

## ***Interactive comment on “A universal error source in past climate estimates derived from tree rings” by Juhani Rinne et al.***

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Received and published: 15 May 2016

In lines 32-33 the authors claim that: “In fact, Franke et al. (2013) succeeded in showing that many present day state-of-the-art reconstructions still tend to be biased in the low frequency part of the spectra.”

However, more recent findings (Iliopoulou et al. 2016; Markonis and Koutsoyiannis 2016) suggest that this may not hold true. Following the approach of Bunde et al. [2013], in determining the low frequency bias by examining the long-term persistence behaviour of precipitation, it has been shown that the low frequency variability is evident in many different types of proxies and not only to the tree-rings. In addition, a simple explanation was provided for this behaviour based on the changing dependence structure of precipitation as the temporal scale increases [Markonis and Koutsoyiannis

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2016].

Long-term persistence, also known as Hurst-Kolmogorov behaviour is linked to the power spectrum by a simple mathematical transformation [Beran 1994] and has been shown that is a more robust estimator of low frequency variability than the spectrum [Dimitriadis 2015].

Therefore, the authors should at least acknowledge that there is an on-going debate of whether there are low-frequency non-climatic biases in paleo records and at what extent.

Beran, J. (1994). *Statistics for Long-Memory Processes*, Monographs on Statistics and Applied Probability Vol. 61. Chapman and Hall, New York.

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Dimitriadis, P., & Koutsoyiannis, D. (2015). Climacogram versus autocovariance and power spectrum in stochastic modelling for Markovian and Hurst–Kolmogorov processes. *Stochastic Environmental Research and Risk Assessment*, 29(6), 1649-1669.

Iliopoulou, T., Papalexiou, S. M., Markonis, Y., & Koutsoyiannis, D. (2016). Revisiting long-range dependence in annual precipitation. *Journal of Hydrology*, in press.

Markonis, Y., & Koutsoyiannis, D. (2016). Scale-dependence of persistence in precipitation records. *Nature Climate Change*, 6 (4), 399-401.

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Interactive comment on *Clim. Past Discuss.*, doi:10.5194/cp-2016-27, 2016.

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