

TABLES

SM-T1. Source data used in the study

Year	Name/Source	Type	Resolution	Note/object	No. of supplemental material
Archival map/ Graphic sources (graphics, pictures)/ Image (photography)/ Oblique images (terrestrial, aerial)/ Aerial images					
1613	Fotherby, Robert (reprint 1860): Narrative of a voyage to Spitzbergen in the year 1613, at the charge of the fellowship of Englishmerchants for the discovery of new trades; commonly called the Muscovy Company: with a description of the country, and the operations of the whale-fishery. Boston, Printed by J. Wilson and Son. ss74. Orginal volumine: https://archive.org	uncalibrated map		Recherchebreen	SM-2A
1634	'Het nieuwe land Spits-berghen'(The new land of Spitsbergen). Kaart van Spitsbergen door M.H. Middelhoven. Reproduction: Tijdschrift. Aardrijksk. Gen., deel III.Schenking de Bas. Zie Verslag 1877, blz. 4.Facsimile van 4.VEL inv.nr. 2. Orginal volumine: https://www.nationaalarchief.nl	uncalibrated map		Recherchebreen	SM-2B
1685	Doncker, Hendrick. Pascaerte van Spitsbergen Met alle Zee-Custen havens en bayen, naer de alderlaeste bevinding, klaerlyck int licht gebracht. t'Amsterdam. Bibliothèque nationale de France. Orginal volumine: https://gallica.bnf.fr	uncalibrated map		Recherchebreen	SM-2C
1714 (1710)	van Keulen, Gerard. Nieuwe afteekening van Het Eyland Spits-Bergen opgegeven door de Commandeurs Giles en Outger Rep, en in't Ligt gebrat en uytgegeven. Bibliothèque nationale de France. Orginal volumine: https://gallica.bnf.fr	uncalibrated map		Recherchebreen	SM-2D
1764	Bellin, Jacques Nicolas. Carte Du Spits-Berg : Suivant les Hollandois. Publisher J.N. Bellin, Paris. Bibliothèque nationale de France. Orginal volumine: https://gallica.bnf.fr	uncalibrated map		Recherchebreen	SM-2E
1815	Norie, John William. etc. A New Chart of the Northern Seas, Greenland, Iceland, and Spitsbergen. Drawn from the Latest Authorities Princally Intended for the Whale Fisheries (A New Edition) /by J.W. Norie, Hydrographer; J. Stephenson, Engraver. Bibliothèque nationale de France. Orginal volumine: https://gallica.bnf.fr	uncalibrated map		Recherchebreen	SM-2F
1820	Scoresby, William. A chart of Spitzbergen or East Greenland, comprising an original survey of the west coast. Above 200 Miles in extent. An account of the Arctic regions with a history and description of the northern whale-fishery. vol. 2. Edinburgh, Pl. 7. ss. 573; Orginal volumine: https://archive.org	uncalibrated map		Recherchebreen Renardbreen	SM-3A SM-3A

1838	Voyages de la Commission Scientifique du Nord, en Scandinavie, en Laponie, au Spitzberg et aux Ferøe, pendant les années 1838, 1839 et 1840, sur la corvette la Recherche, coumandée par M. Fabvre. 8, 3, Publiés par ordre du Roi; sous la direction De M. Paul Gaimard, Météorologie / par Mm .V.Lottin, A.Bravais, C.B.Lilliehöök., P.A.Siljeström, Ch. Martins, J. de Laroche-Poncié , L.L.Læstadius et E. Pottier. Tom 1, Tom 22, tome premier (1842); 236	uncalibrated map		Recherchebreen	SM-3B
1838	Plan de la Baie de Bel Sond au Spitzberg. Levé en juillet et août 1838 (by the French expedition in the corvette 'la Recherche'). Au Dépôt-général de la marine en 1840. Part of the map reproduced in Bienaimé (1894). Pl. 21. Cf. Marmier (1838). Source: Norwegian Polar Institute	map calibrated (?)		Recherchebreen Renardbreen	SM-3C SM-3C
1838	Voyages de la Commission Scientifique du Nord, en Scandinavie, en Laponie, au Spitzberg et aux Ferøe, pendant les années 1838, 1839 et 1840, sur la corvette la Recherche, coumandée par M. Fabvre, Publiés par ordre du Roi; sous la direction De M. Paul Gaimard Atlas Historique et pittoresque, Lithographié d'Après les dessins de Mm. Mater, Lauvergne et Giraud Tome Premier; Paris, Arthus Bertrand, Éditeur; Libraire de la Société de Géographie; Author: Auguste Mayer	graphic		Recherchebreen Recherchebreen	SM-11B SM-12A
1860	Spitzbergen from the surveys of Captn. Broke; H.M.S. Shannon, 1807; Captn. J. Franklin & Lieut.E. Beechey, 1818 & Captn. W.E. Parry, 1827; Bel Sound from the French 1838; The outline completed from the old Danish charts. London: published at the Admiralty	uncalibrated map		Recherchebreen	SM-4A
1861-64	Dunér, N. Nordenskiöld, A. E. Karta öfver Spetsbergen huvudsakligast enligt iakttagelser under de svenska expeditionerna åren 1861 och 1864 af N. Dunér och A. E. Nordenskiöld. Stockholm, Maj 1865. - N. Dunér och A. E. Nordenskiöld. Anteckningar till Spetsbergens geografi. Stockholm 1865. [Annexure.] (Vet.-ak. handl. B. 6. No. 5.)	uncalibrated map		Recherchebreen	SM-4B
1892	Spitzberg. Belle Sound. Baie de la Recherche (1894). Bienaimé, A. (1894). Voyage de 'La Manche' à l'île Jan-Mayen et au Spitzberg (juillet-août 1892). Paris: Ernest Leroux. Source: La bibliothèque Sainte-Genève	map calibrated (?)		Recherchebreen Renardbreen	SM-4C SM-4D
	Plane levé par les officiers de la Manche (Aout 1992). Spitzberg. Belle Sound. Baie de la Recherche. Source: gallica.bnf.fr/Bibliothèque nationale de France	sketch calibrated		Recherchebreen Renardbreen	SM-4D SM-4D
1892	Bienaimé, A. (1894). Voyage de 'La Manche' à l'île Jan-Mayen et au Spitzberg (juillet-août 1892). Paris: Ernest Leroux.; 120-121 (photographie de M.Lancelin); Source: La bibliothèque Sainte-Genève	sketch		Renardbreen	SM-4E
		photography		Recherchebreen Renardbreen	SM-12B SM-14D

1895	Bell Sound, Recherche Bay. Syrveyed by Lieutenanat J.P.Rolleston and the Officers of the Training Squadrone under the direction of Commodore George L. Atkinson 1995. Anchorages in Spitsbergen and Bear Island (1929) (Svalbard) (Björnøy). Source: Norwegian Polar Institute	map calibrated (?)		Recherchebreen	SM-5A
1898	Hamberg, Axel. Karte der Baie Recherche und Van Keulen Bay auf Spitsbergen während der von A.G. Nathorst geleiteten schwedischen Polarexpedition 1898; Generalstabens Litografiska Anstalt. Stockholm. Source: Norwegian Polar Institute	map calibrated		Recherchebreen Renardbreen Scottbreen	SM-5B SM-5B SM-5B
1898	Axel Hamberg; The Svalbard expedition of 1898 (Alfred Gabriel Nathorst). Alvin; Uppsala University Library	oblique images		Recherchebreen Renardbreen Scottbreen	SM-11D,12D Figure 6A, 7A SM-16A,B,C
1902	Tristram James Ellis (1844-1922) - 'Spitzbergen 1904'. Source: www.bonhams.com	painting		Renardbreen	Figure 7C
1908	Halldin Oscar; De Geer Expedition. Alvin; Uppsala University Library	photography		Recherchebreen	SM-12C
1909	Norwegian Polar Institute	photography		Renardbreen	SM-14E
1918	Hoel, Adolf and Røvig, Sverre. Kart over Recherchefjorden på Svalbard fra (1927). Report of the Svalbard commissioner [Kristian Sindballe] concerning the claims to land in Svalbard Copenhagen and Oslo. Source: Norwegian Polar Institute	map calibrated		Recherchebreen Renardbreen Scottbreen	SM-5C SM-5C SM-5C
1918	Adolf Hoel. Norwegian Polar Institute	oblique images		Renardbreen Scottbreen	SM-15A SM-17A
1928	Norwegian Polar Institute	photography		Renardbreen	Figure 7D
1928	Norwegian Polar Institute	photography		Renardbreen	SM-14F
1936	S36, Norwegian Polar Institute	aerial oblique images		Recherchebreen Renardbreen Scottbreen	SM-12E SM-15C SM-17C
1936	Van Keulenfjorden (1: 100 000) (1952) B11, Norwegian Polar Institute. After the oblique images from 1936.	map calibrated		Recherchebreen Renardbreen Scottbreen	SM-5D SM-5D SM-5D
09/09/1948	Vertical aerial image S48. Norwegian Polar Institute	Orthophotomap	3/5 m	Recherchebreen Renardbreen	SM-6A SM-9A
1948	Norwegian Polar Institute	photography		Recherchebreen	SM-12F
08/15/1960	Vertical aerial image S60. Norwegian Polar Institute	Orthophotomap	3/5 m	Recherchebreen Renardbreen Scottbreen	SM-6B SM-9B SM-10A
Early 1970s	Norwegian Polar Institute	photography		Renardbreen	SM-14G
1987	Kazimierz Pękala	photography		Recherchebreen	SM-12G

07/22/1990	Vertical aerial image S90, Norwegian Polar Institute	Orthophotomap	2 m	Recherchebreen Renardbreen Scottbreen	SM-6D SM-9C SM-10B
2000	Author: Piotr Zagórski	photography		Recherchebreen	SM-13A
2006	Author: Piotr Zagórski	photography		Renardbreen Scottbreen	SM-15B SM-17B
2008	Author: Piotr Zagórski	photography		Recherchebreen	SM-11E
2008	Author: Marcin Świtoniak	photography		Renardbreen	Figure 6B
2009	Author: Piotr Zagórski	photography		Recherchebreen	SM-11C,13B
2009	Author: Marek Dwornik	photography		Renardbreen	Figure 7B
07/26/2011	Vertical aerial image S2011, Norwegian Polar Institute	Orthophotomap	2 m	Recherchebreen Renardbreen Scottbreen	SM-7A SM-9E SM-10D
		3D Model image		Renardbreen Scottbreen	Figure 6C; SM-15D SM-17D
2014	Author: Piotr Zagórski	photography		Renardbreen	Figure 7 E
2015	Author: Piotr Zagórski	photography		Scottbreen	SM-16D
2019	Author: Kamil Ziemba	photography		Recherchebreen	SM-13C
Satellite images (used for calculations, in bold – presented in the figures)					
04/09/1975	USGS Landsat - LM22290051975223GMD02	Satellite image	60 m	Recherchebreen	SM-6C
08/04/1987	USGS Landsat - LT52160041987216KIS00	Satellite image	30 m	Recherchebreen	
08/28/1992	USGS Landsat - LT52130041992241KIS00	Satellite image	30 m	Recherchebreen	
09/17/1994	USGS Landsat - LT52150041994260KIS00	Satellite image	30 m	Recherchebreen	
08/19/1995	USGS Landsat - LT52150041995231KIS00	Satellite image	30 m	Recherchebreen	SM-6E
05/08/1996	USGS Landsat - LT52160041996129KIS00	Satellite image	30 m	Recherchebreen	
04/09/1997	USGS Landsat - LT52160041997099KIS00	Satellite image	30 m	Recherchebreen	
03/20/1998	USGS Landsat - LT52150041998079KIS00	Satellite image	30 m	Recherchebreen	
09/23/1999	USGS Landsat - LE72150041999266KIS00	Satellite image	15 m	Recherchebreen	
08/17/2000	USGS Landsat - LE72140042000230KIS00	Satellite image	15 m	Recherchebreen Renardbreen Scottbreen	SM-6F SM-9D SM-10C
06/17/2001	USGS Landsat - LE72140042001168EDC00	Satellite image	15 m	Recherchebreen	
06/22/2002	USGS Landsat - LE72120052002173EDC00	Satellite image	15 m	Recherchebreen	
07/11/2004	USGS Landsat - LE72140042004193EDC01	Satellite image	15 m	Recherchebreen	
07/23/2005	USGS Landsat - LE72130042005204EDC00	Satellite image	15 m	Recherchebreen	SM-6G
07/26/2006	USGS Landsat - LE72130042006207EDC00	Satellite image	15 m	Recherchebreen	
07/17/2008	USGS Landsat - LE72110052008199ASN00	Satellite image	15 m	Recherchebreen	

