



EGUsphere, author comment AC1  
<https://doi.org/10.5194/egusphere-2022-99-AC1>, 2022  
© Author(s) 2022. This work is distributed under  
the Creative Commons Attribution 4.0 License.

## **Reply on RC1**

Xavier Crosta et al.

---

Author comment on "Antarctic sea ice over the past 130 000 years – Part 1: a review of what proxy records tell us" by Xavier Crosta et al., EGU sphere,  
<https://doi.org/10.5194/egusphere-2022-99-AC1>, 2022

---

The paper by Crosta et al. reviews the current knowledge in terms of i) the use of both marine and ice core sea ice proxies in Antarctica, ii) reconstructions so far produced on Antarctic sea ice changes for the last 130,000 years. This review is more than welcome and useful for a broad audience. The introduction brings the reader into the Southern Ocean setting and Antarctic sea ice is described as one of the players in this environment. The interplays between sea ice and the ocean, atmosphere, biosphere and the cryosphere are presented. The mechanisms for sea ice formation are described in Section 2.1, along with the geographical sea ice distribution during the modern time. The authors then describe the satellite-era sea ice trends (1979-present) and the difficulty of climate models to reproduce them, hence highlighting the difficulty to isolate the main forcings responsible for such trends (Sect. 2.2). One way to go is look at the past, and the authors do that by first introducing the marine and ice core proxies (Section 3). A review of the available sea ice reconstructions are presented for the Last Glacial Maximum (Sect. 4.1), the Holocene (Sect 4.2), and for the Last Interglacial (Sect. 4.3). A shorter section presents the results during the glaciation and deglaciation shorter periods (Sect. 4.4). The work ends the authors recommendations on how to use and combine the records together to squeeze out further knowledge and fill the spatio-temporal gaps in Antarctic sea ice reconstructions.

My general comment is that this review is very well structured and I appreciated the combination between marine and ice core data. The phrasing is also very clear and well balanced in highlighting the assumptions behind the proxies and their limitations. It was a great pleasure to read.

**We thank Reviewer 1 for his very positive comments.**

Below a list of mostly minor suggestions and typos:

- Decide on "sea-ice" or "sea ice". I'd use the latter but that's just my taste.

**We followed English grammatical rules on the use of hyphenation. In this case,**

**« sea ice » is used when a noun (Antarctic sea ice expanded...) and « sea-ice » is used when an adjective « Antarctic sea-ice concentration declined....). We were very careful in using the hyphenation adequately but will check again for possible mistakes.**

- L75: "cores" should be "core".

**It will be corrected accordingly.**

- L120: in the Figure caption I'd define again the acronyms.

**Acronyms will be defined again in the figure caption for better readability.**

- L141: I'd add "sea ice" after "observed".

**Sea ice will be added to this sentence.**

- L144: I'd remove "in ice area trends".

**Mesoscale eddies have strong implication for many oceanographic processes (circulation, energy exchange, nutrient input, etc..) that are beyond the reach of the present review paper. We believe it is better to keep « in sea-ice area trends » to avoid any confusion or over-interpretation of our scope.**

- L152: I'd insert a new line or a new paragraph here to introduce the paper. Here or at the end of L149.

**Lines 146-149 present the rationale that has led to the creation of C-SIDE. Breaking down a new paragraph after line 149 will disconnect the issue from how the compilation is designed to solve the issue.**

- L185: 18.10 should be 18 x 10. Also at L201.

**It will be corrected accordingly.**

- L200: I'd replace "decay" with "retreat".

**It will be corrected accordingly.**

- L255: after reading Sect. 3 I asked myself whether it would be beneficial to have a table

summarizing the various proxies with their salient features, as well as pros and cons. I redirect the question to you.

**A summary table with pros and cons will be presented.**

- L288: maybe replace "anti-coherence" ? Negative correlation ?

**It will be corrected accordingly.**

- L291: it should probably read "produced in this way".

**It will be corrected accordingly.**

- L448: I would consider at least mentioning iodine and its linkages to both sea ice and productivity.

**A couple of sentences on iodine and its links to sea ice and productivity will be added.**

- L512: "in the Dome C".

**It will be corrected accordingly.**

- L529: I'd rephrase in "This pattern was attributed to the..", "..location of the first year sea ice".

**It will be corrected accordingly.**

- L534: in this paragraph, maybe here, I'd specifically state that one of the hot topics in Brenr is the relative differences between ssNa and Br transport mechanisms, given the latter is also present in the gas phase.

**A couple of sentences on the relative differences between ssNa and Br transport mechanisms will be added.**

- L615: I would consider showing the SSI lines in red in the upper panels and the *F. obliquecostata* as red shading in the panel below. I would also increase the lat,lon font.

**We will modify WSI and *F. curta* color (to green), but preserve SSI and *F. obliquecostata* color (blue) to ensure that colors used for WSI and SSI are consistent in all figures. To this vein, similar colors will be used in figure 3.**

A question I had while reading the figure is why EDML and PS1768-8 records specifically? Maybe it could be worth adding a sentence on that somewhere. I would be also curious to compute a (normalized) ensemble of all the Winski et al. (2021) ssNa curves to compare to the EDML one - maybe an ensemble would be more representative on a spatially integrated sea ice signal over Antarctica? That's just a curiosity.

**PS1768-8 and EDML are included as reference points for the general trends in the marine and ice core records. Although they are not intended to be representative of the sea-ice signal everywhere in the Southern Ocean, these records adequately demonstrate the general trends (Chadwick et al., 2022, cp-2022-15).**

**Assembling stacks and discussing possible leads-and-lags as well as amplitude changes in the different basins of the Southern Ocean is beyond the scope of the present review. These aspects are developed in Chadwick et al. (2022). Additionally, the Winski et al. (2021) paper only presents Holocene ssNa data, which is much shorter than the temporal range on which C-SIDE focuses.**

- L622. Insert a full stop before "Upper".

**It will be corrected accordingly.**

- L744: I suspect the main reason is because the ice core signal integrates a wide region?

**This aspect will be mentioned.**