Supplement of The Cryosphere, 16, 807–824, 2022
https://doi.org/10.5194/tc-16-807-2022-supplement

The Cryosphere Open Access EGU

Supplement of

Multi-decadal retreat of marine-terminating outlet glaciers in northwest and central-west Greenland

Taryn E. Black and Ian Joughin

Correspondence to: Taryn E. Black (teblack@uw.edu)

SUPPLEMENTARY INFORMATION

Wood et al. (2021) found biases in the ECCO ocean temperatures and applied corrections to the data, including a uniform 0.4 °C correction below 50m depth everywhere, and a linear trend to account for an initial 1 °C bias in Baffin Bay. Here we attempt to take advantage of those corrections by matching our data to those provided in the supplementary information of Wood et al. (2021).

We apply corrections to the deepwater ocean temperatures per each of our ocean points as follows:

1. Extract the temperatures for the bottom 60% of the water column at the given point
2. Determine the mean anomaly over the periods 1992-1997, 1998-2007, and 2008-2017 to match the supplementary data from Wood et al. (2021)
3. Compute the difference of the point data compared to Wood et al. (2021) supplementary data in the same region
4. Find a two-segment piecewise linear fit to the difference from (3), with endpoints at 1995, 2003, and 2013, using the python package scipy.optimize.curve_fit
5. Apply the output from (4) to all years (1992-2017) to compute a correction curve
6. Subtract the correction curve (5) from the original curve (1) to get a corrected temperature

By comparing our resulting means over the periods 1992-1997, 1998-2007, and 2008-2017 with those of Wood et al. (2021), we find that our corrected data agree well with theirs (Supplementary Figure 6).

21 **SUPPLEMENTARY TABLES**

ID	Name	Geographic Coordinates
1	Saqqarliup Sermia	68.88° N, 50.31° W
2	Alanngorliup Sermia	68.94° N, 50.22° W
3	Sermeq Kujalleq (Jakobshavn Isbræ)	69.14° N, 49.58° W
4	Sermeq Avannarleq	69.37° N, 50.30° W
5	Eqip Sermia	69.79° N, 50.24° W
6	Kangilernata Sermia	69.91° N, 50.34° W
7	Sermeq Kujalleq (Alianaatsup Sermia)	69.99° N, 50.16° W
8	Sermeq Avannarleq	70.07° N, 50.31° W
9	Sermeq Kujalleq (Store Gletsjer)	70.40° N, 50.54° W
10	Sermeq Avannarleq (Lille Gletsjer)	70.53° N, 50.50° W
11	Sermilik	70.63° N, 50.62° W
12	Kangilleq	70.72° N, 50.63° W
13	Sermeq Silarleq	70.81° N, 50.79° W
14	Perlerfiup Sermia	70.99° N, 50.91° W
15	Kangerluarsuup Sermia	71.25° N, 51.48° W
16	Kangerlussuup Sermia	71.46° N, 51.38° W
17	Kangilliup Sermia (Rink Isbræ)	71.75° N, 51.61° W
18	Umiammakku Sermiat	71.74° N, 52.39° W
19	Salliarutsip Sermia (Inngia Isbræ)	72.03° N, 52.59° W
20		72.78° N, 54.22° W
21	Sermeq (Upernavik Isstrøm)	72.85° N, 54.31° W
22		72.94° N, 54.33° W
23		73.03° N, 54.30° W
24		73.00° N, 54.64° W
25	Naajarsuit Sermiat	73.23° N, 55.13° W
26		73.38° N, 55.03° W
27	(Kakivfait Sermia A)	73.46° N, 55.29° W
28	(Kakivfait Sermia B)	73.49° N, 55.43° W
29	Qeqertarsuup Sermia	73.59° N, 55.54° W

