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.

The authors would like to thank the reviewer for this positive and constructive input. Amendments made in response have both strengthened the manuscript directly and prompted us to enhance other aspects of the work. As the corresponding author I would also like to apologise for the delayed response. The timing of the review coincided with an Antarctic voyage, as well as other end-of-year academic commitments, thereby delaying the submission of these responses.

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?

  We thank the reviewer for this valuable insight and on reflection, it is certainly helpful to any reader who may not be well-versed to be presented at least some basic context.

  Further contextual details (and specifically those suggested) shall be included in the revision. Further, since the more detailed analysis conducted as part of this review process has elucidated the many possible sources of error, we will include not only some text regarding the sinking and possible reasons for Worsley's position estimate, but also sources of uncertainty generally as regards our simulation estimates.

- Line 56 – Please clarify in text (possibly in the introduction) what "Ocean Camp" is and how that differs from the location of the Endurance.

  The following text (or similar) is the be added to the Introduction, where the enhanced details about the Imperial Trans-Antarctic Expedition are to be included (see previous comment).

  "After Endurance became too badly damaged to be used as the team's primary shelter, the team abandoned the vessel, intending to begin a march to the west. After little more than a week, however, the march was abandoned after harsh conditions greatly hampered progress. Instead, the team would camp on an ice floe until sea ice conditions became more conducive to moving. The floe, located a short distance from the wreckage of the Endurance, was named Ocean Camp by the team."

- 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?

It is not known exactly why Worsley added this offset. It may be that Worsley computed applied some kind of integration of their position change based on his estimate of the sea ice drift, though this is not known with certainty (and also not backed up by Hussey's wind observations). Bergman & Stuart (2018) suggest that this was simply an offset added to the nearest dependable fix (22nd Nov.) available to Worsley.

- 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.

  The following text shall be added to Section 2.3:

  "ERA-20C has a spatial resolution of approximately 125 km on its native triangular grid (Poli et al., 2016). *However, interpolated data were downloaded on a regular grid with a resolution of 0.125. This interpolated product is produced by ECMWF's Meteorological Interpolation and Regridding (MIR) package and is available via ECMWF's download portal at: https://apps.ecmwf.int/datasets/data/era20c-daily/levtype=sfc/type=an/."*

- 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 archaelogy 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.

  We thank the reviewer for this comment as the assumption of free-drift, and the tuning of free-drift parameters is certainly a key issue which materially affects the outcome of this study (and not only the general application of this method to marine archaeology). It prompted us to enhance our approach as explained below.

  A paragraph explaining in detail the strengths, weaknesses, assumptions and implications of the free-drift approach, and a review of free-drift parameter settings is to be included in Section 2.4. The text draws on the findings of (Doble & Wadhams, 2006; Kottmeier et al., 1992; Nakayama et al., 2012; Nie et al., 2022; Uotila, 2001; Uotila et al., 2000; Vihma et al., 1996; Vihma & Launiainen, 1993; Womack et al., 2022).

  A further reason for including this analysis is because after further review of the above literature, it became clear that whilst the free-drift assumption is reasonable for the domain in question, and that wind is the primary forcing, drift trajectories are particularly sensitive to free-drift parameter settings (wind drag and turning angle). In particular, it is apparent that parameter settings derived from buoy experiments in the literature vary widely in space, time and even from instrument to instrument in roughly the same area. As Kottmeier et al. (1992) put it: *"Parameters change both from one data set (buoy, period, region) to the other and within a certain data set."* This prompted us to change our approach from simply reusing the free-drift configuration settings used onboard during the Endurance22 expedition, to a more considered, comprehensive approach whereby setting were tuned in a series of sensitivity analyses. An example of a sensitivity test is shown in Figure 1 below. Given the expanded envelope of results, in Section 2.4 and 2.5, we will therefore describe the range of possible outcomes using different settings, thereby outlining likely scenarios (i.e., consistent aspects of the unknown drift) as well as remaining uncertainty.

