

Supplementary Information

5 Table S1. Details of the various data sources used for this study, including Sentinel-2 imagery sourced from the European Space Agency (ESA) Copernicus Open Access Hub available at <https://scihub.copernicus.eu/> with associated tile IDs (*tile IDs were downloaded for each of the study dates). Information is also provided for the ArcticDEM 10m tile IDs sourced from the Polar Geospatial Centre available at <https://www.pgc.umn.edu/data/arcticdem/>

Image Type	Acquisition Date	Tile ID	Source
Sentinel-2 L1C	22/05/2016	T20XMN*	ESA
		T20XMP*	ESA
		T20XNN*	ESA
		T20XNP*	ESA
	12/06/2016		
	28/06/2016		
	08/07/2016		
	18/07/2016		
	29/07/2016		
	07/08/2016		
	25/08/2016		
	03/09/2016		
	30/05/2017		
	10/06/2017		
	22/06/2017		
	06/07/2017		
	19/07/2017		
	24/07/2017		
	06/08/2017		
	22/08/2017		
	05/09/2017		
	15/06/2018		
	22/06/2018		
	29/06/2018		

	05/07/2018 25/07/2018 02/08/2018 20/08/2018 17/05/2019 04/06/2019 24/06/2019 30/06/2019 07/07/2019 17/07/2019 27/07/2019 05/08/2019 13/08/2019 02/09/2019 15/06/2020 23/06/2020 28/06/2020 25/07/2020 30/07/2020 07/08/2020 17/08/2020 29/08/2020 05/09/2020		
ArcticDEM (10m)		28_36 28_37 28_38 29_36 29_37 29_38 30_36 30_37 30_38	PGC

Table S2. Table showing the satellite-derived water metrics and extracted MAR melt production and runoff values for each study date across the study period (2016 – 2020)

Date	Meltwater Area (km²)	Meltwater Area Fraction (%)	River Fraction (%)	No. Lakes	Lake Size (km²)	Lake Fraction (%)	Daily RCM Surface Runoff (mm w.e d⁻¹)	Cumulative MAR Runoff (mm w.e d⁻¹)
2016-05-22	17.48	0.13	0.13	0	0	0	0.01	0.69
2016-06-12	419.08	3.11	3.11	0	0	0	1.97	3.82
2016-06-28	1538.60	11.41	11.28	73	17.40	0.13	7.12	59.96
2016-07-08	1533.06	11.37	11.22	53	19.10	0.14	14.74	180.89
2016-07-18	1539.78	11.42	11.30	48	15.53	0.12	15.70	338.05
2016-07-29	1021.35	7.57	7.46	37	15.12	0.11	7.44	531.41
2016-08-07	639.77	4.74	4.71	13	4.90	0.04	2.90	624.71
2016-08-25	197.79	1.47	1.45	6	2.03	0.02	0.22	659.19
2016-09-03	122.24	0.91	0.91	0	0	0	0.04	662.11
2017-05-30	10.69	0.08	0.08	0	0	0	0.03	0.37
2017-06-10	15.13	0.11	0.11	0	0	0	0.01	0.60
2017-06-22	28.61	0.21	0.21	0	0	0	1.92	6.98
2017-07-06	131.89	0.98	0.96	15	1.98	0.01	3.56	38.05
2017-07-19	349.65	2.59	2.49	53	13.31	0.10	3.82	98.65
2017-07-24	1039.68	7.71	7.59	54	15.81	0.12	5.68	124.22
2017-08-06	1247.27	9.25	9.13	46	15.30	0.11	4.03	255.56
2017-08-22	1373.33	10.18	10.18	1	0.15	0	0.28	322.40
2017-09-05	195.25	1.45	1.45	0	0	0	0.01	322.89
2018-06-15	16.72	0.12	0.12	0	0	0	0.53	2.15
2018-06-22	86.23	0.64	0.64	0	0	0	1.01	9.66
2018-06-29	230.75	1.71	1.70	12	1.48	0.01	4.28	27.74
2018-07-05	365.10	2.71	2.64	48	8.69	0.06	4.74	55.03
2018-07-25	384.60	2.85	2.77	38	11.29	0.08	0.79	111.69
2018-08-02	905.39	6.71	6.56	74	20.08	0.15	7.09	141.68
2018-08-20	965.73	7.16	7.12	20	5.20	0.04	2.23	235.51
2019-05-17	18.43	0.14	0.14	0	0	0	0.05	0.88