30	Sermeq Kujalleq (Ussingbraer A)	73.83° N, 55.59° W
31	Sermeq Avanarleq (Ussingbraer B)	73.94° N, 55.68° W
32	Ikissuup Sermersua (Cornell Gletsjer)	74.24° N, 56.05° W
33		74.30° N, 56.09° W
34	Illullip Sermia	74.40° N, 56.04° W
35	Nunatakassaap Sermia (Alison Glacier)	74.61° N, 56.06° W
36		74.70° N, 56.32° W
37		74.79° N, 56.53° W
38		74.87° N, 56.76° W
39		74.91° N, 56.91° W
40	Tuttulikassaap Sermia (Hayes Gletsjer)	74.94° N, 57.08° W
41		75.04° N, 57.53° W
42	Kjer Gletsjer	75.14° N, 57.78° W
43		75.20° N, 57.78° W
44	Sermersuaq (Steenstrup Gletsjer)	75.29° N, 57.91° W
45	Dietrichson Gletsjer	75.46° N, 58.03° W
46	Sverdrup Gletsjer	75.59° N, 58.12° W
47	Nansen Gletsjer	75.74° N, 58.89° W
48	Nordenskiöld Gletsjer	75.83° N, 59.04° W
49		75.89° N, 59.16° W
50		75.97° N, 59.49° W
51	Nuussuup Sermia (Kong Oscar Gletsjer)	76.01° N, 59.73° W
52		76.06° N, 59.96° W
53		76.08° N, 60.13° W
54	Issuusarsuit Sermiat (Peary Gletscher)	76.05° N, 60.63° W
55		76.21° N, 60.66° W
56	Rink Gletsjer	76.23° N, 60.92° W
57		76.25° N, 61.38° W
58	Qeqertat Timaanni Sermeq (Döcker Smith Gletsjer)	76.25° N, 61.78° W
59	Döcker Smith Gletsjer C	76.28° N, 61.91° W
60	Döcker Smith Gletsjer B	76.32° N, 61.97° W

61	Morell Gletsjer	76.30° N, 62.52° W
62	Innaqqissorsuup Oqquani Sermeq (Gade Gletsjer)	76.36° N, 62.84° W
63		76.43° N, 63.39° W
64		76.40° N, 63.55° W
65	Yngvar Nielsen Gletsjer	76.35° N, 64.08° W
66		76.37° N, 64.24° W
67		76.29° N, 64.61° W
68	Helland Gletsjer	76.19° N, 64.83° W
69	Savissuup Sermia	76.20° N, 65.24° W
70		76.34° N, 65.68° W
71		76.32° N, 66.84° W
72		76.26° N, 67.28° W
73		76.19° N, 67.48° W
74	Paakitsup Sermersua (Pituffik Gletsjer)	76.23° N, 68.79° W
75	Ullip Sermia (Harald Moltke Bræ)	76.59° N, 67.74° W
79	Leidy Gletsjer	77.26° N, 66.08° W
80	Qaqujaarsuup Sermia (Heilprin Gletsjer)	77.54° N, 66.00° W
81	Qeqertaarsuusarsuup Sermia (Tracy Gletsjer)	77.65° N, 66.05° W
82	Tuttulipaluup Sermia (Farquhar Gletsjer)	77.70° N, 66.25° W
83	Paarnarsuit Sermiat (Hart Gletsjer)	77.69° N, 67.14° W
84	Quinisut Sermiat (Hubbard Gletsjer)	77.54° N, 67.81° W
85	Kangerluarsuup Sermia (Bowdoin Gletsjer)	77.68° N, 68.60° W
86	Qinnguata Sermia (Verhoeff Gletsjer)	77.86° N, 69.89° W
87	Neqip Sermia (Morris Jesup Gletsjer)	77.89° N, 71.13° W
88	Arfalluarfiup Sermia (Diebitsch Gletsjer)	77.94° N, 71.60° W
89	Arfalluarfiup Sermia (Clements Markham Gletsjer)	77.93° N, 71.95° W
90	Bamse Gletsjer	78.02° N, 72.17° W

Table S1: ID, name, and geographic coordinates for all glaciers in this study. Names provided are official names, with alternative or common name in parentheses, from Bjørk *et al.* (2015). Geographic coordinates are for a point feature on each glacier.

Ocean Point	Region	Coordinates
1	Disko Bay	69.25° N, 52.25° W
2	Uummannaq Fjord	70.85° N, 54.25° W
3	Upernavik Icefjord and north	73.25° N, 58.0 ° W
4	South Melville Bay/Wilcox Head	74.5° N, 60.0° W
5	Central Melville Bay	75.5° N, 61.75° W
6	North Melville Bay/Cape York	75.75° N, 65.0° W
7	Wolstenholme Bay/Thule	76.25° N, 71.0° W
8	Inglefield Fjord	77.0° N, 72.5° W

Table S2: Sample point numbers, region names, and geographic coordinates for locations from which ocean data were sampled.

ID	Number of Observations	Net ΔArea (km^2)	Net ΔLength (km)	Breakpoint Year
1	43	-5.11*	-1.24*	2001
2	43	-1.34*	-0.61*	2000
3	43	-125.68*	-16.26*	1993
4	42	-6.76*	-2.73*	1996
5	41	-5.46*	-1.55*	1996
6	41	-9.16*	-2.88*	1997
7	39	-3.36	-0.77	N/A
8	38	-0.31	-0.07	1987
9	41	-0.12	-0.03	2002
10	40	-2.83*	-1.49*	1997
11	40	-0.81	-0.36	2004
12	40	0.06	0.04	2003
13	39	-16.77*	-5.27*	2000
14	39	-6.90*	-2.86*	2006
15	40	-3.01*	-1.41*	1997
16	40	0.46	0.13	1993
17	41	-1.92	-0.47	1984
18	42	-12.11*	-5.05*	1996
19	42	-26.52*	-8.49*	2003
20	41	-10.82*	-6.67*	1985
21	41	-2.08	-0.68	2013
22	42	-15.61*	-4.93*	2007
23	42	-40.62*	-8.42*	1997
24	43	-5.69*	-3.55*	2015
25	45	0.00	0.00	2012
26	43	-0.25	-0.15	1991
27	43	-4.79*	-1.44*	2009
28	42	-17.19*	-5.67*	2007
29	41	-5.02*	-1.35*	1999
30	41	-1.73*	-0.51*	2009

