Supporting Information for "Sentinel-2 Based Melt Pond Fraction A Case Study Along The MOSAiC Drift"

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Introduction This supporting information gives details about the classification algorithm applied to the orthomosaics, presents examples of the Sentinel-2 based classification algo-

rithm and gives an extended insight into the time series of melt pond evolution during the MOSAiC campaign. Additionally an overview table with all Sentinel-2 scenes analyzed is provided.

Text S1. The stitched orthomosaics are brightness adjusted and corrected for cloud shadows with airborne laser scanner reflectivity as described in Neckel et al. (2022). Subsequently, they are classified pixel-wise into surface type classes based on their optical features using a random forest classifier, prepared with a comprehensive sea ice training dataset. Adjacent pixels of similar main surface types are combined to objects when they exceed a minimum threshold of 100 pixels, corresponding to an area here of 25m2 (similar to Huang et al. (2016)). This high-pass filtering is applied to reduce classification noise and justify the definition of high resolution, so that pixel size is below object size. An error estimate is retrieved from a combination of this sieving causing an error of approximately 1 % and confusion between main classes contributing further 1 %. The confusion error is derived from an analysis of the prediction probability and manual verification. The algorithm is accessible under `https://gitlab.awi.de/nifuchs/pasta-ice/`.

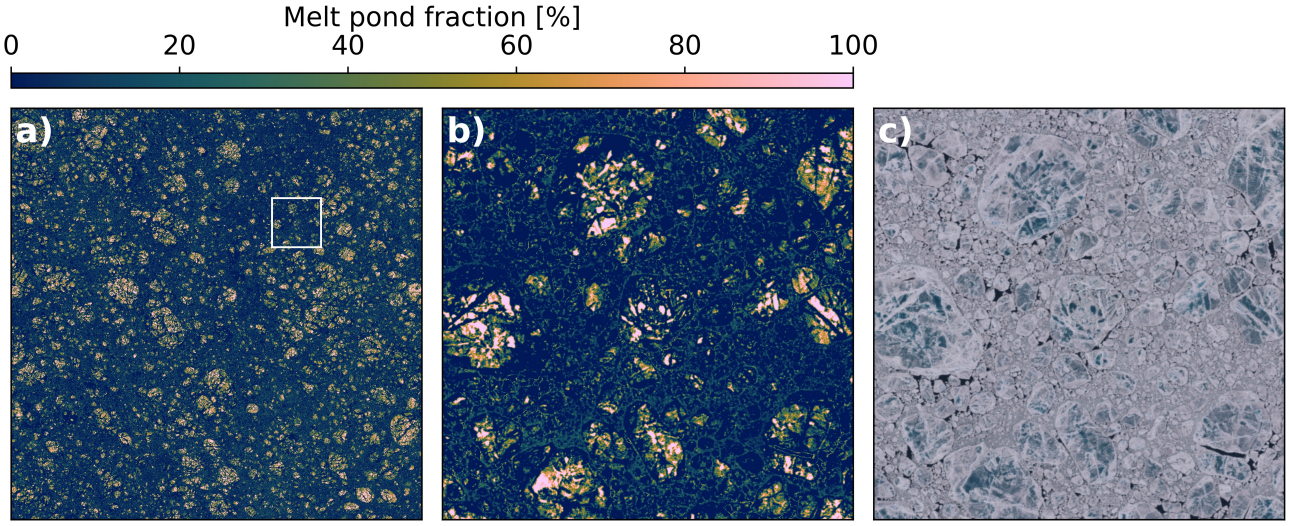

Figure S2. Example of MPF map resulting from the classification algorithm and underlying Sentinel-2 RGB composite. (a) shows the MPF for the full data-covered area of a Sentinel-2 scene (edge length of 50.4 km), (b) the subset marked by the white square in (a) and (c) shows the respective RGB composite. Apposite to figure 1, this example shows the results for scene T31XEL on June 30, 2022.

