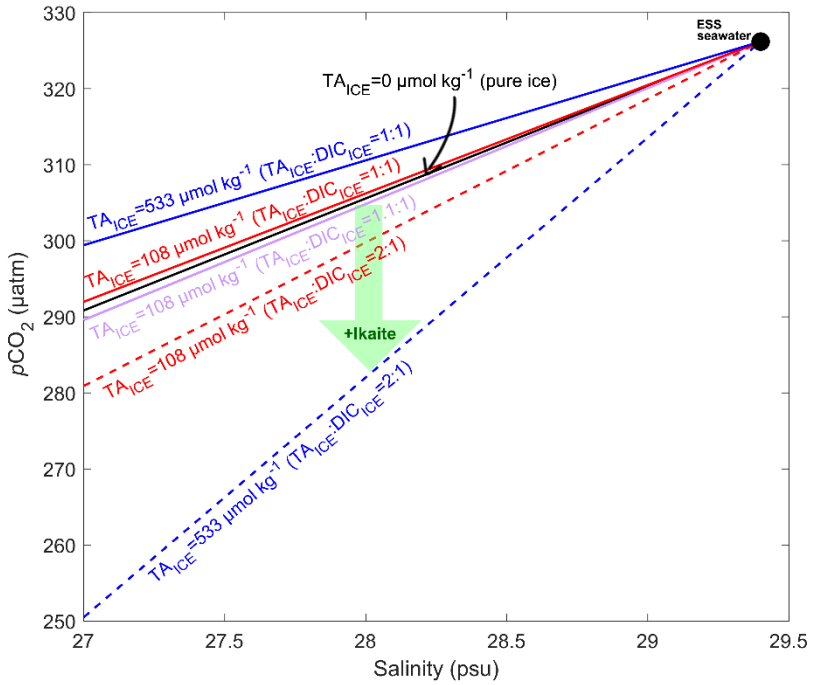
Supplementary Material

1. Supplementary Table

Supplementary Table 1. The total alkalinity (TA_{MIX}) of the mixture of seawater certified reference material (CRM Batch 174 prepared and distributed by Andrew Dickson, Scripps Institution of Oceanography) and deionized water (DW).

No.	Ratio (SW/DW)	salinity	calculated TA_{MIX} ($\mu mol\ kg^{-1}$)	measured TA_{MIX} ($\mu mol\ kg^{-1}$)
Set #1				
CRM		33.408		2212.23
1	28.2	32.264	2136.48	2134.64
2	11.1	30.652	2029.76	2028.30
3	3.8	26.514	1755.74	1754.51
4	1.8	21.480	1422.39	1421.25
5	1.2	18.422	1219.86	1219.42
Set #2				
CRM		33.408		2212.23
1	9.4	30.185	1998.81	2000.03
2	6.3	28.817	1908.25	1907.88
3	3.1	25.179	1667.31	1666.83
4	2.5	23.912	1583.40	1582.25
5	0.8	14.923	988.16	988.02

2. Supplementary Figure



Supplementary Figure 1. Predicted seawater pCO_2 mixed with sea ice melt water at 0°C. The black circle indicates a salinity and pCO_2 value of the East Siberian Sea (ESS). The black and purple lines represent the predicted pCO_2 for seawater mixed with pure ice (TA_{ICE} = 0) and the sea ice of this study (IC1; TA_{ICE} =108 µmol kg^{-1} and DIC_{ICE} = 97 µmol kg^{-1}), respectively. The red and blue solid and dashed lines represent the predicted pCO_2 for seawater mixed with sea ice with fixed TA_{ICE} and variable TA_{ICE}:DIC_{ICE} ratio. The TA_{ICE} of 533 µmol kg^{-1} for blue lines was obtained by Rysgaard et al. (2012), and The TA_{ICE} of 108 µmol kg^{-1} for red lines represents the value of IC1. When ikaite formation and dissolution is a dominant chemical process in sea ice (i.e., TA_{ICE}:DIC_{ICE} = 2:1), sea ice melting-induced TA_{ICE} release significantly decreases seawater pCO_2 (dashed lines) in addition to the dilution effect (black line). On the other hand, this additional effect is not expected for the sea ice with TA_{ICE}:DIC_{ICE} = ~1:1.