

Comment on Figure 2 of “The M& M critique of the MBH98 northern hemisphere climate index: update and implications”, Energy and Environment, 16, 69-100, 2005

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Introduction

In McIntyre and McKittrick (2005) (hereafter eM) the technique of evaluating principal components (hereafter PCs) used in Mann et al. (1998) (hereafter MBH) is criticised. Some of the issues are discussed in Jukes et al. (2006) (hereafter JAB) and references therein. The primary issue is the way in which data is treated prior to the singular value decomposition which generates the principal components.

MBH centre each series on the calibration period and normalise using the detrended variance in the calibration period. MM claim that this is incorrect and that data should be centred on the entire record length.

Figure 2 of MM claims to display the results of the centering advocated by MM against the results of using the MBH algorithm, but examination of the code used by MM shows that this figure is, erroneously, created with uncentred data.

The software used by MM

McIntyre and McKittrick have been strong advocates of the full disclosure of scientific software, arguing that scientific results cannot be trusted if the software used to generate them is not subject to scrutiny.

In response to an email request in December 2005, McIntyre responded that the software for their Energy and Environment paper, published in January 2005, would be available shortly. At the time JAB was submitted the website maintained by McIntyre stated clearly that the software was not currently available. On publication of JAB, McIntyre send an email to the the lead author drawing attention to a web page containing some software.

This software was incomplete, in that the function used to generate the reconstructions in MM was not included, but that was remedied in a few days following another email. The software does includes the full code used to generate the principal components used in figure 2 and figure 4 of MM. We note that the level of disclosure of software by McIntyre and McKittrick, even taking account of the delay between publication and disclosure in this

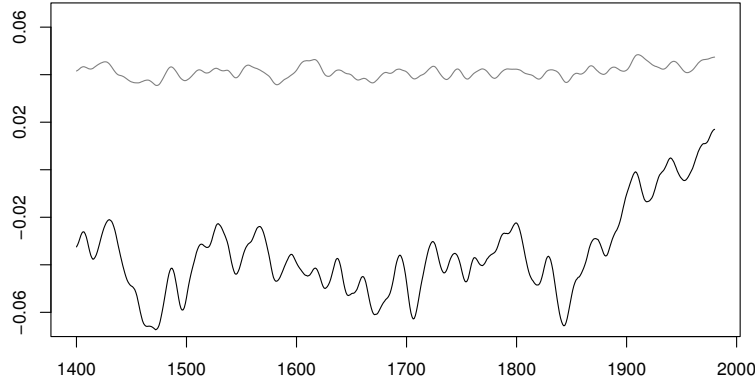


Figure 1: Reproduction of figure 2 of MM, excluding two lines. The lines shown are first PCs of the MBH North American tree-ring data calculated using (1) MBH standardisation (lower) and (2) no standardisation (upper). In MM the upper line is incorrectly described as using data which is centred. Both curves are smoothed with a Gaussian filter, $f \propto \exp(-\delta y^2/2w^2)$, with $w = 3.5$ years and δy the time difference in years.

case, goes well beyond what is normal in this context.

Figure 2 and figure 4

Using the software provided at <http://www.climate2003.com/scripts> and data and scripts from <ftp://ftp.agu.org/apend/g1/2004GL021750/> it has been possible to reproduce figure 2 of MM. The Principal Component which they describe as being produced by the “centred” algorithm is the upper line. It clearly has a non-zero mean, which is not possible for a PC of centred data. Examination of the code confirms that the mean is not an artefact of the plotting but results from calculation of principal components using uncentred data: MM used the “svd” function which does not do any centering or normalisation.

Figure 4 of MM examines properties of the principal components. The code which produces this figure uses the “princomp” function which carries out centering of the data by default. The results of this routine are displayed in figure 2. The solid grey curve uses the default settings (no normalisation), while the dashed curve uses has `cor=TRUE` so that normalisation is carried out.

