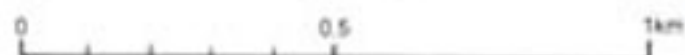


# ÅLFOTBREEN

Southern Norway

1:10 000



## LEGEND

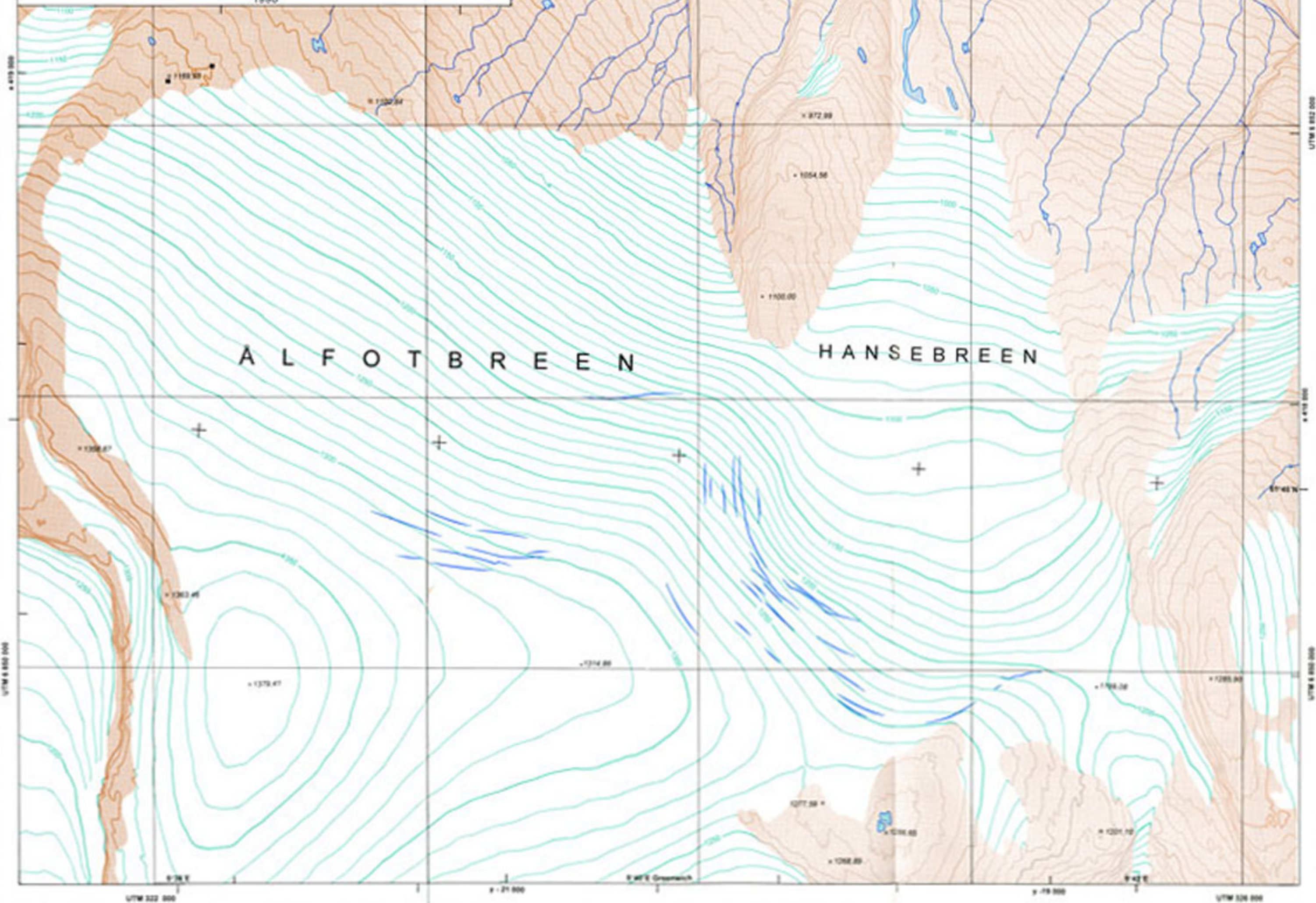
- 1363.46 Spot height (peak)
  - 1054.56 Spot height
  - 751.7 Lake surface level (at time of photography)
- Ditches  
■ Snowdrift  
● Observation hut

CO-ORDINATE SYSTEM: UTM, ZONE 32 (Euref 89)

Aerial photography by Fylanger Videregående AS 7 Sept. 1998  
(Altitude 5700 m a.s.l., Photo scale 1:30 000, Contract No. 9878)  
Plotted by O. M. Bjørndal in 1992. Drafted by Inger Amundsen and Hans Drake

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HYDROLOGISK AVDELING, NORGES VASSDRAGS- OG ENERGIVERK (NVE)

1996





## BRIEF COMMENTS ON THE MAP

This new edition of the *Ålfotbreen* glacier map is based on aerial photographs taken on 7 September 1988 by Fyllanger Widener A/S (Contract No. 9678).

