

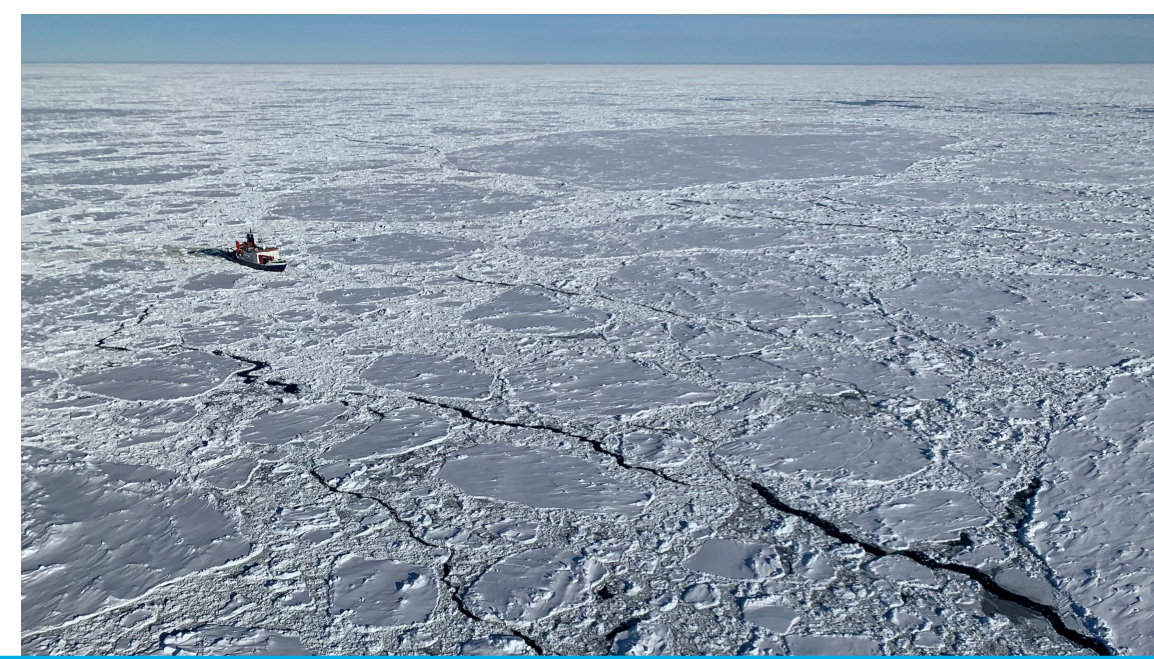
New observations of late summer bio-physical sea-ice and snow conditions in the northwestern Weddell Sea

Introduction: WedIce Project (2019)

Here we present results of the interdisciplinary Weddell Sea Ice (WedIce) project carried out in the northwestern Weddell Sea on board the German icebreaker R/V Polarstern in February and March 2019, i.e. at the end of the summer ablation period. This is the region of the thickest, oldest ice in the Weddell Sea, at the outflow of the Weddell Gyre.

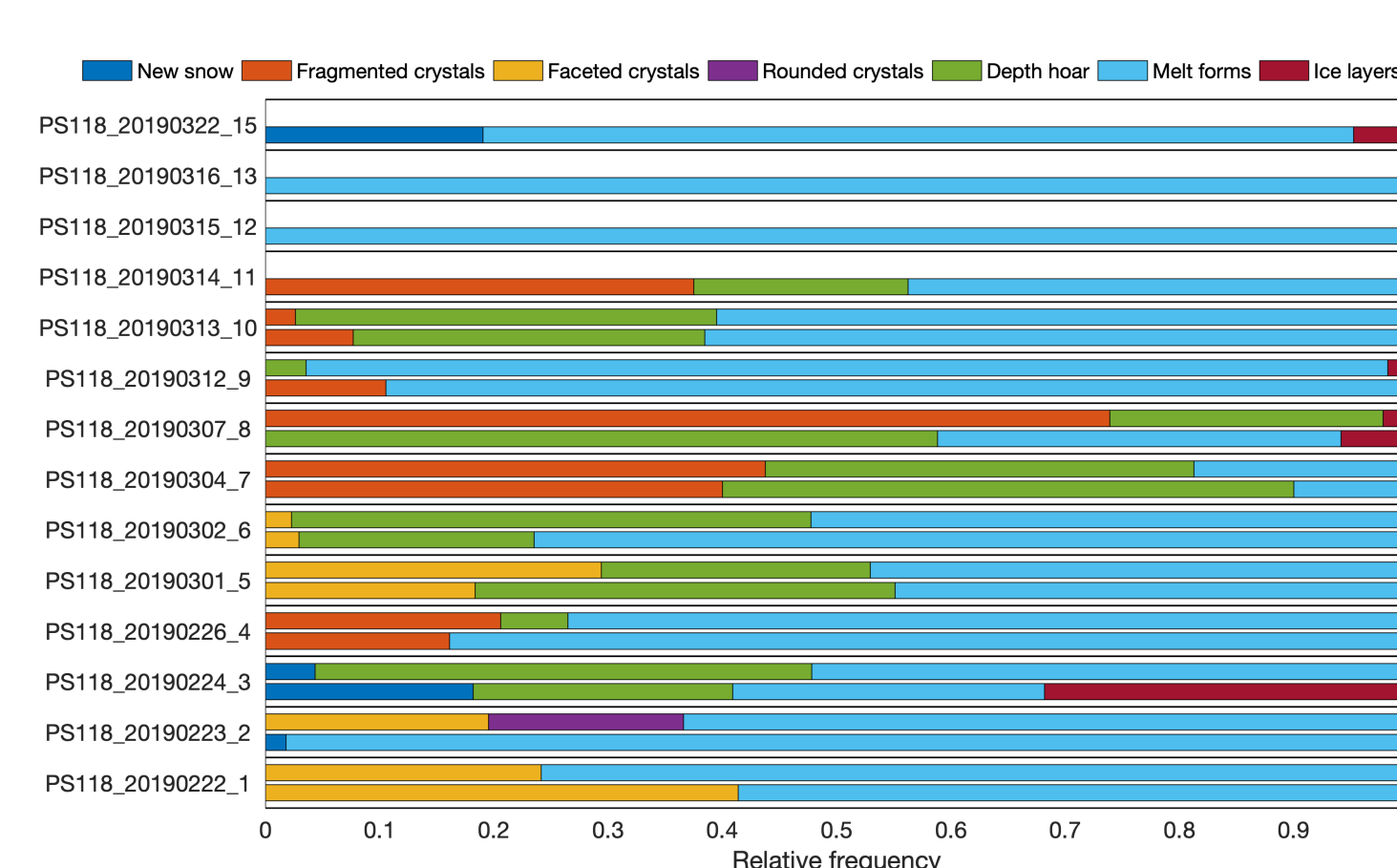
Within the WedIce project, the following measurements were carried out:

