

Title: Estimating summer sea ice extent in the Weddell Sea during the early nineteenth century

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Referee: Seelye Martin

General Comments: This is an interesting paper that with some corrections and additions, should be suitable for publication. As its abstract states, it makes novel use of ship data from the 18th century in an examination of summer sea-ice positions in the Weddell Sea from nine traverses derived from eight Antarctic expeditions during 1820-1840. It compares these with the Comiso bootstrap passive microwave satellite observations from 1987-2017, plus historical data from 1987-2017. Its key finding is that in the nineteenth century, the summer sea ice latitude in much of the Weddell Sea was much further north than during the satellite era.

This reviewer was greatly impressed that in the comparison, and as described on line 214, the satellite data compared with each ship point was the average for the same date, over each of the satellite years. Marvellous!

Also, as described in point 3 below, I strongly urge the authors to consider the addition of Cook's Weddell sea-ice data from 1772-73, as described in their Parkinson (1990) citation. This data is published in an Excel format in the Martin paper below, so its addition should be relatively easy.

Specific Comments: There are three problems that the authors need to address:

1. In their Figure 2, for the 1820s, why does the black line, Bellinghausen, extend north of the region of red-line region of interest? Also, this reviewer cannot distinguish the dotted from the dot-dash line. Perhaps you should use a separate color to distinguish these two. Also, Parkinson (1990, Table I) defines the Weddell as extending to 30°E, to include all of Cook's observations. Do you want to extend it to match her discussion?

2. For December in the Weddell, which has multiple regions of ice and open water, how do we know what the ice edge represents? For example, the figure below is Figure 3 from the recently published open access paper by Martin and others (2022, reference on next page).

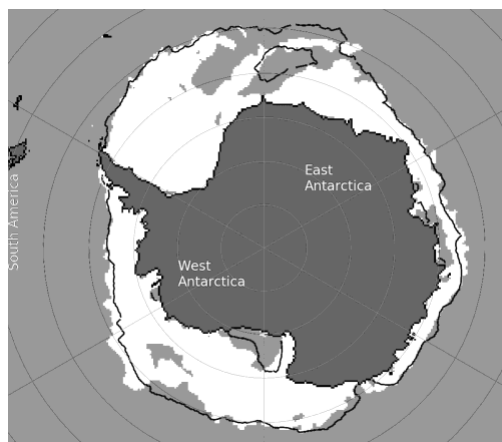


Fig. 3. Passive satellite image of the Antarctic sea-ice extent for 14 December 2018. Sea ice is white, water is light gray, the continent is dark gray. For the same date and the thirty-year period 1981–2010, the black lines show the median ice extent. The open water associated with the Maud Rise Polynya (indicated with arrow) is visible in both the daily and median image (Image courtesy NSIDC).

Martin S, Long DG, Schodlok MP (2022). Comparison of Antarctic iceberg observations by Cook in 1772–75, Halley in 1700, Bouvet in 1739 and Riou in 1789 with modern data. *Journal of Glaciology* 1–8. <https://doi.org/10.1017/jog.2022.111>

Question for authors: for this date, where would you put the ice edge in the Weddell? Following your discussion in your Section 2.5, how do you handle observations of the multiple ice edges as shown in this figure?

This is not an academic question. As Parkinson (1990) describes, and Martin and others (2022) show, Cook mapped the peninsula-like feature in this figure (the more southerly feature just above the polynya). Parkinson (1990) discusses the peninsula and shows that, compared to a similar feature in the 1973-1976 passive microwave data, it occurs several weeks later, which she suggests may be the result of a colder climate. She shows that his 14–18 December observations in the vicinity of 55°S are 2–8° farther north than the mid-December satellite ice edge at the same longitudes in 1973–76.

3. Following Parkinson, consider addition of Cook's data to your analysis. As stated above, the Supplementary Material in Martin and others (2022) contains Cook's observations of icebergs and the ice edge in an Excel format, which can be easily uploaded into Google Earth. Since Cook's first traverse in December 1772 delineates the sea-ice peninsula shown in Fig 3, this would make an excellent addition to the authors' work.

Parkinson concludes that “the evidence from this preliminary study suggests that it is unlikely that a thorough study will yield a strong and consistent Little Ice Age signal from the sea ice of the Southern Ocean, at least for the 1770–1850 period.” Do the authors agree with this? Your analysis combined with Parkinson's suggests that for the 1770–1850 period, the Dec-Jan-Feb ice cover in the Weddell is enhanced.

Given that Cook's data is now formatted and easily available, its addition to their paper would consume a negligible amount of time, enhance their citation of Parkinson (1990), extend their analysis fifty years back in time to 1772-73, give them more data east of the prime meridian in the December Weddell, and allow them to comment on the historic regional climate. For these reasons, I hope the authors extend their analysis through addition of Cook's data.

Technical Corrections:

General: Would like to have **every** line numbered, not just 5, 10, 15, 20...

Line 73: The following sentence needs work. “More specifically, records utilised ~~comprise~~ ship logbooks, meteorological registers, charts and journals, ~~recorded during~~ [from the various] Antarctic expeditions.”

Line 89: Rewrite the end of the first sentence, which currently reads “region of study. This sector is presented in Fig. 2.” As “...region of study (Fig. 2).” This saves five words.

Line 96: point out that Parkinson (1990), in her Little Ice Age paper, also examined Cook's Weddell data from 1772-73, as well as data from the early nineteenth century.

Line 145: Time and date of observation. Are you sure that all of your ships are using civil time and the civil calendar for the dates? Or, are some of them still using naval time (noon-to-noon for days)?

Line 160: How accurate in terms of km or nm is the longitude determined from a chronometer?

Line 338: Minor edit in Acknowledgements. “The authors ~~would like to~~ thank Théo...”

Figures: note with the possible exception of Figure 3, the figures are necessary.