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An inventory of Norway's glaciers and ice-marginal lakes from 2018–19 Sentinel-2 data.

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Tables

Table S1. List of Sentinel-2 scenes used for the glacier mapping in Norway. Scenes no. 1-23 used for northern Norway, scenes 24-39 for southern Norway. Se Figure 1 for tile location. Rel. Or. – relative orbit, Cl – cloud percentage (%), T1: threshold for the band ratio, T2-threshold in band 2 (see chap. 3.2), m-manual editing or visual inspection only. Code denotes: PS-Primary scene, SS- Secondary scene used for parts in clouds or shadow. *DTERRENG (orthorectified scene) not available.

No	Region name	Tile ID	Date	Sensor	Rel. Or.	Cl	T1	T2	Code
1	Vefsn, Børgefjell	T33WVN	2018-09-01	S2A	94	5	2.4	1100	Ss
2	Vefsn, Børgefjell	T33WVN	2018-09-08	S2A	51	18	2.4	1100	Ps
3	Vefsn, Børgefjell*	T33WVN	2018-09-08	S2B	94	14	m		Ss
4	Okstindbreen, Svartisen	T33WVP	2018-09-01	S2A	94	16	2.6	1200	Ss
5	Okstindbreen, Svartisen	T33WVP	2018-09-08	S2A	51	5	2.6	1200	Ps
6	Okstindbreen, Svartisen	T33WVP	2019-08-27	S2A	94	9	m		Ss
7	Saltfjellet	T33WWP	2018-09-01	S2A	94	0	2.4	1100	Ps
8	Nord Svartisen	T33WVQ	2018-09-08	S2A	51	2	2.6	1100	Ps
9	Blåmannsisen	T33WWQ	2018-09-01	S2A	94	5	2.6	1200	Ss
10	Blåmannsisen	T33WWQ	2018-09-08	S2A	51	11	2.6	1200	Ps
11	Blåmannsisen*	T33WWQ	2018-08-07	S2B	94	4	m		Ss
12	Frostisen, Skjomen	T33WWR	2018-09-08	S2A	51	1	2.8	1200	Ps
13	Skjomen	T33WXR	2018-09-08	S2A	51	4	3.0	1200	Ps
14	Skjomen	T33WXR	2018-09-01	S2A	94	3	m		Ss
15	Troms-South	T33WWS	2018-09-08	S2A	51	0	2.8	1100	Ps
16	Troms-Inner	T33WXS	2018-09-01	S2A	94	0	2.8	1050	Ps
17	Kvaløya, Lyngen	T33WXT	2018-09-01	S2A	94	1	2.8	1050	Ps
18	Lofoten	T33WVR	2018-09-08	S2A	51	0	2.6	1100	Ps
19	Troms-Inner, Lyngen	T34WDB	2018-09-08	S2A	51	12	2.6	1100	Ps
20	Troms-Inner, Lyngen	T34WDB	2018-09-05	S2A	8	14	m		Ss
21	Kvaløya, Lyngen, Troms-N.	T34WDC	2018-09-08	S2A	51	25	2.6	1100	Ps
22	Øksfjord	T34WEC	2018-09-08	S2A	51	8	3.4	1100	Ps
23	Seiland	T34WED	2018-09-08	S2A	51	4	3.2	1100	Ps
24	Folgefonna	T32VLM	2019-08-27	S2A	94	2	2.2	1100	Ps
25	Folgefonna	T32VLM	2019-08-04	S2A	51	9	2.2	1100	Ss
26	Hardangerjøkulen	T32VMN	2019-08-27	S2A	94	7	2.4	1100	Ps
27	Hardangerjøkulen	T32VMN	2019-08-04	S2A	51	14	2.4	1100	Ss
28	Voss - Aurland	T32VLN	2019-08-27	S2A	94	1	2.0	1100	Ps
29	Jostedalsbreen, Nordfjord	T32VLP	2019-08-27	S2A	94	9	2.2	1100	Ps
30	Jostedalsbreen, Nordfjord	T32VLP	2019-08-15	S2B	137	28	2,2	1100	Ss
31	Jostedal, Jotunheimen	T32VMP	2019-08-27	S2A	94	12	2.0/2.2	1000	Ps
32	Jostedal, Jotunheimen	T32VMP	2019-08-15	S2B	137	45	2.0	1000	Ss
33	Jostedal, Jotunheimen	T32VMP	2019-08-04	S2A	51	8	2.0	1000	Ss
34	Sunnmøre-West	T32VLQ	2019-08-27	S2A	94	0	2.2	1100	Ps
35	Sunnmøre-East, Romsdal	T32VMQ	2019-08-27	S2A	94	4	2.2	1100	Ps
36	Sunnmøre-East, Romsdal	T32VMQ	2019-08-04	S2A	51	4	2.2	1100	Ss
37	Sunndalsfjella	T32VNQ	2019-08-27	S2A	94	3	2.2	1100	Ps
38	Rondane	T32VNP	2019-08-27	S2A	94	8	2.0	1000	Ps
39	Rondane	T32VNP	2019-08-04	S2A	51	3	m		Ss

