

Glaciological investigations in Norway 2025

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GLACIOLOGICAL INVESTIGATIONS IN NORWAY 2025

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Cover photo: Mjølkedalsbreen, a south-east facing valley glacier in the southwest of Jotunheimen, 27th September 2025. Foto: Jørgen Loe Kvalberg.

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Abstract: Results of glaciological investigations performed at Norwegian glaciers in 2025 are presented in this report. The main part concerns mass balance investigations. Results from observations of glacier front variations and jøkulhlaups are discussed in a separate chapter.

Keywords: Glaciology, Mass balance, Glacier front variations, Glacier dynamics, Ice velocity, Air temperature, Discharge, Jøkulhlaup.

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Preface

This report is a new volume in the series "Glaciological investigations in Norway", which has been published since 1963. From 1963 to 2021 the report was published as a printed edition. From 2022, however, the report will only be published as a digital edition.

The report is based on investigations of several Norwegian glaciers. Measurements of mass balance, glacier length change, glacier velocity, meteorology and other glaciological investigations are presented. Most of the investigations were ordered by private companies and have been published previously as reports to the respective companies. The annual results from mass balance and glacier length changes are also reported to the World Glacier Monitoring Service (WGMS) in Switzerland.

The report is published in English with a summary in Norwegian. The purpose of this report is to provide a joint presentation of the glacier investigations and calculations made mainly by NVE's Section for Glaciers, Ice and Snow during 2025. The chapters are written by different authors, but are presented in a similar format. The individual authors hold the professional responsibility for the contents of each chapter. The fieldwork is mainly the result of co-operative work amongst the personnel at NVE. Bjarne Kjøllmoen was editor of the report.

Oslo, October 2026

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Summary

Mass balance

Mass balance investigations were performed on ten glaciers in Norway in 2025 – two in northern Norway and eight in southern Norway. In this report we refer to the nine mass balance reference glaciers that include Langfjordjøkelen and Engabreen in northern Norway and Ålfotbreen, Hansebreen, Nigardsbreen, Rembesdalskåka, Storbreen, Hellstugubreen and Gråsubreen in southern Norway, according to the Norwegian hydrological reference dataset for climate change studies (Fleig et al., 2013; Andreassen and Elvehøy, 2021). In addition, mass balance was measured on Austdalsbreen, a northern outlet from Jostedalsbreen and on Juvfonne, a small ice patch in Jotunheimen.

The winter balance was greater than the 1991-2020 average for five of the nine reference glaciers. Engabreen on Svartisen had the greatest relative winter balance with 164 % of the reference period average. This is the largest winter balance at Engabreen since the start in 1970. For four of the reference glaciers the winter balance was lower than the 1991-2020 averages. Hansebreen and Ålfotbreen had the lowest relative winter balances with 69 % and 63 %, respectively.

The summer balance was greater than the 1991-2020 average for eight of the nine reference glaciers. Gråsubreen in Jotunheimen had the greatest relative summer balance with 163 % of the reference period average. Only Nigardsbreen had a lower summer balance than the 1991-2020 average, with 97 % of the reference period.

The annual balance thus was negative for seven of the nine reference glaciers. Hansebreen and Ålfotbreen had the greatest deficits with −3.5 m w.e. and −2.4 m w.e., respectively. Nigardsbreen and Engabreen had both surplus with 0.1 m w.e. and 0.6 m w.e., respectively.

Glacier front variations

Glacier front variations were measured at 27 glaciers in southern Norway and 10 glaciers in northern Norway. Thirty-three of the 37 measured glaciers were retreating. The greatest retreat was observed at Austerdalsbreen with 300 metres.

Sammendrag

Massebalanse

I 2025 ble det utført massebalansemålinger på 10 breer i Norge – to i Nord-Norge og åtte i Sør-Norge. I henhold til det norske hydrologiske referansedatasettet for klima-endringsstudier (Fleig et al., 2013; Andreassen og Elvehøy, 2021) refererer vi i denne rapporten til de ni referansebreene for massebalanse som inkluderer Langfjordjøkelen og Engabreen i Nord-Norge og Ålfotbreen, Hansebreen, Nigardsbreen, Rembesdal-skåka, Storbreen, Hellstugubreen og Gråsubreen i Sør-Norge. I tillegg ble det målt massebalanse på Austdalsbreen og Juvfonne, en isfonn i Jotunheimen.

For fem av de ni referansebreene ble vinterbalansen større enn gjennomsnittet for referanseperioden 1991-2020. Engabreen på Svartisen fikk den relativt største vinterbalansen med 164 % av referanseperioden. Det er den største vinterbalansen siden målingene begynte i 1970. For fire av referansebreene ble vinterbalansen mindre enn gjennomsnittet 1991-2020. Hansebreen og Ålfotbreen fikk relativt minst med hhv. 69 % og 63 % av referanseperioden.

Sommerbalansen ble større enn gjennomsnittet for åtte av de ni referansebreene. Gråsubreen i Jotunheimen hadde relativt størst sommerbalanse med 163 % av referanseperioden. Bare Nigardsbreen fikk mindre sommerbalanse enn gjennomsnittet med 97 % av referanseperioden.

Årlig balanse ble dermed negativ for sju av de ni referansebreene. Hansebreen og Ålfotbreen hadde de største underskuddene med hhv. −3,5 m v.ekv. og −2,4 m v.ekv. Nigardsbreen og Engabreen fikk overskudd med hhv. 0,1 m v.ekv. og 0.6 m v.ekv.

Frontposisjonendringer

Frontposisjonendringer ble målt på 27 breer i Sør-Norge og 10 breer i Nord-Norge. Trettitre av de 37 målte breutløperne hadde tilbakegang. Størst tilbakegang ble målt på Austerdalsbreen med hele 300 meter.

1. Glacier investigations in Norway 2025

1.1 Mass balance

Surface mass balance is the sum of surface accumulation and surface ablation and includes loss due to calving. The surface mass-balance series of the Norwegian Water Resources and Energy Directorate (NVE) include annual (net), winter, and summer balances. If the winter balance is greater than the summer balance, the annual balance is positive, and the glacier increases in volume. Alternatively, if the melting of snow and ice during the summer is larger than the winter balance, the annual balance is negative and the ice volume decreases.

Acronyms and terminology

Many acronyms and terminologies are used in this report. Mass balance terms are in accordance with Cogley et al. (2011) and Østrem and Brugman (1991).

AAR
Accumulation-area ratio. The ratio (expressed as a percentage) of the area of the accumulation zone to the area of the entire glacier.

Ablation
All processes that reduce the mass of the glacier, mainly caused by melting. Other processes of ablation can be calving, sublimation, windborne snow and avalanching.

Accumulation
All processes that add to the mass of the glacier, mainly caused by snowfall. Other processes of accumulation can be deposition of hoar, freezing rain, windborne snow and avalanching.

Airborne laser scanning (LiDAR)
Airborne laser scanning or Lidar (Light Detection And Ranging) is an optical remote sensing technique used for measuring position and altitude of the earth surface.

Annual balance (b_a/B_a)
The sum of *accumulation* and *ablation* over the *mass-balance year* calculated for a single point ($b_w + b_s = b_a$) and for a *glacier* ($B_w + B_s = B_a$).

AO
The Arctic Oscillation is a climate index of the state of the atmosphere circulation over the Arctic.

Area-altitude distribution
The glacier is classified in height intervals (50 or 100 m) and the areas within all intervals give the *Area-altitude distribution*.

Density
In this report *density* means the ratio of the mass of snow, *firn* or ice to the volume that it occupies. The *snow density* is measured annually during snow measurements in

April/May. *Firn density* is measured occasionally during ablation measurements in September/October. *Ice density* is not measured but estimated as 900 kg m^{-3}.

DTM/DEM
Digital terrain/elevation model. A digital model of a terrain surface created from terrain elevation data.

ELA
Equilibrium-line altitude. The spatially averaged altitude (m a.s.l.) where *accumulation* and *ablation* are equal.

Firn
Snow which is older than one year and has gone through an ablation period.

Glacier ID
Numbering of Norwegian glacier units. Used as a unique ID for all glaciers.

GNSS/dGNSS
Global Navigation Satellite System/differential. A generic term for all satellite-based navigation systems, e.g. the American GPS, the Russian GLONASS, the Chinese BeiDou and the European Galileo. Differential GNSS (*dGNSS*) makes use of data from at least one reference station which is located in a precise, known location. The purpose of the dGNSS technique is to enhance the accuracy of the measurements.

GOTHECA
Glacier impacts On The Hydrological systems in Europe and Central Asia. A research project about climate change and its impact on increasing meltwater from glaciers.

Jøkulhlaup
A *jøkulhlaup* or Glacier Lake Outburst Flood (GLOF) is a sudden release of water from a glacier. The water source can be a glacier-dammed lake, a pro-glacial moraine-dammed lake or water stored within, under or on the glacier.

Mass balance (also called Glaciological mass balance or Surface mass balance)
The difference between the *accumulation* and the *ablation* for a glacier. In this report the term *mass balance* is equal to «Glaciological mass balance» and «Surface mass balance», which means that internal melting is not included.

NAO
The North Atlantic Oscillation is the anomaly in sea level pressure difference between the Icelandic low-pressure system and the Azores high-pressure system in the Atlantic Ocean. When positive (that is, Azores pressure greater than Iceland pressure), winds from the west are strong, and snow accumulation in Scandinavia is high.

Orthophoto
An aerial photograph which is geometrically adjusted such that the scale is uniform. The orthophoto has the same characteristics and lack of distortion as a map.

Probing/sounding
Measuring method for snow depth measurements using thin metal rods.

Reference glacier
The nine mass balance reference glaciers that include Ålfotbreen, Hansebreen,

Nigardsbreen, Rembesdalskåka, Storbreen, Hellstugubreen, Gråsubreen, Engabreen and Langfjordjøkelen, according to the Norwegian hydrological reference dataset for climate change studies (Fleig et al., 2013; Andreassen and Elvehøy, 2021).

Reference period
The 30-year mass balance reference period 1991-2020 is used as standard normal period.

SATREF data
A network of base stations across the country operated by The Norwegian Mapping Authority. Data from these stations can be used for post-processing of GNSS data.

Sentinel satellite data
Sentinel-1 is a polar-orbiting, all-weather, day-and-night radar imaging mission. Sentinel-2 is a polar-orbiting, multispectral high-resolution optical imaging mission.

SMB
Surface Mass Balance is the difference between snow accumulation and surface ablation of snow, firn and ice.

Smartstake
An autonomous measurement station for high resolution glacier ablation monitoring.

Snow coring
Use of a coring auger to obtain cylindrical samples of snow and *firn*. The purpose is to measure the *density* of the snow or to identify the *summer surface*.

Stake
Aluminum poles inserted in the glacier for measuring snow accumulation (depth) and melting.

Stratigraphic method
A method for calculating the glacier *mass balance*. The method describes the annual balance between two successive *summer surfaces*.

Summer balance (b_s/B_s)
The sum of *accumulation* and *ablation* over the summer season. Internal melting is not included. The summer balance can be calculated for a single point (b_s) and for a glacier (B_s).

Summer surface (S.S.)
The surface that is covered by the first snow of the new balance year.

Tower
Galvanised steel towers inserted in the glacier for measuring snow depth and melting. A tower can survive greater snow *accumulation* than a *stake*.

UAV
Unmanned Aerial Vehicle. An aircraft, commonly known as a drone, without any human pilot, crew or passengers on board, operated remotely or pre-programmed.

Water equivalent/Snow water Equivalent (SWE)

The amount of snow, *firn* and ice (m) converted to the amount of water expressed as «metres water equivalent» (m w.e.).

Winter balance (b_w/B_w)
The sum of *accumulation* and *ablation* over the winter season. The winter balance can be calculated for a single point (b_w) and for a glacier (B_w).

www.norgeibilder.no
An open web portal showing new, as well as a selection of historical orthophotos in Norway.

www.senorge.no
An open web portal showing daily updated maps of snow, weather and water conditions, and climate for Norway as well as Sentinel satellite images.

Method

Methods used to measure mass balance on Norwegian glaciers have generally remained unchanged over the years, although the number of measurements has varied (Andreassen et al., 2016). With the experience gained from many years of measurements, the measurement network was simplified on individual glaciers in the beginning of the 1990s.

Winter balance

The winter balance is normally measured in April or May by probing to the previous year's summer surface along regular profiles or in grids. Stake readings are used to verify the soundings where possible. Since the stakes can disappear during particularly snow-rich winters, and since it is often difficult to distinguish the summer surface (S.S.) by sounding alone, snow coring is also used to confirm the sounding results. Snow density is usually measured in one location on each glacier (Fig. 1-1).



Figure 1-1
Snow density measurements at Austdalsbreen on 25 April 2025. Photo: Hallgeir Elvehøy.

Summer and annual balance

Summer and annual balances are obtained from measurements of stakes and towers, usually performed in September or October (Fig. 1-2). Below the elevation of a glacier's equilibrium line the annual balance is negative, meaning that more snow and ice melts during the summer than accumulates during the winter. Above the equilibrium line, in the accumulation area, the annual balance is positive, meaning that some of the winter snow remains after the summer season. Based on past experience, snow density of the remaining snow in the accumulation area is typically assumed to be 600 kg m^{-3}. After especially cold summers, or if there is more snow than usual remaining at the end of the

summer, snow density is either measured using snow-cores or is assumed to be 650 kg m^{-3}. The density of melted firn, depending on the age, is assumed to be between 650 and 800 kg m^{-3}. The density of melted ice is set as 900 kg m^{-3}.



Figure 1-2
Stake reading on Austdalsbreen on 24 September 2025. Photo: Jostein Aasen.

Stratigraphic method

The mass balance is usually calculated using the stratigraphic method, which means the balance between two successive "summer surfaces" (i.e. surface minima). Consequently, the measurements describe the state of the glacier *after* the end of melting and *before* fresh snow has fallen. On some occasions ablation *after* the final measurements in September/October can occur. Measuring this additional ablation can sometimes be done later in the autumn and then will be included in that year's summer balance. However, measuring and calculating the additional ablation often cannot be done until the following winter or spring. Thus, it is counted as a negative contribution to the next year's winter balance.

Surface mass balance (SMB)

The mass balance presented in this report is the "surface mass balance" which means the sum of *surface accumulation* and *surface ablation*. A detailed definition is given in Cogley et al. (2011).

Uncertainty

The uncertainty of the mass balance measurements depends mainly on the uncertainty in the point measurements themselves, the uncertainty in spatial integration of the point measurements to glacier-averaged values (representativeness, number of points and unmeasured areas of the glacier) and the uncertainty of the glacier reference area

(uncertainties in area-altitude changes and ice-divides) (Zemp et al., 2013). The uncertainty of the point measurements is related to uncertainties in identifying the previous summer surface, in measurements of stakes and towers, in the density measurements and estimates and conversion to snow water equivalents.

As most of the factors are not easily quantified from independent measurements, a best qualified estimate is used to quantify the uncertainties (Andreassen et al., 2016). The determined values of uncertainties are thus based on subjective estimates.

Mass balance programme

In 2025 mass balance measurements were performed on ten glaciers and one ice patch in Norway - nine in southern Norway and two in northern Norway (Fig. 1-3). Included in this total is one small ice mass, Juvfonne, which can be characterised as an ice patch rather than a glacier (chap. 7).

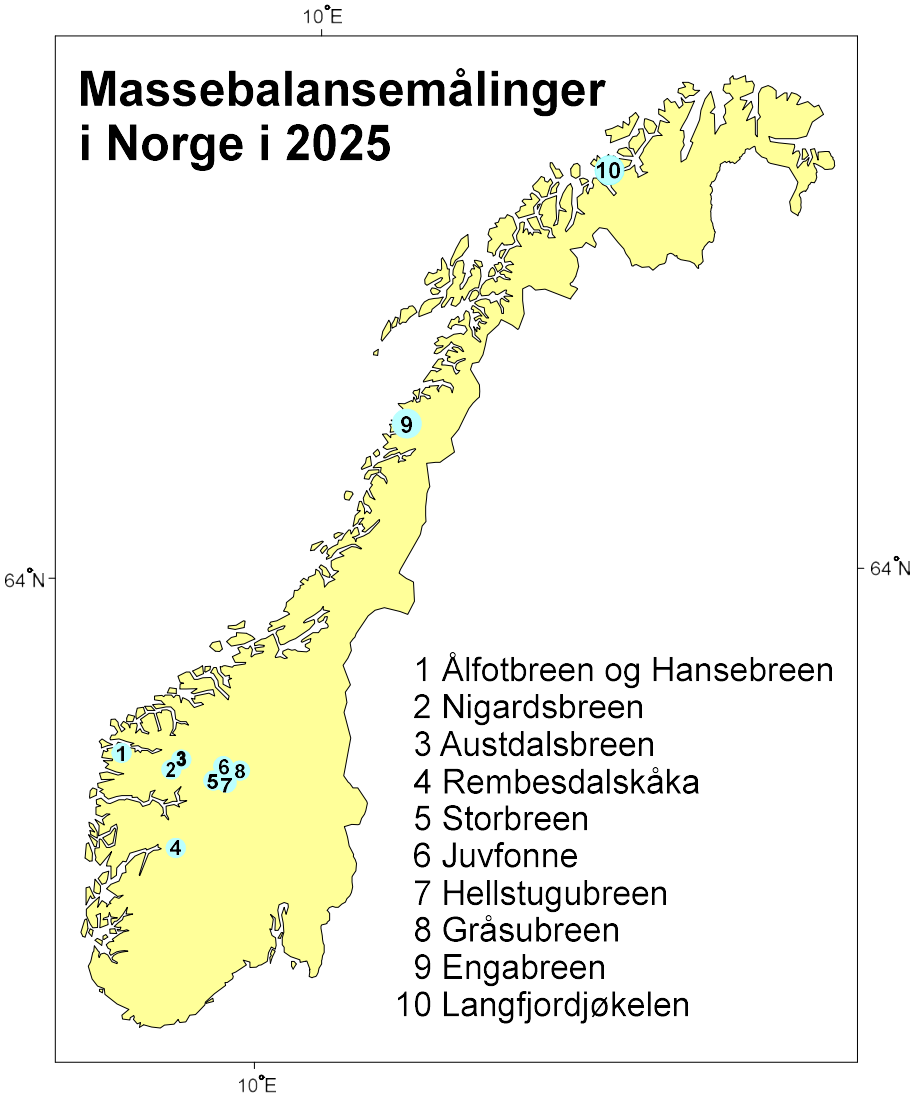


Figure 1-3
Location of the glaciers at which mass balance studies were performed in 2025.

In southern Norway, six of the glaciers (Ålfotbreen, Nigardsbreen, Rembesdalskåka, Storbreen, Hellstugubreen and Gråsubreen) have been measured for 63 consecutive

years or more. They constitute a west-east profile extending from the maritime Ålfotbreen glacier with an average winter balance of 3.6 m water equivalent to the continental Gråsubreen with an average winter balance of 0.7 m w.e. (using the reference period 1991-2020). Storbreen in Jotunheimen has the longest series of all glaciers in Norway with 77 years of measurements, while Engabreen on Svartisen has the longest series (56 years) in northern Norway. The six glaciers measured for 63 consecutive years or more, together with Hansebreen in southern Norway and Langfjordjøkelen and Engabreen in northern Norway, are included in the Norwegian Hydrological Reference Dataset (Fleig et al., 2013; Andreassen and Elvehøy, 2021). These nine glaciers constitute the so-called mass balance reference glaciers. Austdalsbreen was excluded because it is calving into a hydro-power reservoir, and consequently the glacier is influenced by the lake level regulations. For eight of the reference glaciers, a 30-year reference period (1991-2020) is defined and the balance values for 2025 are compared with the average of the reference period. Langfjordjøkelen was not measured in 1994 and 1995 and thus, the reference period 1991-2020 can not be defined. A comprehensive review of the glacier mass balance and front variation measurements in Norway is given in Andreassen et al. (2020).

Mass balance studies performed on Norwegian glaciers in 2025 are reported in detail for each glacier in the following chapters (chap. 2-11).

The mass balance (winter, summer and annual balance) is given in specific water equivalent (m w.e.) for each 50 or 100 m height interval. The results are presented in tables and diagrams. All diagrams have the same ratio between units on the *x*- and *y*-axes in order to make comparison straightforward. Finally, histograms showing the complete mass balance records for each glacier are presented.

Weather conditions and mass balance results

Winter weather, snow accumulation and winter balance

The winter season 2024/25 started with wet and mild weather in October, November and December, particularly in western and northern Norway. January and February, however, were dry over most of the country. The end of the winter season was snow-rich in northern Norway. In southern Norway March was snow-rich, while April was snow-poor.

The winter balance was greater than the 1991-2020 average for five of the nine reference glaciers. Engabreen on Svartisen had the greatest relative winter balance with 164 % of the 1991-2020 average. This is the greatest winter balance measured since measurements started in 1970. The neighbouring glaciers Ålfotbreen and Hansebreen had the lowest relative winter balances with 69 % and 63 % of the 1991-2020 averages, respectively.

Summer weather, ablation and summer balance

The summer season started with a normal June and a warm July all over the country. The warm weather continued in northern Norway, while August was some cool in south. The summer season ended with a warm September all over the country.

The summer balance was greater than the 1991-2020 average for eight of the nine reference glaciers. Only Nigardsbreen had a lower summer balance (95 %) than the

1991-2020 average. Gråsubreen in Jotunheimen had the greatest relative summer balance with 163 % of the reference period average.

Annual balance

The annual balance thus was negative for seven of the nine reference glaciers. Ålfotbreen and Hansebreen had the greatest deficits with −2.4 m w.e. and −3.5 m w.e., respectively. Nigardsbreen and Engabreen had positive annual balances with +0.1 m w.e. and +0.6 m w.e., respectively.

The results from the mass balance measurements in Norway in 2025 are shown in Table 1-1. Winter (B_w), summer (B_s) and annual balance (B_a) are given in m w.e. averaged over the entire glacier area. The figures in the "% of ref." column show the current results as a percentage of the average for the period 1991-2020. The annual balance results are compared with the mean annual balance in the same way. ELA is the equilibrium line altitude (m a.s.l.) and AAR is the accumulation area ratio (%).

Circulation patterns AO and NAO

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. Indices such as the North Atlantic Oscillation (NAO) and the Arctic Oscillation (AO) are used to describe the variation in the pressure gradients in the northern latitudes, and the resulting effects on temperature and storm tracks. When the NAO or AO is positive, the coast of Norway experiences warm and wet winters resulting in high winter precipitation on the glaciers. When the NAO or AO is negative, the winters are colder and drier with less precipitation on the glaciers (Hanssen-Bauer and Førland, 1998; Nesje et al., 2000). Although NAO is more commonly used, winter and annual balance of the northernmost glaciers, Langfjordjøkelen and Engabreen, are better correlated with AO than NAO (Andreassen et al., 2020). For the glaciers in southern Norway, the correlations are similar for NAO and AO, and reduced with distance to the coast (Rasmussen, 2007; Andreassen et al., 2020).

In winter 2024/2025 (December-March) the NAO index was positive in December, February and March, and the AO index was only positive in March. The resulting NAO and AO mean was 0.65 and -0.18 respectively for December-March calculated from the monthly means, source: http://www.cpc.ncep.noaa.gov/. The NAO and AO indexes vary from year to year (Fig. 1-4). Over the period 1989-2024 the most positive NAO and AO years were in the period with mass surplus from 1989 to 1995 and in some more recent years, e.g., 2012, 2014 and 2015 and 2020.

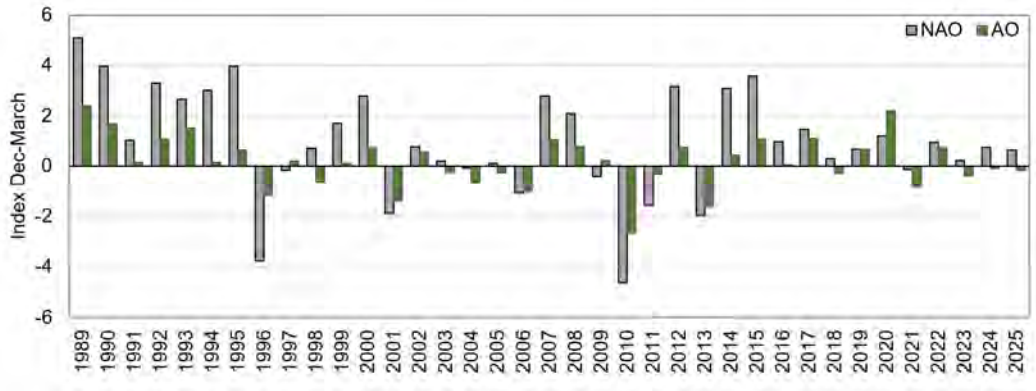


Figure 1-4
NAO and AO index for December–March for 1989–2025. NAO and AO data were downloaded from the NOAA Center for Weather and Climate Prediction (http://www.cpc.ncep.noaa.gov/). Figure updated and modified from Andreassen et al. (2020). The large-scale circulation indices NAO and AO are in units of standard deviations from the mean, in which both statistics are calculated from multi-year records of the two indices.

Table 1-1
Summary of results from mass balance measurements performed in Norway in 2025. The glaciers in southern Norway are listed from west to east. The figures in the *% of ref.* column show the current results as a percentage of the average for the reference period 1991-2020. Glacier IDs from the Inventory of Norwegian Glaciers (Andreassen and Winsvold, 2012).

Glacier name	*Glacier ID*	*Period*	*Area* (km^2)	*Altitude* (*m a.s.l.*)	B_w (*m*)	*% of ref.*	B_s (*m*)	*% of ref.*	B_a (*m*)	B_a *ref.*	*ELA* (*m a.s.l.*)	*AAR* (*%*)
Ålfotbreen	2078	1963-25	3.5	1000-1360	2.51	69	−4.91	121	−2.40	−0.42	>1360	0
Hansebreen	2085	1986-25	2.5	927-1303	2.17	63	−5.62	137	−3.45	−0.66	>1303	0
Nigardsbreen	2297	1962-25	44.9	389-1955	2.30	102	−2.23	97	0.06	−0.05	1510	75
Austdalsbreen	2478	1988-25	10.1	1200-1740	2.05	97	[1)]−2.75	102	−0.70	−0.60	undef.	
Rembesdalskåka	2968	1963-25	17.1	1085-1851	2.08	99	−2.41	101	−0.33	−0.29	1683	69
Storbreen	2636	1949-25	4.9	1420-2091	1.66	119	−2.13	106	−0.47	−0.62	1795	41
Juvfonne[2)]	2597	2010-25	0.1	1852-1985	2.10		−2.62		−0.52			
Hellstugubreen	2768	1962-25	2.7	1482-2229	1.06	101	−1.91	113	−0.85	−0.63	2010	19
Gråsubreen	2743	1962-25	1.7	1854-2277	0.64	91	−2.18	163	−1.54	−0.62	undef.	
Engabreen	1094	1970-25	36.0	177-1532	4.44	164	−3.80	137	0.64	−0.06	1125	70
Langfjordjøkelen	54	1989-93 1996-25	3.7 2.6	280-1050 338-1043	2.46	[3)]117	−3.69	[3)]118	−1.23	−0.13 [3)]−1.04	>1043	0

[1)] *Contribution from calving amounts to −0.11 m for B_s and B_a*
[2)] *Calculated for a point only, b_w, b_s and b_a*
[3)] *Calculated for the measured periods 1989-93 and 1996-2024*

Figure 1-5 presents the mass balance results for eight glaciers in southern Norway for 2025. The west-east gradient is evident for both winter and summer balances.

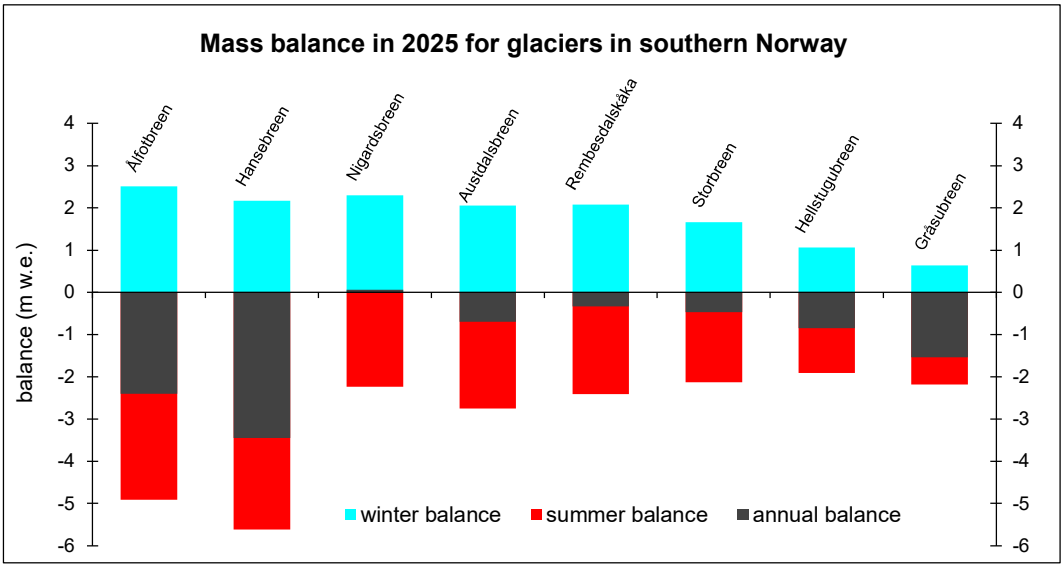


Figure 1-5
Mass balance in 2025 in southern Norway. The glaciers are listed from west to east.

The cumulative annual balance for the six long-term glaciers (measured for 63 consecutive years or more) in southern Norway for the period 1963-2025 is shown in Figure 1-6. The maritime glaciers, Ålfotbreen, Nigardsbreen and Rembesdalskåka, showed a marked surplus during the period 1989-95. The surplus was mainly the result of several winters with heavy snowfall. Nigardsbreen is the only glacier with a mass

surplus over the period 1963-2025. Note that several of the series have been calibrated (Andreassen et al., 2016).

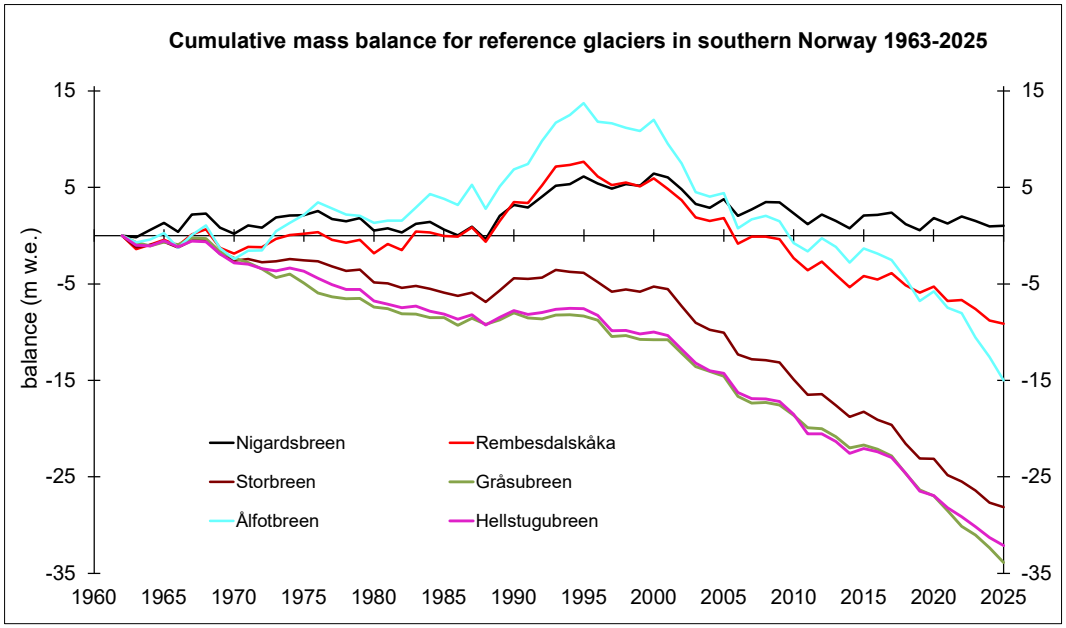


Figure 1-6
Cumulative mass balance for the six long-term glaciers in southern Norway for the period 1963-2025.

1.2 Other investigations

Glacier front variation measurements were performed for 39 glaciers in Norway in 2025. Some of the glaciers have record going back to about 1900. The front variations are summarised in chapter 12.

Glacier dynamics (surface velocity) has been studied at Austdalsbreen, Rembesdalskåka and Storbreen (chap. 4).

Meteorological observations were performed at Ålfotbreen (chap. 2), Engabreen (chap. 10) and Langfjordjøkelen (chap. 11).

Discharge was measured in glacier rivers from Ålfotbreen (chap. 2), Nigardsbreen (chap. 3) and Langfjordjøkelen (chap. 11).

Some jøkulhlaups and runoffs from glacier lakes that occurred in 2025 are described in chapter 13.

The year 2025 was declared as the International Year of Glaciers' Preservation by the UN General Assembly. The activities carried out by NVE are described in chapter 14.

2. Ålfotbreen (Bjarne Kjøllmoen)

The Ålfotbreen ice cap (61°45′N, 5°40′E) has an area of 9.3 km^2 (2019) and is one of the westernmost and most maritime glaciers in Norway. Mass balance studies are performed on two adjacent north-facing outlet glaciers, Ålfotbreen (3.5 km^2, 2019) and Hansebreen (2.5 km^2, 2019) (Fig. 2-1). The westernmost of these two has been the subject of mass balance investigations since 1963 and has always been reported as Ålfotbreen. The adjacent glacier east of Ålfotbreen has been given the name Hansebreen and has been measured since 1986. None of the outlet glaciers of the ice cap are named on official maps.

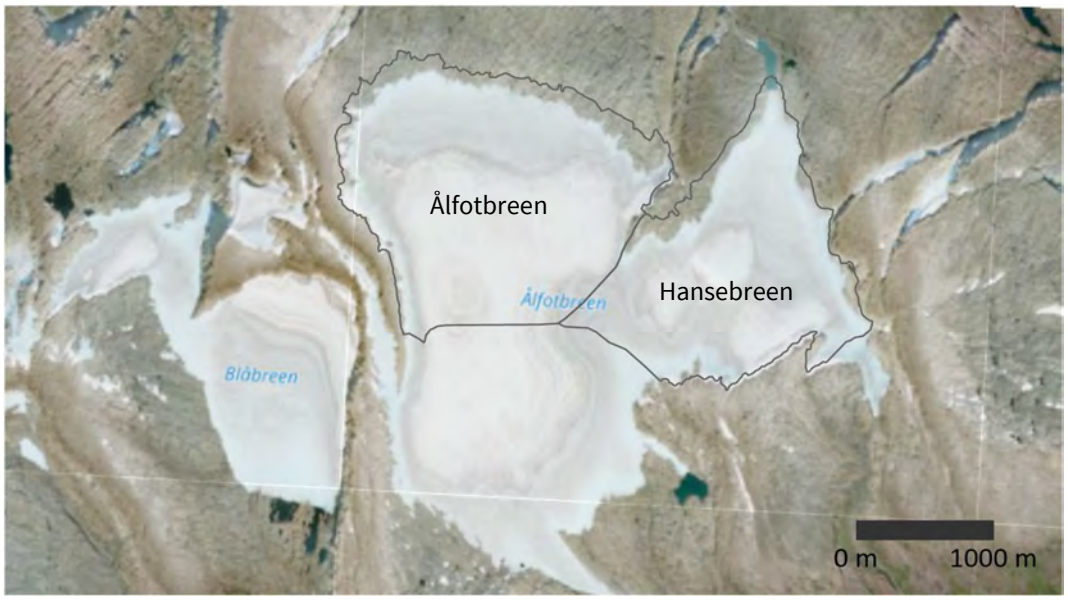


Figure 2-1
Sentinel-2 image from 6 September 2025 showing the Ålfotbreen ice cap. Mass balance measurements are performed on the two north-facing outlet glaciers, here called Ålfotbreen (left) and Hansebreen (right). The basin outlines are based on orthophoto from 2019. Source: Copernicus Browser.

2.1 Mass balance 2025

Fieldwork

Snow accumulation measurements were performed on 24 and 25 April. The sounding conditions were good on both glaciers, and the summer surface could be reliably detected. However, six of the soundings on Hansebreen were discarded as the snow depths were considered to be overestimated. Hence, the calculation of winter balance was based on 57 and 46 snow depth soundings on Ålfotbreen and Hansebreen, respectively. Generally, the snow depth varied between 4 and 6½ m on Ålfotbreen, and between 3 and 6 m on Hansebreen. Snow density was measured in one location (pos. 30, 1284 m a.s.l.), assumed to be representative for both glaciers (Fig. 2-2). The mean density of the snowpack in position 30 was 495 kg m^{-3}. The measured mean snow density for the ten-year period 2015-2024 is 516 kg m^{-3}.

The location of stakes, density pit and soundings are shown in Figure 2-2.

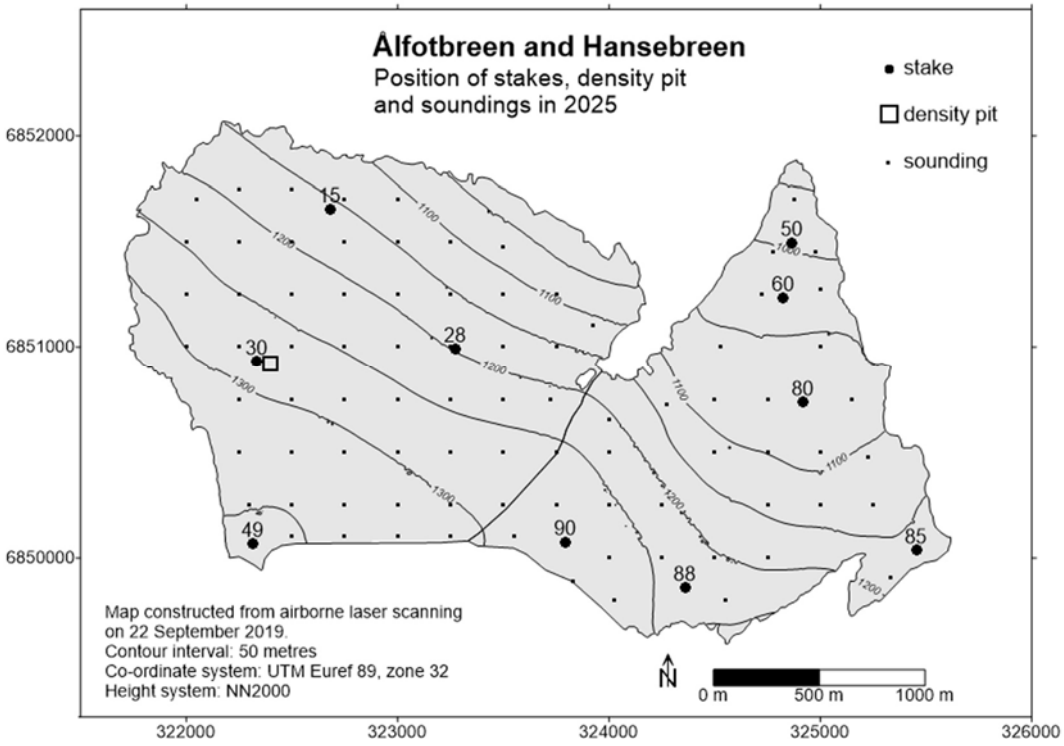


Figure 2-2
Location of stakes, soundings and snow pit on Ålfotbreen (left) and Hansebreen (right) in 2025.

Ablation was measured on 17 October. The annual balance was measured at stakes in four positions on Ålfotbreen and six positions on Hansebreen (Fig. 2-2). At the time of the ablation measurements up to 15 cm fresh snow had fallen on the glaciers.

Results

The calculations are based on the DTM from 2019.

All height intervals are represented with point measurements (bw) for both glaciers. However, there are no stake measurements below 1159 m a.s.l. on Ålfotbreen.

The winter balance was calculated as a mean value for each 50-m height interval and was 2.5 ±0.2 m w.e. on Ålfotbreen, which is 69 % of the mean winter balance for the reference period 1991-2020. The winter balance on Hansebreen was calculated as 2.2 ±0.2 m w.e., which is 63 % of the mean winter balance for the reference period 1991-2020. Spatial distribution of the winter balance on Ålfotbreen and Hansebreen is shown in Figure 2-3.

The density of melted ice was set as 900 kg m^{-3}. The summer balance for Ålfotbreen was calculated at stakes at four different altitudes, and there were no stake measurements below 1159 m a.s.l. Thus, stake values from the two lowest stakes on Hansebreen (○) (1078 and 1029 m a.s.l.) were used to support the assessment of the summer balance curve in the lowermost part of Ålfotbreen (Fig. 2-4). The summer balance for Hansebreen was calculated at stakes in six different altitudes.

