

Reviewer: Anna Olivé Abelló

Title: Iceberg B09B grounding: a plausible trigger for more persistent marine cold-spells off Commonwealth Bay, East Antarctica

General overview:

Studies like this one are particularly important because they highlight the role of giant icebergs in the complex interactions of the Southern Ocean and their effects on both the generation of marine cold spells and the distribution and characteristics of sea ice. The manuscript is very well written and easy to read, and I would also like to acknowledge the care devoted to the figures, which are clear and easy to interpret. The collision of iceberg B09B with the Mertz Glacier Tongue triggered the enhanced MCS event. However, stronger justification or supporting evidence is needed to demonstrate that, once stationary at the Adélie Sill, B09B remained the sole or main factor contributing to the persistence of marine cold spells in subsequent years.

Major comments:

Line 18: Consider indicating the SST threshold below which a period is classified as an MCS, or refer the reader explicitly to Sections 2.2.1–2.2.2. This information would help introduce the concept before the detailed methodological description.

Line 20: Be more specific about how MCSs may affect upper-ocean stratification, air–sea fluxes, and polar ecosystems. For example, indicate whether they may **strengthen** stratification, **reduce** vertical mixing or air–sea heat exchange, and affect biological productivity or habitat conditions. This would better establish both the physical and ecological relevance of MCSs, as is commonly done for MHWs.

Line 31: Consider adding one sentence with further information on iceberg B09, such as its original dimensions, trajectory, previous grounding episodes, etc.

Lines 32–35: Clarify which 2010 calving event is being referred to. Did the collision between B09B and the Mertz Glacier Tongue directly trigger the major calving of the glacier tongue?

Lines 30–40: Clarify the reason for selecting this study period. Has B09B remained grounded or stationary in the region since 2011? Why this long period, 1982–2024? Is it to study MCS events before, during and after the iceberg's presence? (The reason appears in Line 53; consider placing it here) Is the hypothesis that these giant icebergs can be related to long MCS events? From my point of view, it is clear in the title but not in the section!

Lines 40–45: Consider presenting the analytical sequence more clearly and briefly explaining how the different diagnostics contribute to the study objectives. In particular, justify briefly the reason to use or focus on B-SOSE, and mCDW transport and volume rather than on other water masses, and explain how these diagnostics help assess the proposed mechanism linking B09B to surface cold-spell variability.

Lines 69–73: I suggest showing the 5th-percentile baseline derived from the 1982–2011 OSTIA foundation-SST climatology, either as an additional panel in Figure 2 or as a separate figure in the Supplementary Information. This would provide a useful reference for interpreting the detected MCS events.

Section 2.2: Consider consolidating the subsections within the 2.2 MCS framework. Several elements, including the reference to Schlegel et al. (2021) and the use of the 5th-percentile threshold, are repeated. A more concise structure would allow the key methodological choices—event duration, permitted gaps, threshold, cumulative intensity, and the -1.7°C MCSice criterion—to be presented more directly.

Section 2.2.4: Please indicate where the results of the sensitivity experiments are presented. I suggest including a dedicated figure, either in the main text or in the Supplementary Information, showing the effects of the alternative climatological baseline and SST detrending.

Line 124: Please justify the selection of B-SOSE over other available ocean reanalyses or state estimates, such as GLORYS12v1 or ORAS5. It would also be useful to discuss in the Discussion section the main advantages and limitations of B-SOSE relative to these products, particularly regarding regional resolution, data assimilation, sea-ice processes, freshwater fluxes, and subsurface circulation.

Line 129: Explain why open-water and polynya conditions are represented as 1-fractional sea ice area, rather than using the commonly applied criterion of sea-ice concentration below 0.15.

Line 149. Specify the potential-density range used to identify mCDW. At present, the definition relies on the upper 0.5% of the annual density distribution, but the resulting density limits are not reported.

Section 2.6: I would rename the section to reflect the ERA5 and Copernicus dataset information, and remove from this section “Bathymetry for the Adélie Sill-Commonwealth Bay region was taken from the Terre Adélie and George...” and place the depth breaks below where they correspond, i.e., the caption of one figure, and remove the domain (140–148°E, 65.5–68.5°S) as it has been repeated throughout the text.

Line 262: Discuss what may cause the apparent delay between the winter peaks and the subsequent summer MCSice maxima immediately after 2011.

Figure 3: Since the strongest post-2011 MCSice intensification occurs in summer, why are the freshwater diagnostics restricted to winter? Summer freshwater flux may be more directly related to contemporaneous surface stratification and cold SST anomalies, particularly if meltwater from B09B is proposed as part of the mechanism. Maybe I’m missing something...

Line 283: Why would an immediate reduction in deep warm water be expected following the calving event? Please explain the physical reasoning behind this expectation. Increased freshwater input and shelf stratification could instead strengthen or modify the eastward undercurrent at the shelf break, potentially promoting greater mCDW inflow onto the continental shelf instead of reducing its presence.

