

Journal of Geophysical Research

Supporting Information for

**Fetch-limited, strongly forced wind waves in waters with frazil
and grease ice – spectral modelling and satellite observations
in an Antarctic coastal polynya**

Agnieszka Herman^{1*}, Katarzyna Bradtke²

¹ Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland

² Institute of Oceanography, University of Gdansk, Gdynia, Poland

* corresponding author: agaherman@iopan.pl

Contents of this file

Figures S1 to S7

Introduction

This file contains additional figures presenting the results of satellite data analysis (Fig. S1) and spectral wave modelling (Figs. S2–S7), described in the main paper.

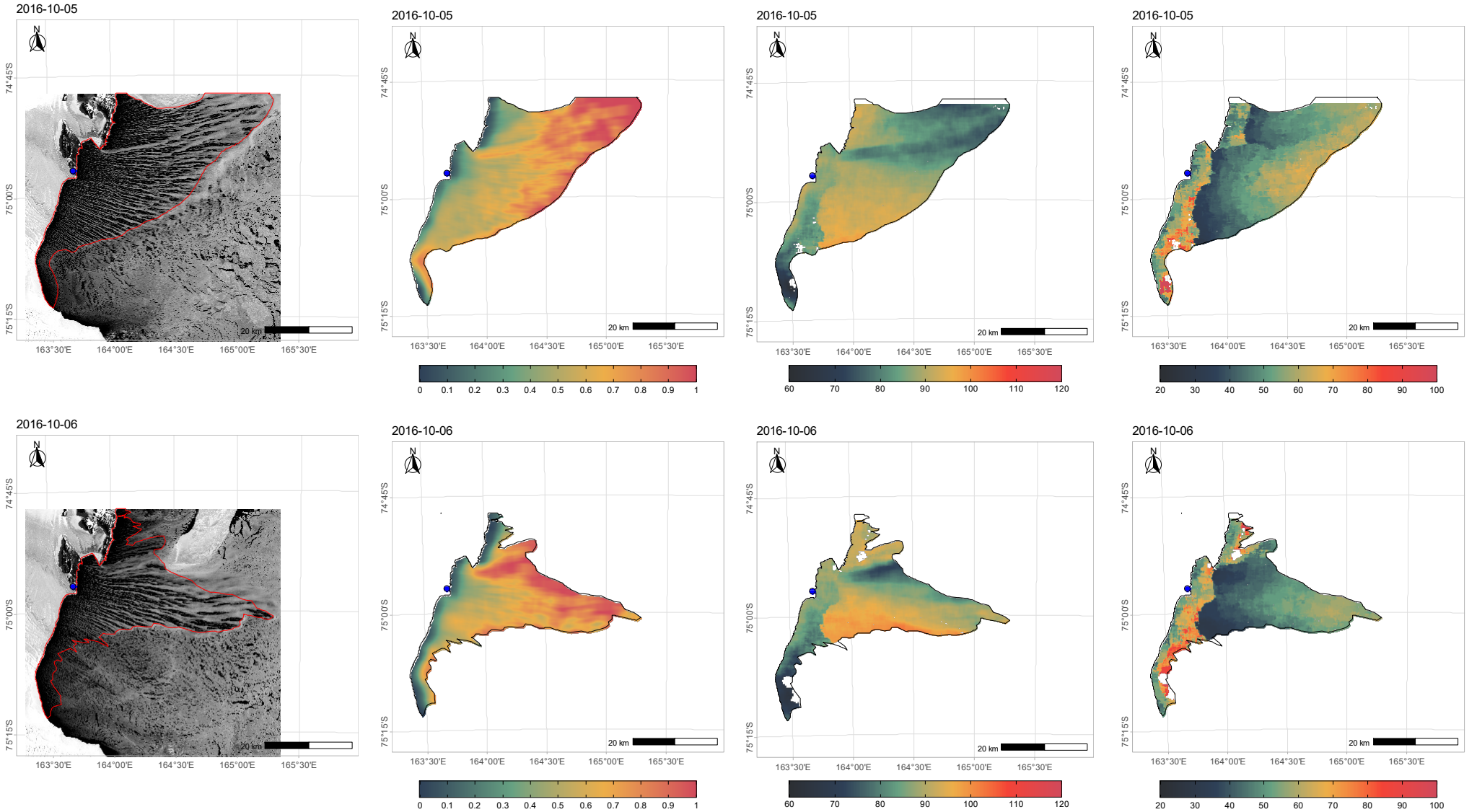


Figure S1 (continued on the following four pages): Satellite images analyzed in the study (panchromatic band reflectance; red lines mark the boundaries of regions classified as polynyas; blue dot mark the location of Manuela WS), frazil ice concentration A , mean wave direction at the peak frequency θ_p (degrees), and peak wavelength L_p (m).

