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

Anonymous Referee #1

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The manuscript touches upon an important topic within tree-ring research and climate reconstruction, namely sample replication and the ontogenetic or age trend present within tree-ring series (hence referred to as detrending methods). Especially, removing age-related trends while maintaining low-frequency climatic signals is of great interest to better understand earths climatic system. Both the fact that a new detrending methodology is presented to address this issue and a case study is provided on a widely used tree-ring record gives this manuscript great potential. However, the poor link to other detrending methods and work that has been done on other relevant tree-ring biases, weakens the message given by the manuscript although very strong statements are made. Additionally, for this method to be useful to the community more emphasis should be put on clearly explaining the steps needed to execute this detrending technique. Because of this I would like to present a few points of discussion

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Discussion paper

in relation to; a) inclusion of other detrending techniques, b) the impact of tree-ring related biases and c) expanding the methodology.

Due to both the title and the context of the paper it appears that the issues in relation to RCS deterending are present within most chronologies and has not been properly addressed. However, recently a lot of work has been done on addressing and resolving detrending related issues, while these methods and sources are not being addressed or mentioned within this manuscript. This for instance includes work on the RCS related issues in Briffa & Melvin (2011 in Hughes et al. Dendroclimatology, Developments in Paleoenvironmental Research) or the work done on comparing multiple dentrending methods and their potential to maintain low-frequency signals (Peters et al. 2015 Global Change Biology). Additionally other detrending methods like the signal-free detrending should be considered as they show great potential in being less affected by age-related issues (see Melvin & Briffa 2008 Dendrochornologia). It was also surprising to see the comparison between the proposed method and the reconstruction performed by Briffa 1992, while multiple comments and revisions have been made on this chronology (see: Melvin et al. 2013 Holocene; Matskovsky et al. 2014 Climate of the Past). The current comparison is therefore very difficult to interpret as it is not clear whether one can state that one is better than the other. Additionally, the fact that the difference between the methods is very small when the sample size is higher than 14 raises more debate on sample replication than on the relevance of the method. To validate the value of the newly proposed method it is therefore crucial to include more dentrending methods and more recent Torneträsk reconstructions.

Many biases and problem are present within tree-ring data. One of these includes the ontogenetic or age trend. However, many other biases are present like the persistent growth patterns or management related issues. Multiple of these biases have been addressed in literature and have been shown to affect low-frequency patterns, which is the main interest of this manuscript. However little attention is provided on either how these biases affect the proposed method or discussed how these could af-

fect the low-frequency signals. Work on both sampling strategy (Nerhbass-Ahles et al. 2014 Global Change Biology) and multiple biases described in literature should be addressed as these are common problems in constructing chronologies (See: Brienen et al. 2012 Global Biogeochemical Cycles; Bowman et al. 2013 Trends in Plant Science; Groenendijk et al. 2015 Global Change Biology; Autin et al. 2015 Dendrochronologia).

For reproducibility it is essential when introducing a new method that all steps and components within the procedure are clear. In general it is therefore important that enough attention is given to the methodology section, which currently is not sufficient to apply this method on other datasets. As an example more information should be provided on how the sensitivity analysis is performed to determine the upper limit of the age classes (bmax). Additionally, how one should determine the other required parameters to perform the computation is unclear (e.g. r1 and rn). What is also vague within this method is how the extrapolation affects the results (see Figure 2). If there is for instance a year with only a few young age classes a large proportion of the mean is determined by the extrapolated older classes, which are heavily dependent upon the assumption you make within this extrapolation procedure (which, if I understand correctly, in the manuscript is proposed as a negative linear relationship which can be highly debated). How these situations affect the method should be described or analysed. Finally, the error estimation and the representation of missing age classes in Figure 3 could be of great value to the community. Especially, visually showing where specific age-classes are lacking could help to detect specific biases and to disentangle whether low-frequency signals are caused by sample replication or climate. Because of this relevance I feel more attention should be given to the methods section on this as currently the description is highly condensed and in some parts not clear.

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