08/12/2009	Google Earth - 20090812114526484GE10332358_004	Satellite image	1.5 m	Recherchebreen	SM-6H
08/24/2010	USGS Landsat - LE72110052010236EDC00	Satellite image	15 m	Recherchebreen	
05/15/2012	DigitalGlobe - WV01_102001001BB15400	Satellite image	15 m	Recherchebreen	
03/25/2013 (1)	USGS Landsat - LC82140042013084LGN01	Satellite image	15 m	Recherchebreen	
08/17/2013	DigitalGlobe - 13AUG17130953-S2AS-010486906030_01_P001	Satellite image	0.5 m	Renardbreen Scottbreen	SM-10E
08/24/2013 (2)	USGS Landsat - LC82110052013236LGN00	Satellite image	15 m	Recherchebreen	SM-7B
04/07/2014 (1)	USGS Landsat - LC82090052014097LGN01	Satellite image	15 m	Recherchebreen	
07/15/2014 (2)	USGS Landsat - LC82140042014196LGN01	Satellite image	15 m	Recherchebreen	SM-7C
08/04/2014 (3)	USGS Landsat - LC82100052014216LGN00	Satellite image	15 m	Recherchebreen	
08/23/2014 (4)	USGS Landsat - LC82150042014235LGN00	Satellite image	15 m	Recherchebreen	
09/21/2014 (5)	USGS Landsat - LC82100052014264LGN01	Satellite image	15 m	Recherchebreen	
04/08/2015 (1)	USGS Landsat - LC82110052015098LGN01	Satellite image	15 m	Recherchebreen	
07/05/2015 (2)	USGS Landsat - LC82100052015187LGN00	Satellite image	15 m	Recherchebreen	SM-7D
09/15/2015 (3)	USGS Landsat - LC82110052015258LGN00	Satellite image	15 m	Recherchebreen	
03/25/2016 (1)	USGS Landsat - LC82110052016085LGN01	Satellite image	15 m	Recherchebreen	
08/22/2016 (2)	Planet Labs Inc. - 20160822_123708_3374914_RapidEye-1	Satellite image	5 m	Recherchebreen	
09/10/2016 (3)	USGS Landsat - LC82100052016254LGN01	Satellite image	15 m	Recherchebreen	SM-7E
03/30/2017 (1)	Planet Labs Inc. - 20170330_110332_0e0f	Satellite image	3 m	Recherchebreen	SM-7F
07/17/2017	DigitalGlobe - 17JUL31184148-S2AS-010486906040_01_P001	Satellite image	0.5 m	Renardbreen Scottbreen	SM-9F SM-10F
07/24/2017 (2)	Planet Labs Inc. - 20170724_105547_100c; 20170724_105548_100c	Satellite image	3 m	Recherchebreen	
10/07/2017 (3)	Planet Labs Inc. - 20170710_110326_1001; 20170710_110327_1001	Satellite image	3 m	Recherchebreen	SM-7G
03/05/2018 (1)	Planet Labs Inc. - 20180305_111310_1011	Satellite image	3 m	Recherchebreen	SM-7H
05/14/2018 (2)	Planet Labs Inc. - 20180514_073114_1053; 20180514_073115_1053	Satellite image	3 m	Recherchebreen	
07/30/2018 (3)	Planet Labs Inc. - 20180730_111713_0f17	Satellite image	3 m	Recherchebreen	
09/20/2018 (4)	Planet Labs Inc. - 20180920_111906_1009	Satellite image	3 m	Recherchebreen	SM-8A
03/07/2019 (1)	USGS Landsat - LC82140042019066LGN00	Satellite image	15 m	Recherchebreen	SM-8B
04/07/2019 (2)	Planet Labs Inc. - 20190407_113045_0f31; 20190407_113046_0f31	Satellite image	3 m	Recherchebreen	
05/07/2019 (3)	Planet Labs Inc. - 20190507_063838_1048; 20190507_063839_1048	Satellite image	3 m	Recherchebreen	
06/18/2019 (4)	Planet Labs Inc. - 20190618_183559_1035	Satellite image	3 m	Recherchebreen	SM-8C
07/24/2019 (5)	Planet Labs Inc. - 20190724_183954_103b	Satellite image	3 m	Recherchebreen	
08/21/2019 (6)	Planet Labs Inc. - 20190821_113413_1009	Satellite image	3 m	Recherchebreen	
09/18/2019 (7)	Planet Labs Inc. - 20190918_112349_0f31	Satellite image	3 m	Recherchebreen	SM-8D
03/17/2020 (1)	Planet Labs Inc. - 20200317_114552_11_1064; 20200317_114554_16_1064	Satellite image	3 m	Recherchebreen	SM-8E
04/23/2020 (2)	Planet Labs Inc. - 20200423_112934_1001	Satellite image	3 m	Recherchebreen	
05/17/2020 (3)	Planet Labs Inc. - 20200517_053541_0f44; 20200517_053542_0f44	Satellite image	3 m	Recherchebreen	

06/22/2020 (4)	Planet Labs Inc.- 20200622_074244_37_106b	Satellite image	3 m	Recherchebreen	
07/31/2020 (5)	DigitalGlobe – 20JUL31113940-M2AS-013735816010_01_P001/P002; 20JUL31113940-P2AS-013735816010_01_P001/P002	Satellite image	0.5 m	Recherchebreen	SM-8F
07/31/2020	DigitalGlobe – 20JUL31113940-M2AS-013735816010_01_P001/P002; 20JUL31113940-P2AS-013735816010_01_P001/P002	Satellite image	0.5 m	Renardbreen Scottbreen	SM-9G SM-10G
08/25/2020 (6)	Planet Labs Inc. - 20200825_120747_67_1064	Satellite image	3 m	Recherchebreen Renardbreen Scottbreen	Figure 1 Figure 1 Figure 1
09/26/2020 (7)	Planet Labs Inc. - 20200926_120505_31_1064	Satellite image	3 m	Recherchebreen	SM-8G
03/17/2021 (1)	Planet Labs Inc. - 20210317_111754_103c	Satellite image	3 m	Recherchebreen	
08/14/2021 (2)	Planet Labs Inc. - 20210814_042609_104b	Satellite image	3 m	Recherchebreen	SM-8H
Unmanned aerial vehicle (UAV)					
07/17/2021	Background:	Orthophotomap	0.04 m	Renardbreen	SM-9H
07/22/2021	Planet Labs Inc. - 20210814_042609_104b; 20210814_042610_104b	Orthophotomap	0.04 m	Scottbreen	SM-10H
Precise GNSS measurements (Leica system 500)					
08/02/2000		'shp' data	0.2 m	Scottbreen	Figure 5
08/04/2000		'shp' data	0.2 m	Renardbreen	Figure 4
08/01/2005		'shp' data	0.2 m	Scottbreen	Figure 5
08/03/2005		'shp' data	0.2 m	Renardbreen	Figure 4
08/12/2008		'shp' data	0.2 m	Scottbreen	Figure 5
08/07/2011		'shp' data	0.2 m	Scottbreen	Figure 5
08/09/2011		'shp' data	0.2 m	Renardbreen	Figure 4
08/02/2015		'shp' data	0.2 m	Scottbreen	Figure 5
07/31/2015		'shp' data	0.2 m	Renardbreen	Figure 4
DEM data					
2011	Source: vertical aerial image S2011 (07/26/2011), Norwegian Polar Institute	DEM	2 m	Recherchebreen Renardbreen Scottbreen	Figure 3 Figure 4; SM-1; SM-6; SM-15 SM-17D
2020	Source: satellite image (07/31/2020), DigitalGlobe	DEM	0.5 m	Scottbreen	Figure 5