31	41	-3.45*	-0.76*	1994
32	40	-6.54*	-1.54*	2013
33	40	-3.28*	-1.50*	2002
34	41	-4.76*	-1.10*	2001
35	40	-58.08*	14.31*	1996
36	40	-46.00*	-13.36*	2001
37	39	-21.03*	-5.42*	1984
38	39	-9.08*	-3.31*	1994
39	40	-5.66*	-2.00*	2008
40	40	-10.76*	-2.65*	1996
41	40	-8.19*	-1.20*	1997
42	43	-83.26*	-14.98*	2010
43	43	-23.55*	-7.51*	2013
44	43	-34.67*	-7.27*	1995
45	42	-7.11*	-2.78*	2006
46	41	-39.48*	-7.93*	2000
47	42	-28.35*	-4.83*	2014
48	42	-8.71*	-2.67*	2010
49	42	-1.74*	-0.64*	1993
50	42	-3.09*	-1.94*	1988
51	42	-10.84	-3.09	1989
52	43	-11.47*	-3.93*	2006
53	44	-8.36*	-3.49*	2011
54	46	-13.51*	-3.65*	2019
55	45	-1.63	-0.85	1992
56	44	-11.23*	-3.87*	1995
57	45	-1.90*	-0.97*	2002
58	46	-10.93*	-3.47*	1996
59	46	-15.36*	-9.22*	2001
60	46	-19.59*	-6.38*	1993
61	46	-16.46*	-5.38*	2005

62	46	-9.27*	-1.84*	1982
63	45	-8.65*	-3.17*	2012
64	45	-4.03*	-1.96*	1997
65	40	-16.14*	-7.01*	2013
66	39	-0.21	-0.12	N/A
67	38	-3.22*	-1.61*	1998
68	38	-4.36*	-1.43*	1996
69	39	-5.68*	-1.89*	1996
70	38	-23.86*	-5.69*	2001
71	39	-5.78*	-2.28*	1997
72	33	-7.71*	-3.27*	1998
73	34	-18.44*	-5.19*	1992
74	33	-11.10*	-2.45*	1996
75	39	-33.54*	-6.10*	1999
79	44	-2.06*	-0.74*	1999
80	44	-6.12*	-1.78*	1996
81	44	-51.06*	-12.17*	1982
82	38	-7.28*	-3.83*	1998
83	45	-1.45*	-0.87*	2006
84	45	-2.10*	-1.01*	1994
85	43	-2.70*	-1.24*	2003
86	42	-0.83	-0.29	1997
87	42	-1.25	-0.42	1998
88	42	-5.11*	-1.72*	1997
89	38	-1.03*	-0.85*	1996
90	42	-1.27*	-0.80*	1997

Table S3: Total number of observations, net area and equivalent length change since first observation, and breakpoint year for area and equivalent length. Significant area and length changes are indicated by an asterisk (*) after the value.

