfonn	STF	35	2
77	Storsteinsfjellbreen	STB	9	3
78	Strupbreen/Koppangsbreen	SKB	4	3
79	Stølsnosbreen	SNB	28	4
80	Sulitjelmaisen	SUI	12	6
81	Svardalsbreen	SVA	26	6
82	Svartfjelljøkelen	SVJ	2	4
83	Sveidalsbreen	SVB	27	2
84	Søndre Folgefonna	SFF	36	20
85	Tindefjellbreen	TIB	26	8
86	Tverrbotnbreen	TBB	27	4
87	Tverrdalsbreen	TVE	26	2
88	Tystigbreen	TYB	27	7
89	Vassdalsbreen	VAS	26	2
90	Veikdalsisen	VEI	11	4
91	Vestbreen/Fugldalsbreen/ Rypdalsbreen	VFR	5	6
92	Vestre Svartisen	SVV	14	41
93	Visbrean	VIB	28	2
94	Vivakulen	VIV	27	3
95	Øksfjordjøkelen	ØKJ	2	13
96	Østre Svartisen	SVØ	15	23
97	Ålfotbreen	ÅLB	24	5
98	Årnesbreen/ Vesledalsbreen	ÅRV	26	4

Tuftebreen is part of the glacier complex Jostedalsbreen. Photo: Kristen Åsen, October 2008.

Rundvassbreen is part of the glacier complex Blåmannsisen. Photo: Miriam Jackson, NVE, September 2005.

Appendix B: **List of named glacier units**

Name	ID	Code	Region
A			
Adelsbreen	1754		21
Alsnosibreen	2898		32
Alvbreen	2677		28
Ausebreen	1962		22
Austdalsbreen	2478	JOB	27
Austerdalsbreen	2327	JOB	26
Austerdalsisen	1361	SVØ	15
Austre Kollebreen	2502	HAB	27
Austre Memurubrean	2769		29
Austre Okstindbreen	1438	OKB	17
Austre Svartfjellbreen	1447	OKB	17
Austre Vaggasblåisen	177		4
B			
Baklibreen	2309	JOB	26
Basejiekna	620		9
Beatnatjiekna	645		9
Berdalsbreen	2705		28
Bergsetbreen	2318	JOB	26
Bessedørbreen	1449	OKB	17
Besshøbrean	2785		29
Bjørnabreen	2194		25
Bjørnakyrkjebreen	2341	JOB	26
Bjørnbrean	2640		28
Bjåstadbreen	2177		25
Bjåstadbreen	2178		25
Bliehtjedielhtie	1528		19
Blikskårbreen	1630		20
Blomstølskardsbreen	3141	SFF	36
Blåbrean	2770		29
Blåbreen	1978		23
Blåbreen	1975		23
Blåfonna	2098		24
Blåisen	84		3
Blåisen	256	JIE	5
Blåisen	382		6
Blåisen	327		5
Blåisen	540		8
Blåisen	592		9
Blåisen	2966	HAJ	33
Blåskavlen	833		11
Blåskavlen	2838		31
Bogfjellbreen	1301		15
Bohrsbreen	2265	JOB	26
Bondhusbrea	3133	SFF	36
Botløyrabreen	1087		14
Botnabrea	3117	NFF	36
Botnisen	768	SBO	10
Botntindbreen	1083	SVV	14
Brangsbrean	2619		28
Brangsbrean	2623		28
Brattbreen	2174		25
Brattskavlen	2878		31
Breidablikkbrea	3128	SFF	36
Breidfonna	2198	BRE	26
Breifonn	3099		35
Brekketindbreen	1991		23
Brenndalsbreen	2301	JOB	26
Brenndalsbreen	2305	JOB	26
Briksdalsbreen	2316	JOB	26
Brottefonn	3110		36
Brovresenspeatnoe	1406		16
Brufossbrea	3130	SFF	36
Buerbreen	3131	SFF	36
Bukkabreen	2389		26
Bukkeholsbrean	2635		28
Bødalsbreen	2273	JOB	26
Bøverbrean	2643	SMB	28
Bøyabreen	2349	JOB	26
C			
Cainhavarre	703		9
Charles Rabot-breen	1434		17
Corneliussenbreen	1439	OKB	17
D			
Dettebrea	3116	NFF	36
Dimdalsbreen	1090	SVV	14
Dukfonna	1569		20
Dumhøbrean	2607		28
Dyrafonn	2985		34
E			
Eidsbreen	2243		26
Eldalsbreen	2379		26
Engabreen	1094	SVV	14
Erdalsbreen	2481	JOB	27
Evelsfonn	1673		20
F			
Fannaråkbreen	2656	FAB	28
Fingerbreen	1328	SVØ	15
Flakavassfonn	2923		32
Flatebreen	2306		26
Flatisen	1109	SVV	14
Flydalsbreen	1943		22
Fonna	527		7
Fonndalsbreen	1097	SVV	14
Fonnisen	164		4
Forholtbreen	204		4
Frukosttindbreen	1089	SVV	14
Fugldalsbreen	235	VFR	5
Fåbergstølsbreen	2289	JOB	26
G			
Gammvikblåisen	167		4
Gihccejiehkki	305		5
Gjertvassbreen	2683		28
Gjømmerdalsbreen	398		6
Glitterbrean	2745	GGG	29
Goahtejiehkki	127		3
Goasstejiegna	849		11
Grasdalsbreen	1968		22
Grjotåbreen	2543		28
Grotbrean	2742	GGG	29
Gryteskarvbreen	2837		31
Gråfjellsbrea	3127	SFF	36

