

1) GENERAL COMMENTS

The authors made a notable effort to deal with all the comments and suggestions I made in my first review, and I thank them very much for that.

Re. general comments #2 (site map, field and lab protocol pictures) and #4 (statements not supported by figures, data or references), the authors answered to the concerns I raised, and I have nothing more to add.

Re. general comment #1 (broad-audience impact), I still think that this work is relevant for a rather specialized audience, but I understand the points brought by the authors. I'll let the final decision to the Editor and I'm OK with the acceptance of the manuscript (after minor revision, see below).

Re. general comment #3 (main text structure, methods vs. results sentences), I totally get it that this paper mainly focuses on experimental/methodological aspects, as the authors say. In fact, the manuscript reads easily as is (as I already mentioned in my first review). Still, many sentences appearing in the Results and Discussion section are indeed associated to the work conducted in the lab, i.e. methods. If the Editor agrees to accept this non-conventional structure, I am OK with that.

I made a few (minor) specific comments, see below.

General question: What is the difference between 'Appendix' figures (included in the submitted manuscript) and 'Supplementary' figures (appearing in a separate file)? Why not group them all in the same category?

A final, important remark: according to the journal's guidelines, the data availability question (P26, L467-468, see below) should be settled BEFORE publication, not after.

2) SPECIFIC COMMENTS AND EDITORIAL SUGGESTIONS

P= page number, L = line number.

P1, L18-19. « However, existing gas extraction methods HAVE not been well tested. »

P2, L30-31. Carbon and nitrogen have just been mentioned in the line above, so I suggest using 'C' and 'N' from now on (« ... temporarily removing this frozen C and N from active global cycles. »).

P4, L98. If we are talking about the gas mixing ratios of the ice-wedge ice, then we should read « ... in that ITS gas mixing ratios are not homogenous... ».

P8, L190-193. I don't understand this sentence. Maybe it's related to the phrase 'of in centimetre scales'. What does it mean, this 'OF IN' phrase? Is there a word missing here, or a word that should not appear?

P11, L240-241. In my first review I suggested to display this information as a figure, rather than in a busy table (former manuscript version: P11, L236-237). The authors prefer to keep it as a table, arguing that the large ranges in CH₄ and N₂O mixing ratios make figures less readable. To me, the supplementary figure provided by the authors in their reply (same page, just below) looks great, and we see the significant differences not only between sites (central Yakutia, eastern Siberia, Alaska), but also between extraction techniques ('hit5' vs. 'hit100'). I thus prefer by far a figure, compared to a table. However, if the Editor also favors a table, then I would suggest to at least add some basic stats

(min-max-mean-SD) below each of the 3 sites, so that the reader can easily and efficiently have a 'big picture' view of these data.

P14, L311. « Even though a small ~~of~~ contamination does exist, ... » (remove 'of').

P17, L357-359. Please add a reference (re. solubility of N₂O in water compared to CH₄).

P20, L409. Repetition of the bullet point just above (« Our findings indicate... »). Suggestion: « These results indicate/suggest that... ».

P26, L467-468. Data availability: How to make sure that the data will indeed be uploaded in a public repository (e.g., Pangaea) only AFTER publication? For several journals now, including TC, the datasets must be CITED within the text and included in the reference list (including an individual DOI): https://www.the-cryosphere.net/about/data_policy.html

I thus suggest submitting the datasets to a public repository with the FAIR approach ('findable, accessible, interoperable, and reusable'), and launch the process BEFORE the manuscript is accepted for publication. I let the Editor take the final decision about this.

3) FIGURES AND TABLES

See general comment above: some figures are in the Appendix, and some others (map, field and lab protocol pictures) appear separately in the Supplementary document. Why?