SUPPLEMENTARY FIGURES

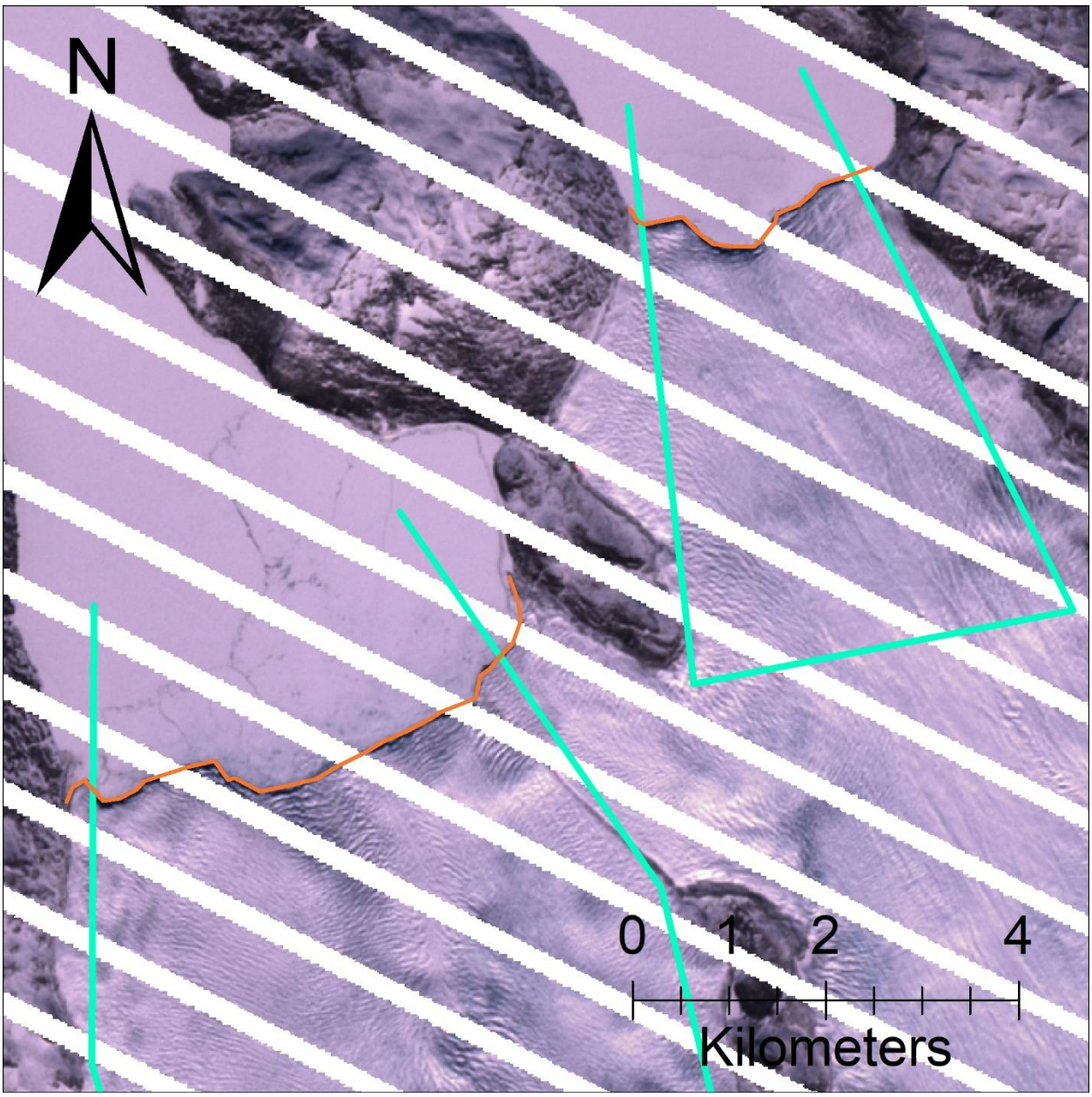

Figure S1: Example of terminus digitization (red lines) across Landsat-7 scan-line corrector gaps, for glaciers #1 (Saqqarliup Sermia) and #2 (Alanngorliup Sermia). The base image is a Landsat-7 image from 25 April 2012. This image is typical of the images we used to digitize across scan-line corrector gaps.