Table S2. Detailed information of orthophotos from © Norgeibilder.no used in figures in the paper. Images are available for viewing at norgeibilder.no.

Figure	Glacier		Contract no	Data owner
3a S3	Midtdalsbreen and Blåisen Rembesdalskåka/Hardangerjøkulen	Hardangervidda 2019	TT-14441	Omløpsfoto
3b	Adelsbreen	Møre 2019	TT-14439	Omløpsfoto
3c	Austre Okstindbreen	Nordland Sør 2014	TT-14145	Omløpsfoto
3d	Sekkebreen	Sogn 2015	TT-14188	Omløpsfoto
3e	Jostefonni	Sogn 2017	TT-14233	Omløpsfoto
9, 10, 11, 16	Snøhetta, Digervarden, Langfonna, Møre	Møre 2019	TT-14439	Omløpsfoto
17, S7	Troms	Troms 2016	TT-14232	Omløpsfoto
		Troms 2011	TT-13989	Omløpsfoto
		Troms Finnmark 2006	TT-13342	Omløpsfoto
S1	Fresvikbreen	Sogn 2017	TT-14233	Omløpsfoto
		Sogn 2010	BNO10044_01_04	Omløpsfoto
		Indre Sogn 2006	BG-BNO06060	Omløpsfoto

Table S3. Table used by Leigh and others (2019) to score glaciers. Glaciers are categorized as certain (11-20), probable (6-10), possible (2-5) and perennial snow (1).

Feature	Score
Crevasses	5
Flow features and deformed stratification	5
Multiple debris bands in ice	3
Ice	3
Bergschrund	2
Moraine(s)	1
Unbroken snow accumulation	1
Total	**20**

Figures

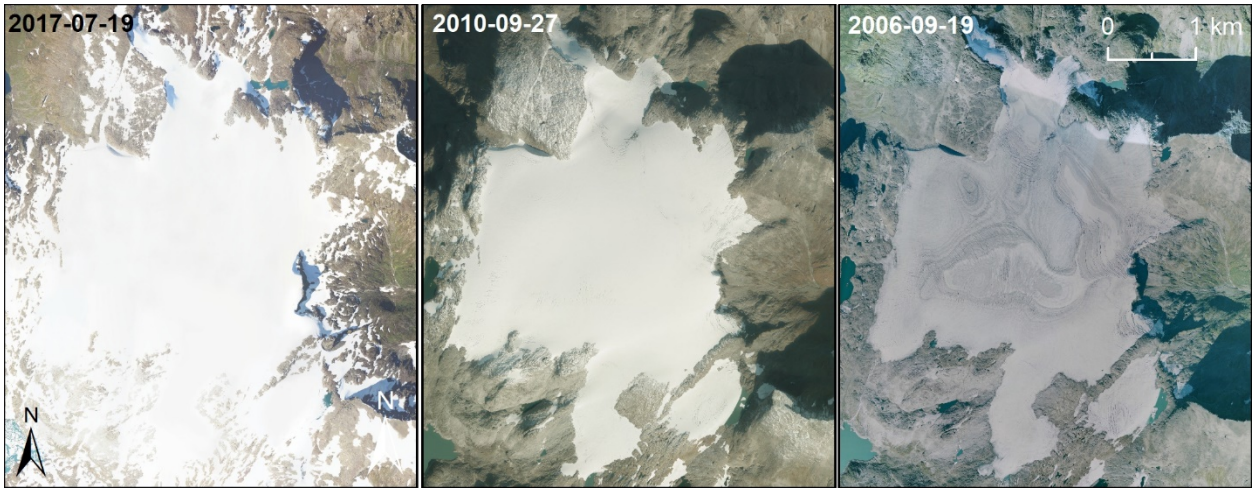

Fig. S1. Orthophotos of Fresvikbreen showing orthophoto available from 2017, 2010 and 2006. /© Norgeibilder.no/

