AGU PUBLICATIONS

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Supporting Information for

Ice and snow thickness variability and change in the high Arctic Ocean observed by in-situ measurements

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Table S1: Summary of ice and snow thicknesses of thick ice (excluding refrozen leads) carried out in this study in 2017 and in previous years. Cf. Figure 1 for locations.

			Total ice thickness			**Snow thickness**		
Site	**Latitude (°)**	**Longitude (°)**	**Length (m)**	**Mode (m)**	**Mean (m)[a]**	**N**	**Mode (m)**	**Mean (m)[a]**
1	83.05	-63.62	1760	2.35	3.46 (1.03)	529	0.5	0.46 (0.24)
2	83.44	-64.42	2335	2.35	3.23 (0.87)	113	0.4	0.32 (0.15)
3	83.98	-66.36	2125	2.75	3.65 (0.98)	523	0.35	0.3 (0.25)
3b	83.96	-67.01	4440	2.85	3.42 (1.1)	1232	0.35	0.39 (0.28)
5	84.86	-69.71	4025	2.75	3.44 (1.06)	1108	0.35	0.35 (0.2)
6	85.45	-73.43	2230	2.45	3.24 (1.04)	1173	0.25	0.4 (0.25)
7	85.85	-76.64	2395	2.05	2.56 (0.6)	529	0.25	0.4 (0.23)
8	86.28	-80.08	3025	1.75	2.52 (0.61)	480	0.35	0.43 (0.14)
9	86.74	-84.65	3405	1.85	2.67 (0.76)	644	0.35	0.47 (0.24)
10	87.08	-91.16	4085	1.75	2.75 (0.82)	2417	0.25	0.34 (0.22)
NE1	83.22	-53.95	2315	3.15	3.76 (1.18)	797	0.1	0.46 (0.33)
NE3	84.82	-47.88	4595	2.15	3.41 (1.16)	1029	0.4	0.4 (0.16)
CryoVEx 2014								
Main camp	84.00	-40.00	800	3.05	3.47 (0.49)			
North site	86.00	-35.00	475	2.35	2.43 (0.2)			
CryoVEx 2011								
North site	85.58	-69.58	1110	2.1				
South site	83.62	-62.87	425	2.8				
Fast ice	82.55	-62.38	1235	3.4				
GreenICE 2004								
Ice camp	84.89	-71.08	2125	3.5	4.1 (1.3)			

[a]Mean (and standard deviation)

Figure S1. Photo of the EM31SH ice thickness sounder and Magnaprobe snow thickness sensor used in this study. The EM instrument is strapped onto a toboggan dragged by one person and operated in horizontal dipole mode. The Magnaprobe is carried by another person. Note rather level ice surface morphology (Site 5; cf. Figure 2) and Twin Otter aircraft in the background (small black spot).