- 10 airborne ice thickness surveys
- 15 ice stations working on ...
 - ... sea-ice and snow thickness transects
 - ... snow characteristics
 - ... sea-ice coring for physical and biological analysis
- 3 deployments of drift arrays containing 17 surface velocity profiler (not presented here)

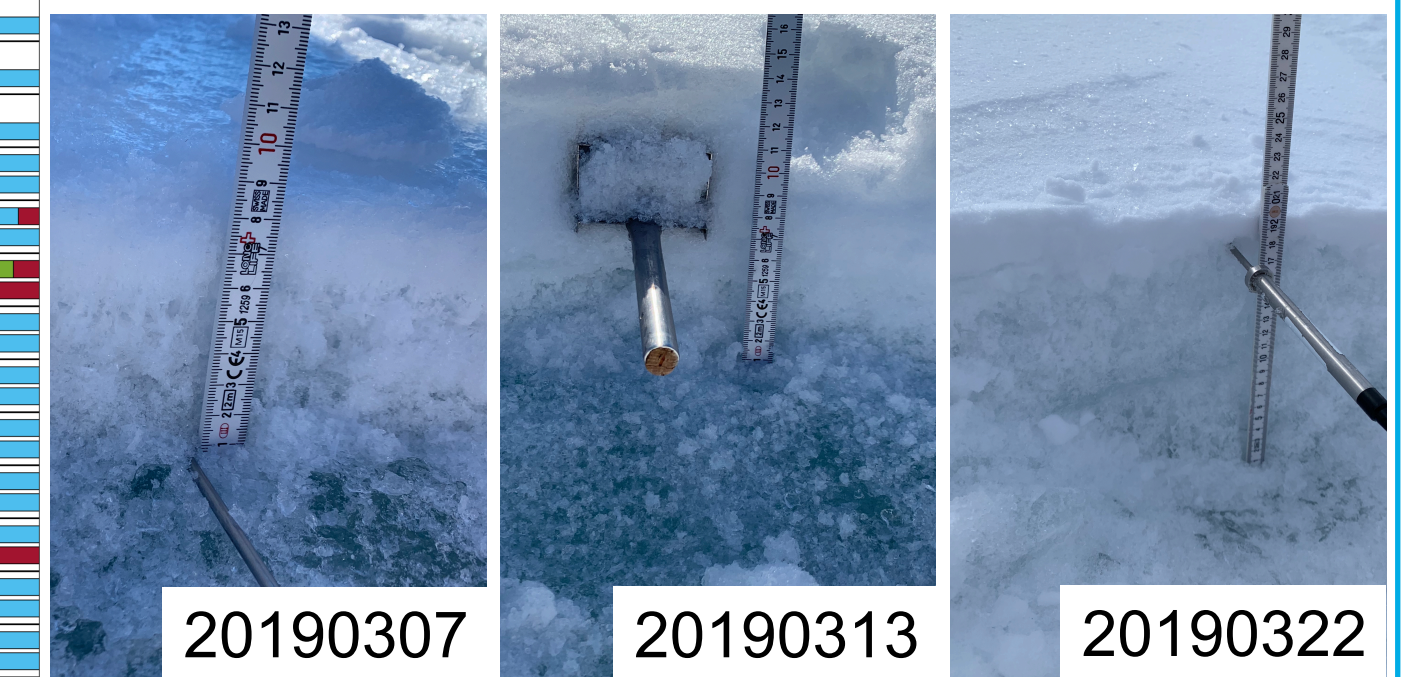


Snow and the underlying superimposed ice

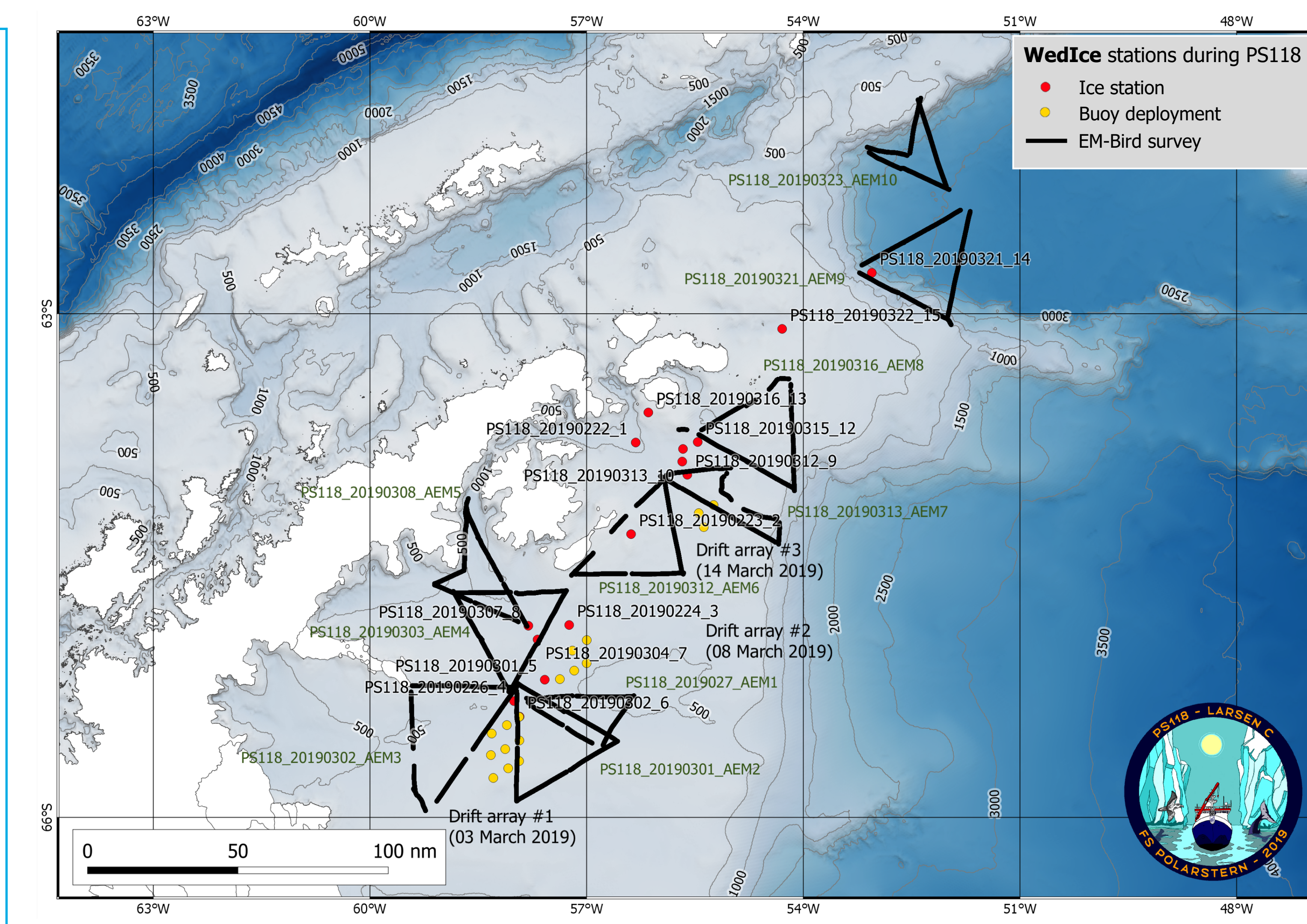
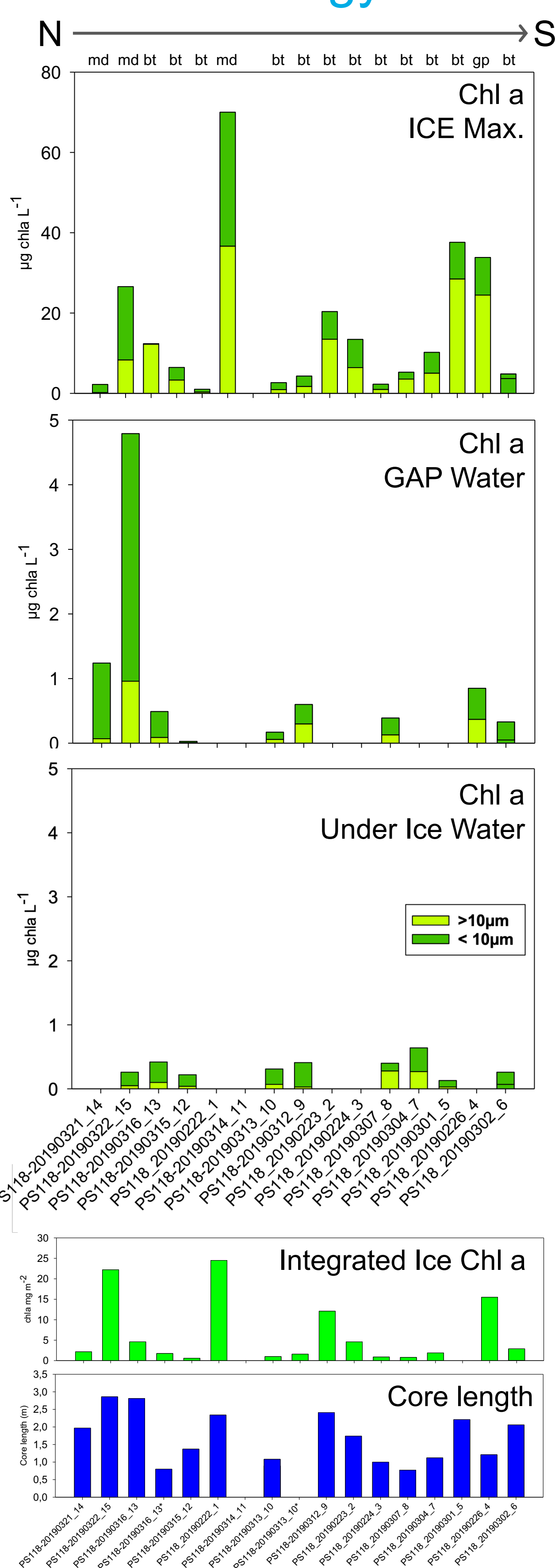
Composition of sampled snowpack