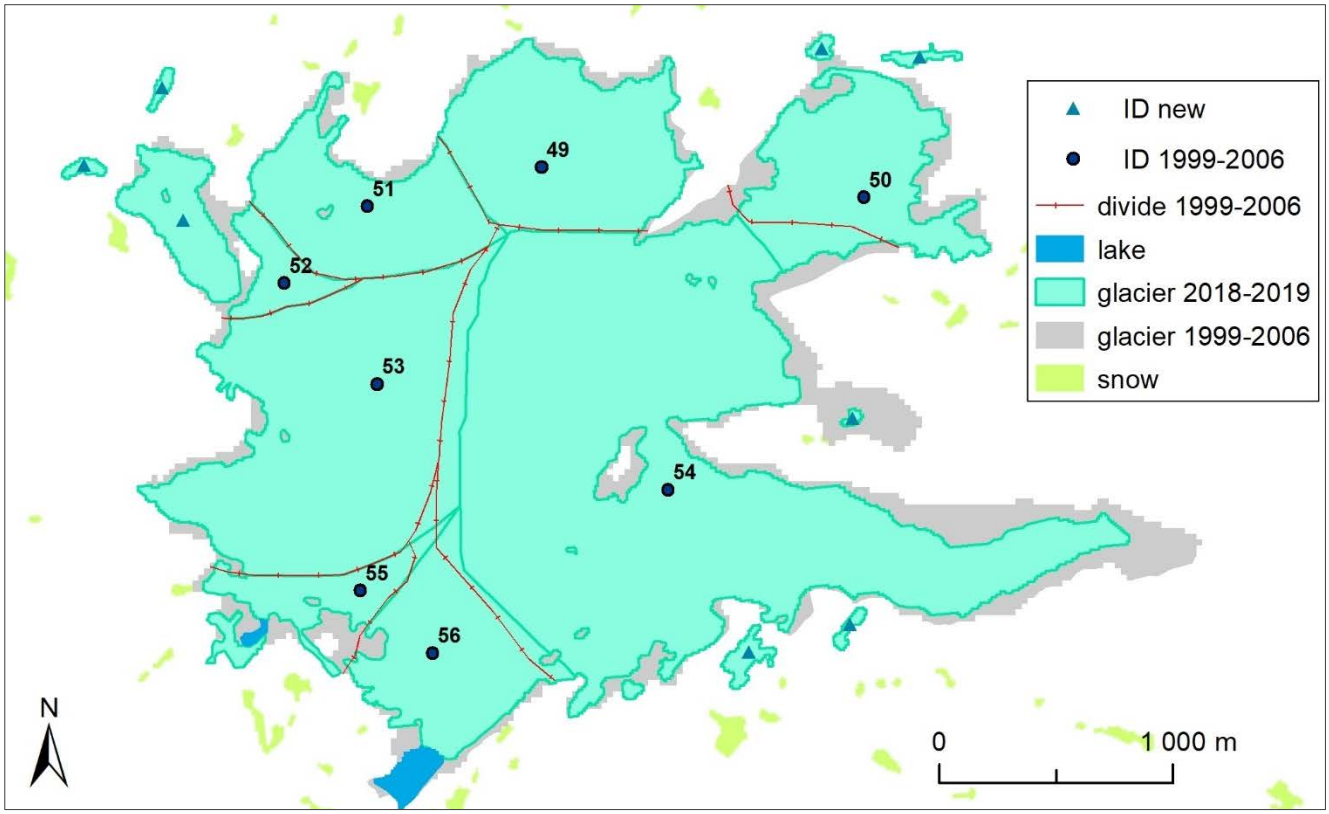

Fig. S2. Illustration of ice divide updates between NGI199-2006 (red line) and NGI2018/2019 (green) for Langfjordjøkelen (LAN). The divides were updated for selected glaciers such as mass balance glaciers as Langfjordjøkelen east (ID 54). New IDs were given for detached parts (e.g. part detached from ID 52) or inclusion of smaller bodies (e.g. north of ID 50).