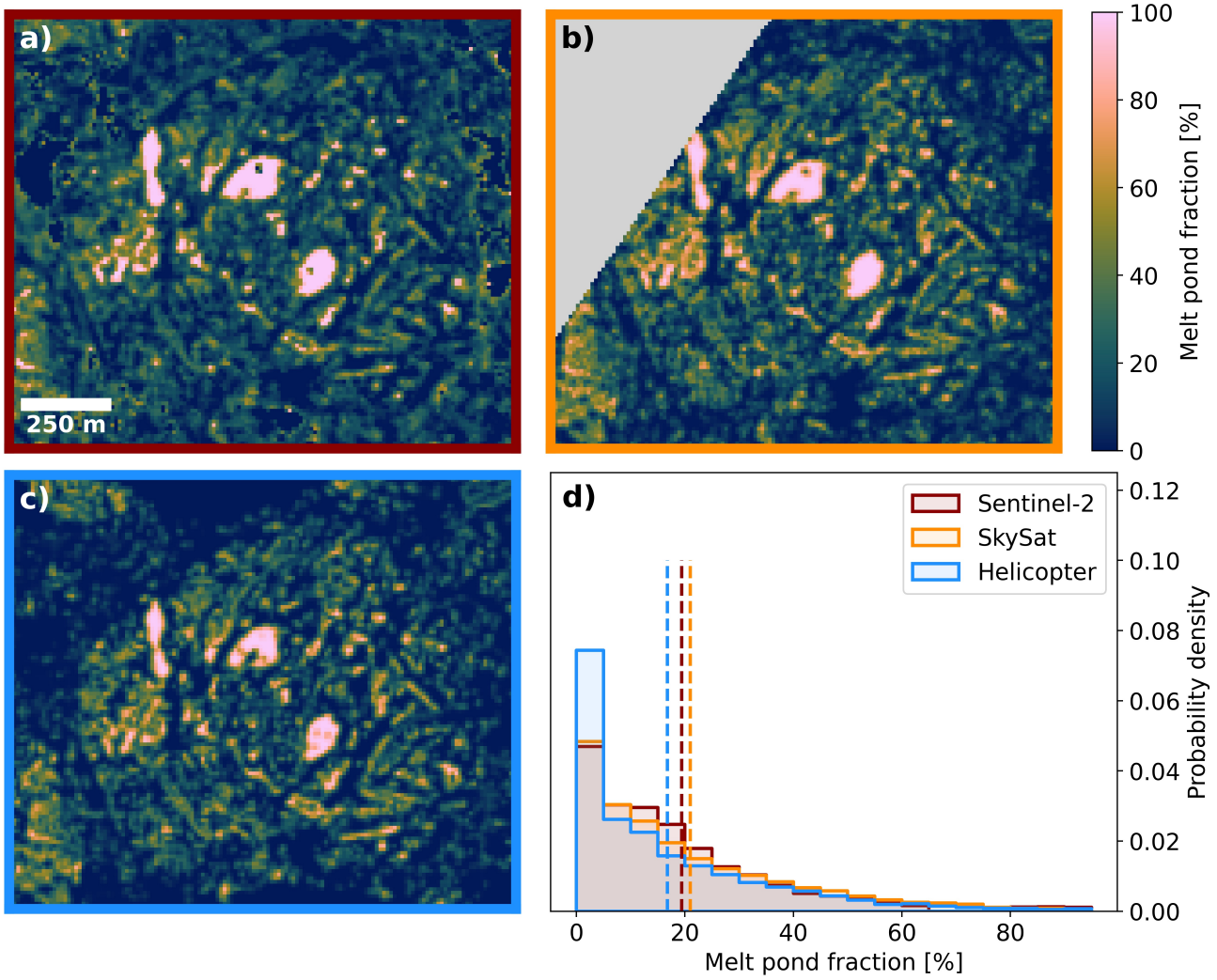

Figure S3. Same as figure 2 but for July 7: MPF maps derived from Sentinel-2 (a), SkySat (b) and Helicopter observations (c) and histograms of the MPF distributions (d). The colored frames of the maps indicate the different datasets according to the colors in the histograms. The scalebar in panel (a) is valid for all maps.