Name	ID	Code	Region
Gråsubrean	2743	GGG	29
Gullmorbreen	1992		23
Gunvordalsbreen	2182		25
Gunvordalsbreen	2185	MYR	25
H			
Habostadbreen	1989		23
Halvardsvorfonna	2446		27
Handklefonne	2735		29
Hansebreen	2085	ÅLB	24
Hanspolsabreen	1272		15
Haugabreen	2298	MYB	26
Heimaste Hestbreen	2579		28
Heimre Illåbrean	2606		28
Heimstre Gjelåbreen	2552		28
Heksetebrean	2586		28
Helldalisen	873		11
Hellevassfonni	2945		32
Hellstugubrean	2768	HMB	29
Helsetbreen	2240		26
Hengfonna	1234	SIB	15
Hestbrean	2581	HEB	28
Hestfonni	2568		28
Hoemsbreen	1642		20
Holåbreen	2577	HOL	28
Holåbreen	2562	HOL	28
Holåbreen	2466	SSB	27
Hurrbrean	2626		28
Høgalmebreen	2300	MYB	26
Høgskridubrean	2615		28
Høgvaglbreen	2673		28
Høgvaglbreen	2675		28
Høybrean	2588	HØY	28
Håskredskavlen	2216		26
I			
Instebreen	2269	MYB	26
Isdaljøkelen	43	ØKJ	2
Isfjordjøkelen	47	ØKJ	2
Isskardbreen	213		4
J			
Jervefonne	2631		28
Jervåfonna	1228	SIB	15
Juklavassbrea	3115	NFF	36
Juvfonne	2597		28
K			
Kaldfonna	1598		20
Kalvehøgdbreene	2824		29
Kampliisen	1358	SVØ	15
Kjelen	2598		28
Kjenndalsbreen	2296	JOB	26
Kjosbreen	221		4
Kjølbreen	1093	SVV	14
Kluftutefonni	2540		28
Koldedalsbreen	2732		28
Koldedalsbreen	2734		28
Kolåsbreen	1976		23
Koppangsbreen	205	SKB	4
Kristenbreen	2676		28
Krokebreen	2251		26
Krunebreen	2280	JOB	26
Kvitingsbreen	2536		28
Kvitingsbreen	2538		28
Kvitlabreen	2384	SVA	26