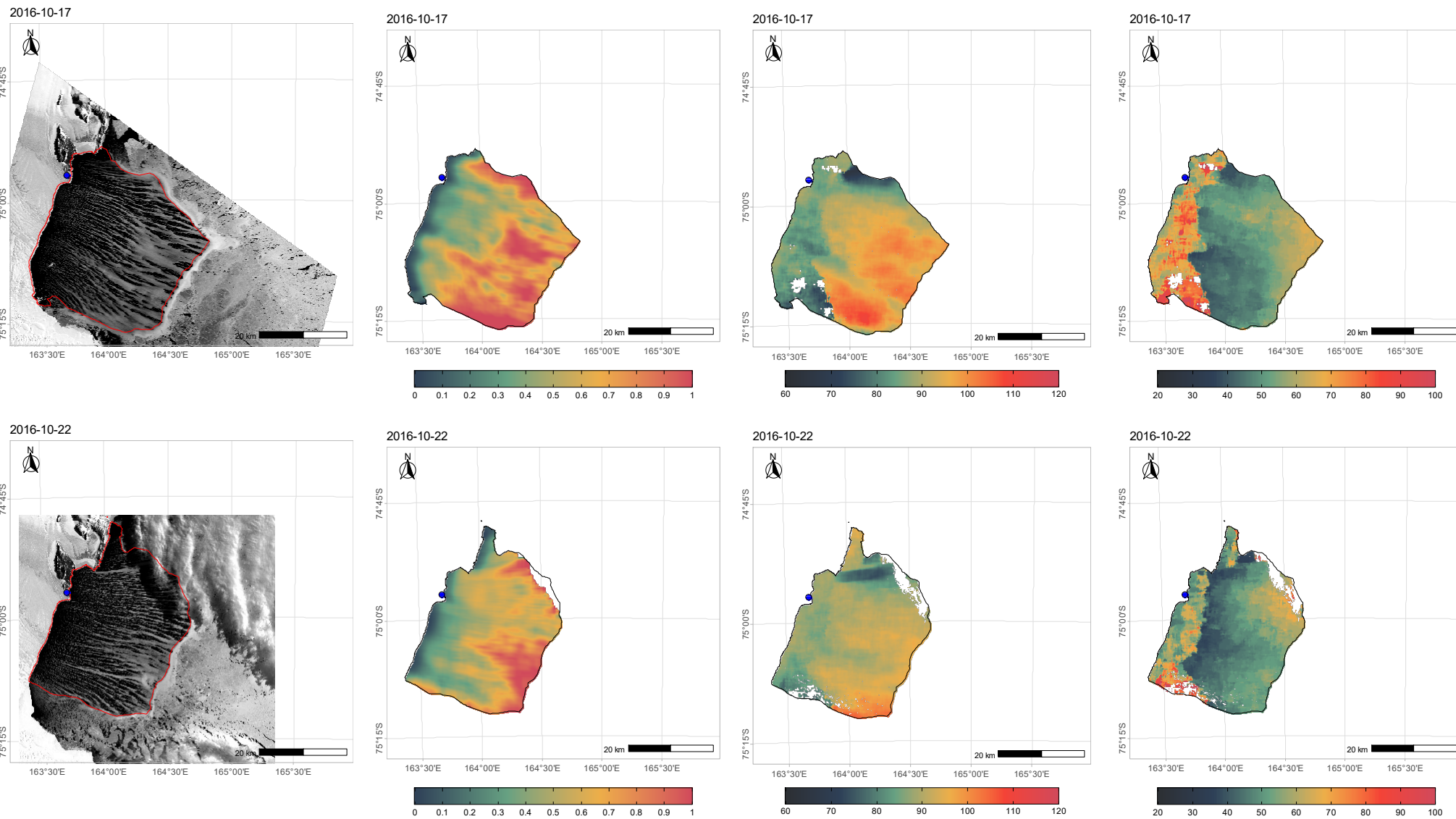


Figure S1 (continued)