Based on estimated density and stake measurements the summer balance was also calculated as a mean value for each 50 m height interval and was −4.9 ±0.3 m w.e. on Ålfotbreen, which is 121 % of the reference period. The summer balance on Hansebreen

was −5.6 ±0.3 m w.e., which is 137 % of the mean summer balance for the reference period 1991-2020.

Hence, the annual balance was negative for both glaciers. Ålfotbreen had a deficit of −2.4 ±0.4 m w.e. The mean annual balance for the reference period 1991-2020 is −0.42 m w.e.

The annual balance on Hansebreen was −3.5 ±0.4 m w.e. The mean value for the reference period 1991-2020 is −0.66 m w.e.

The mass balance results are shown in Table 2-1 and the corresponding curves for specific and volume balance are shown in Figure 2-4.

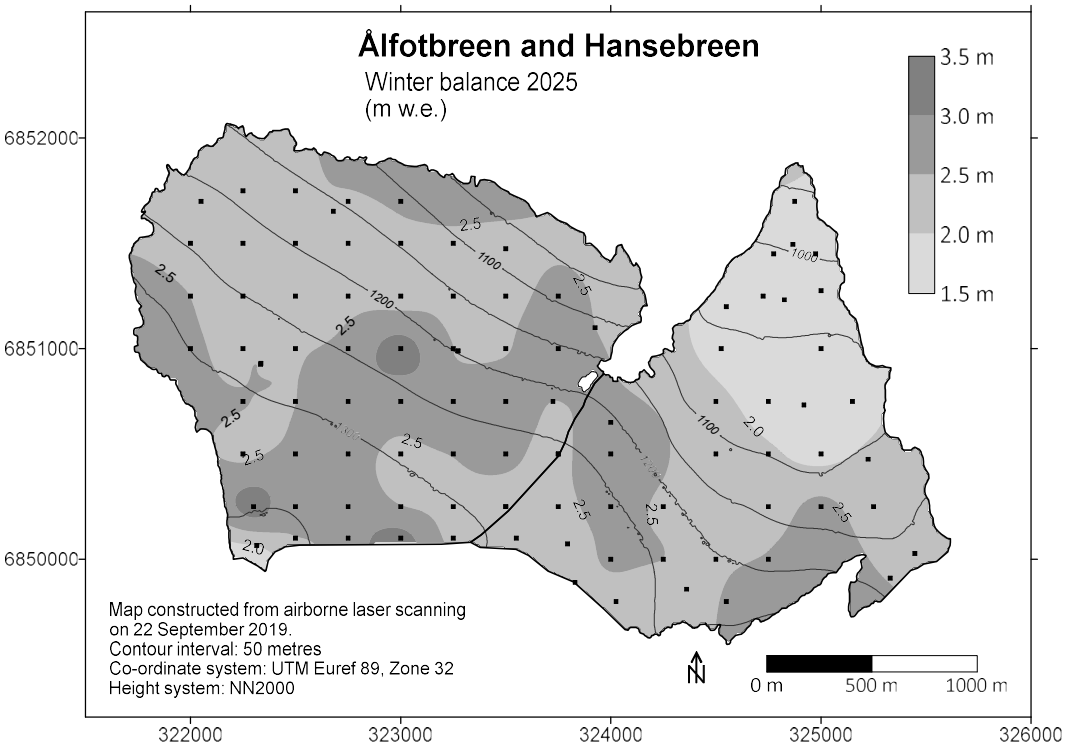


Figure 2-3
Spatial distribution of the winter balance on Ålfotbreen (left) and Hansebreen (right) in 2025.

According to Figure 2-4 the ELA was above the highest point on both glaciers, and consequently, the AAR was 0 %.

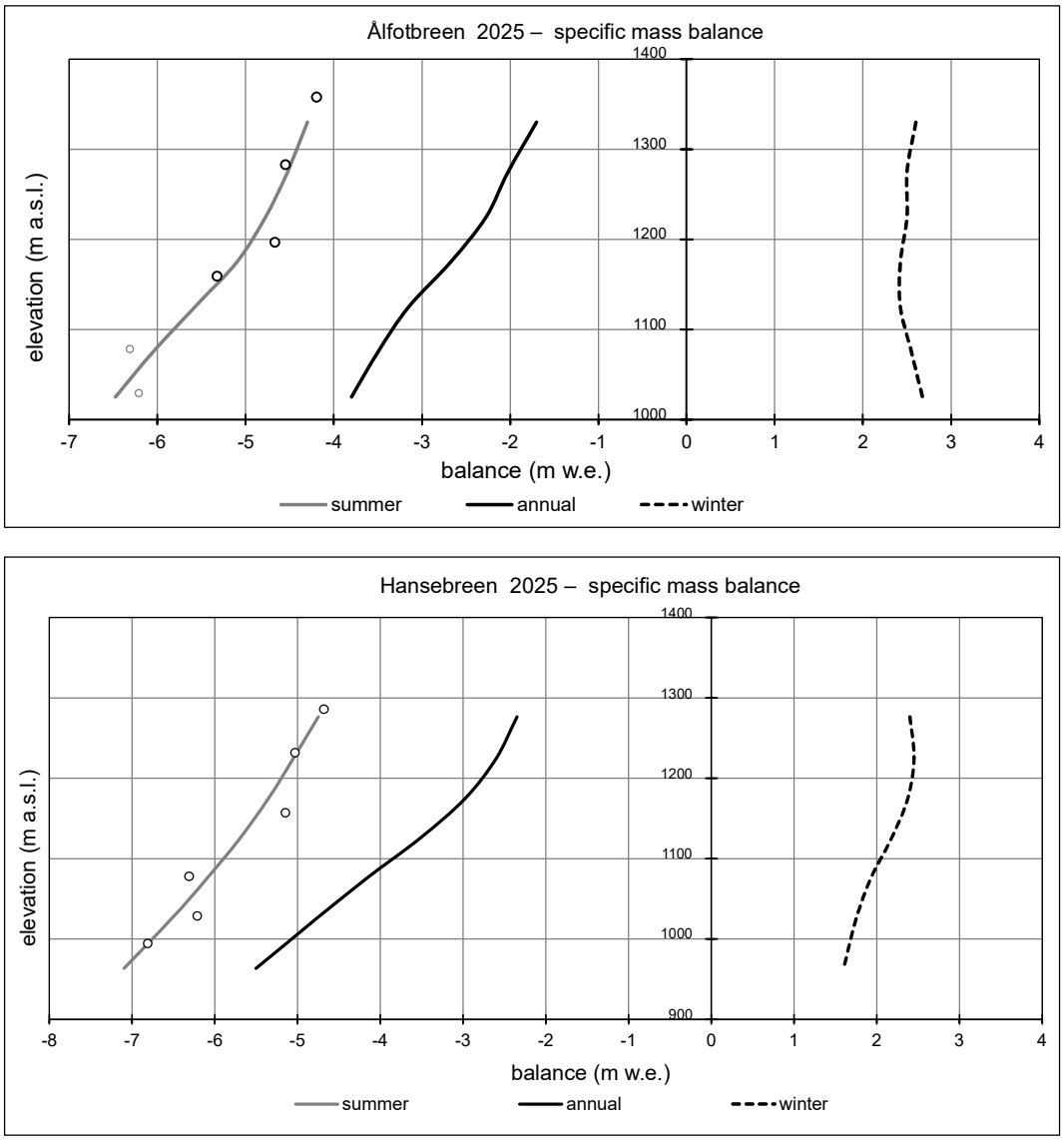


Figure 2-4
Mass balance diagram for Ålfotbreen (upper) and Hansebreen (lower) in 2025 showing altitudinal distribution of specific winter, summer and annual balance. Specific summer balance at each stake is shown (○). The two lowest stakes on Hansebreen are used to control the summer balance curve below 1159 m a.s.l. on Ålfotbreen.

Table 2-1
Winter, summer and annual balance for Ålfotbreen (upper) and Hansebreen (lower) in 2025.

Mass balance Ålfotbreen 2024/25 – stratigraphic system

Altitude (m a.s.l.)	Area (km^2)	Winter balance Measured 24 Apr (m w.e.)	Summer balance Measured 17 Oct (m w.e.)	Annual balance S.S. 2024-2025 (m w.e.)
1300 - 1360	0.901	2.600	-4.300	-1.700
1250 - 1300	0.782	2.500	-4.525	-2.025
1200 - 1250	0.699	2.500	-4.775	-2.275
1150 - 1200	0.577	2.425	-5.100	-2.675
1100 - 1150	0.449	2.425	-5.575	-3.150
1050 - 1100	0.296	2.550	-6.050	-3.500
1000 - 1050	0.183	2.675	-6.475	-3.800
Specific mass balance				
1000-1360	**3.476**	**2.51**	**-4.91**	**-2.40**

Mass balance Hansebreen 2024/25 – stratigraphic system

Altitude (m a.s.l.)	Area (km^2)	Winter balance Measured 24 Apr (m w.e.)	Summer balance Measured 17 Oct (m w.e.)	Annual balance S.S. 2024-2025 (m w.e.)
1250 - 1303	0.371	2.400	-4.750	-2.350
1200 - 1250	0.415	2.450	-5.050	-2.600
1150 - 1200	0.389	2.375	-5.350	-2.975
1100 - 1150	0.425	2.175	-5.700	-3.525
1050 - 1100	0.537	1.925	-6.100	-4.175
1000 - 1050	0.243	1.750	-6.525	-4.775
927 - 1000	0.101	1.600	-7.100	-5.500
Specific balance				
927-1303	**2.481**	**2.17**	**-5.62**	**-3.45**

2.2 Mass balance 1963(86)-2025

The mass balance was negative on both glaciers in 2025, −2.4 m w.e. on Ålfotbreen and −3.5 m w.e. on Hansebreen. The historical mass balance results for Ålfotbreen and Hansebreen are presented in Figure 2-5. The cumulative annual balance for Ålfotbreen for 1963-2025 is −15.1 m w.e., which gives a mean annual balance of −0.24 m w.e. a^{-1}. Over the last ten years (2016-2025), the mean annual balance was −1.38 m w.e. The cumulative annual balance for Hansebreen for 1986-2025 is −33.2 m w.e., which gives a mean annual balance of −0.83 m w.e. a^{-1}. Over the last ten years, the mean annual balance was −2.01 m w.e.

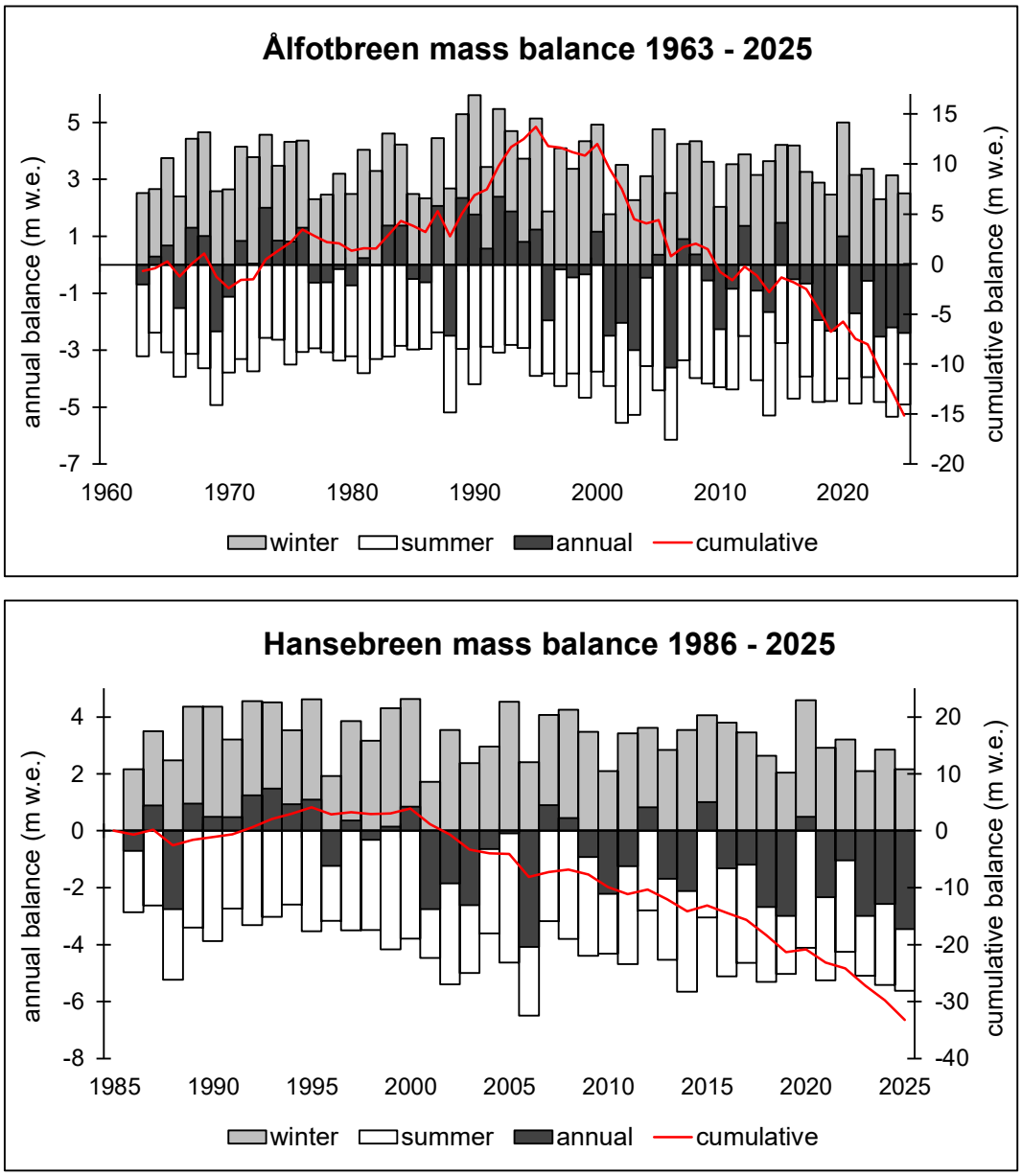


Figure 2-5
Mass balance on Ålfotbreen (upper) 1963-2025 and Hansebreen (lower) 1986-2025. Cumulative mass balance is given on the axis to the right.

2.3 Water discharge and air temperature

A measuring station (86.56.0 Breelva) for recording water discharge and air temperature is located in the glacier river Bredelva just north of Ålfotbreen (712 m a.s.l., Fig. 2-6). The current station has been in operation since September 2014 for water discharge and since September 2019 for air temperature (Fig. 2-7).

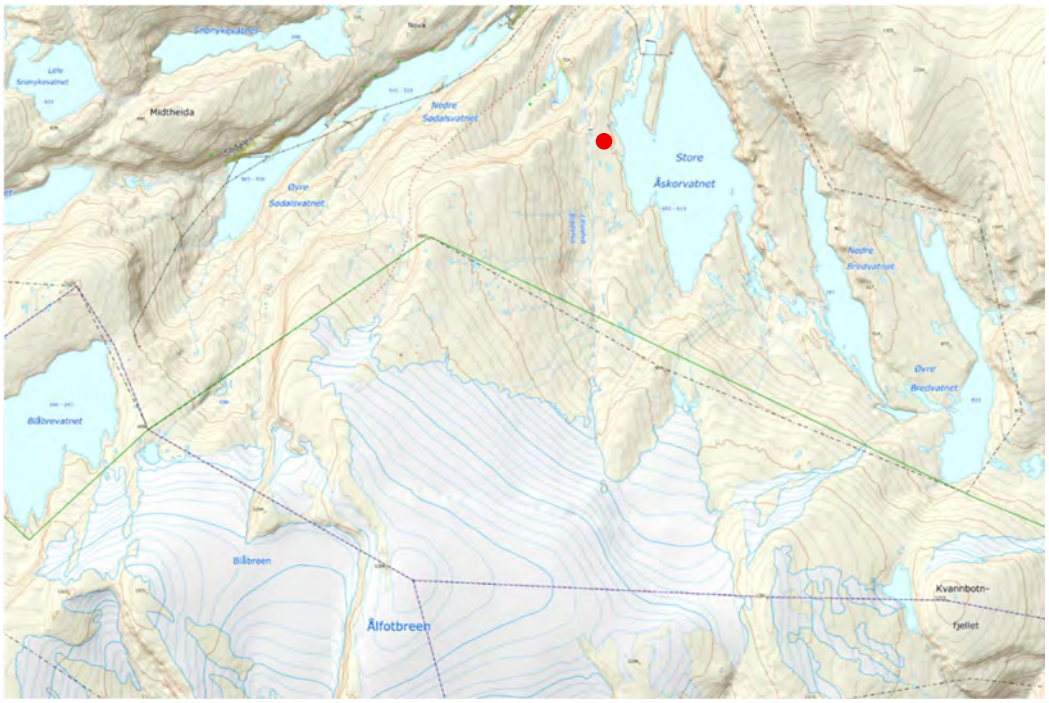


Figure 2-6
The measuring station 86.56.0 Breelva (red dot) is located north of Ålfotbreen in the glacier river Bredelva.



Figure 2-7
Measuring station for water discharge and air temperature in Bredelva photographed on 27 August 2019. In the background on the right, you can see the lower part of Ålfotbreen. Photo: NVE.

Air temperature and water discharge in the glacier river during the summer season are relevant and important parameters that are related to the summer balance and glacier changes. In the following some results from water discharge and air temperature measurements in 86.56.0 Breelva during the "summer season" 15 May-15 October are presented.

The total discharge from 15 May to 15 October 2025 at 86.56. Breelva was 42.7 mill. m^3. The mean discharge during the same period for the years 2016-2024 was 46.1 mill. m^3. The water discharge record from 1 May to 31 October 2025 is shown in Figure 2-8.

The monthly discharges for the “summer season” 2025 are summarized in Table 2-2. The discharge was slightly lower in 2025 than the mean value during the 9-year period 2016-2024.

Table 2-2
Seasonally and monthly total discharges (mill. m³) at 86.56.0 Breelva from 15 May to 15 October 2025.

	15 May-15 Oct	May*	June	July	August	September	October**
2025	42.7	4.3	8.8	7.7	8.4	6.1	7.4
2016-2024	46.1	6.2	9.4	8.6	9.3	7.7	4.9

*15-31 May

**1-15 Oct

The mean air temperature from 15 May to 15 October 2025 at 86.56.0 Breelva was 9.1 °C. The mean temperature during the same period for the years 2020-2024 was 8.7 °C. The temperature record from 1 May to 31 October 2025 is shown in Figure 2-8. The melt season on the upper part of the glacier (above 1250 m a.s.l.) started in the beginning of June and lasted until the middle of October.

The monthly temperatures for the “summer season” 2025 are summarized in Table 2-3. The summer season 15 May-15 October 2025 was slightly warmer than the mean value during the 5-year period 2020-2024. June 2025 was cooler and July was warmer than the 2020-2024 mean values.

The summer balances for the corresponding years were 4.91 m w.e. for 2025 and 4.58 m w.e. on average for the years 2016-2024.

Table 2-3
Seasonally and monthly temperatures (°C) at 86.56.0 Breelva from 15 May to 15 October 2025.

	15 May-15 Oct	May*	June	July	August	September	October**
2025	9.1	5.4	6.8	13.8	9.6	9.1	6.6
2020-2024	8.7	6.4	9.6	10.3	10.3	8.1	4.6

*15-31 May

**1-15 Oct

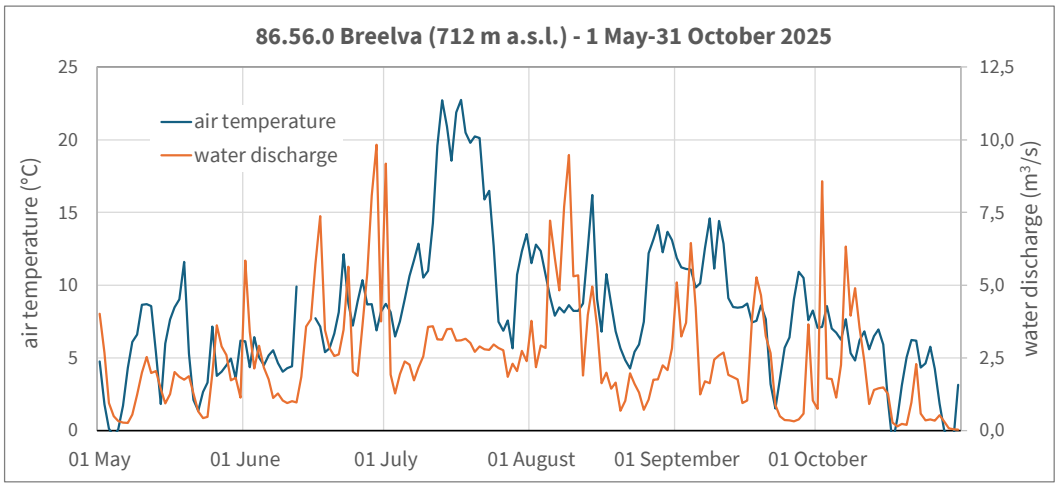


Figure 2-8
Water discharge and air temperature at station 86.56.0 Breelva for the months May-October 2025.

3. Nigardsbreen (Bjarne Kjøllmoen)

Nigardsbreen (61°42′N, 7°08′E) is one of the largest and best-known outlet glaciers from Jostedalsbreen. It has an area of 44.9 km^2 (2020) and flows south-east from the centre of the ice cap (Fig. 3-1). Nigardsbreen accounts for approximately 10 % of the total area of Jostedalsbreen, and extends from 1955 m a.s.l. down to 389 m a.s.l.

Glaciological investigations in 2025 include mass balance, front variations and discharge from the glacier river. Nigardsbreen has been the subject of mass balance investigations since 1962.

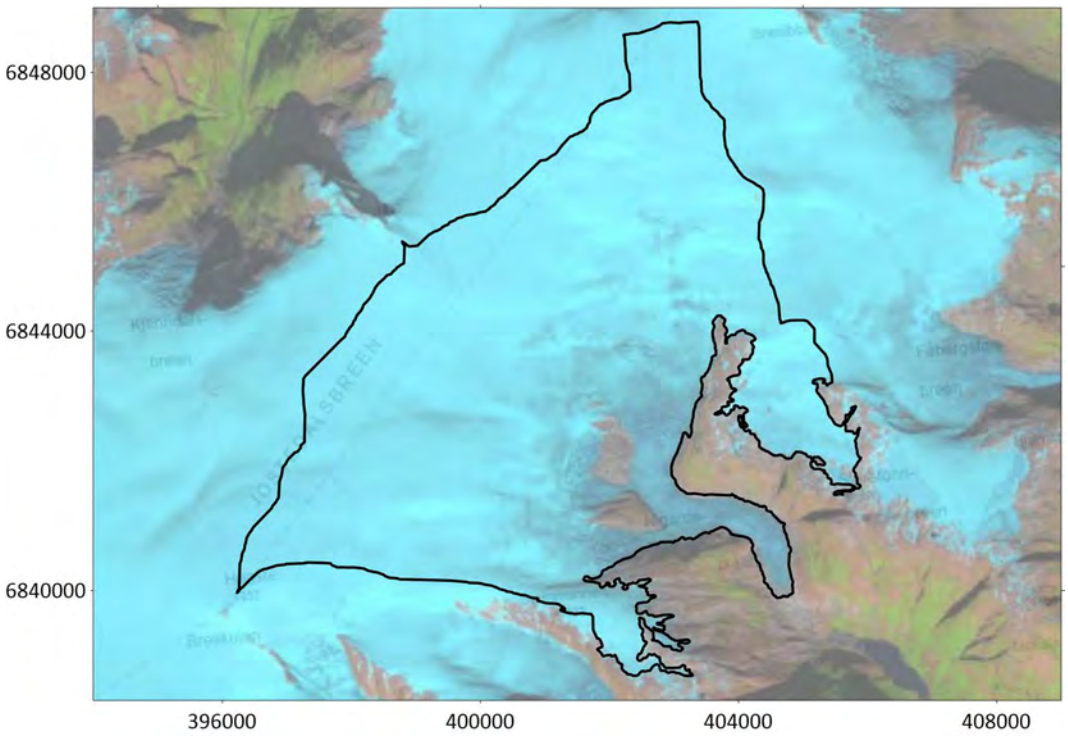


Figure 3-1
Satellite image showing Nigardsbreen on 25 August 2025. Source: senorge.no.

3.1 Mass balance 2025

Fieldwork

Snow accumulation was measured on 6 and 7 May and the calculation of winter balance is based on measurements of stakes and towers in six different positions, and 120 snow depth soundings (Fig. 3-2). The sounding conditions were some difficult with a solid ice layer at about 4 m depth and sometimes indistinct summer surface. On the plateau the snow depth varied between 4 and 6 m with a mean snow depth of 5.2 m. On the glacier tongue, the snow depth was 1.9 m at stake location 1000 (972 m a.s.l.). Snow density was measured at location 94 (1682 m a.s.l.), and the mean density of the snowpack was 482 kg m^{-3}.

Ablation was measured on 24 September. Measurements were made at stakes and towers in nine locations (Fig. 3-2). In the accumulation area there was up to 2.3 m of snow remaining from winter 2024/25. At the time of measurement, there was between

20 and 70 cm of fresh snow at the stakes on the glacier plateau. Comparison of stake measurements and snow depth soundings 29 April 2026 indicated that some melting occurred on the glacier tongue after the ablation measurements on 24 September 2025. This additional melting is included in the calculation of the mass balance for 2025.

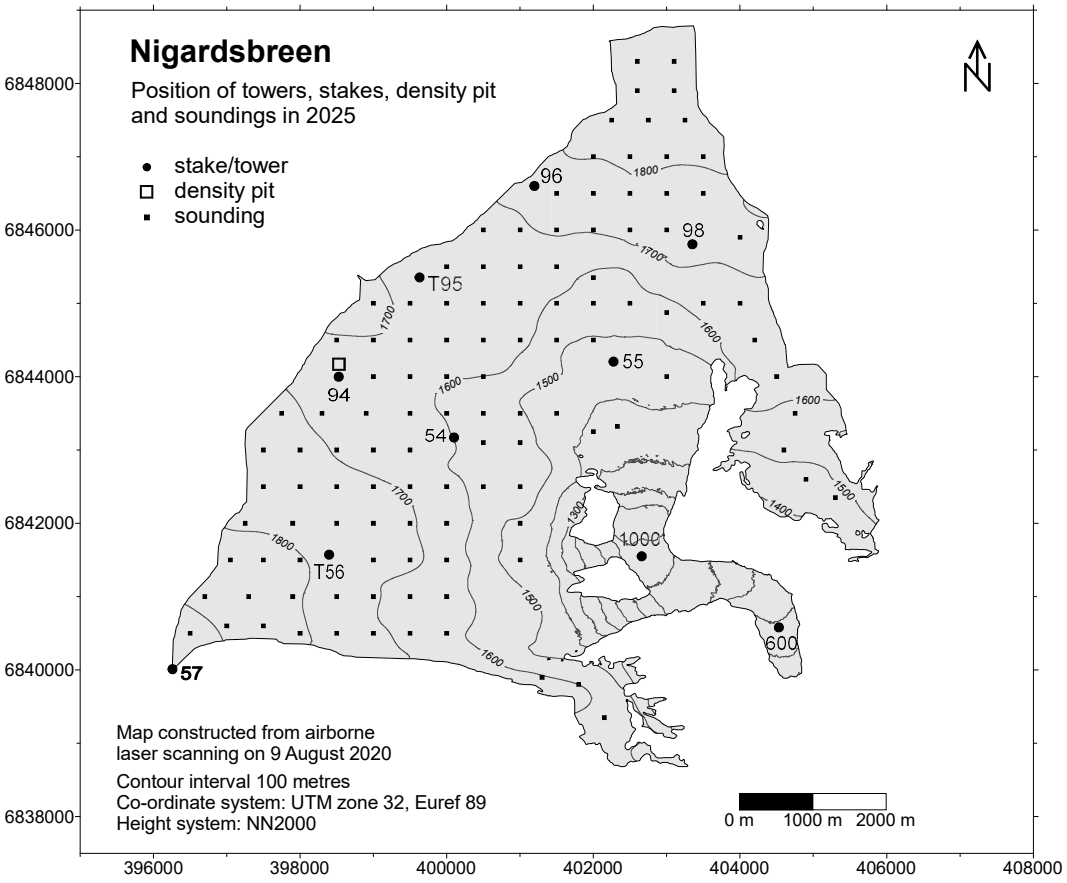


Figure 3-2
Location of towers, stakes, snow pit and soundings on Nigardsbreen in 2025.

Results

The calculations are based on a DTM from 2020.

The areas above 1450 m a.s.l., which cover about 83 % of the catchment area, were well-represented with point measurements. Below this altitude the curve pattern was based on point measurements at 972 and 584 m a.s.l.

The winter balance was calculated from mean values for each 100 m height interval and was 2.3 ±0.2 m w.e., which is 102 % of the mean winter balance for the reference period 1991-2020. Spatial distribution of the winter balance is shown in Figure 3-3.

The density of remaining snow was assumed to be 600 kg m^{-3}. The density of the melted ice was assumed to be 900 kg m^{-3}. Based on the estimated density and stake measurements the summer balance was calculated for each 100 m height interval and was −2.2 ±0.3 m w.e., which is 97 % of the mean summer balance for the reference period.

Hence, the annual balance was slightly positive, at 0.06 m ±0.40 m w.e. The mean annual balance for the reference period 1991-2020 is −0.05 m w.e.

The mass balance results are shown in Table 3-1 and the corresponding curves for specific and volume balances are shown in Figure 3-4.

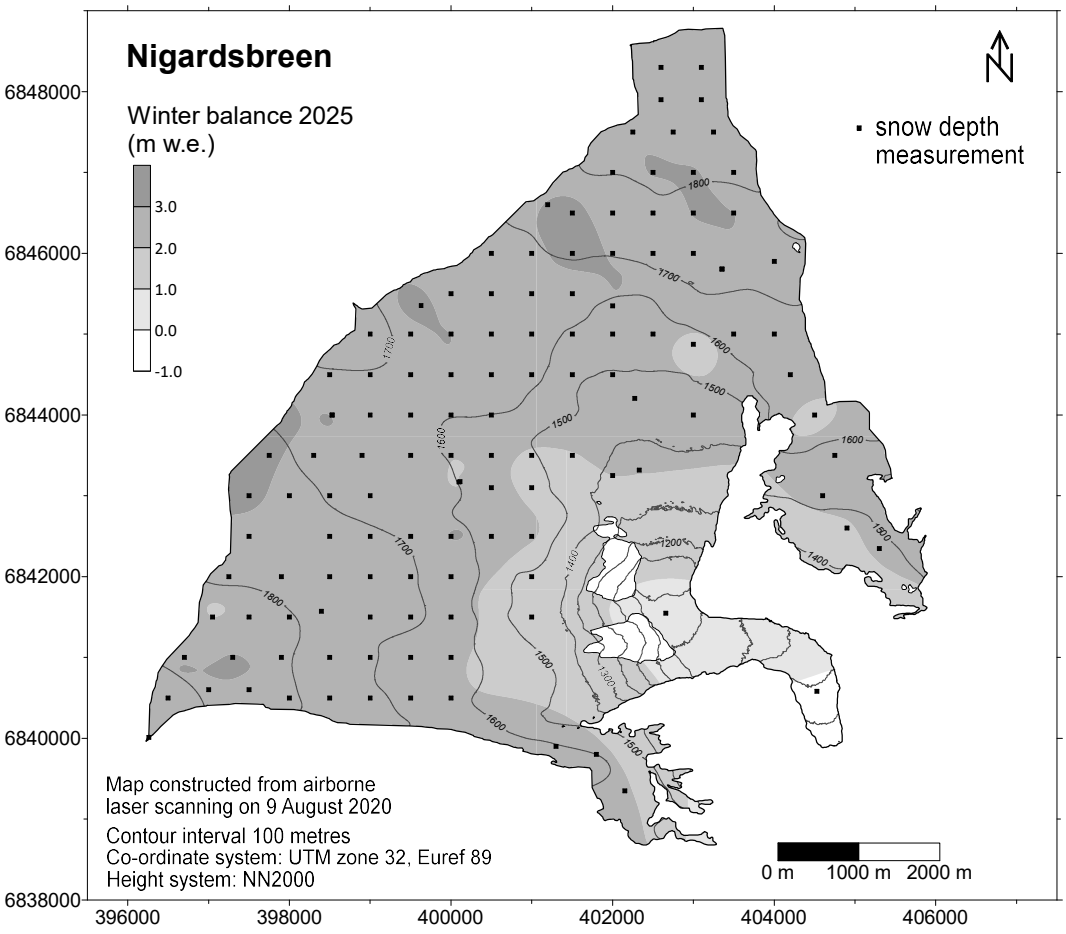


Figure 3-3
Spatial distribution of winter balance on Nigardsbreen in 2025.

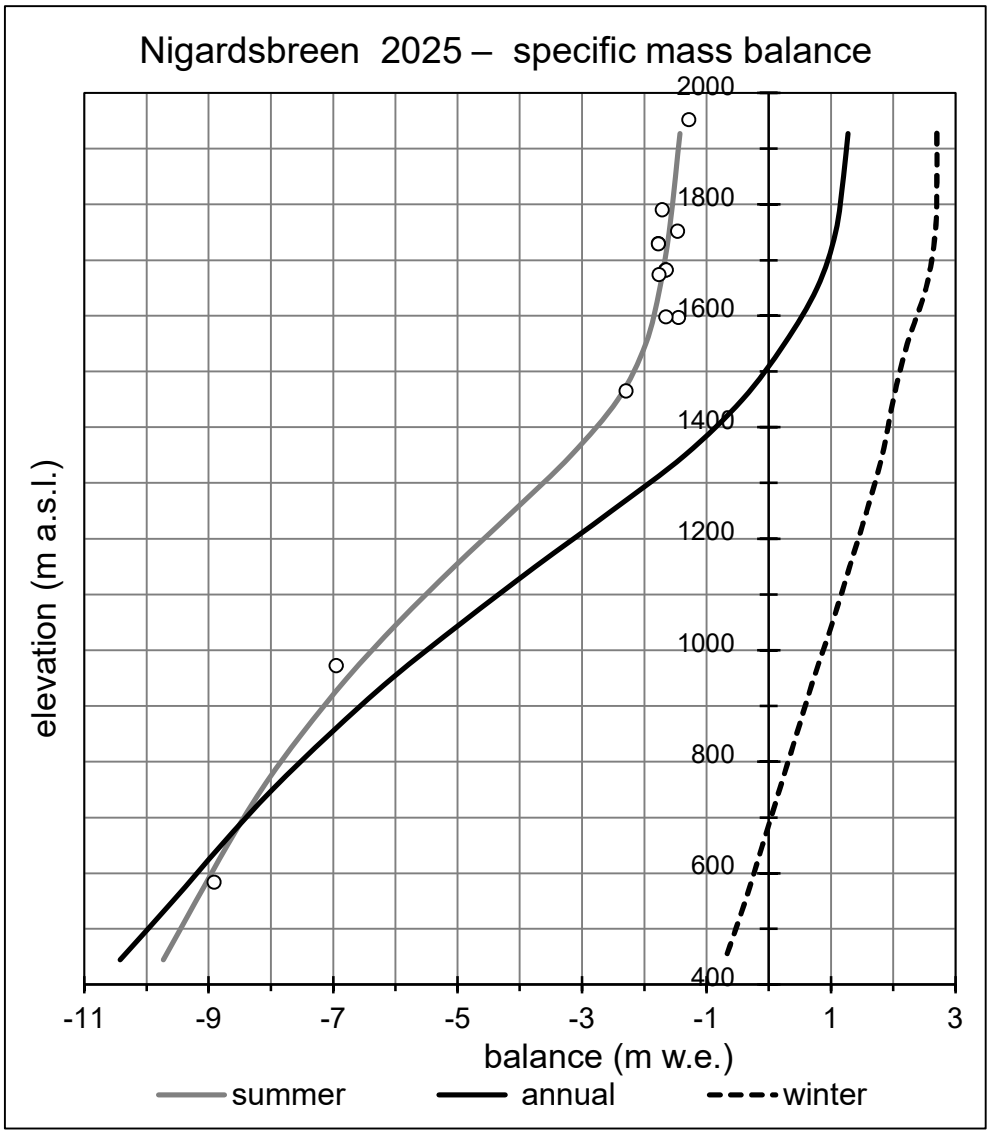


Figure 3-4
Mass balance diagram showing specific balance for Nigardsbreen in 2025. Specific summer balance at 10 different stake locations is shown as circles (○).

According to Figure 3-4, the equilibrium line altitude was 1510 m a.s.l. Consequently, the accumulation area ratio (AAR) was 75 %.

Table 3-1
The altitudinal distribution of winter, summer and annual balance in 100-m intervals for Nigardsbreen in 2025.

Mass balance Nigardsbreen 2024/25 – stratigraphic system

Altitude (m a.s.l.)	Area (km^2)	Winter balance Measured 4 May (m w.e.)	Summer balance Measured 22 Sep (m w.e.)	Annual balance S.S. 2022-2023 (m w.e.)
1900 - 1955	0.310	2.700	-1.425	1.28
1800 - 1900	4.056	2.700	-1.500	1.20
1700 - 1800	9.194	2.675	-1.600	1.08
1600 - 1700	12.738	2.525	-1.750	0.78
1500 - 1600	8.938	2.225	-1.975	0.25
1400 - 1500	5.921	2.000	-2.425	-0.43
1300 - 1400	2.082	1.825	-3.175	-1.35
1200 - 1300	0.787	1.575	-4.100	-2.53
1100 - 1200	0.390	1.300	-5.050	-3.75
1000 - 1100	0.580	1.025	-5.950	-4.93
900 - 1000	0.456	0.725	-6.775	-6.05
800 - 900	0.471	0.450	-7.500	-7.05
700 - 800	0.321	0.175	-8.150	-7.98
600 - 700	0.405	-0.100	-8.700	-8.80
500 - 600	0.261	-0.375	-9.200	-9.58
389 - 500	0.157	-0.700	-9.725	-10.43
Specific mass balance				
389-1955	**44.945**	**2.296**	**-2.233**	**0.063**

3.2 Mass balance 1962-2025

The mass balance results for Nigardsbreen 1962-2025 are presented in Figure 3-5. The cumulative annual balance for 1962-2025 is +3.3 m w.e., corresponding to a mean annual balance of +0.06 m w.e. a^{-1}. Over the past ten years (2016-2025), the mean annual balance was −0.10 m w.e.

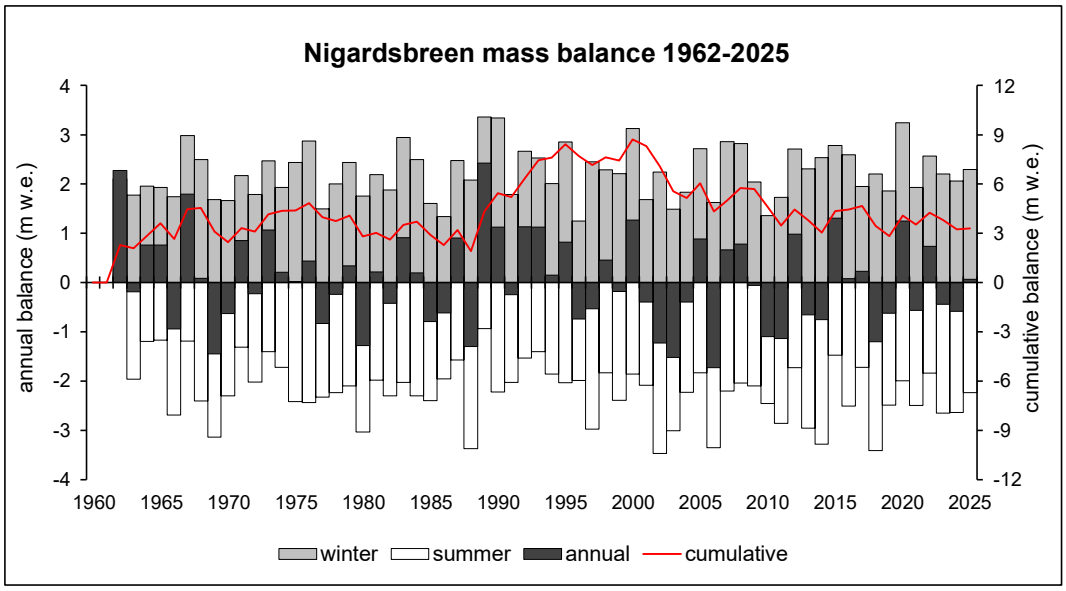


Figure 3-5
Winter, summer and annual balance on Nigardsbreen for 1962-2025. Cumulative mass balance is given on the right axis.

3.3 Water discharge

A discharge station (76.5.0 Nigardsbrevatn) is located at the outlet of the lake Nigardsbrevatnet, approximately 2.7 km southeast of the snout of Nigardsbreen (285 m a.s.l., Fig. 3-6). The station has been in operation since 1962 (Fig. 3-7).

