**Climate
of the Past**

Discussions

Interactive comment on "Warm-season hydroclimate variability in Central China since 1866 AD and its relations with the East Asian Summer Monsoon: evidence from tree-ring earlywood width" *by* Yesi Zhao et al.

Anonymous Referee #1

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Dear editor and authors manuscript Warm-season hydroclimate variability in Central China since 1866 AD and its relations with the East Asian Summer Monsoon: evidence from tree-ring earlywood width

Thank you for the task of reviewing the manuscript "Warm-season hydroclimate variability in Central China since 1866 AD and its relations with the East Asian Summer Monsoon: evidence from tree-ring earlywood width". The report is interesting and attempts to provide new exiting information of the application of traditional proxy-parameters derived from tree rings and at the same time attempts to provide informa-

tion on the relationship between hydroclimate and the Eastern Asian Summer Monsoon (EASM). PDSI was used before in relationship to EASM at a broader scale by Cook et al. (2013), Deng et al. (2013), been applied before The manuscript is very interesting, tidy presented, with interesting figures. The work is ambitious and reach partly the objectives. I consider that the methods are appropriate to a great extent but not determinant to fully accept the conclusions of the study. The main problem as I see, is that the authors attempted to do two papers in one, one on the quality of the signal detected by different tree ring parameters, and one on the relationship of the reconstructed regional reconstruction. These are well reflected in the objectives. As a consequence, each aim is partially achieved, but not beyond doubts.

1- For the aim n1, (1) " (To) compare the climate sensitivity of tree-ring parameters earlywood width (EWW), latewood width (LWW), and total tree-ring width (TRW) in P. tabulaeformis at BYS and LCM" (where BYS and LCM two study sites). The authors compare tree ring data with means of temperature, precipitation totals and hydroclimatic index scPDSI. This aim is partially reached by the authors. It needs to be completed with further assessment of LWW and TRW parameters have significance, but are left aside for the more sensitive EWW and not further analysed. The probable relationships at different frequencies (interannual, to decadal) are tested only very succinctly with no exploration on the possible lags.

Moreover, only one detrending procedure was reported, a rather conservative one, not that it is wrong, but certainly other routines should tried when investigating aim 1. In this case, the frequency responses of each of the parameters tested should have been analysed and tailor-made detrending options to preserve best the signal characteristics The climate data should also be enhanced, different temperature patterns to start, min-max temperature and different precipitation indices.

Since there is no mention of the detrended interannual correlations except as in figure 8b (this is not mentioned in the methods) or the lower frequencies the exploration of this frequency domain can be seen as incomplete. Please see through to discuss the

differences of why PDSI indices are of higher relevance than precipitation alone mostly if tree rings series are irresponsive to precipitation. It is still unclear whether the partial correlation tests were run for precipitation and temperature excluding PDSI, etc please explain.

The authors indicate that MJJ (early season moisture availability) can be driver for the growing season increment of EWW. It can be considered that previous years moisture also affects the present year increment (see Fritts 1976) for example. The correlations tested start from July in the previous year. This means that April -Maj and June one or two years before can have importance. If this analysis is done please present the results. If it is not done yet please add it to the report. Regarding this problem, I may suggest the authors do additional tests either wavelet analysis, or evolutionary and moving intervals as those available in Dendroclim package (Biondi and Waikul, 2004) on longer temporal extension data. On the other hand, the positive correlation of LWW with PDSI indicates that there is an effect of this index on tree growth at some point in the growing season. The relationship between August temperatures on LWW with the previous year may be at least discussed. The opposite patterns of correlations found for precipitation and temperature in May (current growing season) indicates that trade-off mechanisms between these two factors and photosynthesis are in action through the beginning of the growing season. This may perhaps be clarified with extending the study period to two years before the growing season as well as testing residual chronologies against residuals of the climate data

2- " (To) Attempt to reconstruct regional hydroclimate variability using the parameter that contains the strongest hydroclimate signals". I think this is what the authors really had in mind when writing the report. I think it is brave to attempt to reconstruct regional features based on two sampling plots (33 trees) merged, located in the edge of the region in focus. Let alone to call it regional or local, to reach wider spatial representation more proxy data should be added. And previous to merge these datasets, more tests could have been attempted to see if both sites have same climatic signals. This com-

ment is grounded on the small sample size, its only 33 individuals that can be deeply explored.