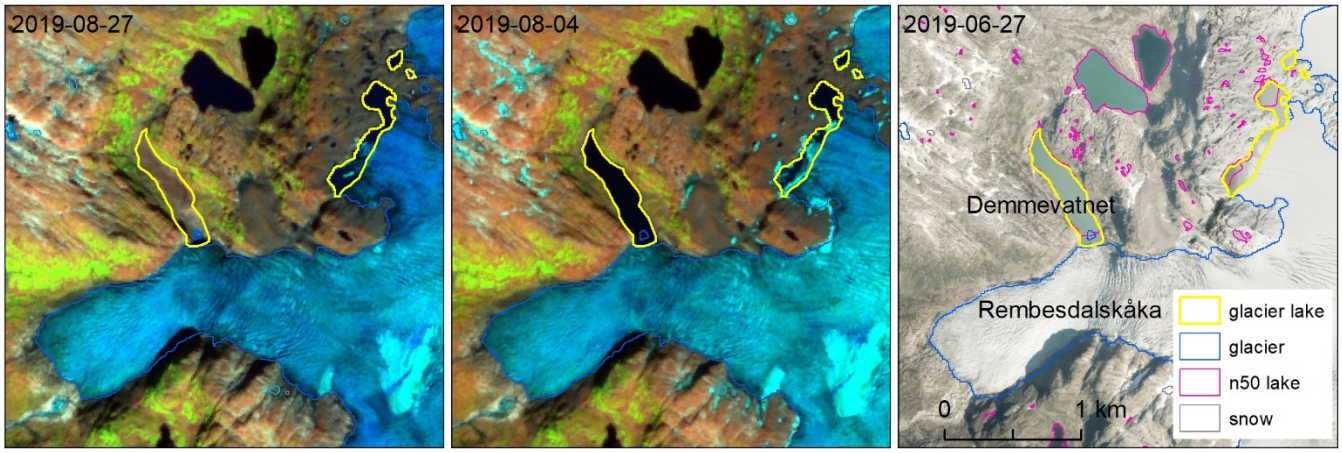

Fig. S3. Sentinel scenes of 27 August and 4 August 2019 showing the lower part of Rembesdalskåka, an outlet of Hardangerjøkulen and orthophoto (lower part 26 June, upper part 21 September 2019). Glacier lakes and glacier outlines as mapped from the Sentinel scene 27 August, except for the glacier dammed lake Demmevatnet that was emptied on 24 August. Some ice is left on the lake floor. Her lake outline was derived from the 4 August Sentinel 2 image. The lakes from the 1: 50 000 topographic map series of Norway (n50) are also shown. Notice the growth of glacier lakes as glacier has retreated. See also figure L. /Copernicus Sentinel data 2019/© Norgeibilder.no/