The photography was originally done for the Norwegian State Power Authority in connection with possible further water power development in the area. However, the digital plotting of this particular map was made independently for glaciological purposes. Consequently, particular glaciological features (e.g. crevasses, predominant rocks etc.) were emphasized in the production of the map.

The first International Symposium on Glacier Mapping, held 1965 in Ottawa, Canada, recommended the scale of 1:10 000, contour intervals of 10 m and the use of UTM co-ordinates for glacier maps. This recommendation has been followed for this map - and also for most of the other Norwegian glacier maps produced since then (compare the list on the Location Map to the right).

Crevasses, as they appeared at the time of photography, are marked in blue. Although the exact form and size of each crevasse are not depicted in detail, the main directions of the crevasses are shown. There are, in general, not many large crevasses on this glacier because ice movement is relatively slow. Several narrow crevasses are not shown on the map, because they could not be identified on the photographs.

The border between the glacier and ice-free ground is slightly generalized, whereas "perennial" snow patches are shown as white areas, similar to the glacier. Melt-water streams are numerous in the area, so it was necessary to select only those which were deemed to be most important for a general use of the map.

A number of predominant features (mainly large rocks or small "peaks" in the terrain) were plotted together with triangulation points in the local network and their elevation given in metres above sea level. These points are marked with an X on the map, and may be useful for navigation or triangulation work for movement studies. Other spot heights, marked with a dot, are points used in the stereo model during the plotting procedure and cannot be easily found in the field.

The accuracy is estimated to be better than 40 cm in horizontal direction and better than 75 cm in vertical direction. This edition is a great improvement over the previous glacier map of *Ålfotbreen*, issued in 1969 (based upon the 1968 aerial photography - see further below).

The Universal Transverse Mercator (UTM) grid set, Zone 32, in the EUREF 89 geodetic datum is drawn on the map for each 1000 metres. NOTE: This "new" UTM set differs from the previously used set (as marked on the 1969 map edition) in the following way: The East-West lines are on this map 208 m further north, the North-South lines 82 m further east, compared to the "old" UTM grid set. The EUREF 89 datum is now being gradually implemented on all Norwegian topographic maps, so we decided to use it also for this glacier map.

Geographical co-ordinates are indicated for three longitudes (5° 38', 5° 40', and 5° 42' East) and for two latitudes (61° 45' and 61° 46' North) by tick-marks. NOTE: This grid refers to the International Ellipsoid used in European Datum 1950 (ED50), as was also used on the 1969 edition. Finally, the co-ordinates in the Norwegian national geodetic set, Axis I, (NGO 1948), are indicated as X and Y coordinates for each 1000 m, as tick marks in the frame.

Co-ordinates for the four main triangulation points used as base for the stereo model are given in a table. Another table shows similar data for the five main points used for the construction of the previous glacier map of *Ålfotbreen*. NOTE: when the 1969 map was plotted, these points proved to have great errors in co-ordinate determination due to a scattered and unreliable geodetic network. Their co-ordinates have, therefore, been re-calculated by astro-triangulation, and the corrected data are given in the table.

Several lakes in the area were used to level the stereo model. Their locations are shown on the small sketch map to the right, together with all control points listed in the tables.

## A NEW CONSTRUCTION FROM THE 1968 PHOTOGRAPHS

A comparison of the glacier surface in 1968 with the glacier surface in 1988 could not be done by direct comparison between the old map (published in 1969) and the present map. The main reason was that the old map was based upon an unreliable geodetic network (see above), which caused vertical errors of several metres on the map.