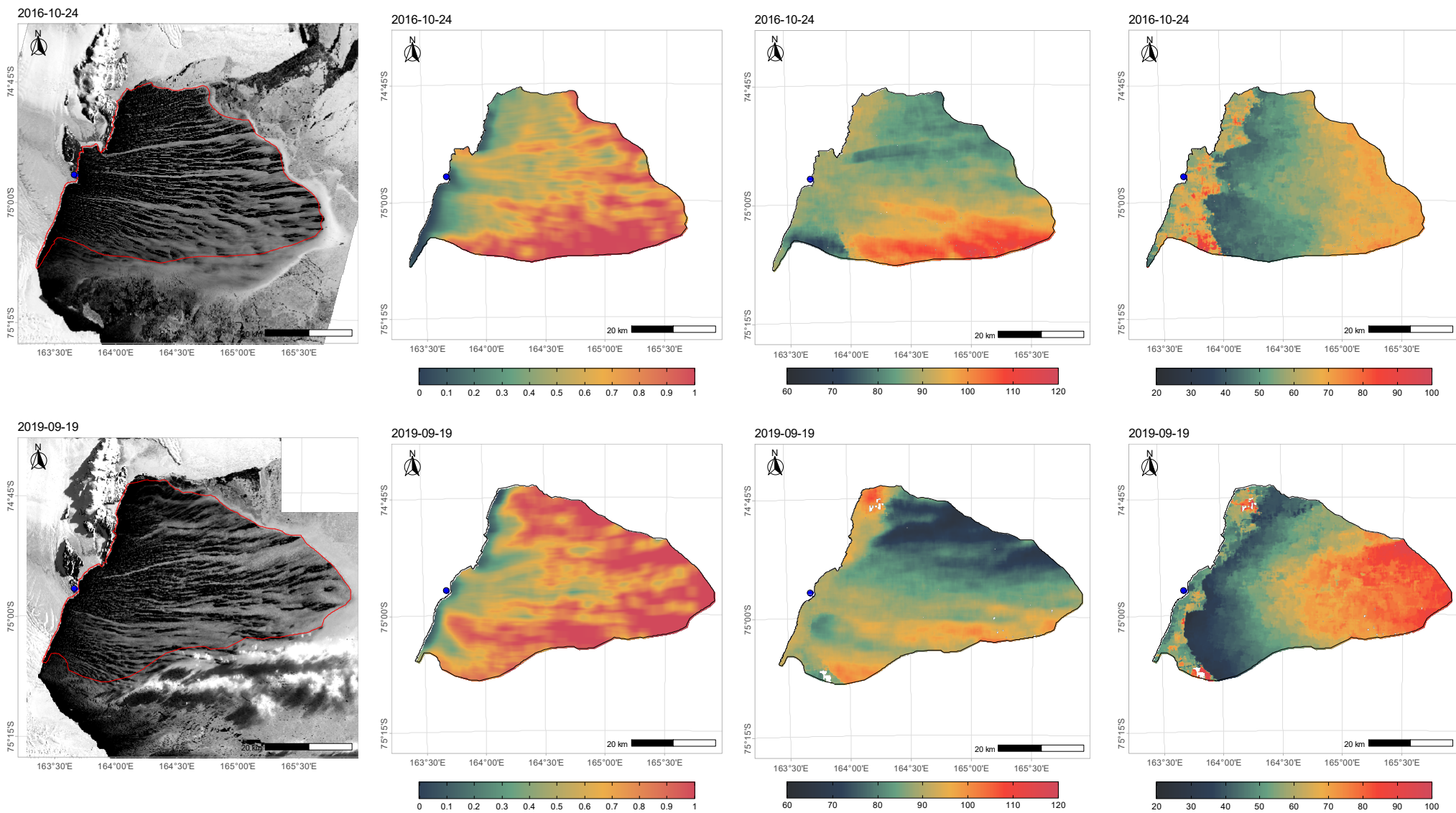


Figure S1 (continued)

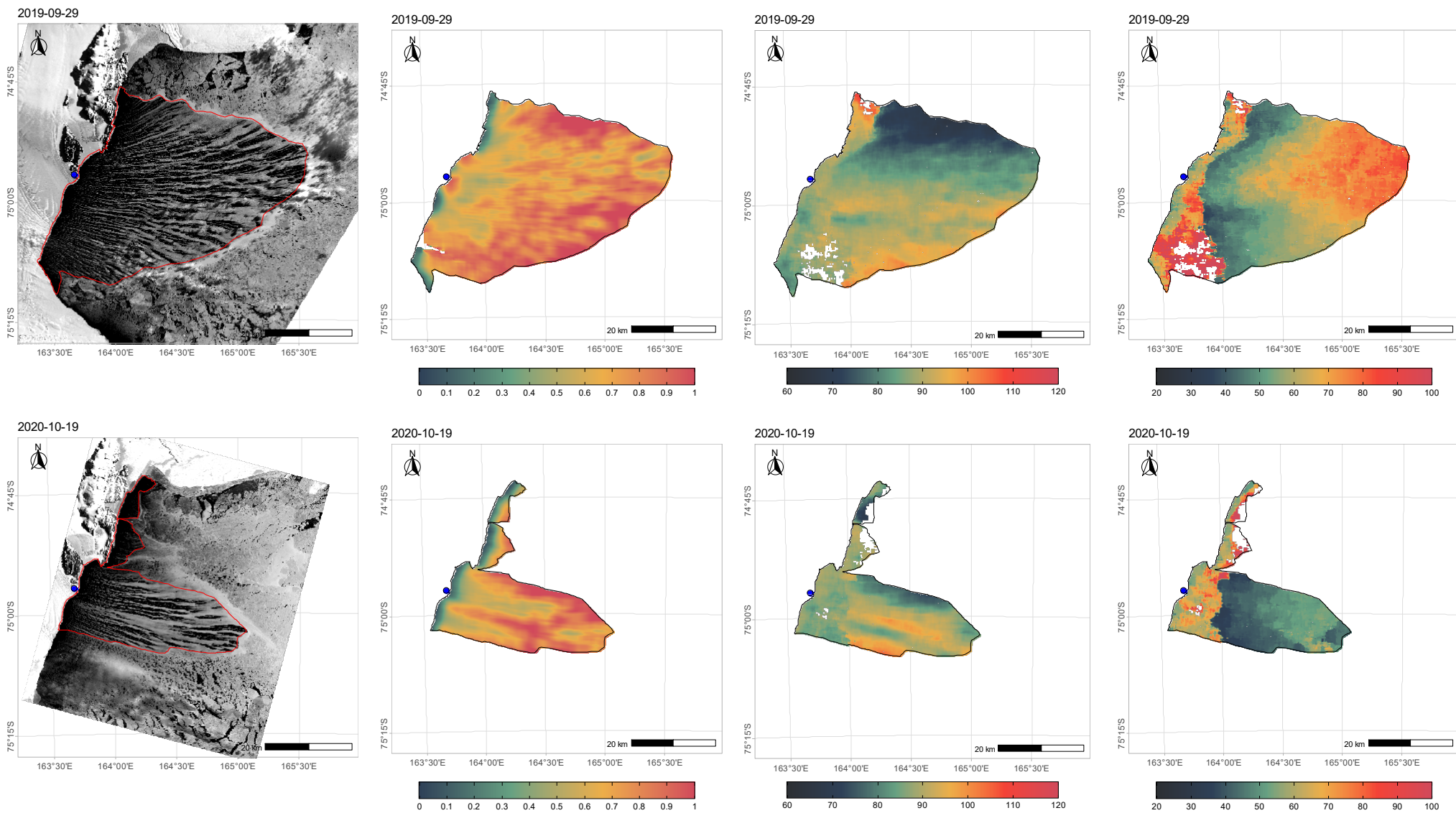


Figure S1 (*continued*)