SM-T2. Recherchebreen – value of change of front glacier position

Period [m/d/y]*	Mean value of change of front glacier position			Advance (max) [m]	Recession (max) [m]
	[m] (NSM)	[m a ⁻¹] (EPR)	[m day ⁻¹]		
c. 1810s/1820s	deeply retracted glacier front				
1820s/1830s; max. of LIA surge (<i>Rc1</i>)	advancement of the front glacier c. 7.5 km				
1820s/30s – 1838; after surge	c. -680	c. -60			-1100
1838 – early 1860s	c. -1700	c. -70			-2000
early 1860s – early 1880s; surge (<i>Rc2</i>)	c. 500	c. 55		c. 750	
early 1880s – 1892; after surge	c. -750	c. -70			c. -1150
1892 – 1895	-80	-27		110	-230
1895– 1898	-360	-120			-660
1898 – 1918	-300	-15			-550
1918 – 1936	-440	-25			-770
1936 – early 1940s; surge (<i>Rc3</i>)	c. 700	c. 90		c.1000	
early 1940s – 1948; after surge	c. -100	c. -20			c. -250
09/09/1948 – 08/15/1960	-70	-5.8		90	-340
08/15/1960 – 04/09/1975	-300	-20.4			-590
04/09/1975 – 08/04/1987	-142	-11.8	-0.03		-570
08/04/1987 – 07/22/1990	-36	-12.3	-0.03		-110
07/22/1990 – 08/28/1992	-52	-25.1	-0.07		-140
08/28/1992 – 09/17/1994	-30	-14.5	-0.04		-70
09/17/1994 – 08/19/1995	-28	-30.1	-0.08		-100
08/19/1995 – 05/08/1996	-25	-34.4	-0.09		-75
05/08/1996 – 04/09/1997	-31	-33.8	-0.09		-75
04/09/1997 – 03/20/1998	-18	-19.4	-0.05		-85
03/20/1998 – 09/23/1999	-28	-18.6	-0.05		-110
09/23/1999 – 08/17/2000	-52	-57.9	-0.16		-190
08/17/2000 – 06/17/2001	-61	-74.1	-0.20		-240
06/17/2001 – 06/22/2002	-55	-54.6	-0.15		-180
06/22/2002 – 07/11/2004	-125	-60.9	-0.17		-385
07/11/2004 – 07/23/2005	-75	-72.8	-0.20		-250
07/23/2005 – 07/26/2006	-59	-58.5	-0.16		-180
07/26/2006 – 07/17/2008	-160	-81.1	-0.22		-335
07/17/2008 – 08/12/2009	-73	-68.4	-0.19		-290
08/12/2009 – 08/24/2010	-76	-73.4	-0.20		-290
08/24/2010 – 07/26/2011	-53	-57.8	-0.16		-145
07/26/2011 – 05/15/2012	-60	-74.5	-0.20		-270
05/15/2012 – 03/25/2013 (1)	-49	-57.4	-0.16		-155
03/25/2013 (1) – 08/24/2013 (2)	-37	-88.8	-0.24		-235
08/24/2013 (2) – 04/07/2014 (1)	-62	-100.0	-0.27		-195
04/07/2014 (1) – 07/15/2014 (2)	-22	-79.4	-0.21	60	-80
07/15/2014 (2) – 08/04/2014 (3)	-34	-614.7	-1.68		-125
08/04/2014 (3) – 08/23/2014 (4)	-31	-603.4	-1.65		-160
08/23/2014 (4) – 09/21/2014 (5)	-16	-196.6	-0.54	20	-140
09/21/2014 (5) – 04/08/2015 (1)	-5	-9.5	-0.03	60	-180
04/08/2015 (1) – 07/05/2015 (2)	-14	-56.2	-0.15	40	-100
07/05/2015 (2) – 09/15/2015 (3)	-16	-81.6	-0.22	40	-110
09/15/2015 (3) – 03/25/2016 (1)	-21	-40.2	-0.11	40	-140
03/25/2016 (1) – 08/22/2016 (2)	-20	-50.2	-0.14	50	-180
08/22/2016 (2) – 09/10/2016 (3)	-30	-571.0	-1.56		-140
09/10/2016 (3) – 03/30/2017 (1)	-30	-54.0	-0.15	90	-190
03/30/2017 (1) – 07/24/2017 (2)	-2	-0.4	-0.01	90	-90

07/24/2017 (2) – 10/07/2017 (3)	-27	-130.8	-0.36	30	-120
10/07/2017 (3) – 03/05/2018 (4); surge beginning (<i>Rc4</i>)	12	31.0	0.08	80	-70
03/05/2018 (1) – 05/14/2018 (2)	22	112.1	0.31	90	-10
05/14/2018 (2) – 07/30/2018 (3)	20	82.2	0.22	170	-80
07/30/2018 (3) – 09/20/2018 (4)	7	48.1	0.13	140	-100
09/20/2018 (4) – 03/07/2019 (1)	293	636.9	1.75	420	
03/07/2019 (1) – 04/07/2019 (2)	54	637.3	1.74	200	
04/07/2019 (2) – 05/07/2019 (3)	52	639.2	1.75	180	
05/07/2019 (3) – 06/18/2019 (4)	96	838.6	2.30	210	
06/18/2019 (4) – 07/24/2019 (5)	120	1216.2	3.33	270	
07/24/2019 (5) – 08/21/2019 (6)	40	509.3	1.39	90	
08/21/2019 (6) – 09/18/2019 (7)	60	241.8	0.66	70	-60
09/18/2019 (7) – 03/17/2020 (1)	102	206.5	0.57	180	
03/17/2020 (1) – 04/23/2020 (2)	20	191.8	0.53	60	
04/23/2020 (2) – 05/17/2020 (3)	30	397.6	1.09	60	
05/17/2020 (3) – 06/22/2020 (4)	51	522.3	1.43	100	
06/22/2020 (4) – 07/31/2020 (5)	32	296.9	0.81	70	-40
07/31/2020 (5) – 08/25/2020 (6)	-3	-35.0	-0.10	30	-100
08/25/2020 (6) – 09/26/2020 (7)	-19	-216.4	-0.59	20	-140
09/26/2020 (7) – 03/17/2021 (1) surge ending	-14	-29.9	-0.08	30	-150
03/17/2021 (1) – 08/14/2021 (2)	-3	-7.1	-0.05	70	-55

*In the absence or incomplete date, July 15 was assumed for the calculations in the DSAS GIS Application.

SM-T3. Renardbreen – value of change of front glacier position

Period [m/d/y]*	Mean value of change of front glacier position		Advance (max) [m]	Recession (max) [m]
	[m] (NSM)	[m a ⁻¹] (EPR)		
1820s/1830s	max. of LIA surge, submarine moraine ridge (<i>Rn1</i>), moraine ridge (M1)			
1820s/30s; 1838	after surge, recession			
1838 – 1892	glacier front oscillation, surge episode, submarine moraine ridge (<i>Rn2</i>), moraine ridge (M2)			
1892 – 1898	-40	-6.7	190	-150
1898 – 1918	-80	-4.0		-220
1918 – late 1920s	glacier front oscillation, surge episode, submarine moraine ridge (<i>Rn3</i>), moraine ridge (M3)			
late 1920s – 1936	after surge, recession			
1936 – 09/09/1948	-250	-21.1		-520
09/09/1948 – 08/15/1960	-230	-19.1		-560
08/15/1960 – 07/22/1990	-335	-11.3		-820
07/22/1990 – 08/04/2000	-133	-13.2		-250
08/04/2000 – 08/03/2005	-68	-13.8		-180
08/03/2005 – 07/26/2011	-80	-13.5		-180
07/26/2011 – 08/17/2013	-40	-19.2		-70
08/17/2013 – 07/31/2015	-25	-12.9		-80
07/31/2015 – 07/17/2017	-35	-18.1		-100
07/17/2017 – 07/31/2020	-47	-15.6		-90
07/31/2020 – 07/17/2021	-8	-8.3		-130

*In the absence or incomplete date, July 15 was assumed for the calculations in the DSAS GIS Application.

SM-T4. Scottbreen – value of change of front glacier position

Period [m/d/y]*	Mean value of change of front glacier position		Recession (max) [m]
	[m] (NSM)	[m a ⁻¹] (EPR)	
c. 1880 (<i>Sc1</i>)?	max. of LIA surge		
c. 1880 - 1898	after surge, stagnation of glacier front position		
1898 – 1918	-30	-1.5	-80
1918 – 1936	-45	-2.6	-100
1936 – 08/15/1960	-80	-3.3	-210
08/15/1960 – 07/22/1990	-235	-7.8	-460
07/22/1990 – 08/02/2000	-175	-17.5	-380
08/02/2000 – 08/01/2005	-82	-16.6	-190
08/01/2005 – 08/12/2008	-70	-23.0	-285
08/12/2008 – 07/26/2011	-55	-18.7	-180
07/26/2011 – 08/17/2013	-71	-22.2	-130
08/17/2013 – 08/02/2015	-43	-34.7	-280
08/02/2015 – 07/17/2017	-83	-42.0	-200
07/17/2017 – 07/31/2020	-53	-17.8	-90
07/31/2020 – 07/22/2021	-13	-14.4	-40

*In the absence or incomplete date, July 15 was assumed for the calculations in the DSAS GIS Application.

SM-T5. List of glacier on Svalbard quoted in the literature for which the year/period of the surge occurrence is given

Lp.	Glacier name	Type of glacier	Surge year/period (years in bold are quoted in this article)
1	Recherchebreen	T	1838 ^{7,4} , 1945 ^{7,4} , 1820s/30s, 1860s/80s; early 1940s; 2018–2020
2	Renardbreen	L/T	1820s/30s, 1860s/80s, 1920s/30s
3	Scottbreen	L	ca 1880 ⁴ , 1880s (?)
4	Aavatsmarkbreen	T	1982–85 ⁷ , 2013–2014 ¹² , 2018 ¹⁶
5	Alfarvegen	T	1970–80 ⁷
6	Allfarvegen	T	2019 ¹⁶
7	Anna Margrethebreen	T	1970 ⁷
8	Arnesenbreen	T	1925–35 ⁷ , 2017 ¹⁶
9	Austjøkulen	T	2004 ⁸
10	Bakaninbreen	T	1985–90 ⁷
11	Bjorlykkobreen	T	2019 ¹⁶
12	Blomstrandbreen	T	1910–1928 ¹⁴ , 1956–1966 ¹⁴ , 1960 ⁷ , 2008–2009 ⁹ , 2006–2013 ¹⁴
13	Bodleybreen	T	1973–80 ⁷
14	Brasvellbreen	T	1937–38 ⁷
15	Brodtkorbfjellet	L	1990 ⁸
16	Bungebreen	L	2004 ⁸
17	Chaveauxbreen	T	1990 ⁸
18	Comfortlessbreen	T	2006 ⁸ –2008 ⁹
19	Crollbreen	T	1936–61 ⁷ , 2019 ¹⁶
20	Davisbreen	T	ca 1960 ⁷
21	Dobrowolskibreen	L/T	2003 ⁸ , 2008–2009 ⁹
22	Duckwitzbreen	T	1918 ⁷
23	Elisebreen	L	2006 ⁸
24	<u>Emil’janovbreen</u>	T	1970–1990 ⁶
25	Emmabreen	T	2018 ¹⁶
26	Etonbreen	T	1938 ⁷
27	Firmbreen	L	2006 ⁸
28	Finsterwalderbreen	L	1898–1910 ¹
29	Fjortende Julibreen	T	2019 ¹⁶
30	Freemanbreen	T	1955–56 ⁷
31	Fridtjovbreen	T	1861 ⁷ , ca 1991–1997 ⁷
32	Glitnefonna Ne	T	1938 ⁷
33	Hambergbreen	T	ca 1890 ⁷ , ca 1960 ⁷
34	Hayesbreen	T	1901 ⁷
35	Helsingborgbreen	L	b. 1961 ⁵
36	Hessbreen	L	1969 ⁶
36	Hinlopenbreen	T	1969–1972 ⁷
37	Hochstatterbreen	T	1895–1900 ⁷
38	Høgstebreen – a. Torellbreen	L	1990 ⁸
39	Ingerbreen	L/T	2001 ⁸
40	Inglefieldbreen	T	1952 ⁷
41	Jemelianovbreen	T	1971 ⁷
42	Kantbreen	T	b. 1936 and 1966 ⁵
43	Kjølhø south	L	1990 ⁸
44	Kjølhøbreen	L	1970 ⁸
45	Kleivbreen	L	2003 ⁸
46	Klubbebreen	L	1990 ⁸
47	Klubbebreen S.	L	1990 ⁸
48	Knoppbreen	L	1970 ⁸

