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Supplement of

Calving front monitoring at a subseasonal resolution: a deep learning application for Greenland glaciers

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	Jakobshavn Isbræ	Sermeq Avangnardleq	Helheim Glacier	Kangerdlugssuaq Glacier	Daugaard-Jensen Glacier	Nioghalvfjerdsbræ	Zachariæ Isstrøm	Humboldt Glacier	Ingia Isbræ	Ryder Glacier	Academy Glacier	Hagen Bræ	Kangiata Nunaata Sermia	Hayes Glacier	Sverdrup Glacier	Upernavik Isstrøm	Kong Oscar Glacier	Døcker Smith Glacier	Harald Molke Bræ	Waltershausen Glacier	Tracy Glacier	Rink Isbræ	Store Glacier	Boydell Glacier	Drygalski Glacier	Storbreen	Upsala Glacier	
2013	4	1	4	7	1	4	3	2	4	4	4	6	3	2	3	2	1	1	3									
2014	5	3	5	6	8	8	8	3	2	2	6	10	8	1	4	4	1	2	5									
2015	8	3	3	6	6	5	6	3	3	4	6	4	9	3	6	6	5	6	5									
2016	10	3	8	8	11	8	9	4	5	7	5	6	8	5	7	7	5	4	5									
2017	7	3	6	5	10	7	7	2	3	5	4	6	4	4	4	8	4	5	4									
2018	8	2	2	9	13	5	5	4	4	4	2	9	8	4	4	4	4	4	4									
2019	6	6	9	9	8	13	8	3	4	6	2	8	5	7	9	8	8	7	3									
2020	8	5	5	5	7	4	6	4	5	5	5	8	7	6	5	7	5	5	5	6	5	5	3	4	5	5	2	
2021	2	1	2	2	2	2	2	1	2	2	2	2	2	1	2	1	2	1	1	2	4	4	3	3	4	3	3	
Total	58	27	44	57	66	56	54	26	32	39	36	59	54	33	44	47	35	35	35	8	9	9	6	7	9	8	5	898

Entries: 1 – 13

Figure S1. Temporal coverage of the reference data used in this study. The numbers and the color intensity indicate the amount of calving front positions in the respective year. Calving fronts from 2013 to 2019 were used for model training, and calving fronts from 2020 and 2021 were used for model testing.

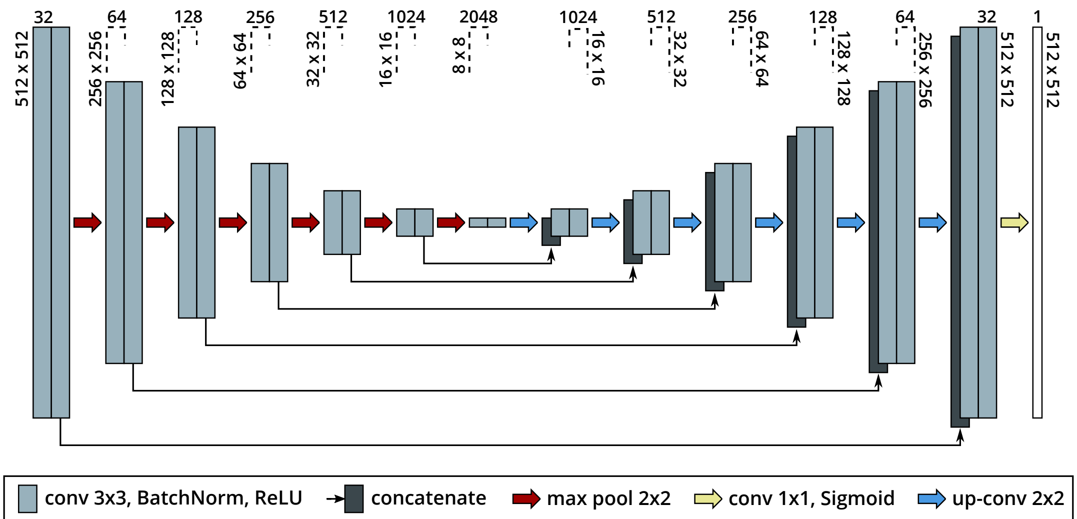

Figure S2. The U-Net based ANN architecture that was applied in this study. One single contracting sequence comprises convolutions followed by batch normalization, a rectified linear unit (ReLU), and a max-pooling operation. One single expanding sequence consists of concatenation with spatial context from the contracting path, convolutions followed by batch normalization, and a ReLU. All dimensions are denoted at the top of the blocks.