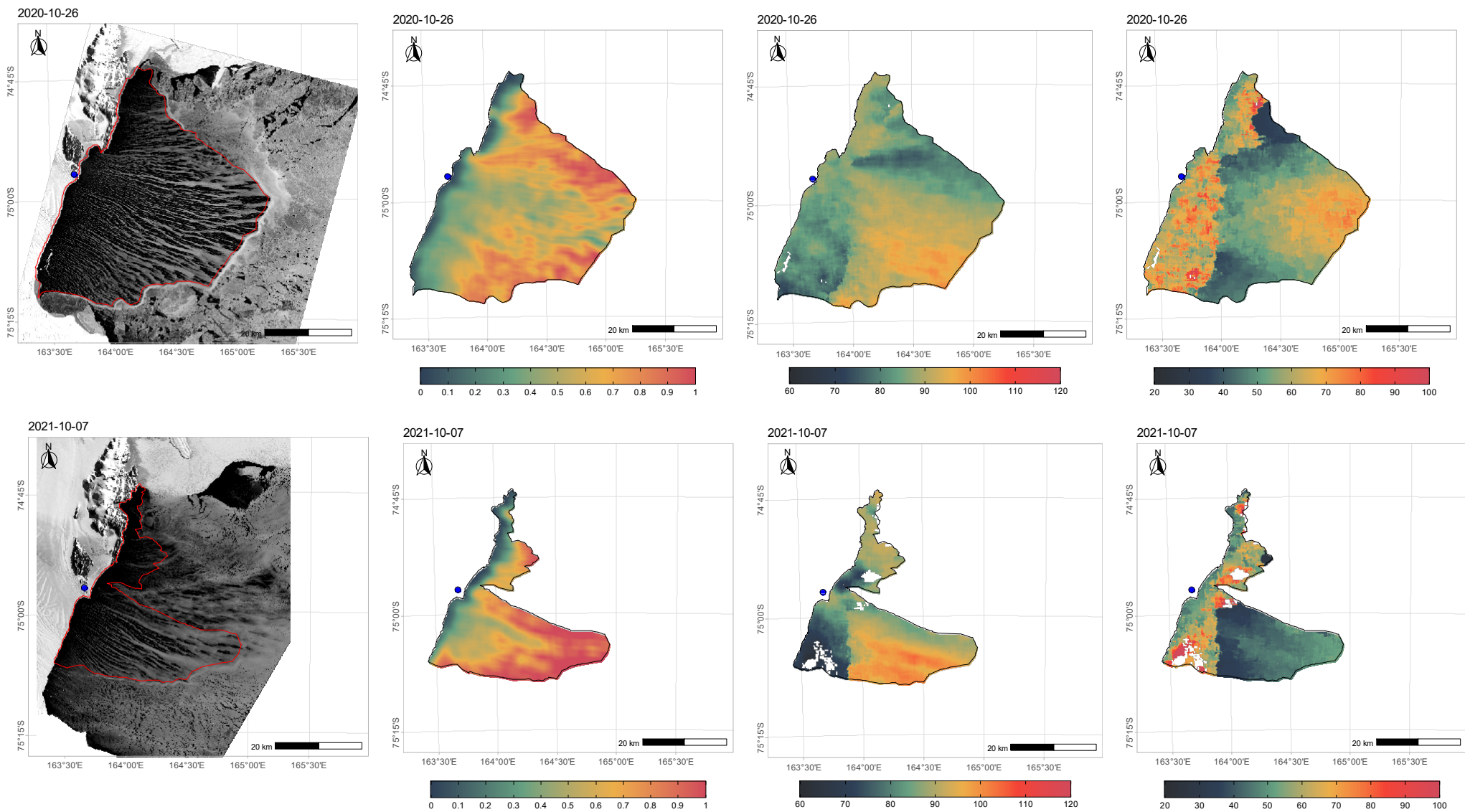


Figure S1 (*continued*)