49	Kong Johans Bre	T	1925–1930 ⁷
50	Kongsvegen	T	1800 ¹³ , 1869 ¹³ , 1948 ⁷
51	Körberbreen	T	1938 ⁷ , ca 1960 ⁷
52	Kosterbreen	T	ca 1930 ⁷ , 1956–1970 ⁷
53	Kronebreen	T	1869 ⁷
54	Kroppbreen	L	2000 ⁸
55	Kroppbreen small glacier N.	L	1990 ⁸
56	Kroppbreen small glacier S.	L	1990 ⁸
57	Kvalbreen	T	2018 ¹⁶
58	Liestølbreen	T	2003 ⁸
59	Luntebreen	L	1961 ⁸
60	Markhambreen	T	1930–1936 ⁷ , 2010 ⁶ , 2019 ¹⁶
61	Marstrandbreen	T	2017 ¹⁶
62	Mendeleyevbreen	T	1996(1997)–2006(2010) ¹⁶
63	Mendeleyevbreen–Fredfonna	T	2000 ⁸
64	Midtbreen	T	2017 ¹⁶
65	Moltkebreen	T	2019 ¹⁶
66	Monacobreen	T	ca 1991–1997 ⁷ , 2019 ¹⁶
67	Moršnevbreen	T	2016 ¹⁵
68	Mühlbacherbreen	T	1961 ⁸ , 1990 ¹¹
69	Naglebreen	L	1970 ⁸
70	nameless 211 08	T	b. 1850–1873 ⁷ , 1992–1994 ⁷
71	Nansenbreen	T	1947 ⁷
72	Nataschabreen	L	1970 ⁸
73	Nathorstbreen–Ljosfonn	T	ca 1870 ² , 2003 ⁸ , 2006–2015 ¹⁶
74	Negribreen	T	1935–1936 ⁷ , 2018 ¹⁶
75	Nordenskiöldbreen	T	b. 1936 and 1948 ⁵ , 2018 ¹⁶
76	Nornebreen–Paierlbreen	T	1990 ⁸
77	Nordsysselbreen	T	b. 1936 ⁵
78	Odinajokulen N	T	b. 1965–1970 ⁷
79	Osbornebreen	T	1987–1990 ⁷
80	Paierlbreen	T	1993–1999 ⁷
81	Palanderbreen	T	1969–1970 ⁷
82	Paulabreen	T	2003–2005 ¹⁰
83	Pedasjenkobreen	T	1925–1935 ⁷
84	Perseibreen	T	2000–2016 ¹⁶ , 2000–2002 ¹⁵
85	Perseibreen–Vindeggbreen	T	2000 ⁸
86	Polakkbreen	L/T	2003 ⁸
87	Profilbreen–a. Torellbreen	L/T	2007 ⁸
88	Ragna-Mariebreen	L	2003 ⁸
89	Richardsbreen	T	1990–2002 ⁷
90	Rijpbreen	T	1938, 1992 ⁷
91	S Franklinbreen	T	1956 ⁷
92	S. Osbornebreen	T	1990 ⁸
93	Scheelebreen	L/T	b. 1956 ⁵ , 2003 ⁸
94	Sefströmbreen	T	1896 ⁷
95	Sergievskefjell	L	1990 ⁸
96	Skilfonna	T	2004 ⁸
97	Skimebreen	T	1970 ⁷
98	Skobreen	L	1990 ⁸ , 2000 ⁸
99	Skobreen–Paulabreen	T	2003–2005 ¹⁰
100	Søkkbreen	L	1990 ⁸
101	Sonklarbreen	T	ca 1910 ⁷ , 2019 ⁶
102	St. Olgafjellet	L	1990 ⁸
103	Staupbreen	T	ca 1960 ⁷

104	Stonebreen	T	1850–1860 ⁷ , 1936–1971 ⁷ , 2013 ¹⁵
105	Storbreen	T	1958 ¹¹ , 1990 ¹¹
106	Størmerbreen	L	1990 ⁸
107	Strongbreen	T	1870–1876 ⁷ , 2017 ¹⁶
108	Svalisbreen	T	2018 ¹⁶
109	Sveabreen	T	b. 1936 ⁵
110	Thomsonbreen	T	1950–1960 ⁷ , 2019 ¹⁶
111	Tinkarpbreen	L	2000 ⁸
112	Tunabreen	T	1930 ⁷ , 1970 ⁷ , 2002–2010 ¹⁶ , 2018 ¹⁶
113	Ulvebreen	T	1896–1900 ⁷
114	Usherbreen	L	1978–1985 ³
115	Vaigattbreen	T	2017 ¹⁶
116	Vallåkrabreen	L	2006 ⁸
117	Vallåkrabreen (Bringen)	L	1990 ⁸
118	Vasilievbreen	T	ca 1961 ⁷
119	Ve Osbornebreen	T	2019 ¹⁶
120	Vintervegen	L	1990 ⁸
121	Von Postbreen	T	1870 ⁷ , 1980 ⁷
122	Wahlenbergbreen	T	1908 ⁷ , 2009 ¹⁵ , 2012 ¹⁶ , 2017 ¹⁶
123	Zawadzki breen	T	b. 1961 ⁵ , 2003 ⁸ , 2006–? ⁷

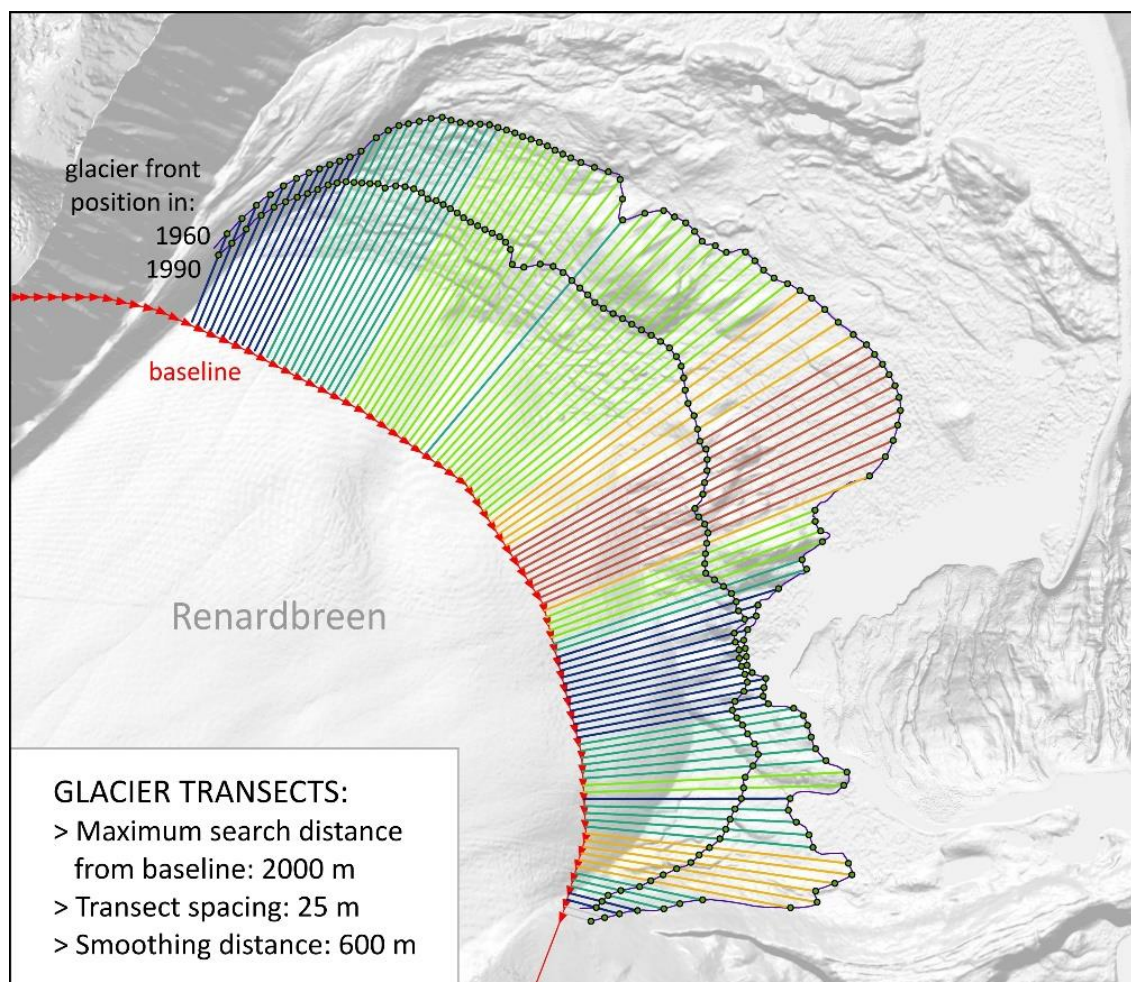
L – land-terminating, T – tidewater-terminating, b. – before

References

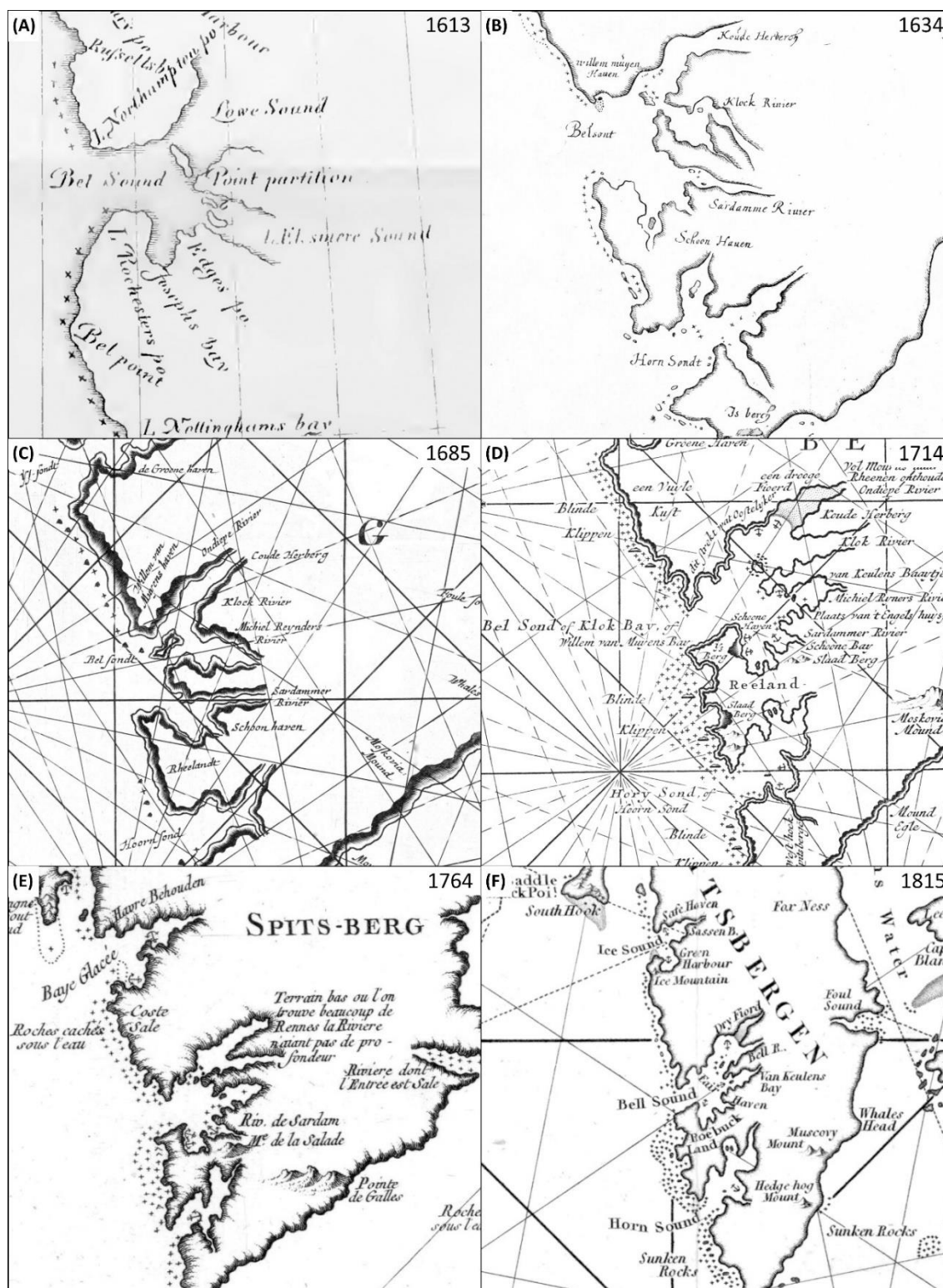
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ADDITIONAL FIGURES

