

Hist. Geo Space. Sci. Discuss., referee comment RC2
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Comment on hgss-2022-9

Anonymous Referee #2

Referee comment on "Understanding the drift of Shackleton's *Endurance* during its last days before it sank in November 1915, using meteorological reanalysis data" by Marc de Vos et al., Hist. Geo Space. Sci. Discuss., <https://doi.org/10.5194/hgss-2022-9-RC2>, 2022

The authors present work that describes how they have used reanalysis data to better understand the sea ice conditions and trajectory before the *Endurance* sank in the Weddell Sea in November 1915. They find that the trajectory using reanalysis data has a more accurate wreck site to the actual location as compared to trajectories using observational data from the *Endurance* crew. Overall, this study is novel in that it presents some new methods for Polar marine archeology and how to use new data. I have some moderate to minor concerns that I think should be addressed before this is accepted for publication, including addition of another figure.

Specific comments:

- Introduction: It would be nice to include details about the 1914-1915 expedition for those readers unfamiliar with it. For example, it's worth mentioning briefly that the crew all survived and was rescued from Elephant Island and how that compares in location to the wreck. Additionally, it would be useful to summarize other expeditions searching for the *Endurance* and how the successful approach in 2022 was different from those ventures. Finally, I didn't really understand how the sinking happened and it would be useful to clarify: was the vessel stuck in the ice and drifted several days before sinking or did it sink immediately? Could this account for some of the poor estimate in location from Worsley's location?
- Line 56 – Please clarify in text (possibly in the introduction) what "Ocean Camp" is and how that differs from the location of the *Endurance*.
- Line 58 – Why did Worsley add further offset? Is this known? Is the star on Figure 1 showing Worsley's location of the sinking include the offset?
- Line 78 – Please give the horizontal resolution of the ERA20 data (1degree? Higher resolution?) as this is relevant for how well it can resolve sea level pressure fields and near surface winds.
- Line 93 and conclusion – You should mention that free drift is reasonable over short time scales *in the Antarctic* only - Kwok et al. 2017 is a good source for this (which is already in your reference list). This is relevant because you can't make the same assumptions in the Arctic (e.g. to have found the *Erebus* and *Terror* from the Franklin Northwest Passage Expedition). This is relevant because one of your main conclusions

is that marine archaeology in sea ice covered oceans can benefit from drift data, but the hemisphere may affect this technique. If you know of other Antarctic vessels that might benefit from this technique it would be useful to list them in the introduction or conclusion.

- Line 144-146: It's interesting that ERA20 aligned to Nov.22, 1915 produced the most accurate wreck location. In addition to your possible explanations about only having 12 hrs of observations in a day from the logs and possible not free drift, I think you should mention that it's possible that if the sinking happened during/after a storm (cyclone) then changes in near-surface wind gustiness and direction, which are notoriously poor in models and short lived, could have been relevant and caused the pack to break up in sometimes not predictable ways. This has happened for recent voyages (see. Nicolaus et al. 2022, "Overview of the MOSAiC Expedition: Snow and sea ice", doi: <https://doi.org/10.1525/elementa.2021.000046>) where sea ice deformation and motion during a storm was certainly not in free drift.

Comments on Figures:

- A map of the region would be very helpful showing at minimum the Weddell Sea, Elephant Island, and S. Georgia Island. This could be combined with Figure 1 perhaps.
- Figure 1 – it appears the point 10 is off the map. Having a compass for directions would be helpful for immediate orientation. It's worth mentioning as well that the actual wreck is well within the uncertainty region for the ERA winds but right on the edge of the uncertainty region with observed winds.
- I think it would be useful to have ERA20 sea level pressure maps at 12GMT from Nov.18-22 showing both pressure contours and wind vectors in relation to where the ship was, roughly. It would also be useful to list the modeled wind speed and direction at the ship's location and the observations at that time. Those values could be listed in the panels for each day. This will help the readers understand how different the model is from observed winds and how the local, observed wind field may have differed from the large scale flow.