Name	ID	Code	Region
L			
Langedalsbrean	2802		29
Langedalsbreen	2195		25
Langedalsbreen	2329	JOB	26
Langedalsbreen	2332	JOB	26
Langfonna	1864		21
Lappbreen	1348	SVØ	15
Leirbotnbreen	2520	SPB	27
Leirbrean	2638	SMB	28
Leirbreen	1233	SIB	15
Leirungsbrean	2813		29
Leiråbre	1247		15
Lenangsbreen	201	LEB	4
Lendbreen	2541		28
Liabreen	2603		28
Liabreen	2610		28
Liabreen	2605		28
Liabreen	2616		28
Liastølbreen	2345		26
Likkájiehkki	426		7
Litlbreen	1091	SVV	14
Ljøsabreen	1973		23
Lodalsbreen	2266	JOB	26
Lokebreen	2331	JOB	26
Lundabreen	2348	JOB	26
Lysebreen	2394		26
M			
Marabreen	2364	JOB	26
Maradalsbreen	2697		28
Melkevollbreen	2324	JOB	26
Memorgebreen	1099	SVV	14
Meraftesbreen	759		10
Midtbreen	251		5
Midtdalsbreen	2964	HAJ	33
Midthøbreen	1755		21
Midtmaradalsbreen	2699		28
Midtre Gjelåbreen	2553		28
Mjølkedalsbreen	2717	SMU	28
Myrdalsbreen	2191	MYR	25
Møsevassbrea	3138	SFF	36
Møyldulbreen	2551		28
Mårådalsbreen	2438	TYB	27
N			
Nakkebreen	1816		21
Nautbreen	1966		22
Nautgardsbrean	2751		29
Nautgardsbrean	2755		29
Nerisen	48		2
Nigardsbreen	2297	JOB	26
Noammerjiehkki	158		3
Nontagsbreen	853		11
Nordfjordbreen	1103	SVV	14
Nordre Meraftesbreen	758		10
Nufsfonne	2629		28
Nystølsbreen	2361	JOB	26
Nørdre Illåbrean	2624		28
O			
Oksfjellbreen	1450	OKB	17
Oksskoltbreen	1433		17
Olsskavlen	2884		31
Omnsbreen	2927		32
Omnsbreen	2926		32
Opptaksbreen	2347	JOB	26

Name	ID	Code	Region
P			
Pyttabrea	3132	SFF	36
R			
Ramnabergbreen	2962	HAJ	33
Reindalsblåisen	185		4
Reinkalvfonna	1229	SIB	15
Reinsnosfonni	3043		35
Reintindbreen	745		10
Reinvikisen	865		11
Reinvikisen	868		11
Rembesdalskåka	2968	HAJ	33
Riehppejiehkki	306		5
Ringsbreen	2700		28
Rivgojiekna	714		9
Rottenvikbreen	219		4
Ruklebreen	3129	SFF	36
Rundvassbreen	941	BLÅ	12
Runningsbrean	2574		28
Runningsbrean	2572		28
Russetindbreen	409		6
Ruteflotbreen	2294	JOB	26
Rypdalsbreen	232	VFR	5
Rødbergdalsbreen	224		5
S			
Sandelvbrean	2652	SMB	28
Sandfonna	1937		22
Sandskarfonna	2450		27
Sandåbreen	2434		27
Sauanutbreen	3142	SFF	36
Sealggajiekna	664		9
Sekkebreen	2470	SSB	27
Semelbrean	2782		29
Senlenskebreen	2242	RAM	26
Sikilbreen	2462	SSB	27
Sikilbreen	2457	JOB	27
Simlefonna	1221	SIB	15
Skadefonna	2217		26
Skagastølsbreen	2693		28
Skarvflybrean	2791		29
Skarvflyløyftbrean	2797	SFB	29
Skipedalsfonna	2447		27
Skjellåfonna	1230	SIB	15
Skjelåtindbreen	1265		15
Skogadalsbreen	2715	SMU	28
Skomabreen	2866		31
Skomabreen	2867		31
Skomabreen	2870		31
Skålebreen	2233	TIB	26
Skårisen	767	SBO	10
Slettmarkbrean	2803		29
Slingsbybreen	2694		28
Smiugjelsbrean	2739		29
Snøggeken	2729		28
Solfonn	3020		34
Sorbmejiehkki	121		3
Stefjellblåisen	176		4
Steikvassbreen	1451	OKB	17
Steindalsbreen	288		5
Steinflybrean	2789		29
Stigaholtbreen	2480	JOB	27
Storbrean	1723		20
Storbrean	2636		28
Storbreen	1667		20
Storbreen	1823		21
Storbreen	1796		21
Storbreen	2097		24