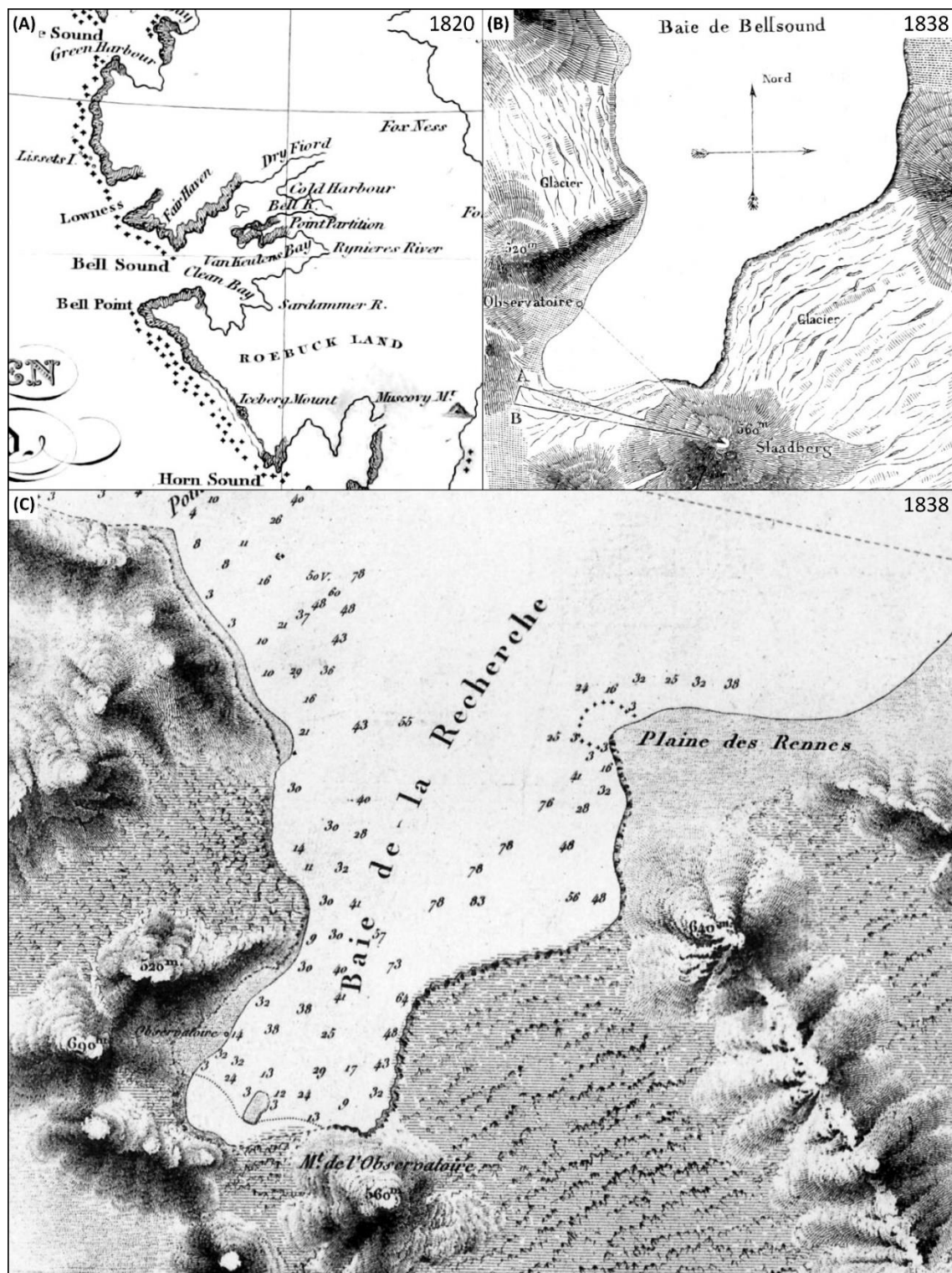
SM-1. Methodology DSAS GIS. Background: bathymetric (DEM; 2013 Norwegian Hydrographic Service); land (DEM; computed from aerial images S2011, NPI).



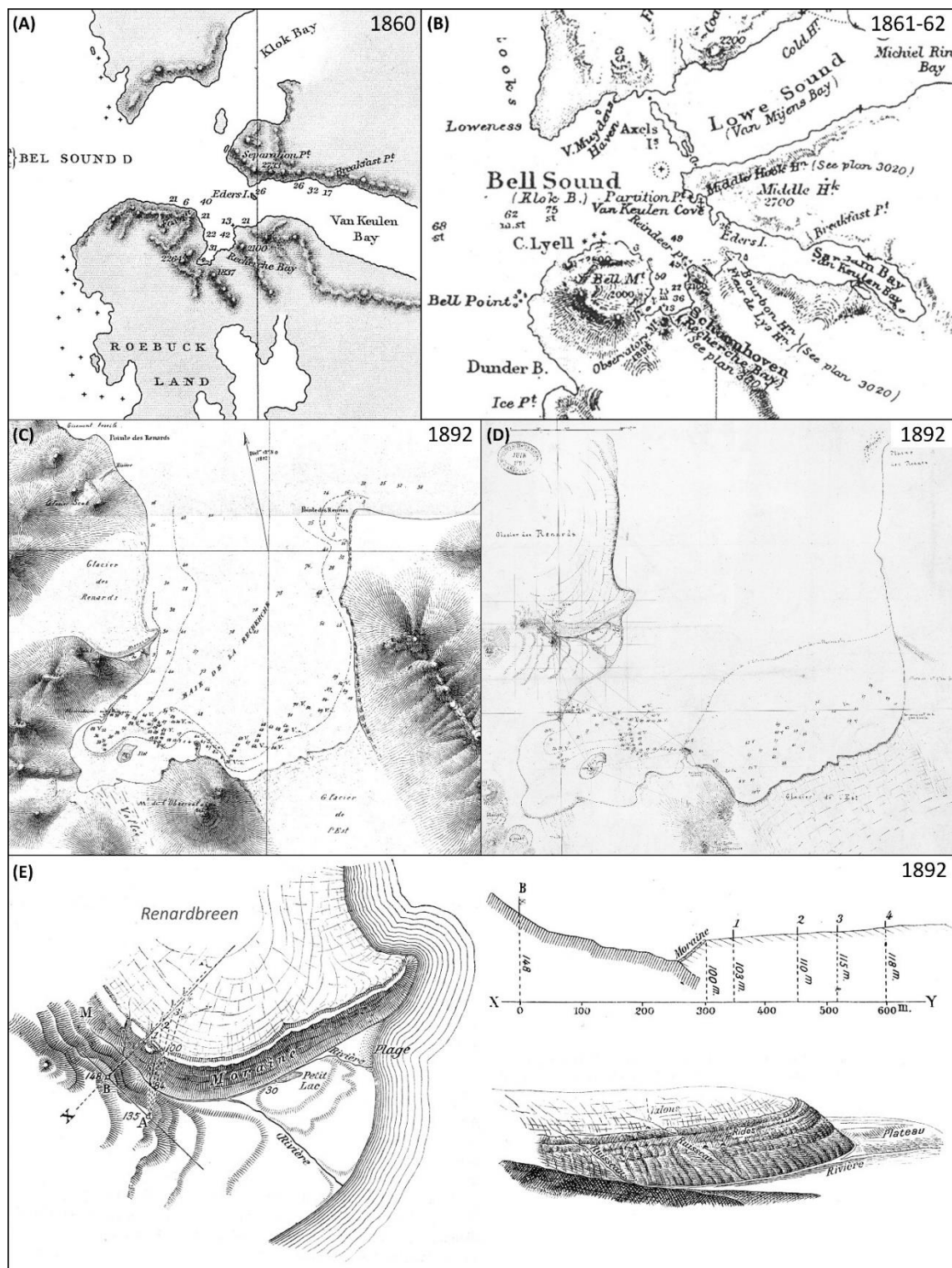
SM-2. Archival data see Table (SM-T1)



SM-3. Archival data see Table (SM-T1)



