

Point-by-point response

***Reply to comments from Seelye Martin***

**I have added suitable comments in the Introduction and the Discussion sections looking back to the Parkinson reference to extensive sea-ice in the Weddell Sea.**

**I have had the UKPDC remove the embargo in anticipation of the paper being accepted. The supplementary dataset is now freely available via Bigg (2024) in the reference list.**

**With respect to the iceberg part of the dataset I have amended the text in section 2.3, as suggested by Dr. Martin. I have expanded the Figure 6 legend to make it clear part b uses the iceberg field data (ie. Category '3').** In Figure 5, I decided for clarity in an already busy figure to only note the presence of icebergs. This is the summary iceberg figure, and the detail of iceberg density is better left to Figure 6, for comparison with the modern observations. I stand by this division, which I think makes the paper clearer.

Specific Concerns

**I have said more about the 1820s record in the Discussion and I have added an additional couple of sentences in the revision on what Love and Bigg found of relevance here.**

I agree with Dr. Martin that Wales' journal of Cook's expedition needs to be checked for the iceberg data. It is worth noting however that while there are a few occasions where Forster recorded icebergs and Cook's journal did not, on the whole the two records were very similar so I suspect that Wales' journal is unlikely to add too much.

I. 32: I think it is an interesting context that a British expedition was seeking the North Pole at the same time as Cook's expedition south, but that they seem not to be linked. **While of tangential importance to the paper overall I believe it is an important contextual observation regarding contemporary polar expeditions and do not wish to remove it. The editor has agreed with me retaining this.**

I. 86-88: **I have expanded the section in the Introduction on later nineteenth century expeditions, while keeping it clear that Cook and Bellingshausen offer unique, circum-Antarctic perspectives worthy of a paper in its own right.**

I. 69: apologies. **This should be section 2.1. I have corrected this in the revision.**

I. 143: **This text has been changed as suggested in the revision.**

I. 208: The Comiso and Worby result doesn't have a significant impact on the analysis (note the large error bar). I already note this in the second phrase of the sentence.

Figure 1: The fish-hook south of Africa is an illusion. The outbound green line starts only a few days before ice was observed, and so is well south of Africa at the top of the fish-hook, while the inbound green line goes all the way to Cape Town. **I have added a note to the Figure 1 legend explaining this, as well as information about the exploration voyage section's in a new Table 1.**

Figure 2: I agree this Figure could be confusing. **I have put all the colour (Cook is red Xs, Bellingshausen is blue crosses) and shape information into the Figure legend in the revision.**

Figure 3: The purpose of this figure is to demonstrate that there may be open water or polynyas south of the northern sea ice limit, particularly, but not exclusively, in the Weddell Sea. I tried to find

an example where this was most obvious, and related to one of the observation days from both Cook and Bellingshausen's journals. The text does imply this, but is not too clear, so **I have added some explanatory text to the Figure legend in the revision.**

Figure 4: I welcome the helpful comments regarding this pivotal figure. **In the revision I have extended the y-axis northwards and southwards, to make all points clearer. I have altered the size of the symbols so that the historical and modern observations are the same size. I have made clear the Weddell ice tongue area in the textual discussion accompanying this figure. I have added a panel b to this figure, in response to the second reviewer's comments, showing the day of the summer for each historical observation, to help explain the variation in sea ice extent variability around the Antarctic.**

Figure 5: **I have put all the information about the figure in the legend in the revision. This is a summary iceberg figure – I use the extreme iceberg field data in the lower panel of Figure 6 and suggest this is a clearer way of allowing the reader to see the difference.**

Figure 6: **I have changed the panels to be Figures 6a and b, as suggested, both in the Figure and references in the text, in the revision. I have add a note to the legend to explain that the bottom panel is indeed showing the category '3' iceberg data.**

Figure 7: **I have put all the figure colour and symbol information in the legend, rather than mix between legends on and off figure, in the revision. The iceberg data is the same as in Figure 5, but it is true that some ship observations go further east than the Tournadre data of Figure 6 suggests. I think this is because the ship data goes further back in time and have added such an explanatory note to the text discussion in the revision. I do currently note in the Conclusion that marine ice (ie sea-ice and icebergs) suggest a colder Weddell Sea in the past than today, but have made it more explicit in the revision that it is both icebergs and sea-ice that show this eastwards trend.**

### ***Reply to comments from Irina Rogozhina***

#### Major Concerns

The Introduction section was difficult to write as it needs to combine background with some discussion of the two expeditions' timeframes and comparisons. **The suggestion of adding a Table to make the timings of the different ship voyages clearer is an excellent one. I have added this Table in the revision and made more explicit reference to it, and Figure1, in the Introduction. I think it makes the surrounding text more directed and fitting to the narrative.**

I thank Dr. Rogozhina for pointing out that the modern data methods are not given sufficient background. I agree with her, on re-reading the paper. I think there is some risk of duplicating material if too much is added to the Introduction, while Sections 2.2 and 2.3 are improved by adding more detail. **I have enhanced both Sections 2.2 and 2.3 significantly, introducing new references in the modern sea ice methodology especially.**

I agree that much of the first paragraph of section 3 belongs in the Introduction. I have **moved much of this section 3 paragraph to expand the Introduction mention of the Martin et al. work. With this being done there seemed no need for an introductory paragraph to section 3.**

The apparent difference in uncertainties, or current variability, between the Cook and Bellingshausen data is almost certainly linked to the day of the year when a given ship was in a particular longitude. Cook spent less time in southerly latitudes, and this was mostly in the early summer months of December and January, while Bellingshausen was mostly in such latitudes in

January and February, when there is less sea-ice typically. **I have added a new panel for Figure 4 (4b) which shows the date in the summer for each historical sea ice observation. This has some new text in the accompanying text on the figure to explore the above points more.**

Minor Concerns

l. 53: **You are correct – I should have said “temperate climate” and have done so in the revision.**

l. 79: **Again, you are correct. I have added a “were” in the revision.**

Figs. 1-3 and 5-7: Thank you pointing out the offset of some of the longitude markers. This must be something to do with the matlab code **and I have corrected it in the revision. Please note that in doing this for Figure 7 the two modern ship-board iceberg limits needed to be redrawn by hand. This is an imprecise process and you will notice slight differences from the lines in the original figure. They are not significant and have not affected the discussion.**

Figure 2: The tif file for Figure 2 is the same physical size as for Figure 3. I think the small size in the pdf is an artefact of trying to fit the figure in the page in WORD. **I have provided the tif files for all figures directly in the revision.**

Figure 6: **I have made it clear in the revised section 2.3 how the iceberg probabilities are calculated by Tournadre et al. I have slightly expanded the discussion of Figure 6 in the text to make clearer the correspondence between past observations and modern “iceberg alleys” such as the Weddell iceberg tongue.**

l. 269: Thanks very much for pointing this out. **I have moved the comma to after the Budge et al. reference in a revision.**