Name	ID	Code	Region
Store Nupsfonn	3071	NUP	35
Storfjellbreen	1807		21
Storfjellbreen	1806		21
Storfonn	2917		32
Storfonne	2736		29
Storglombreen nord	1092	SVV	14
Storglombreen sør	1096	SVV	14
Storgrovbrean	2600		28
Storjuvbrean	2614		28
Storløypbreen	1857		21
Storskavlen	2852		31
Strupbreen	200	SKB	4
Strupebreen	2250	JOB	26
Styggebrean	2608		28
Styggedalsbreen	2680		28
Styggehøbrean	2762		29
Stølsbotnbreen	2380	SVA	26
Stølsmaradalsbreen	2708		28
Støvelbreen	190		4
Sulbrean	2565		28
Sundsbreen	2281	JOB	26
Supphellebreen	2352	JOB	26
Surtningsbreen	2655		28
Svartavassbreen	2900		32
Svartdalsbrean	2804		29
Svartisheibreen	1135	SVV	14
Sveidalsbreen	2533	SVB	27
Svelgjabreen	3137	SFF	36
Svelingsfonna	2444		27
Svellnosbrean	2622		28
Sydbreen	257		5
Sygneskarsbreen	2471	JOB	27
Sygneskarsbreen	2461	JOB	27
Sygneskarsbreen	2465	JOB	27
Syrdalsbreen	2843		31
Søre Illåbreen	2634		28
Søre Skavlen	3035		35
Sørsendalsbreen	2104		25
Såta	2377		26
Såtaskavlen	2885		31
T			
Teibreen	2246	JOB	26
Tjøtabreen	2322	JOB	26
Torsbreen	1867		21
Torsteinsfonna	2970	HAJ	33
Tretten-null-to-breen	1084	SVV	14
Trollabotnen	2877		31
Trollbergdalsbreen	1280		15
Trollbotnbre	1597		20
Trollbreen	202		4
Trollkyrkjebreen	1804		21
Trongurskarfonna	2445		27
Træsfonn	2988		34
Tuftabreen	2396	STE	26
Tuftebreen	2308	JOB	26
Tundraskarsbreen	2222	TIB	26
Tunsbergdalsbreen	2320	JOB	26
Tverradalsbreen	2330		26
Tverrbyttnbreen	2459	JOB	27
Tverråbrean	2632		28
Tverrådalsfonna	1227	SIB	15
U			
Uranosbreen	2720	SMU	28
V			
Vargabreen	2907		32


Ytstebreen.
Photo: Morten Kielland, August 2011.

Name	ID	Code	Region
Vargabreen	2908		32
Vassdalsbreen	2351		26
Vegdalsisen	1237		15
Veobrean	2757		29
Veslbrean	2630		28
Vesledalsbreen	2260	ÅRV	26
Vesledalsbreen	2474	JOB	27
Vesljuvbrean	2601		28
Vestbreen	240	VFR	5
Vestisen	1448	OKB	17
Vestra Leirebottsskåka	2974	HAJ	33
Vestre Kollebreen	2495		27
Vestre Memurubrean	2772	HMB	29
Vestre Okstindbreen	1443	OKB	17
Vestre Svartfjellbreen	1446	OKB	17
Vestre Vaggasblåisen	178		4
Vetle Supphellebreen	2355	JOB	26
Vetlebreen	2362	JOB	26
Vetledalsbreen	2326	JOB	26
Vetlefjordbreen	2148	JOF	25
Vinnufonna	1601		20
Voggebreen	2190	MYR	25
Vossaskavlen	2868		31
Y			
Ytre Gjelåbreen	2564	HOL	28
Ytstebreen	2578		28
Ø			
Øyaskavlen	2847		31
Øykjafonn	2858		31
Å			
Årnesbreen	2257	ÅRV	26