2019-06-04	136.99	1.02	1.02	0	0	0	0.05	1.83
2019-06-24	636.04	4.72	4.51	108	27.65	0.20	1.18	100.54
2019-06-30	2684.99	19.91	19.70	111	27.35	0.20	19.37	147.26
2019-07-07	1659.37	12.30	12.13	95	22.61	0.17	21.46	286.49
2019-07-17	1870.99	13.87	13.70	79	23.11	0.17	16.80	473.14
2019-07-27	1566.27	11.61	11.49	45	16.77	0.12	12.62	617.05
2019-08-05	1031.83	7.65	7.53	45	16.73	0.12	11.22	764.95
2019-08-13	1595.78	11.83	11.71	41	16.48	0.12	8.20	858.76
2019-09-02	1506.69	11.17	11.16	3	1.08	0.01	0.78	924.32
2020-06-15	1572.85	11.66	11.58	57	11.19	0.08	0.57	6.36
2020-06-23	526.47	3.90	3.77	63	17.78	0.13	6.94	36.46
2020-06-28	1637.63	12.14	12.02	70	16.10	0.12	19.60	102.56
2020-07-25	1213.84	9.00	8.91	43	12.53	0.09	14.57	572.35
2020-07-30	560.86	4.16	4.10	37	8.30	0.06	11.41	642.56
2020-08-07	312.61	2.32	2.30	8	2.08	0.02	1.16	681.21
2020-08-17	349.44	2.59	2.58	3	1.01	0.01	0.95	694.33
2020-08-29	371.43	2.75	2.75	2	0.78	0.01	0.29	751.94
2020-09-05	156.02	1.16	1.16	0	0	0	0.01	752.52

