

## ***Interactive comment on “Inconsistencies between observed, reconstructed, and simulated precipitation over the British Isles during the last 350 years” by Oliver Bothe et al.***

### **Anonymous Referee #1**

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Overall, I found this paper to be very confusing to read and also not surprisingly hard to follow. Also in this form I don't think that it is worth publishing. I think this is because it is attempting to do too much in a single paper. I would be more interested in one where the observations and reconstructions are compared, then a separate paper or a separate part of a single paper, where the climate simulations are compared. It seemed to me that every time there was something interesting, the discussion went on to a discussion of the models and initially a list of the models and all the necessary details about them in terms of refs/names/resolution/forcing etc. It would have been better if all this latter part was in a separate Appendix. The basic premise of the paper is that regional-scale precipitation (here for England and Wales) should show some impact of external

forcing, but it seems that not surprisingly that internal variability dominates. Maybe the authors should spend some more time looking at long observational series, and less time looking at climate model simulation output. There are long precipitation records for the England and Wales region (including also the Central England Temperature series) and they have been analysed for a long time (i.e. there is a vast literature on analyses of these series, that this paper doesn't consider at all). Figure 2 clearly realizes the seasonal nature of the reconstructions plotting seasons such as MAMJJ and JJA. Figure 1 though appears to look at annual averages for CET. So when in Figure 4 running correlations are shown for CET with precipitation observations, drought/precipitation reconstructions what season is being used. Is this CET for MAMJJ or JJA or is it annual CET? I couldn't decide what it is from the text or the captions. If it is CET annual then this is wrong. CET correlates with England and Wales rainfall in winter positively (warmer winters tend to be wetter) and inversely in summer (warmer summers tend to be drier). So relationships change with the season. Need to specify for every season what season is being used, otherwise people will assume annual like I did. These relationships ought to be captured by models, which is what I think you say, but this is buried in text somewhere else. This is another problem with the paper, that there appears little structure to it and the text doesn't flow in a logical order, and there is no summary at the end of the Introduction of what to expect in each of the subsequent sections. Some specific points

1. SPI. Using a distribution for this is discussed. Whatever is chosen, the parameters ought to be compared. Tree-ring based reconstructions generally explain only a portion of the variance, so these are likely to have a lot less variance than the observations. This issue needs to be discussed. Comparison of series at SPI doesn't let the reader see the effects of the differences in explained variance.
2. When you compare the reconstructions with England and Wales precipitation series in Figure 2, you seem to think that they will agree well. It is essential to look at how well SW England and also East Anglia compares with England and Wales. You can get the observed data here <https://www.metoffice.gov.uk/climate/uk/summaries/datasets> for periods since 1910. The correlations will not be as high as you imagine, partly because

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East Anglia is dry and also how the England and Wales series is put together. See the brief discussion in Kendon and Hollis (2014). 3. There are odd bits of discussion almost on every page. On p7, why do you think the late-18th century dip in temperatures is due to the Laki Eruption? The references don't look at CET and the eruption did not put material in the stratosphere. I've assumed you're referring to CET as the paper is about this region, but the Laki eruption has been postulated as causing cooler weather in central Europe in 1784 and 1785, but as said this isn't very convincing at all (compared to say the eruption of Tambora in 1815). 4. You should state that all you expect with the models for this small a region is to get the precipitation amount right. You would need ensembles of runs to see if any of the low-frequency might agree. You seem to be expecting too much, or you need to explain why you're expecting as much as you are. 5. As stated the text is difficult to follow. Much of p10 comes into this category. The bottom line of Figure 2 shows Weibull standard deviations, but what does this mean? Surely this is showing what I was talking about in #2? The whole running numbers are confusing. It doesn't help putting too many coloured series on the already quite small plots. 6. The opposite evolution in East Anglia and SW England might be correct (p11)? You need to look at the observations to check this. There is an out-of-phase correlation between SE England and NW Scotland. 7. If series (p12) have the order of one degree of freedom, then what are you doing showing them. Parts of this page are very difficult to read and follow. 8. No seasons are given with Figures 4 and 5. 9. Trouet et al (2018) would have done better to have used the 300-year long instrumental records from the British Isles instead of going straight to tree-ring reconstructions. There are large variations across the British Isles with the size of the influence of the westerlies on precipitation amounts in the spring and summer. For example (p16) the NAO has no influence on East Anglian precipitation amounts in the winter half year. The NAO effect is much stronger on the western and northern areas of Britain, and it is mainly in the winter season. When you talk about spring/summer and the NAO are talking about the same NAO as in winter? It would be useful to discuss how the North Atlantic Jet that Trouet et al (2018) talks about relates to the NAO, if

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it does? 10. P17 states that standardization of precipitation goes beyond comparing means and deviations. I'm not sure that you have shown anything other than just the means and SDs.

References Kendon M and D Hollis, 2014: How are UK rainfall-anomaly statistics calculated and does it matter? *Weather* 69, 37-39.

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