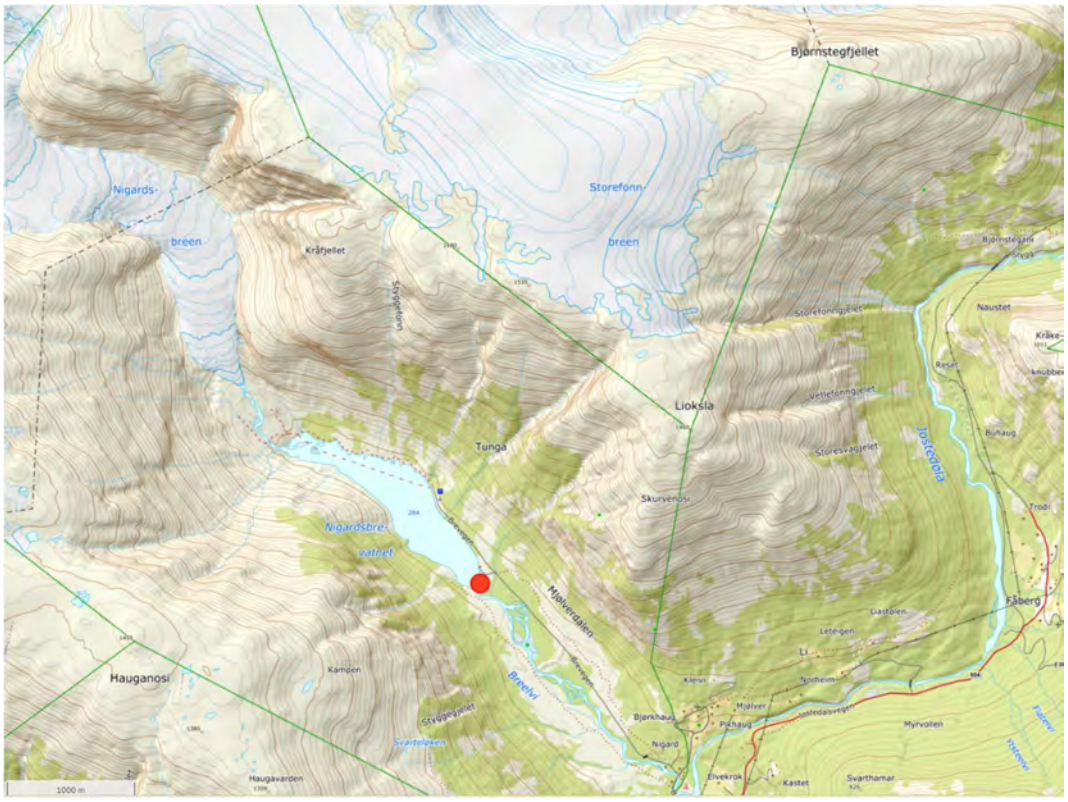


Figure 3-6
The water discharge station 76.5.0 Nigardsbrevatn (red dot) is located southeast of the Nigardsbreen glacier snout.



Figure 3-7
The water discharge station at the outlet of Nigardsbrevatnet photographed on 15 July 2014.
Photo: Ronny Løland.

Water discharge at the outlet of the lake Nigardsbrevatnet during the summer season is a relevant and important parameter that is related to the summer balance and glacier changes. In the following some results from water discharge measurements in 76.5.0 Nigardsbrevatn during the “summer season” 1 June-30 September are presented.

The total discharge from 1 June to 30 September 2025 at 76.5.0 Nigardsbrevatn was 219 mill. m^3. The mean discharge during the same period for the years 1963-2024 was 177 mill. m^3. The daily water discharge record from 1 June to 30 September 2025 is shown in Figure 3-8.

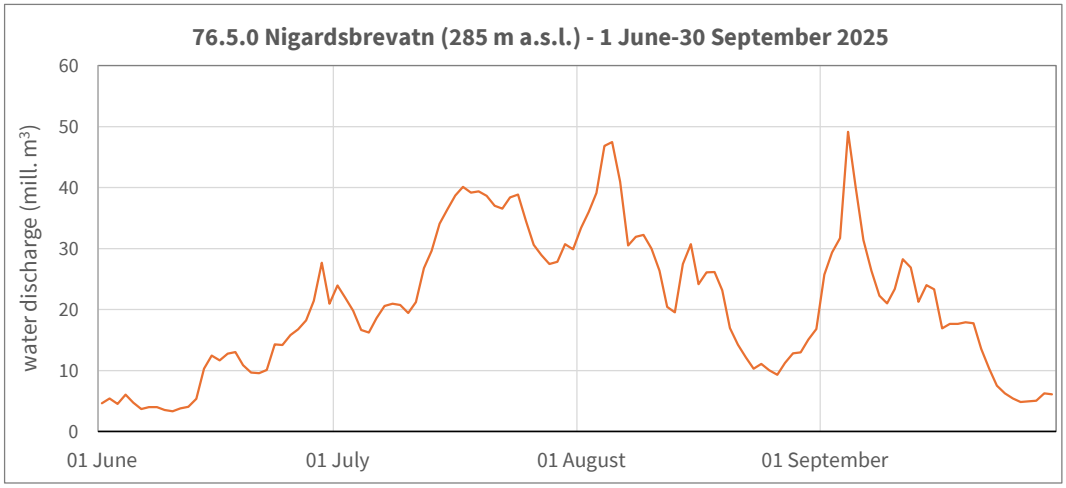


Figure 3-8
Daily water discharge at station 76.5.0 Nigardsbrevatn for the summer season June-September 2025. The high water discharge at the beginning of September is mainly due to heavy rainfall.

The seasonal and monthly discharges for the “summer season” 2025 are summarized and compared to previous years in Table 3-2. The total discharge was higher in 2025 (219 mill. m^3) than the mean value during the period 1963-2024 (177 mill. m^3). Except of June, every summer month in 2025 had higher water discharge than the average for 1963-2024.

Table 3-2
Seasonally and monthly total discharges (mill. m^3) at 76.5.0 Nigardsbrevatn from 1 June to 30 September 2025.

	1 June-30 Sept.	June	July	August	September
2025	219	27	78	64	50
1963-2024	177	30	58	58	32

4. Austdalsbreen (Hallgeir Elvehøy)

Austdalsbreen (61°45′N, 7°20′E) is an eastern outlet of the northern part of Jostedalsbreen, ranging in altitude from 1200 to 1740 m a.s.l. The glacier terminates in 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. The mass balance has been measured on Austdalsbreen since 1988.



Figure 4-1
Austdalsbreen on 24 September 2025. The lake level was close to 1200 m a.s.l., the highest regulated lake level. Photo: Arvid Holen/Statkraft.

4.1 Mass balance 2025

Fieldwork

Stakes were maintained through the winter in five stake locations. The snow accumulation was measured on 25 April. The calculation of the winter balance was based on measurements in seven stake locations and 42 snow depth sounding locations (Fig. 4-2). Detecting the summer surface was mainly easy. Most of the snow depth measurements were between 3.4 and 5.2 meters, and the average snow depth was 4.3 meters. The mean density of the snowpack down to 4.1 meters at stake A60 (1480 m a.s.l.) was 458 kg m^{-3}. Here the snow depth was 4.35 meters.

Summer and annual balance measurements were carried out on 24 September. Up to 30 cm of fresh snow covered the glacier. Stakes were found in all the seven stake locations. Between 4 and 6 meters of snow and ice had melted since 25 April. Only in the upper basin around A70 some winter snow remained (Fig. 4-2).

Stakes were re-measured and snow depth sounded on 21 April 2026, indicating up to 0.25 meter of additional ice melt after 24 September at stakes below 1450 m a.s.l.

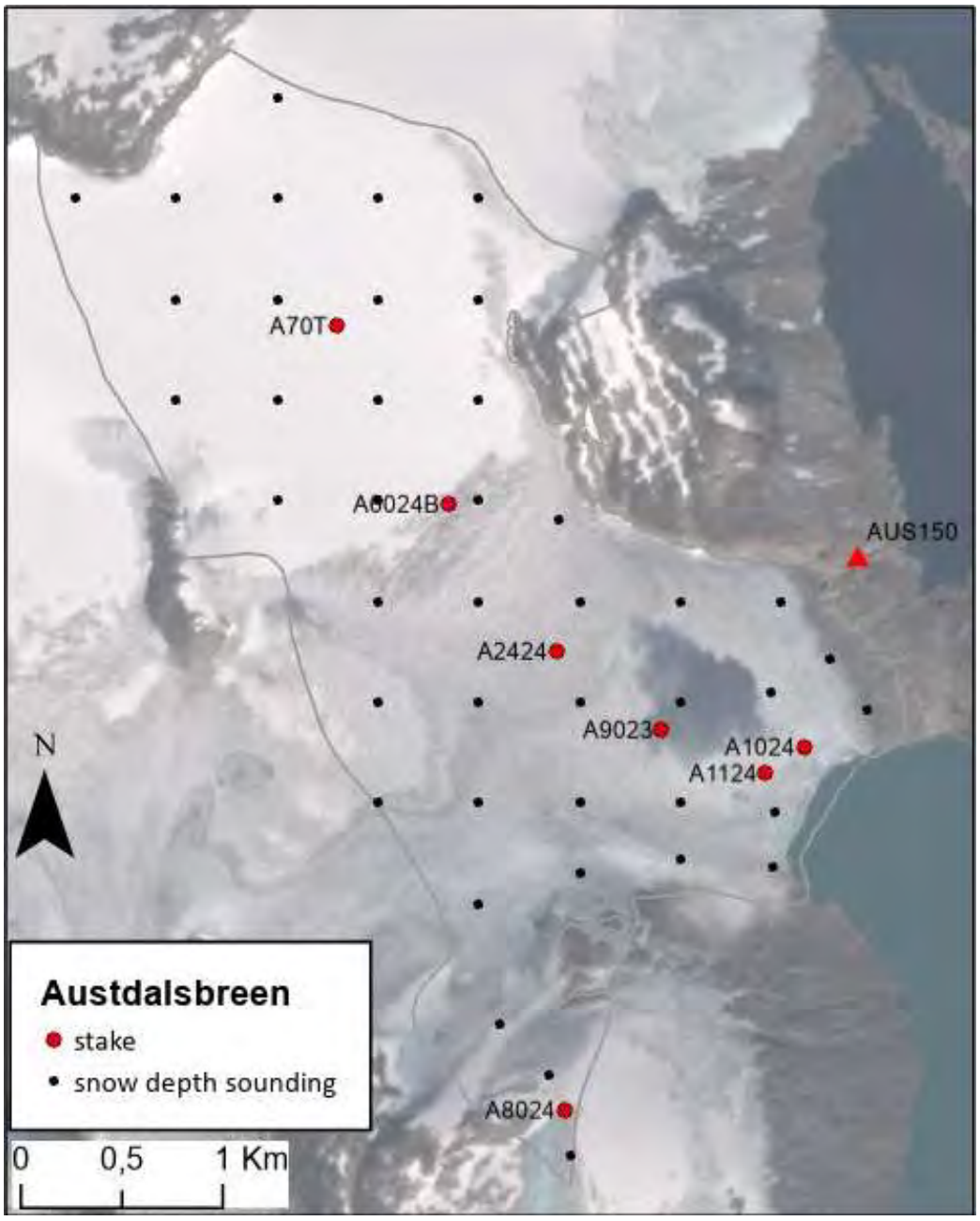


Figure 4-2
Location of stakes and snow depth soundings on a true-colour satellite image from 7 September 2025. The 2019 basin outline and terminus position is shown in grey. The snow density was measured at A6024B.
Image source: Copernicus Sentinel-2 (2025).

Results

The calculations are based on a DEM from 27 August 2019. The winter balance was calculated from snow depth and snow density measurements on 25 April. A function correlating snow depth with water equivalent values was calculated based on snow density measurements at stake A60 (1480 m a.s.l.). Point winter balance values were calculated from the snow depth measurements using the water equivalent value function. Averages for 50-meter elevation intervals were calculated and plotted against altitude. The winter balance curve was then adjusted to the averages and interpolated

where necessary (Fig. 4-3). The total winter balance was 21 ±2 mill. m^3 water or 2.1 ±0.2 m w.e., which is 97 % of the 1991-2020 average (2.11 m w.e.).

The summer balance was calculated for six stake locations between 1280 and 1715 m a.s.l. Stake A60 appeared to be sinking, so consequently it was not included in the calculations. The density of the remining snow, the melted old firn at A24 and A80, and the melted ice was set as 600, 800 and 900 kg m^{-3}, respectively. The summer balance curve was drawn from these six point values (Fig. 4-3).

Calving from the glacier terminus was calculated as the annual volume of ice (in water equivalent) transported through a cross section close to the terminus and adjusted for the volume change related to the annual front position change (chapter 4.2 and 4.3). The calving volume is calculated as:

$$Q_k = \rho_{ice} * (u_{ice} - u_f) * W * H$$

where ρ_{ice} is 900 kg m^{-3}, u_{ice} is annual glacier velocity (25 ±10 m a^{-1}), u_f is front position change averaged across the terminus (−13 ±5 m a^{-1}), W is terminus width (840 ±20 m) and H is mean ice thickness at the terminus (40 ±5 m). The width of the calving terminus was defined from an orthophoto from 27 August 2019. The mean ice thickness was calculated from the mean surface elevation along the calving terminus on 1 October 2024 (1226 m a.s.l.) and mean bottom elevation along the termini calculated from a bathymetry map (1186 m a.s.l., Kjøllmoen and others, 2020). The resulting calving volume was 1.1 ±0.8 mill. m^3 water equivalent.

The summer balance including calving was calculated as −28 ±3 mill. m^3 of water, and corresponds to −2.7 ±0.3 m w.e. The result is 103 % of the 1991-2020 average (−2.70 m w.e.). The calving volume was 4 % of the summer balance.

The annual balance on Austdalsbreen was calculated as −7 ±3 mill. m^3 water, corresponding to −0.7 ±0.3 m w.e. The average annual balance for the period 1991-2020 is −0.60 m w.e. The ELA and AAR in 2025 could not be defined as the area around A80 on Austdalsnuten was snow free (Fig 4-2). The altitudinal distribution of winter, summer and annual balance is shown in Table 4-1 and Figure 4-3. Results for 1988-2025 are shown in Figure 4-4.

Table 4-1
Altitudinal distribution of specific winter, summer, and annual balances for Austdalsbreen in 2025.

Mass balance Austdalsbreen 2024/25 - stratigraphic system

Altitude (m a.s.l.)	Area (km^2)	Winter balance Measured 25 April (m w.e.)	Summer balance Measured 24 Sep (m w.e.)	Annual balance Summer surface 2024 – 2025 (m w.e.)
1700 - 1740	0.090	1.70	-2.10	-0.40
1650 - 1700	0.119	2.20	-2.10	0.10
1600 - 1650	0.172	2.30	-2.10	0.20
1550 - 1600	1.584	2.40	-2.10	0.30
1500 - 1550	2.748	2.40	-2.10	0.30
1450 - 1500	1.503	2.10	-2.50	-0.40
1400 - 1450	1.594	1.90	-2.90	-1.00
1350 - 1400	0.952	1.70	-3.30	-1.60
1300 - 1350	0.721	1.40	-3.80	-2.40
1250 - 1300	0.457	1.20	-4.20	-3.00
1200 - 1250	0.182	1.00	-4.60	-3.60
Calving			-1.138 mill m^3	-1.138 mill m^3
Specific mass balance including calving				
1200 - 1740	**10.121**	**2.050**	**-2.771**	**-0.721**

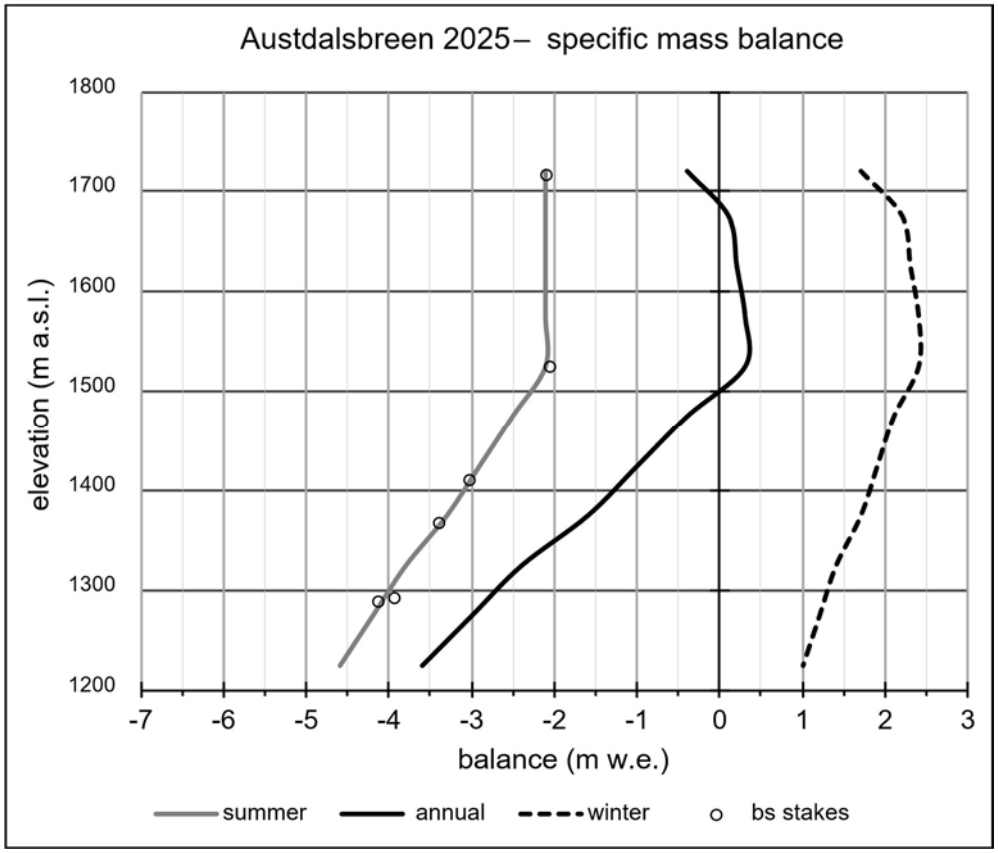


Figure 4-3
Hypsometric areal distribution (grey bars) and altitudinal distribution of specific winter, summer, and annual balance on Austdalsbreen in 2025. Specific summer balance in six stake locations is shown.

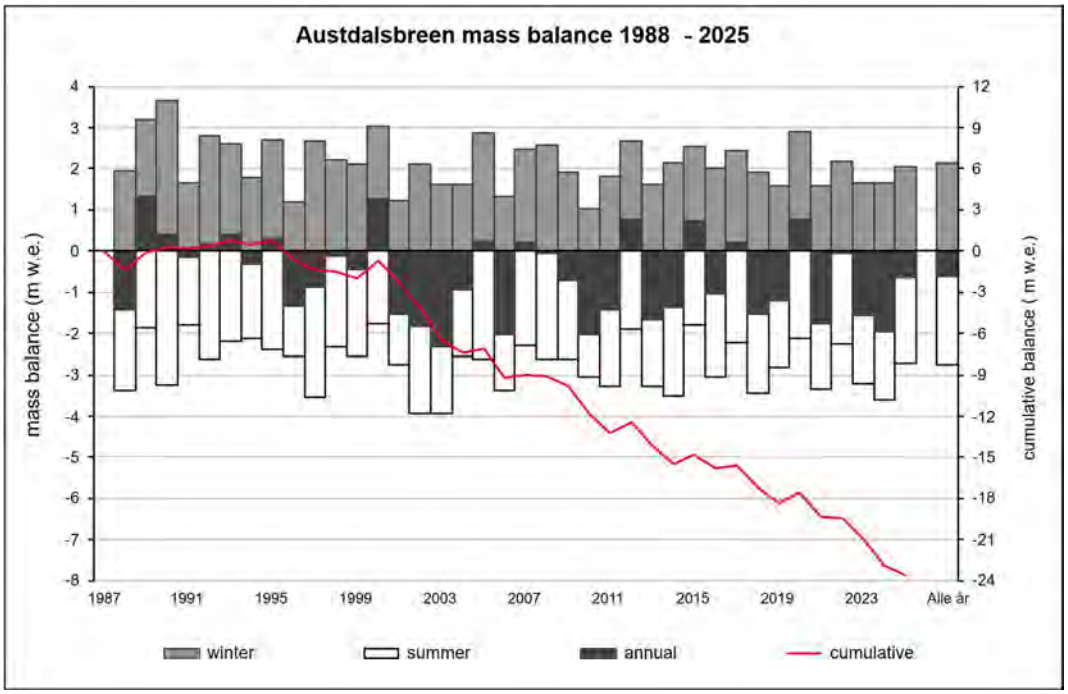


Figure 4-4
Winter, summer, annual and cumulative balance on Austdalsbreen during the period 1988-2025. Mean winter and summer balance is 2.13 and −2.75 m w.e., respectively. The cumulative mass balance is −23.6 m w.e.

4.2 Front position change

The terminus position was measured using a navigational GPS in a helicopter on 24 September and a true-colour image from the Sentinel-2 satellite on the same date. The average front position change between 1 October 2024 and 24 September 2025 and was −13 ±5 m (Fig. 4-5). The glacier terminus had retreated 757 m since 1988, and the lake area had increased by 0.759 km^2.

4.3 Glacier dynamics

Glacier velocities are calculated from repeated GNSS surveys of stakes. The stake network was surveyed on 21 August and 1 October 2024, and on 24 April and 18 August 2025. Annual velocities were calculated for the three stake locations A10, A11 and A90 (Fig 4-6) close to the glacier terminus between 1250 and 1350 m a.s.l. for the period between 21 August 2024 and 18 August 2025 (362 days). The annual results are comparable to results from 2011-15 (Kjøllmoen and others, 2016).

The glacier velocity averaged across the front width and thickness was estimated to calculate the calving volume. We assume the average of A10 and A11 is representative for the centre line surface velocity. The annual velocity at stake A10 and A11 between 21 August 2024 and 18 August 2025 was 34 and 42 m a−1, respectively. The glacier velocity averaged over the cross-section is calculated as 70 % of the central surface velocity based on earlier measurements and estimates of the amount of glacier sliding at the bed. The resulting cross-sectional mean velocity for 2024/25 is 25 ±10 m a^{-1}.

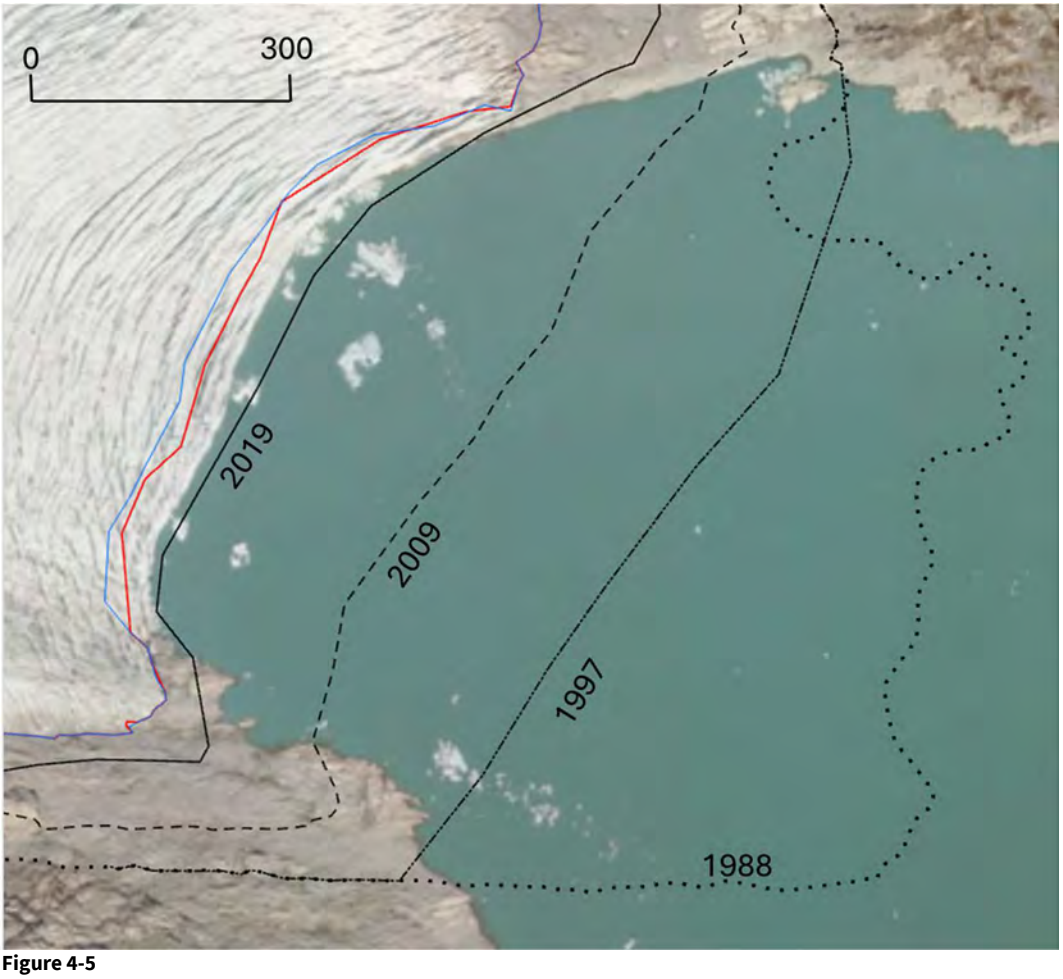


Figure 4-5
Surveyed front positions of Austdalsbreen in Styggevatnet on 24 September 2025 (blue) and 1 October 2024 (red), and mapped front positions from 1988, 1997, 2009 and 2019. The background is an orthophoto from 1 September 2024 from www.norgeibilder.no.



Figure 4-6
The southern, steep part of Austdalsbreen on Austdalsnuten as seen from stake A90 on 18 August 2025. Stake A80 is located close to the summit (see Fig. 4-2 for location). Stake A90 was re-drilled ca. one year's glacier movement upstream. Photo: Jostein Aasen.

5. Rembesdalskåka (Hallgeir Elvehøy)

Rembesdalskåka (17 km^2, 60°32′N, 7°22′E) is a southwestern outlet glacier from Hardangerjøkulen (Fig. 5-1), the sixth largest (64 km^2) glacier in Norway. Rembesdalskåka is situated on the main water divide between Hardangerfjorden and Hallingdalen valley and drains towards Simadalen valley and Hardangerfjorden. In the past Simadalen was flooded by jøkulhlaups from the glacier-dammed lake Demmevatnet. Since 2014 annual jøkulhlaups have occurred, but they have been captured by the Rembesdalsvatnet reservoir, thus causing no damage. In 2025 a small jøkulhlaup occurred on 26-28 April (Chap. 13, Fig 5-1).

Front variation measurements started in 1917 and have been measured annually since 1995. After an advance culminating in 2000, measurements show a frontal retreat of 496 meters (Chap. 12).

The Norwegian Polar Institute initiated the mass balance measurements on Rembesdalskåka in 1963. Norwegian Water Resources and Energy Directorate (NVE) has been responsible for the mass balance investigations commissioned by Statkraft AS since 1985. The investigated basin covers the altitudinal range between 1085 and 1851 m a.s.l. as mapped in 2020.



Figure 5-1
The empty lake Demmevatnet with crumbled lake ice next to the glacier photographed on 7 May 2025. Photo: Harald Midtbø, Statkraft.

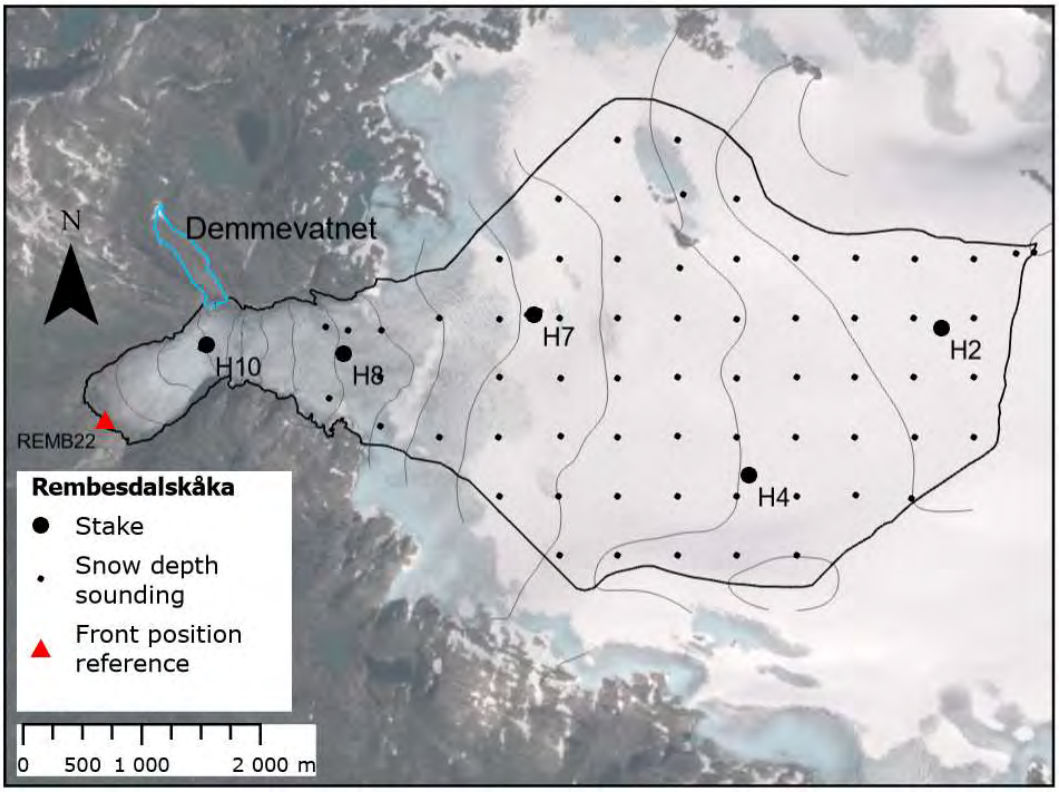


Figure 5-2
Location of stakes, snow depth soundings and front position reference on Rembesdalskåka in 2025. The snow density is measured at H7. Outline of the glacier dammed lake Demmevatnet as mapped before jøkulhlaup in 2020 is shown in turquoise. Lake Demmevatnet was empty at this time after the drainage in April. The background is a true-colour image from 17 August 2025. Source: @SeNorge/Copernicus Sentinel data 2025/.

5.1 Mass balance 2025

Fieldwork

Stakes in locations H2, H4, H8 and H10 were maintained through the winter (see Fig. 5-2 for locations). The snow accumulation was measured on 7 May. Snow depth was measured in 63 sounding locations in a 500 by 500 m grid on the glacier plateau above 1490 m a.s.l (Fig. 5-2). The average snow depth on the plateau was 4.8 meters and varied between 2.9 and 5.9 meters. The summer surface was well defined. At stake H10 on the glacier tongue the snow depth was ca. 1.8 meters. The mean snow density down to 3.65 meters at stake H7 (1650 m a.s.l.) was 443 kgm^{-3}. Here the total snow depth was 4.8 meters.

Summer and annual balances were measured on 26 September (Fig. 5-5). Stakes were found in all five stake locations. There were up to 10 cm of new snow on the upper part of the glacier. At the two upper stakes, 0.75 and 1.4 meters of winter snow remained. At stake H10 (1245 m a.s.l.) all the winter snow and 5.7 meters of ice had melted. Based on the stake measurements, the transient snow line was located between H7 and H4 (Fig. 5-2).

Stake measurements and snow depth sounding at stake H10 on 19 January 2026 showed that 0.4 meters of additional ice melt occurred after 26 September.

Measurements at stake H8 in April and July 2026 showed that an additional 0.1 meter of melt occurred after 26 September 2025.

Results

The calculation of the mass balance is based on a DTM from 16 August 2020. The winter balance was calculated from the snow depth and snow density measurements on 7 May. A function correlating snow depth and water equivalent values was calculated based on the snow density measurement. Point winter balance values were calculated from snow depth observations using this function. From the calculated water equivalent values, averages for 50 m elevation bands were calculated and plotted against altitude. An altitudinal winter balance curve was drawn from these averages (Fig. 5-3). Below 1500 m a.s.l. the winter balance curve was interpolated from the measurements at stakes H8 (1510 m a.s.l.) and H10 (1240 m a.s.l.). For each 50 m elevation interval a winter balance value was determined from this curve. The resulting winter balance was 2.1 ±0.2 m w.e. corresponding to 36 ±3 mill. m^3 water. This is 101 % of the 1991-2020 average of 2.10 m w.e. a^{-1}.

The summer balance was calculated directly at all five stake locations, including ice melt after 26 September 2025. The density of the remaining winter snow at H2 and H4, the melted firn at H7, and the melted ice at H8 was set as 600, 750 and 900 kg m^{-3}, respectively. The summer balance curve in Figure 5-3 was drawn from these five point values. The summer balance was calculated as −2.5 ±0.2 m w.e., corresponding to −43 ±3 mill. m^3 of water. This is 104 % of the 1991-2020 average of −2.40 m w.e. a^{-1}. The annual balance on Rembesdalskåka was calculated as −0.4 ±0.3 m w.e. or −6 ±5 mill. m^3 water. The 1991-2020 average is −0.29 m w.e. a^{-1}. The ELA in 2025 was 1695 m a.s.l., and the corresponding AAR was 66 %. The altitudinal distribution of winter, summer and annual balances is shown in Table 5-1 and Figure 5-3. Since 2000 the glacier has had a mass deficit of −15.0 m w.e. or −0.60 m w.e. a^{-1} (Fig. 5-4).

The date of the 2025 mass balance minimum on the glacier plateau and on the glacier tongue was assessed from the daily gridded data of temperature and snow depth from www.senorge.no as 3 October on the upper plateau above 1650 m a.s.l., 20 October on the lower plateau between 1450 and 1650 m a.s.l., and 15 November on the glacier tongue below 1450 m a.s.l.

Mass balance Rembesdalskåka 2024/25				
Altitude (m a.s.l.)	Area (km^2)	Winter (m w.e.)	Summer (m w.e.)	Annual (m w.e.)
1800 - 1851	2.825	2.35	-1.85	0.50
1750 - 1800	4.059	2.40	-2.00	0.40
1700 - 1750	4.130	2.30	-2.15	0.15
1650 - 1700	2.267	2.20	-2.30	-0.10
1600 - 1650	1.167	1.90	-2.60	-0.70
1550 - 1600	0.534	1.60	-3.05	-1.45
1500 - 1550	0.523	1.45	-3.50	-2.05
1450 - 1500	0.381	1.40	-4.00	-2.60
1400 - 1450	0.201	1.30	-4.45	-3.15
1350 - 1400	0.107	1.20	-4.90	-3.70
1300 - 1350	0.071	1.05	-5.35	-4.30
1250 - 1300	0.126	0.90	-5.85	-4.95
1200 - 1250	0.202	0.75	-6.30	-5.55
1150 - 1200	0.289	0.60	-6.75	-6.15
1100 - 1150	0.194	0.45	-7.25	-6.80
1085 - 1100	0.010	0.40	-7.55	-7.15
Specific mass balance				
1085 - 1851	**17.086**	**2.12**	**-2.50**	**-0.38**

Table 5-1
Altitudinal distribution of winter, summer, and annual mass balance on Rembesdalskåka in 2025. All values are in meter water equivalents.

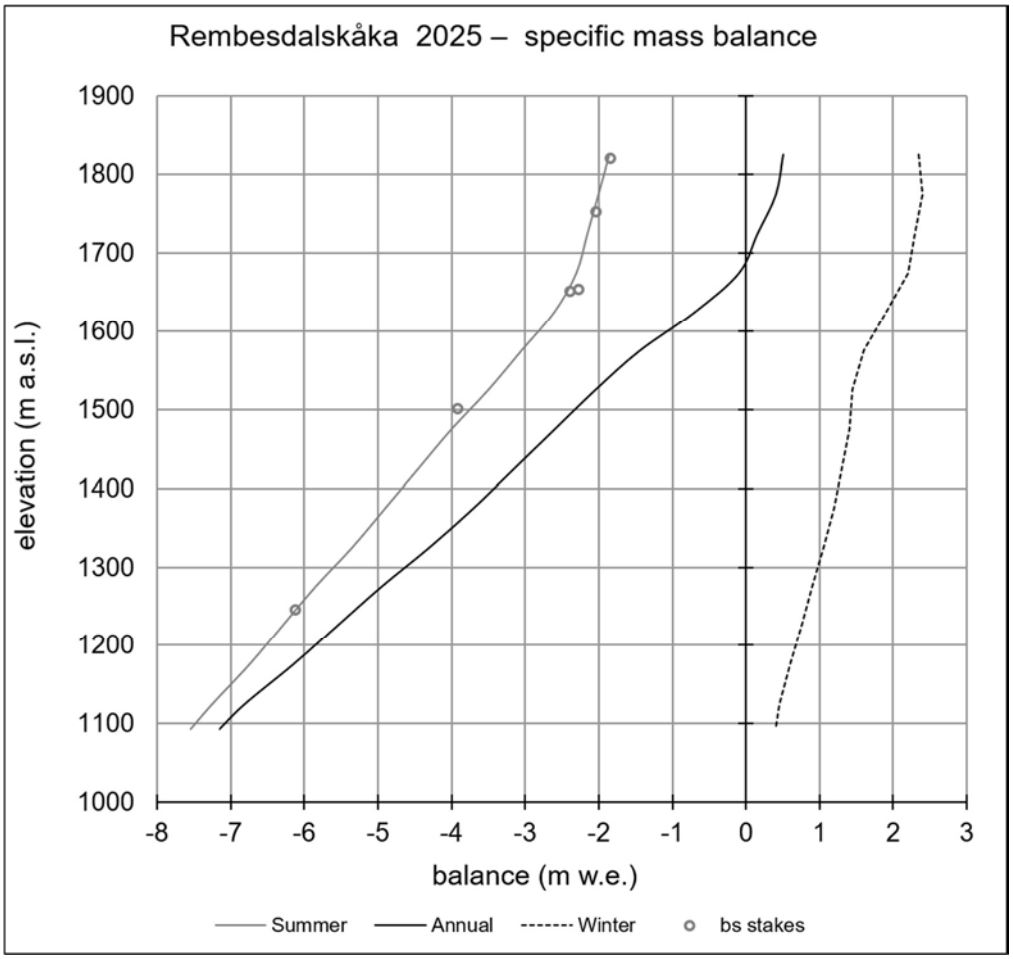


Figure 5-3
Altitudinal distribution of specific winter, summer, and annual mass balance on Rembesdalskåka in 2025. The specific summer balance, bs, is shown for five stake locations (circles).

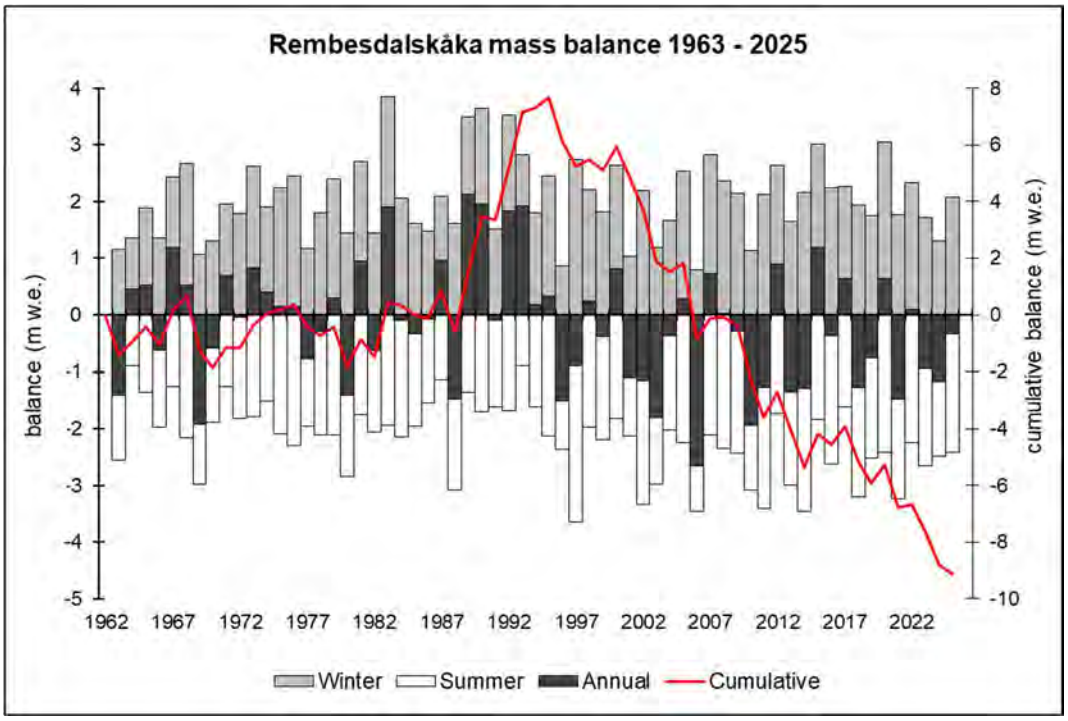


Figure 5-4
Winter, summer, annual and cumulative mass balance on Rembesdalskåka during the period 1963-2025. Mean values (1963-2025) are B_w=2.05 m w.e a^{-1} and B_s=−2.20 m w.e a^{-1}.

