Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-314-RC2, 2020

Hydrology and Earth System Sciences
Discussions

Interactive comment on "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* Anna L. Flack et al.

Lisa Davis (Referee)

lisa.davis@ua.edu

Received and published: 2 September 2020

General Comments (overall quality)

This paper examines decadal and sub-decadal hydroclimatological changes in eastern Australia by performing a metanalysis or synthesis of pre-existing multi-proxy paleorecords from within or in proximity to the region. The results of the paleorecord analyses are applied within the context of a water resources management framework. This paper does several things that make it a novel and timely contribution of broad interest

to many communities (including the paleoenvironmental, hydrologic, hydroclimatologic, and water resources communities) and a good fit for HESS, with its integrative perspective as a journal.

Although the number of regional and continental scale syntheses of paleoenvironmental data have increased over the last decade, too few exist for many locations in the world to make these data accessible and viable for use by hydrologists and water resource professionals. This paper helps ameliorate this issue for a large region of the Australian continent. A second contribution of this work is that it presents a methodology for others to follow to increase the number of regional to continental scale interpretations of paleoenvironmental data for the purposes of water resource management. There is a great need for longer records of hydroclimatological data, particularly when it comes to extremes and droughts because 20th century precipitation and flow records, typically used as the basis for forecasting the occurrence of future extremes, is too short to have a statistically relevant number of extreme event observations to make their predictions of extremes reliable. This problem has been documented worldwide and it could be argued all of humanity is at the precipice of a hydrological crisis given how many major infrastructure designs are based on a 20th century record that no longer applies. Many researchers are producing site specific, paleoenvironmental data, spanning millennia and thus a wide range of hydroclimatological regimes. But they are not analyzing and disseminating the results in a framework that would facilitate the adoption of this information by the hydrologic modeling and water resources community. Thus, the importance of this paper is that it demonstrates a method for interpreting and applying paleoenvironmental data to address water resources and hydrologic assessments of extreme events for others to follow.

This paper being published so soon after the revision of flood frequency guidelines (US Geological Survey Bulletin 17C, released in final form in 2017) makes the paper a very timely publication. These guidelines, designed to inform federal water regulators in the U.S. but used the world over, recommend combining paleodata with instrumented pre-

cipitation and streamflow records to improve the reliability of extreme flood prediction.

Specific Comments

1. Introduction - The emphasis of the introduction should be flipped to make the Australia specific information, currently in the first paragraph, be secondary to the information in the bulleted points about the global issue of short, 20th century records being used as the basis of precip and hydo forecasts. As part of making the broader relevance of the paper more apparent, I suggest expanding the bulleted information between 45-55. I think the point made later about the recommendations of the USGS's newly revised flood frequency guidelines (Bulletin 17C) should be introduced in here as well.

2. Table 1: I would state which multiproxy methods were used so that it is easier for the reader to quickly verify that an annual resolution of data applies. For the Gallant and Gergis (2011), for example, I would change to "Tree Rings & Coral."

3. Table 1: Regarding the remote records, McGowan et al. 2009 is not included in the references. It needs to be added.

4. I found a paper by the same lead author (McGowan) about streamflow reconstructions in the MD River Basin: Geophysical Research Letters (GRL) https://doi.org/10.1029/2008GL037049

If the GRL paper is the same used as a data source for the analyses, I'm not sure I agree that it fits the needs of the analysis. The GRL paper reconstructs streamflow for the Murray River in Australia based on a statistical correlation between the instrumented streamflow record and a reconstruction of the Pacific Decadal Oscillation from paleo records in Canada and China. But no paleorecord was used to validate the association between streamflow in the PDO from anywhere near Australia.

I know there are limited datasets to work with, but this seems too indirectly tied to Australia to be meaningful. The other PDO reconstruction data source used (Buckley

et al. 2019) uses paleorecords from across the Pacific and seems more reasonable to include.

I know the Pacific is large and perhaps by having both PDO reconstructions the goal was to cover all of the Pacific?

This is relevant because of the discussion in Lines 158-171, pgs. 7-8 concerning the accuracy of localized vs. remote reconstructions. The PDO reconstruction for the McGowan paper was built on paleorecords that were the most geographically remote of all the data sources. If this is the same paper.

5. What instrumented data were used in the analyses? Was it precipitation or streamflow or both and how are the instrumentation data distributed over the study area?

Technical Corrections

1. Line 159, pg. 7: commas needed around "however."

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-314, 2020.