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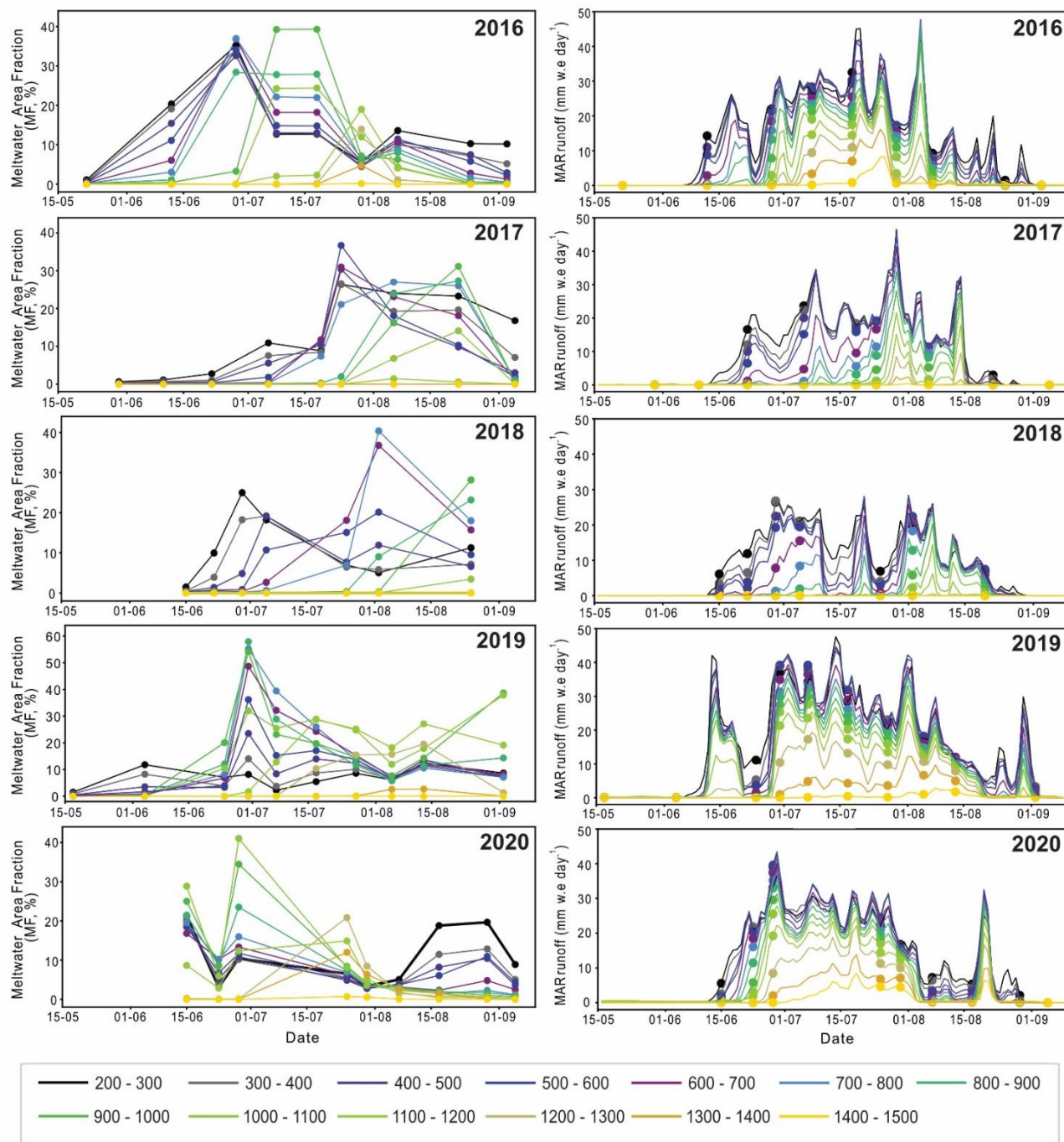
