

## ***Interactive comment on “CO<sub>2</sub> flux over young and snow-covered Arctic sea ice in winter and spring” by Daiki Nomura et al.***

**Anonymous Referee #2**

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The manuscript makes interesting observations of CO<sub>2</sub> flux through sea ice, but requires extensive improvement. It was never articulated how this study is novel. I feel that it perhaps may be novel, but it is unclear how in its current form. Major revisions are needed before this manuscript can be considered publishable.

The abstract is borderline uninformative. What are characteristic fluxes? Are these important? Of course CO<sub>2</sub> can flux through sea ice, but it's hard for the reader to gage exactly how trivial this is without values in the abstract to justify reading the rest of the paper.

The sentence beginning line 61 is a reference dump. What did these studies find and how does it build to the importance (or lack thereof) of the present manuscript?

C1

68: Sea-ice CO<sub>2</sub> fluxes

On line 81, please see Massman et al. (1995) as the fundamental reference on this topic ([https://www.fs.fed.us/rm/pubs\\_exp\\_for\\_glees/exp\\_for\\_glees\\_1995\\_massman.pdf](https://www.fs.fed.us/rm/pubs_exp_for_glees/exp_for_glees_1995_massman.pdf)).

Somewhat harsh transition before the last paragraph of the introduction. Please state more clearly how the background materials presented tie directly to the proposed study and therefore what makes the present study novel. Material in section 4.3 could help. (note that there are also many reference dumps here. Please explain what the studies found; it is your job to make the reader's job easy (<https://www.sesync.org/blog/the-writers-job>)).

on line 132, how was it ensured that placement of chambers did not perturb the pressure gradients in the snow? Creating pressure gradients can push CO<sub>2</sub> out (or pull it in).

on 144, please see Bain et al. (2005) as a relevant reference for wind-induced effects (<https://www.sciencedirect.com/science/article/pii/S0168192305001164>)

Frost flowers are first introduced in the paragraph beginning on line 146. One assumes that these are somehow important for CO<sub>2</sub> flux? The notion was not previously introduced. (see line 360. This belongs in the intro). I agree with Reviewer 1 that the manuscript was prepared somewhat hastily.

153: what is station FI6? Abbreviations are introduced before they are explained. It would help to explain the geography of the site before the measurements, also to ensure that measurements were made with a random design in mind.

Extensive English improvement is needed in section 2.3

On line 266, what does 'near-constant 0 C' mean?

60.0 cm sounds rather specific for a measurement of snow which I assume has frequent small undulations, either at the snow surface or snow-ice interface

C2

in section 3.4, per day is not a SI unit, and diurnal patterns in the flux may make it difficult to scale from the native measurements (in the SI units of seconds) to the full day.

416: the abbreviation F was introduced far earlier.

432: this is actually interesting. By focusing on the challenge of estimating gas transfer velocity, the manuscript has some novel features. These might be initial hypotheses for future work if causality can't be determined, but the mechanisms of sea ice/atmosphere gas exchange make for a more interesting analysis even if remaining questions are left.

Figure 4: avoid simultaneous use of red and green in a figure.

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