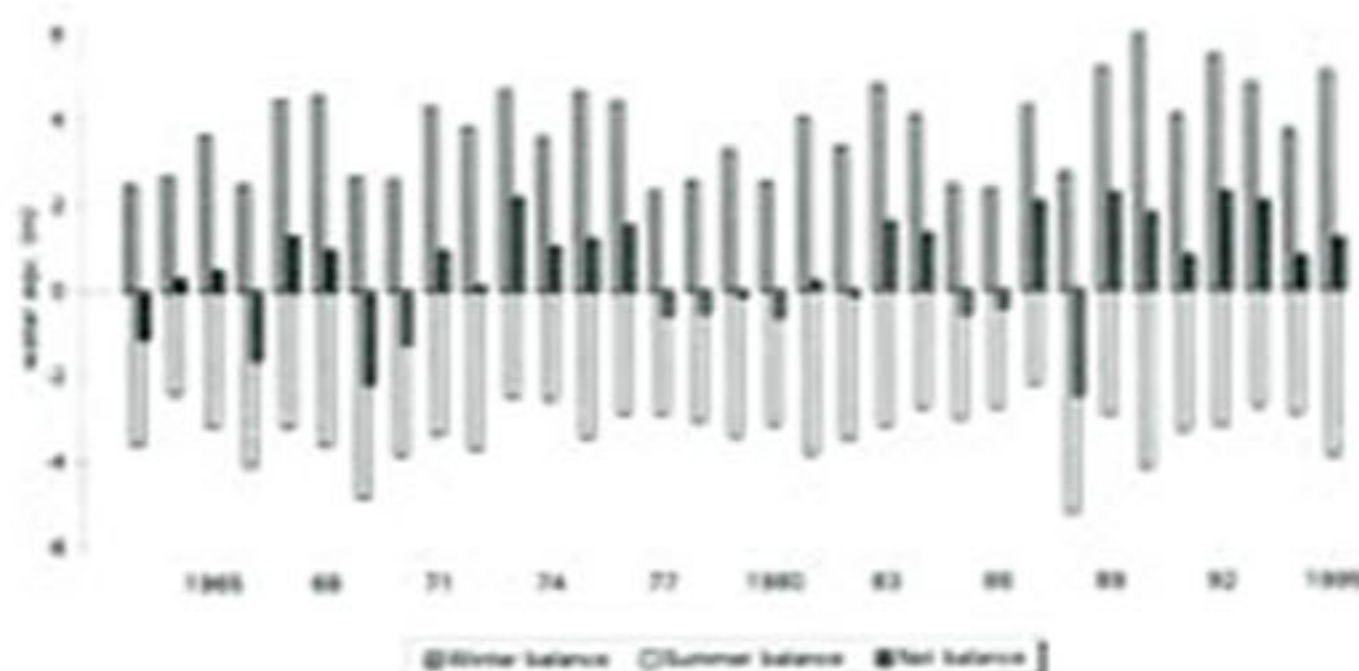
Therefore, a completely new digital map construction was made from the 1968 aerial photographs, using the same control points as were used for the present map. A simplified version of this new construction from the old pictures is shown below, but only in black-and-white and with less contour lines as in the far more detailed original digital construction.

Thus, two maps with almost the same accuracy and constructed in the same manner could be used to calculate change in surface elevation. The result of this comparison, which was made digitally using terrain models, is shown on a separate map.