- The late-summer snowpack in the northwestern Weddell Sea is clearly dominated by melt forms

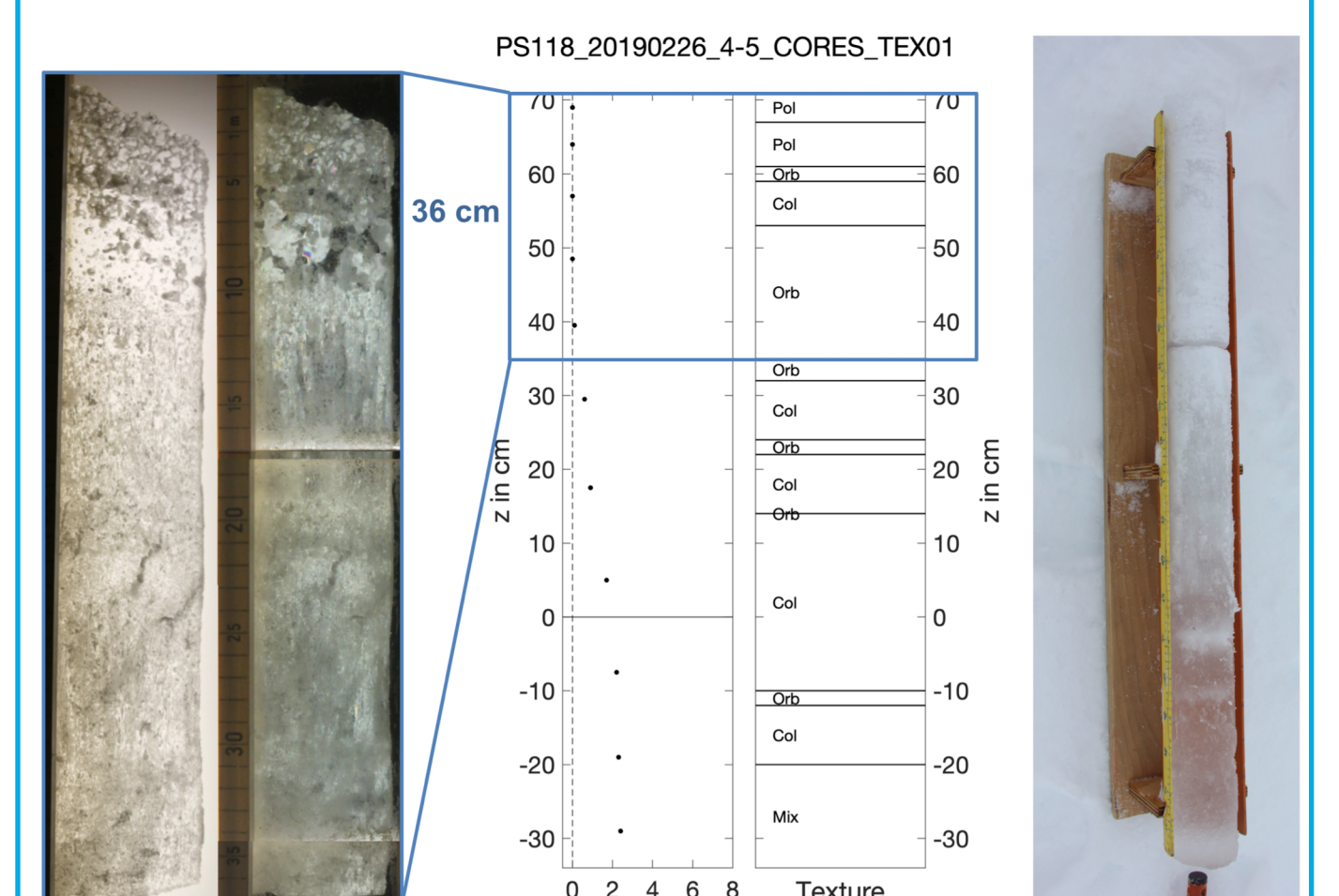


Sea-ice biology



Superimposed ice

- The thickness of superimposed ice was derived from ice-core texture (thick sections, TEX) and salinity profiles (salt-free sea ice, SAL):
 - TEX – 12 ± 6 cm / SAL – 16 ± 13 cm
- Assuming sea-ice and snow densities of ~900 kg m⁻³ and 300 kg m⁻³, 36/ 48 cm of the seasonal snow are transformed into superimposed ice



Example of an ice core for station PS118_20190226_4. While the ice-core texture is visually analyzed from the thick sections (left), salinity is measured from the melted ice core sections.