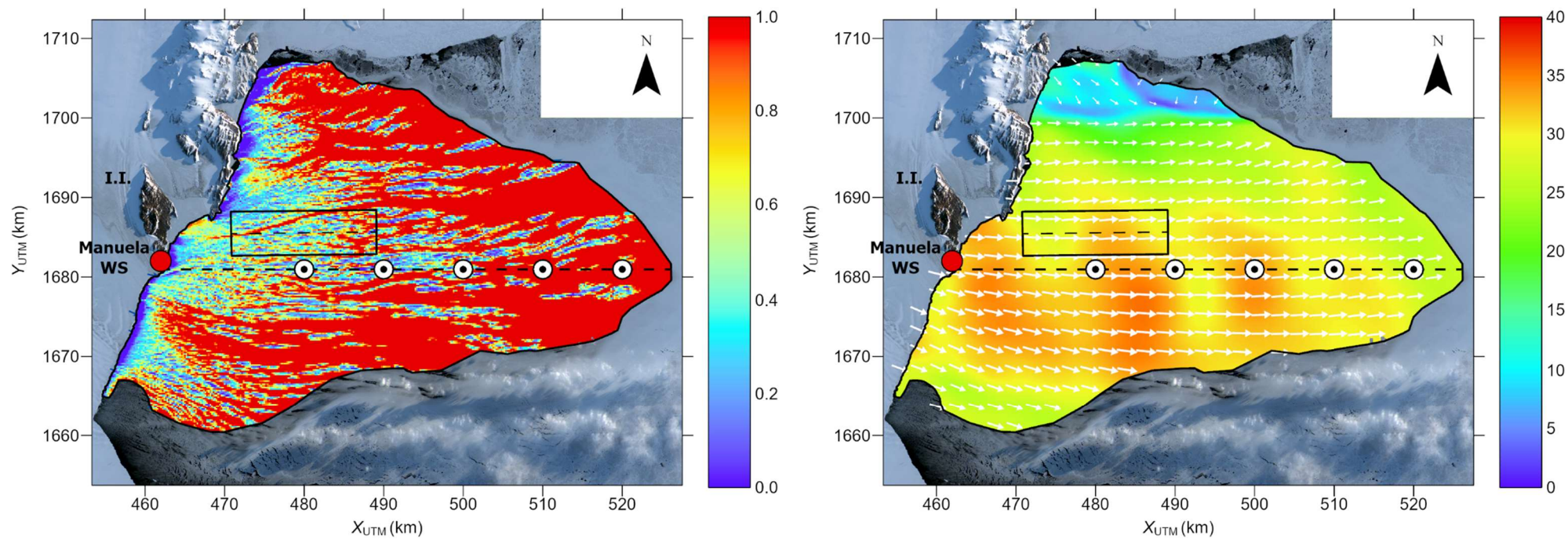


Figure S2. Maps of frazil ice concentration A and AMPS wind speed (m/s; colors) and direction (arrows) for the polynya from 19. Sep. 2019.

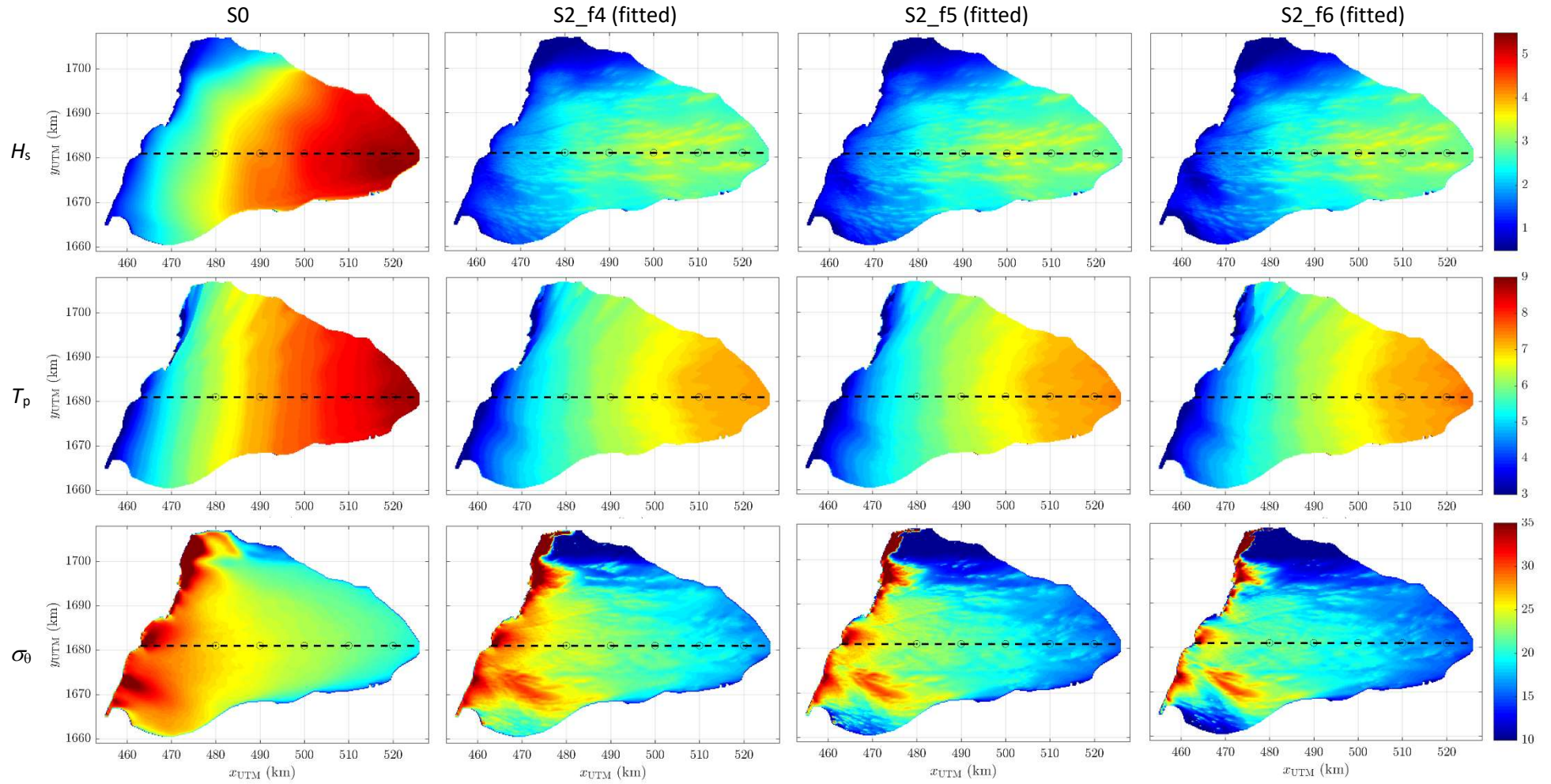


Figure S3. Maps of significant wave height H_s (m), peak wave period T_p (s) and directional spreading σ_0 (degr) for model setups S0, S2_f4 (fitted), S2_f5 (fitted) and S2_f6 (fitted). Polynya from 19.09.2019.