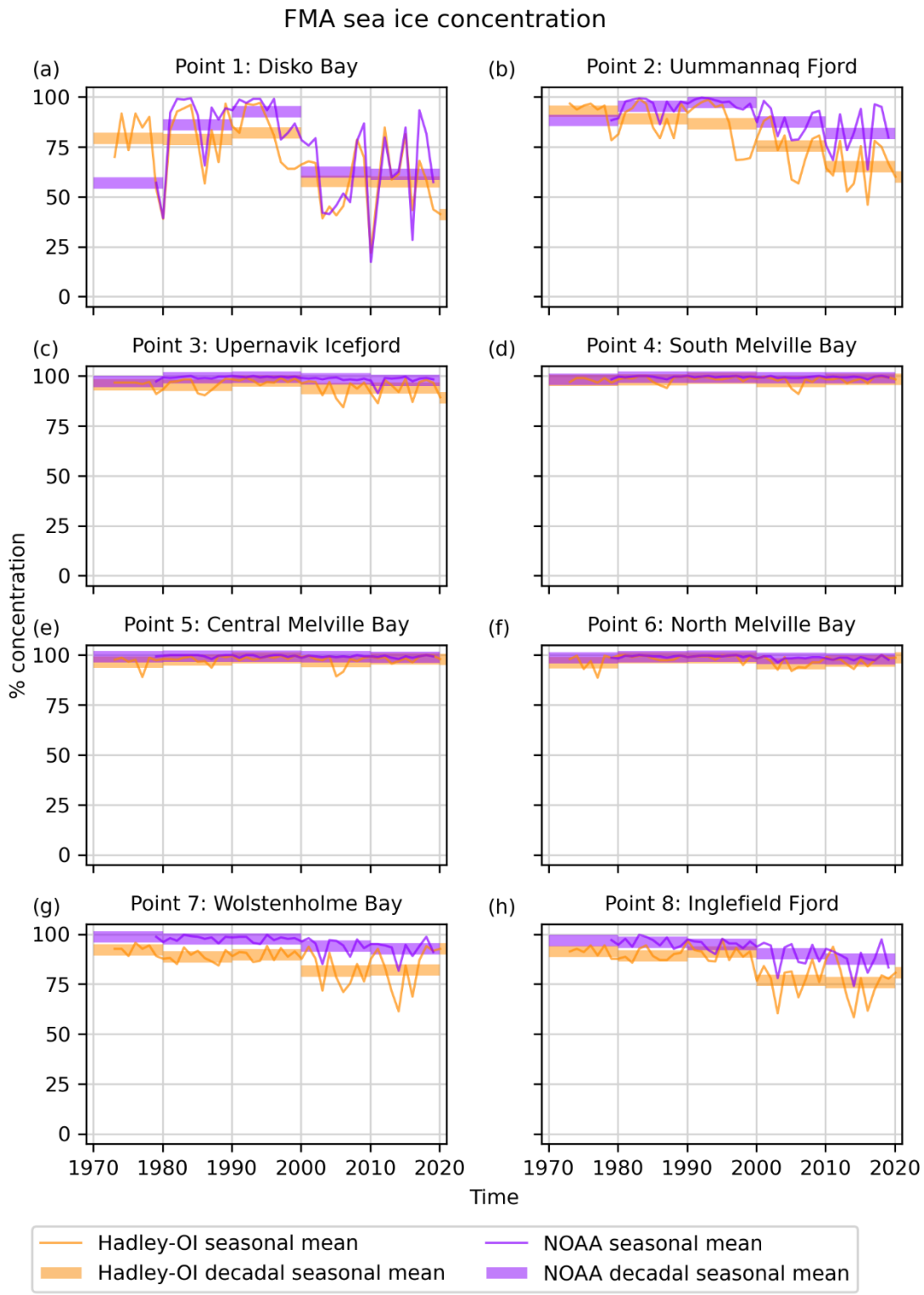

Figure S2: Annual and decadal February-April mean sea-ice concentration from Hadley-OI (orange) and NOAA (purple). Each panel corresponds with an ocean point in Figure 1.