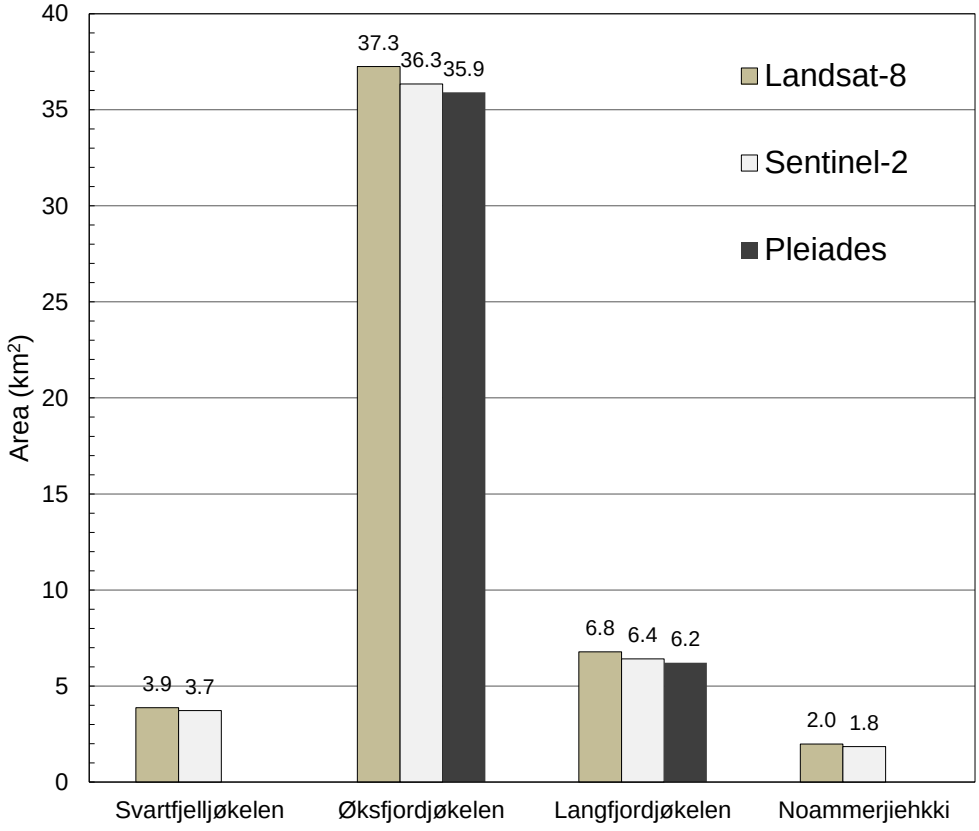

Fig. S4. Comparison between glacier outlines of the largest four glaciers in the central region of the Troms and Finnmark county using three different imagery types with different image capture dates: pansharpened Landsat-8 (15 m resolution) of 28 July 2018, Sentinel-2 (S-2) of 8 September 2018, and Pléiades (0.5-2 m resolution) of 1 September 2018. Note that for the Sentinel-2 imagery-based outlines for Landfjordjøkelen, the Pléiades image and outlines was compared when deciding the ratio and as such, these outlines are not independent. See Fig. 12 for the Pléiades imagery.

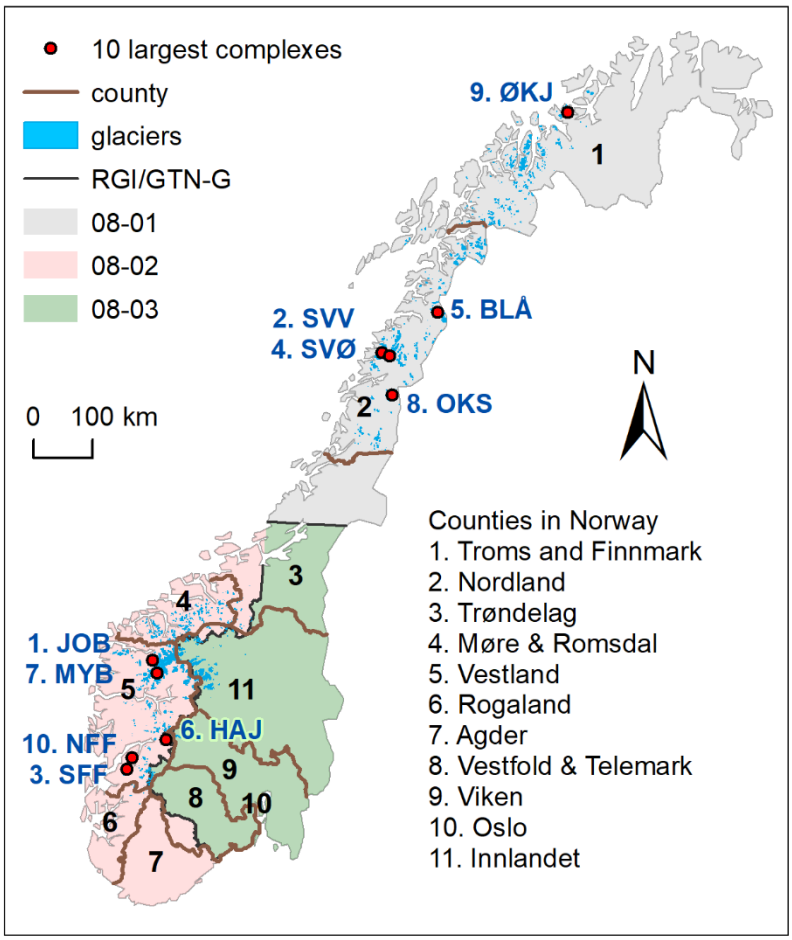

Fig. S5. Glaciers mapped for 2018/2019 displayed with the 10 largest glacier complexes marked (see Table 4), the GTN-G (RGI) division of subregions for Scandinavia (GTN-G, 2017) and the 11 counties (administrative boundary) in Norway per 2021. The counties 7. Agder and 10. Oslo do not contain glaciers.