Appendix C: **List of special investigations**

ID	Inventory name	Other name	Code	Region	Mass balance
26	Svartfjelljøkelen		SVJ	2	1978-79
54	Langfjordjøkelen	Langfjord East	LAJ	2	1989-93, 1996-
200	Strupbreen		SKB	4	
205	Koppangsbreen		SKB	4	
257	Sydbreen			5	
288	Steindalsbreen			5	
703	Cainhavarre			9	1965-68
596	Blåisen		BLI	9	1963-68
675	Storsteinsfjellbreen		STB	9	1964-68, 1991-95
941	Rundvassbreen		BLÅ	12	2002-04, 2011-
1084	Tretten-null-to-breen		SVV	14	1985-86
1093	Kjølbreen		SVV	14	1954-56
1094	Engabreen	Engenbreen	SVV	14	1970-
1135	Svartisheibreen		SVV	14	1988-94
1092	Storglombreen		SVV	14	1985-88, 2000-05
1144	Høgtuvbreen		HØG	14	1971-77
GLO	Glombreen		GLO	14	1954-56
1280	Trollbergdalsbreen			15	1970-75 1990-94
1361	Austerdalsisen	Østerdalsisen	SVØ	15	
1439	Corneliussenbreen		OKB	17	
1434	Charles Rabot-Breen			17	1970-73
1438	Austre Okstindbreen	Okstindbreen austre	OKB	17	1987-96
1804	Trollkyrkjebreen			21	
2078	Ålfotbreen		ÅLB	24	1963-
2085	Hansebreen		ÅLB	24	1986-
2145	Jostefonni	Jostefonn	JOF	25	1996-2000
2273	Bødalsbreen		JOB	26	
2289	Fåbergstølsbreen		JOB	26	
2297	Nigardsbreen		JOB	26	1962-
2301	Brenndalsbreen	Åbrekkebreen	JOB	26	
2308	Tuftebreen	Tverrbreen	JOB	26	
2316	Briksdalsbreen	Brigsdalsbreen	JOB	26	
2320	Tunsbergdalsbreen		JOB	26	1966-72
2327	Austerdalsbreen	Odinsbreen, Torsbreen	JOB	26	
2349	Bøyabreen		JOB	26	
2352	Supphellebreen	Flatbreen, Store Supphellebreen	JOB	26	1964-67, 73-75, 79-82
2474	Vesledalsbreen	Vetledalsbreen	JOB	27	1967-72
2478	Austdalsbreen		JOB	27	1988-

Length	Detailed map survey	Thickness	Velocity	GLOFs
1998-	1966, 1994, 2008	X	X	
	1952, 1978, 1985, 1998, 2010			X
1998-	1978, 1985, 1998, 2010			X
2007-				
1998-				
	1963			
2006-	1966, 1993, 2010			
2011-	1961, 1998, 2011	X	X	X
1903-	1968, 1985, 2001-2003, 2008	X	X	
	1968, 1995, 2001	X	X	X
	1968, 1985, 2002, 2008	X	X	
	1972, 1998			
2010-				
2010-	1968, 1985, 1998	X		
	1945, 1954, 1968, 1979, 1985			X
2006-	1965,1975, 1978, 1979, 1981, 2011			
	1965, 2011			
1909-44, 2006-	1965, 2011			X
1944-74, 2008-				
	1968, 1997, 2009		X	
	1968, 1997, 2009			
	1966, 1993, 2011			X
1900-53, 1996-		X		
1899-		X		
1899-	1964, 1974, 1984, 2009	X	X	
1900-62, 1996-		X		
2007-				
1900-		X		
1900-1960, 2010-	1955, 1964	X		X
1905-20, 1933-		X		
1899-1953, 2003-		X		
1899-1958, 1977-83, 1992-		X		X
	1966	X	X	
	1988, 2009	X	X	

ID	Inventory name	Other name	Code	Region	Mass balance
2480	Stigaholtbreen	Stegholtbreen, Stegaholtbreen	JOB	27	
SPB	Spørteggbreen		SPB	27	1988-91
2514	Harbardsbreen		HAB	27	1997-2001
2597	Juvfonne	Juvfonna		28	2010-
2614	Storjuvbrean	Storgjuvbreen, Storjuvbreen		28	
2632	Tverråbrean	Tverråbreen		28	1962-63
2636	Storbrean	Storbreen		28	1949-
2638	Leirbrean	Leirbreen	SMB	28	
2643	Bøverbrean	Bøverbreen	SMB	28	
2680	Styggedalsbreen			28	
2743	Gråsubrean	Gråsubreen	GGG	29	1962-
2768	Hellstugubrean	Hellstugubreen	HMB	29	1962-
2769	Austre Memurubrean	Austre Memurubre, Austre Memurubreen	HMB	29	1968-72
2770	Blåbrean	Blåbreen		29	1962-63
2772	Vestre Memurubrean	Vestre Memurubre, Vestre Memurubreen	HMB	29	1968-72
OMN	Omnsbreen		OMN	32	1966-70
2964	Midtdalsbreen	Kongsnutbreen	HAJ	33	2000-2001
2968	Rembesdalskåka	Rembesdalsskåka, Rembedalsskåki	HAJ	33	1963-
3117	Botnabrea		NFF	36	
3127	Gråfjellsbrea	Gråfjellsbreen, Gråbreen	SFF	36	1964-68, 74-75, 2003-12
3128	Breidablikkbrea	Breidablikkbreen	SFF	36	1963-68, 2003-12
3129	Ruklebreen*	Ruklenutbrean, Ruklenutbreen	SFF	36	1963-68
3131	Buerbreen	Buarbreen, Øvre Buerbreen, Nedre Buerbreen	SFF	36	
3137	Svelgjabreen**	Blomsterskardsbreen	SFF	36	2007-
3141	Blomstølskardsbreen**	Blomsterskardsbreen	SFF	36	1971-77, 2007-
3133	Bondhusbrea	Bondhusbreen	SFF	36	1977-81
MFF	Midtre Folgefonna		MFF	36	1970-71