- High concentrations of ice algae biomass dominated by large species with maxima in various core sections (gp: gap, bt: bottom, md: middle)
- Latitudinal gradient in flagellate dominated gap water communities
- Small algae also dominate the low under ice water biomass

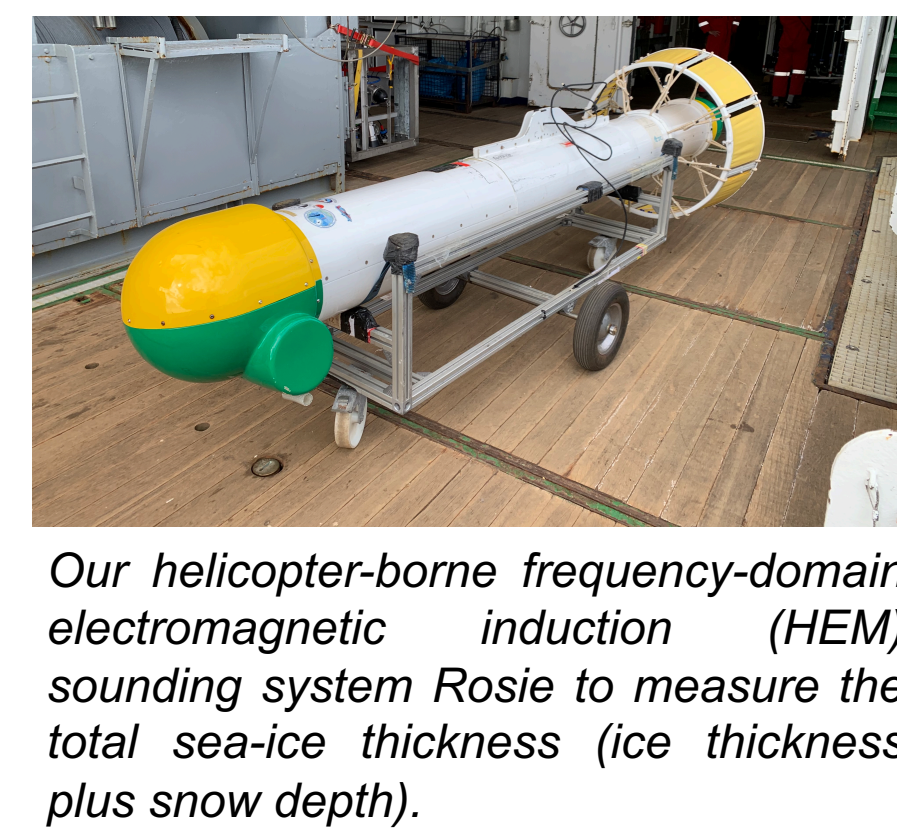
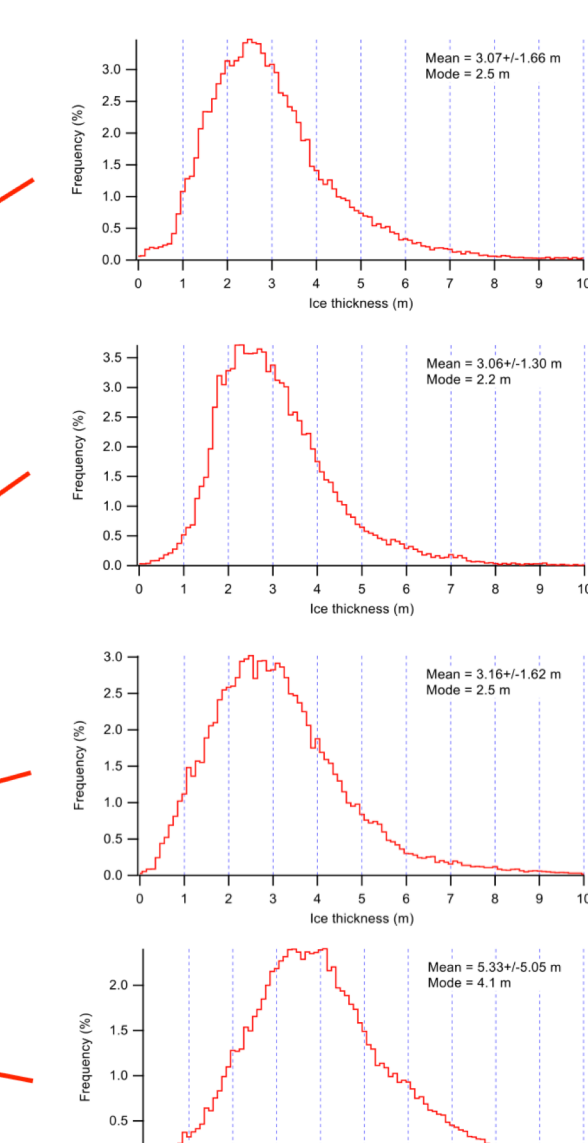
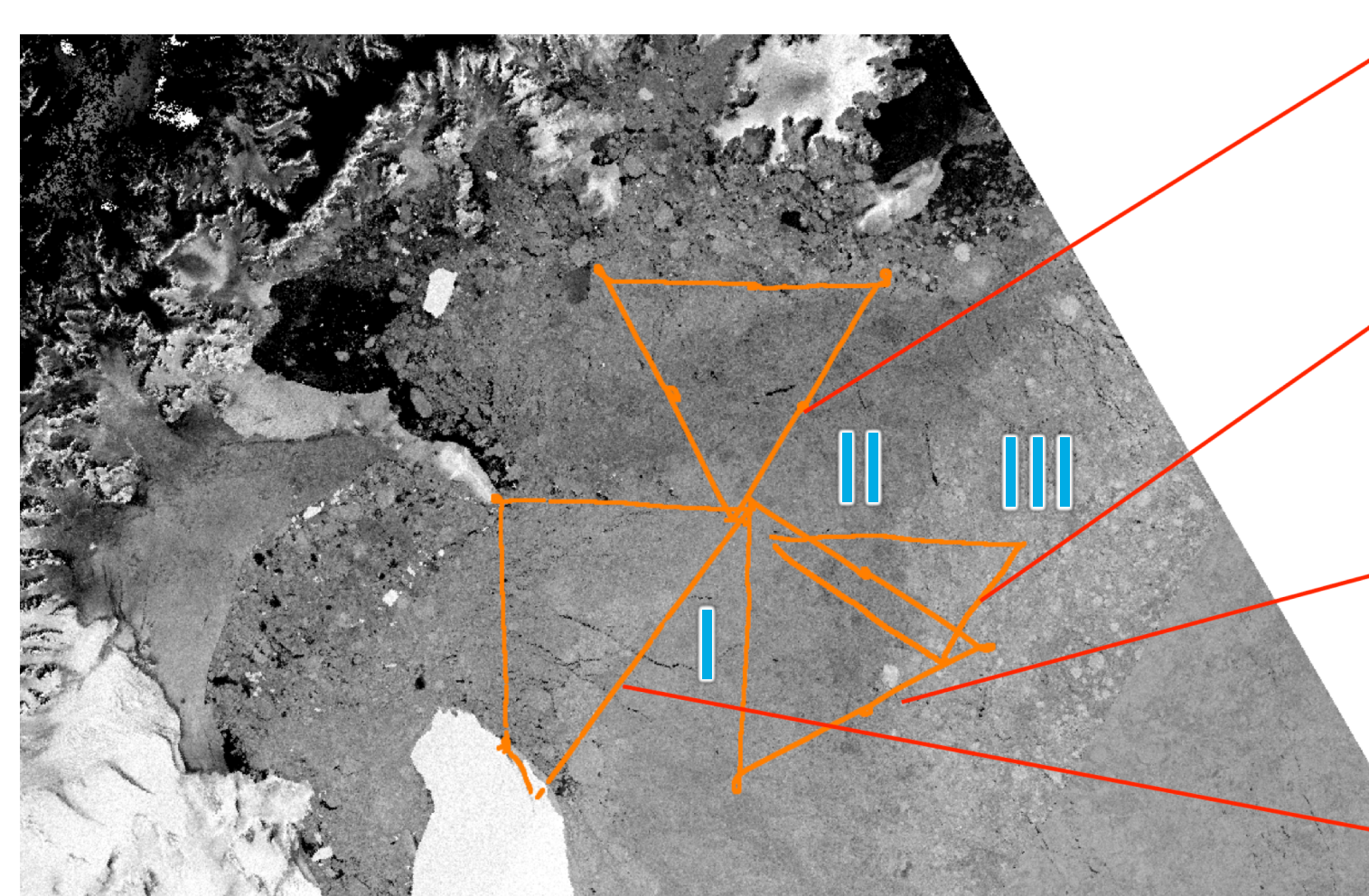