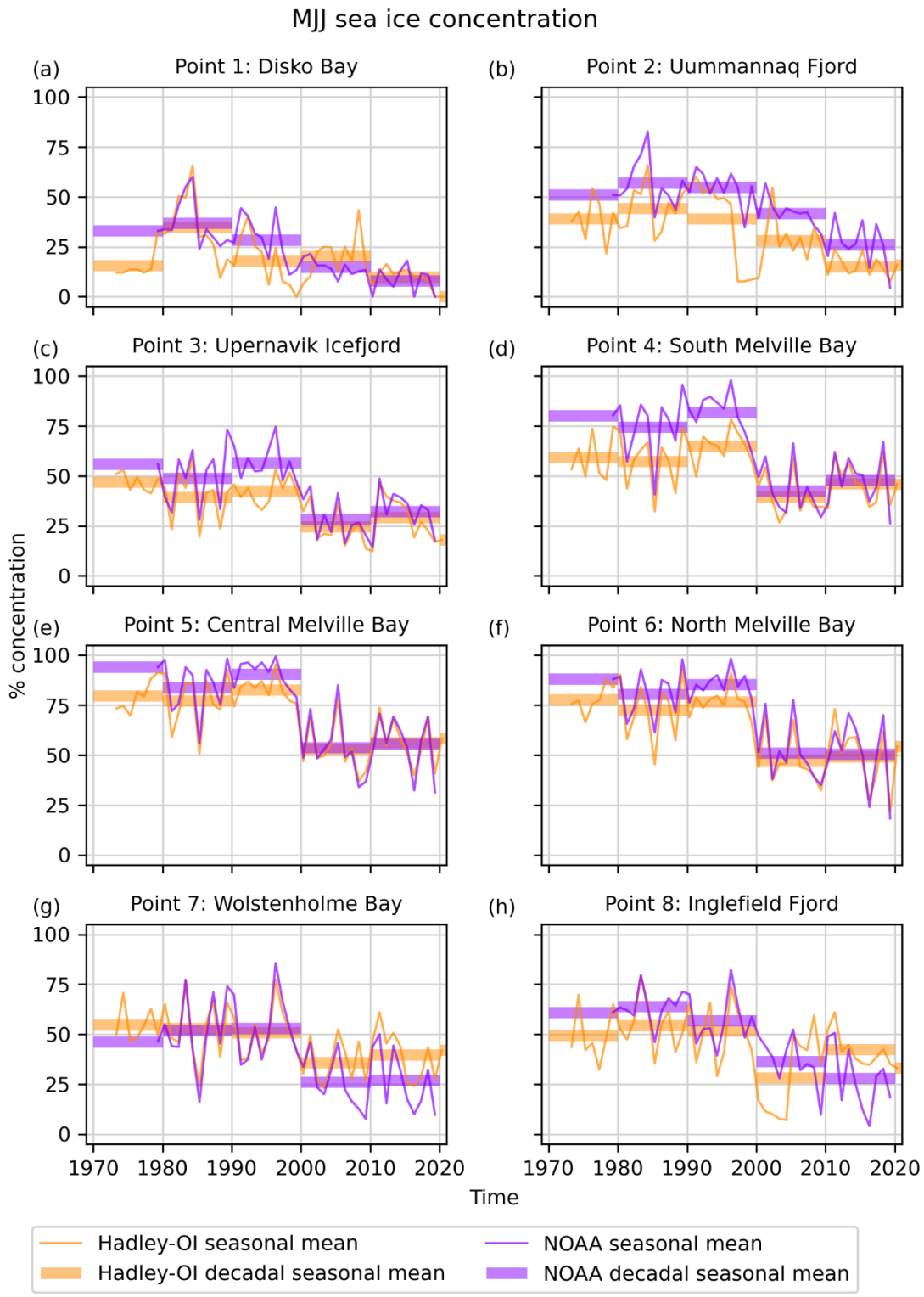

Figure S3: Annual and decadal May-July mean sea-ice concentration from Hadley-OI (orange) and NOAA (purple). Each panel corresponds with an ocean point in Figure 1.

