Review of a manuscript for *The Cryosphere*

Estimating the extent of Antarctic summer sea ice during the Heroic Age of Exploration

Summary:

In the manuscript the authors present a synthesis of sea ice observations from logbooks of eleven scientific expeditions to Antarctica during the so-called Heroic Age of Exploration in late 19th-early 20th century. Due to apparent difficulties of navigation in sea ice covered waters for the vessels of that period the retrieved data is mostly represented by austral summer months. The observed local daily ice edge positions are compared with satellite observations of the modern era. The authors conclude that pan Antarctic summer sea ice extent must have exhibited little changes since the early 20th century, acknowledging nevertheless possible regional contrasts in the inferred centennial trends and a hidden imprint of the multidecadal variability on sea ice extent. A substantial discrepancy with the available sea ice climatology for the study period suggests that more efforts should be invested into recovery/processing the relevant historical data from various voyages to the region for the pre- IGY1957 period.

Main comment

The sparse and very fragmentary climate data for the period preceding the IGY, when the consistent exploration of the entire Antarctic region has begun, substantially limits our understanding of the present and future effects of the ongoing climate change in Antarctica. It concerns both the evaluation/improvement of the skills of GCMs and the interpretation of climate proxies from the region. In that respect the paper touches upon a very relevant and timely subject of exploration of the alternative sources of instrumental and observational data that can partly fill the existing data gaps. The Southern Ocean, at least during the austral summers, was a region of a noticeable international economical activity already since the end of the 19th century. Logbooks from numerous whaling and, occasionally, research vessels may therefore contain invaluable weather/sea ice information that yet to be uncovered. This paper represents one of the relatively few attempts made so far to systematize the sea ice observations from the early expeditions to Antarctica. The paper is generally well written and the results are presented consistently. I believe therefore that the manuscript certainly deserves to be published in *The Cryosphere* with relatively minor changes that are mainly related to the data presentation.

Please see my comments below:

Page 5 line 7: "…15% threshold in sea ice concentration…" Not entirely clear how the actual threshold concentration was estimated, is it based on a frequency of sea ice occurrence for a specific pixel or a mean concentration over the period of satellite observations for a specific day of year?
Page 6 line 14: … "corresponding contour whose coordinates have been shifted by the calculated change in latitude to give an approximate estimate of the ice edge during…" Again, the procedure is somewhat unclear. Did the authors apply a radial scaling (with respect to latitude) fitting the modern pan-Antarctic SIE for a particular day of year to local sea ice observations available for that day? Such extrapolation should be supported by estimates, for example using the EOF analysis, demonstrating that most of the variance for this day (or period of the season) is represented by a single principal component.

Table 2: Line “Variance of difference”
I wonder how symmetric the derived distributions are and if using a normal pdf (and hence sample variance) is adequate?