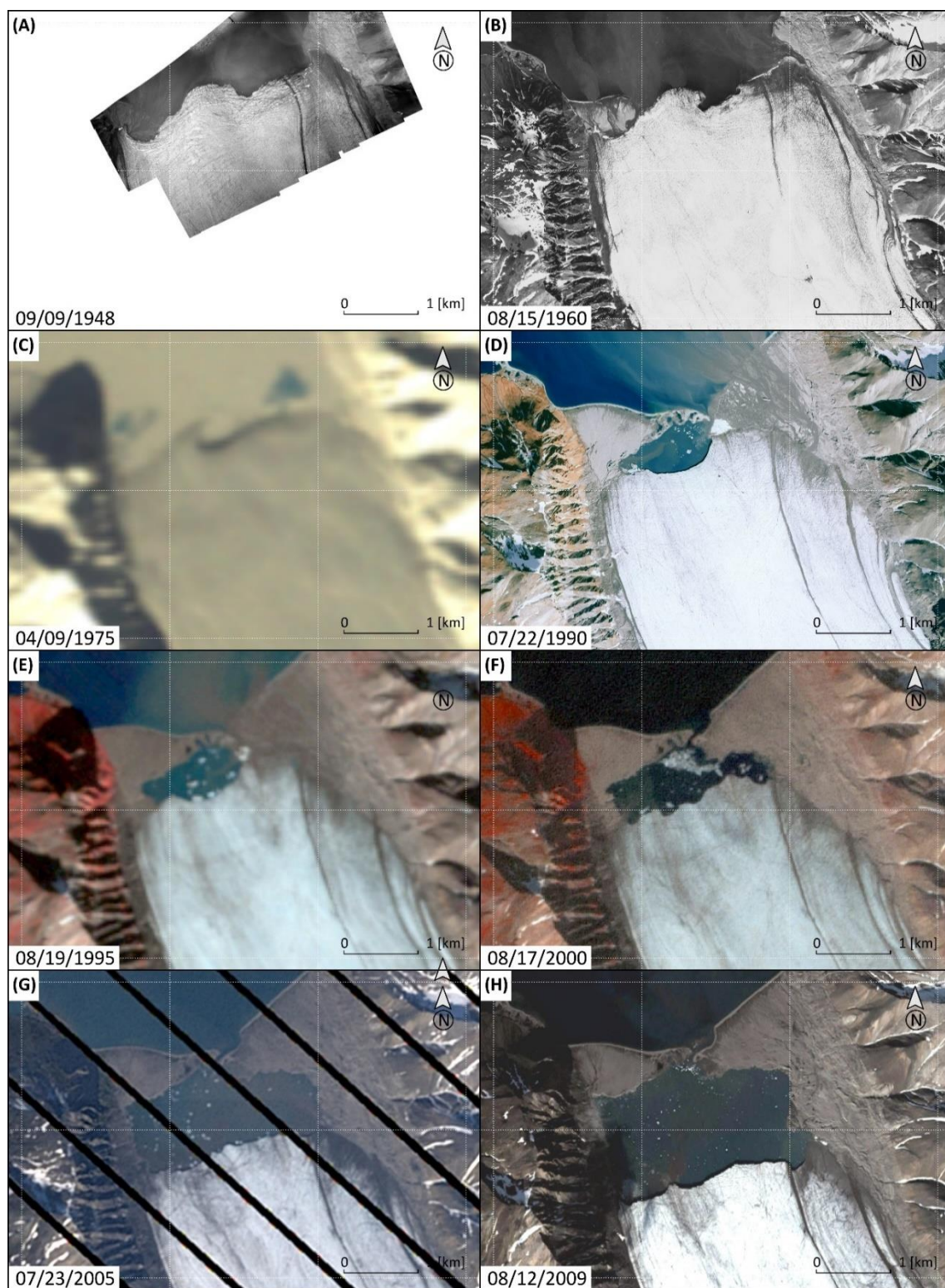
SM-4. Archival data see Table (SM-T1)



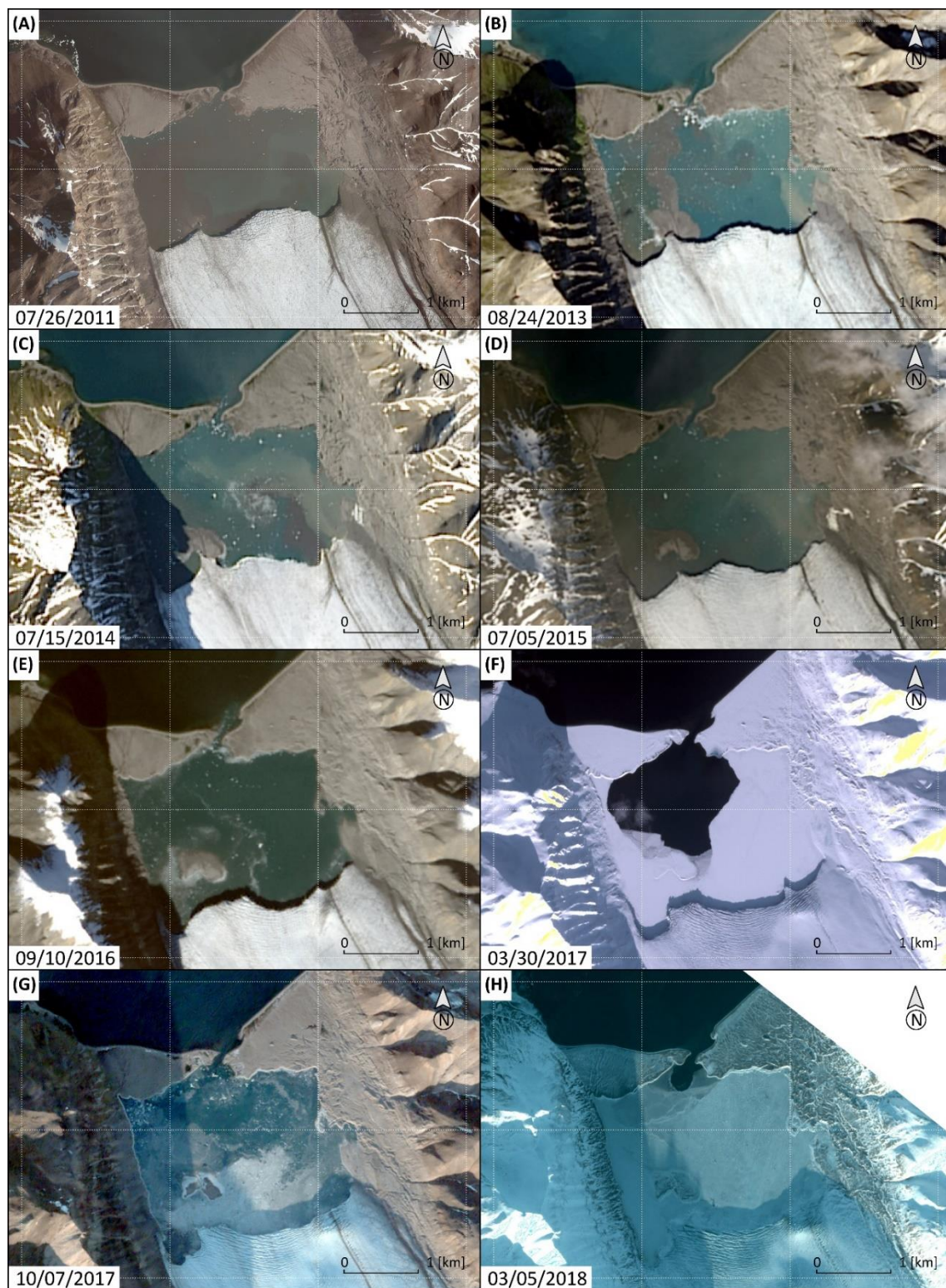
SM-5. Archival data see Table (SM-T1)



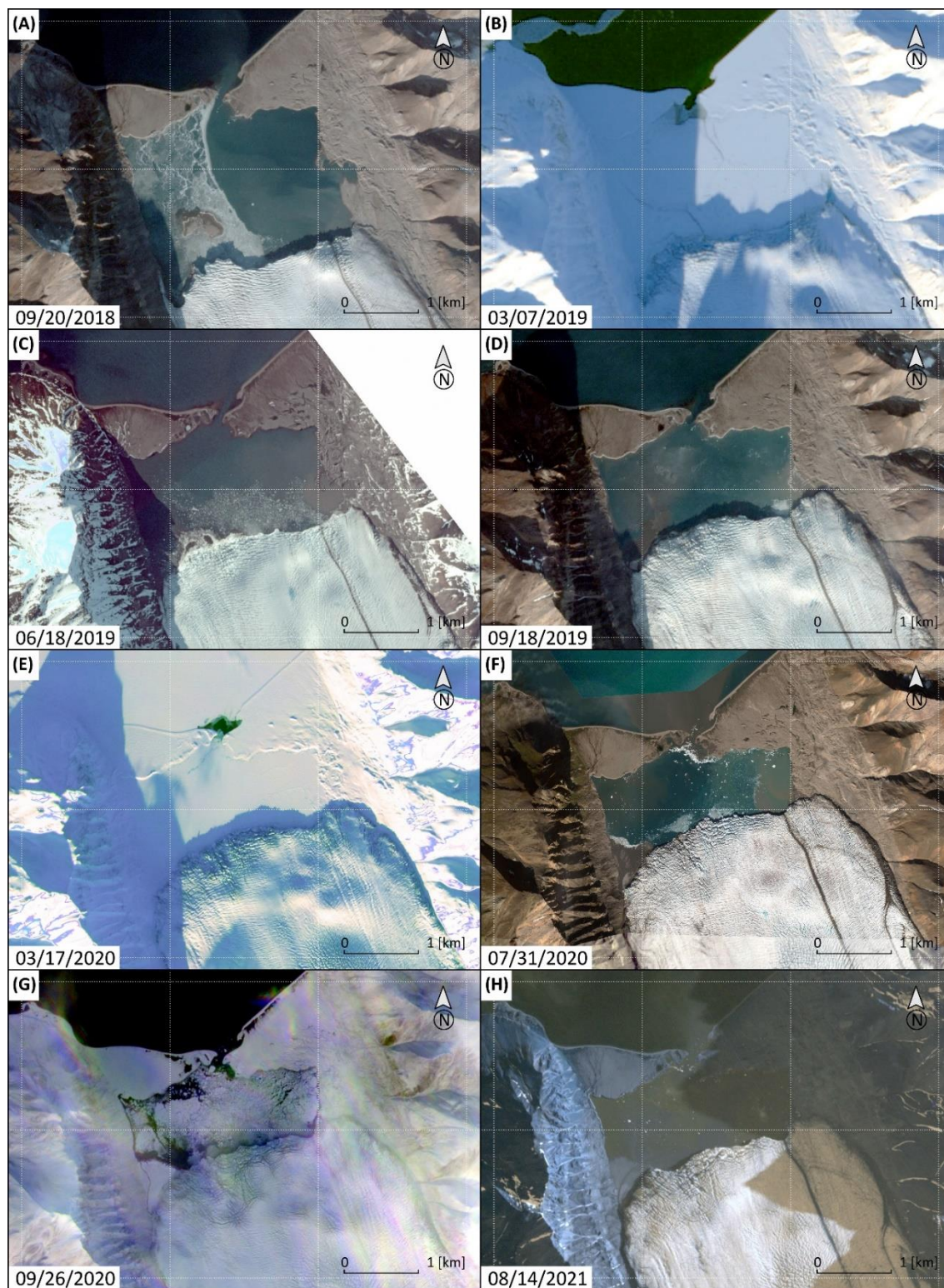
SM-6. Archival data see Table (SM-T1)



