

Clim. Past Discuss., referee comment RC3
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Comment on cp-2022-39

Anonymous Referee #3

Referee comment on "Hydrological change in southern Australia over 1750 years: a bivalve oxygen isotope record from the Coorong Lagoon" by Briony Kate Chamberlayne et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2022-39-RC3>, 2022

This paper provides a hydroclimate reconstruction for south eastern Australia based on a bivalve oxygen isotope record, providing new insights into climate variability and change over 1750 years. This covers two periods of high interest – the MCA and LIA. The paper is well written and focused on a topic of high importance due to the scarcity of mainland Australia palaeoclimate records. Prior to publication the authors should address the following issues.

Scientific concerns:

The two primary concerns I have are 1) if this is a temperature or hydroclimate record and 2) in relation to the age model.

Firstly – the authors provide fairly weak evidence that despite establishing a $\delta^{18}O$ and temperature relationship for this site, they believe their $\delta^{18}O$ record better represents rainfall/flow. The authors need to provide further evidence/discussion of this through analysis between contemporary flow/rainfall and $\delta^{18}O$ in the top layers. This is crucial as an alternative interpretation of the results (based on the stated temperature relationships) is that that 500-1100 was cool rather than wet and 1100-1750 was warm rather than dry.

Secondly – The top 500 years of the age model doesn't appear to be well constrained and the authors exclude some dates based on being outliers. There is a sedimentary horizon at 40cm with a date below of 1444 and a date above (20cm) of 1783. This is a big gap. Could there be a hiatus in between these dates or a change in deposition rate? Another question is if the shells were in dead or live position as I am aware they can burrow into sediments and therefore may 'move into older layers'. Also the marine reservoir effect may vary over time. For example, a bushfire could result in a high influx of young carbon, so subtracting 800 years in this instance would be erroneous. If the lake has a lot of

vegetation and organic matter surrounding it, this may act to offset the carbon - groundwater age. While this may not be able to be completely addressed, the authors should discuss this in their discussion and conclusions as potential sources of uncertainty.

Other comments:

- In the first line of the abstract, the authors mention the resilience of aquatic ecosystems, however, palaeoclimate data is relevant to all ecosystems including terrestrial.
- Line 35 – highlights the lack of decadal scale records. However this statement is true for both high and low frequency reconstructions
- Reference to Dixon et al 2007 as 'recent' is probably not quite right. There have been advancements in the last 5 years. Particularly for Tasmania for example but also WA.
- Of the 9 records in Dixon, how many are on the mainland in SE Australia – it is worth noting for context for this study
- Line 40 – I don't think it is appropriate to lump the ANZDA in with reconstructions based on a single remote proxy. The ANZDA is based 176 tree-ring chronologies and one coral series from both Australia and wider Pacific.
- Line 47 – A flood is not a decadal phenomenon. Floods tend to build rapidly, peak and subside within a week or so. Droughts can last seasons to years. The term pluvial or flood dominated epoch would be more appropriate.
- It would be good if the authors could provide a stronger case as to why low frequency reconstructions are useful. In the first line of the introduction the authors state that "Multi-decadal to centennial records of past hydroclimate variability are crucial for understanding long term climate drivers, for calibrating and validating climate models, for assessing hydroclimate sensitivity to external drivers and for estimating the probability of multi-decadal climate extremes", however much of this requires annual or sub annual data. I am not suggesting low frequency reconstructions that cover longer periods are not useful but please spell out why they are an important piece of the puzzle in the introduction.
- Line 70 – 'Moreover' should be 'however'
- Line 91 – Remove "formally speaking"
- The authors mention the use of Pinus Pollen in identifying when modern section of the record. How is the pollen actually identified? Please include details
- Line 135 – missing "the"
- The authors mention some samples with erroneous dates, where they were identified as older than the sequence in which they were in. is this evidence of the aged carbon offset not being constant? If not, why might then be in error?
- Section 4.1 – Perhaps the authors could compare to Tasmanian temperature reconstructions by Allen et al? Or the Lake Tay reconstruction by Cullen and Grierson 2009
- Figure 1 – Add a box around Australia as it is a different scale to the rest of the map