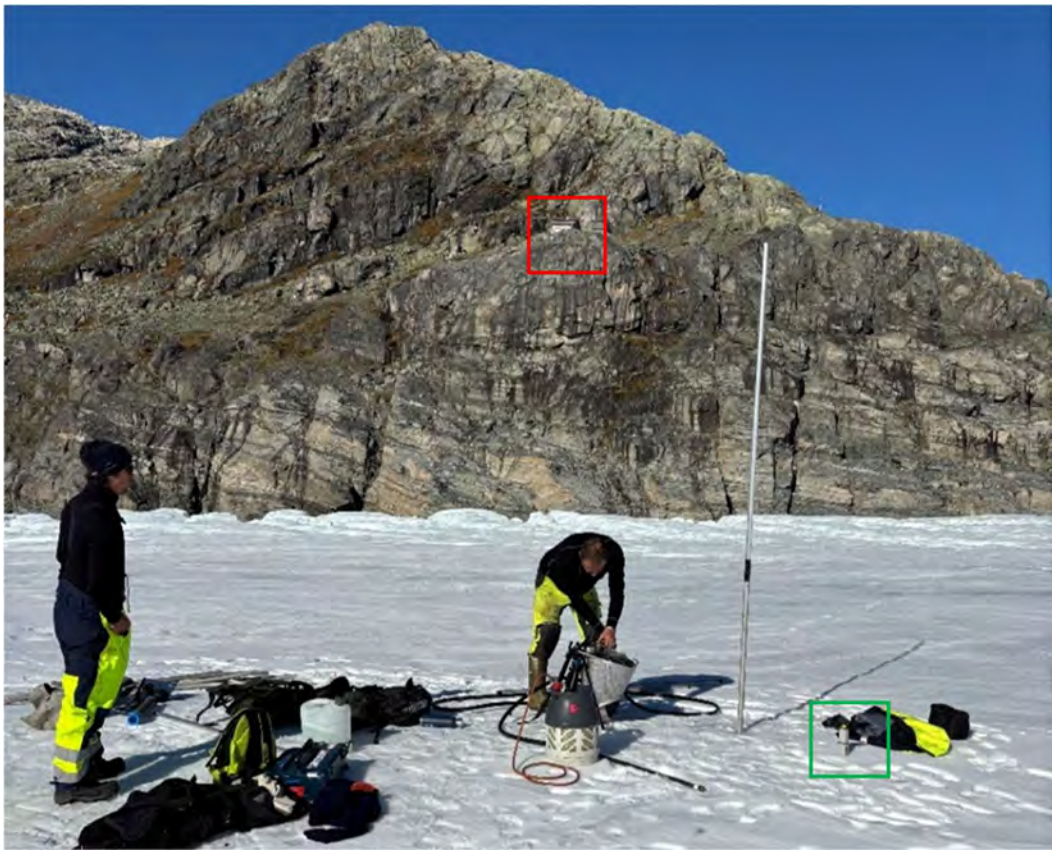


Figure 5-5
Stake H10 was re-drilled using a Heucke steam drill on 26 September 2025. The stake was surveyed using a GNSS (green square). Since 1996, when the glacier was advancing, the glacier has thinned ca. 50 meters in this area. The cabin Demmevasshytta is shown in the upper middle of the photo (red square). Photo: Hallgeir Elvehøy.

5.2 Glacier velocity

Glacier velocities were calculated from repeated surveys of stakes. The stake network has been surveyed regularly since 2010 using differential GNSS (Fig. 5-5) for documentation of elevation changes, comparison to LIDAR-based DTMs and calculation of stake velocities. The data are referenced with SATREF data from Maurset, 14 km south of Rembesdalskåka. The stake locations have been kept as constant as possible, but changes in crevasse patterns at stakes H10 and H8 have forced us to shift the stake positions up-glacier slightly (ca. 100 meters).

Annual velocities were calculated for the five stake locations for the period between 18 September 2024 and 26 September 2025 (tab 5-2). At the stake locations H10 and H8 the stake velocities have decreased considerably since 2010 (Tab 5-2, Fig. 5-6). For stake H7 the decrease is less pronounced (Fig. 5-6), and for the two upper-most stakes the change is negligible (not shown in Fig. 5-6).

Table 5-2
Glacier velocities on Rembesdalskåka in 2024-25 compared to velocities in 2010-15, and elevation change between 16 August 2020 (DTM) and 26 September 2025 (GNSS). See Fig 5-2 for locations.

Stake	Velocity 2024-25 (m/y)	Direction (360°)	Velocity 2010-15 (m/y)	Elevation 26 Sept 2025 (m a.s.l.)	Elevation change 2020-25 (m)
H10	37.2	245	54	1225.1	−20.8
H8	60.6	273	70	1493.1	−8.0
H7	17.9	272	20	1646.1	−6.7
H4	11.3	279	11	1746.6	−5.3
H2	3.3	232	3	1814.2	−5.3

At the same time the glacier thickness in the stake locations has decreased. To evaluate the surface elevation change based on slightly different stake positions the observed elevations measured in the autumn have been compared to the DTM from 2020, and then the elevation changes were assessed from these differences (Fig 5-7). Particularly for the lower-most stake H10 the decrease in glacier thickness is large and accelerating, possibly influenced by the new epoch with jøkulhlaups from Demmevatnet starting in 2014. At stake H10 the thinning rate was −1.9 m /year between 2010 and 2020, increasing to −3.8 m/year in 2020-2025. At stakes H8 and H7 the thinning rates are smaller but increasing from −0.6 and −0.3 m / year in 2010-2020 to −1.3 and −1.1 m / year in 2010-2020 for H8 and H7, respectively. For the upper-most stake locations H2 and H4 the elevation decrease is small but larger in 2020-25 (−0.9 m/y) than in 2010-2020 (−0.3 m/y).

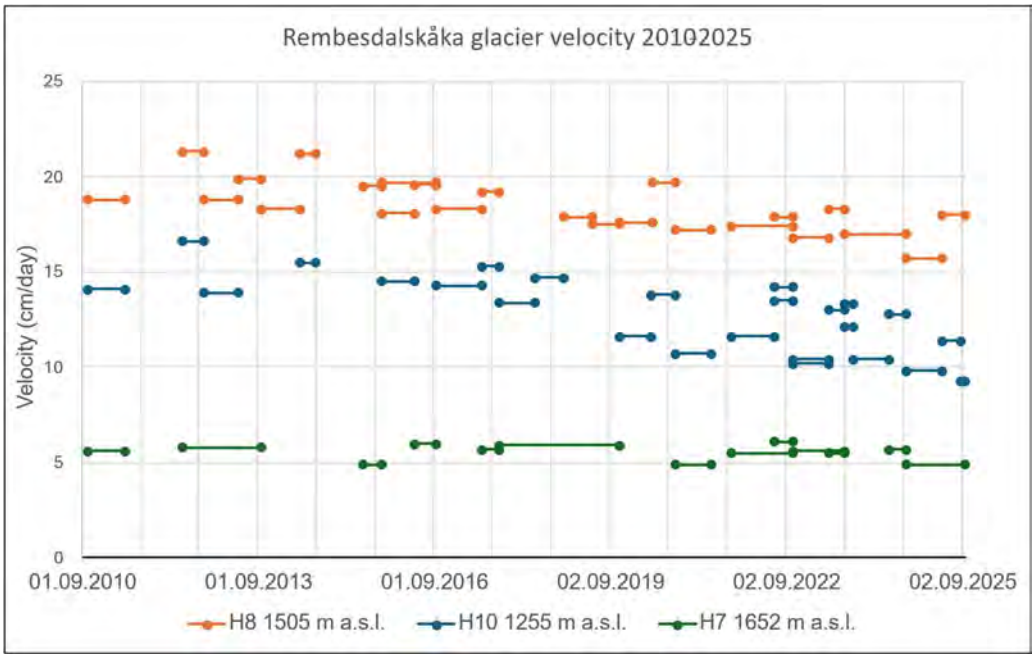


Figure 5-6
Glacier velocities on Rembesdalskåka between 2010 and 2025. See Fig. 5-2 for location.

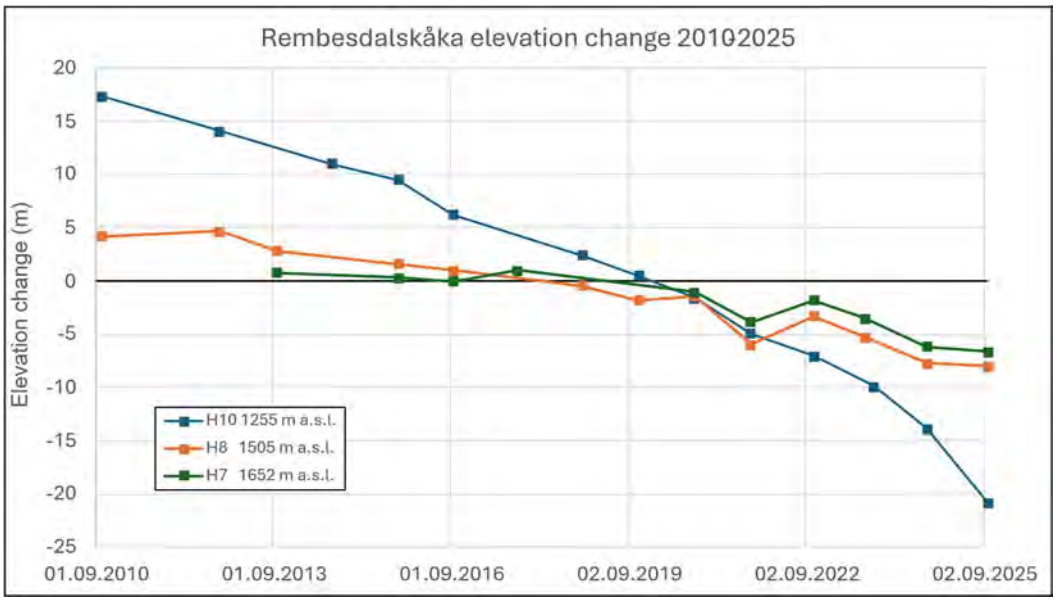


Figure 5-7
Elevation change relative to the DTM from 2020 at stake H10, H8 and H7 on Rembesdalskåka between 2010 and 2025. See fig. 5-2 for location.

6. Storbreen (Liss M. Andreassen)

Storbreen (61°34′N, 8°8′E) (now written as “Storbrean” on official maps) is situated in the Jotunheimen mountain massif in central southern Norway. The glacier has a relatively well-defined border and is surrounded by high peaks (Fig. 6-1). Mass balance has been measured there since 1949 and front position (change in length) has been measured since 1902 (chap. 12). In 2025 a smartstake was installed on the lower part on 12 August to observe the ablation (Fig. 6-1, 6-2). A thermistor cable was installed on 24 September at the same location for temperature measurements. Repeat drone surveys were also conducted by the University of Bergen in April 2025 and September 2025 at the same time as the mass balance measurements.

Storbreen has a total area of 4.9 km^2 and ranges in altitude from 1420 to 2091 m a.s.l. (map of 2019, Fig. 6-2). The mass balance for 2025 was calculated based on the DTM and glacier outline from 2019.

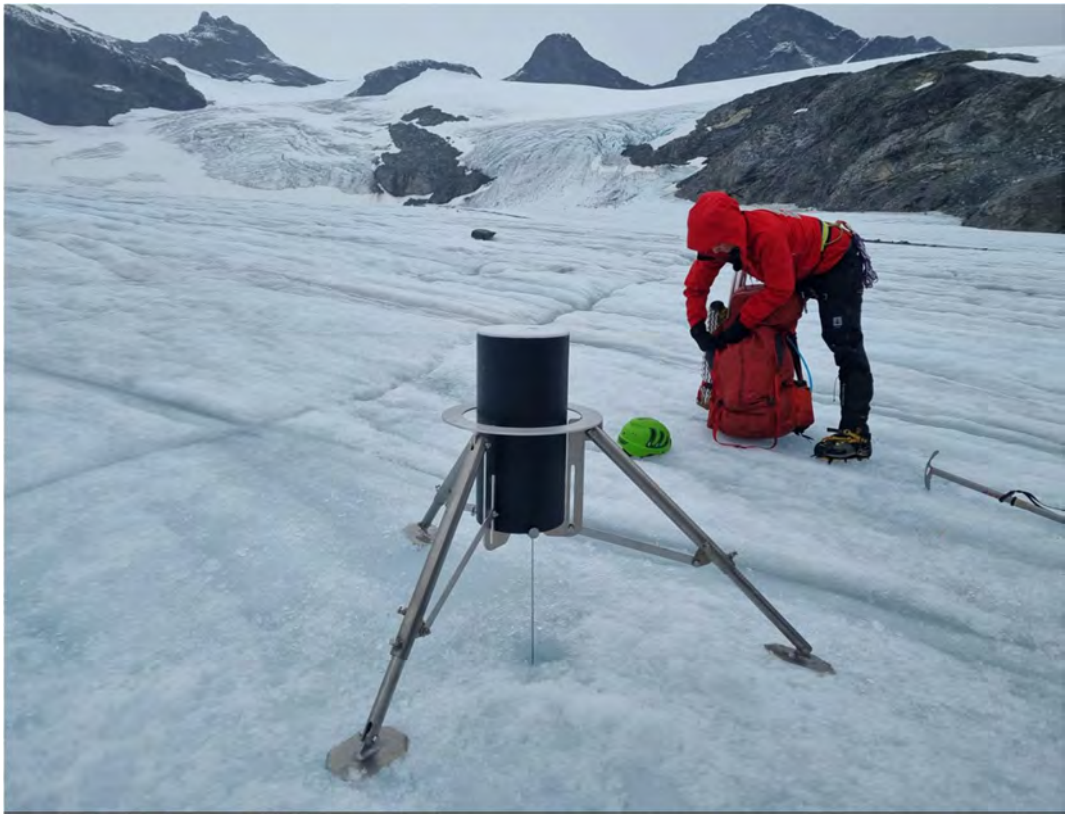


Figure 6-1
A smartstake was installed on the lower part of Storbreen on 12 August 2025 (see location in Fig. 6-2). The stake measures ablation. The smartstake is part of the Fjellviten project by the Norwegian Mountain Center and Klimapark 2469. Photo: Liss M. Andreassen.

6.1 Mass balance 2025

Fieldwork

Snow accumulation measurements were performed on 24 April on the lower tongue (stake 1-3) and on 25 April on the upper part (stakes 4-9) (Fig. 6-2, 6-3). Stakes were visible in three positions. A total of 154 snow depth soundings between 1438 and 1982

m a.s.l. were made (Fig. 6-2). The snow depth varied between 1.50 and 5.66 m, the mean and median being 3.33 and 3.29 m, respectively. Snow density was measured at the upper part at stake 4 (1703 m a.s.l.) and at the lower part close to the smartstake position (1529 m a.s.l.). The snow depth was 2.9 m at both locations. The average snow density measured was 417 and 430 kg m^{-3}, respectively. Extra field visits were done on 19 July to drill the two lowermost stakes and on 12 August to erect the smart stake. Ablation measurements were performed on 24 September (lower part) and 25 September (upper part) at all stake positions.

A smart stake equipped with a cord uncoiled into a hole drilled in the ice was installed on Storbreen on 12 August (Fig. 6-1). The winding of the cord provides the corresponding vertical displacement (and thus ice height) at a 30-minute time interval.

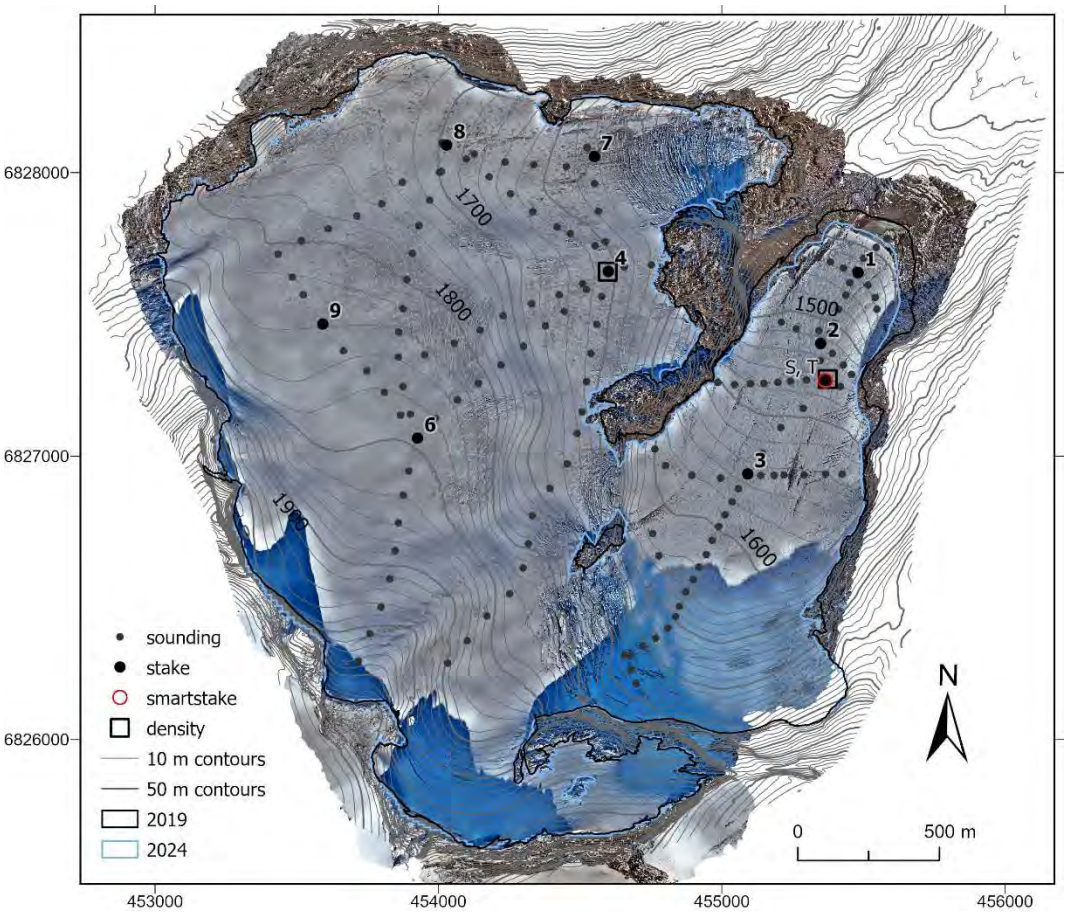


Figure 6-2
Location of soundings, stakes, smartstake and density pits on Storbreen in 2025. S, T – position of smartstake and thermistor. Outlines from 2019 and 2024 digitised from orthophotos. Background orthophoto from UAV survey at ablation measurements on 24-25 September provided by Ingrid Jørgensen Valstad, University of Bergen.



Figure 6-3
Field work on Storbreen in 2025. Left: Density measurement on the lower part of Storbreen, 24 April. Right: The glacier was covered in 5-25 cm of fresh snow at the time of measurements 24-25 September and the field team roped in when measuring the stakes on the upper part. Photos: Kristine Haualand and Liss M. Andreassen.

Results

The winter balance was calculated from the mean of the soundings within each 50 m height interval and was 1.66 ±0.2 m w.e., which is 119 % of the mean winter balance for the reference period 1991-2020. Annual balance was calculated directly from stakes at seven locations. The annual balance of Storbreen was –0.47 ±0.3 m w.e. in 2025. The resulting summer balance was –2.13 ±0.3 m w.e., which is 106 % of the mean summer balance for the reference period 1991-2020. The annual balance curve from the annual balance diagram (Fig. 6-3) indicates an ELA of ~1795 m a.s.l. resulting in an estimated accumulation area ratio (AAR) of ~41 %.

The mass balance results are shown in Table 6-1 and in Figure 6-4.

Mass balance Storbreen 2024/25

Altitude (m a.s.l.)	Area (km^2)	Winter (m w.e.)	Summer (m w.e.)	Annual (m w.e.)
2050 - 2091	0.030	2.00	-1.20	0.80
2000 - 2050	0.138	1.90	-1.15	0.75
1950 - 2000	0.198	1.54	-0.89	0.65
1900 - 1950	0.317	2.27	-1.77	0.50
1850 - 1900	0.425	2.01	-1.68	0.33
1800 - 1850	0.846	1.48	-1.34	0.14
1750 - 1800	0.763	1.71	-1.79	-0.08
1700 - 1750	0.628	1.46	-1.91	-0.45
1650 - 1700	0.414	1.78	-2.68	-0.90
1600 - 1650	0.334	2.05	-3.45	-1.40
1550 - 1600	0.390	1.50	-3.40	-1.90
1500 - 1550	0.197	1.21	-3.61	-2.40
1450 - 1500	0.146	0.96	-3.76	-2.80
1420 - 1450	0.050	0.96	-4.01	-3.05
1420 - 2091	**4.876**	**1.66**	**-2.13**	**-0.47**

Table 6-1
The distribution of winter, summer and annual balance in 50 m altitudinal intervals for Storbreen in 2025.

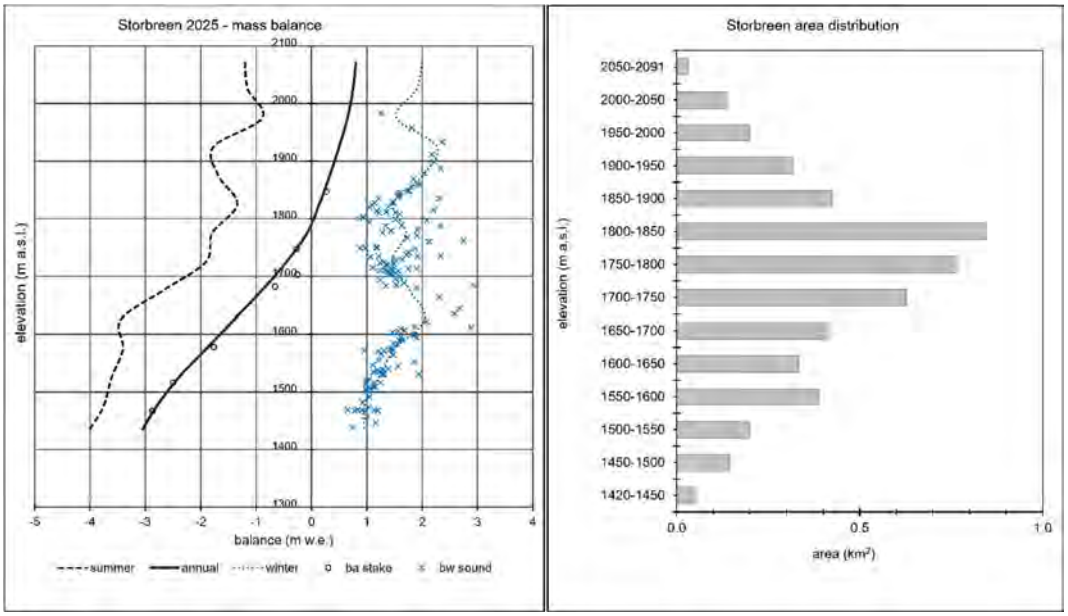


Figure 6-4
Left: Mass balance diagram for Storbreen for 2025. Right: The area-elevation distribution of Storbreen from the map survey of 2019.

The smartstake records ice melt in the lower part of the glacier (Fig. 6-5). The measured change in ice-surface height between 9 August and 24 September was –1.35 m. Less than 1 cm of melt occurred between the ablation measurements on 24 and 25 September, followed by a further 8 cm of melt by 8 October.

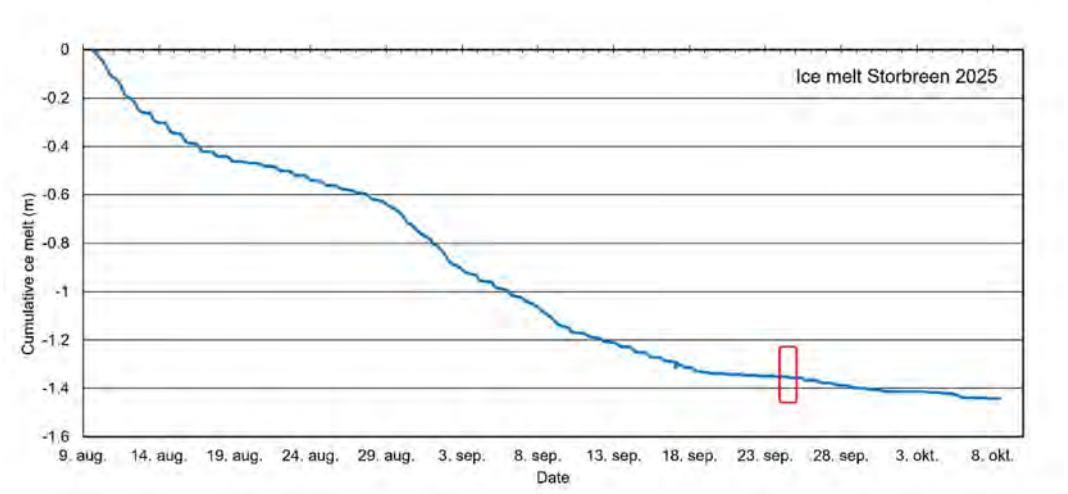


Figure 6-5
Ice melt recorded by the smartstake on Storbreen. The red box indicates when the ablation measurements were made on 24 and 25 September.

6.2 Mass balance 1949-2025

The cumulative balance for 1949-2024 is –32.9 m w.e. (Fig. 6-6). The mean annual balance for the period of 77 years is −0.43 m w.e. For the period 1949-2000 (52 years) the mean annual balance is −0.19 m w.e., whereas for the period 2001-2025 (25 years) the mean annual balance is −0.91 m w.e.

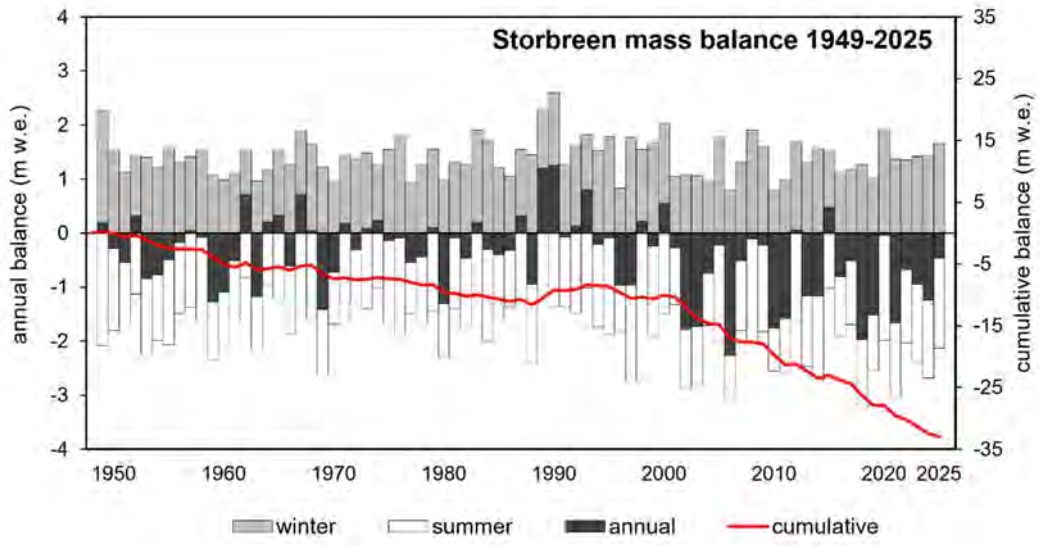


Figure 6-6
Winter, summer, annual and cumulative mass balance on Storbreen for the period 1949-2025.

6.3 Ice velocity 2024-2035

The surface ice velocity was calculated from GNSS measurements of the stakes. The position of the stakes was measured on 18 September 2024 and on 24-25 September 2025. Measurements were also done on 19 July 2025 on the two lower stakes that were redrilled. The calculated surface ice velocities reveal annual velocities between 2.0 and 10.2 m/year (Fig. 6-7). The uncertainty of the measurements is estimated to be within 0.3 m.

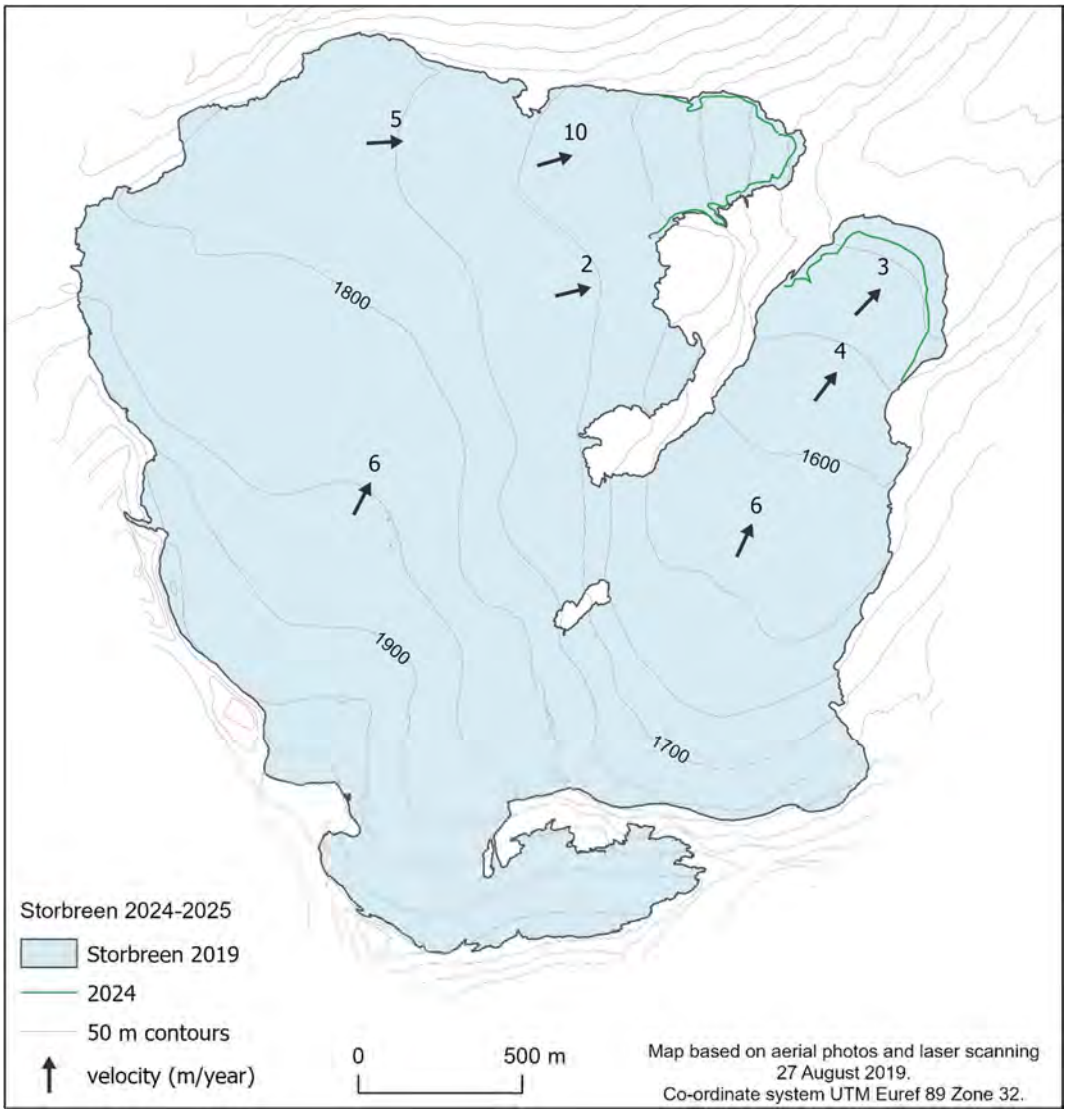


Figure 6-7
Map of Storbreen showing annual surface velocities calculated from stake position measurements on 18 September 2024 and 24 -25 September 2025. The measurements are rounded to next meter. See also Figure 6-2.

7. Juvfonne (Liss M. Andreassen)

Juvfonne (61°40′N, 8°21′E) is a small ice patch in the Jotunheimen mountain massif in south-central Norway (Fig. 7-1). According to the 2019 map, it covers an area of 0.086 km^2 and extends from 1852 to 1985 m a.s.l.

Mass-balance measurements began in May 2010. The measurements at Juvfonne contribute to 'Klimapark 2469', a nature park and outdoor discovery centre in the alpine area surrounding Galdhøpiggen, Norway's highest mountain (2469 m a.s.l.). They also contribute to the 'Fjellviten' project (2024–2027), which is led by Norsk fjellsenter (Norwegian Mountain Center) and funded by Sparebankstiftelsen DNB. The project communicates mountain climate research to the public and aims to increase understanding of it.

The 2025 observation programme at Juvfonne comprised accumulation measurements in May, seasonal and annual mass-balance measurements at one stake, and a front-variation measurement in September. A time-lapse camera installed in July 2025 provides daily images of the ice patch (Fig. 7-2).

In addition, the surface extent and elevation of the ice patch were mapped using an uncrewed aerial vehicle (UAV) on 27 August and 2 September (Fig. 7-3). Ice-thickness measurements conducted in September 2025 indicated a maximum thickness of less than 9 m and an average thickness of less than 3 m (Andreassen et al., 2026).



Figure 7-1
Panoramic view from the summit of Juvvasshøe (1894 m a.s.l.) towards Lake Juvvatnet showing the glacier Vesljuvbrean and its summer ski centre, the small cirque glacier Kjelen, and the Juvfonne ice patch on 13 August 2025. Most of Juvfonne was still snow-covered at the time of survey. Photo: Solveig H. Winsvold.



Figure 7-2
Selected images from the time-lapse camera in front of Juvfonne from 23 July to the minimum measurements on 24 September 2025. Photos: Norwegian Mountain Center/Fjellviten.

7.1 Survey 2025

The extent of Juvfonne has been regularly measured since 2010 using differential GNSS or by digitising extents from orthophotos. The surface extent and ice patch elevation were mapped by uncrewed aerial vehicle (UAV) on 27 August by NVE and on 2 September by the University of Oslo providing detailed orthophotos and digital elevation models (Fig. 7-3). At this time the lower parts had ice exposed. The outer ice patch extent was digitised from the 2 September orthophoto and revealed an area of 0.090 km^2. This is slightly larger than the 2024 extent due to more snow remaining in 2025 than in 2024 (Fig. 7-3). The 2024 orthophoto can be viewed in the previous annual report (Kjøllmoen et al., 2025).

7.2 Mass balance 2025

Field work

The accumulation measurements on Juvfonne were carried out on 20 May (Fig. 7-3). Snow depth was measured in 24 positions from 1865 to 1957 m a.s.l. The snow depth varied between 3.65 and for three of the points it was above 5.6 m (the length of the probe) with a median of 4.81 m. The measurements will to some extent be influenced by the redistribution of snow prior to the measurements to protect the tunnel (Fig. 7-4). Nevertheless, this is the highest snow amounts observed on Juvfonne since measurements started in 2010. The snow density was measured in a pit near stake 2 where the depth to the 2024 summer surface was 4.3 m. The resulting density was calculated to be 482 kg m^{-3}. Ablation measurements were carried out on 24 September at stake 2.

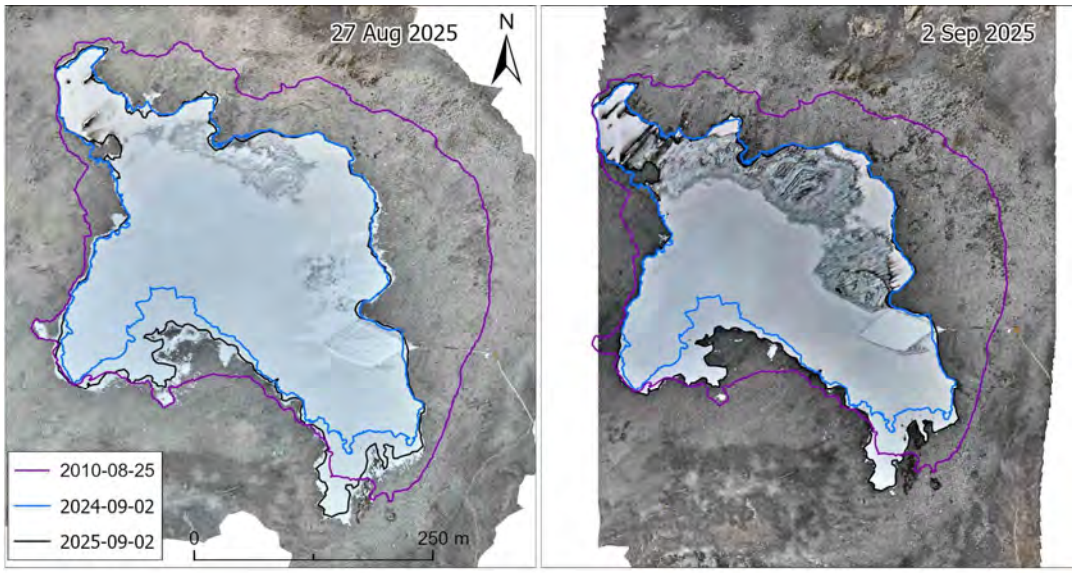


Figure 7-3
Orthophoto of Juvfonne from uncrewed aerial vehicle on 27 August 2025 (NVE, Simon Oldani) and 2 September 2025 (University of Oslo, Luc Girod). Outlines from 2010 (GNSS) and 2024 (orthophoto) are shown. The extent from 2025 was digitised from the 2 September 2025 orthophoto due to less snow along the margin, the 27 August 2025 was used in the western parts where the 2 September lacked full coverage. Note the diamond shape of the tunnel covered in white geotextiles.

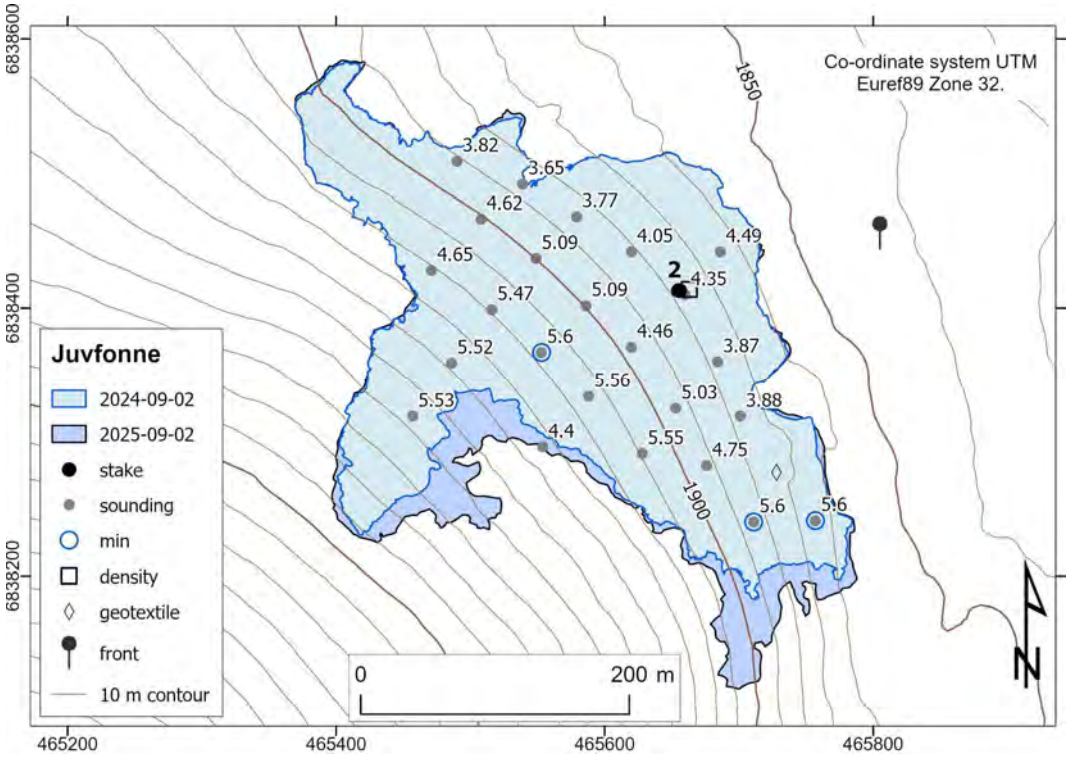


Figure 7-4
Location of snow depth soundings in 2025 and the position of stake 2 where density was measured. "min" marks three points where snow depths were ≥5.6 m. The ice patch extent from 2024 and 2025 are shown (see also fig. 7-3). "front" marks the reference point for front variation measurements. "geotextile" is point not measured due to geotextile coverage. The 10 m contours are derived from the 2019 DTM.