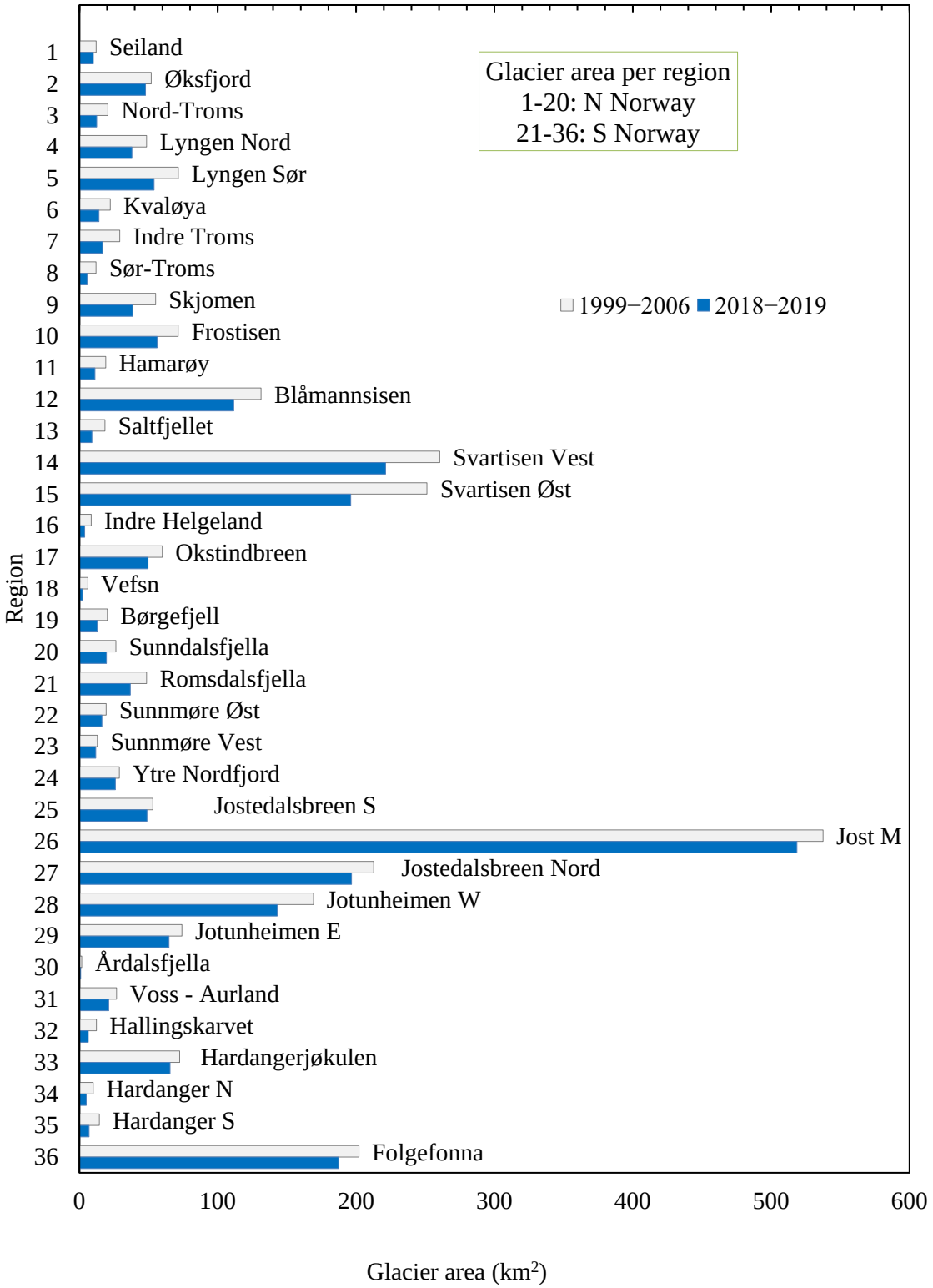

Fig. S6. Glacier area in 1999−2006 and 2018—19 divided by regions ranging from north (1) to south (36). A few of the names are shortened. See Andreassen and others (2012) for location and maps of each region.