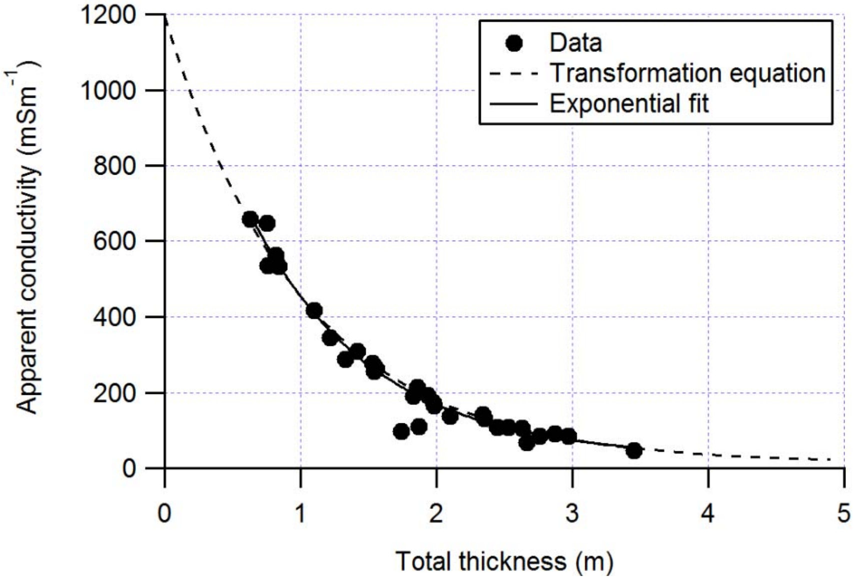

Figure S2. Comparison of coincident measurements of apparent conductivity σ_a and drill-hole total thickness h_{drill}. Measurements were carried out with a short EM31SH instrument at a height of 0.15 m above the snow. From many years of measurements we obtained a transformation equation of σ_a = 13.4 + 1366.4 * exp(-0.9823 * h_{drill}) used to invert measurements of apparent conductivity into ice thickness (Haas et al., 1997). Validity of this transformation equation is confirmed by the close agreement with an exponential fit to the data.

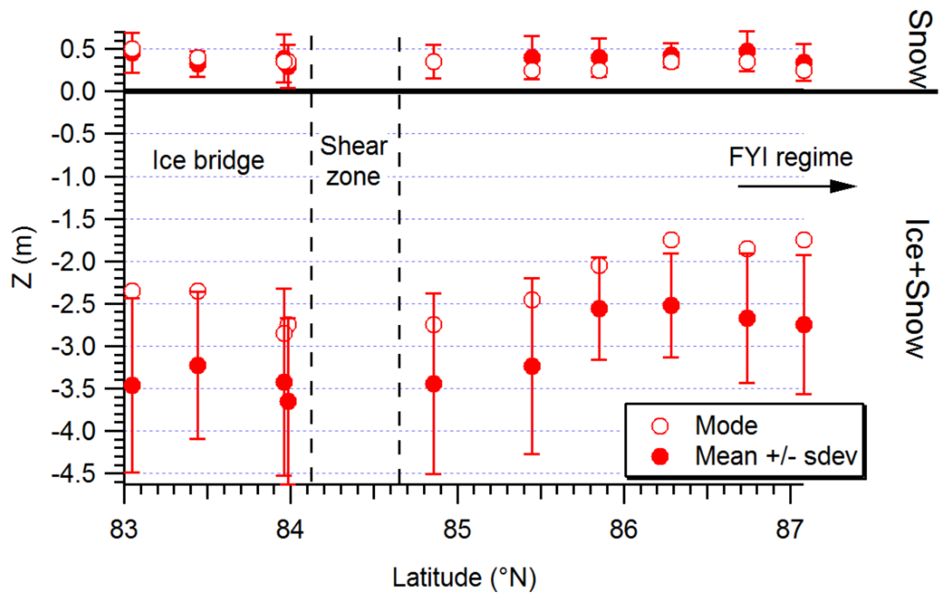

Figure S3. Ice and snow thickness measured in April 2017 on 10 ice floes along CryoSat orbit 37159 (see map in main manuscript, Figure 1), from south (left) to north (right). Error bars show +/- one standard deviation. Ice thickness is plotted with negative sign, illustrating approximate sea ice draft. Note that ice thicknesses were derived by EM sounding and actually represent snow-plus-ice thickness. This is a modified version of a figure shown at the European Space Agency's campaign blog at http://blogs.esa.int/campaignearth/2017/05/01/cryovex-first-results-show-sea-ice-continues-to-thin . Here, mean thickness represents the total thickness of thick ice, i.e. excluding the thickness of thin refrozen leads of the landing sites as described in the methods section.