Table S1. Binary classification results of the TUD test set for the glacier/land class. The binary classification metrics accuracy, F1-Score and recall as well as the normalized confusion matrix are given. In addition, the standard deviation of the respective parameters is indicated. Example: TP is the amount of all glacier/land image pixels of the test data set that are correctly classified on average across all 50 models.

Binary classification metrics			Normalized confusion matrix			
Accuracy	F1-Score	Recall	TP	TN	FP	FN
0.987 ± 0.001	0.982 ± 0.001	0.996 ± 0.001	0.334 ± 0.002	0.653 ± 0.001	0.011 ± 0.002	0.001 ± 0.001

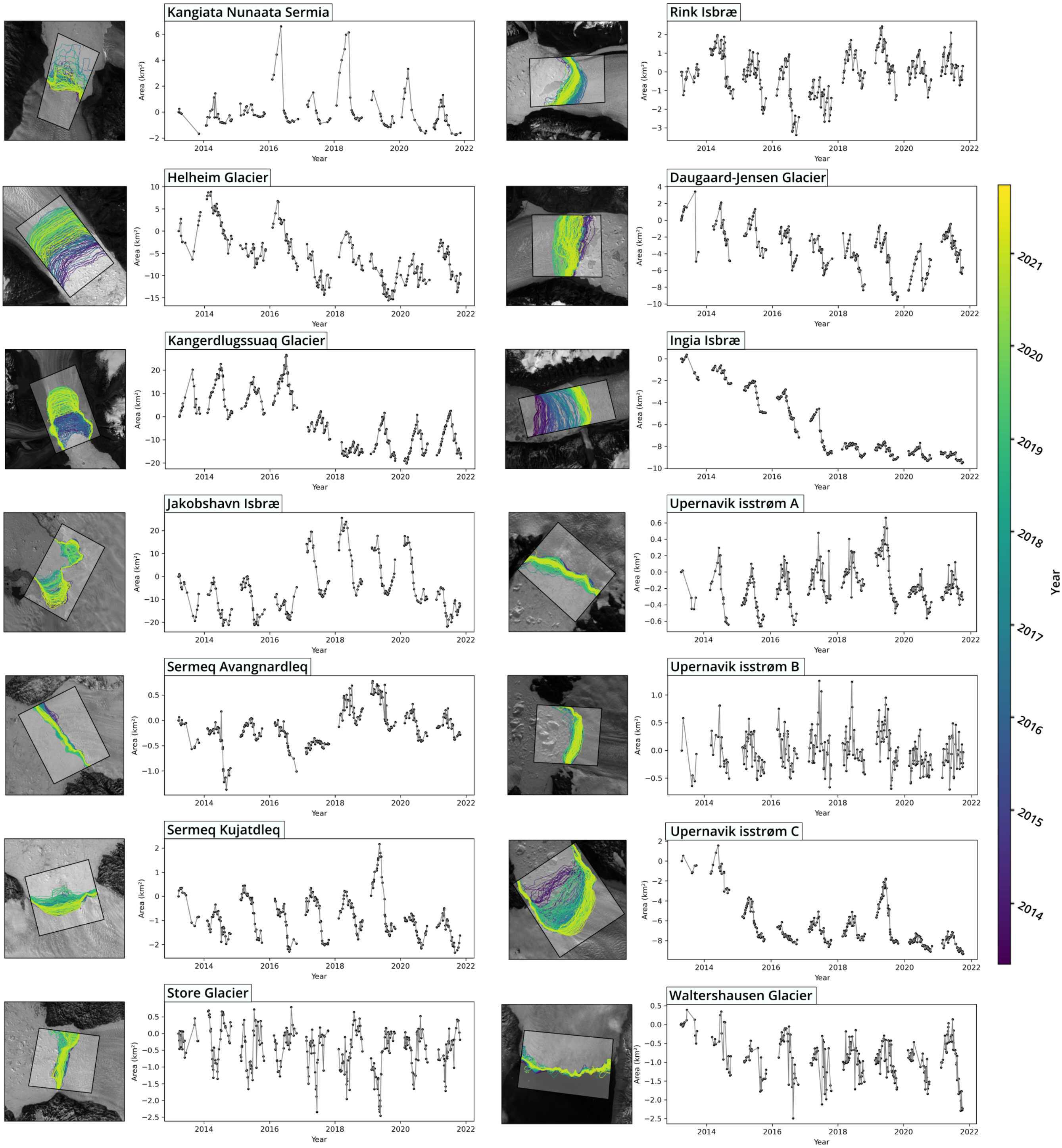

Figure S3. Time series generated by our ANN algorithm for 14 Greenland glaciers. For each glacier, a satellite image, containing the color-coded calving front trajectories, and the corresponding time series is shown. Here, calving front positions are marked by black dots and solid lines connecting entries each year. Note that the ordinate axis is scaled differently for each glacier. Landsat-8 imagery courtesy of the U.S. Geological Survey.