Figure 7-5
Measurements of stakes in position 2 on 24 September 2025 at the time of the ablation measurements. A few centimetres of snow covered the surface. Photo: Truls Telle/Gudbrandsdølen Dagningen.

Results

Seasonal surface mass balances have been measured since 2010 at stake 2 (Fig. 7-4). In 2025 the point winter balance was 2.10 ±0.15 m w.e., the highest winter balance on record. The annual point balance at this location was –0.52 ±0.15 m w.e., resulting in a point summer balance of −2.62 ±0.15 m w.e. The cumulative mass balance for stake 2 over the 15 years of measurements is –15.1 m w.e., or –0.94 m w.e. a^{-1} (Fig. 7-6). The mass balance of the entire ice patch was not calculated; this was calculated only for the first year of measurements in 2009/2010 when more stakes were measured. The mass balance of Juvfonne is likely influenced by the tunnel that is protected in fabric and by redistribution of snow (Andreassen et al., 2026).

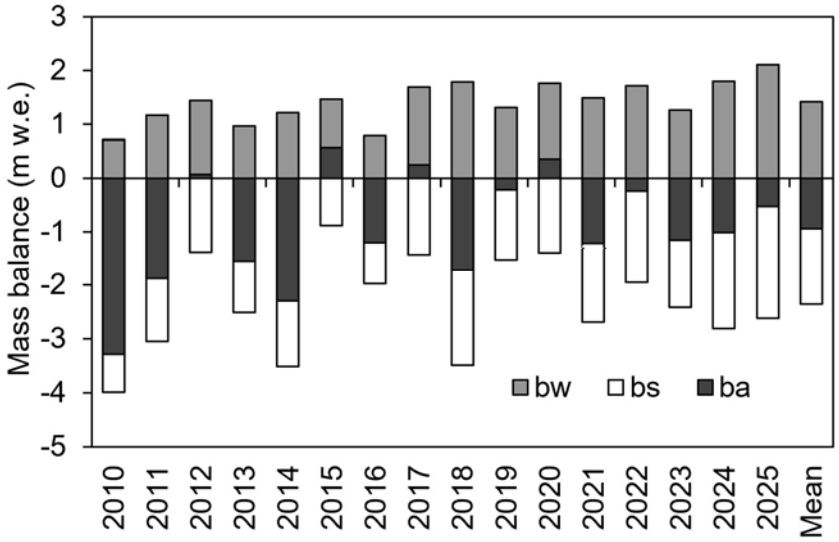


Figure 7-6
Point mass balance at stake 2 on Juvfonne 2010-2025, given as winter balance (bw), summer balance (bs) and annual balance (ba).

8. Hellstugubreen (Liss M. Andreassen)

Hellstugubreen (61°34′N, 8° 26′E) (now written as “Hellstugubrean” on official maps) is a north-facing valley glacier situated in central Jotunheimen (Figs. 8-1, 8-2). The glacier shares an ice divide with Vestre Memurubre (Fig. 8-2). Annual mass balance measurements began in 1962. Hellstugubreen ranges in elevation from 1487 to 2213 m a.s.l. and has an area of 2.7 km^2 (as of 2019).



Figure 8-1
Hellstugubreen on 23 September 2025. Photo: Liss M. Andreassen.

8.1 Mass balance 2025

Fieldwork

Accumulation measurements were performed on 26 April (Fig. 8-3). Snow depths were measured in 56 positions between 1520 and 2109 m a.s.l., covering most of the altitudinal range of the glacier (Fig. 8-2). The snow depth varied between 0.73 and 4.20 m, with a mean (median) of 2.24 (2.19) m. Snow density was measured in a density pit at 1953 m a.s.l. The total snow thickness measured was 2.88 m and the resulting density was 435 kg m^{-3}. Ablation measurements were carried out on 23 September (Fig. 8-4).

Results

The calculations are based on the DTM from 2019. The winter balance was calculated as the mean of the soundings within each 50-metre height interval and was 1.06 ± 0.2 m w.e., which is 101 % of the mean winter balance for the reference period 1991-2020. The annual balance was interpolated to 50 m height intervals based on the stake readings in seven positions and was −0.85 ± 0.3 m w.e. The resulting summer balance was –1.91 ±0.3 m w.e., which is 113 % of the mean summer balance for the reference period 1991-2020. The equilibrium line altitude (ELA) was estimated from the images and the mass balance curve to be 2010 m a.s.l., giving an accumulation area ratio (AAR) of 19 %. The mass balance results are shown in Table 8-1 and Figure 8-5.

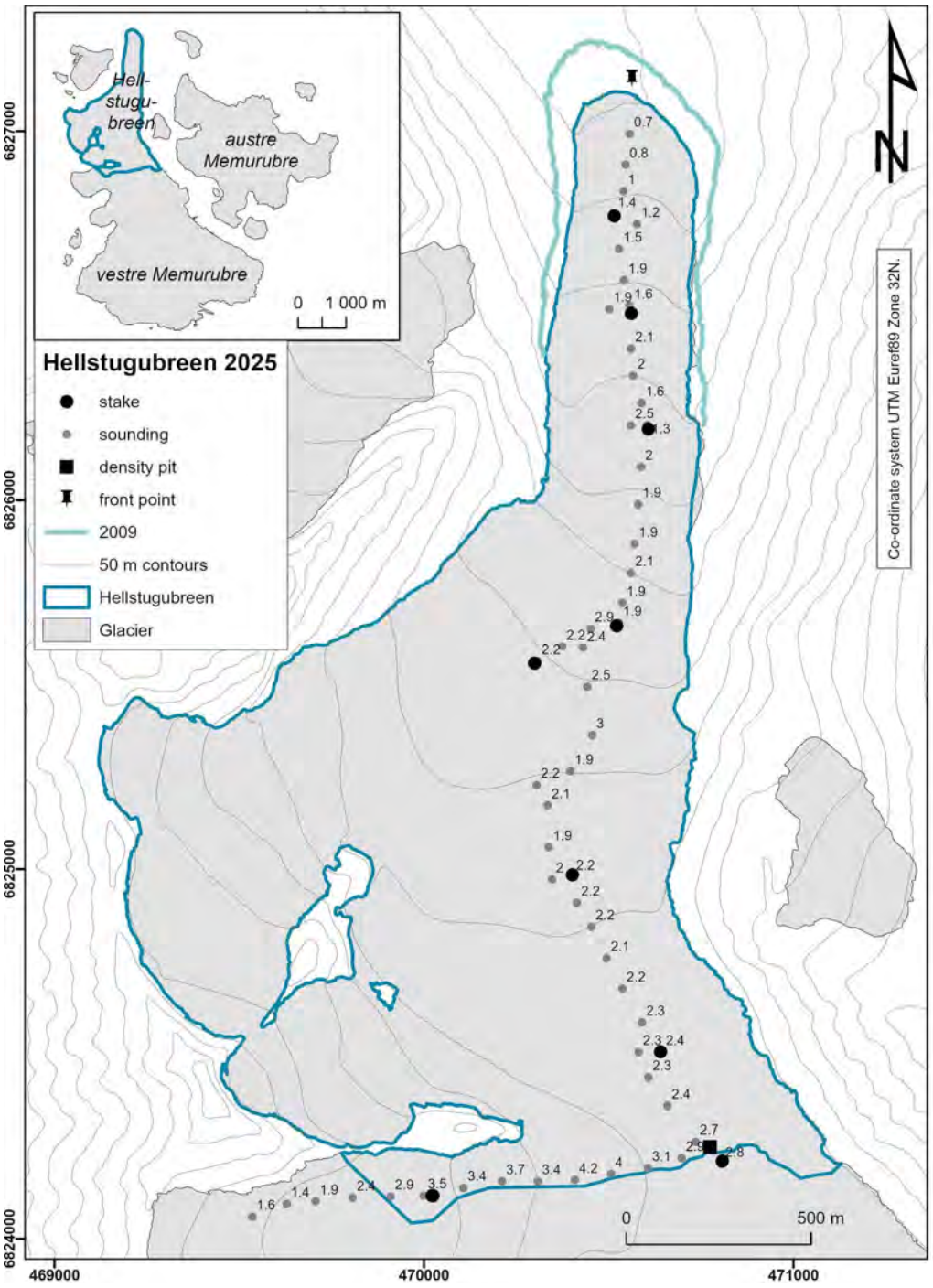


Figure 8-2
Map of Hellstugubreen showing the location of stakes, snow depth soundings (in meters) and snow pit in 2025. Front point: reference points used for front position and length change measurements (chap. 12-1). Inset shows Hellstugubreen and surrounding glaciers.



Figure 8-3
Field work. Accumulation measurements on 26 April 2025. Upper photo: On the way to do snow depth soundings done with probe. Lower photo: Snow density measurements in snow pit. Photos: Liss M. Andreassen.



Figure 8-4
Field work. Ablation measurements on 23 September 2025. A layer of fresh snow covered the glacier, and we roped in when walking on the upper parts. Photo: Jostein Aasen.

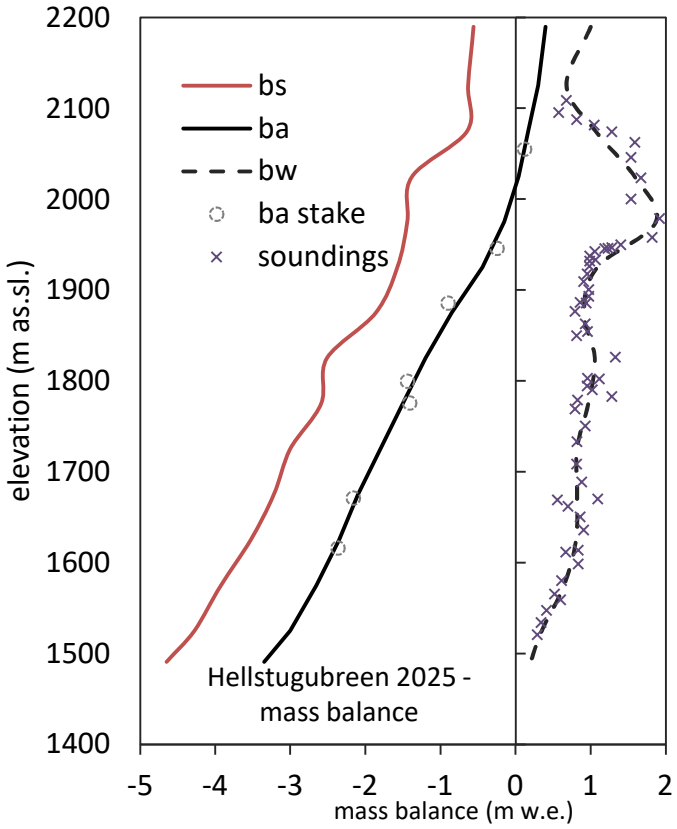


Figure 8-5
Mass balance diagram for Hellstugubreen in 2025 with winter (bw), summer (bs) and annual (ba) balance. Annual balance at stakes (ba stake) and soundings are also shown.

Mass balance Hellstugubreen 2024/25				
Altitude (m a.s.l.)	Area (km^2)	Winter (m w.e.)	Summer (m w.e.)	Annual (m w.e.)
2150 - 2229	0.017	1.00	-0.60	0.40
2100 - 2150	0.060	0.68	-0.38	0.30
2050 - 2100	0.278	1.06	-0.89	0.17
2000 - 2050	0.178	1.58	-1.54	0.04
1950 - 2000	0.186	1.87	-2.02	-0.15
1900 - 1950	0.607	1.09	-1.53	-0.44
1850 - 1900	0.404	0.91	-1.76	-0.85
1800 - 1850	0.295	1.05	-2.25	-1.20
1750 - 1800	0.181	0.97	-2.47	-1.50
1700 - 1750	0.076	0.82	-2.62	-1.80
1650 - 1700	0.107	0.82	-2.92	-2.10
1600 - 1650	0.104	0.80	-3.15	-2.35
1550 - 1600	0.079	0.64	-3.29	-2.65
1500 - 1550	0.077	0.35	-3.35	-3.00
1482 - 1500	0.007	0.20	-3.55	-3.35
1420 - 2091	**2.656**	**1.06**	**-1.91**	**-0.85**

Table 8-1
The distribution of winter, summer and annual balance in 50 m altitudinal intervals for Hellstugubreen in 2025.

8.2 Mass balance 1962-2025

The cumulative annual balance of Hellstugubreen since 1962 is –31.4 m w.e. (Fig. 8-6), giving a mean annual balance of –0.49 m w.e. a^{-1}. The cumulative mass balance for the period 2000/2001 to 2022/2025 (25 years) is –22.2 m w.e. or –0.89 m w.e. a^{-1}.

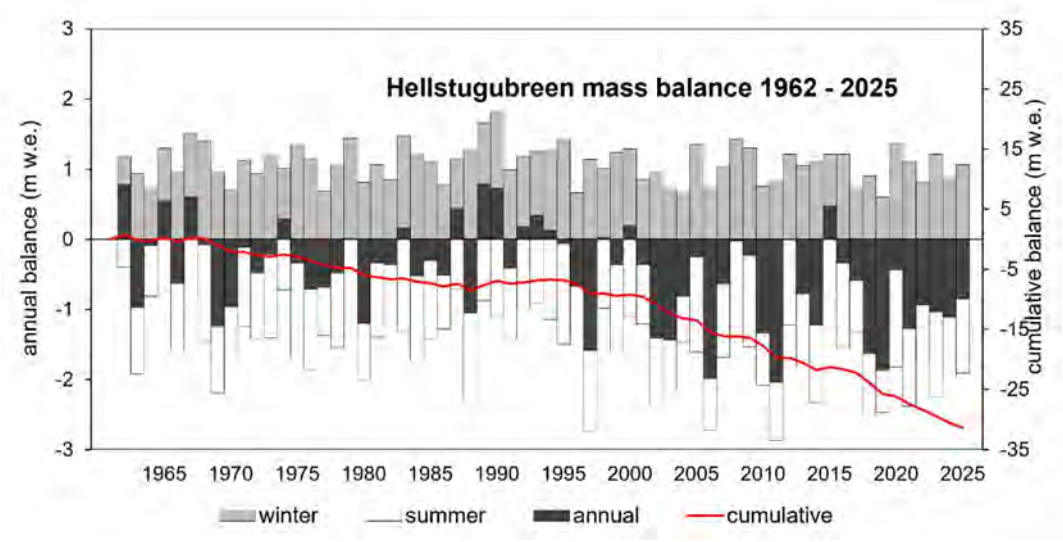


Figure 8-6
Winter, summer and annual balance at Hellstugubreen for 1962-2025, and cumulative mass balance for the whole period.

9. Gråsubreen (Liss M. Andreassen)

Gråsubreen (61°39′N, 8°37′E) (now written Gråsubrean on official maps) is a small, polythermal glacier in the eastern part of the Jotunheimen mountain area in southern Norway (Fig. 9-1). Gråsubreen has an area of 1.74 km^2 and ranges in elevation from 1854 to 2277 m a.s.l. (map of 2019). Mass balance investigations have been carried out annually since 1962.

Gråsubreen consists of relatively thin, cold ice which is underlain by a zone of temperate ice in the central, thicker part of the glacier. The distribution of accumulation and ablation at Gråsubreen is strongly dependent on the glacier geometry. In the central part of the glacier wind removes snow causing a relatively thin snowpack, whereas snow accumulates in sheltered areas at lower elevations. The ELA and AAR are therefore often difficult to define from the mass balance curve or in the field, and the estimated values of ELA and AAR have little physical significance.

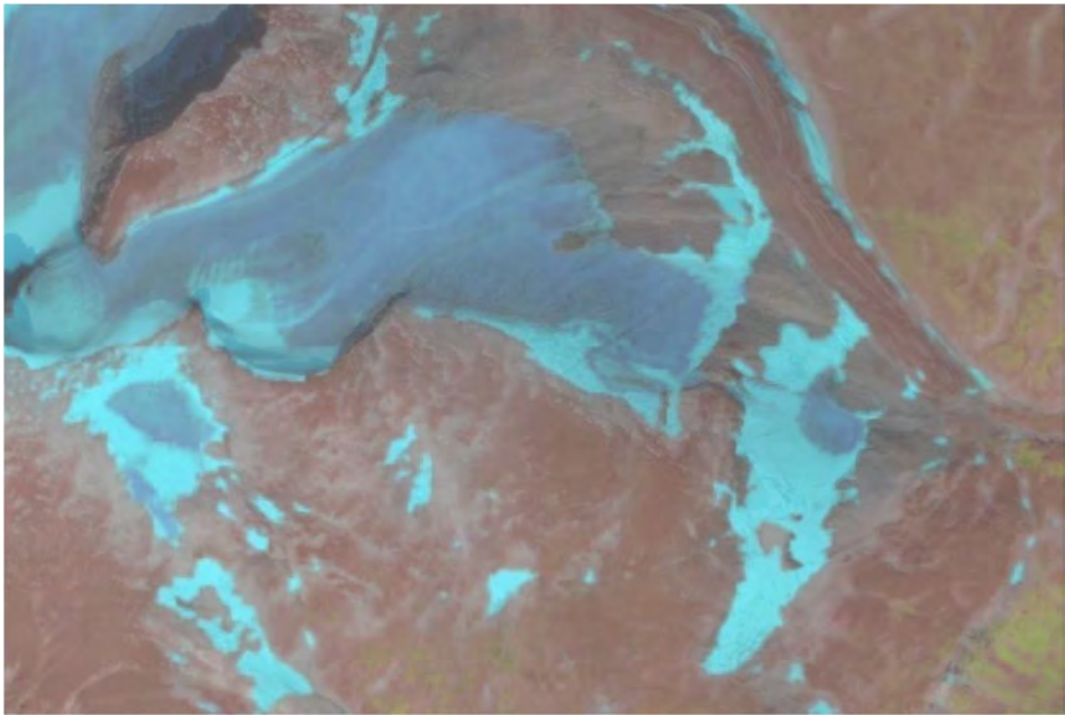


Figure 9-1
Sentinel-2 satellite image of Gråsubreen and surrounding glaciers taken on 14 August 2025 in false colours using bands 11-8-4 (SWIR-NIR-Red). @SeNorge/Copernicus Sentinel data 2025/.

9.1 Mass balance 2025

Fieldwork

Accumulation measurements were performed on 18-19 May 2025. The calculation of winter balance is based on stake measurements and snow depth soundings in 87 positions between 1871 and 2257 m a.s.l. (Fig. 9-2). The snow depth varied between 0.04 and 4.25 m with a mean and median of 1.35 and 1.20 m respectively. The snow density was measured in a density pit near stake 8 (elevation 2135 m a.s.l.) where the total snow depth was 1.36 m and the mean density was 424 kg m^{-3} (Fig. 9-3). Stake maintenance

was also done on 13-14 August when the surface was mainly free of the winter snow (Fig. 9-1, Fig. 9-3). Ablation measurements were carried out on 20 September 2025, when all visible stakes were measured. A layer of fresh snow covered the surface (Fig. 9-4). The winter snow was gone at all stake positions.

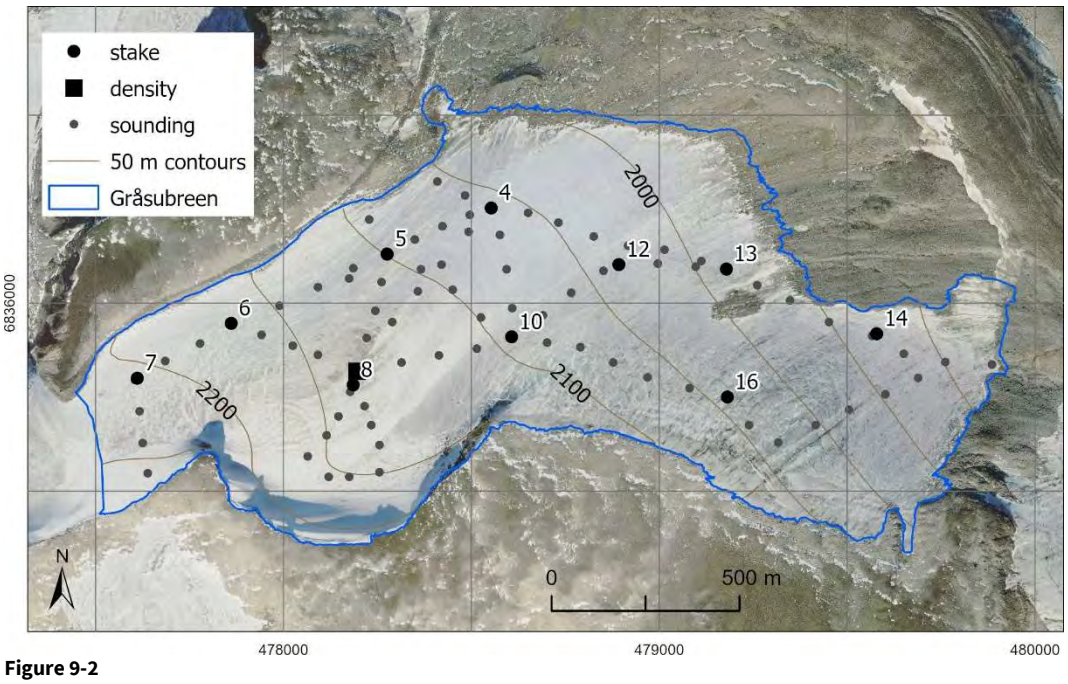


Figure 9-2
Map of Gråsubreen showing the location of stakes, density pit and soundings in 2025. Co-ordinate system UTM WGS84 Zone 32N. Contours and outline of Gråsubreen based on aerial photos and laser scanning on 26 August 2019. The background orthophoto is from on 18 September 2024 /Norgeibilder.no/Norwegian Mapping Authority. © Statens kartverk, Geovekst og kommunene, Innlandet NV 2024.



Figure 9-3
Stake measurement at the summer field work on 13-14 August 2025. Photo: Solveig H. Winsvold.



Figure 9-4
The glacier was covered in a thin layer of snow at the ablation measuremetns on 26 September.
Photo: Liss M. Andreassen.

Results

The winter balance was calculated as the mean of the soundings within each 50-metre height interval. This gave a winter balance of 0.64 ±0.2 m w.e., which is 91 % of the mean winter balance for the reference period 1991-2020. Annual and summer balance were calculated from direct measurements of nine stakes. The resulting summer balance was −2.18 ±0.3 m w.e., which is 163 % of the mean summer balance for the reference period 1991-2020. The annual balance of Gråsubreen was negative in 2024 at −1.54 ±0.3 m w.e. The ELA and AAR were not defined from the mass balance curve or observed in the field. The mass balance results are shown in Table 9-1 and Figure 9-5.

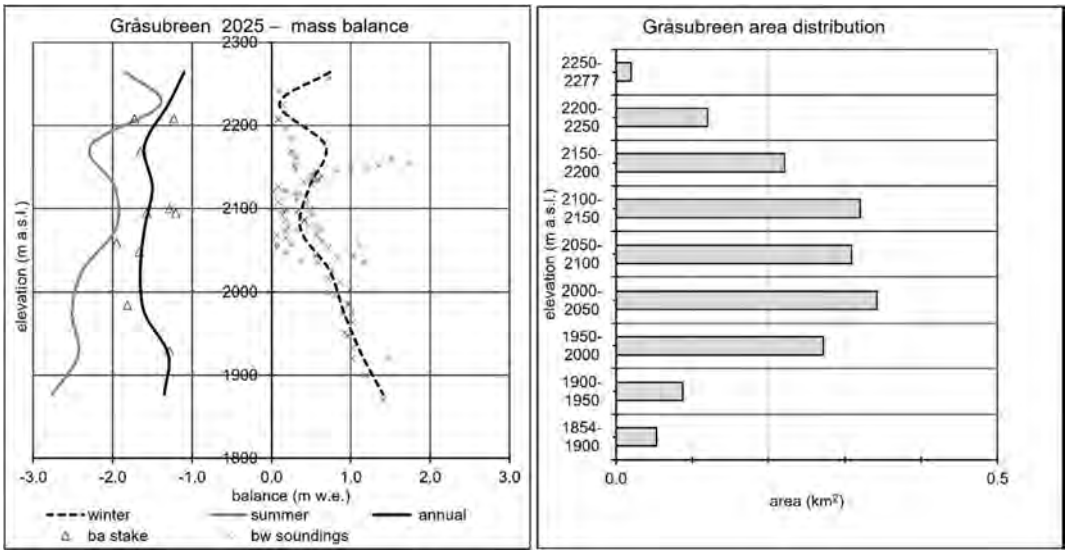


Figure 9-5
Mass balance diagram for Gråsubreen for 2025. The area-elevation distribution is from the map survey of 2019.

Table 9-1
The distribution of winter, summer and annual balance in 50 m altitudinal intervals for Gråsubreen in 2025.

Mass balance Gråsubreen 2024/25					
Altitude (m a.s.l.)		Area (km^2)	Winter (m w.e.)	Summer (m w.e.)	Annual (m w.e.)
2250	2277	0.020	0.73	-1.83	-1.10
2200	2250	0.120	0.10	-1.40	-1.30
2150	2200	0.221	0.68	-2.28	-1.60
2100	2150	0.320	0.47	-1.97	-1.50
2050	2100	0.309	0.36	-1.96	-1.60
2000	2050	0.342	0.73	-2.38	-1.65
1950	2000	0.272	0.91	-2.51	-1.60
1900	1950	0.087	1.13	-2.43	-1.30
1854	1900	0.053	1.41	-2.76	-1.35
1854 - 2277		**1.744**	**0.64**	**-2.18**	**-1.54**

9.2 Mass balance 1962-2025

The cumulative annual balance of Gråsubreen is –33.1 m w.e. since measurements began in 1962 (Fig. 9-6). The average annual balance is –0.54 m w.e. a^{-1}. Gråsubreen has had a negative mass balance every year since 2001, except for slight surpluses in 2008 and 2015.

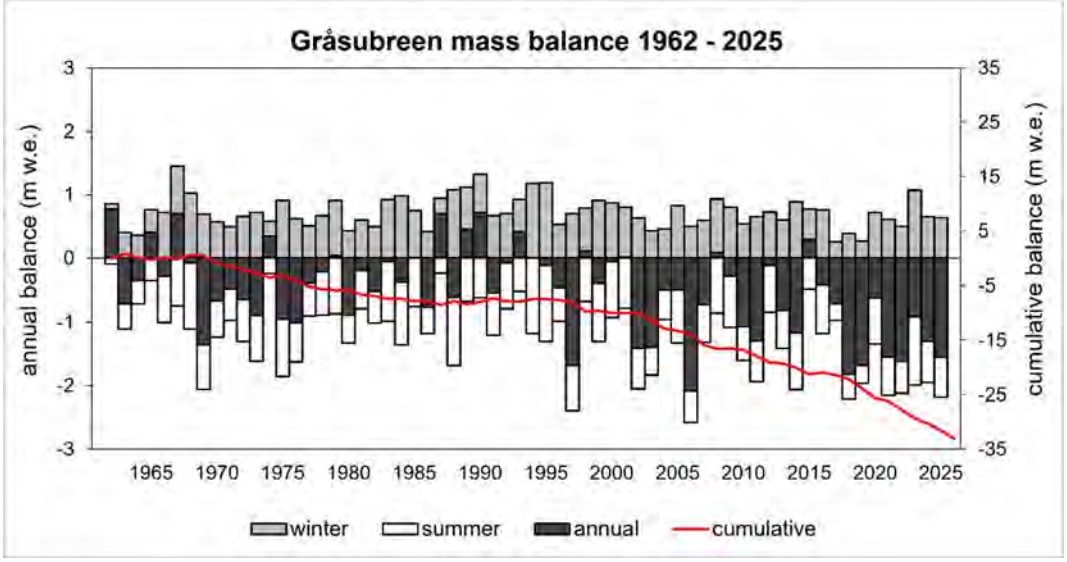


Figure 9-6
Winter, summer and annual balance on Gråsubreen for 1962-2025, and cumulative mass balance for the whole period.

10. Engabreen (Hallgeir Elvehøy)

Engabreen (66°40′N, 13°45′E) is a north-western outlet from the western Svartisen ice cap (Fig. 10-1). In 2020 it covered an area of 36.0 km^2 and an altitude range from 1532 m a.s.l. at Snøtinden down to 176 m a.s.l. close to Engabrevatnet (Fig. 10-2). Front variation observations started in 1903 (chap. 12), and mass balance measurements have been performed annually since 1970.

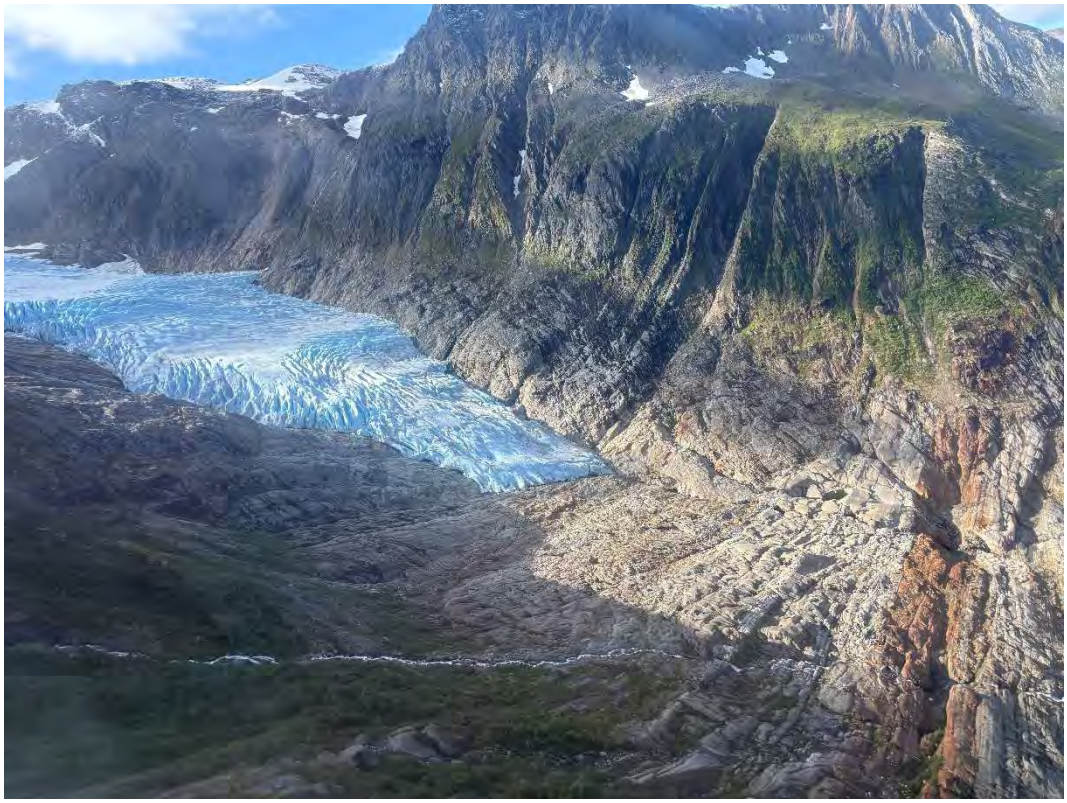


Figure 10-1
Engabreen on 22 August 2025. In 2018 the glacier terminus was located on the brown rock band to the right. Between 2018 and 2025 the glacier retreated 357 meters. Photo: Hallgeir Elvehøy.

10.1 Mass balance 2025

Fieldwork

Stakes in three locations on the glacier plateau and one stake on the glacier tongue were checked on 9 March and showed between 4 and 8 meters of snow on the plateau.

The snow accumulation measurements were performed on 22 May. Stakes were found in the same four stake locations on the plateau and one location on the glacier tongue. Stake E121 showed 10.6 meters of snow, - one of the largest verified snow depths measured at Engabreen since the start of measurements in 1970. Even though all the winter snow melted in 2024, the summer surface from 2024 was difficult to detect above 1300 m a.s.l. Snow depth was measured in 18 sounding locations along the profile from E101T (1305 m a.s.l.) to E34 (Fig. 10-2). The summer surface was easy to define in most sounding locations. The snow depth on the plateau varied between 5.3 and 10.8 meters, and the mean snow depth was 7.3 meters. The mean snow density down to the previous

summer surface at 8.75 m depth at stake E5 was 551 kg m^{-3}. At stake E400 on the glacier tongue 0.9 m of glacier ice had melted since 19 November 2024.

Stake E400 on the glacier tongue was re-drilled on 26 June but melted out around 5 August. A new stake was drilled on 22 August. On the glacier plateau up to 0.45 meter of new snow had accumulated above ca. 1050 m a.s.l. on 22 August (Fig. 10-3). Between 4 and 6 meters of snow and ice had melted since 22 May.

The summer ablation measurements were carried out on 1 October. Up to 0.2 meters of new snow had accumulated at the stake locations. Between 1.5 and 2 meters of snow and ice had melted after 22 August on the plateau, and up to 4.8 meters of winter snow remained at stake locations above 1100 m a.s.l. On the glacier tongue 2.35 meters of ice had melted after 22 August.

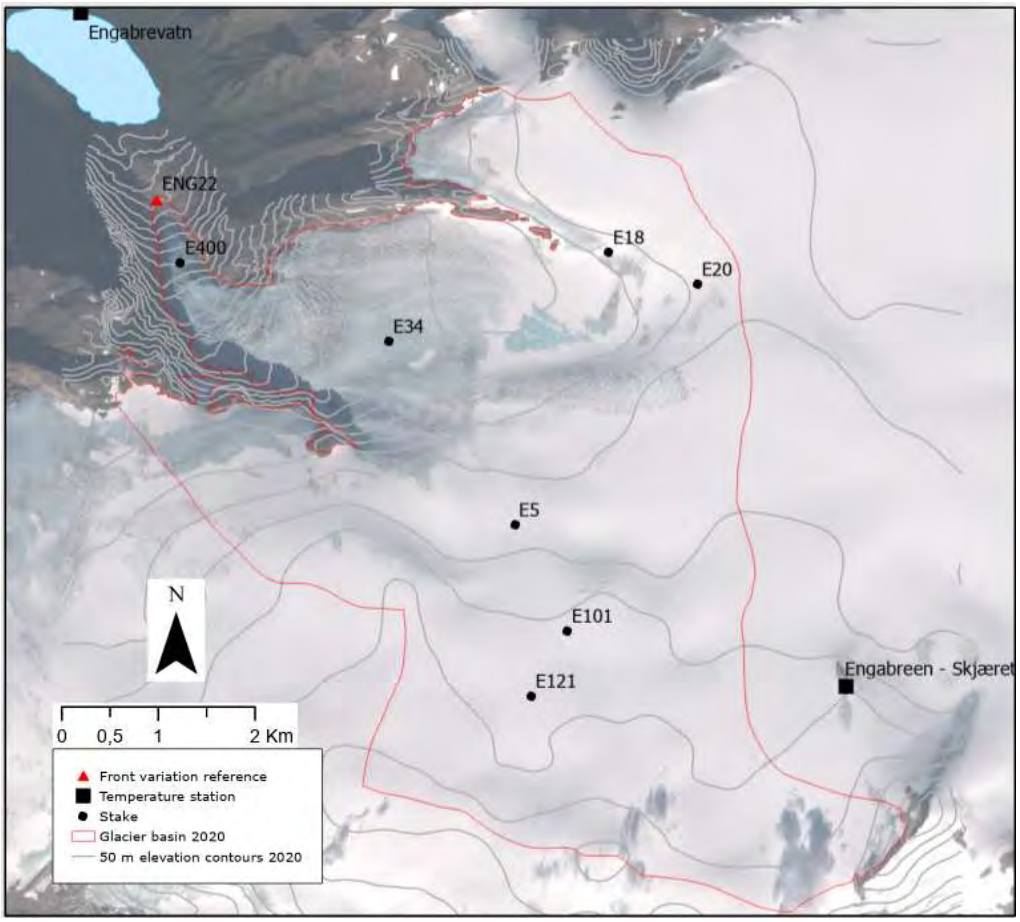


Figure 10-2
Location of stakes and soundings on Engabreen in 2025. The density measurement was performed at E5 (1220 m a.s.l.). The temperature station (Ch. 10-2) is located at Skjæret (1364 m a.s.l.). ENG22 is the reference point for the front variation measurements (chap. 12). The background is a Sentinel-2 satellite image from 9 September 2025. Source: @SeNorge/Copernicus Sentinel data 2025/.

Results

The calculations are based on a DEM from 10 August 2020. All the stake and sounding locations are appointed elevations from the 2020 DEM.

The winter balance on the glacier plateau was calculated from the snow depth and snow density measurements on 22 May. On the glacier tongue the point specific winter

balance at E400 was calculated from measured ice melt between 19 November 2024 and 22 May 2024. The total specific winter balance was calculated as 4.4 ±0.2 m w.e. This is 164 % of the average winter balance for the normal period 1991-2020 (2.71 m w.e. a^{-1}), and the largest winter balance since the start in 1970.

The date of the 2025 mass balance minimum on Engabreen was assessed from the daily changes in gridded data of temperature and snow amount from Senorge.no (Lussana et al., 2019) and the temperature record from the meteorological station Engabreen-Skjæret (Fig. 10-2 and Chap. 10-2). The snow accumulation on the glacier plateau probably started on 21 September. Between 900 and 1200 m a.s.l. some melting of new snow occurred until 8 October without changing the annual minimum.

Between 1 October 2025 and 4 February 2026 0.9 meters of ice melted at stake E400. Based on the temperature record from the discharge station Engabrevatn (Fig 10-2) and snow amount from Senorge.no this ice melt occurred before 9 November.

The point summer balance was calculated directly for six stake locations on the glacier plateau. The melting at stake E400 between 29 July and 22 August was estimated as 2.0 m of ice based on measured melt during several periods in July and daily air temperature recorded at the Engabrevatn discharge station (10 m a.s.l.) approximately 3 km from the stake location (Fig. 10-2). The specific summer balance was calculated from the summer balance curve drawn from seven point values (Fig. 10-4) as −3.9 ±0.2 m w.e. This is 139 % of the average summer balance for the normal period 1991-2020 (−2.77 m w.e. a^{-1}).

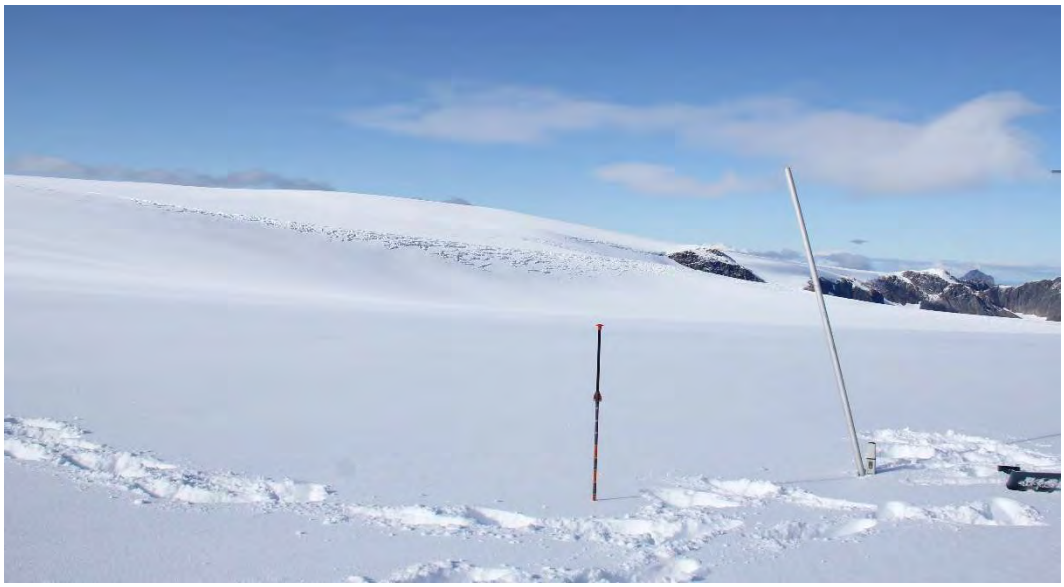


Figure 10-3
Stake E20 (1150 m a.s.l) was visited on 22 August. Here 25 cm of new snow had accumulated recently, and 2.1 m of winter snow remained. Photo: Hallgeir Elvehøy.

Table 10-1
Specific winter, summer and annual balance calculated for 100 m elevation intervals on Engabreen in 2025.