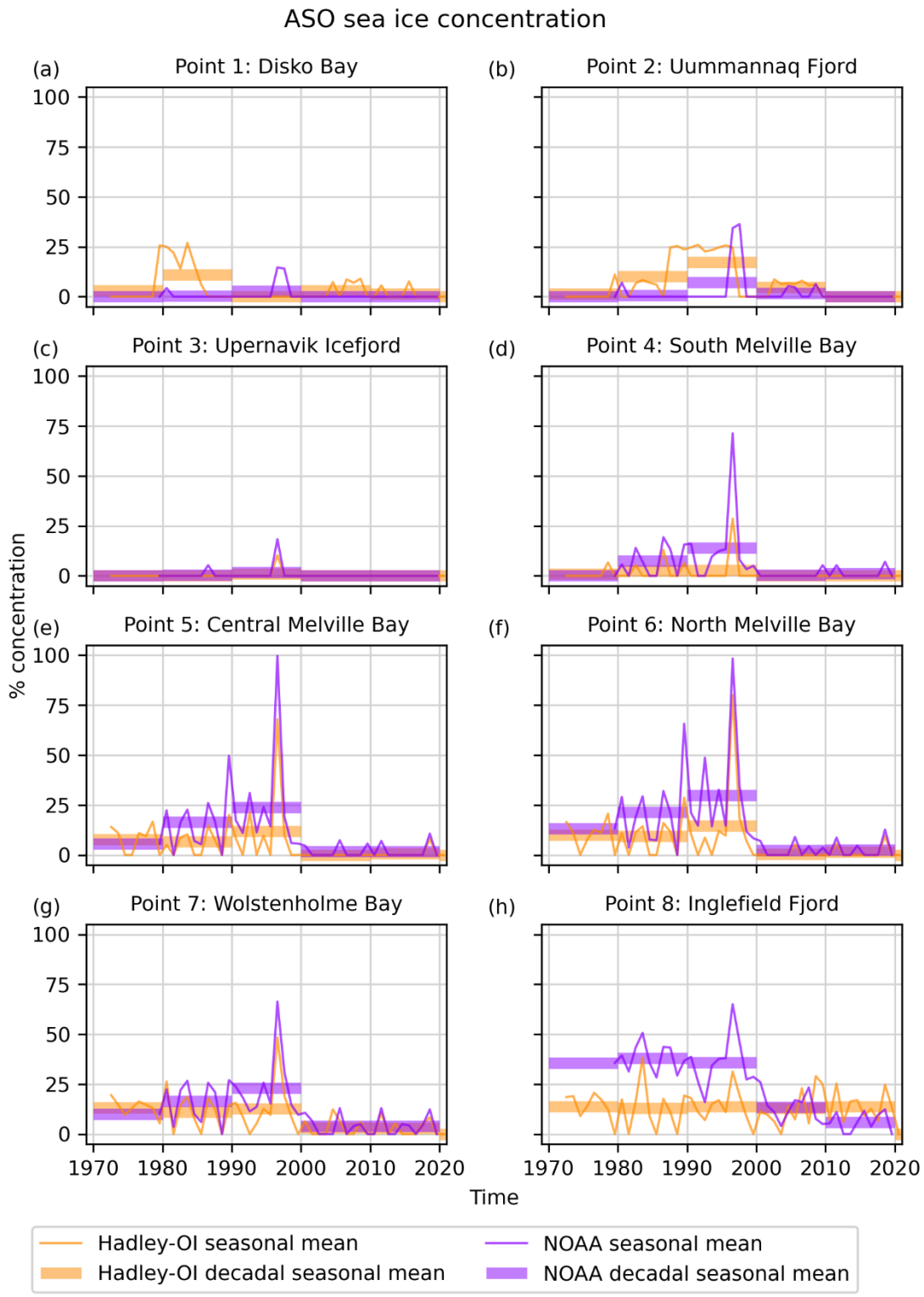

Figure S4: Annual and decadal August-October mean sea-ice concentration from Hadley-OI (orange) and NOAA (purple). Each panel corresponds with an ocean point in Figure 1.

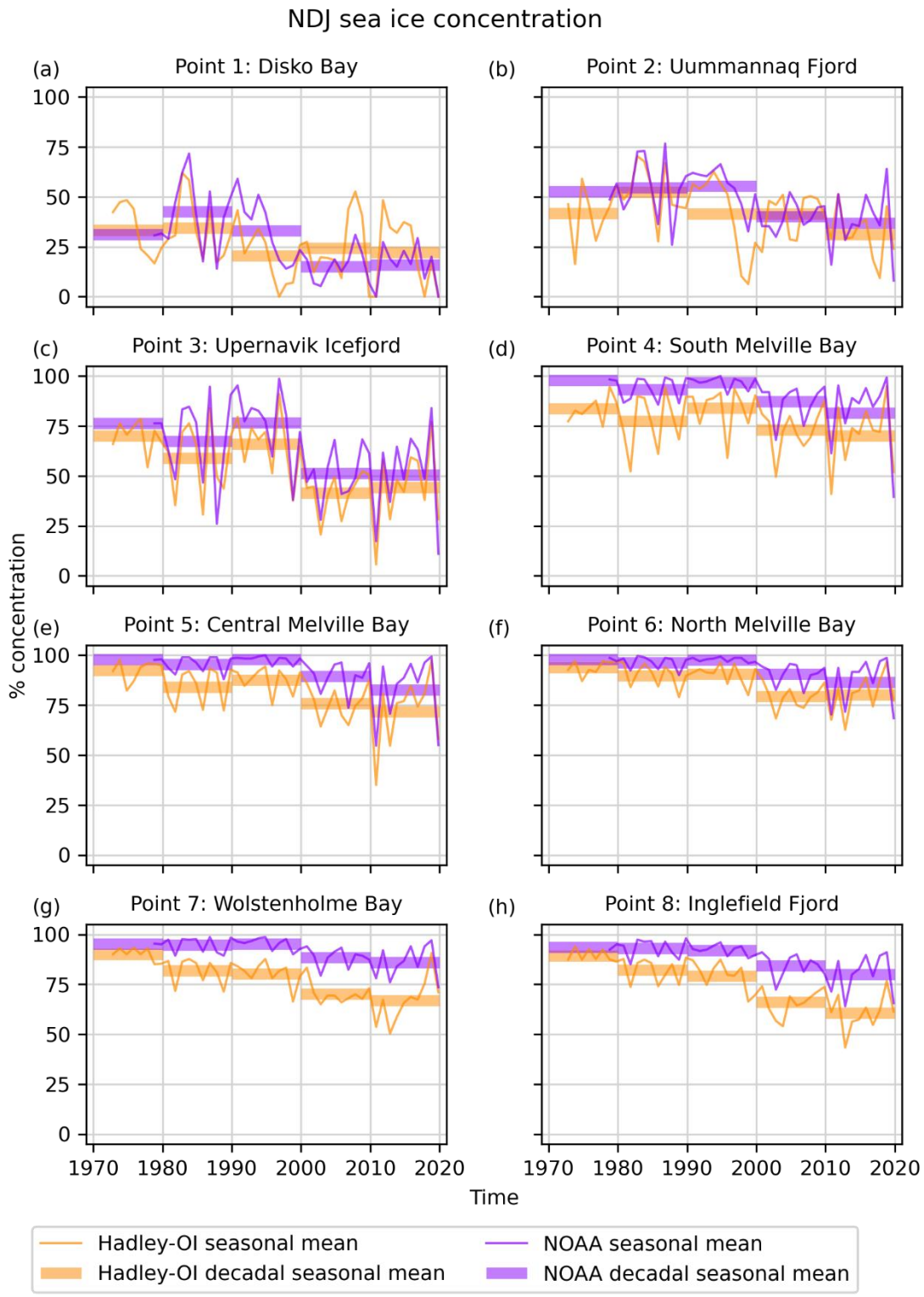

Figure S5: Annual and decadal November-January mean sea-ice concentration from Hadley-OI (orange) and NOAA (purple). Each panel corresponds with an ocean point in Figure 1.