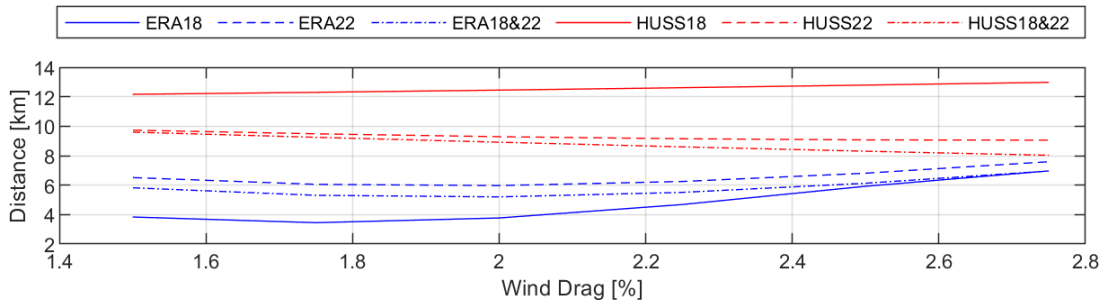

Figure 1. An example of a sensitivity test which shows how the distance of the ERA and Hussey simulated sinking position varies as a function of wind drag parameter selection. For each of the ERA and Hussey simulations, results for the trajectories aligned at the 18th, 22nd and both the 18th and 22nd are shown (e.g., HUSS18&22 is the distance of the sinking site from the actual wreck site according to the Hussey-simulated trajectory aligned at both the 18th and 22nd).

- 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.

  First, we qualify this finding in light of the additional work which we have done and changes we have made to the simulation configuration. Further, we thank the reviewer for this excellent suggestion and shall include text to explain this in Section 3.3. This also ties into an expanded explanation which we are to include about the discrepancies between the Hussey and ERA-20C wind directions. We explain this in the context of how we arrived at out optimal free-drift parameter settings. For example, it may be that the ERA-20C winds have an anti-clockwise bias, since Hussey's winds are quite significantly rotated clockwise relative to ERA-20C (though are of course also subject to error) and the optimal turning angle is smaller than what we might expect from (some of) the literature.

- 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.

  We thank the reviewer for the suggestion and agree, this would aid in readability. A context map shall be added and first referred to in Section 1. A preliminary map has been prepared (Figure 2).

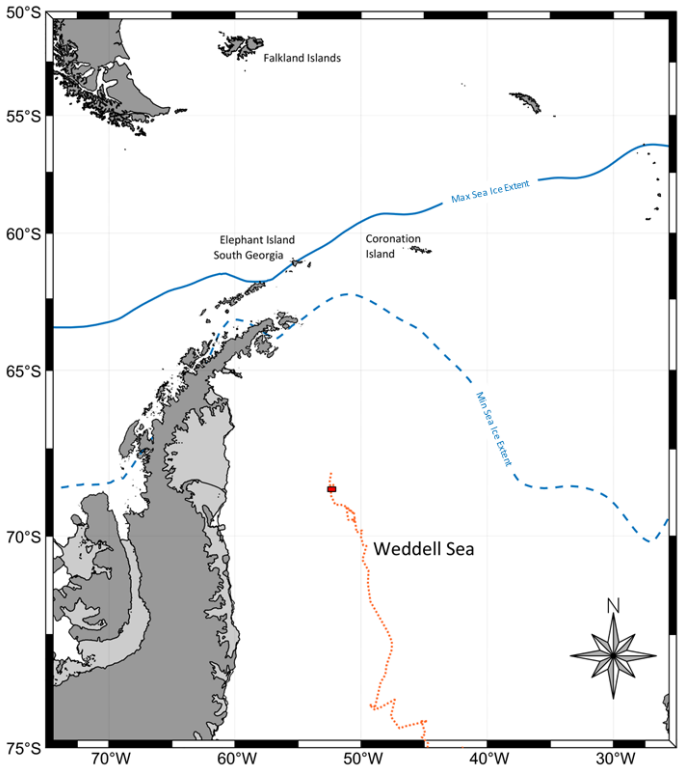

Figure 2. A map showing the context of the study, to be included in the revised manuscript.

- 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.

  This figure's map boundaries have been revised so that the position for the 10th is not cut off, and a compass pointer added. Commentary will be added to the manuscript which makes reference to the wreck location in relation to the trajectory envelopes.

- 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.

  Maps of mean sea level pressure (contours), wind speed (shading, vector length) and direction (vector orientation) which also show the search area and Endurance trajectory have been created. Figure 3 below is an example. Select snapshots which summarise conditions during the period shall be selected for inclusion in the revised manuscript.

  In response to another review comment, time series graphs of ERA-20C and Hussey's observed wind data have been created to facilitate easy comparison. We trust that this satisfies the second part of this comment.