Gunnar Ostrem

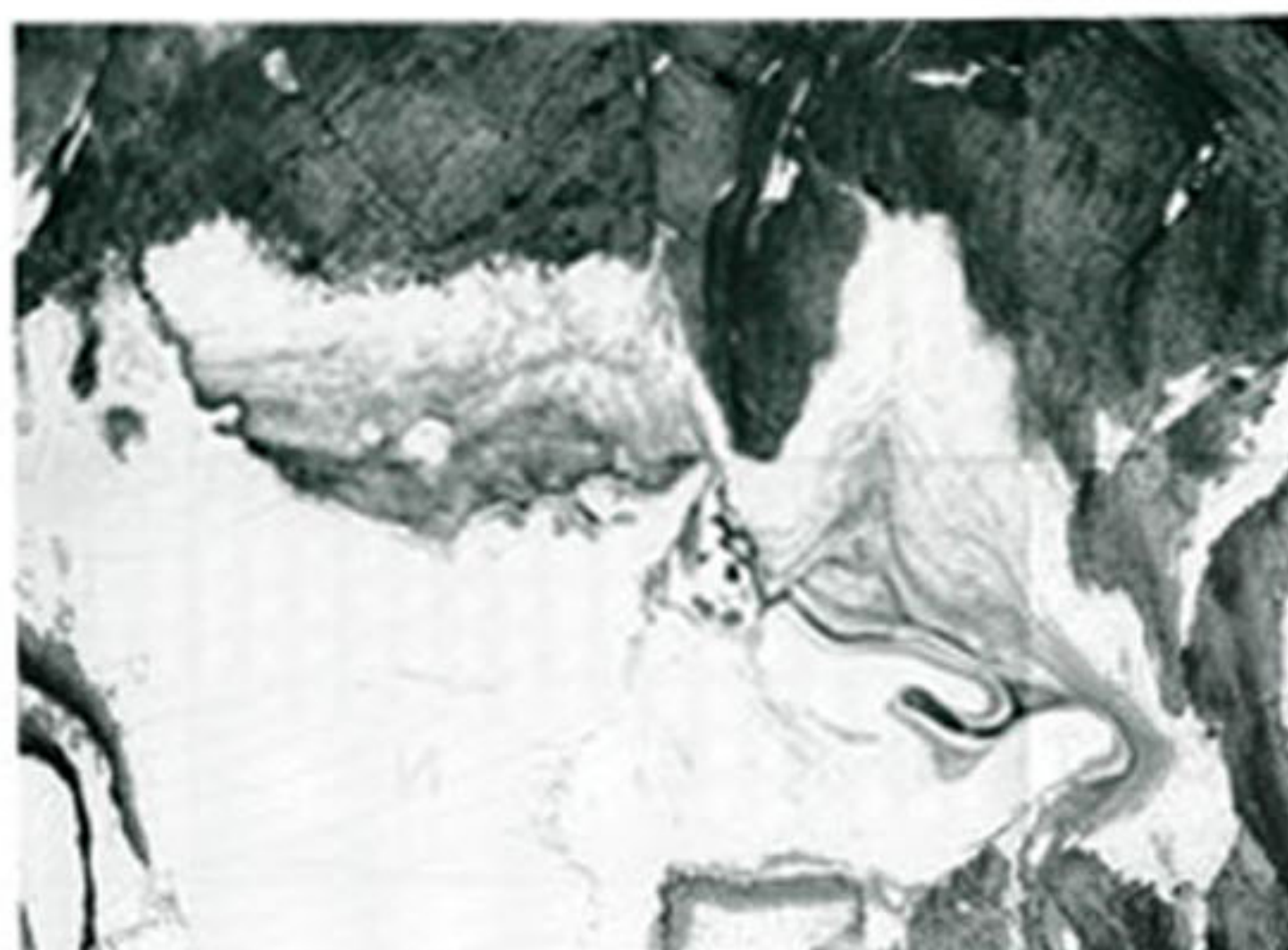


## Ålfotbreen mass balance 1963 - 95

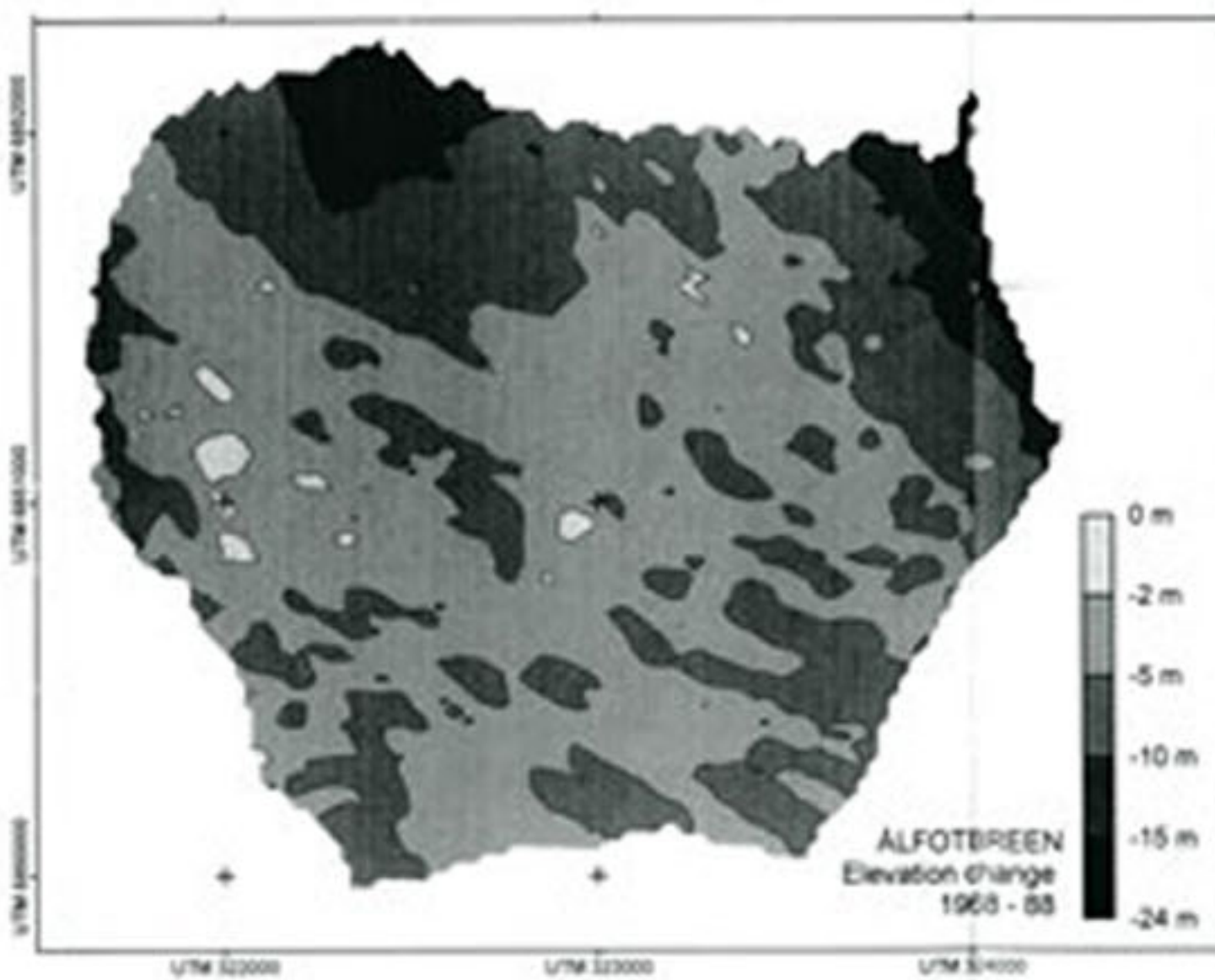


## Aerial photography of the Ålfotbreen area

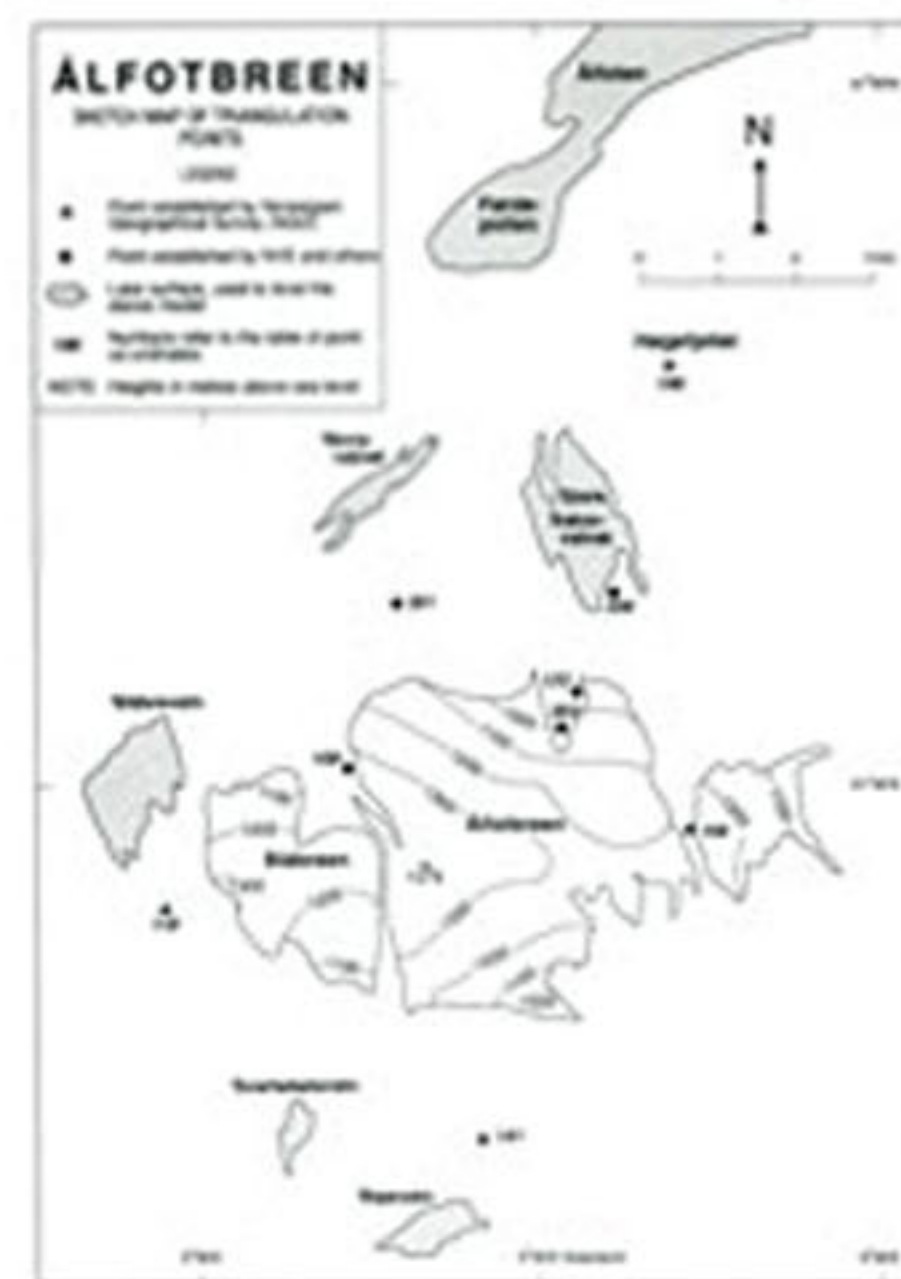
Year	Date	Photo scale	Contract No.	Picture No.	Note
1965	29 July	1:80 000	4885 (Kult 85)	509, 51, 5054-5058	Snow on glacier
1965	29 July	1:80 000	Norfly 304	305, 401A-403A	Only lower part of glacier tongue
1968	9 Aug.	1:30 000	FW 3270	F 10-12	Snow on glacier
1968	12 Aug.	1:30 000	FW 3430	A 10, 17, 18	Only western part of the glacier
1968	26, 28 July	1:10 000	NLF 6454	J 1, 2, 3	Only south of water divide
1965	17 Aug.	1:30 000	NLF 6704	A 1, 4, B 1, 2	All Color
1968	7 Sept.	1:30 000	NLF 9076	A 1, 4, B 1, 2	All Color, excellent pictures
1965	4 July	1:40 000	NLF 11405	10, 4 No 11, 14 10, 5 No 11, 14	Snow on glacier
1968	27 Aug.	1:40 000	NLF 11536	10, 4 No 1, 2	Only SE part of glacier



