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Ranking of tree-ring based hydroclimate reconstructions of the past millennium

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We evaluate all currently available millennium-long tree-ring based hydroclimate reconstructions, and consider their data homogeneity, sample replication, growth coherence, chronology development, and climate signal, with the aim to provide an objective evaluation of the reconstructions. We go beyond simply considering their correlation to instrumental data during the reconstructions' relatively short, and typically well-replicated, calibration period. This survey adheres to the criteria established in an earlier study by Esper et al. (2016) to assess and "rank" tree-ring based temperature reconstructions.

This assessment examines 53 individual calibrated site reconstructions, extending back to at least 1000 CE, and representing 44 different tree species (some reconstructions are composed of up to nine different tree species). Of the extant millennium-long tree-ring based hydroclimate reconstructions, 13 are from Asia, 6 from Europe, 32 from North America, 1 from (northwest) Africa, and 1 from (southern) South America. The reconstruction' scores are similar across continents and diverse growth environments. However, large differences between the individual reconstructions are detected from within the same regions even when the same tree species are used.

A particular, and potentially problematic feature, of the tree-ring based hydroclimate reconstructions, as opposed to the temperature reconstructions, is that relatively few reconstructions are produced by Regional Curve Standardization (RCS). The application of individual-series detrending methods (e.g. ratios from negative exponential curves or smoothing splines) to produce most of the hydroclimate reconstructions risks removal of centennial-scale variability. By providing a quantitative and uniform evaluation of available tree-ring based hydroclimate reconstructions, we hope to facilitate further improvements in the development of hydroclimate reconstructions as well as offer practical guidance to secondary users of these reconstructions.

Reference:

Esper, J., Krusic, P.J., Ljungqvist, F.C., Luterbacher, J., Carrer, M., Cook, E., Kirdyanov, A., Salzer, M., Myglan, V., Timonen, M., Treydte, K., Trouet, V., Villalba, R., Wilson, R.S., Yang, B., and Büntgen, U. 2016: Ranking of tree-ring based temperature reconstructions of the past millennium. *Quaternary Science Reviews*, 145: 134–151.