Preliminary examples of the wind maps (Figure 3) and timeseries graphs (Figure 4) to be included in the revised manuscript are shown below.

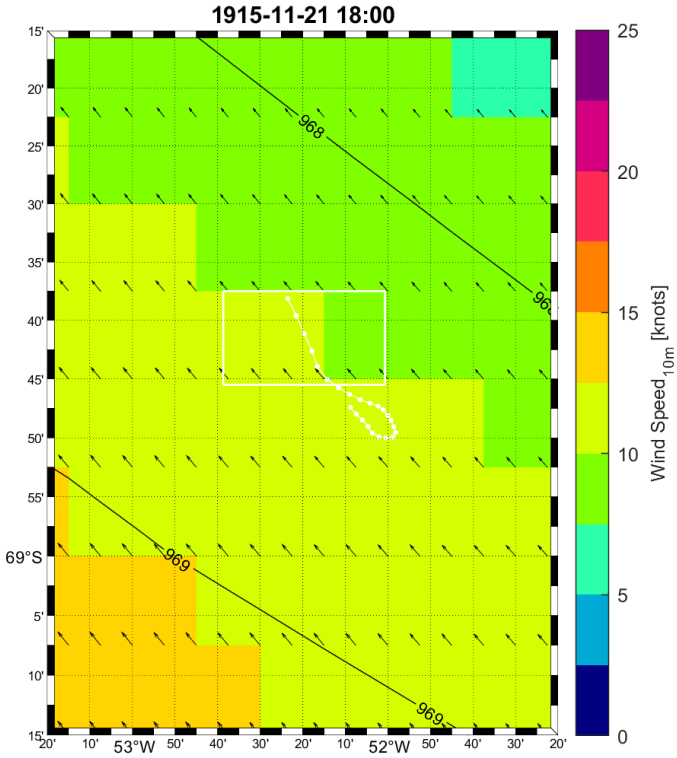

Figure 3. A snapshot of wind speed (shading & arrow length) and direction (arrow orientation) and mean sea level pressure (isobars) from ERA-20C. The search area and target period drift trajectory at that point in time are shown in white.

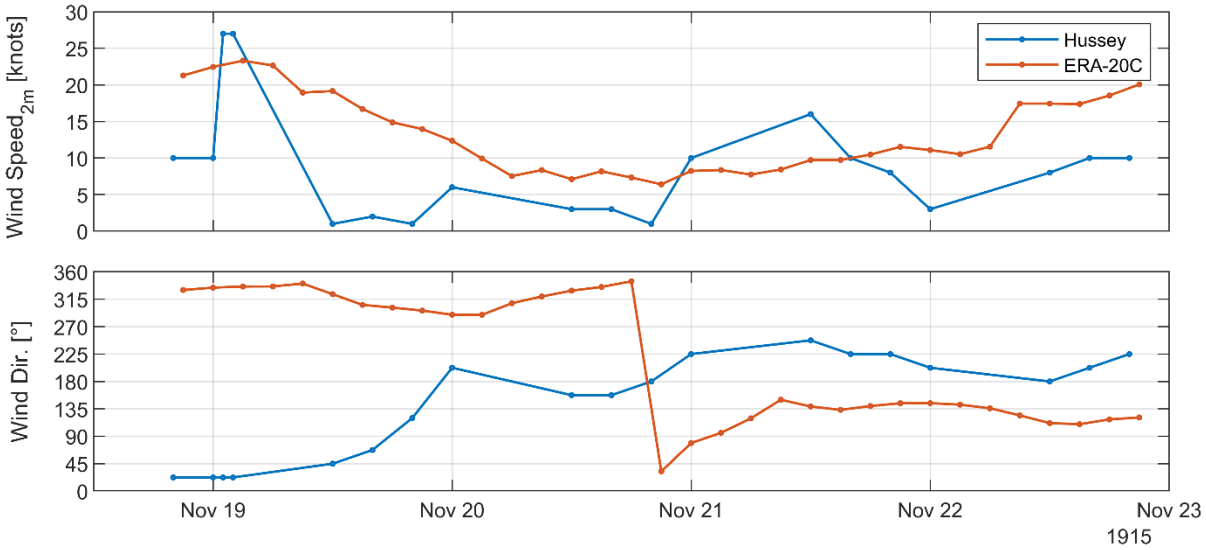

Figure 4. A time series comparison of wind speeds and directions observed by Hussey and those produced by the ERA-20C reanalysis.

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