Ålfotbreen and Hansebreen shown on a vertical photograph taken on 7 Sept. 1988 (contract No. 9678, frame B-J). Approximate scale 1:50 000. This photography was used to construct the present glacier map.



From terrain models of the 1968 and 1988 glacier surfaces, it was possible to calculate the elevation change during this period.



## Co-ordinates for points used for the 1968 map construction

Point No.	Old Name	Co-ordinates, National net (NGO Axis I)			Co-ordinates UTM, Zone 32 (Euref 89)		
		X (m)	Y (m)	Z (m)	X (m)	Y (m)	Z (m)
108	Tp A8	418 285 21	-22 808 37	1332 12	6 851 288 72	321 562 05	
123	Tp A23	418 114 72	-19 898 61	993 08	6 852 177 42	324 545 99	
208	Tp B8	420 395 56	-19 406 91	742 12	6 853 437 29	325 032 20	
301	NVE 1	420 212 81	-21 624 95	983 18	6 853 352 85	322 858 17	
302	NVE 3	418 601 20	-20 148 53	1369 04	6 851 676 11	324 260 13	

## Co-ordinates for triangulation points used as base for the stereo model

Point No.	Co-ordinates, National net (NGO Axis I)			Co-ordinates UTM, Zone 32 (Euref 89)		
	X (m)	Y (m)	Z (m)	X (m)	Y (m)	Z (m)
118	418 232 27	-25 276 85	1309 81	6 849 541 66	319 329 94	
141	413 185 75	-21 208 60	878 81	6 848 314 27	322 956 13	
186	423 378 06	-18 601 32	1410 90	6 856 377 60	326 021 80	
198*	417 151 84	-18 448 50	1280 84	6 850 151 35	325 884 75	

\* Earlier known as "A 1"



This new glacier map of *Ålfotbreen* is a result of a cooperation between the Norwegian Water Resources and Energy Administration (NVE) and Stockholm University. Support was also provided by the Swedish National Science Research Council. The editorial work, collection of data and lay-out was made by Dr. Gunnar Ostrem, with assistance from Hallger Ejeby, Nils Haakonsen, Bjarne Kjellmoen, and Jack Köhler at the Hydrology Department, NVE.