

Interactive comment on “Impacts of a changing climate on a century of extreme flood regime of northwest Australia” by A. Rouillard et al.

Anonymous Referee #1

Received and published: 20 December 2014

Overall this paper is good, interesting and suitable for HESS. However, you nearly lost me in the abstract and the first paragraph (see details below). There are a few other questions and comments I have which if satisfactorily addressed would make this paper acceptable for publication. Hence my decision “accept subject to major revisions”.....the revisions listed are mostly minor but there is a lot and i would like to re-review hence the choice of “major revisions”.

My comments, questions and suggested additions/revisions are listed below:

1. The first paragraph I think should be deleted. It isn't needed (better to start with line 19 – “Quantifying the “hydroclimatic expression” of regional events remains challenging.”) and what is written has several problems:

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a. My understanding is TCs are weather events not climate

b. TC, rain and drought “are projected to become more intense and less frequent”. According to IPCC (and hundreds of other references I could cite) my understanding was: (i) the jury is still out on whether TCs/typhoons/hurricanes would become more/less frequent or intense; (ii) same with whether or not extreme rain will become more frequent or intense (see IPCC special report on extremes where they classify this as something with “high uncertainty”) ; and (iii) for Australia, IPCC, CSIRO, BoM and many other studies suggest drought will become more frequent but again there is high uncertainty. If you want to make such a statement then I think you need a lot more evidence and references to existing literature to support it (while also fairly representing the published literature that says the opposite). Bottom line is there is a high degree of uncertainty about what will happen to intensity and frequency (and duration for droughts) of extremes in the future. This is a complex issue and doesn't need to be covered in this paper. My suggestion is delete first para.

c. Post-1955 wettenning in north-west Australia (line 12) is also misleading.both in terms of what the literature says and what your own data and model says (e.g. fig 3a and fig 3c). Yes there was a wet period from ~mid-1950s to mid-2000s and yes 1999-2006 appeared to be particularly wet.but since about 2006 things have not been so wet (maybe with exception of 2012).with 2006-2012 mostly back to average (maybe even drier than average).either way it is misleading to lump 2006-2012 in with 1955-2012 and say “post-1955 wettenning” as the so called trend appears to be more of a cycle (See next point).again better to avoid the semantics and controversy and just leave this paragraph out (but you will need to fix the abstract)

d. Talking about “trends” in this paragraph is misleading.looking at the data (e.g. figure 3 and other observations from the area) what I see is dry (~1988-1996), wet (1999-2006) then dry again post-1997.I don't see a trend in either fig 3a or 3c.i see cycles or variability or interannual to multidecadal wet/dry phases. I am aware the papers cited (and others) say otherwise but I disagree and the very recent literature

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is beginning to recognise this. You also recognise this on page 11920 (lines 23-27) when you mention the importance of exploring “cyclicality”. I would avoid mentioning trends.and in the case of para 1 just delete it and start at line 19.

2. Abstract.2nd sentence. ...you mention inundations of 1000km² and 300km² but reader cannot put this into context without knowing the total possible area.this is covered on page 11910 line 15 but the total area ~1300km² also needs to be in the abstract

3. Abstract. ...line 22,,,,,1999-2006 were “above average”.average calculated on what period? 1988-2012 or 1912-2012 or both or something else??

4. Abstract. ...final sentence. ...in line with comment 1c and 1d.yes if wet epochs like 1999-2006 continue then wetland will become more persistent.but where is the evidence that frequency or intensity of rain/TCs etc will increase or be same as 1999-2006?? I don't see it in this paper (in fact Fig 3a and fig3c suggests opposite) and I don't see it in other literature.therefore need to tone this down a bit.something like “While there is high inter-annual variability in the system, it is clear that that the wetland will become more persistent if the frequency and intensity of extreme rainfall events for the region were to increase (or be similar to 1999-2006), which in turn will likely impact on the structure and functioning of this highly specialized ecosystem.”

