

Interactive comment on “Two millennia of Main region (southern Germany) hydroclimate variability” by Alexander Land et al.

Anonymous Referee #3

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Major comments:

This article has a potential to be a valuable scientist contribution but it needs, in my opinion, much additional work prior to publication. There are a number of issues that I would like to see addressed, or at least discussed, by the authors. In order to make them easier to follow, I list them in bullet points below (in no particular order of importance):

* A discussion is needed with regard to what extent any, likely non-linear, temperature sensitivity in the data affects the precipitation reconstruction. Given the region, some temperature influence on the reconstructed precipitation signal is likely to exists and such a signal is likely to be non-linear and thus different between warmer and colder climate states during the past two millennia.

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* I would like to see some “sensitivity tests” in the use of calibration window by using other seasonal windows than February 26 to July 6. It would be interesting to see how sensitive the skill of the reconstruction is to particular seasonal windows, especially as the presently used seasonal window is extremely well-defined down to single dates rather than months.

* I would like to see a longer discussion about the implication is the huge differences in MSL (see, e.g., Fig 2b). In my opinion, this is likely to result in a bias of the results to a larger extent than the authors acknowledge. Even if the problem cannot be solved (although it may be possible to use a subset of the data of the same segment length to conduct a “sensitivity test”), it needs to be discussed much more critically.

* It would be better to present all the result with regard to the climate mean of 1961–1990 instead of the mean of 1901–2000. This would make the results more comparable to other studies.

* The implications of the detrending choice much critically be discussed and the possibilities, or limitations, to apply RCS detrending (or “signal-free” detrending) must be seriously addressed.

Minor comments:

Page, 1, lines 13–15: This first sentence of the Abstract seems a bit out of place as the article only addresses the past two millennia and not the whole Holocene.

Page, 1, lines 27–28: The exact amplitude of the precipitation reduction is likely very sensitive to scaling/regression method.

Page 2, lines 1–3: The introduction is a bit vague and a bit out of place here. It is simply too general and not clearly related to the research problem in the article.

Page 2, lines 6–8: This is actually wrong. A number of two millennium-long calibrated precipitation reconstructions do exist. This is especially true for western North America. Moreover, MORE millennium-long hydroclimate reconstructions from tree-rings exist to

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date than millennium-long tree-ring based reconstructions of temperature. This whole part needs to be rewritten and up to date with the present state of research.

Page 2, line 8: I would also cite here:

Cook, E.R., Woodhouse, C.A., Eakin, M., Meko, D.M., Stahle, D.W., 2004. Long-term aridity changes in the western United States. *Science* 306, 1015–1018.

Ljungqvist, F.C., Krusic, P.J., Sundqvist, H.S., Zorita, E., Brattström, G., Frank, D., 2016. Northern Hemisphere hydroclimate variability over the past twelve centuries. *Nature* 532, 94–98.

Prokop, O., Kolář, T., Büntgen, U., Kyncl, J., Kyncl, T., Bošek, M., Choma, M., Barta, P., Rybníček, M., On the palaeoclimatic potential of a millennium-long oak ring width chronology from Slovakia. *Dendrochronologia* 2016, 40, 93–101.

Page 2, line 13: I would also cite:

Büntgen, U., Trouet, V., Frank, D., Leuschner, H.H., Friedrichs, D., Luterbacher, J., Esper, J., 2010. Tree-ring indicators of German summer drought over the last millennium. *Quat. Sci. Rev.* 29, 1005–1016. <https://doi.org/10.1016/j.quascirev.2010.01.003>.

Helama, S., Meriläinen, J., Tuomenvirta, H., Multicentennial megadrought in northern Europe coincided with a global El Niño–Southern Oscillation drought pattern during the Medieval Climate Anomaly. *Geology* 2009, 37, 175–178.

Klippel, L., Krusic, P. J., Brandes, R., Hartl, C., Belmecheri, S., Dienst, M., Esper, J., A 1286–1296 year hydroclimate reconstruction for the Balkan Peninsula. *Boreas* 47 2018, 1218–1229.

Kress, A., Hangartner, S., Bugmann, H., Büntgen, U., Frank, D.C., Leuenberger, M., Siegwolf, R.T.W., Saurer, M., 2014. Swiss tree-rings reveal warm and wet summers during medieval times. *Geophys. Res. Lett.* 41, 1732–1737. <http://dx.doi.org/10.1002/2013GL059081>

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Page 2, lines 16–18: Strange formulation here. What is said is unclear to me.

Page 4, Fig. 1: The Figure can be much improved, i.e. using ArcGIS or similar software, as well as be in colour for better clarity.

Page 5, Section 2.2: Are any references available for the various instrumental datasets from the various stations?

Page 5, line 22: Please, provide the standard references for RBAR and EPS.

Page 8, line 5: It should be mentioned that the Old World Drought Atlas is calibrated to scPDSI.

Page 8, lines 8–9: Are there any references to these datasets?

Page 8, line 10: For the Old World Drought Atlas (Cook et al., 2015), all included datasets are listed in the Supplement to the article in a table there.

Page 9, lines 7–9: Please, discuss the implication of these RBAR values more in detail.

Page 9, lines 12–13: A more detailed discussion about this problem is needed here.

Page 10, lines 11–12: A number of other references could also be added here.

Page 13, lines 17, 21: The word “connection” here could be replaced with “agreement” or “correlation”.

Page 16, line 28: The same problem has also extensively been discussed in numerous other studies, e.g.:

Bürger, G., and U. Cubasch (2005), Are multiproxy climate reconstructions robust?, *Geophys. Res. Lett.*, 32, L23711, doi:10.1029/2005GL024155.

Bürger, G., I. Fast, and U. Cubasch (2006), Climate reconstruction by regression–¹³C variations on a theme, *Tellus A*, 58, 227–235.

Christiansen, B. (2011), Reconstructing the NH mean temperature: Can underestima-

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tion of trends and variability be avoided?, *J. Clim.*, 24, 674–692.

Christiansen, B. and Ljungqvist, F. C. 2017: Challenges and perspectives for large-scale temperature reconstructions of the past two millennia, *Reviews of Geophysics*, 55, 40–96.

Smerdon, J. E., A. Kaplan, D. Chang, and M. N. Evans (2011), A pseudoproxy evaluation of the CCA and RegEM methods for reconstructing climate fields of the last millennium, *J. Clim.*, 24, 1284–1309.

Wang, J., J. Emile-Geay, D. Guillot, J. E. Smerdon, and B. Rajaratnam (2014), Evaluating climate field reconstruction techniques using improved emulations of real-world conditions, *Clim. Past*, 10, 1–19.

Page 17, line 4: Would blue intensity be an alternative to traditional density measurements in this context?

Page 19: Would not storage at the ITRDB also be a good option for long-term availability?

Page 27: It would be informative to also have a table for the wettest and driest decades.

Page 27: “Low pluvials” appears a strange expression to me. Do the authors mean “Droughts” here?

Interactive comment on *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2018-143>, 2018.