Lines 392–398: The discussion of Adélie penguins is relevant as a broader ecological implication, but the proposed relationship between stronger MCSice exposure and reduced open-water access is not supported by the results presented here and appears inconsistent with the reported increase in open-water fraction and decrease in sea-ice volume after 2011. Please either remove this statement or rephrase it.

MC – Lines 349–354: Please show the spatial evolution of winter sea-ice concentration, ideally in maps comparable to Figures 2 or 5, and indicate areas with SIC < 0.15 (commonly considered open water). If possible, also show the spatial distribution of leads. This would better support the interpretation of post-2011 changes in polynya geometry, sea-ice retention, and winter surface conditions than the current domain-averaged indices alone.

MC: Line 208: Do the authors have satellite-altimetry measurements of B09B thickness to confirm that its draft exceeded the Adélie Sill depth and that the iceberg was therefore grounded? According to Figure 2, its position changes between years before 2019, suggesting that it may not have remained continuously grounded from 2011 onward. Moreover, an iceberg may remain temporarily stationary because ocean currents and winds are too weak to move it, without necessarily being grounded. Please clarify how grounding was distinguished from temporary stationarity, specify its timing, and provide supporting evidence.

MC: Line 230: The manuscript attributes the increase in MCSice cumulative intensity mainly to the grounding of B09B. However, the observed changes may also reflect the broader post-calving reorganisation, including the persistence of other large fragments and the presence of B09B itself. How can these different effects be disentangled? Satellite images showing the evolution of B09B and the absence or drift of other fragments outside the region would help support the proposed attribution.

MC Methods: The source and processing of the B09B position data should be described in the Materials and methods. Although the BYU iceberg tracking database is mentioned in the **Code and data availability section**, the temporal resolution of the tracking data is not specified, nor is it stated which specific satellites were considered or how uncertainties or gaps in the iceberg trajectory were handled. In addition, I suggest including a two-panel figure showing the track of B09B from the time it enters the study region to its most recent position: one panel showing the trajectory coloured by month/year, and a second panel showing the residence time in each area. This would help assess whether the iceberg became effectively stationary.

MC – Results: The persistence of MCSs appears to be associated with increased open-water exposure and reduced sea-ice volume. However, the link between these changes and the presence of B09B remains unclear. Please explain how the giant iceberg could promote more recurrent ice-free conditions or reduced sea-ice retention in the following years.

MC – Lines 265–276: The reported diagnostics do not show a clear post-2011 increase in freshwater forcing. Sea-ice freshwater flux trend decreases, sea-ice volume is reduced, and lead and open-water fractions increase. Could the lower SSTs therefore be driven primarily by enhanced ocean–atmosphere heat loss through more frequent leads and open-water areas, rather than by freshwater-induced stratification associated with B09B freshwater flux?

MC – Appendix A / Figure A1: Appendix A is not explicitly introduced or discussed in the main text, although Figure A1 is cited. Moreover, the appendix heading appears after Figure A1 and no accompanying methodological or explanatory text is provided, making the appendix appear incomplete. Please move the Appendix A heading before the figure and add a short self-contained description of the sensitivity experiments and their interpretation. Alternatively, if the appendix is

intended only to contain an additional figure, consider moving Figure A1 to the Supplementary Information and referring to it accordingly in the main text.

MC – Title: The title assumes that iceberg B09B was grounded during the whole period, although the manuscript does not provide direct evidence of grounding from prolonged stationarity. Unless grounding can be independently demonstrated through satellite-altimetry-derived thickness, iceberg draft–bathymetry comparison, or other observational evidence, I suggest using a more cautious term such as “arrival”, “presence”, “collision” or “prolonged residence near the Adélie Sill”.

Minor Comments:

General: Please standardise the spelling of “cold-spells” and “cold spells”. Both forms are currently used.

General: Use dashes consistently for geographical ranges or linked geographical names, e.g. “Adélie Sill–Commonwealth Bay” and “Adélie–George V Land”, rather than alternating between hyphens and en dashes.

Line 29: poorly **documented** and understood

Lines 75–76: Replace “more common 10th percentile for cold-spells” with “more commonly used 10th-percentile threshold for cold spells”.

Line 79: Please specify the threshold for only the most pronounced cold anomalies.

Line 84-86: repeated information? Otherwise, clarify better.

Line 129: Replace “one minus fractional sea-ice area” with “one minus the fractional sea-ice area”.

Figure 2: The first panel is labelled “1982–1983”, although the caption states that each panel represents one year. Please either separate 1982 and 1983 or explain why these two years are combined.

Figures 2 and 5: Please consider changing the colour used for the ice shelves/ice tongue, as it is too similar to the shading used for cells with no data to improve the readability of the maps.

Line 268: Delete “respectively” after the list “2015, 2023, 2022, 2014, and 2018”, because the list is not paired with a second corresponding list.

Lines 280- 285: Sort the years chronologically throughout the text.

Line 315: Replace “does not indicate disappearance of the corridor signal” with “does not indicate the disappearance of the corridor signal”.

Figure 4 caption: Replace “with strongest negative trends” with “with the strongest negative trends”.

References: Fischer et al. (2025a, b): These two entries have the same title, journal, volume, article number, and DOI and therefore appear to be duplicate references.