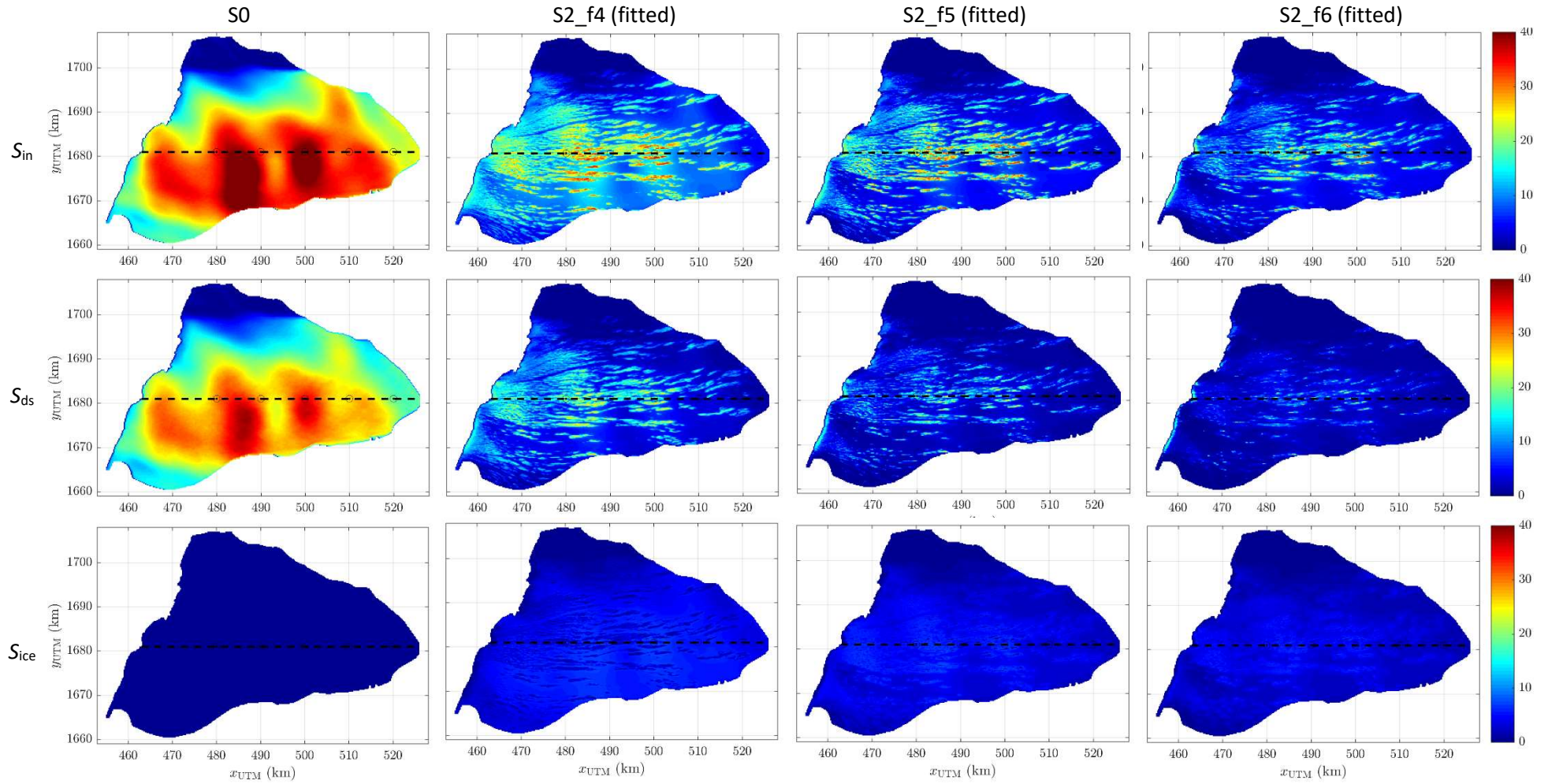


Figure S4. Maps of S_{in} , S_{ds} and S_{ice} (integrated over f and θ ; in W/m^2) for model setups S0, S2_f4 (fitted), S2_f5 (fitted) and S2_f6 (fitted). Polynya from 19.09.2019.

