

The Cryosphere Discuss., author comment AC1
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Reply on RC1

François Burgay et al.

Author comment on "200-year ice core bromine reconstruction at Dome C (Antarctica): observational and modelling results" by François Burgay et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-139-AC1>, 2022

Dear editor,

We thank the reviewers for their work and suggestions.

Below you will find the reviewers' concerns in bold and our answers as plain text.

Best regards

Andrea Spolaor and Francois Burgay on behalf of the co-authors

Overall the manuscript contributes new and important understanding of bromine preservation and potential environmental influences at Dome C. The manuscript objectives, methodology and results are mostly clear. Minor revision suggestions below:

We would like to thank the reviewer for the general feedback to our manuscript and for all the suggested implementations/comments.

Method suggestions:

- move equations from the results section to method section. e.g. equation 1. Discuss only results / discussion in results / discussion section.

We moved eq.1 to the methodological section as suggested (L132-134)

- move the matlab function description to the method section

We moved the findchangepts() Matlab function description to the method section (L168-169)

- move the correlation analysis methods + note the 3-yr moving average (& why this time period was chosen) used for correlation to the methods section - currently in the results / discussion and table 2.

We moved this part in the method section and we briefly explained why we used the 3-years moving average (L165-168):

The correlations computed among the different variables of this study (Na, Br, Br_{enr}, sea-ice extent data, SAM index) were performed using a 3-year moving average. This choice takes into account both the dating error of the core (≈ 3 years) and the effects of wind erosion on the age distribution of surface snow that spans over more than a year (Picard et al., 2019). To identify any abrupt change point in the records, the findchangepts() Matlab (Mathworks) function was used.

Results / Discussion suggestions:

- **First sentence (line 204) is repeated from methods / add to methods.**

We removed the sentence.

- **Suggest moving Figure S1 to main figures - its your first result that you discuss and you refer to it alot throughout your manuscript**

Thanks for the suggestion. Done

- **Line 214 / Figure 1: the recent increase / peak that you mention look similar to previous increases in Na over the record presented. Recent increase in line with past conditions? The current text is misleading suggesting that the recent abrupt Na increase are unprecedented.**

We agree and we reformulate the sentence (L214-216)

Line 228 - reference needed after 400km inland

Reference added

Line 260: replace regions with wavelengths?

We replaced regions with wavelength bands.

Line 263: reference need at end of line

Reference added

Line 280: add wavelengths after 340nm

Done

Line 398: add a reference to Figure S1 (but suggest moving this to main text)

Done

Line 401: sentence unclear. Is the 800km referring to Dome C or a different site. Suggest adding the values from the 800km from coast site for comparison.

We reformulate the complete sentence (L403-404), and now it should be clearer. In Vallelonga et al., 2021 (see quote below) is reported that Brenr < 1 are usually observed in sites that are located more than 800 km inland from the coast. Considering that Dome C is located 1000 km inland from the coast, our findings are consistent with what has been reported in literature. For the sake of clarity we also changed the sentence at

L239-241.

The different Na and Br spatial snowpack concentration patterns are also reflected in the resulting Brenr and nssBr patterns, which are again very similar for the Arctic and Antarctic. Brenr starts with low values near the coast and gradually increases to the highest values approximately 300-600 km inland. Brenr values then quickly decrease further inland and are less than 1 for all sites greater than 800 km from the coast.

Line 407: is the correlation seasonal / annual / inter-annual time period. 3 yr moving average mentioned in table but no reference in methods or discussion. Also recommend stating the resolution / dating error of Dome C and the temporal resolution that can be explored for correlations.

The correlation was performed using the annual averaged Southern Annular Mode (SAM). More details regarding the 3 yr moving average (L165-168), the age uncertainties (L96-97) and the temporal resolution (L109) are now reported in the methodological section. A full discussion about the shallow core chronology is provided in Spolaor et al., 2021 (e.g. Table S1)

Line 410: reference for Law Dome MSA record

Added at L412-413

Line 418: can you expand on why Br and Br enrich have a different correlation result with SAM?

We did not deepen our understanding on why Br and Br enr have a different correlation with SAM since our focus was mainly on investigating the suitability of Brenr as a sea-ice proxy for the East Antarctic Sector. However, we hypothesize that the lack of correlation between SAM and Brenr is due to the enhanced transport of Na during the positive SAM phase (SAM and Na are indeed positively correlated), which results into lower Brenr values (since Brenr is defined as Br-to-Na ratio). We believe that it is not worth include it in the main text since it is just a consequence of the positive correlation between SAM and Na.

Line 426: suggest adding 'defined through back trajectory analysis (Figure S1)'.

Done

Minor revision suggestions:

- multiple long sentences throughout the manuscript. Suggest splitting these into 2 sentences to make the message clearer. Examples start on: line 10, line 42, line 225, line 228, line 242, line 316

We edited the suggested and few other sentences accordingly to the reviewer suggestion.

- abbreviations - need to be consistent with using them. Recommend only adding an acronym if you refer to it more than 5 times.

We modified some of the acronyms accordingly.