5. Page 11908, line 4.suggest the following Australian specific references should also be included here.you should also include this when talking about ENSO/IOD cycles on page 11920: a. Flood i. Kiem, A.S., Franks, S.W. and Kuczera, G. (2003): Multi-decadal variability of flood risk. *Geophysical Research Letters*, 30(2), 1035, doi:10.1029/2002GL015992. ii. Ishak, E.H., Rahman, A., Westra, S., Sharma, A. & Kuczera, G., 2013, Evaluating the non-stationarity of Australian annual maximum floods, *Journal of Hydrology*, 494, 134-145, DOI: 10.1016/j.jhydrol.2013.04.012. iii. Kiem, A.S. and Verdon-Kidd, D.C. (2013): The importance of understanding drivers of hydroclimatic variability for robust flood risk planning in the coastal zone. *Australian*

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Journal of Water Resources, 17(2), 126-134. iv. Pui, A., A. Lal, and A. Sharma (2011), How does the Interdecadal Pacific Oscillation affect design floods in Australia?, *Water Resour. Res.*, 47, W05554, doi:10.1029/2010WR009420. b. Drought i. Kiem, A.S. and Franks, S.W. (2004): Multi-decadal variability of drought risk – Eastern Australia. *Hydrological Processes*, 18(11), 2039-2050. ii. Verdon-Kidd, D.C. and Kiem, A.S. (2010): Quantifying drought risk in a non-stationary climate. *Journal of Hydrometeorology*, 11(4), 1019-1031.

6. Page 11912.line 25.are the units correct?? I think what you are saying is 22 mm of rain per rain day??.....but what does 22 mm of monthly rain per rain day mean?? Please check and clarify.

7. Page 11913.30 out of 60mths when extreme happened were associated with one or more cyclone.so 50%.....what were the other 50% of extremes associated with or caused by?? Need a comment on this. what else causes rainfall extremes in this region?

8. Page 11913.line 10-26,,,,,all these other sources of verification sounded interesting to me (especially the field and helicopter groundtruthing).I might have missed it but I couldn't find where the results of this are reported or discussed. I think you need a section which covers: a. how your reconstruction compares with landsat (Appendix A, sect A2 describes this but you need images/plots to verify and demonstrate your model/reconstruction is realistic b. how your reconstruction compares with the 40cm and 5m ortho images.again, plots, figures etc would be good c. demonstrate how your reconstruction compares with the groundtruthed info (helicopter and field expedition)

9. page 11918, first para.this is confusing and I think needs to be reworded.rather than speaking about years you need to talk about months since F(A) and change in F(A) are monthly terms.are you saying that all preceding months in 1941 were drier than 1999??? i think what you are saying is that if the Marsh is inundated in mth x to

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say 80% then the decrease from that month of inundation to the next is larger than if month x was inundated to say 50%??? Is that right?? If so that would make sense as more water to lose to evaporation etc.or are you saying something else??? Either way this para is confusing and needs clarification.

10. Page 11920.line 14-20.you said it."significance of this finding should be treated with some caution".yet abstract and intro does not show the caution you recommend.....see previous comments on apparent trends and their spurious significance.suggest remove or reword so it is toned down and caveats above are included.there are also issues with using linear regression tests for processes that are inherently non-linear and non-stationary.see refs listed above for further details on this

11. Page 11920.line 17.Fierro and Leslie 2013 ref not in ref list....check all cites and references as there may be others missing also.

12. Page 11920.line 25-28.this is good.and I think this point should be included in the abstract.also suggest including Interdecadal Pacific Oscillation (IPO) and cites to refs listed in comment #5 which discuss its role in driving multidecadal variability of flood and drought risk in Aust.most of this work has focused on eastern Aust but it is still relevant and needs to be investigated for WA.

13. Page 11908.line 7.severity, intensity, duration.what is difference between severity and intensity? Do you mean frequency, intensity and duration?

14. Fig 1.in legend PLACES NAME should be PLACE NAME.also places indicated in Fig 1c (e.g. Roy Hill, Warrie Outcamp) should also be included on Fig 1b so easier to get bearings etc

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