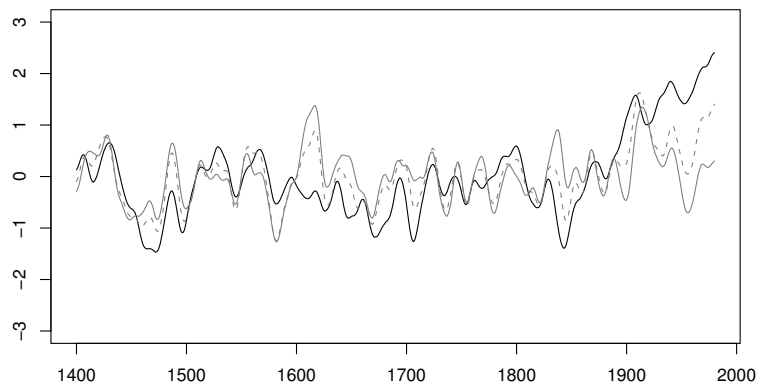


Figure 2: As figure 1, but using the grey curve is generated using the “prin-comp” function instead of the “svd” function, so that the data is automatically centred. Also shown is the PC generated when the data is also standardised (grey dashed curve). As in figure 1, the PCs have been smoothed with a Gaussian weighting. Here the curves have also been normalised to unit variance. All these curves have, by construction, zero mean (prior to smoothing).

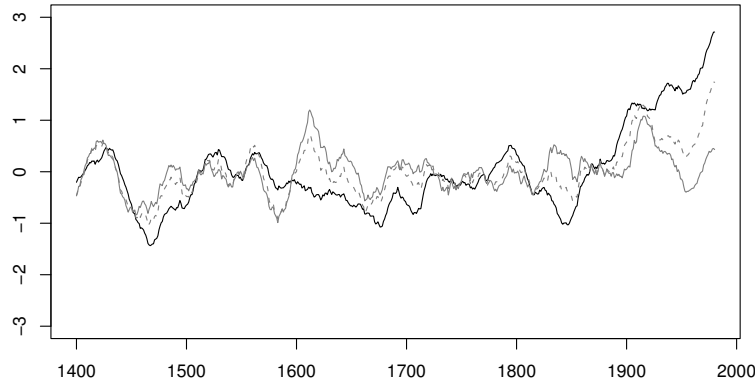


Figure 3: As figure 2, but using a 21 year block average instead of Gaussian smoothing.

The dashed curve in figure 2 is related to the blue curve in figure 1 of the supplementary material to JAB, but looks rather different. The three sources of difference are (1) the use of Gaussian smoothing in figure 2 with a width of 3.5 years versus the block filter of width 21 years used in JAB, (2) plotting of the PCs in figure 2 versus the plotting of PCs shifted to have zero mean in the calibration period in JAB (the regression algorithms require input with zero mean in the calibration period, so this shift is a required part of the algorithm) and (3) different normalisation. Figure 3 shows the effect of changing the smoothing from that of figure 2 to that used in JAB. It is now clear that the dashed line in figure 3 corresponds to the blue curve in figure 1 of the JAB supplement apart from a shift of the origin, confirming that the software used here and the data used here are consistent with that used in JAB.

Conclusions

It is clear that the graph displayed in figure 2 of MM cannot be, as claimed, the leading principal component of centred data because all principal components of centred data have zero mean. Analysis of the code provided by Stephen McIntyre shows that the graph actually shows a principal component of uncentred data. As emphasised repeatedly by MM, centering of the data is crucial. This error appears to only affect figure 2 of MM, as other calculations in their paper use the centred version obtained with the

“princomp” function.

References

M. N. Juckes, M. R. Allen, K. R. Briffa, J. Esper, G. C. Hegerl, A. Moberg, T. J. Osborn, S. L. Weber, E. Zorita, Millennial temperature reconstruction intercomparison and evaluation, *Climate of the Past Discussions*, Vol. 2, pp 1001-1049, 26-10-2006.

Mann, M. E., Bradley, R. S., and Hughes, M. K.: Global-scale temperature patterns and climate forcing over the past six centuries, *Nature*, 392, 779–787, 1998.

McIntyre, S. and McKittrick, R.: The M&M critique of the MBH1998 northern hemisphere climate index: update and implications, *Energy and Environment*, 16, 69–100, 2005.

Software

The software and data used to generate the figures in this note is available at: http://home.badc.rl.ac.uk/mjuckes/mitrie_files/software/mcintyre_mckitrick2005/r_code.zip.

If you have R installed (see <http://www.r-project.org/>), the figures can be generated unzipping `r_code.zip`, starting R and then entering `source("fig2.txt")` and `source("fig2p.txt")` at the R prompt.