

Review of “The development and duration of doldrums over the Great Barrier Reef” by Lara Richards et al.

Marine heatwaves and coral bleaching on the Great Barrier Reef are often intensified by persistent doldrums—periods of weak winds and reduced cloud cover that enhance ocean warming. In their paper, Richards et al. investigate the formation and temporal evolution of these periods using K-means clustering. They show that doldrums are initiated by Rossby wave packets in which a cyclonic anomaly and anomalous westerlies over eastern Australia disrupt the typical trade wind easterlies over the Great Barrier Reef. The doldrums are further sustained by stalled cyclonic anomalies, Rossby wave breaking, blocking near New Zealand, and favorable tropical variability. During longer doldrum phase, slower-moving Madden-Julian Oscillation and Equatorial Rossby wave align their suppressed phases over the Great Barrier Reef, reinforcing anomalous westerlies to counter the trade easterlies. Lagrangian trajectory analysis further reveals that dry descending air in the doldrums usually comes from the mid-latitudes. A cyclonic anomaly or cut-off low forces parcels across southern Australia before reaching the Great Barrier Reef. These coupled tropical–extratropical processes explain the persistence of doldrums and associated heat extremes.

This is an impressive paper, and it was a pleasure to review it. It is well written, the figures are clear, and the quality is high. The different analysis steps are clearly outlined and scientifically sound, and the methods and assumptions applied are valid. The results are summarised nicely in a schematic overview figure. I have listed a few items below that might be helpful for a revised version of the paper.

Major comments

- The article should make it clear right from the start how it differs from its predecessor paper in WCD (Richards et al, 2026). For example in their already published paper the authors write in their abstract: “ ..., ***we find the formation of the doldrums is linked to the passage of a Rossby-wave train over eastern Australia.....***” and in the current paper abstract:“.... ***We show that doldrums formation is linked to the passage of a Rossby wave packet,....***”. This sounds quite similar to me. In my opinion, the paper would benefit from a clearer distinction from its predecessor, even in the abstract. In the introduction section, the authors could dedicate a short paragraph to explaining the results of their previous work and the specific questions that this follow-up paper addresses.
- I wonder about the role of interannual variability and large-scale dynamics e.g. ENSO, how could they influence your results. A short discussion about their potential impact in section 4 would have been quite useful.
- I also miss a critical discussion of the limitations of the current study, what is currently missing, what might be potential error sources and what could be improved in further studies.

Specific comments

- Line 21: Zone instead of zZone
- Line 78: As mentioned above the link to the previous paper could be a bit more elaborated
- Line 86: How dependent are your results from the selection of the time period, do you see a trend there?
- Line 144: Did you develop this method or employ it? For the first a short explanation, for the latter a citation is missing.
- Line 319: better a bit more specific here e.g.: ***over the tropical Atlantic***

- Line 324: *This process is similar to studies of other tropical dry intrusions. Aemisegger et al. found for example*
- Line 327: *“to the dry intrusions from Raveh-Rubin (2017)” ?* unspecific
- Line 355: *.... the formation and persistence of GBR doldrums in Austral summer and autumn, highlighting...*
- Figure 8: I am not sure if *Hovmöller composites* is here the right word?
- Figure 9: The mean trajectory path in panel c) is difficult to read, maybe another color?
- Figure 10: The red line lies with 50 hours so the test is a bit confusing

References

Some links were not working, I listed them below. Please double check

- Line 399: <https://www.doi.org/doi.org/10.1175/JAS-D-21-0337.1>
- Line, 405: [https://doi.org/doi.org/10.1175/1520-0493\(1973\)101<0101:MAETIA>2.3.CO;2](https://doi.org/doi.org/10.1175/1520-0493(1973)101<0101:MAETIA>2.3.CO;2),
- Line, 458: [https://doi.org/doi.org/10.1175/1520-0469\(1972\)029<1109:DOGSCC>2.0.CO;2](https://doi.org/doi.org/10.1175/1520-0469(1972)029<1109:DOGSCC>2.0.CO;2)
- line, 461: <https://doi.org/doi.org/10.1002/qj.990>,
- Line, 479: <https://doi.org/10.3389/fclim.2022.792730> instead of <https://www.frontiersin.org/journals/climate/articles/10.3389/fclim.2022.792730, 2022>.
- Line, 482: [https://doi.org/doi.org/10.1175/1520-0469\(2003\)060%3C0743:ANPOB%3E2.0.CO;2](https://doi.org/doi.org/10.1175/1520-0469(2003)060%3C0743:ANPOB%3E2.0.CO;2)
- Line, 510: [https://doi.org/doi.org/10.1175/1520-0493\(1996\)124<0245:ACOAAB>2.0.CO;2](https://doi.org/doi.org/10.1175/1520-0493(1996)124<0245:ACOAAB>2.0.CO;2)
- Line, 514: the link is not working anymore
- Line, 526 : <https://doi.org/doi.org/10.1175/2008JCLI2595.1>

Literature:

Richards, L. S., Siems, S. T., Huang, Y., Harrison, D. P., and Zhao, W.: Trade wind regimes during the Great Barrier Reef coral bleaching season, *Weather and Climate Dynamics*, 7, 109–127, <https://doi.org/10.5194/wcd-7-109-2026>, 2026.