* Ruklebreen and Blåbreen (part of 3126)
** Part of Blomsterskardsbreen

Length	Detailed map survey	Thickness	Velocity	GLOFs
1903-		X		
	1988, 2011	X		
	1966, 1996, 2010	X		X
2010-	2011	X	X	
1901-1912, 1933-63, 1997-	2011			
1901-1963, 1971-76	1927, 1968, 1984, 1997, 2011			
1902-	1951, 1968, 1984, 1997, 2009	X	X	
1909-				
1903-12, 1936-63, 1997-				
1901-				
	1968, 1984, 1997, 2009	X	X	
1901-	1942, 1962, 1968, 1980, 1997, 2009	X	X	
	1966, 1997, 2009		X	
	1966, 1997, 2009	X		
	1968			
1982-	1961, 2010	X	X	
1918-41, 1968-83, 1995-	1961, 2010	X	X	X
1996-	1959, 2007			
2002-	1959, 1997, 2007	X		
	1959, 1997, 2007	X		
	1959, 2007		X	
1900-80, 1995	1959, 2007			X
2007-	1959, 2007	X		
1994-	1959, 2007			X
1901-86, 1996-	1959, 2007	X		
	1959, 1981, 2007			

Appendix D: **List of acronyms and abbreviations**

Acronym	Meaning
AD	Anno Domini (years after Christ)
Atlas69	Atlas of South Norway published in 1969
Atlas73	Atlas of northern Scandinavia published in 1973
Atlas88	Atlas of South Norway published in 1988
BC	Before Christ
BP	Before Present
DTM	Digital Terrain Model
E	East
ELA	Equilibrium Line Altitude
ERTS	Earth Resources Tecnology Satellite
ETM+	Enhanced Thematic Mapper Plus
GIS	Geographic Information Systems
GLIMS	Global Land Ice Measurements from Space
GLOFs	Glacier Lake Outburst Floods
GTN-G	Global Terrestrial Network for Glaciers
ID	Identification - unique number for each glacier
LIA	Little Ice Age
LIDAR	LIght Detection And Ranging
m.a.s.l.	metres above sea level
MSS	Multispectral Scanner
N	North
N50	Main topographic Norwegian map series (1:50 000)
NAO	North Atlantic Oscillation
NASA	National Aeronautics and Space Administration
NE	North East
NIR	near infrared
No.	Number
NVE	Norwegian Water Resources and Energy Directorate
NW	North West

Acronym	Meaning
RGB	Red Green Blue
rmse	root mean square error
S	South
SE	South East
SW	South West
SWIR	shortwave infrared
TIR	thermal infrared
TM	Thematic Mapper
TSL	Transient Snow Line
USGS	United States Geological Survey
VIS	visible (part of spectrum)
W	West
WGMS	World Glacier Monitoring Service
YD	Younger Dryas

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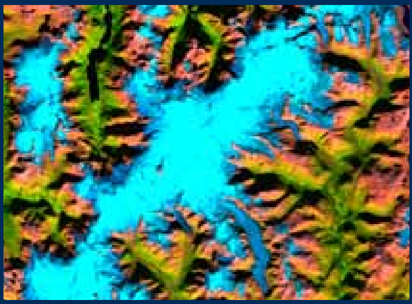

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