Mass balance Engabreen 2024/25 – stratigrafic system

Altitude (m a.s.l.)	Area (km^2)	Winter balance Measured 22 May (m w.e.)	Summer balance Measured 1 October (m w.e.)	Annual balance Summer surfaces 2024 - 2025 (m w.e.)
1500 - 1532	0.048	5.50	-3.15	2.35
1400 - 1500	2.129	6.00	-3.20	2.80
1300 - 1400	9.241	5.80	-3.30	2.50
1200 - 1300	8.044	4.80	-3.40	1.40
1100 - 1200	7.572	3.90	-3.70	0.20
1000 - 1100	4.607	3.40	-4.00	-0.60
900 - 1000	2.431	2.80	-5.20	-2.40
800 - 900	0.797	2.30	-6.10	-3.90
700 - 800	0.455	1.70	-7.00	-5.40
600 - 700	0.285	1.10	-7.90	-6.90
500 - 600	0.245	0.50	-8.80	-8.40
400 - 500	0.144	-0.05	-9.70	-10.00
300 - 400	0.099	-0.50	-10.60	-11.50
200 - 300	0.117	-1.00	-11.50	-13.00
111 - 200	0.035	-1.30	-12.00	-14.00
Specific mass balance				
111 - 1532	**35.960**	**4.43**	**-3.86**	**0.57**

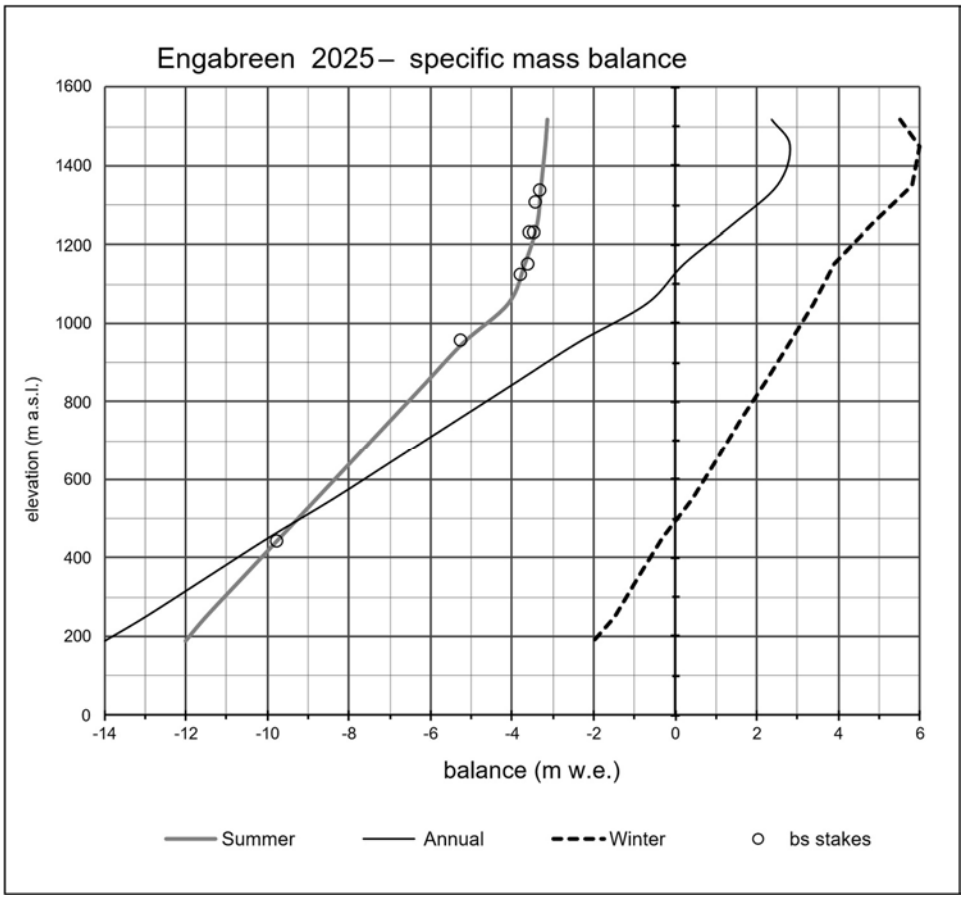


Figure 10-4
Altitudinal distribution of specific balance for Engabreen in 2025. Specific summer balance for seven stake locations is shown (o).

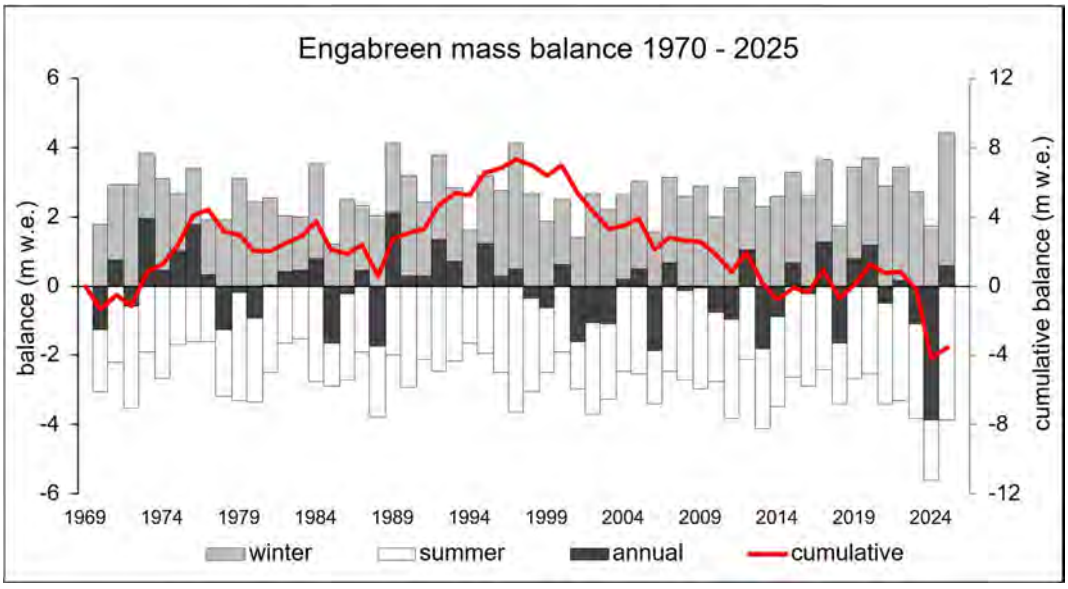


Figure 10-5
Mass balance on Engabreen during the period 1970-2025. Cumulative mass balance is given on the right axis. The mean winter and summer balances are B_w =2.72 m w.e. a^{-1} and B_s =−2.78 m w.e. a^{-1}.

The resulting annual balance for 2025 was 0.6 ±0.3 m w.e. (Tab. 10-1). The ELA was 1130 m a.s.l. and the corresponding AAR was 70 %. The average annual balance for the normal period 1991-2020 is −0.06 m w.e. a^{-1}. The annual surface mass balance on Engabreen for 1970-2025 is shown in Figure 10-5. The cumulative surface mass balance since the start of mass balance investigations on Engabreen is −3.5 m w.e.

10.2 Meteorological observations

The meteorological station 159.20 Engabreen–Skjæret (1364 m a.s.l.) is located on a nunatak close to the drainage divide between Engabreen and Storglombreen (Fig. 10-2). The station is recording air temperature and global radiation at 3 m above ground level. The station has been operating since 1995 with gaps.

The temperature record for the 2024/2025 mass balance year is shown in Figure 10-6. The winter season lasted approximately from 20 September 2024 to 12 June 2025, and the summer season ended on 3 October 2025. Between 19 and 21 August new snow accumulated on the upper part of the glacier (Fig. 10-3) and the temperature record reveals subzero temperatures prior to the field visit on 22 August (Fig. 10-6).

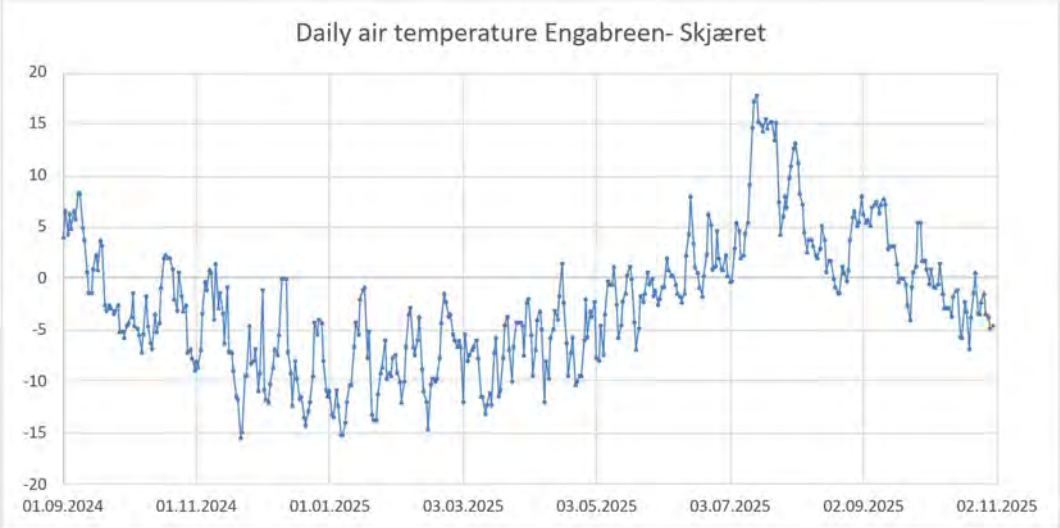


Figure 10-6
Air temperature at Engabreen-Skjæret (1364 m a.s.l.) from 1 September 2024 to 31 October 2025.

The mean summer temperature (1 June – 30 September) at Engabreen-Skjæret in 2025 was 4.4 °C. This is well above the average summer temperature of 3.16 °C for 24 out of 30 years between 1995 and 2024.

10.3 Svartisen Subglacial Observatory

The Observatory is situated under the icefall in Engabreen. Load cells have been measuring variations in subglacial pressure on glacier bed since December 1992. The data collection from four load cells stops on 8 January 2025. Then there is data from 8 March until 27 June 2025. Consequently, the record from 2025 is not shown.

11. Langfjordjøkelen (Bjarne Kjøllmoen)

Langfjordjøkelen (70°10′N, 21°45′E) is a plateau glacier situated on the border of the Troms and Finnmark counties, approximately 60 km northwest of Alta. It has an area of about 5.8 km^2 (2024), and of this, 2.4 km^2 drains eastward. The investigations are performed on this east-facing part (Fig. 11-1), where the glacier ranges in elevation from 338 to 1043 m a.s.l. (2018).

The glaciological investigations in 2025 include mass balance and front variations (chap. 12). Langfjordjøkelen has been the subject of mass balance measurements since 1989 with exception of 1994 and 1995.

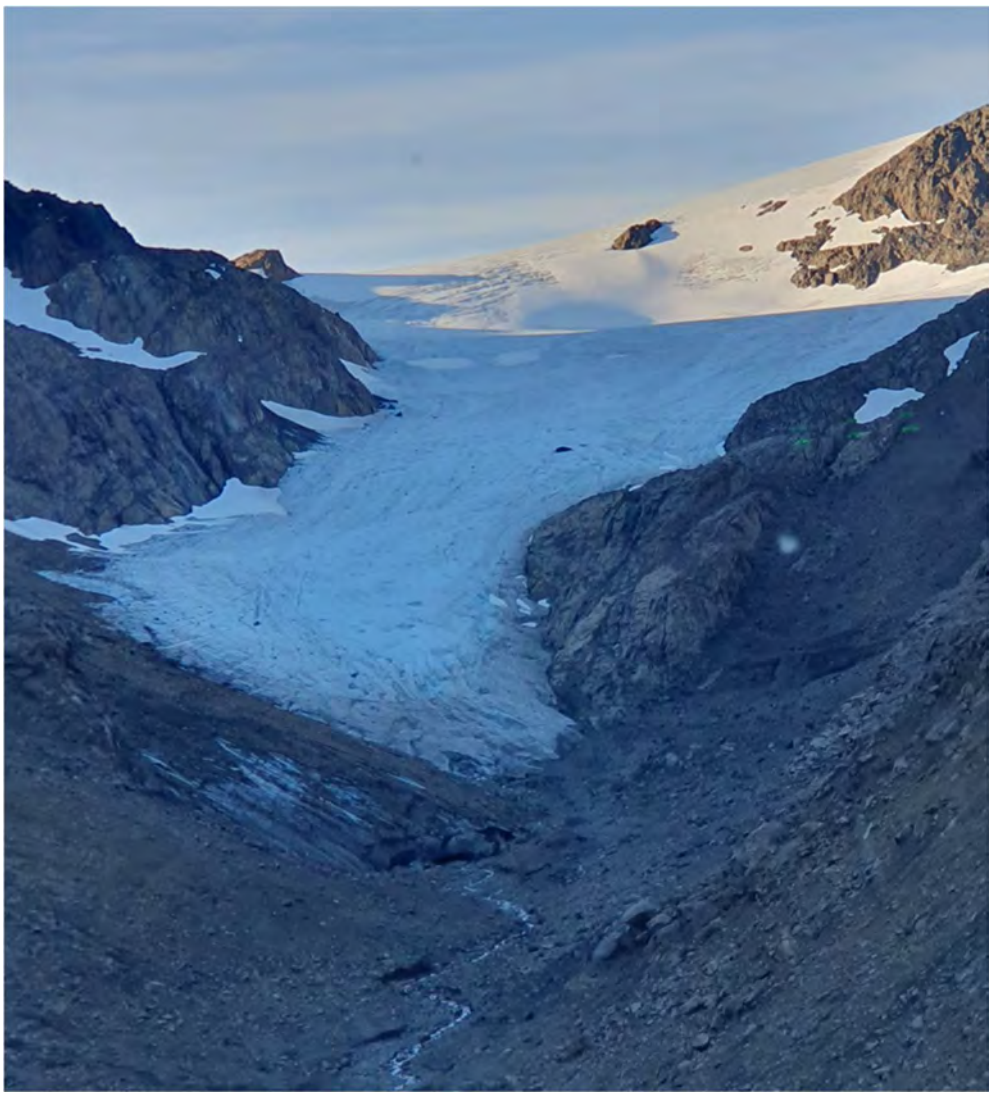


Figure 11-1
The east-facing outlet of Langfjordjøkelen photographed on 2 October 2025. Photo: Bjarne Kjøllmoen.

11.1 Mass balance 2025

Fieldwork

Snow accumulation was measured on 23 May. The calculation of winter balance was based on 52 snow depth soundings (Fig. 11-2). Generally, the snow depth varied between 4 and 7 m. Snow density was measured in location 25 (707 m a.s.l.) and the mean density of the snowpack (5.05 m) was 481 kg m^{-3}.

Ablation was measured on 2 October. The annual balance was measured at stakes in six locations (Fig. 11-2). There was no snow remaining on the glacier from the winter season 2024/25. At the time of measurement, no fresh snow had fallen on the glacier.

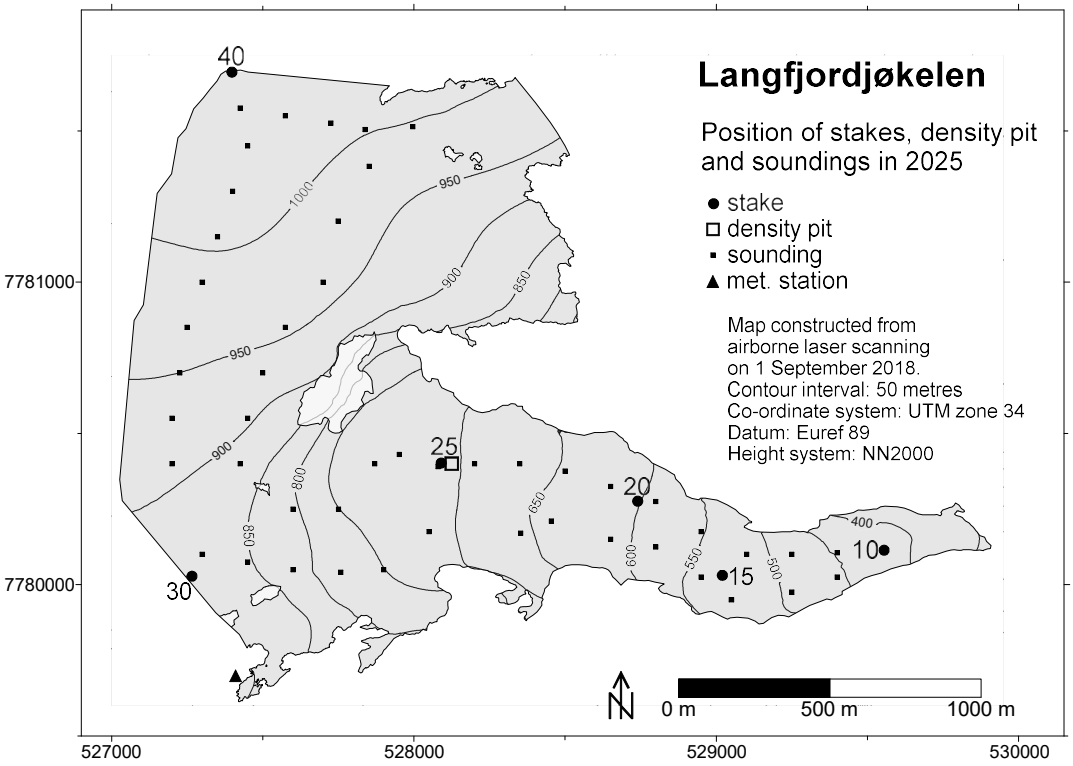


Figure 11-2
Location of stakes, soundings and snow pit on Langfjordjøkelen in 2025.

Results

The calculations are based on the DTM from 2018.

All elevations are well-represented with snow depth measurements. The winter balance was calculated as a mean value for each 50 m height interval and was 2.5 ±0.2 m w.e., which is 120 % of the mean winter balance for the reference period 1991-2020 (except 1994 and 1995). The interpolated spatial distribution of the winter balance is shown in Figure 11-3.

The ablation stakes cover elevations from the glacier summit (1042 m a.s.l.) to 418 m a.s.l. The summer balance for the lowest stake is estimated for the period 8 August-2 October. The density of the ice before melting was assumed to be 900 kg m^{-3}. Based on estimated density and stake measurements, the summer balance was also calculated

as a mean value for each 50 m height interval and was −3.7 ±0.3 m w.e., which is 123 % of the mean summer balance for the reference period 1991-2020.

Hence, the annual balance was negative at −1.23 ±0.40 m w.e. The mean annual balance for 1991-2020 is −0.90 m w.e. The mean annual balance for the past ten years (2016-25) is −1.31 m w.e.

The mass balance results are shown in Table 11-1 and the corresponding curves for specific and volume balance are shown in Figure 11-4.

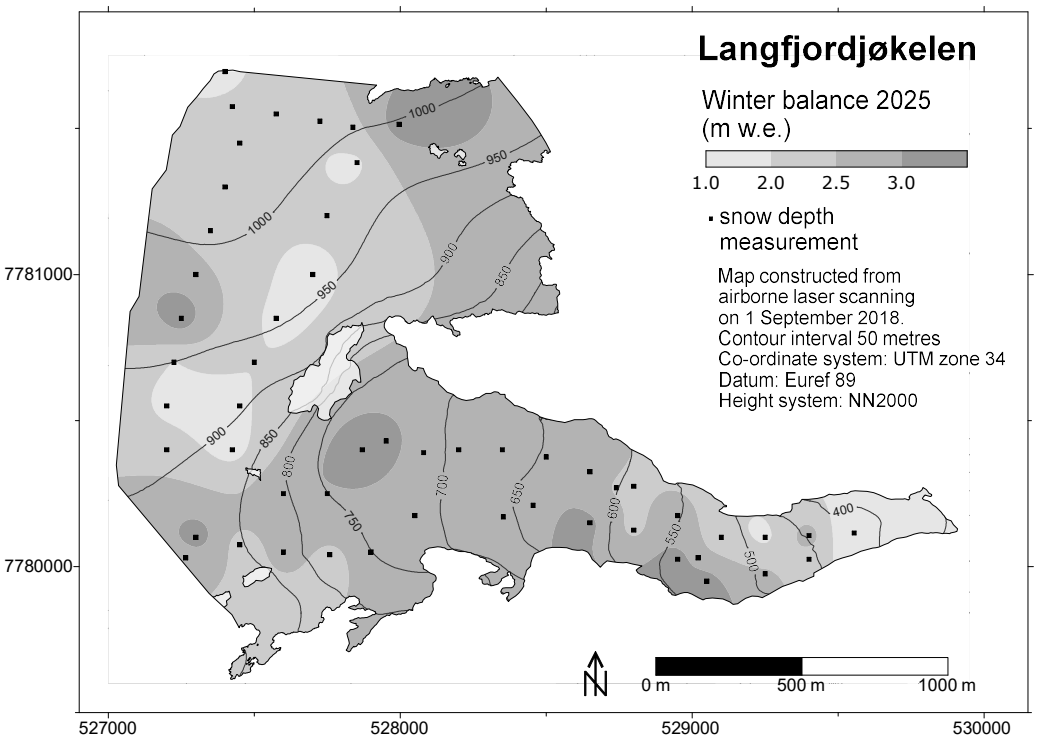


Figure 11-3
Spatial distribution of winter balance on Langfjordjøkelen in 2025.

According to Figure 11-4, the equilibrium line altitude was above the highest point of the glacier. Consequently, the accumulation area ratio was 0 %.

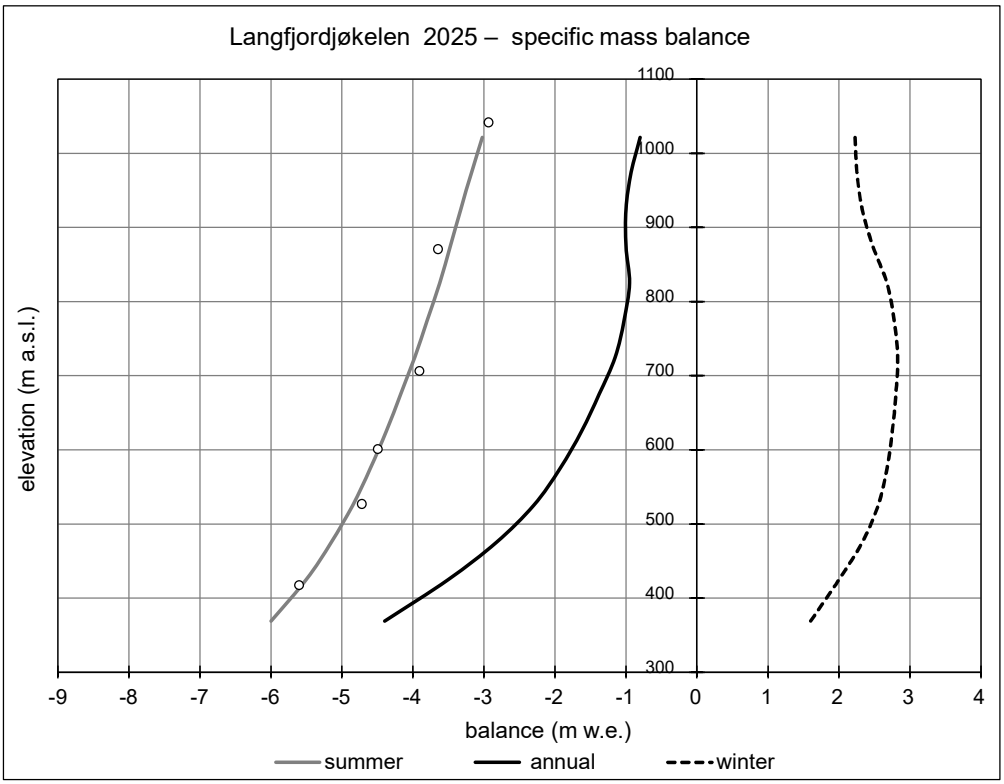


Figure 11-4
Mass balance diagram showing specific balance for Langfjordjøkelen in 2025. Specific summer balance for six stakes is shown as circles (○).

Table 11-1
Winter, summer and annual balance for Langfjordjøkelen in 2025.

Mass balance Langfjordjøkelen 2024/25 – stratigraphic system

Altitude (m a.s.l.)	Area (km²)	Winter balance Measured 18 June (m w.e.)	Summer balance Measured 15 Sep (m w.e.)	Annual balance S.S. 2021-2022 (m w.e.)
1000 - 1043	0.417	2.225	-3.025	-0.800
950 - 1000	0.467	2.250	-3.175	-0.925
900 - 950	0.376	2.325	-3.325	-1.000
850 - 900	0.362	2.475	-3.475	-1.000
800 - 850	0.232	2.675	-3.625	-0.950
750 - 800	0.217	2.775	-3.800	-1.025
700 - 750	0.267	2.825	-3.975	-1.150
650 - 700	0.203	2.800	-4.175	-1.375
600 - 650	0.168	2.750	-4.375	-1.625
550 - 600	0.128	2.675	-4.600	-1.925
500 - 550	0.121	2.550	-4.850	-2.300
450 - 500	0.095	2.325	-5.150	-2.825
400 - 450	0.096	2.000	-5.500	-3.500
338 - 400	0.049	1.600	-6.000	-4.400
Specific mass balance				
338-1043	**2.607**	**2.462**	**-3.694**	**-1.232**

11.2 Mass balance 1989-2025

The mass balance results for Langfjordjøkelen are presented in Figure 11-5. The cumulative annual balance for 1989-2025 (including estimated values for 1994 and 1995) is –36.9 m w.e., corresponding to a mean annual balance of –1.00 m w.e. a^{-1}.

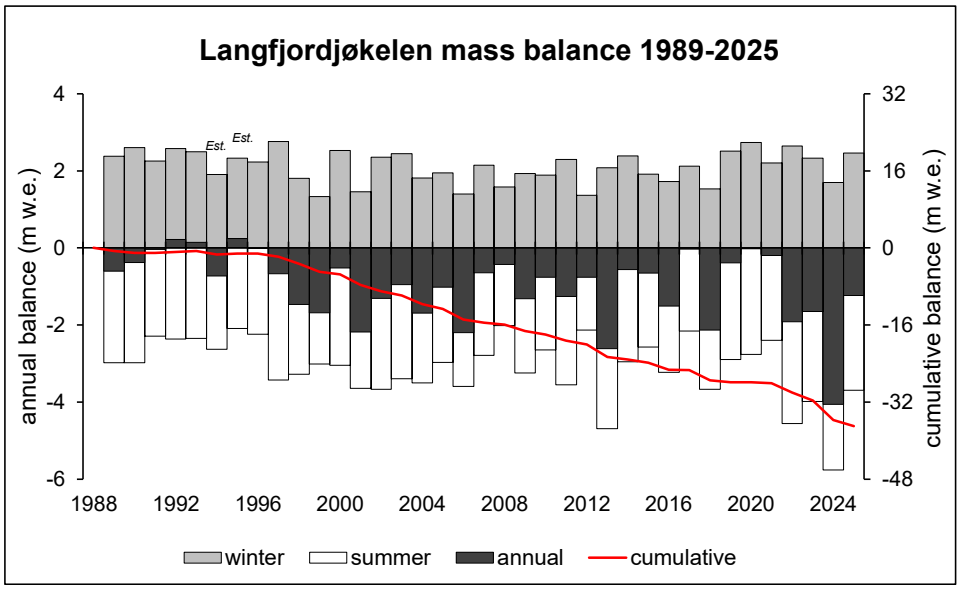


Figure 11-5
Mass balance on Langfjordjøkelen for the period 1989-2025. The total accumulated mass loss for 1989-2025 is 36.9 m w.e. (including estimated values for 1994 and 1995).

11.3 Water discharge and air temperature

Water discharge and air temperature during the summer season is a relevant and important parameter that is related to the summer balance and glacier changes.

Air temperature

A meteorological station (Langfjord met, 211.7.0) recording air temperature, air pressure, relative humidity and global radiation (Fig. 11-6) is located on rock south of the glacier (915 m a.s.l., Fig. 11-2) close to the glacier margin. The station has been in operation by NVE since August 2006. However, the data record for 2006-2008 and 2011 is incomplete. Thus, more continuous data exist for the periods 2009-2010 and 2012-2025. In the following some results from air temperature measurements at Langfjord met during the “summer season” 1 June-30 September are presented.



Figure 11-6
The meteorological station Langfjord met, 211.7.0.
Photo: Nils Larsen.

The mean summer temperature (1 June – 30 September) at Langfjord met in 2025 was 6.2 °C. The mean summer temperature for the period 2012-2024 was 5.3 °C. The melt season on the upper part of the glacier (above 900 m a.s.l.) started in the end of May 2025 and lasted until the turn of the month between September and October. The monthly temperatures for 2025 were 2.3 °C (June), 9.2 °C (July), 6.9 °C (August) and 6.1 °C (September). The corresponding monthly mean summer temperatures for the period 2012-2024 are 3.4 °C (June), 8.1 °C (July), 6.6 °C (August) and 3.0 °C (September). Hence, three of the "summer months" (July, August and September) were warmer in 2025 than for the mean values during the 13-year period 2012-2024. June, however, was a little cooler in 2025 than for the 2012-2024 average. The air temperature record for the summer season 2025 is shown in Figure 11-7.

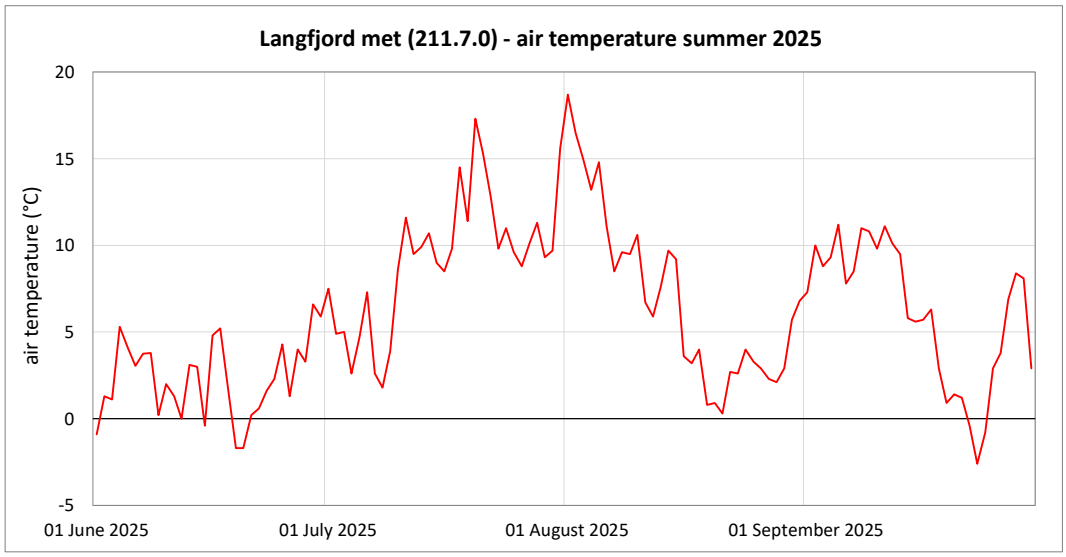


Figure 11-7
Air temperature at Langfjord met, 211.7.0 (915 m a.s.l.) from 1 June to 30 September 2025.

Water discharge

The meltwater from Langfjordjøkelen flows eastward into the lake Andrevatnet (254 m a.s.l.) and further northward into the lake Førstevatnet (248 m a.s.l.). Discharge stations

are located in both lakes (Fig. 11-8), approximately 2.6 km east of the glacier snout. The discharge station in Førstevatnet (Langfjordhamn, 211.1.0) has been in operation by NVE since 1980, while the station in Andrevatnet (Andrevatn, 211.2.0) has been in operation since 1989 (Fig. 11-9).

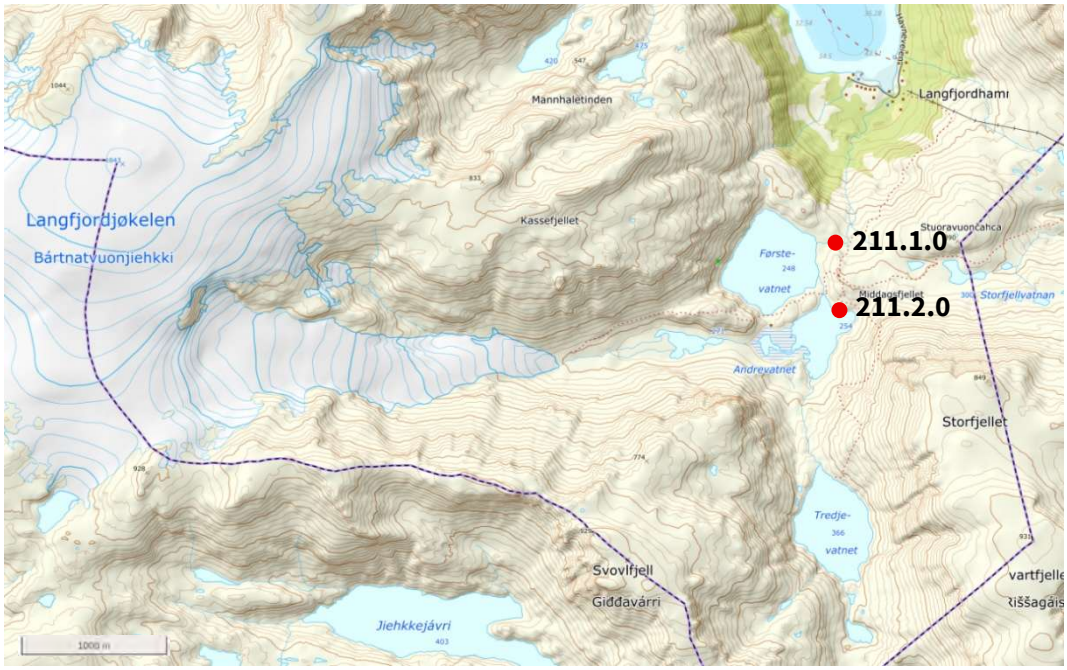


Figure 11-8
The discharge stations in Førstevatnet (211.1.0) and Andrevatnet (211.2.0) are located approximately 2.6 km east of the Langfjordjøkelen glacier snout.

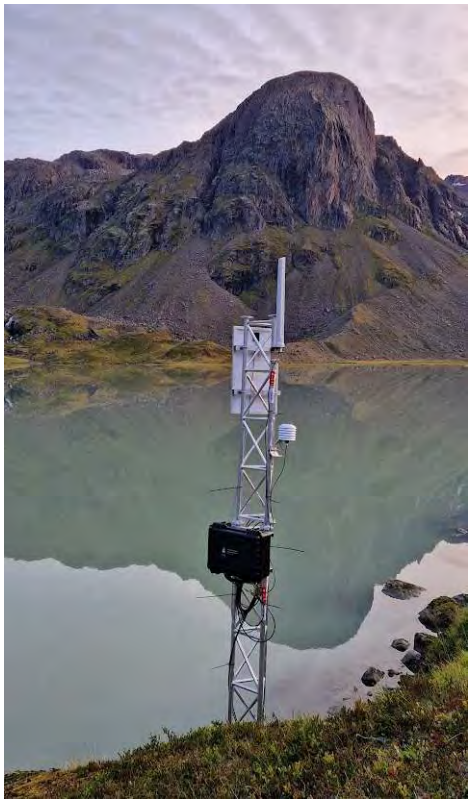


Figure 11-9
The water discharge station 211.2.0 Andrevatn, photographed on 31 August 2023. Photo: Turid Haugen.

In the following some results from discharge measurements at 211.2.0 during the "summer season" 1 June-30 September are presented.

The total discharge from 1 June to 30 September 2025 was 36 mill. m^3. The mean discharge during this period for the years 1990-2018 and 2022-2024 was 28 mill. m^3. The daily water discharge record from 1 June to 30 September 2025 for the station 211.2.0 is shown in Figure 11-10.

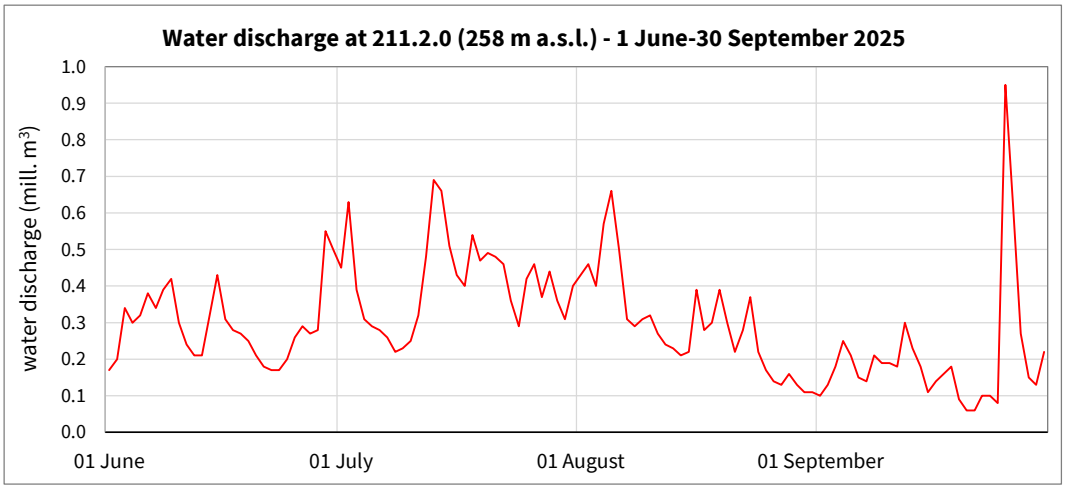


Figure 11-10
Daily water discharge at station 211.2.0 Andrevatn for the summer season June-September 2025. The high water discharge in late September is due to heavy rainfall, approximately 130 mm in two days at a nearby station.

The seasonal and monthly discharges for the "summer season" 2025 are summarized and compared to previous years in Table 11-2. The total discharges for each summer month and for the whole summer season were higher in 2025 than the mean values during the periods 1990-2018 and 2022-2024.

Table 11-2
Seasonally and monthly total discharges (mill. m3) at 211.2.0 Andrevatn from 1 June to 30 September 2025.

	1 June-30 Sept.	June	July	August	September
2025	36	8.6	12.4	8.9	6.1
1990-2024	*28	**7.0	**9.8	**7.0	*4.2

*1990-2018 and 2022-2024

**1990-2019 and 2022-2024

In Figure 11-11 the daily water discharge and air temperature from 1 June to 30 September are plotted together. The correlation between the two parameters is clearly visible.

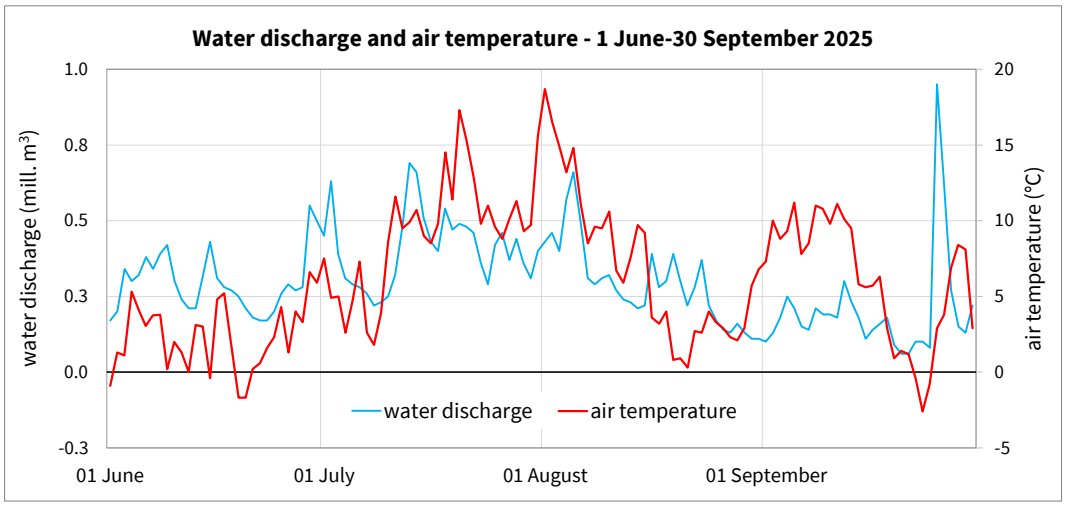


Figure 11-11
Daily water discharge at station 211.2.0 Andrevatn and air temperature at station 2011.7.0 Langfjord met for the summer season June-September 2025.

12. Glacier front variations 2025

(Hallgeir Elvehøy)

Systematic observations of front variations of Norwegian glaciers started around Jostedalsbreen in 1899 (Rekstad, 1902), in Jotunheimen in 1902 (Øyen, 1906) and in Nordland in 1908 (Hoel, 1910; Rekstad, 1910). Since then, front variations have been measured over several years for at least 83 glaciers in Norway. In 2025 the monitoring programme of front variations included 28 glaciers in southern Norway and 11 glaciers in northern Norway (Fig. 12-2 for location). In the latest glacier inventory from 2018-2019 the area of the monitored glaciers was 371 km^2, and they constituted about 16 % of the glacier area in Norway (Andreassen et al., 2022).



Figure 12-1
Brenndalsbreen (Glacier ID 2301) in Stryn, Vestland photographed on 19 October 2025 from the front variation reference point BREN2024. This re-generated glacier tongue is fed by snow and ice avalanches from the main glacier plateau of Jostedalsbreen. Close to the terminus is remnants of a rock avalanche that occurred in the spring 2010. Front variation measurements started in 1900 and recorded a prominent advance in the second half of the 20th century. Since 2000 the glacier terminus has retreated ca. 900 meters. Photo: Ruben Briksdal/NVE.

