

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2021-320

Eric Mortenson (Referee)

Referee comment on "Variability in sea ice carbonate chemistry: a case study comparing the importance of ikaite precipitation, bottom-ice algae, and currents across an invisible polynya" by Brent G. T. Else et al., The Cryosphere Discuss.,
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General comments

The study presents a comparison of the ice carbonate system throughout the ice column between two sites exhibiting different biological (ice algal) and physical (currents, snow cover) conditions. One of the main results is emphasis on the importance of brine drainage over secondary processes like primary productivity and ikaite precipitation in characterizing the ice-carbonate system. They acknowledge that air-sea exchange and ikaite precipitation may be important near the surface, and that primary productivity be important near the bottom, but the much thicker middle of the ice column has a stronger influence when averaging over the entire ice column.

The challenge to the main result above is the TIC and TA deficits in the surface ice, as shown in the S:TIC and S:TA plots (fig 7). Although this layer is small relative to the entire ice column (therefore making the deficits not as important when considering the entire ice column), why are the nDIC:nTA slopes (fig 8) so close to the ikaite precipitation slope?

I think the answer is that the different horizons are improperly weighted in fig 8. I.e., with the exception of the "high-resolution" core, there are an equal number of measurements for the relatively thin surface and bottom layers as there are for the thicker middle layer. I suggest making separate regression lines for each layer for the 2 cores, and stating that the thicker middle layer dominates the bulk characteristics (per unit area).

After addressing the above, as well as fixing the minor comments below, I would recommend this article for publication in The Cryosphere.

Cheers,

Eric Mortenson

Specific comments

-84: I suggest adding underlined: ...and under-ice seawater temperature and currents...

-104: I suggest adding underlined: ...a function of under-ice seawater nutrient concentration and turbulence, ...

-259-260: Note that the respective magnitudes of tidal amplitudes and of tidally-induced currents are not necessarily related (e.g., currents can be quite strong at the mouth of an enclosed bay with a small opening, due to small amplitude changes in the enclosed bay)

-323: As mentioned just above this line, snow cover has a strong effect on light penetration, it would be nice to see a number for (or quantitative comparison to) Dalman's snow cover measurement.

Table1/2: It would be nice to see these separated by date, in addition to the totals, at least for mean and standard deviation

Technical corrections

-Please be consistent using either DIC or TIC, but not both.

-Just a stylistic comment, why use "horizons", instead of strata or levels?

-102-103, twice there are "(" with no ending parentheses, replace with commas maybe

-Lines 119 and 125, Please spell Mortensen with "-son"

-To me, it seems a bit clearer if the paragraph on all cores collected (lines 187-196) came before the paragraph on individual core carbon sampling (lines 177-186)

-Line 372: Nomura, Nomura should be Nomura, 2014

-Line 433: remove "to" at end of line

-Tables 1 and 2 appear to be identical, but with slightly different captions.

-Fig. 1: I recommend changing the font color for POLY to white to improve visibility