3- "To explore the relationship between reconstructed scPDSI with EASM", I understand the need to use EASM. This exploration is also succinct. But, it can and should be explored more in detail. With that in mind, almost trivial analysis are well tested and available: e.g. evolutionary response, moving intervals, coherency and wavelet analysis among others. The aim is to find synchrony (asynchrony) between datasets and extreme episodes that can be used to link two signals. These tests can really help to clarify when and how these signals could have been related and the stability of the relationship. To achieve this aim, I consider that other environmental signals with their lags should be ruled out as well. The authors mention other circulation patterns that are expected to influence the climate in the study area.

4- . 5-

Once these issues are solved, the authors will have material to two good papers: one on comparison between two or three tree ring parameters and one on the reconstruction of scPDSI and its subsequent comparison with the EASM and other atmospheric circulation patterns. I consider that the authors should take a decision on this issue and work on these alternatives separated. Each of these alternatives are promising contributions to the scientific community. Further, I provide detailed comments that may improve the article readability and content to rise its quality to a more publishable level.

Page 1 lines 15-18: Please be so kind to avoid redundancy. Page 1 line 16, MJJ scPDSI was used to denominate both the reconstruction and the scPDSI data targeted which made it rather confusing. Please use other denomination for the reconstructed data.

Introduction. Generally, the introduction is somewhat confusing, mostly due to alternation of subjects either focusing on hydroclimatic data or the EASM. Then the real

product of this article is a reconstruction hydroclimatic patterns, or an attempt to provide a predictor for the EASM, or comparisons between TRW, EWW and LWW. The authors claim that a comparison of the sensitivity to climate patters is the first objective, then the introduction should start in that way, and not focusing on EASM or scPDSI indices. WDI should be properly introduced and described.

Page 1, lines 24-25. Please consider explain the frequency domain of these examples as well as the temporal extension. If the aim is decadal to interdecadal variability, the authors could explain these anomalous events in this frequency context. Anomalous in terms of strength of the wind? The timing in the season? The spatial extension? Please explain. Line 29. "enabling it possible to study..." Please reword. Page 2, lines 4-5. The study is not focused on comparison with other proxies please reword. Page 2 lines 14-15. "and suggested the use of tree-ring stable isotopes to capture hydroclimate signals" Is this sentence relevant to the study? It suggests that the study focuses on these proxies. Page 2, line 20 . "These findings inspired us reconstructing hydroclimate variations..." please change to inspired us "to reconstruct..." please consider that reconstructions of past climate can not be achieve by inspiration alone. Intensive experimentation is a previous process in such an attempt. More over this sentence introduces the study aims, but later, the authors continue with introductory facts. Please consider to move this sentence further in the introduction.

Methods The authors are too general in the description of the methods. Please be specific to guarantee reproducibility of the results.

Page 3 lines 3-9: Please indicate the extension of the datasets do they start in 1887? Please indicate correlation values of detrended data, either resuduals or first differences, otherwise is a trend relationship that the authors are describing. Page 3 line 19-27. With aims of reconstruct climate data, would it not be better to keep two separate chronologies and use them as independent predictors to the PDSI? Provided that there are issues on the signal strength and intercorrelation between the two datasets may expected to be higher due to the distance between sites, whereas it may be ex-

pected to have different climatic signal due to the altitude difference... Page 3 lines 32 to Page 4 line 1: "and were quality checked before release" vague sentence and perhaps not really relevant as written here if the authors of this article have not done this quality check. What do the authors mean with quality check? Is the data homogenised in any way? Page 4 line 4. PDSI is not described in the introduction either its application in relevant articles in the area. Please be so kind to complete or specify. Page 4 lines 7-10. Please be specific what frequency domain is tested in the correlation test. Only data with no autocorrelation can give interannual responses without low frequency noise. If the standard versions of the chronologies were used the authors, they should indicate the possibility of inflated correlation values due to the slope effects of the curves. Page 4 lines 8-10. Please be more specific on what limiting factors, since the authors are performing the analysis at this stage, do they assume hydrological deficit is a limiting factor? Or temperature alone? Regional means, or extremes, etc.