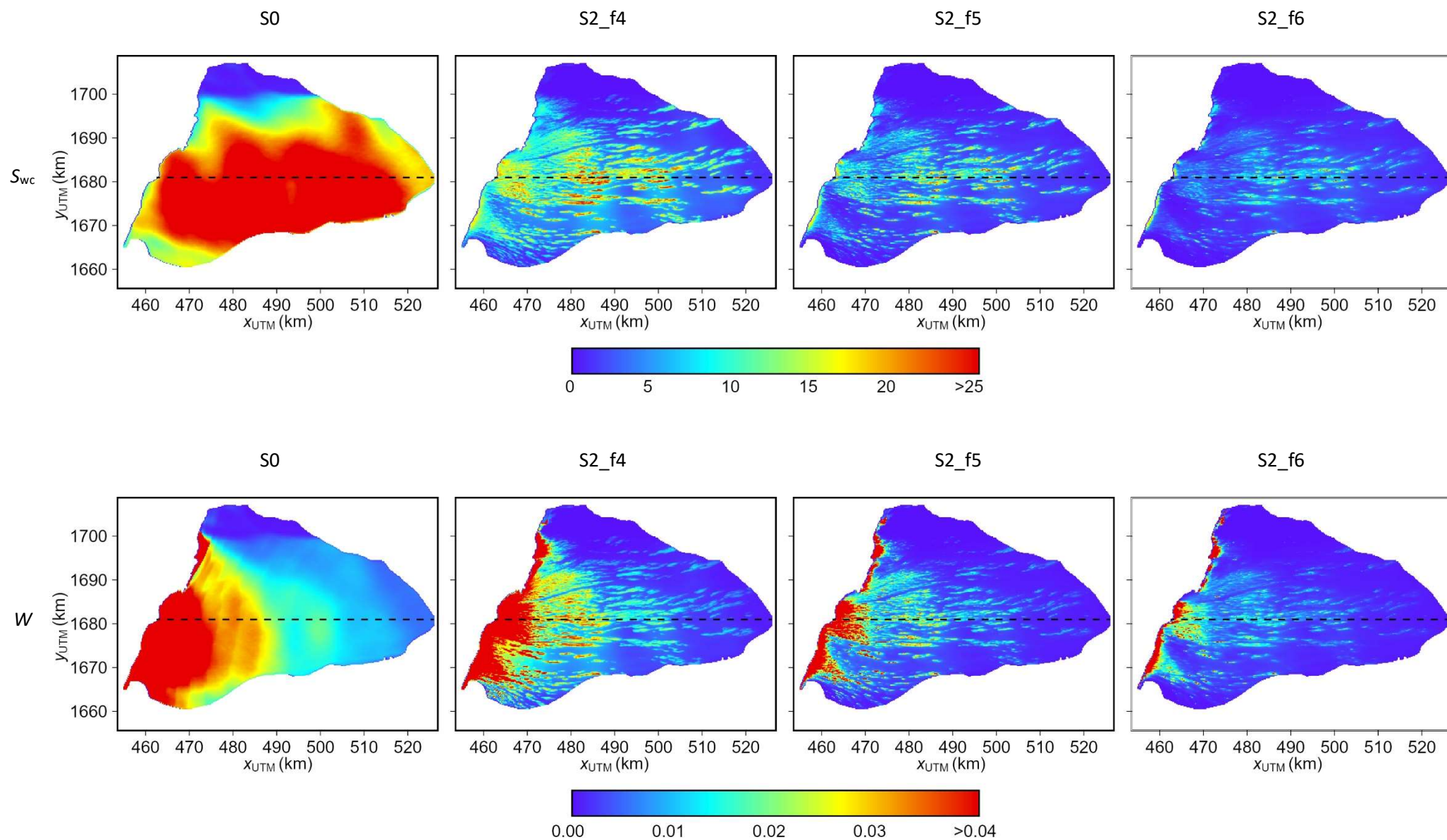


Figure S5. Maps of simulated S_{wc} (integrated over f and θ , in W/m^2) and W (–) for model setups S0, S2_f4 (fitted), S2_f5 (fitted), and S2_f6 (fitted). Polynya from 19. Sep. 2019.

S0

S2_f4

S2_f5

S2_f6

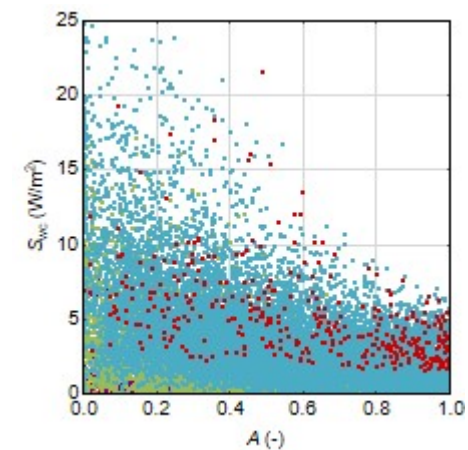
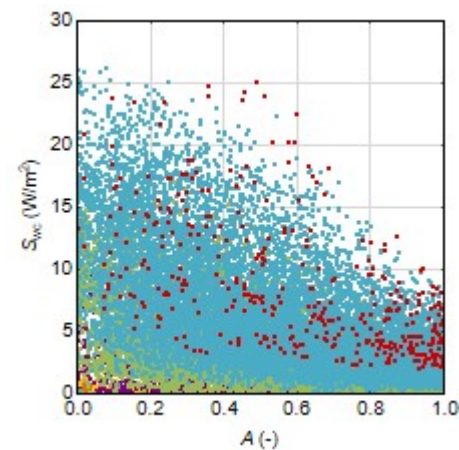
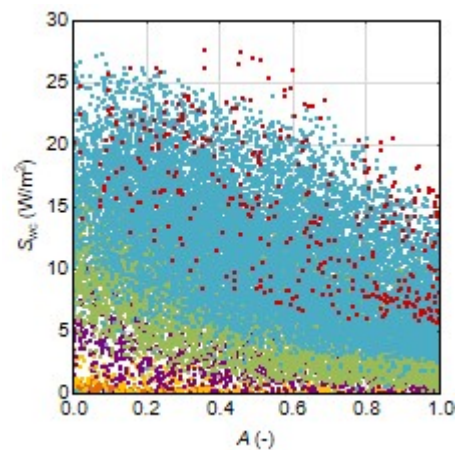
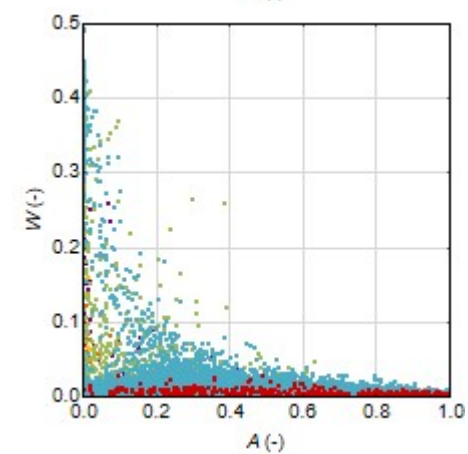
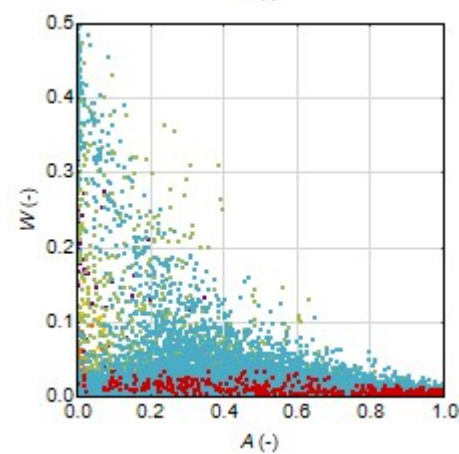
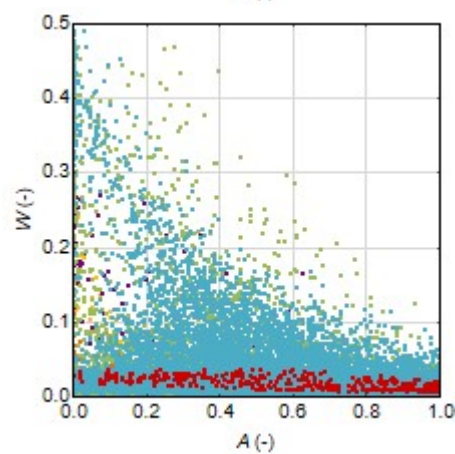
 S_{wc}  W 