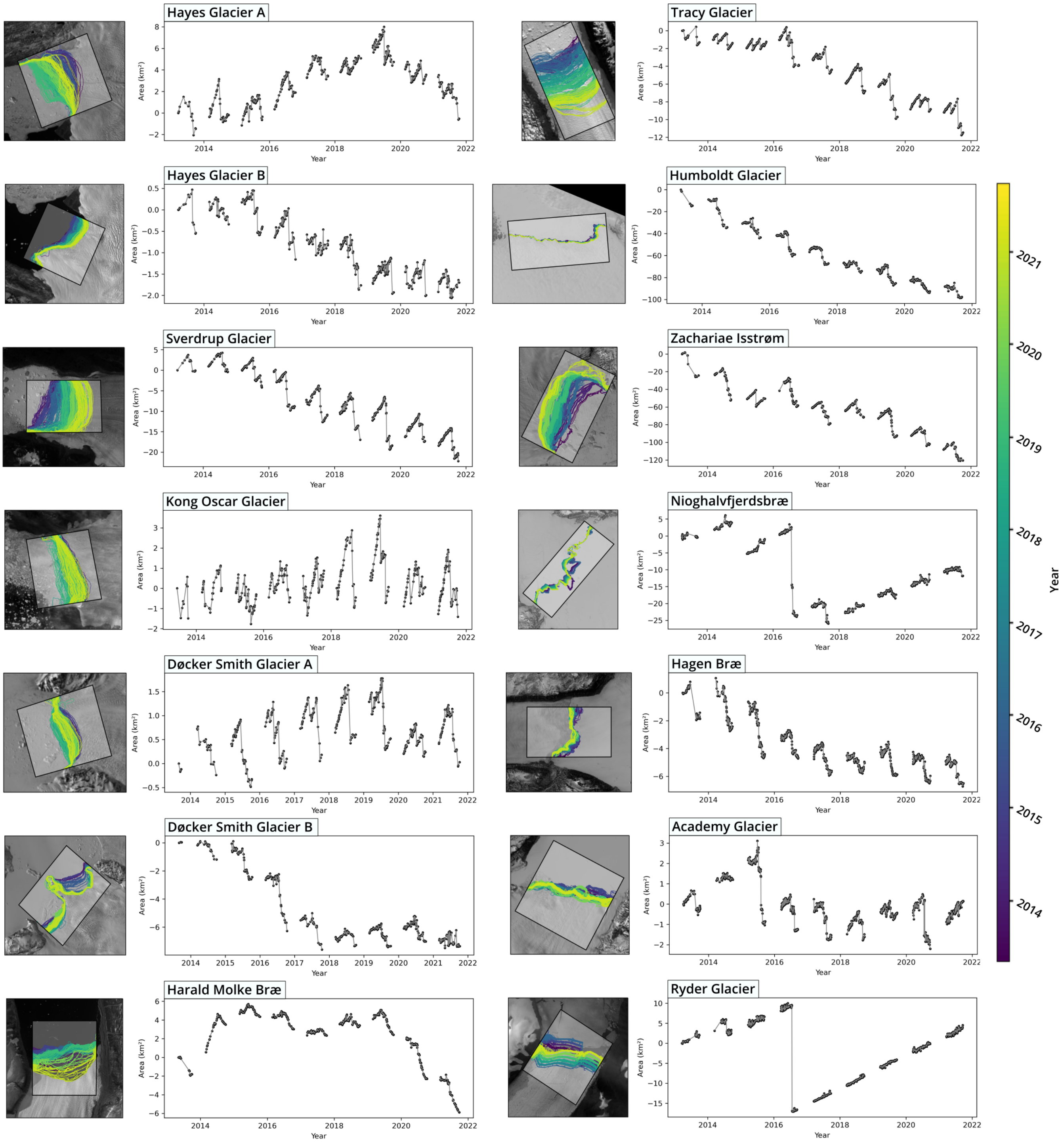

Figure S4. Time series generated by our ANN algorithm for 14 Greenland glaciers. For each glacier, a satellite image, containing the color-coded calving front trajectories, and the corresponding time series is shown. Here, calving front positions are marked by black dots and solid lines connecting entries each year. Note that the ordinate axis is scaled differently for each glacier. Landsat-8 imagery courtesy of the U.S. Geological Survey.