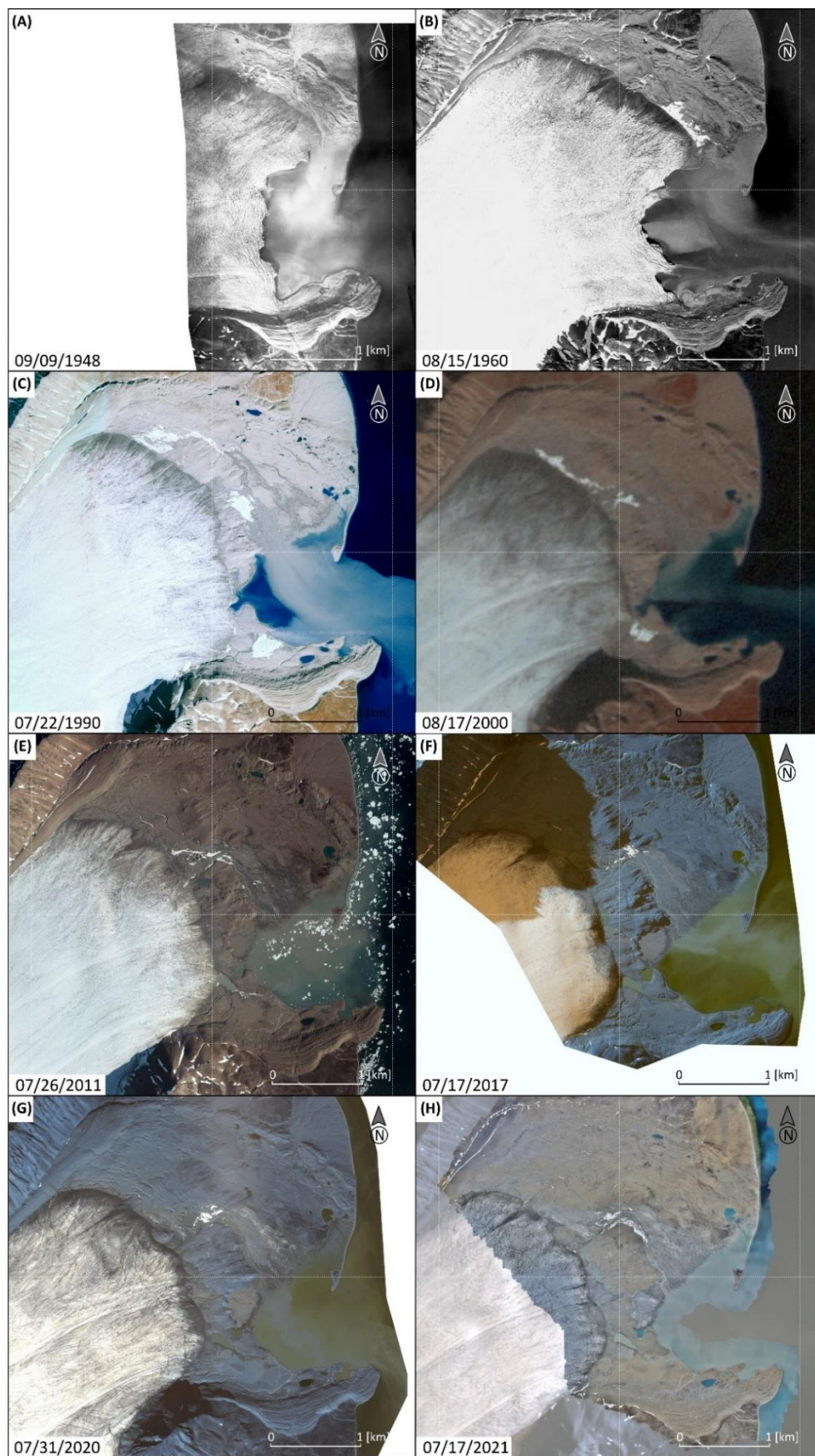
SM-7. Archival data see Table (SM-T1)



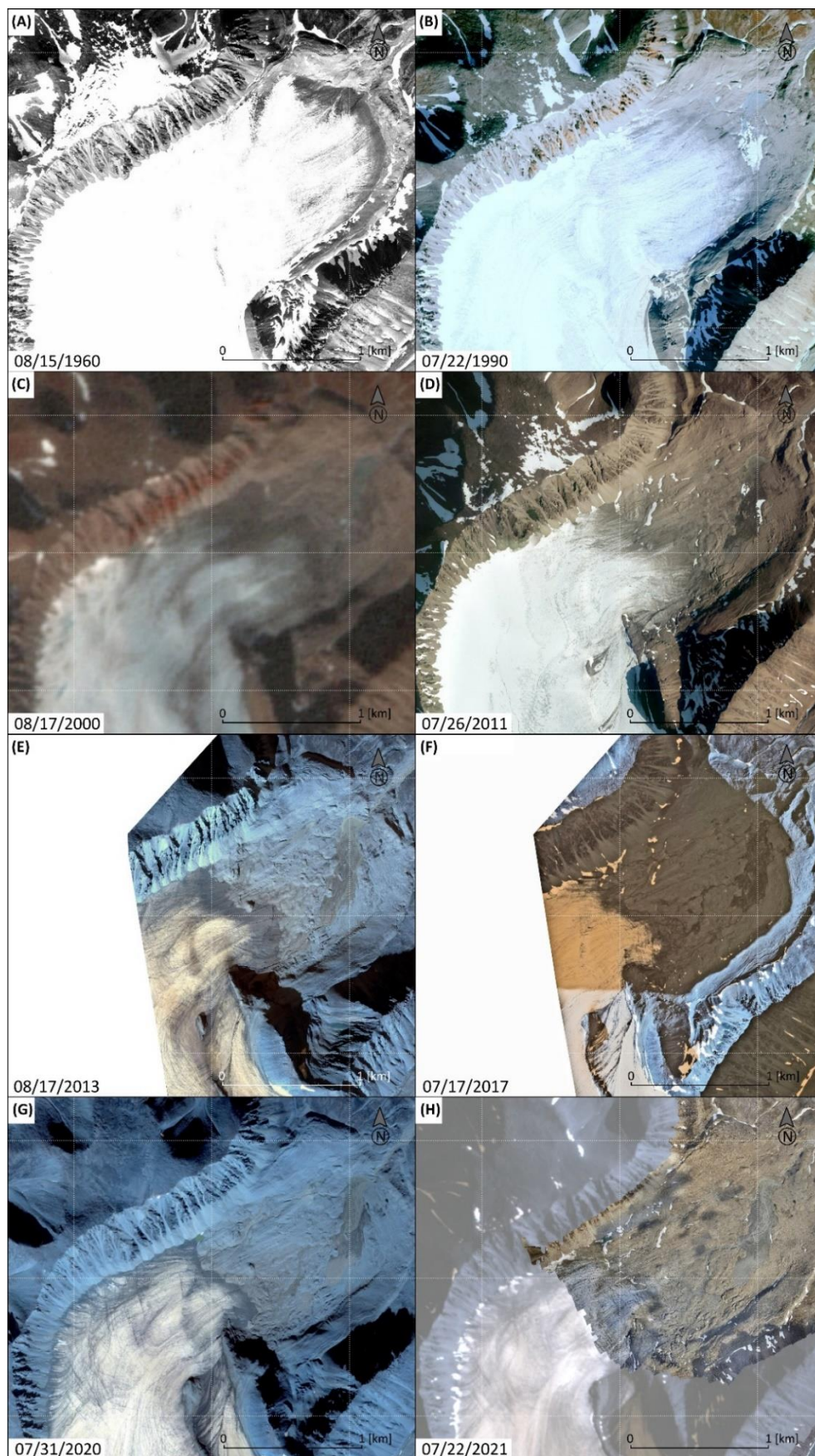
SM-8. Archival data see Table (SM-T1)



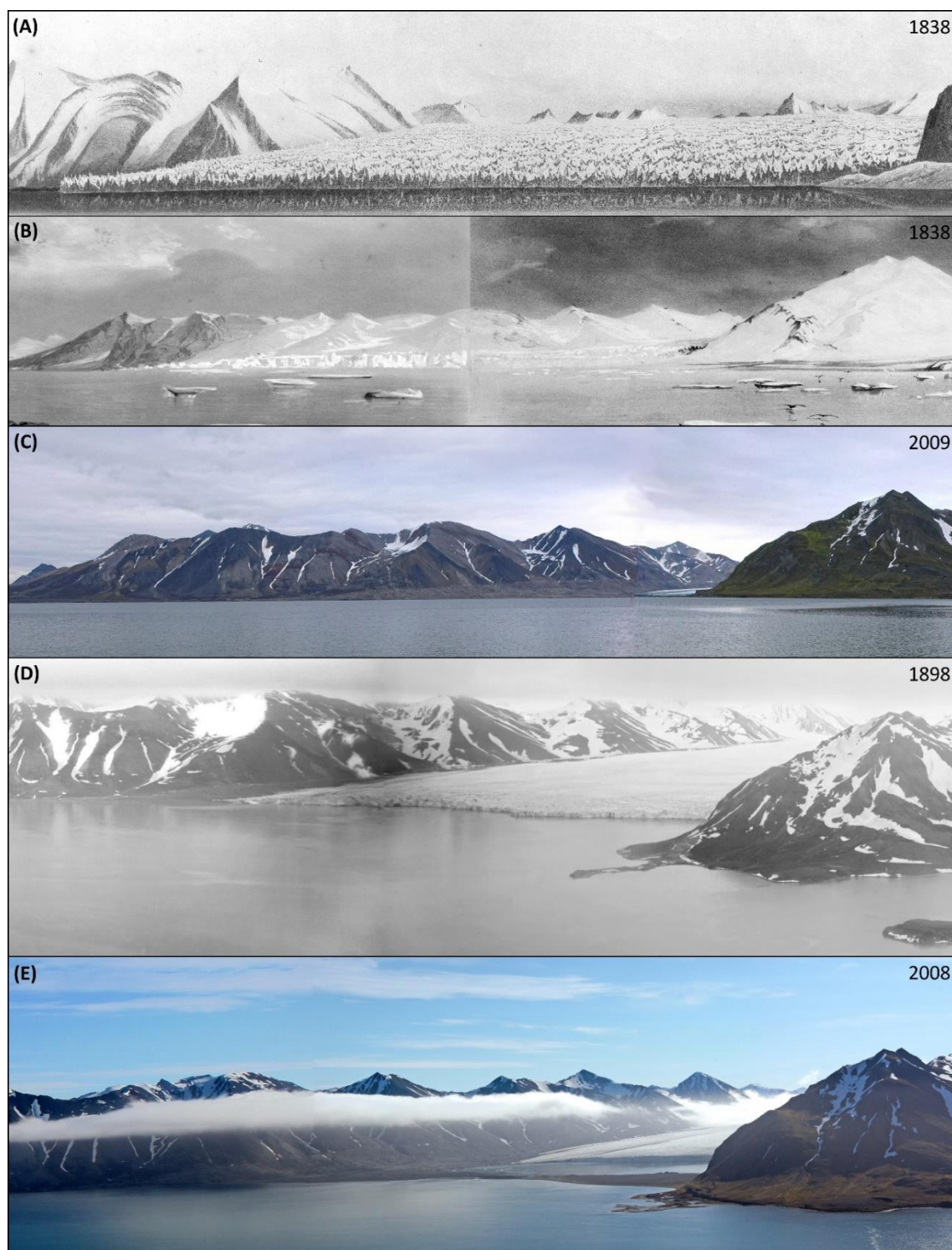
SM-9. Archival data see Table (SM-T1)



SM-10. Archival data see Table (SM-T1)



SM-11. Archival data see Table (SM-T1)