Figure S6. Scatterplots of simulated S_{wc} (top) and W (bottom) against ice concentration A for the polynya from 19 Sep. 2019. Colors show different wind speed classes (legend to the right; in m/s). Note different scales on the y axes in the top plots. Note also that no results for S0 are shown as in this case $A = 0$ everywhere.

- $U_w \leq 10$
- $10 < U_w \leq 15$
- $15 < U_w \leq 20$
- $20 < U_w \leq 25$
- $25 < U_w \leq 30$
- $30 < U_w \leq 35$
- $U_w > 35$

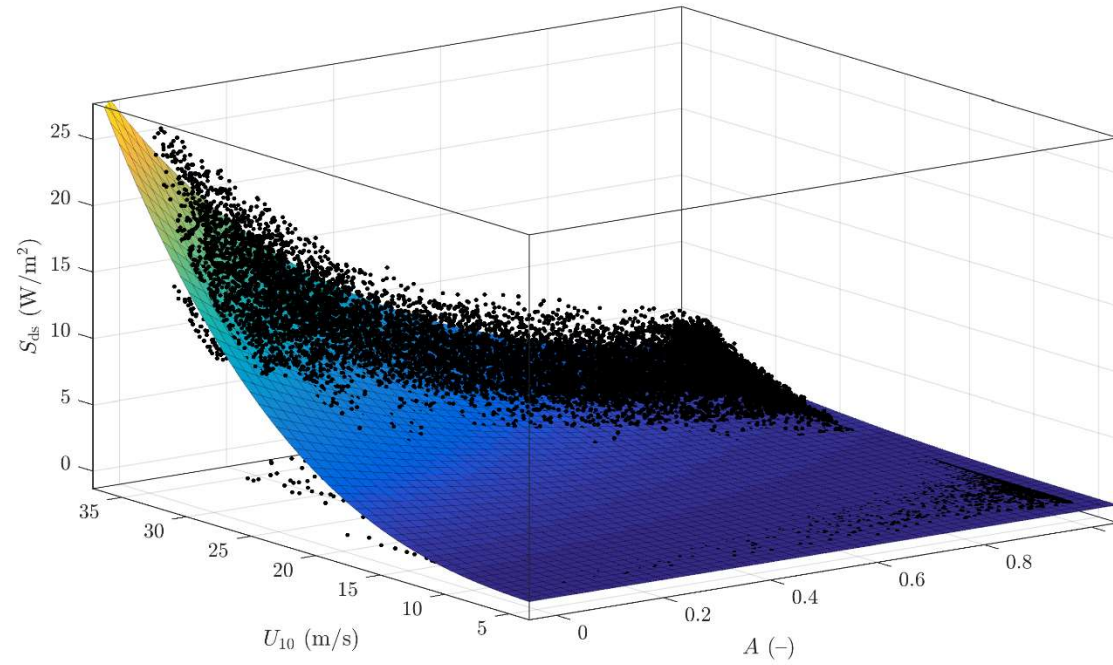


Figure S7. Scatterplot of simulated S_{ds} against ice concentration A and wind speed U_{10} , for the polynya from 19.09.2019 (model setupS2_f5). Black dots are modelling results, color surface shows the least-square fit of the function $S_{ds} = a(d-A)^b U_{10}^c$. The fitted coefficients are $a = 5 \cdot 10^{-9}$, $b = 8.55$, $c = 2.88$ and $d = 4.07$. The correlation coefficient between the fitted and original values equals 0.87 and the root-mean-square error 1.3 W/m².