Methods

The standard method is to measure the distance to the glacier terminus from one or several fixed points in defined direction(s), usually in September or October every year. The change in distance gives an estimate of the length change of the glacier. Alternatively, the front variation is measured between mapped terminus positions along a central flow line, or a combination of the methods are used. It is questionable how representative a single front variation estimate for one year based on measurements from one reference point can be for the entire glacier terminus. However, when longer periods are considered, the measurements give valuable information about glacier fluctuations, and when several glaciers are observed regional tendencies are outlined (Andreassen et al., 2020).

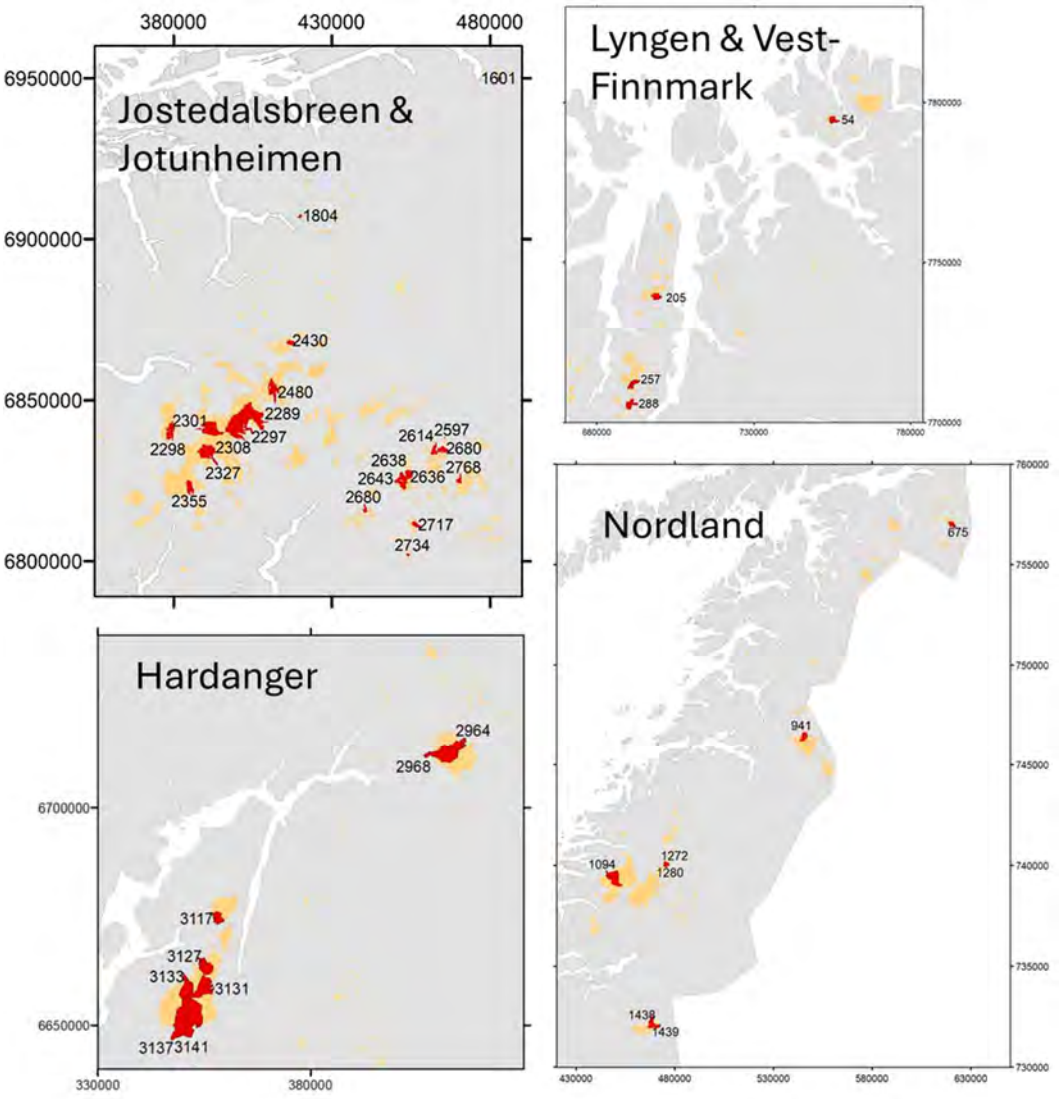


Figure 12-2
Map showing glaciers included in the front variation monitoring programme (in red) with glacier IDs (Tab. 12-1). Note that the different glacier areas are not to the same scale.

Results 2025

Thirty-seven glaciers were measured, ten glaciers in northern Norway and twenty-seven glaciers in southern Norway. The results for 2025, period(s) of measurements and number of observations (calculated front variations) are listed in Table 12-1. Thirty-three glaciers retreated, three glaciers showed no change (defined as within ±2 meters), and one glacier showed a small advance. The annual front variation varied from +5 meters for Botnabrea to −300 meters for Austerdalsbreen. The average annual retreat for the thirty-seven glaciers was −25 meters. Two glaciers in the monitoring programme, Vetle Supphellebreen (Fig. 12-3) and Corneliussenbreen, were not measured in 2025.

For the ten-year period 2015-2025 the mean cumulative front variation for 36 glaciers was −228 meters, ranging from −540 meters at Austerdalsbreen to −50 meters at Koldedalsbreen. Ten glaciers in northern Norway retreated on average 248 meters, and 26 glaciers in southern Norway retreated on average 221 meters. The data are available at https://www.nve.no/hydrology/glaciers/.

Table 12-1
Glacier front variations measured in 2025. See Figure 12-2 for glacier locations.

	Glacier	Glacier-ID	2025	Observer	Period(s)	Number obs.
Finnmark & Troms	Langfjordjøkelen	54	−16	NVE	1966-	29
	Koppangsbreen	205	+1	NVE	1952-	26
	Sydbreen	257	−27	NVE	1988-	21
	Steindalsbreen	288	−29	NVE	1953-	33
Nordland	Storsteinsfjellbreen	675	0	NVE	1960-	20
	Rundvassbreen	941	−50*	SISO	1961-	13
	Engabreen	1094	−36	S	1903-	93
	Skjelåtindbreen	1272	−2	NVE	2014-	8
	Trollbergdalsbreen	1280	−12	NVE	2010-	11
	Austre Okstindbreen	1438	−19	NVE	1908-44, 2006-	33
	Corneliussenbreen	1439	NM	NVE	2006-	10
Sunnmøre & Breheimen	Vinnufonna	1601	−20	NVE	2019-	5
	Trollkyrkjebreen	1804	−12	NVE	1944-74, 2008-	30
	Heimsta Mårådalsbreen	2430	−10	NVE	1966-	13
Jostedalsbreen	Fåbergstølsbreen	2289	−20	NVE	1899-	120
	Nigardsbreen	2297	−23	NVE	1899-	115
	Haugabreen	2298	−29	NBM	1933-41, 2013-	20
	Brenndalsbreen	2301	−42	NVE	1900-62, 1964-65, 1996-	86
	Tuftebreen	2308	−14	NVE	1937-	26
	Austerdalsbreen	2327	−300	NVE	1905-19, 1933-	105
	Vetle Supphellebreen	2355	NM	NBM	1899-44, 2011-	48
	Stigaholtbreen	2480	−11	NVE	1903-	119
Jotunheimen	Styggebrean	2608	−9	NFS	1951-63, 2011-	22
	Storjuvbrean	2614	−18	NVE	1901-07, 1908-12,1933-61, 1997-	65
	Storbreen	2636	−18	NVE	1902-	87
	Leirbrean	2638	−12	NVE	1907-77, 1979-	66
	Bøverbrean	2643	−21	NVE	1903-46, 1950-	52
	Styggedalsbreen	2680	−42	NVE	1901-	104
	Mjølkedalsbreen	2717	−40*	NVE	1978-	29
	Koldedalsbreen	2734	−7*	NVE	1978-	17
	Hellstugubreen	2768	−20	NVE	1901-	86
Hardanger	Midtdalsbreen	2964	−20	UiB	1982-	43
	Rembesdalskåka	2968	−35	S	1917-	50
	Botnabrea	3117	+5	GK	1996-	22
	Gråfjellsbrea	3127	−14	S	2002-	23
	Buerbreen	3131	−40	NVE	1900-	79
	Bondhusbrea	3133	−18	S	1902-	94
	Svelgjabreen	3137	−21	SKL	1959-	24
	Blomstølskardsbreen	3141	−13	SKL	1994-	26

* – two years

NM – not measured in 2025

Observers other than NVE:

SISO Siso Energi
S Statkraft AS
NBM Norsk Bremuseum & Ulltveit-Moe senter for klimaviten, Fjærland
NFS Norsk Fjellsenter, Lom
UiB Prof. Jostein Bakke, University of Bergen
GK Geir Knudsen, Tyssedal
SKL Sunnhordland Kraftlag



Figure 12-3
Vetle Supphellebreen (2355) photographed in 1899 by J. Rekstad (upper) and in 2024 from the same spot by Mark Reysoo (lower). The reference mark used in 1899 was carved into a large block close to the river and glacier terminus (a white cross on the 1899 photo) and was re-located by Pål H. Kielland at the Norwegian Glacier Museum in 2018. In recent years the front variation has been measured since 2011 from reference points close to the present terminus. Between 1899 and 2025 the glacier terminus retreated ca. 1.1 km.

Corrections of previously reported results

Nigardsbreen (Glacier ID 2297) for 1921-22 was reported as +16 meters on the right (southern) side and as −2 meters on the left (northern) side (Rekstad, 1922). From the observations the front variation on the northern side was −14 meters and on the southern side −12 meters. The mean front variation was −13 meters.

13. Jøkulhlaup and runoff from glacier lakes (Bjarne Kjøllmoen)

Jøkulhlaups, also known as Glacier Lake Outburst Floods (GLOFs), and drained glacier lakes, were registered at seven glaciers in Norway in 2025. Two of them were registered based on direct observations from glacier lakes, whereas five of the events were detected on photographs and satellite images only. All events are recorded in the NVE event database.

The two events with direct GLOF observations from glacier lakes were 1) Nupsfonn (Haukelifjell) and 2) Rembesdalskåka (Hardangerjøkulen) (Fig. 13-1).

Inspection of glacier lakes on Sentinel imagery revealed drainage events at five additional locations; 3) Svartisheibreen (Svartisen), 4) “Hengfjellbreen” (Beiarn, Nordland), 5) Oksfjellbreen (Okstindbreen), and 6) Ruteflotbreen and 7) Marabreen (both Jostedalsbreen) (Fig. 13-1).

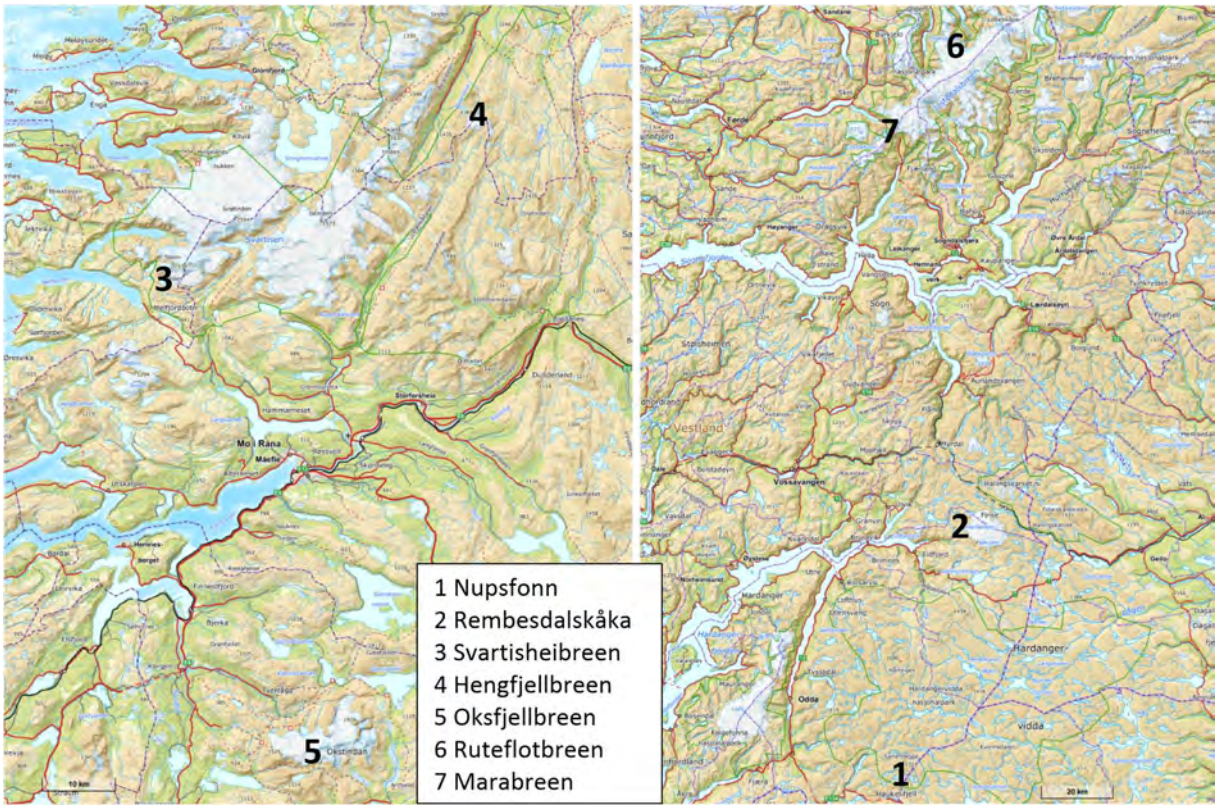


Figure 13-1
Jøkulhlaups and runoffs from glacier lakes were registered at seven glaciers in 2025, three in northern Norway (left) and four in southern Norway (right). Map source: norgeskart.no.

13.1 Events observed in the field

1 Nupsfonn (Glacier ID 3075)

Nupsfonn is a small glacier on Haukelifjell in Ullensvang community, Vestland county (Fig. 13-1). In the latest inventory Nupsfonn is divided in two parts, ID 3071 and 3075, with a total area of 0.93 km^2 (Andreassen et al., 2022). Orthophotos of the glacier suggest that the glacier had an area of ca. 1.7 km^2 in July 2006 and ca. 1.0 km^2 in September 2019 (Fig. 13-2). Since 2019, the glacial shrinkage has continued, and on 24 September 2025 the glacier covered ca. 0.5 km^2 (Fig. 13-3).

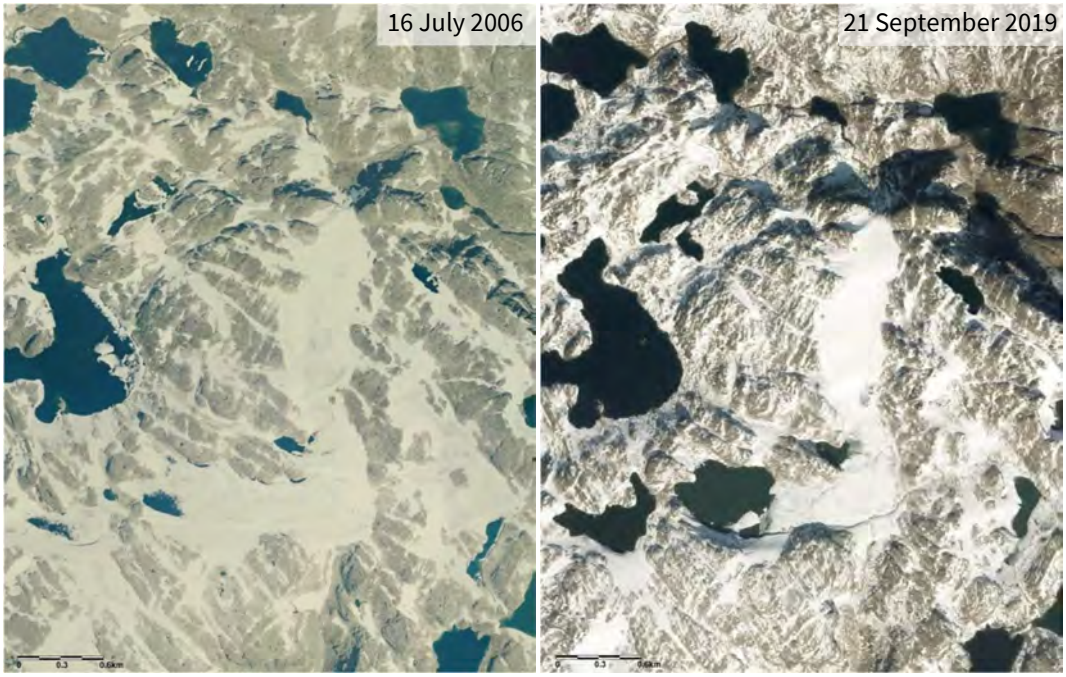


Figure 13-2
Orthophotos of Nupsfonn from 16 July 2006 (left) and 21 September 2019 (right). Source: norgeibilder.no.



Figure 13-3
Sentinel-2 image of Nupsfonn from 24 September 2025. Source: SeNorge.

As the glacier melted and receded, a glacier lake appeared and has grown larger, from 0.18 km^2 in 2006 (Fig. 13-2), to 0.29 km^2 in 2019 (Fig. 13-2) and 0.91 km^2 in September 2025 (Fig. 13-3).

The first, and only previous event from this glacier lake was observed in August 2019 (Kjøllmoen et al., 2020) when approximately 10 million m^3 of water drained through the river Nupselva to the lake Trolltjønn and further to the hydropower reservoir Ulevåvatnet/Ståvatn. The locations of the glacier, river and lakes are shown in Figure 13-4.

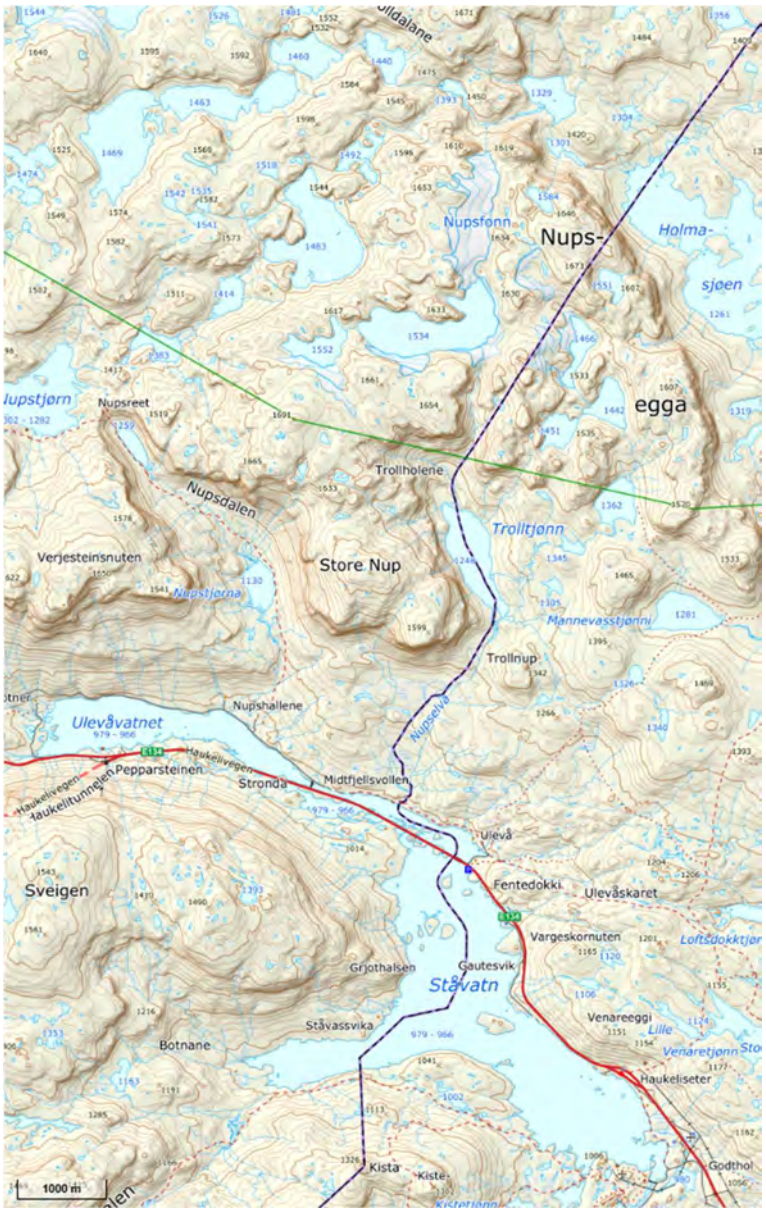


Figure 13-4
Location map showing Nupsfonn with the glacier lake, the river Nupselva, the lake Trolltjønn and the hydropower reservoir Ulevåvatnet and Ståvatn. Map source: norgeskart.no.

Jøkulhlaup 2025

The 2025 event from Nupsfonn occurred from evening 19 to the middle of the day 21 September. Drainage from the glacier lake caused high discharge in the river Nupselva and into the hydropower reservoir Ulevåvatnet/Ståvatn.

On 22 September the water in the lake Trolltjønn and the hydropower reservoir Ulevåvatnet/Ståvatnet was observed by locals to be very cloudy (Fig. 13-5). A helicopter overflight on 25 September by crew from the hydropower company Statkraft could also reveal the breach in the ice dam where the water drained out of the glacier lake (Fig. 13-6). The drop of the lake level was not measured, nor is it easy to estimate from the photos.



Figure 13-5
Part of the hydropower reservoir Ståvatn close to the inlet from the river Nupselva (upper) and part of the lake Trolltjønn (below), both photos from 22 September 2025. Photos: Nils Ove Hauge.



Figure 13-6
Part of the glacier lake. Notice the breach in the ice dam (arrow) where the water drained out of the lake, and the line in the ice remnants that marks the water level before the runoff. Photo: Lars Ole Hagen, Statkraft.

The water volume caused by the jøkulhlaup is estimated as 2.7 million m^3 between 19 September at 15:00 and 21 September at 13:00 (Fig. 13-7). The estimate is based on measured inflow to the reservoir Ulevåvatnet/Ståvatn. The hydropower company, Statkraft, calculated the volume of the flood as 3.5-4.0 million m^3 water.

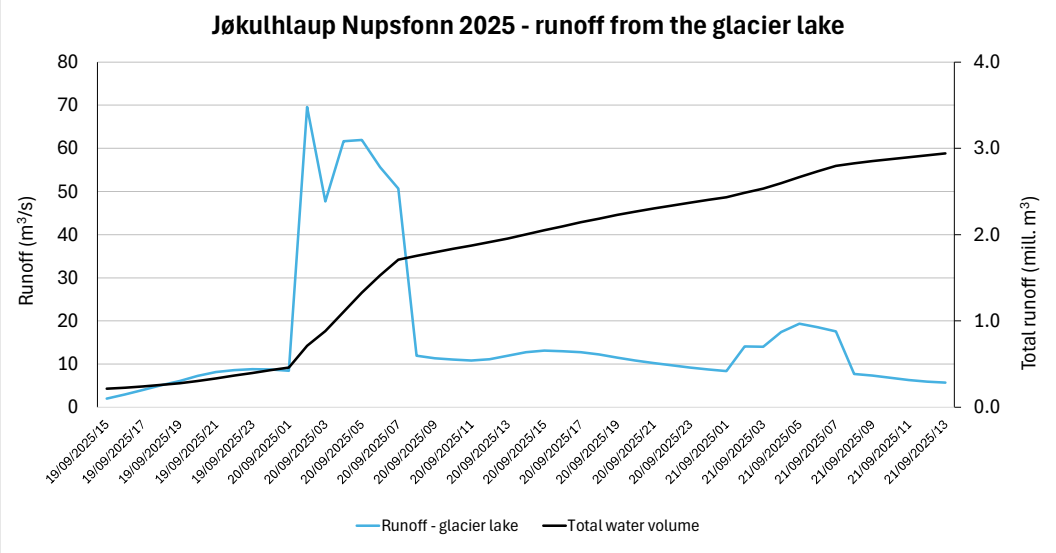


Figure 13-7
Runoff from the glacier lake based on measured inflow in the power reservoir Ulevåvatnet/Ståvatn.

The topography around the glacier lake is quite steep, so a drop in water level does not affect the extent of the glacier lake significantly. Hence, the drainage was not visible in any Sentinel images taken before and after the event.

2 Rembesdalskåka (Glacier ID 2968)

Rembesdalskåka, an outlet glacier of Hardangerjøkulen, dams a lake called Nedre Demmevatnet (0.14 km^2) (Fig. 13-8). There have been many previous events recorded from Nedre Demmevatnet (Tab. 13-1), the earliest prior to 1813 (Liestøl, 1956). In the years leading up to 1893 the lake emptied almost every year, usually taking two to three weeks to drain. However, individual events without damage were not recorded. During the event in 1893, the lake drained in just 24 hours.



Figure 13-8
Orthophoto from 26 July 2019 showing the lower part of Rembesdalskåka and the glacier-dammed lake Nedre Demmevatnet. The hydropower reservoir Rembesdalsvatnet is seen to the left. Source: norgeibilder.no.

Jøkulhlaup 2025

The 2025 event occurred at the glacier-dammed lake from morning 25 to afternoon 28 April. An unknown, but rather small volume of water drained under Rembesdalskåka and subsequently to the hydropower reservoir Rembesdalsvatnet (Fig. 13-8). Web camera photos from Gotheca show the inner part of the lake (close to the ice barrier) before, during and after the event (Fig. 13-9). A photograph of the inner part of the empty lake is also shown in figure 13-10.



Figure 13-9
Web camera photos taken before (left), during (middle) and after (right) the event. Dates and times of the photos are shown below each photo. Source: Gotheca/Norwegian University of Science and Technology.



Figure 13-10
Part of the empty glacier lake Nedre Demmevatnet, and the ice barrier photographed on 12 August 2025, three and a half months after the jøkulhlaup. Source: Gotheca/Norwegian University of Science and Technology.

Table 13-1
Dates and approximate volumes of jøkulhlaups from Nedre Demmevatnet. For events that occurred since 2014 the water volume is calculated by Statkraft as extra inflow to the hydro-power reservoir Rembesdalsvatnet.

Year	Date	Comment	Water volume (mill. m^3)
1736	unknown	Earliest record of flood from Demmevatnet	unknown
1813	unknown	Flood damages	unknown
1842	unknown	Flood damages	unknown
1861	17 September	Damage, including two bridges	unknown
1893	Late August	Catastrophic flood, lake drained in 24 hours	35
1897	17 Aug.-12 Sep.	Event occurred over 26 days	35
1937	10 August	Drained in 3.5 hours	11.6
1938	23 August	Flood before new drainage tunnel completed	10
2014	24 August	Event occurred over ~3 hours	1.9
2016	~25 January	Lake observed full 24th January and empty 30th January	1.44
2016	6 September	Event occurred over ~4 hours	1.87
2017	27 October	Event occurred over ~22 hours	1.85
2018	10-11 August	Event occurred over 10-12 hours	unknown
2019	24 August	Event occurred over ~3 hours	1.8
2020	6 September	Event occurred over 5-6 hours	2.3
2021	13 July	Event occurred over 3-4 hours	1.75
2022	29-30 August	Event occurred over ~11 hours	2.19
2023	22 June	Event occurred over ~6 hours	1
2024	3 June	Event occurred over ~7 hours	1
2025	25-28 April	Event occurred over ~3 days	unknown

13.2 Events observed by photography and satellite images only

3 Svartisheibreen (Glacier ID 1135)

Svartisheibreen is a small valley glacier (4.7 km^2 in 2020) south-west of the western Svartisen ice cap (Fig. 13-1). The glacier snout calves into a recently formed proglacial lake, here called Heiavatnet (0.51 km^2 in 2019) (Fig. 13-11). Several previous events have occurred at Heiavatnet, the last one at the turn of July/August 2021 (Tab. 13-2).

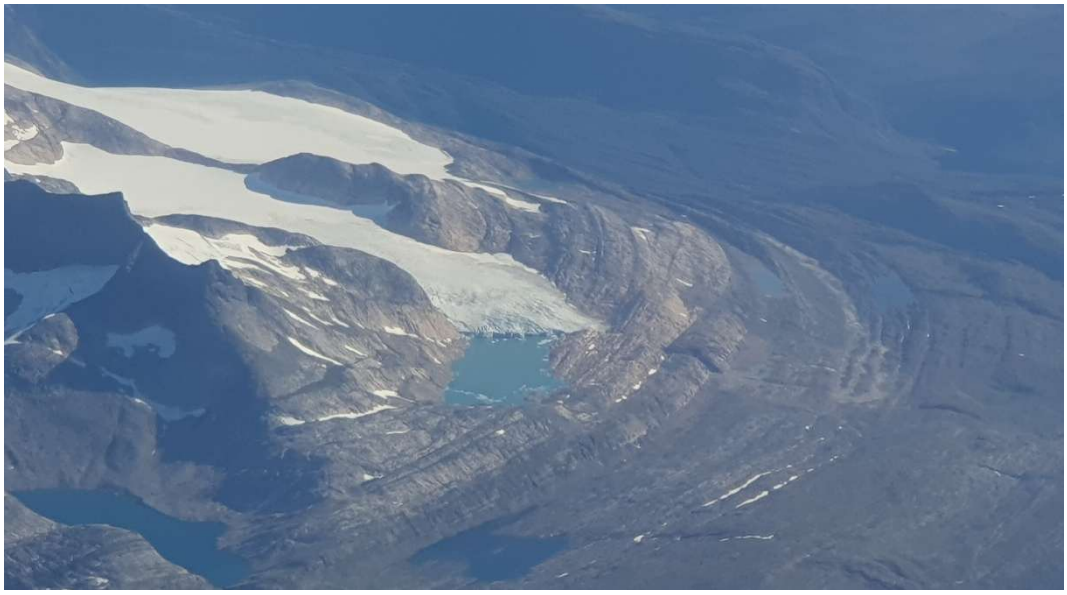


Figure 13-11
Svartisheibreen and Heiavatnet photographed from an aircraft on 27 August 2025, three weeks before the jøkulhlaup. Photo: Bjarne Kjøllmoen.

Jøkulhlaup 2025

Examination of Sentinel-1 images (radar) suggests that the glacier lake was drained between 18 and 19 September (Fig. 13-12). Sentinel-2 images (optical) from 14 and 28 September confirmed the event (Fig. 13-13).

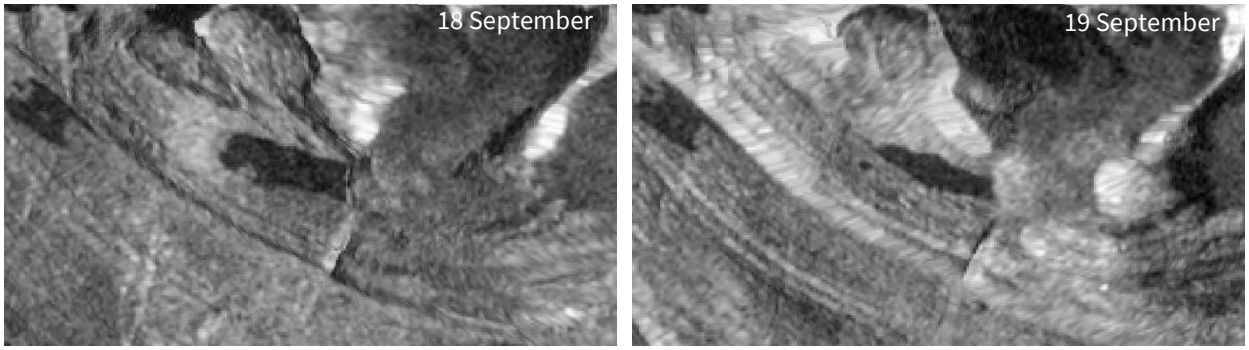


Figure 13-12
Sentinel-1 radar images of the glacier lake Heiavatnet from 18 September (left) and 19 September (right) 2025. The images show less water in the lake on 19 September than it was the day before, indicating that the lake was drained at the turn of the day between 18 and 19 September. Source: SeNorge/Copernicus Sentinel data 2025/.

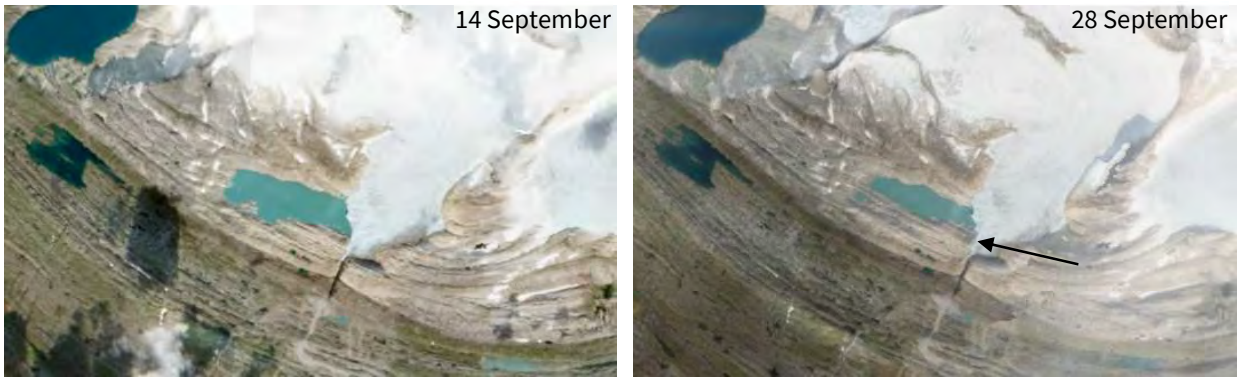


Figure 13-13
Sentinel-2 optical images of the glacier lake from 14 September (left) and 28 September (right) 2025. The arrow in the right image indicates where the water drained under the ice and out of the lake.
Source: /Copernicus Sentinel data 2025/.

The water flood from the jøkulhlaups at Heiavatnet drains into the river Tverråga and further into Glomåga (Fig. 13-14). Close to Glomåga there is a hydrometric station (156.10. Berget, 61 m a.s.l.) recording water level and water discharge (Fig. 13-14). The diagram in Figure 13-15 show water discharge at Berget during the period 18 September at 10:00 to 19 September at 13:00. The discharge increased from approximately 35 to approximately 120 cubic metres per second within 10 hours. The water volume from the jøkulhlaup is estimated as 2.2 million m^3 during a time span of 27 hours.



Figure 13-14
Water from the glacier lake Heiavatnet drains into the river Tverråga and Glomåga. The hydrometric station Berget is located downstream from Heiavatnet close to Glomåga. Source: norgeibilder.no.

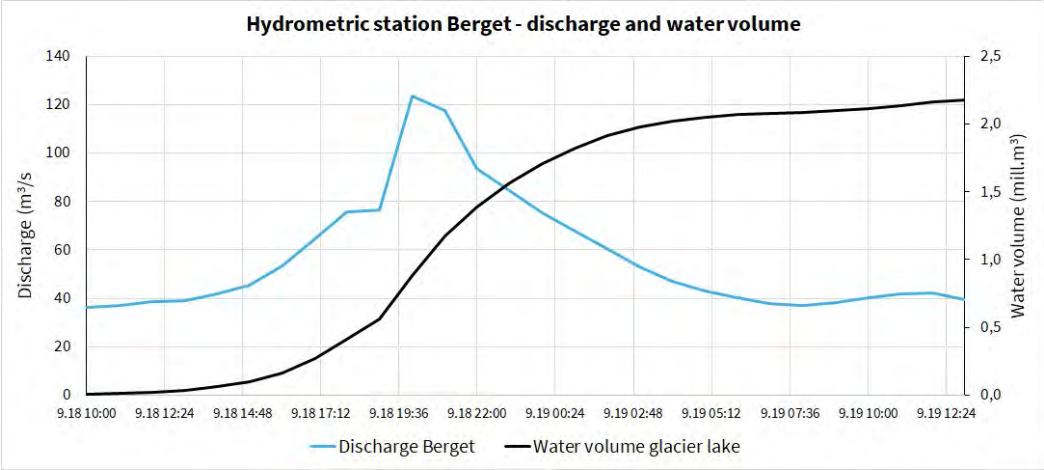


Figure 13-15
Water discharge at the hydrometric station 156.10 Berget and the total water volume from the jøkulhlaup over the period 18 September at 10:00 to 19 September at 13:00.

Table 13-2
An overview of jøkulhlaups from Heiavatnet since 1989.

Year	Date	Comment
1989	unknown	P Low water level observed in August
1991	7-15 April	Water level recordings. Water volume estimated to 1.8 mill.m^3
1999	unknown	P Low water level observed in September
2000	unknown	P Low water level and stranded icebergs observed in September
2014	late summer	P Low water level and stranded icebergs observed in September
2016	late summer	P Low water level and stranded icebergs observed in September
2020	late July	P/S Low water level and stranded icebergs observed in August
2021	July/August	P/S Low water level and stranded icebergs observed in August
2025	18-19 September	S Discharge measurement. Water volume estimated to 2.2 mill.m^3

P Photograph
S Sentinel image
D Discharge

4 Hengfjellbreen (Glacier ID 1260)

Hengfjellet is a mountain peak northeast of Svartisen in Beiarn community, Nordland county (Fig. 13-1). One kilometer south of the mountain peak a small glacier (0.32 km^2 in 2024), here called Hengfjellbreen, and a glacier lake (0.30 km^2 in 2024) is situated (Fig. 13-16). No earlier events have been registered from this glacier lake.

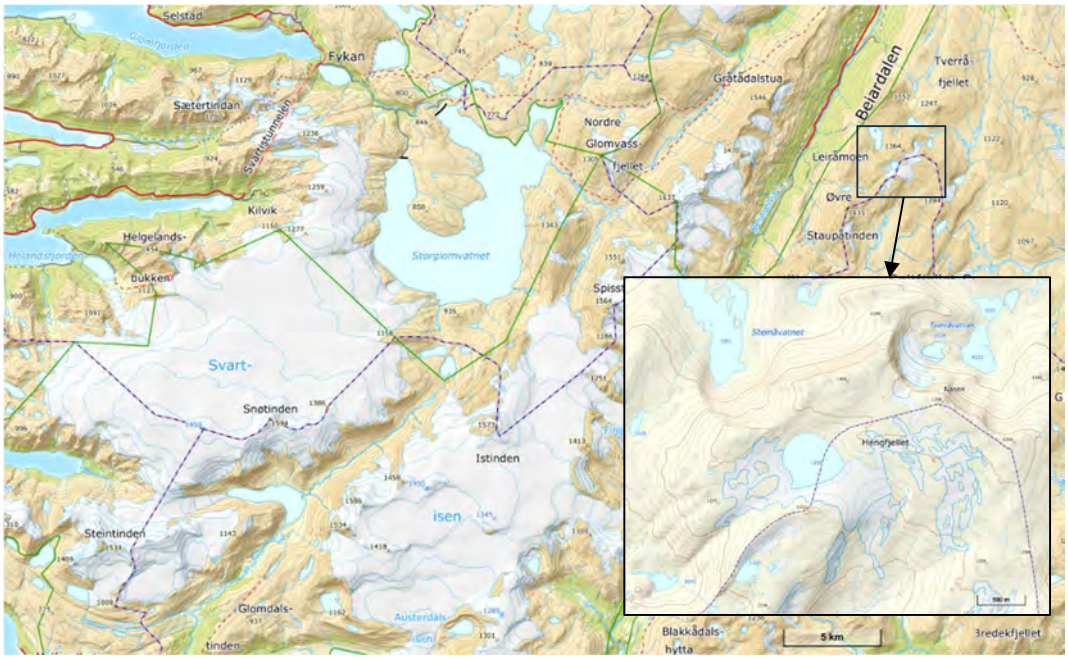


Figure 13-16
Location map showing Hengfjellbreen and the glacier lake. Source: norgeskart.no.

Jøkulhlaup 2025

Satellite images suggest that the glacier lake was emptied between 9 and 19 September 2025 (Fig. 13-17).