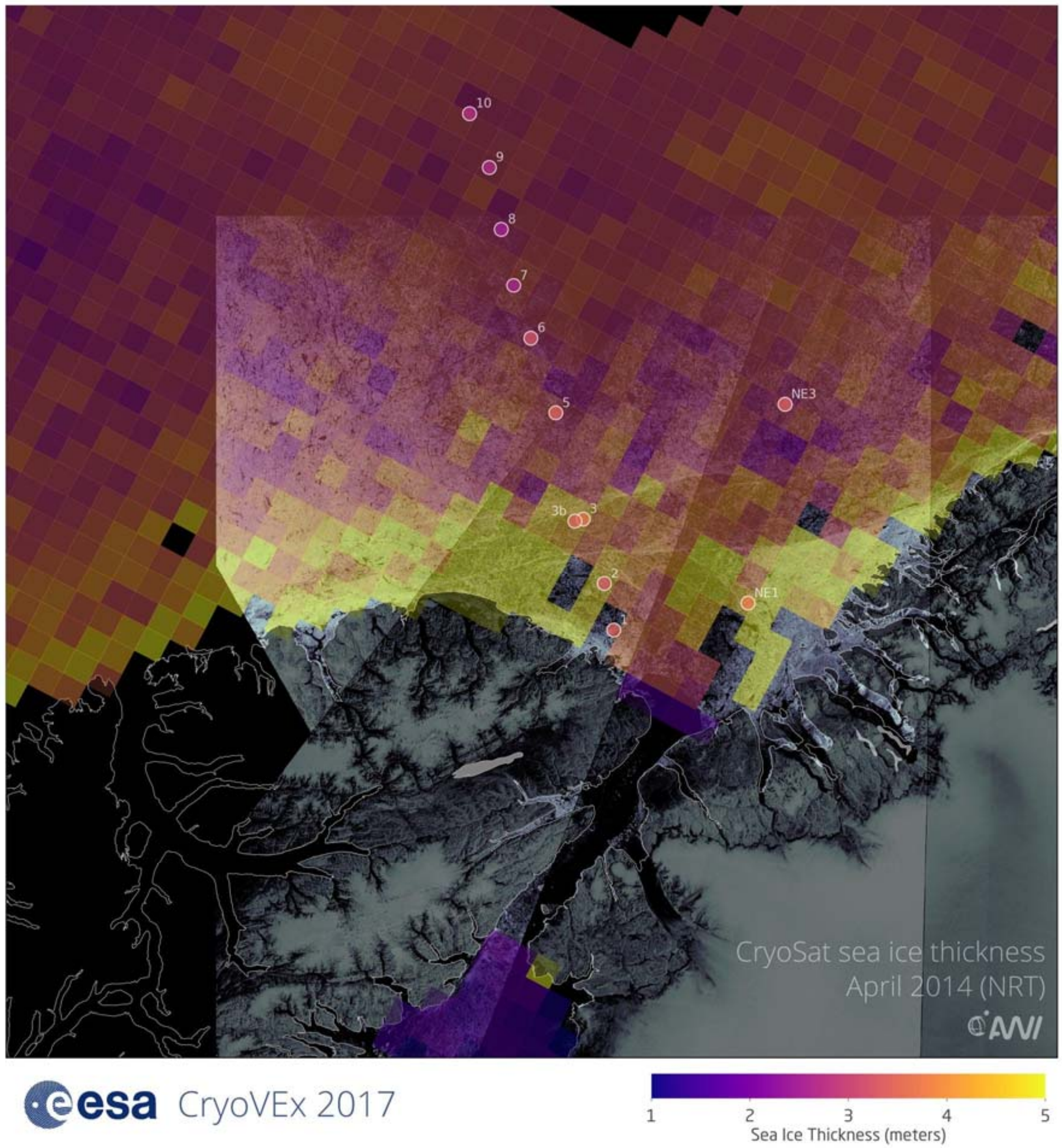

Figure S4. Map of the study area, showing mean ice thickness observed at sampling locations and retrieved from CryoSat-2. The comparison of both measurements is also shown in Figure 3b. CryoSat-2 data are from the Alfred Wegener Institute (AWI) near-real-time product downloaded from https://meereisportal.de. Background image shows radar backscatter from ESA Sentinel-1 SAR. Note coincidence of large CryoSat thicknesses (yellow) with extensive shear ridges visible in the SAR image.