Key points

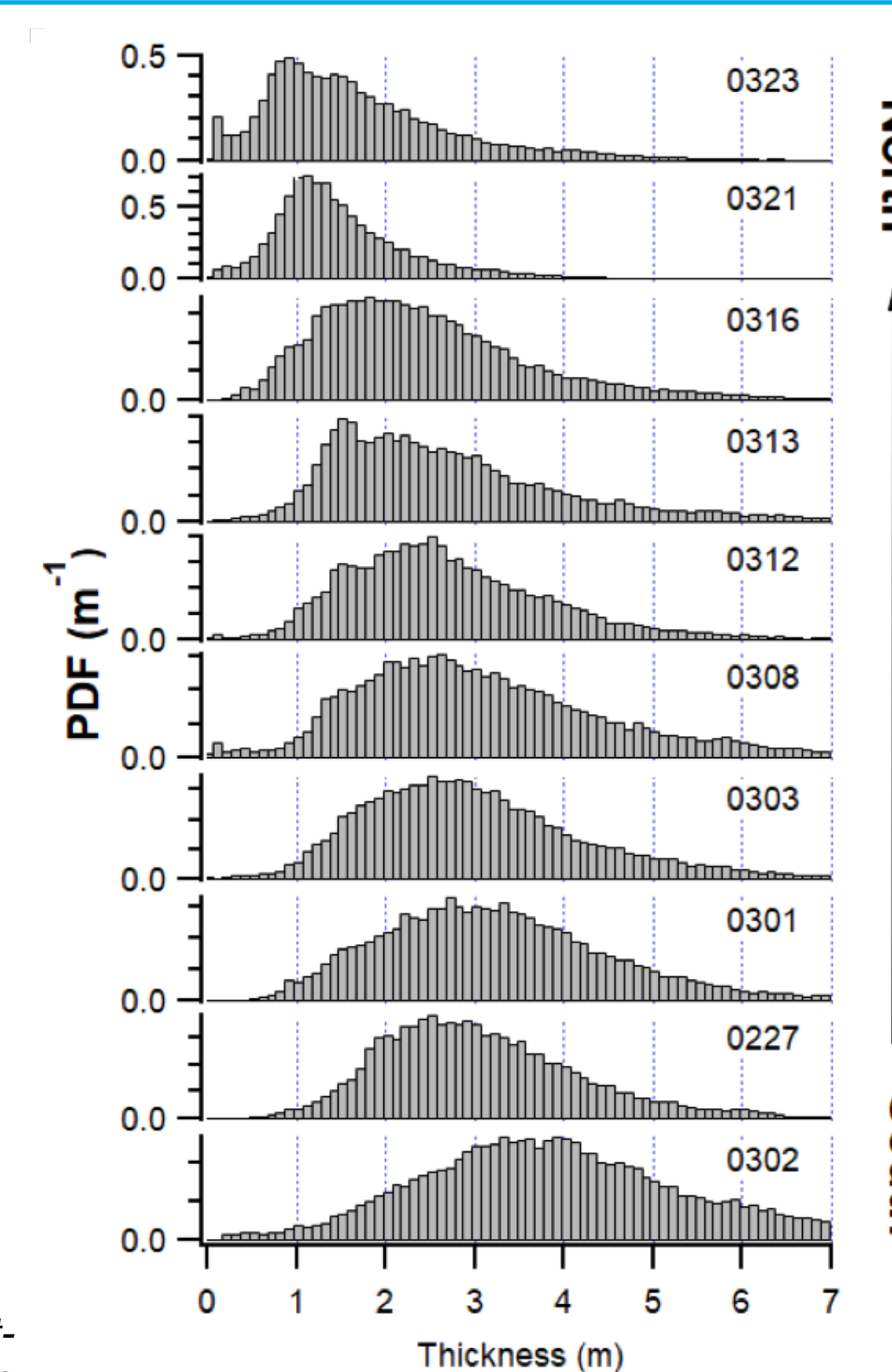
- Sea ice conditions in the northwestern Weddell Sea are still severe and have not changed significantly since the last observations carried out in 2004/2006
- Observed snow depth was comparably low as a consequence of summer's thaw and therefore its significant transition into superimposed ice
 - The presence of relatively thin, icy snow has strong implications for the sea-ice mass balance, for freshwater oceanography, and for the application of remote sensing methods
- Standing stocks of integrated sea ice algae biomass are among the highest observed in Antarctica with a slight "seasonal" trend
 - Higher trophic levels in the Western Weddell Seas can be related to concentrated food source from the ice

Sea-ice thickness in the western Weddell Sea

- The study region was characterized by the presence of at least three different ice regimes:
 - Heavily deformed ice near the coast and A68
 - A band of younger, thinner, less deformed ice originating from the Ronne Ice Shelf east of (I)
 - Older, strongly deformed, thick ice originating from the southeastern Weddell Sea in the very east