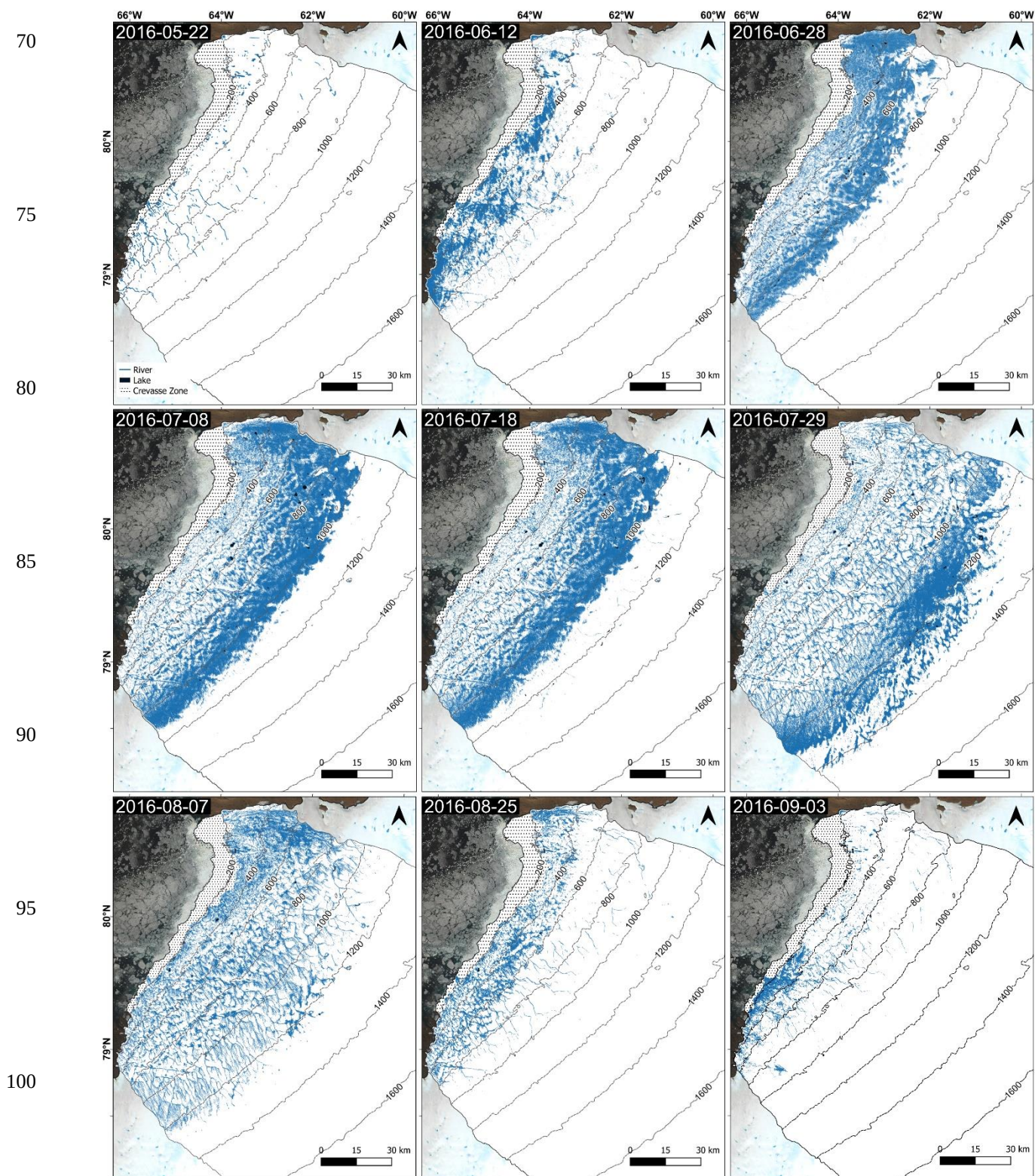
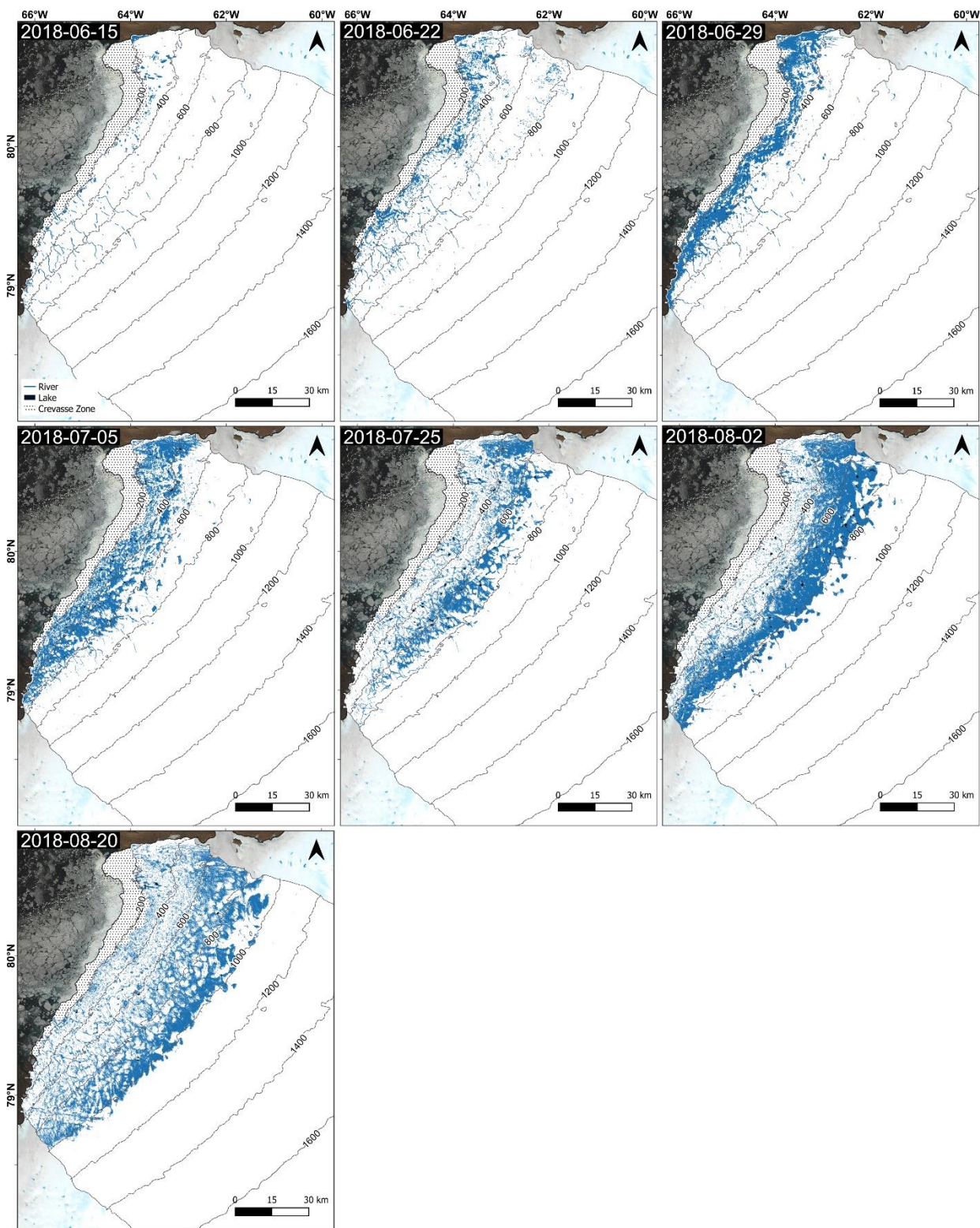
