

Response to review comments on the paper “Comparison of published palaeoclimate records suitable for reconstructing annual to sub-decadal hydroclimatic variability in eastern Australia: implications for water resource management and planning” by Flack et al. (Manuscript number: hess-2020-314)

Reply to comments from Reviewer #1 (Anonymous):

1-1. This paper provides very interesting results, and topic of the research is within the scope of this journal. The manuscript is well written and organized. Some minor revisions are recommended.

Author Response: Thanks for the positive comments. The requested revisions are addressed in the responses below.

1-2. The P7, L135 The advantage of using "composite index" is a little unclear. We can understand that the composite index would give conservative estimate of wet/dry condition (as described in P16, L294), however, it is still unclear why composite index would be better rather than the use of "best-perform single palaeoclimate records". #no palaeoclimate records could be selected as "best-perform"(?).

Author Response: It is not possible to identify the “best-performing” palaeoclimate record. Each individual palaeoclimate record has strengths and weaknesses and some are more/less applicable for certain locations. As documented in previous studies (e.g. Tozer et al., 2016, 2018; Dixon et al., 2017, 2019; Zhang et al., 2018), and as evident from Section S1 in the Supplementary Material, there are numerous sources of uncertainty associated with individual palaeoclimate records and lack of agreement across different sources of palaeoclimate information is common. However, there are also instances of agreement and it is these periods where multiple lines of independent evidence agree that we focus on here. Therefore the advantage of using a composite index is that it enables the analysis to concentrate only on the dry/wet epochs that we are confident occurred (i.e. that are evident in the majority of individual palaeoclimate records).

1-3. P6, L131 "... uncertainty associated with palaeoclimate records ..." -> It would be better to describe (explain) a little more about uncertainty and/or accuracy (precision) of paleoclimate records, if possible. (which sources of uncertainty and how large/small uncertainties are expected, difference in precision between older records (-1000years) and recent (after 1900), ...) # The response to this comment is not mandatory, however, this information would be helpful # for reader's understanding of characteristics (limitation) of palaeoclimate records.

Author Response: The references provided in this section (e.g. Ho et al., 2015a; Tozer et al., 2016, 2018; Dixon et al., 2017, 2019; Zhang et al., 2018) give comprehensive details about the uncertainties associated with palaeoclimate records. It is not appropriate to repeat that information in this paper.

1-4. P3, L85 "11 palaeoclimate records that were selected ..." -> How many "candidates" of palaeoclimate records were reviewed (in total) to select 11 palaeoclimate records?

Author Response: We conducted a literature review using “palaeoclimate” and “Australia” as the search terms. More than 100 papers were returned but sometimes multiple papers were based on the same palaeoclimate record so this does not mean that more than 100 palaeoclimate reconstructions are available. Focusing on palaeoclimate information relevant to eastern Australia only, available at sub-decadal temporal resolution, covering the last 1000 years, and related to hydroclimate (as opposed to temperature) reduced the “candidate” records to 24. The 11 chosen were the ones that were available/accessible and in some cases represented an update of earlier work (e.g. Ho et al. (2015b) is based on earlier work by McDonald et al. (2007) and Vance et al. (2015) is an upgrade of Vance et al. (2013)).

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1-5. P3, L92 "... however, two records with –4-5 year temporal resolution ..." → How did you use (and composite) 4-5 years temporal resolution data with other annual resolution data? # ex. interpolated in annual resolution (?)

Author Response: Yes, every year within the 4-5 year block was given the same value.

1-6. P6, L124 "... more than 20% above (below average) ..." → How to set the "20%" as a threshold? # following to other past research (?)

Author Response: The 20% threshold was chosen to be consistent with the rainfall decile approach used by the Australian Bureau of Meteorology to determine whether rainfall is above average, average or below average for a given time period and location (<http://www.bom.gov.au/climate/glossary/deciles.shtml>). Following this approach rainfall in deciles 1, 2, and 3 (i.e. more than 20% below average) is considered dry and rainfall in deciles 8, 9, and 10 (i.e. more than 20% above average) is considered wet.

1-7. P7, L135 "... majority of palaeoclimate records analyzed here agree were wet or dry..." → - "majority" means that if 6 of palaeoclimate records show the signal of wet/dry, the period is considered as wet/dry period. (?)

Author Response: Yes, that is correct. Text has been adjusted to clarify as follows (new text is highlighted):

A wet/dry composite index is developed which identifies 5-year periods that the majority of palaeoclimate records (i.e. 6 or more) analysed here agree were wet or dry (Figure 3).

1-8. Does the number of agreed palaeoclimate records (wet or dry, among 11 records) have any relationship with degree (severity) of wetness/dryness of the period?

Author Response: No, the magnitude of the event (i.e. how dry or wet it was) is not assessed here. If a large number of palaeo records agree that a certain epoch was dry (or wet) then we have increased confidence that it was actually dry (or wet) at the locations represented by those palaeo records. So a large number of palaeo records agreeing that it is dry (or wet), even though they sometimes represent different locations, is more indicative of the spatial extent of the dry (or wet episode) rather than the magnitude of the event.

1-9. P16, L316 "Based on annual rainfall ..." → Which rainfall data was used to calculate averages for wettest, driest and middle input? # AWAP data (?)

Author Response: Yes, AWAP data.