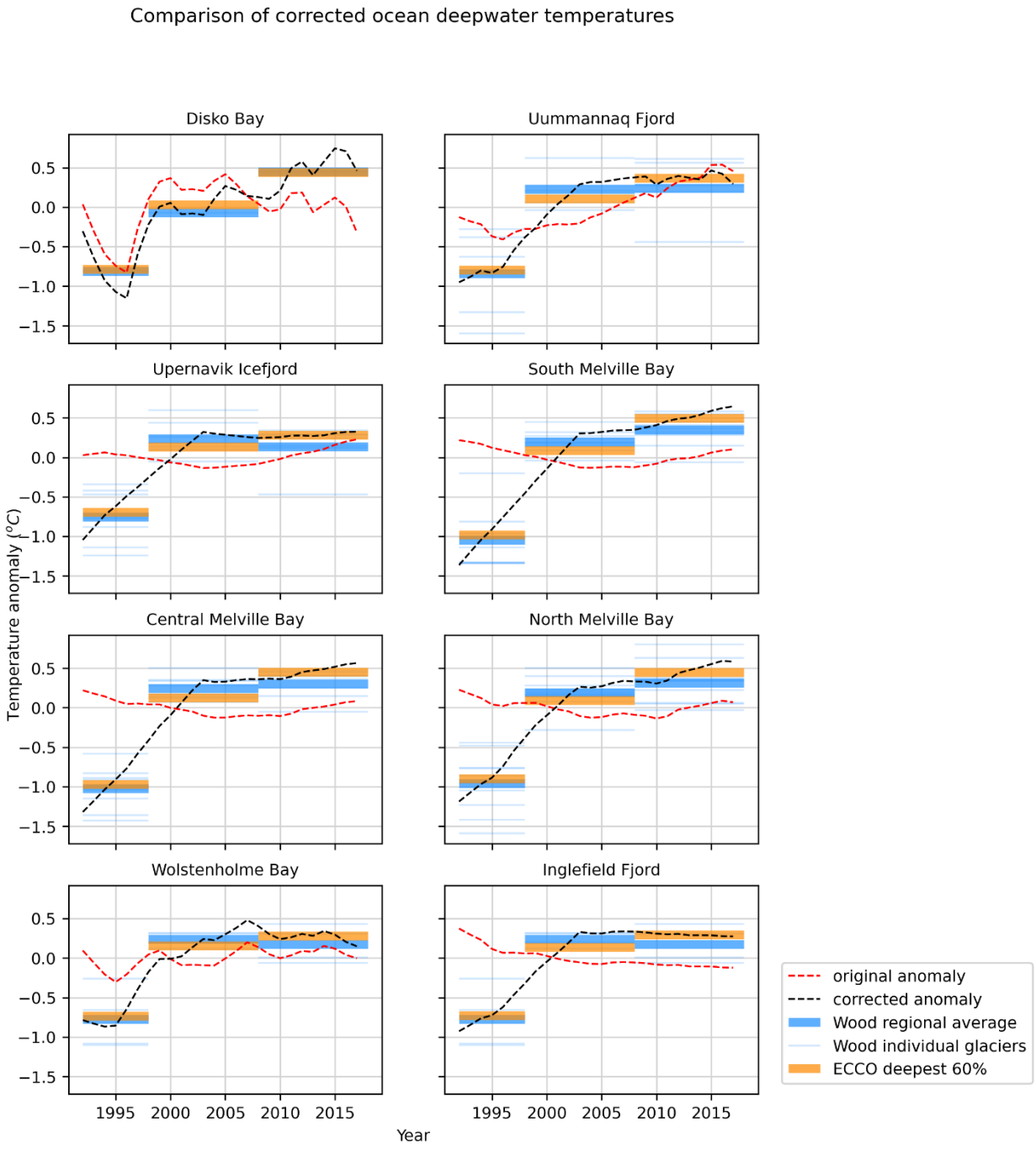

Figure S6: Comparison of our uncorrected (red) and corrected (black) deepwater ocean temperatures and decadal means (orange) to the decadal means of Wood et al. (2021) (blue). Each panel corresponds with an ocean point in Figure 1.