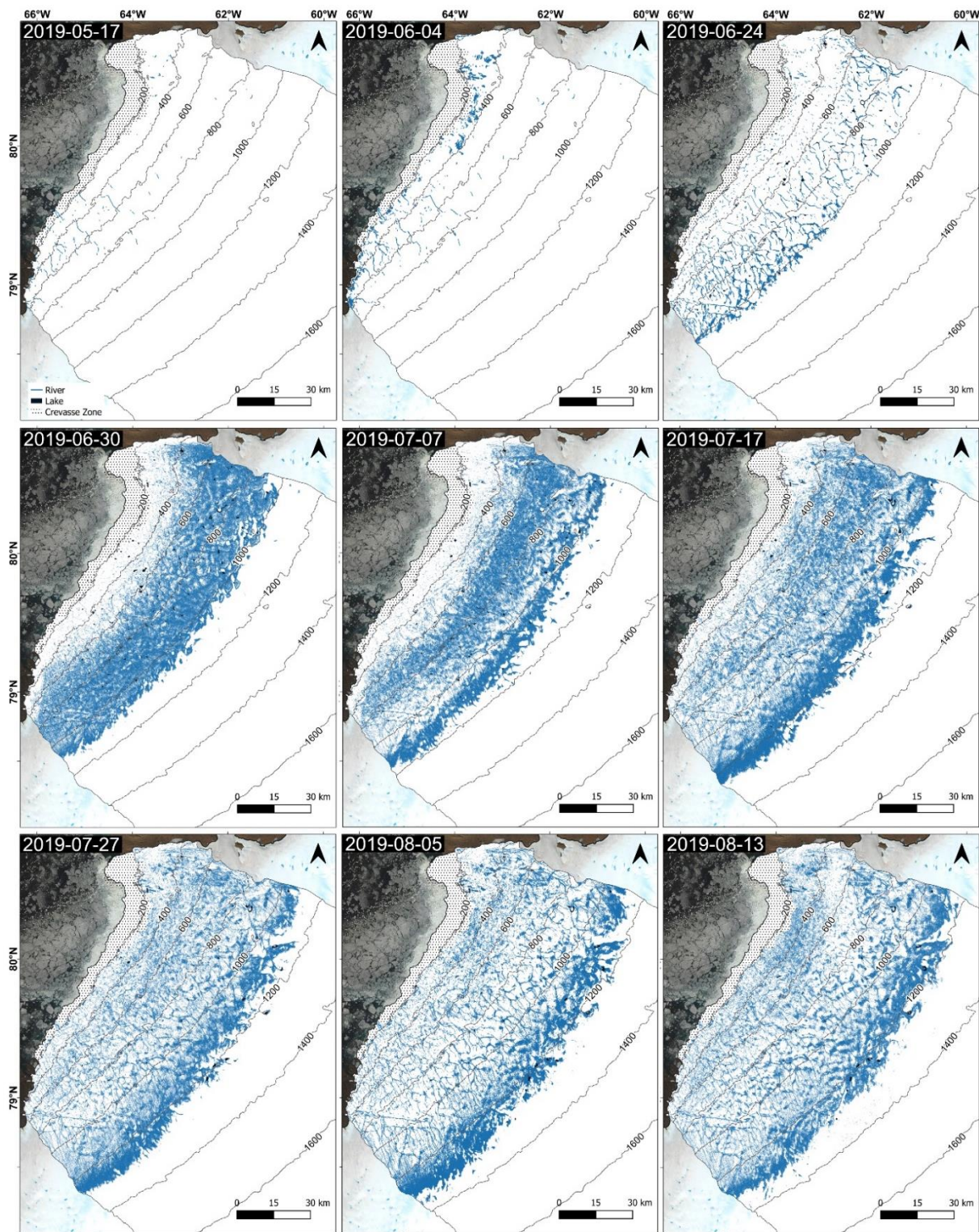