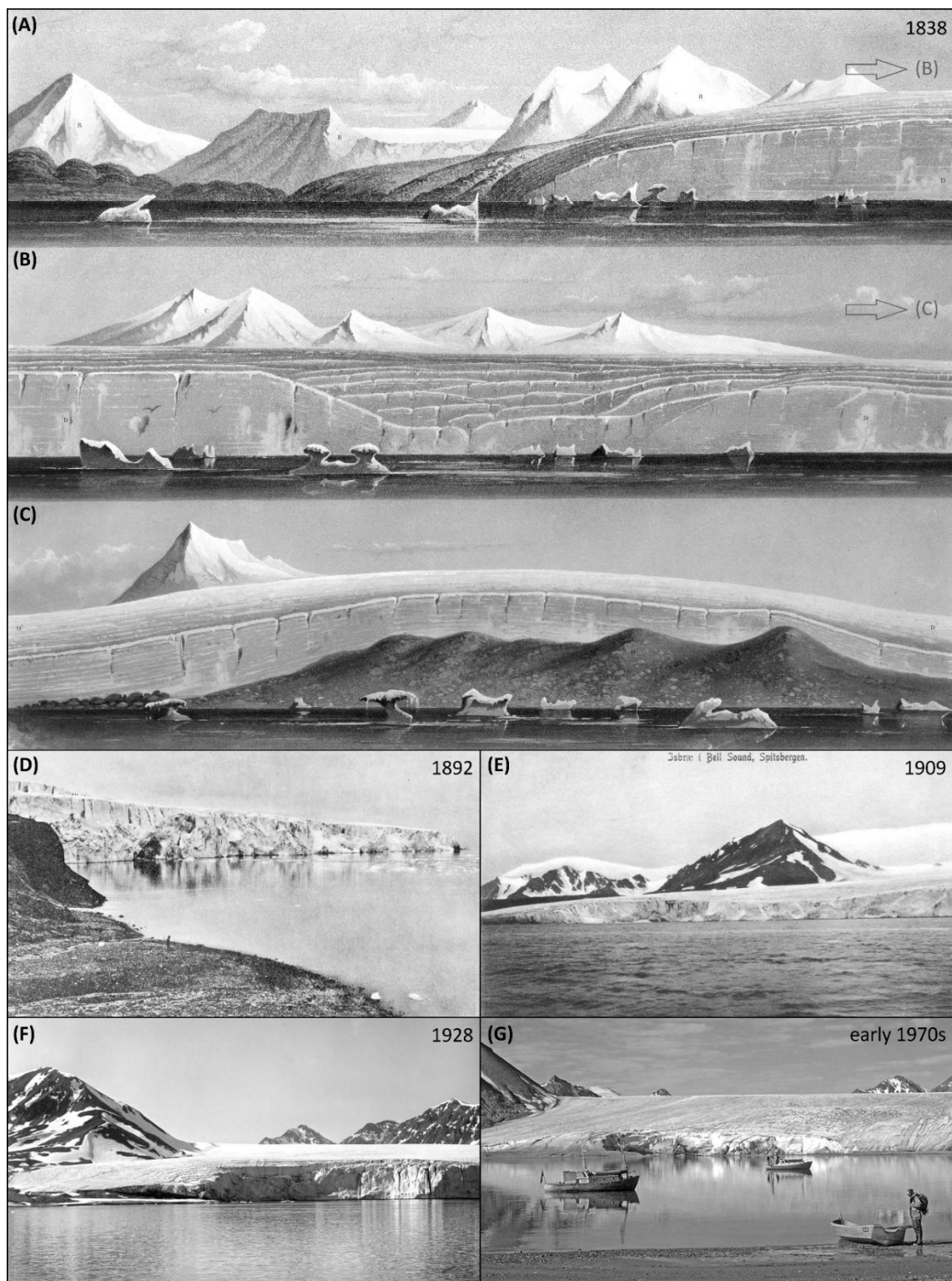
SM-12. Archival data see Table (SM-T1)



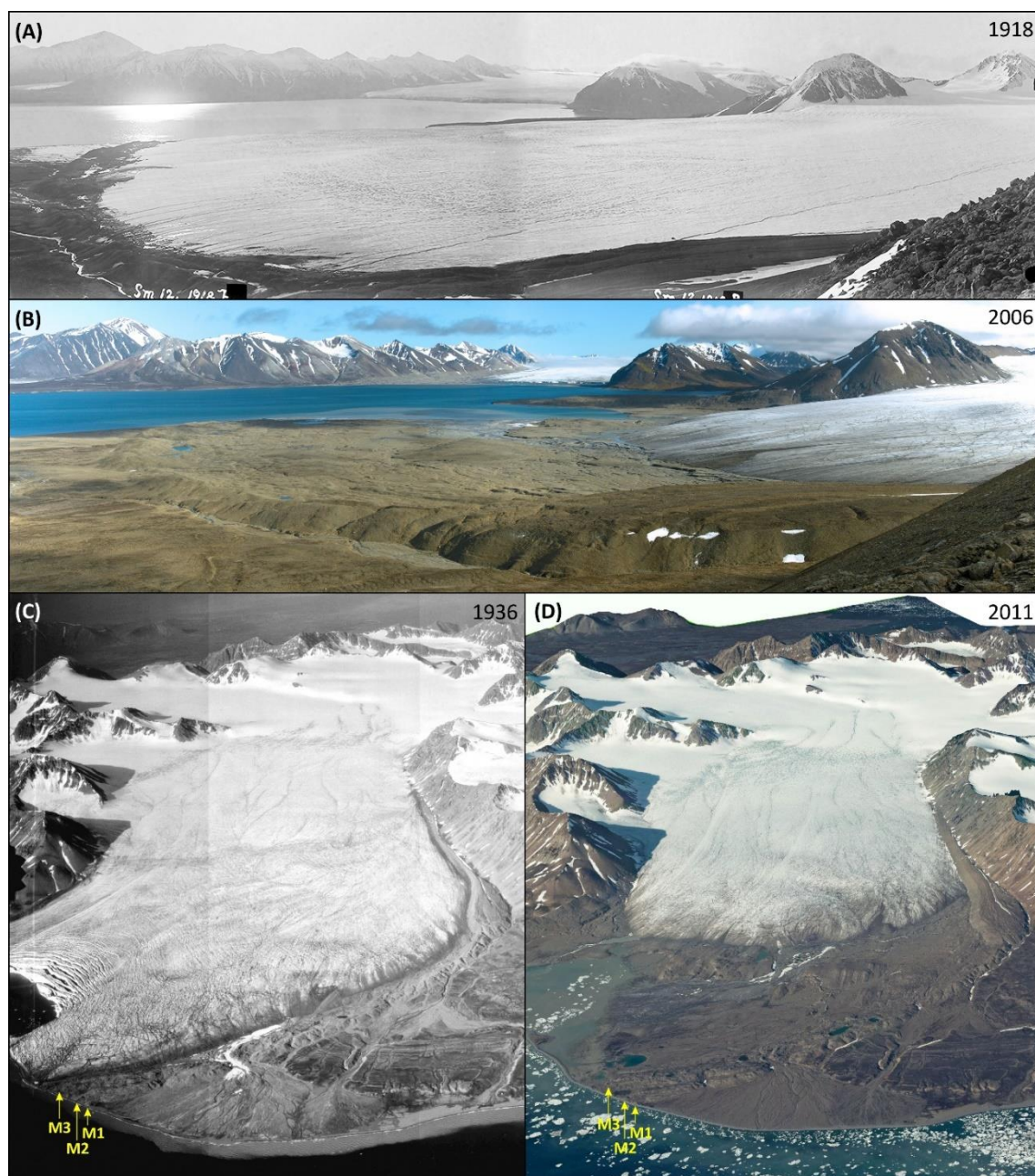
SM-13. Archival data see Table (SM-T1)



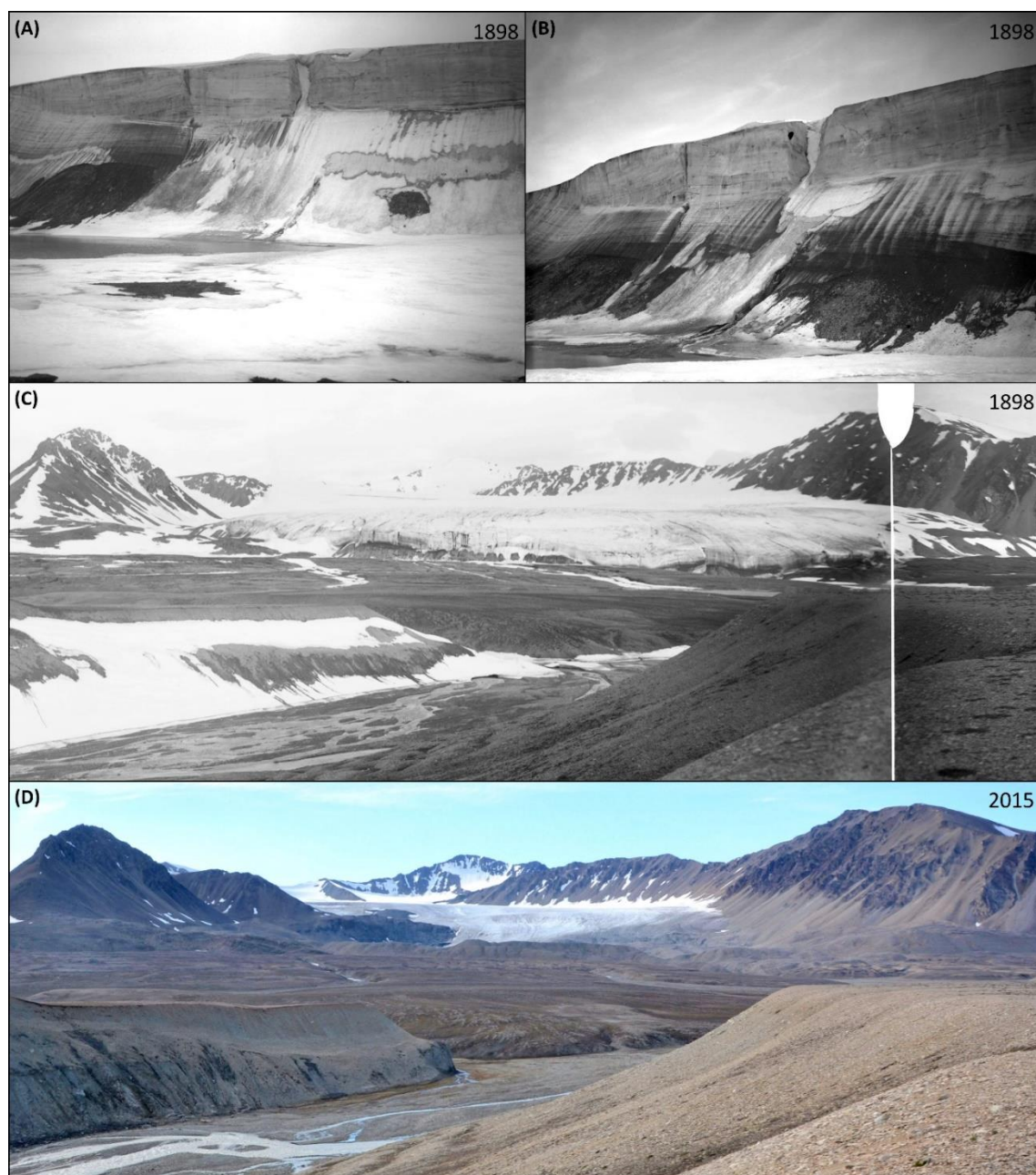
SM-14. Archival data see Table (SM-T1)



SM-15. Archival data see Table (SM-T1)



SM-16. Archival data see Table (SM-T1)



SM-17. Archival data see Table (SM-T1)