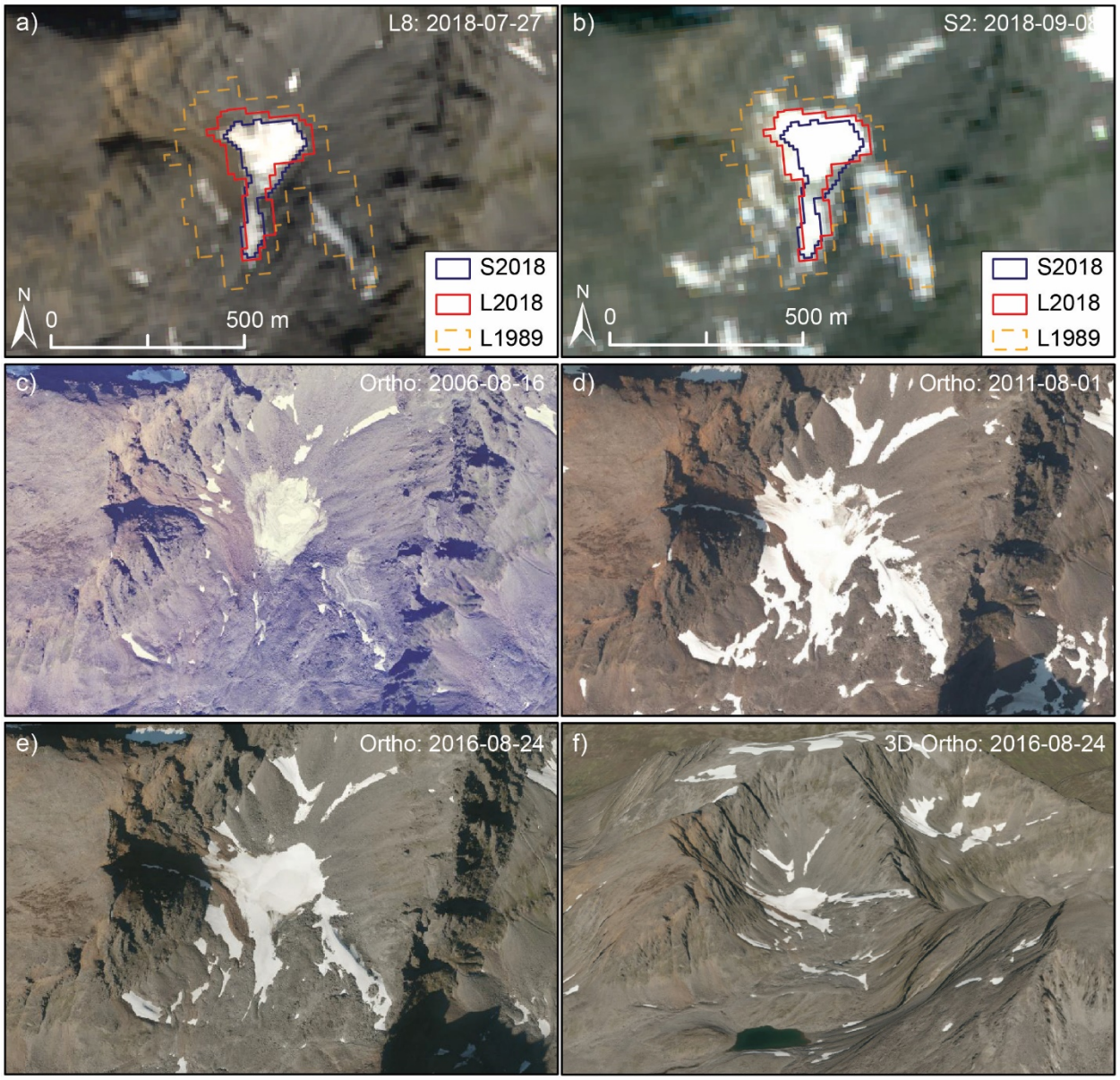

Fig. S7. Comparison between outlines and classification of a previously unmapped unit, both panels (a) and (b) show the same outlines; (a) using a Sentinel-2 image with R-G-B as bands 4-3-2, (b) using a Landsat-8 image with R-G-B as bands 4-3-2. Solid pink lines represent the 2018 Sentinel-2 outlines, solid red lines represent the 2018 Landsat-8 outlines (Leigh and others, 2020), dashed orange lines represent the historic 1989 Landsat-5 outlines for comparison (Leigh and others, 2020). Panel (c-e) show the same ice/snow unit on 0.25 m resolution colour vertical orthophotographs from various time-steps and (f) shows an oblique 3D render using 2006 imagery. Panels (c) – (f) use imagery from (c) Norgeibilder.no. /Copernicus Sentinel data 2018/