Figure S1. Meltwater area fraction (%) and MAR runoff (mm w.e day⁻¹) per 100 m contour band from 200 m a.s.l. to 1500 m a.s.l. (conservative limit of maximum mapped network extent) across the Humboldt Glacier catchment for each mapped date across the study period



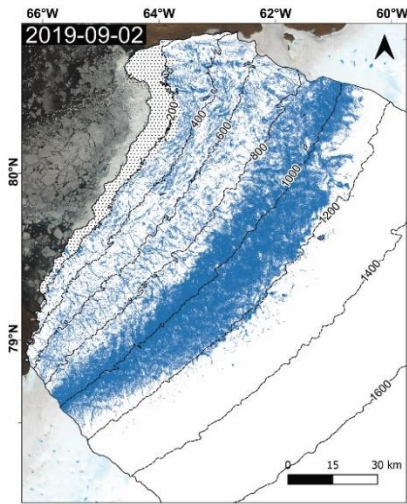




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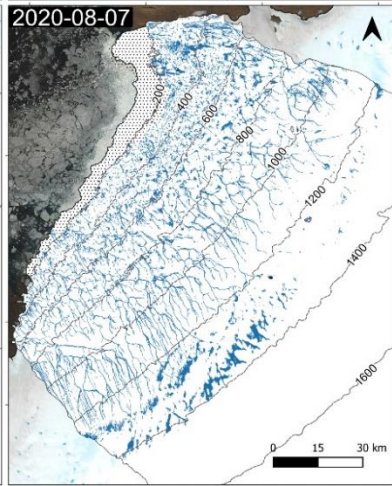
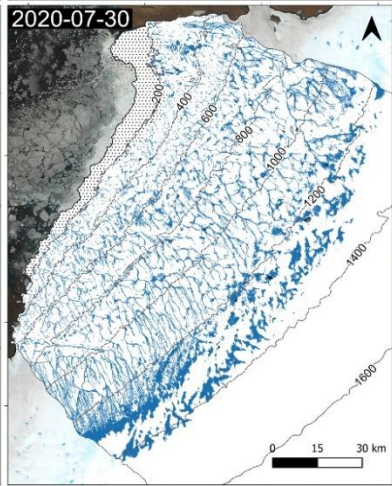
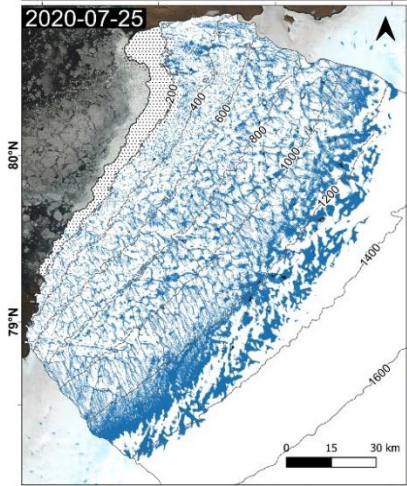
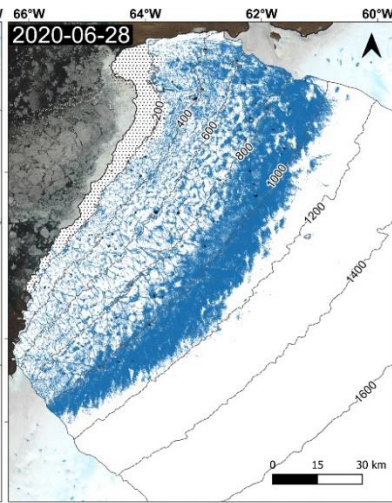
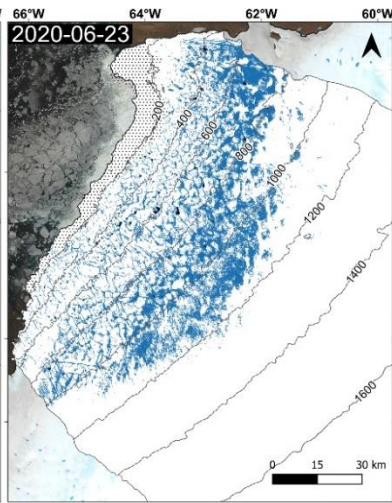
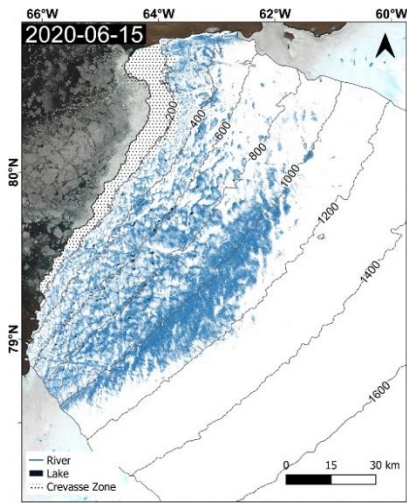


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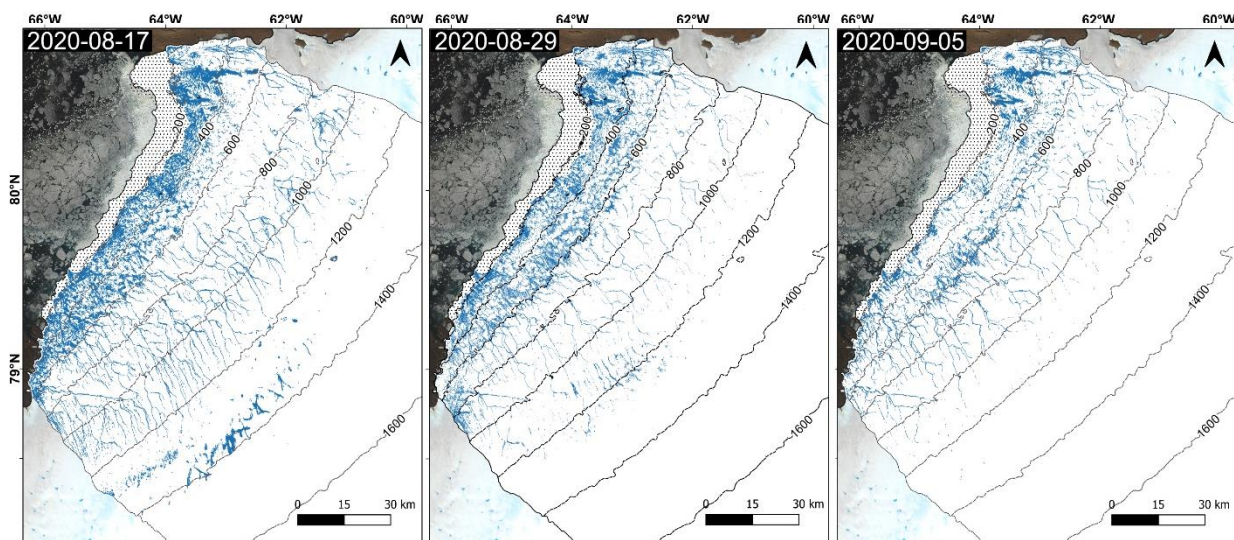