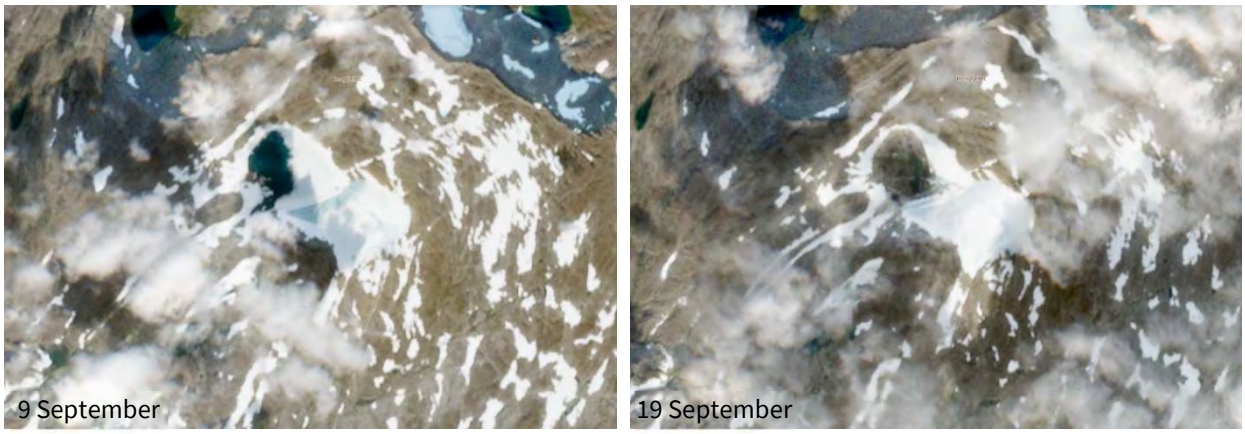


Figure 13-17
Sentinel- 2 images taken on 9 (left) and 19 September (right) 2025. The glacier-dammed lake at the north-western edge of the glacier was emptied during this period. Source: /Copernicus Sentinel data 2025/.

5 Oksfjellbreen (Glacier ID 1450)

Oksfjellbreen is a southern outlet (3.1 km^2 in 2019) from the ice cap Okstindbreen in Nordland County (Fig. 13-1). A small ice-dammed lake (0.04 km^2 in 2024) is located at the northeastern part of the glacier (Fig. 13-18). Runoffs from Oksfjellbreen are registered every year since 2020.

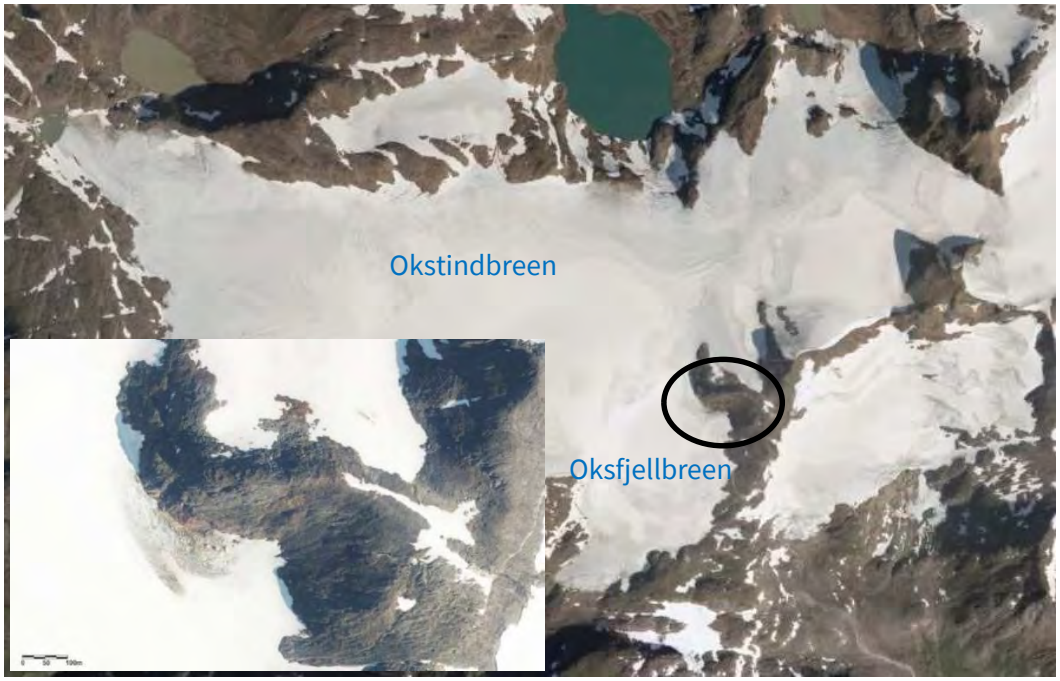


Figure 13-18
Oksfjellbreen is a southern outlet from the ice cap Okstindbreen. The glacier-dammed lake is located on the north-eastern side of the Oksfjellbreen outlet, indicated by the black ellipse in the orthophoto from 9 August 2014. The inset orthophoto shows an empty glacier lake on 28th July 2021. Source: norgeibilder.no.

Jøkulhlaup 2025

Examination of Sentinel-2 images from 22 and 26 June 2025 suggests that the glacier-dammed lake emptied during this period (Fig. 13-19).

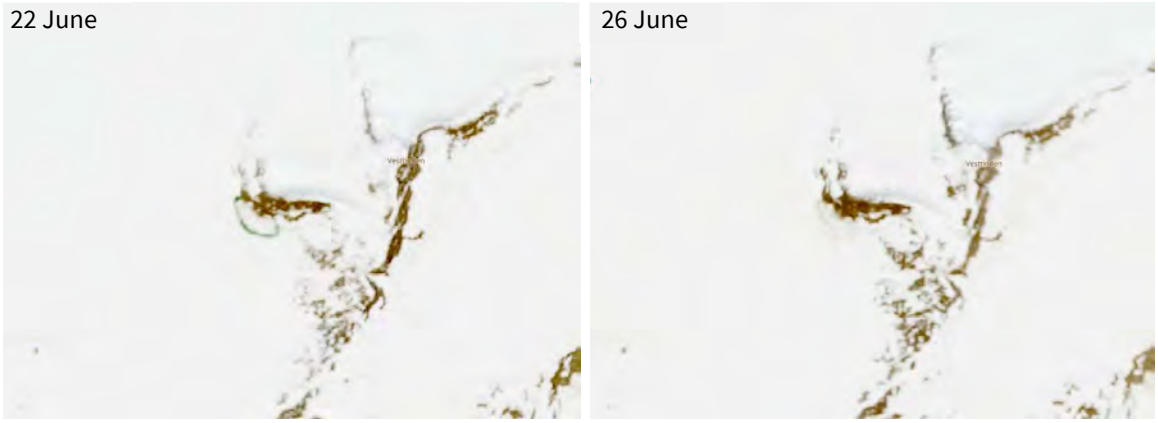


Figure 13-19
Sentinel-2 images from 22 June (left) showing water in the lake, and from 26 June (right) showing an empty lake. Source: SeNorge/Copernicus Sentinel data 2025/.

6 Ruteflotbreen (Glacier ID 2294)

Ruteflotbreen is a northern outlet (5.8 km^2 in 2019) from the ice cap Jostedalsbreen (Fig. 13-1). In recent years, a glacial lake (0.29 km^2 in 2024) has formed on the northern side of the glacier (Fig. 13-20). No earlier events have been registered from this glacier lake.



Figure 13-20
Ruteflotbreen and the glacier lake photographed from an aircraft on 6 September 2024. Photo: Jostein Aasen.

Jøkulhlaup 2025

The last legible Sentinel-2 image without snow and ice cover from autumn 2024 is from 19 October, and the first usable image from 2025 is taken 26 July (Fig. 13-21). Examination of those images suggests a lowering of the water level during this period of nine months. Whether the lowering occurred in late autumn 2024, or in the first half of 2025 is uncertain, but it most likely occurred in the spring or early summer of 2025. Sentinel-2 images suggest a further lowering between 7 and 9 September 2025 (Fig. 13-21).

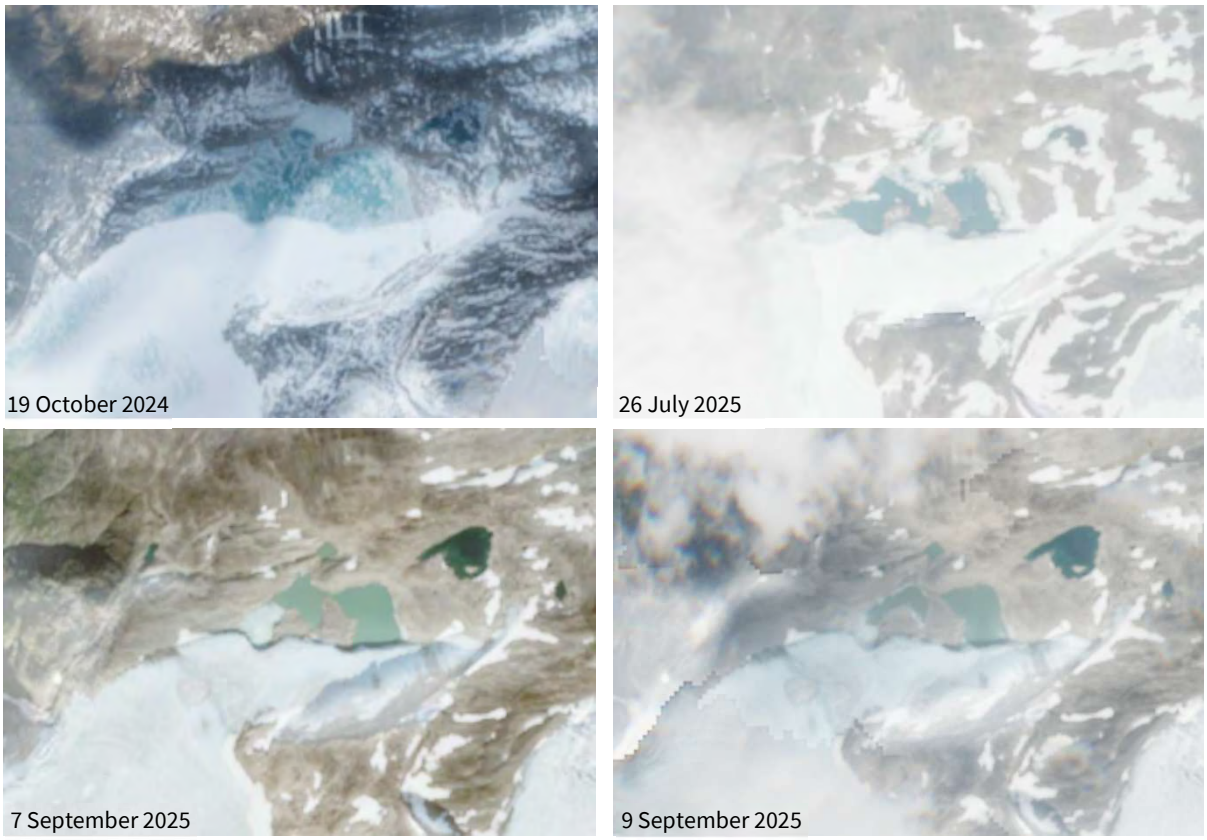


Figure 13-21
Sentinel-2 images from 19 October 2024 (upper left), 26 July 2025 (upper right), 7 September 2025 (lower left) and 9 September 2025 (lower right). Source: /Copernicus Sentinel data 2024/2025/.

7 Marabreen (Glacier ID 2364)

Marabreen is a small outlet glacier (2.4 km^2, 2024) at the southwestern edge of Jostedalsbreen (Fig. 13-1). A small ice-dammed lake (0.02 km^2 in 2024) is located north of the glacier (Fig. 13-22). Previous runoffs from Marabreen are registered in 2004, 2015 and 2018.



Figure 13-22
Orthophoto from 2 August 2024 showing Marabreen and the glacier-dammed lake at the northern edge of the glacier. The hydropower reservoir Trollavatnet to the left. Source: norgeibilder.no.

Jøkulhlaup 2025

The 2025 event is thought to have occurred from the glacier-dammed lake in summer. The event was identified based on changes in Sentinel images from 24 July and 17 August (Fig. 13-23).



Figure 13-23
Sentinel-2 images from 24 July 2025 (left) and 17 August 2025 (right). Source: /Copernicus Sentinel data 2025/.

The water from this runoff would have drained to the hydropower reservoir Trollavatnet (Fig. 13-22). Changes in the water level of the reservoir were analysed to see if the event could be observed and timed more accurately, but the volume from the glacier-dammed lake is minimal compared with the volume of the reservoir and no clear evidence of the event was detected. However, heavy rainfall was recorded at the nearby weather station Fjærland from 3 to 15 August (200 mm), and this may have triggered an event.

14. International Year of Glaciers' Preservation 2025 (Liss M. Andreassen)

14.1 Background

The UN General Assembly declared 2025 as the International Year of Glaciers' Preservation (IYGP) and designated 21 March as the annual International Glacier Day, beginning in 2025. The IYGP was co-ordinated by UNESCO and the World Meteorological Organisation (WMO). NVE was involved in the governance of the initiative as a member of the advisory board and of several task forces. In the following, we describe the activities NVE carried out in mainland Norway in 2025 to mark this special year. These activities included documenting the stories of vanishing glaciers through articles, exhibitions and lectures. NVE also cooperated with the Norwegian Trekking Association on several events and excursions. NVE was a co-organizer of a full-day seminar in Oslo marking the first World Days of Glaciers.

Figure 14-1
Logo of the year.

14.2 Global Glacier Casualty List

The Global Glacier Casualty List is a collection of stories about glaciers that have recently disappeared or are in the process of disappearing (Boyer and Howe, 2024). NVE has contributed stories about the southernmost glacier, Breifonn (including text on Juvfonne), and the northernmost glacier, Nordmannsjøkelen.



Figure 14-2
Different views of Nordmannsjøkelen in 1936, 2022 and 2024, prepared for the Global Glacier Casualty List. Some glacier IDs from the national glacier inventory have been added for reference (Andreassen and Winsvold, 2012). The glacier previously covered the plateau, but by 2022 and 2024 only remnants remained.
Photos: 1936: Widerøe Flyveselskap, 2022: Ingunn Ims Vistnes, Seiland National Park, 2024: Flytjenesten i Tromsø.

14.3 Annals of Glaciology collection on Vanishing glaciers

NVE contributed to a total of five papers and to the editorial work for a special issue of the *Annals of Glaciology* on Vanishing glaciers that have recently disappeared or are about to disappear.

NVE led the editorial work and summarized the 29 papers that form the collection in an editorial letter (Andreassen et al., 2026). The studies document glaciers in various states of decline across six continents, including Svalbard, Iceland, Norway, Germany, France, Italy, Spain, Austria, Switzerland, New Zealand, Indonesia, USA, Canada, Peru, Bolivia and Chile. Europe is comparatively well monitored, with repeat inventories and ongoing long-term field investigations, making it easier to detect vanishing glaciers.

The development of Breifonn is detailed in a paper describing the changes from its 'pre-industrial' Little Ice Age extent to its present size (Andreassen et al., 2025). The glacier reconstruction indicates that Breifonn covered an area of 5.8 ± 1.2 km^2 during the Little Ice Age (Fig. 14-3). Its main body decreased in area from 3.3 ± 0.3 km^2 in 1955 to 0.17 ± 0.02 km^2 in 2024 (94 %). Since the 1980s, the glacier has fragmented into several disconnected bodies.

The development of Nordmannsjøkelen, mainland Europe's northernmost glacier, is described in Winsvold et al. (2026). Nordmannsjøkelen has fragmented into small remnants, with only one unit showing signs of active ice flow (Fig. 14-2). The glacier has lost 92% of its area since 1970 (September 2024 area relative to 1970 area).

The archaeological potential and recent fluctuations in extents from 2017 to 2024 of three Norwegian ice patches, Storhornet, Elghøa and Lågtangan, are detailed in Kristensen and Andreassen (2026). The paper introduces the term *ghost patch* to describe archaeological ice-patch sites no longer containing ice.

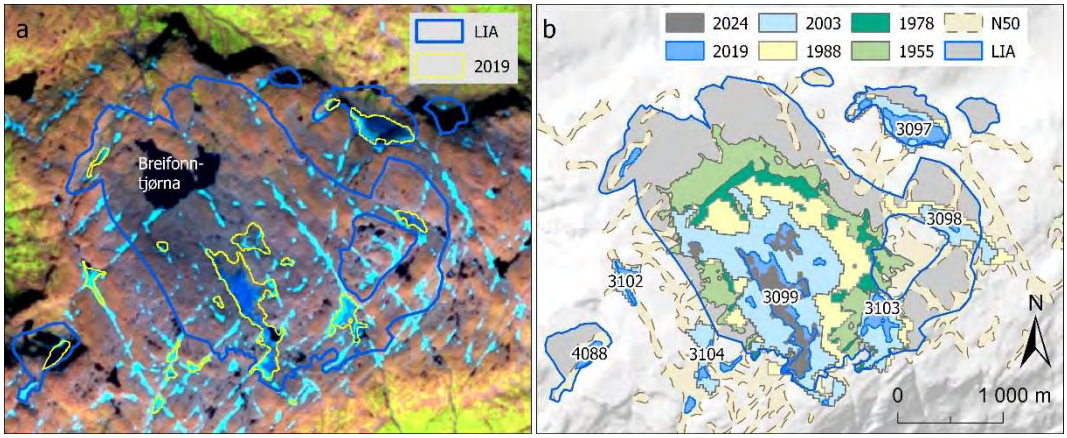


Figure 14-3
Glacier outlines of Breifonn from the 'pre-industrial' Little Ice Age (LIA) to 2024. (a) LIA and 2019 outlines shown on a Sentinel-2 satellite image in false colours from 6 September 2024 (Copernicus Sentinel data). The dark grey-brownish zone (in the centre of the figure) southeast of the lake Breifonntjørna is interpreted as the footprint left by glacier cover during the LIA. (b) Outlines shown as coloured polygons on a terrain-shadow background (Norwegian Mapping Authority). The 2024 outline was manually digitised from a UAV orthophoto. Figure adapted from Andreassen et al. (2025), Annals of Glaciology.

The Global Land Ice Measurements from Space (GLIMS) is an initiative to build and distribute database of global glacier data. GLIMS has recently begun tracking glaciers that have disappeared and NVE submitted data for 20 smaller bodies to this list (Raup et al., 2025).

14.4 Exhibition Norwegian Mountain Center

The Norwegian Mountain Center in Lom created the exhibition *'Når isen bryt/Breaking the Ice'* in collaboration with NVE, that opened on 5 June 2025. The exhibition aims to share knowledge about the current state of glaciers, both in Norway and around the world. Through interviews, photos, and videos, it explores how different communities are adapting to the changes taking place. The exhibition is also available online at https://www.fjellviten.no/. The exhibition opening featured a musical performance by Iselin Anna Aukrust and short talks by Thea Grobstok Dalen, Liss Andreassen and Miriam Jackson (Fig. 14-4).



Figure 14-4
From the exhibition *Når isen bryt/Breaking the ice* that opened on 5 June 2025 at the Norwegian Mountain Center in Lom. Upper left: The exhibition showing before-and-after images on the left, with the central piece, the ice stupa, in the background. Upper right: The exhibition displayed results from the international Glacier Mass Balance Intercomparison Exercise, including results from NVE (The Glambie Team, 2025), as well as interviews and examples from around the world. Middle left: Virtual reality options in the physical exhibition. Middle right: Sonam Wangchuk talks about the ice stupa project, which can be seen in the physical and digital exhibition. Lower left: Thea Grobstok Dalen, Miriam Jackson, Merete Dagsgard and Liss M. Andreassen. Lower right: Miriam Jackson speaking at the opening. Photos: Live Sulheim and Liss M. Andreassen.

14.5 Events with the Norwegian Trekking Association

The Norwegian Trekking Association (*Den Norske Turistforeningen*, DNT) is Norway's largest hiking and outdoor recreation organization. NVE cooperated with DNT on

several events during the year. On 22 January, DNT fjellsport Oslo and NVE invited to an evening event on glaciers. The programme included two talks: one by Liss Andreassen and Hallgeir Elvehøy from NVE on glacier measurements in a historical perspective, and one by DNT's Sven Bjørne Larsen on the use of glaciers over the past two hundred years (Fig. 14-5). Sven Bjørne Larsen also gave a talk at the seminar on 20 March (see chapter 14.7 and Fig. 14-8). The DNT hut Leirvassbu celebrated its 150-year anniversary in June. On 21 June Liss Andreassen from NVE presented results on glacier changes in Jotunheimen in an evening talk.



Figure 14-5
From the glacier evening at the venue of DNT Oslo on 22 January with glaciers as the theme. There were two talks: one by Hallgeir Elvehøy and Liss M. Andreassen from NVE who talked about glacier measurements in a historical perspective, and one by DNT's Sven Bjørne Larsen (right photo). Photos: Stig Storheil.

DNT organized a hiking trip across Hardangerjøkulen to the mountain hut Demmevasshytta on 28-31 August (Fig. 14-6). Hallgeir Elvehøy participated and presented glacier results as well as the history of Demmevatnet and its glacier lake outburst floods. DNT also arranged a trip to Tungestølen and Jostedalsbreen national Park for the Crown Prince of Norway on 1-2 September. Liss Andreassen gave a talk on glaciers to the group at Tungestølen on 1 September. On 2 September, the group hiked to Opptaksbreen, an outlet glacier of Jostedalsbreen in the national park.

As the final event of the year, Hallgeir Elvehøy gave a talk at the autumn meeting of Hamar and Hedemarken Turistforening on 12 November.



Figure 14-6
Upper photos: Left: Trip to Rembesdalskåka (Hardangerjøkulen) and Demmevasshytta (the hut is shown in the red box) in August. Right: Sven Bjørne Larsen in front of the hut. Photos: Hallgeir Elvehøy. Lower photos: Left: Trip to Opptaksbreen (Jostedalsbreen) in September with the Crown Prince leading the roped team with Gaute Bøyum in second place as local guide. Right: DNT General Secretary Inger Lise Blyverket, Liss Andreassen from NVE and Crown Prince Haakon on the walk on the glacier. Photos: Marius Dalseg, DNT.

14.6 Glacier seminar

To mark the first World Day of Glaciers, the University of Oslo, NVE and other partners organized a one-day seminar on 21 March at Klimahuset in Oslo (Fig. 14-7). This joint event celebrated both the annual World Day of Water (20 March) and the first World Day of Glaciers (21 March). The program included a range of presentations on glacier changes and its consequences for glacier archaeology, glacier lake outburst floods, water quality, ecology and glacier hiking and exploration (Fig. 14-8).



Figure 14-7
The seminar was held at Klimahuset in Oslo. Upper right: Hege Hisdal and Brita Lisa Skjelkvåle opened the seminar. Lower left: Rune V. Engeset and Christina Dvergsdal Prestegård. Photos: Bjørn Lytskjold.

Seminar: Den internasjonale Bredagen og Verdens vanndag

Dato: 21. mars 2025
Sted: Klimahuset på Naturhistorisk museum
↗ **Påmelding her**



Foto:Fabrizio Conti

08:45 Ankomst, registrering

09:15 Velkommen
Ordstyrer: Brita Slettemark, Klimahuset

Åpningshilsen:
- Hege Hisdal, NVE
- Elise Trondsen, Hydrologirådet
- Brit Lisa Skjelkvåle, NHM

09:30 Globalt og nasjonalt overblikk

- Videohilsen fra World Glacier Monitoring Service
- Globalt overblikk. Regine Hock, UiO
- Hva skjer med breene i Norge? Liss Marie Andreassen, NVE
- Breenes påvirkning på vannkvalitet og økologi - innsikt fra fjellsjøen Gjende. Sigrid Haande, NIVA

11:00 Breenes betydning for norsk fjellsport og kulturhistorie

Ordstyrer: Liss Marie Andreassen, NVE

- Bresportens historie i DNT. Sven Bjørne-Larsen, DNT
- Jøkullaup fra Demmevatn. Ronja Lappe, NTNU
- Hva kan funnene på Lendbreen fortelle oss? Julian Robert Post-Melbye, KHM
- W.C. Slingsby og Jostedalsbreen. Inge Kjell Holme, Frilansjournalist

12:20 Utdeling av norsk Juniorvannpris 2025

Norsk vannforening. Finalistene presenterer sine forskningsresultater og vinneren, som sendes videre til den internasjonale finalen i Stockholm, kåres.

12:35 – 13:30 Lunsj

13:30 – 14:30 Hva skjer på Svalbard

Ordstyrer: Elise Trondsen, Oslo kommune

- Hva skjer med breene på Svalbard? Jack Kohler, Norsk Polarinstitutt
- Hva betyr isglidning og brebevegelser for havnivåstigningen. Thomas Schuler, UiO
- Utgravningene på Svalbard før og nå. Aubrey Roberts, NHM

14.30 Presentasjon av ny utstilling i Klimahuset

Den lille istiden: hvordan taklet vi forrige klimakrise? Ingar Mørkestøl Gundersen, UiO

15:00 Avslutning og takk for i dag

Naturhistorisk museum · FTU · Tekna · Norsk vannforening · Norsk hydrologiråd

Figure 14-8
Program of the full-day seminar held at Klimahuset, Naturhistorisk museum, Oslo, 20 March 2025.

14.7 Other activities

Several other activities related to IYGP took place during the year. Results were disseminated in a popular article in *forskning.no* (Andreassen & Engeset, 2025) and in *Naturen* (Andreassen et al., 2025). In March, NVE issued a press release presenting results from a new global study (The Glambie Team, 2025). In addition, several talks were given at local seminars, for example in Ås (19 March), in Fjærland (20 May) and in Oslo at the *Norsk Geofysisk Forening/ Norwegian Geophysical Society* (10 June).

Press release

Den første internasjonale bredagen markeres 21. mars - NVE

15. References

Andreassen, L. M., K. Isaksen, L.J. Monrad-Krohn, J.M. Abderhalden, L. Girod, J. De Marco, B. Etzelmüller, S. Oldani and R.S. Ødegård
2026: Rapid mass loss and climate-driven dynamics of the Juvfonne ice patch, Norway (2010–2025). *EGUsphere [preprint], https://doi.org/10.5194/egusphere-2026-3152*.

Andreassen, L.M., G. Aðalgeirsdóttir, E. Berthier, G.E. Flowers, H. Hannesdóttir, M. Huss, B. Menounos, F. Paul and L. Ruiz.
2026: Vanishing and vanished glaciers: Introduction to the Annals of Glaciology Collection. *Annals of Glaciology, 67, Accepted*.

Andreassen, L.M. and R. Engeset
2025: Breene i både Norge og resten av verden smelter i rekordfart. Kronikk. *Forskersonen.no*.

Andreassen, L.M. B.A. Robson, M. Smith, P. Weber, J.L. Carrivick and B. Kjøllmoen
2025: Tracing the rapid loss of Breifonn, Norway's southernmost glacier. *Annals of Glaciology, 66, e30, https://doi.org/10.1017/aog.2025.10029*.

Andreassen, L.M., H. Elvehøy and B. Kjøllmoen
2025: *NATUREN nr 2 -2025, 62-70. https://doi.org/10.18261/naturen.149.2.*

Andreassen, L.M., T. Nagy, B. Kjøllmoen and J.R. Leigh
2022: An inventory of Norway's glaciers from 2018-19 Sentinel-2 data. *Journal of Glaciology, 1-22, https://doi.org/10.1017/jog.2022.20*.

Andreassen, L.M. and H. Elvehøy
2021: Norwegian Glacier Reference Dataset for Climate Change Studies. *NVE Rapport 33 2021*, 21 pp.

Andreassen, L.M., H. Elvehøy, B. Kjøllmoen and J.M.C. Belart
2020: Glacier change in Norway since the 1960s – an overview of mass balance, area, length and surface elevation changes. *Journal of Glaciology, 66 (256),* p. 313-328. *https://doi.org/10.1017/jog.2020.10*.

Andreassen, L.M. and S.H. Winsvold (Eds)
2012: Inventory of Norwegian Glaciers. *NVE Report 28*, 236 pp.

Boyer, D. and C. Howe
"Global Glacier Casualty List." *Global Glacier Casualty List. August 17, 2024. DOI: https://doi.org/10.25613/CZJA-9V56*.

Cogley, J.G., R. Hock, A.L. 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, Paris, UNESCO-IHP*, 114 pp.

Hoel, A.
1910: Okstinderne. Fjeldgrunden og bræerne. *Norges Geologiske Undersøgelses Aarbok 1910 Bind 2*.

Hoel, A., and W. Werenskiold
1962: Glaciers and snowfields in Norway. *Norsk Polarinstitutt Skrifter Nr.114*, 291 s.

Jackson, M.
2000: Svartisen Subglacial Laboratory. *NVE Document 14 2000*. 27 pp.

Kjøllmoen, B. (Ed.), L.M. Andreassen, H. Elvehøy
2025: Glaciological investigations in Norway 2024. NVE Rapport 27-2025, 110 pp +app. https://doi.org/10.58059/2xvm-1x48

Kjøllmoen, B. (Ed), L.M. Andreassen, H. Elvehøy and M. Jackson
2020: Glaciological investigations in Norway 2019. *NVE Rapport 34 2020*, 86 pp.

Kjøllmoen, B. (Ed), L.M. Andreassen, H. Elvehøy, M. Jackson and R.H. Giesen
2016: Glaciological investigations in Norway 2011-2015. *NVE Rapport 88 2016*, 171 pp.

Kristensen, E. and L.M. Andreassen
2026: Vanishing ice patches and archaeological potential? *Annals of Glaciology, 67, e6, https://doi.org/10.1017/aog.2026.10039*.

Lefeuvre, P.-M., M. Jackson, G. Lappegard and J.O. Hagen
2015: Interannual variability of glacier basal pressure from a 20 year record. *Annals of Glaciology 56(70). doi: 10.3189/2015AoG70A019*.

Liestøl, O.
1956: Glacier Dammed Lakes in Norway. *Norsk geografisk tidsskrift nr. 3-4.* Bind XV, 1955-1956.

Lussana, C., O.E. Tveito, A. Dobler and K. Tunheim
2019: SeNorge_2018, daily precipitation, and temperature datasets over Norway, *Earth System Science Data, 11, 1531–1551. https://doi.org/10.5194/essd-11-1531-2019*.

Raup, B., L.M. Andreassen, D. Boyer, C. Howe, M. Pelto and A. Rabatel
2025: Tracking Extinct Glaciers in GLIMS. *Annals of Glaciology, 66, e35, https://doi.org/10.1017/aog.2025.10027*.

Rekstad, J.
1902: Iagttagelser fra bræer i Sogn og Nordfjord. *Norges geologiske undersøgelses, Aarbog for 1902*, No. 3, p. 1-48.

Rekstad, J.
1910: Forandringer ved norske bræer i aaret 1908-09. Bergens Museums Aarbok 1910 Nr. 4.

Rekstad, J.
1922: Forandringer ved norske bræer 1921-22. *Bergens Museums Aarbok 1921-22. Naturvidensl. Række nr. 5*.

The GlaMBIE Team
2025: Community estimate of global glacier mass changes from 2000 to 2023. *Nature.* https://doi.org/10.1038/s41586-024-08545-z.

Winsvold, S.H., L.M. Andreassen and B. Kjøllmoen
2026: Northernmost no more? The fragmentation of Nordmannsjøkelen in Norway. *Annals of Glaciology, 67, https://doi.org/10.1017/aog.2026.10047*.

Østrem, G. and M. Brugman
1991: Glacier mass-balance measurements. A manual for field and office work. National Hydrology Research Institute, Scientific Report, No. 4. Environment Canada, N.H.R.I., Saskatoon and Norwegian Water Resources and Energy Directorate, Oslo, 224 pp.

Øyen, P.A.
1906: Klima- und Gletcherschwankungen in Norwegen. *Zeitschrift für Gletcherkunde, Eiszeitforschung und Geschichte. 1*, p. 46-61.

Appendix A

Publications published in 2025

Andreassen, L.M., S. Blumentrath, R.V. Engeset, S.A. Kolberg, K. Melvold, K. Müller, N.K. Orthe, P. Weber, A. Widforss and S.H. Winsvold
NVE Copernicustjenester. Sluttrapport for Copernicus aktiviteter i NVE 2022-2024. *NVE Rapport 12-2025*, 104 pp.

Andreassen, L.M., H. Dannevig og R.V. Engeset
Har norske breer blitt farligere? Kronikk. *Forskersonen.no*. Published 4 June 2025.

Andreassen, L.M., H. Elvehøy and B. Kjøllmoen
Norske breer i endring. *NATUREN nr 2-2025, 62-70*.
https://doi.org/10.18261/naturen.149.2.2.

Andreassen, L.M., B.A. Robson, M. Smith, P. Weber, J.L. Carrivick and B. Kjøllmoen
Tracing the rapid loss of Breifonn, Norway's southernmost glacier. *Annals of Glaciology, 66, e30*. https://doi.org/10.1017/aog.2025.10029.

Andreassen, L.M. and R.V. Engeset
Breene i både Norge og resten av verden smelter i rekordfart. Kronikk. *Forskersonen.no*. Published 11 February 2025.

Andreassen, L.M., S. Blumentrath, R.V. Engeset, S.A. Kolberg, K. Melvold, K. Müller, N.K. Orthe, P. Weber, A. Widforss and S.H. Winsvold
NVE Copernicustjenester. Sluttrapport for Copernicus aktiviteter i NVE 2022-2024 med anbefalinger. *NVE Rapport 12-2025*, 104 pp.

Kjøllmoen, B. (Ed.), L.M. Andreassen and H. Elvehøy
Glaciological investigations in Norway 2024. *NVE Rapport 27-2025*, 110 pp +app.

NVE 2025. Rekordsmelting på breene i nord/Record melting on glaciers in north. *NVE Fakta 02/2025*, 4 pp. https://publikasjoner.nve.no/fakta/2025/fakta2025_02.pdf

Raup, B., L.M. Andreassen, D. Boyer, C. Howe, M. Pelto and A. Rabatel
Tracking Extinct Glaciers in GLIMS. *Annals of Glaciology, 66, e30*.
https://doi:10.1017/aog.2025.10027.

Sjursen, K.H., T. Dunse, T.V. Schuler, L.M. Andreassen and H. Åkesson
Spatiotemporal mass-balance variability of Jostedalsbreen Ice Cap, Norway, revealed by a temperature-index model using Bayesian inference. *Annals of Glaciology*.
https://doi:10.1017/aog.2024.41.

Sjursen, K.H., J. Bolibar, M. van der Meer, L.M. Andreassen, J.P. Biesheuvel, T. Dunse, M. Huss, F. Maussion, D.R. Rounce and B. Tober
Machine learning improves seasonal mass balance prediction for unmonitored glaciers. *The Cryosphere, 19,* 5801-5826. https://doi.org/10.5194/tc-19-5801-2025.

The GlaMBIE Team
Community estimate of global glacier mass changes from 2000 to 2023. *Nature.*
https://doi.org/10.1038/s41586-024-08545-z.

Åkesson, H., L.M. Andreassen and T.V. Schuler
Norges største isbre kan være halvert om 75 år. Kronikk. *Forskersonen.no.* Published 23 November 2025.

Åkesson, H., K.H. Sjursen, T.V. Schuler, T. Dunse, L.M. Andreassen, M.K. Gillespie, B.A. Robson, T. Schellenberger and J.C. Yde
Recent history and future demise of Jostedalsbreen, the largest ice cap in mainland Europe. *The Cryosphere, 19,* 5871-5902. https://doi.org/10.5194/tc-19-5871-2025.

Appendix B

Mass balance measurements in Norway – an overview

Area/ No. Glacier	Glacier ID	Lat., Long.	Area (km^2)	Altitude (m a.s.l.)	Mapping year	Period	No. of years
Ålfotbreen							
1 Ålfotbreen	2078	61°45', 5°38'	3.5	1000-1360	2019	1963-	63
2 Hansebreen	2085	61°44', 5°40'	2.5	927-1303	2019	1986-	40
Folgefonna							
3-4 Blomsterskardsbreen	[1]	59°58', 6°19'	45.7	850-1640	1959	1970-77	8
3 Svelgjabreen	3137	59°58', 6°18'	22.3	829-1634	2017	2007-17	11
4 Blomstølskardsbreen	3141	59°59', 6°21'	22.5	1011-1634	2017	2007-17	11
5 Møsevassbreen	3138	59°59', 6°16'	15.5	873-1617	2017	2017	1
6 Bondhusbrea	3133	60°02', 6°20'	10.7	477-1636	1979	1977-81	5
7 Breidablikkbrea	3128	60°03', 6°22'	3.9	1217-1660	1959	1963-68	6
			3.2	1232-1648	2013	2003-13	11
8 Gråfjellsbrea	3127	60°04', 6°24'	9.7	1034-1656	1959	64-68, 74-75	7
			8.1	1049-1647	2013	2003-13	11
9 Blåbreen	3126	60°05', 6°26'	2.3	1060-1602	1959	1963-68	6
10 Ruklebreen	3129	60°04', 6°26'	1.8	1603-1235	1959	1964-68	5
11 Midtre Folgefonna	[2]	60°08', 6°28'	8.6	1100-1570	1959	1970-71	2
Jostedalsbreen							
12 Jostefonn	[3]	61°25', 6°33'	3.8	960-1622	1993	1996-2000	5
13 Vesledalsbreen	2474	61°50', 7°16'	4.1	1126-1745	1966	1967-72	6
14 Tunsbergdalsbreen	2320	61°36', 7°02'	52.2	536-1942	1964	1966-72	7
15 Nigardsbreen	2297	61°42', 7°08'	44.9	389-1955	2020	1962-	64
16 Store Supphellebreen	2352	61°31', 6°48'	12.0	80-300/ 720-1740	1966	1964-67, 73-75, 79-82	11
17 Austdalsbreen	2478	61°45', 7°20'	10.0	1200-1740	2019	1988-	38
18 Spørteggbreen	[4]	61°36', 7°28'	27.9	1260-1770	1988	1988-91	4
19 Harbardsbreen	2514	61°41', 7°40'	13.2	1242-1978	1996	1997-2001	5
Hardangerjøkulen							
20 Rembesdalskåka	2968	60°32', 7°22'	17.1	1085-1851	2020	1963-	63
21 Midtdalsbreen	2964	60°33', 7°26'	6.7	1380-1862	1995	2000-2001	2
22 Omnsbreen	2919	60°39', 7°28'	1.5	1460-1570	1969	1966-70	5
Jotunheimen							
23 Tverråbreen	2632	61°35', 8°17'	5.9	1415-2200		1962-63	2
24 Blåbreen	2770	61°33', 8°34'	3.6	1550-2150	1961	1962-63	2
25 Storbreen	2636	61°34', 8°08'	4.9	1420-2091	2019	1949-	77
26 Vestre Memurubre	2772	61°31', 8°27'	9.2	1565-2270	1966	1968-72	5
27 Austre Memurubre	2769	61°33', 8°29'	8.7	1627-2277	1966	1968-72	5
28 Juvfonne	2597	61°40', 8°21'	0.1	1852-1985	2019	2010-	16
29 Hellstugubreen	2768	61°34', 8°26'	2.7	1487-2213	2019	1962-	64
30 Gråsubreen	2743	61°39', 8°37'	1.7	1854-2277	2019	1962-	64
Okstindbreene							
31 Charles Rabot Bre	1434	66°00', 14°21'	1.1	1090-1760	1965	1970-73	4
32 Austre Okstindbre	1438	66°00', 14°17'	14.0	730-1750	1962	1987-96	10
Svartisen							
33 Høgtuvbreen	1144	66°27', 13°38'	2.6	588-1162	1972	1971-77	7
34 Svartisheibreen	1135	66°33', 13°46'	5.7	765-1424	1995	1988-94	7
35 Engabreen	1094	66°40', 13°45'	36.0	176-1532	2020	1970-	56
36 Storglombreen	[5]	66°40', 13°59'	59.2	520-1580	1968	1985-88	4
			62.4	520-1580		2000-05	6
37 Tretten-null-tobreen	1084	66°43', 14°01'	4.3	580-1260	1968	1985-86	2
38 Glombreen	1052	66°51', 13°57'	2.2	870-1110	1953	1954-56	3
39 Kjølbreen	1093	66°40', 14°05'	3.9	850-1250	1953	1954-56	3
40 Trollbergdalsbreen	1280	66°42', 14°26'	2.0	907-1366	1968	1970-75	6
			1.8	907-1369	1998	1990-94	5
Blåmannsisen							
41 Rundvassbreen	941	67°17', 16°03'	11.7	788-1533	1998	2002-04	3
			10.8	853-1527	2017	2011-17	7
Skjomen							
42 Blåisen	596	68°20', 17°51'	2.2	860-1204	1959	1963-68	6
43 Storsteinsfjellbreen	675	68°13', 17°54'	6.2	926-1846	1960	1964-68	5
			5.9	969-1852	1993	1991-95	5
			5.2	1038-1836	2019	2025-	1
44 Cainhavarre	703	68°06', 17°59'	0.7	1214-1538	1960	1965-68	4
Vest-Finnmark							
45 Svartfjelljøkelen	26	70°14', 21°57'	2.7	500-1080	1966	1978-79	2
46 Langfjordjøkelen	54	70°10', 21°45'	3.6	277-1053	1994	1989-93	5
			2.6	338-1043	2018	1996-	30

[1] 3137 and 3141, [2] 3119, 3120 and 3121, [3] 2146 and 2148

[4] 2519, 2520, 2522, 2524, 2525, 2527, 2528, 2530, 2531 and 2532, [5] 1092 and 1096

Mass balance measurements were carried out at 46 Norwegian glaciers during the period 1949-2025. The table lists characteristic data for the investigated glaciers. The Glacier ID refers to ID in the glacier inventory of Norway (Andreassen et al., 2012).

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