



EGUsphere, referee comment RC1  
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## **Comment on egusphere-2022-99**

Niccolò Maffezzoli (Referee)

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Referee 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,  
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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.

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.

- L75: "cores" should be "core".
  
- L120: in the Figure caption I'd define again the acronyms.
  
- L141: I'd add "sea ice" after "observed".
  
- L144: I'd remove "in ice area trends".
  
- L152: I'd insert a new line or a new paragraph here to introduce the paper. Here or at the end of L149.
  
- L185: 18.10 should be 18 x 10. Also at L201.
  
- L200: I'd replace "decay" with "retreat".
  
- 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.
  
- L288: maybe replace "anti-coherence" ? Negative correlation ?
  
- L291: it should probably read "produced in this way".
  
- L448: I would consider at least mentioning iodine and its linkages to both sea ice and productivity.
  
- L512: "in the Dome C".
  
- L529: I'd rephrase in "This pattern was attributed to the..", "..location of the first year sea ice".

- 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.

- 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. 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.

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

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

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