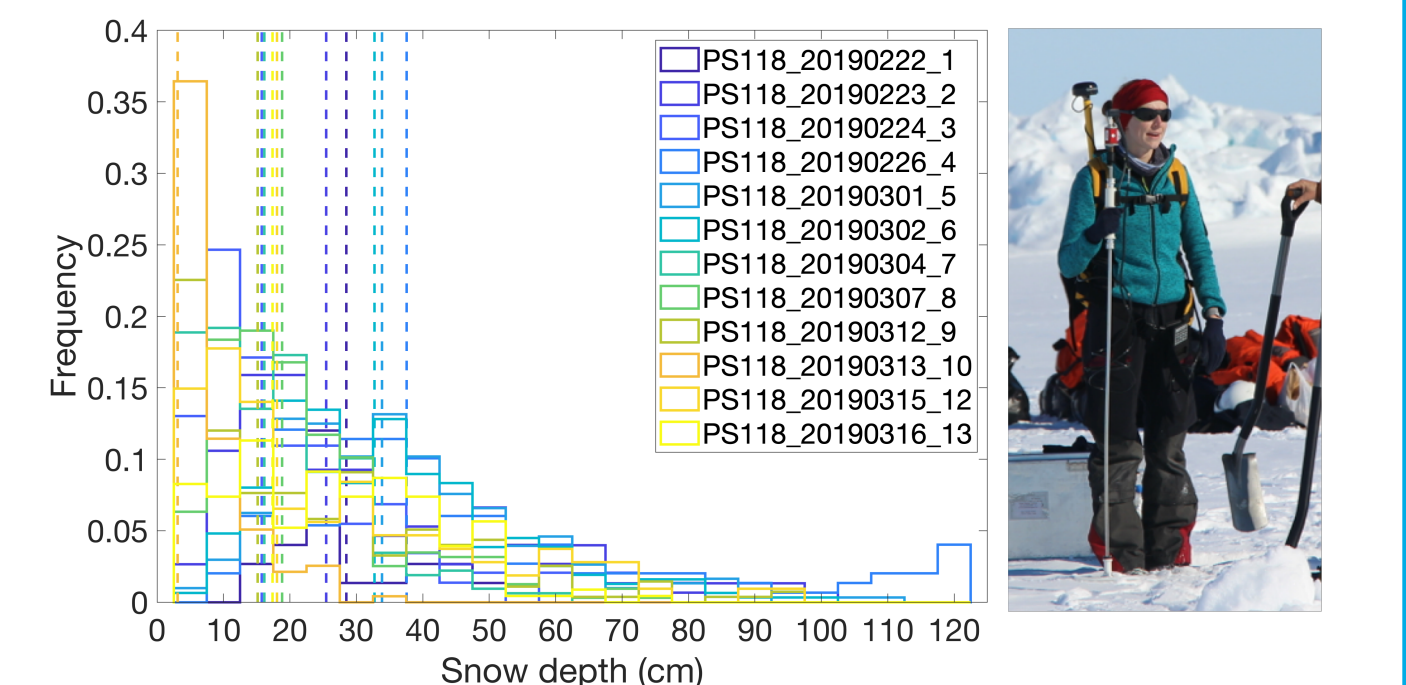


Ice thickness distribution of the four most-southern ice-thickness survey flights close to the iceber A68. Background of the map shows the Sentinel-1 image of March 07, 2019.

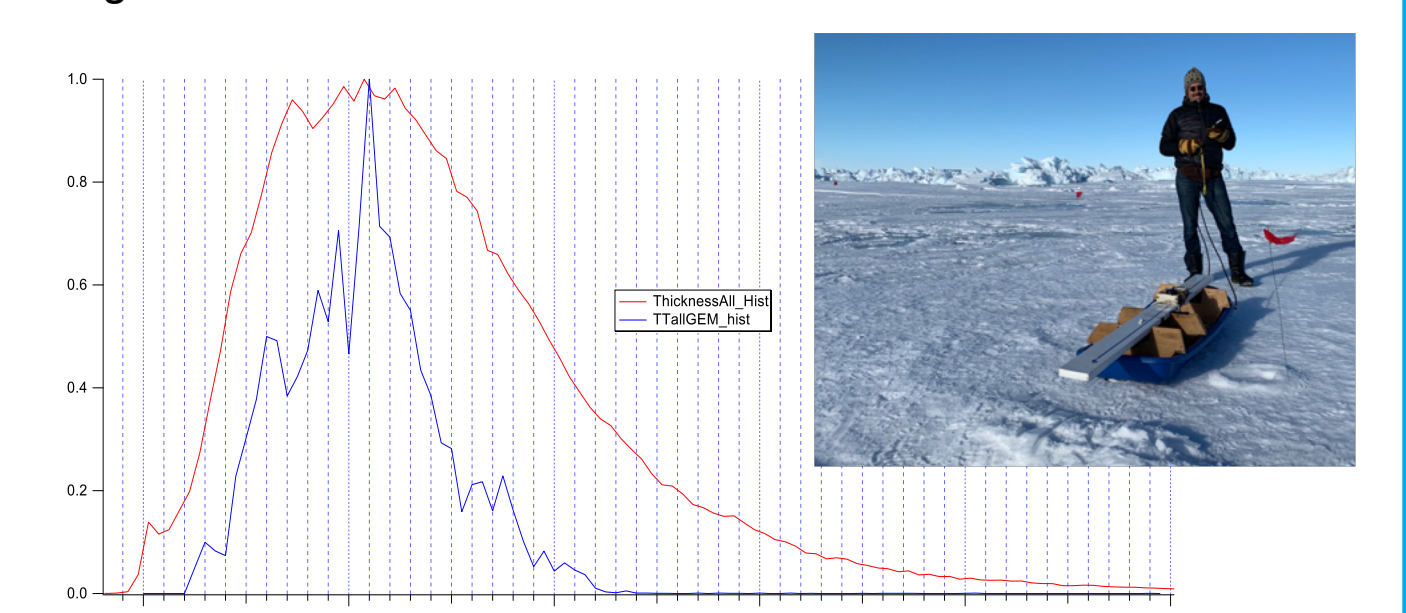


Ice thickness distributions of all flights, from the south (bottom) to the north (top).

Ground-based snow and sea-ice thickness



Snow depth distribution for all ice stations measured with the MagnaProbe.



Overall ice thickness distributions from all ground-based (GEM, blue) and helicopter-based (HEM, red) surveys.

Acknowledgements:

We gratefully acknowledge the support of the cruise leader Boris Dorschel and the captain and crew of R/V Polarstern during expedition PS118 (Larsen 2019). Especially, we thank Erika Allhusen and Kerstin Jerosch for supporting the entire sea-ice work on the ice, in the lab as well as in all needed preparations.



Contact:
 Christian.Haas@awi.de
 Stefanie.Arndt@awi.de
 Ilka.Peeken@awi.de