Figure S2. Supraglacial drainage network maps for all mapped study dates between 2016 – 2020. Blue lines represent delineated supraglacial rivers, black polygons represent SGLs (>0.1 km²) and the crevasse zone within the lower 25 km of the glacier is denoted by black and white dots. Elevation contours extracted from the 10 m ArcticDEM mosaic are presented for every 200 m a.s.l. up to 1600 m a.s.l. The background Sentinel-2 image is courtesy of the Copernicus Open Access Hub (<https://scihub.copernicus.eu>).

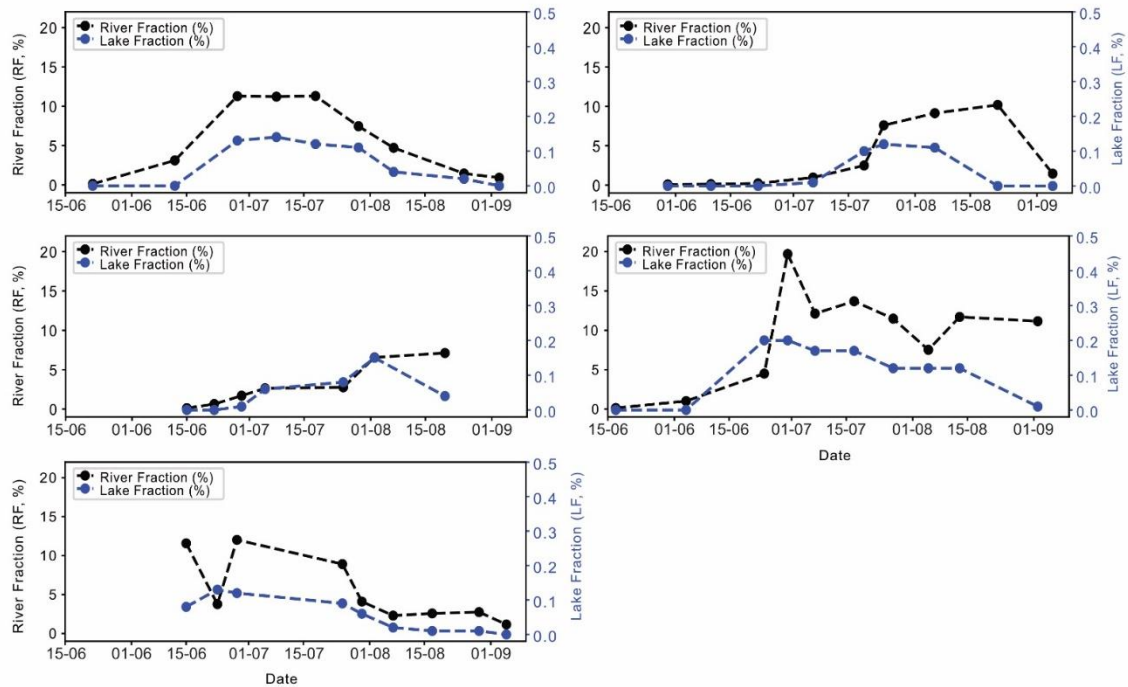


Figure S3. River fraction (%) and lake fraction (%) for each mapped date across the study period, with 98% of the supraglacial drainage system made of the river fraction.