Page 4 line 11: "For hydroclimate reconstruction", grammatically incorrect, please revise. Page 4 line 13: Please specify the periods which were used to split the data. Page 4 line 13: The authors could be so kind to add Durbin Watson test and Cox and Stuart Tests for the autocorrelations of the regression residuals. Page 4 Lines 13-14. Please be specific: What spatial data were compared the reconstructed time series with? Page 4 line 16. Please explain the criteria for selection of the spatial extension of the scPDSI data used in the study. Page 4 lines 21-24. This description introduces the reader to EASMI indices and should be properly described in the introduction. If you please. Page 4 lines 15-20. Could you please indicate the length of the time series named here. Page 4 line 21. Vague sentence since the term "notions" is confusing in this context, please reword. Page 4 lines 24-25. Please describe how this index was calculated, even if it is described in Zhao et al. (2015) Page 4 line 25. "the used 200 ha..." Please remove "The used" Page 4 line 31. First differences or trends? Please see comment on this issue above reference to the page 4 lines 7-10. Page 4 line 30-34. I Don't understand, is this only one procedure? correlation tests on FFT filtered series? And that is why the authors adjusted the degrees of freedom, right? Page

4 Line 34 to page 5 line 5: Is this the spatial correlation the authors used Climate explorer suite? Please explain how this was done, for example, lags, filtering, first differences, etc. Page 4 line 34. These datasets can be used to represent temperature and precipitation, rather than "reproduce". On the methods section, the descriptions of the data are good, but can be favourable to present it as well in a table. In addition, pleas be so kind to check for repetition in lines 4-6 and 16-17 in page 4. Page 5 lines 8-9: If the extension of the chronology are not specific results of this reaserch should be stated in the methods section. Moreover, these descriptions temporal extension of the data, EPS, Rbar, mean, etc are better presented in a table. If the authors will keep the paragraph, please add some values, these give base to the comparison between chronologies. For example, how much stronger were the common signals of EWW? Page 5 line 20: Please revise the grammar, "time stable" change to "is more stable through time than…" but then what do the authors mean with this? Could you please prove this with values. Page 5 line 23. "By contrast, LWW almost has no significant correlations" please add the values to make it comparable, and change "almost has no" to "has almost no..." Page 5 line 24. A conceptual observation, LWW can not induce anything… The researchers included LWW information in TRW information. The effect is understandably a decrease of climate sensitivity for the months and frequency tested. But please consider to test the data with no trends.

One more observation: the positive correlations between tree ring data and temperature and PDSI in months other than growing season can be seen as an alarm. Is it possible that there is an artefact rising the correlation values? Following the same reasoning, the spread of the correlation values is quite low both before and after the growing season, and I do not think that the trees continue photosynthesizing in December? This issues needs to be explored and analysed more deeply before publication.

Page 6 line 5, did the authors consider two chronologies for predictors of scPDSI?

Page 6 lines 12-13. "We restored the variance of reconstruction… " Do the authors mean scaled? Also consider pleas to add "the" before "reconstruction". Page 6 lines