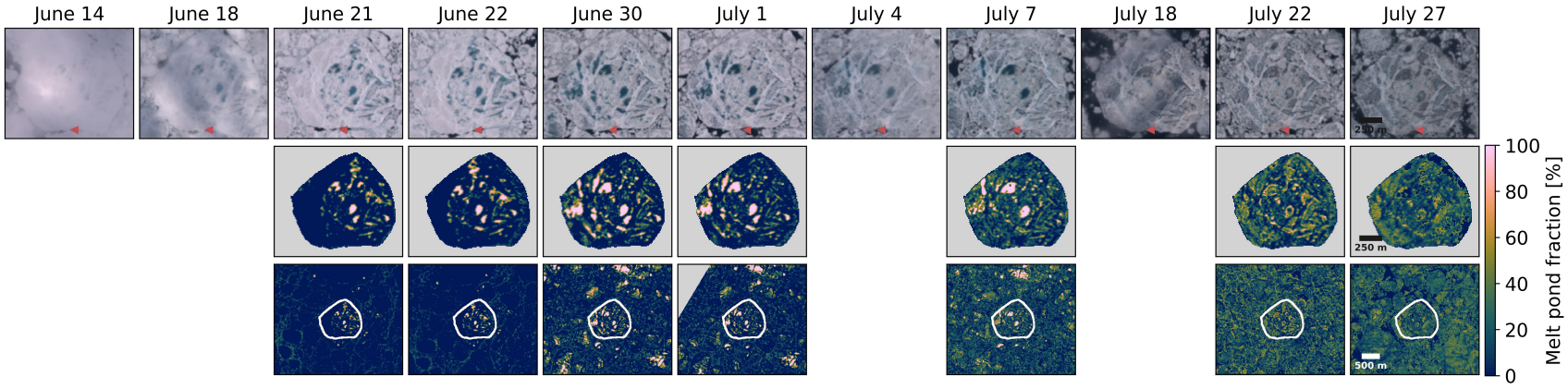

Figure S4. Same as figure 3 (a) but extended by images that are partly contaminated with clouds. Upper row: Sentinel-2 true color composites of the MOSAiC floe area defined relatively to the Polarstern vessel position marked by the red triangle. Middle row: Mpf classification results for the same area as in the upper panel. The fraction is given in values between zero and one as shown in the colorbar. Bottom row: Mpf for wider area around the Polarstern vessel displayed in the same colorscale as above, the indicated CO area is excluded from the comparison. The MPF maps of the days with cloud contamination are omitted.

November 17, 2022, 9:36am

Table S5. Sentinel-2 Imagery Information

Date	Time	Central Lat [°]	Central Lon [°]	Tile	Use	Mean MPF [%]
03-07-2017	21:51	78.766	-120.489	T10XEN	T	27.75
05-07-2017	20:50	76.793	-111.943	T12XVL	T	37.28
10-06-2018	06:36	77.889	105.511	T48XWM	D	62.24
25-06-2018	10:46	82.399	77.031	T43XEM	T	2.29
28-06-2018	21:51	79.661	-114.274	T11XNJ	T	8.81
05-07-2018	21:41	79.711	-109.014	T12XWP	T	25.37
11-08-2018	02:16	74.607	157.642	T57XVC	T	21.44
06-07-2019	20:19	77.054	-102.211	T14XML	T	40.46
07-07-2019	20:40	77.320	-113.538	T11XNF	D	58.65
10-07-2019	02:26	74.877	159.720	T57XWD	T	39.37
30-07-2019	21:41	81.449	-101.709	T13XEL	T	32.20
05-08-2019	22:51	82.263	-101.366	T13XEM	T	28.95
21-06-2020	14:48	82.113	12.112	T33XVM	D	2.44
22-06-2020	15:08	82.052	8.527	T31XEM	D	1.63
30-06-2020	14:28	81.696	8.253	T31XEL	D	17.17
01-07-2020	13:58	81.582	11.298	T33XVL	D	9.79
05-07-2020	23:42	80.370	-138.496	T08XMQ	T	48.72
07-07-2020	15:58	81.633	4.230	T31XEL	D	21.09
11-07-2020	22:21	81.449	-101.709	T13XEL	T	25.59
14-07-2020	22:21	79.613	-108.018	T12XWP	T	23.39
22-07-2020	15:08	80.563	-1.099	T30XWQ	D	23.71
27-07-2020	14:18	79.836	-1.173	T30XWP	D	25.80
06-08-2020	15:58	81.748	-2.014	T31XDL	T	30.10
10-08-2020	00:32	80.422	-125.284	T09XWK	T	18.35
10-06-2021	22:01	77.873	-124.939	T10XDM	T	1.18
17-06-2021	23.31	81.354	-131.136	T08XNR	T	2.48
04-07-2021	21:41	79.618	-118.992	T11XMJ	T	12.97
04-07-2021	23:21	80.559	-125.483	T10XDQ	T	10.74
19-07-2021	08:16	80.387	86.204	T45XVK	D	4.41
19-07-2021	21:41	80.645	-101.505	T14XMQ	T	15.26
19-07-2021	22:31	80.646	-102.520	T13XEK	T	14.99

D indicates usage of the scene for development of the algorithm, T for testing.
The gray highlighted scenes are part of the MOSAiC time series.