15-16. Please indicate the frequency domain the correlation is tested on. Page 6 lines 19-21. Please consider the number of datasets used in Cook et al, 2010 (>300) in relation to this study where the authors used two chronologies, it could be argued that the spatiotemporal signal strength in this study is restricted to the area shown in the figure 1. But also, be so kind to consider the different target seasons of these datasets (MJJ and JJA). In relation to the figure 1(b): Do the authors refer to NADA dataset only to the grid point indicated in the map with the red triangle? If so, it is not clear in the text, or in the figure. I also consider that a suggestion that NADA is biased and the results presented here are more correct is premature (just on regard of the sample size). Page 6 lines 21-22. As mentioned before, please report the frequency domain of the test. Page 6 lines 25-26. Please notice that Van der Schrier et al. (2013) explains values between 2 and 3 (-2- -3) as moderated wet (moderately dry). Since the authors are using their data is worth to be consistent with their definition. Page 6 lines 26-32. It could be valuable if the authors could show some statistics (significance) of these coincident events and if possible, described events shown in different sources that are not detected by the reconstruction. Page 7 lines 5-6. Very interesting! Please consider explain in the methods how this breaking point (1956) was established. Page 7 lines 12-13. Please explain this claim, what is the importance of a dipole pattern? Is it miningful? Is a dipole pattern contrasting to conditions previous 1950s decade? Page 7 line 13. Please demonstrate thi claim with some tests. Page 7 line 14. Please change "and there are no significant spatial pattern changes" for "and there are no significant changes on the spatial patterns" Page 7 lines

Figures Figure 1(a) units or information on the colour bar are missing. Figure 1(b) Please add code or name of the stations, altitude can be also relevant. Since the EASM is relevant to the article can be good to indicate the spatial influence of this phenomena in the map.

Figure 1 caption Page 17 line 3. Please change "Cycle" for "circles". "Monsoon atlas…" "…grid point triangle" please reword this sentence, since it is not altogether clear what

the authors mean. The last sentence "and the range . . ." please clarify that is a selection taken from Van der Schrier et al., (2013) larger dataset.

Figure 2. Please list the stations if possible, with the temporal extension. Figure 3. Please change "piece" for "section". These examples usually list the sample ID. Figure 4. Figure caption line 4. Please change "size" for "depth". Figure 5. Is this figure really relevant? Please write the names of the datasets. Figure 6. This is a key figure for the study. It must be complete. Please add at least from April in the previous growing season, and I wish to suggest the authors to add 2 years before the current growth year. I assume these correlations are run with the standard chronologies which probably contain a significant amount of trends. A figure similar to this could be added with prewhitened tree ring and station data for each chronology. Figure 7. It is a very interesting figure. This can be completed with LWW and TRW information, to rule out the possibility that there has been loss of signal for LWW. The figure itself is good and illustrative but highlights that no lags were tested.

Consider that this figure is made on time span after 1956, a date that the authors claim there is a change in the relationship of hydroclimatic variability and EASM. Thus this figure is restricted to "actual" conditions and not useful to illustrate past relationships. This is a subtle problem that challenges the temporal stability of the relationship between the datasets tested (tree-rings and climate).

Figure 8. Caption: a, "Raw time series" is this the raw chronology? or standard chronology "raw"?. b, 1st order difference over raw time series or standard chronologies? Please add some statistics on the figure, and analysis of residuals. Figure 9. It is demanding for the reader to guess all the time whether is scPDSI reconstruction or original data. Please make a denomination of the reconstructed index. Please add the authors in the corresponding axis of the charts. There is a lag between precipitation and scPDSI (d). This is not discussed at all, as the information in this figure is hardly integrated in the manuscript. Figure 10, caption. Please indicate what type of filter. Pearson correlation? Figure 11, please indicate what represent the colour bar in the

figure. Caption: Please indicate what type of filter, reconstructed scPDSI?, source of the datasets: "author et al (year)", Mean (?) temperature. This figure answers the question "is any change of atmospheric regime in the EASM area" not altogether relevant with the objectives, since the time domain is marginal within the reconstruction period. Are the rivers set as geographical reference?

Missing in the manuscript:

The more urgent motivation, local reconstruction, should have more local facts. More accurate description of the data, what was originally used for and why was it relevant to this one study. Often reports do not include such information, but since the dataset is small, it is worth to convince the reader of the robustness of the data. An overview table and figures with the chronology information: this because different tree ring datasets are compared. This comparison must be done in deep. An overview table with the climate data used An overview of the data used for comparison (discussion) Better descriptions of the methods used (more accurate) Better descriptions of some of the datasets e.g. DWI. The relevance of the findings. Why are these results valuable? Please be so kind to explain. Axis information in the figures (colour bars information) Text information within the figures. Acronyms to the specific datasets, two datasets can not be called in the same way. Please fix this detail.