

Interactive comment on “Millennial-to-centennial patterns and trends in the hydroclimate of North America over the past 2000 years” by Bryan N. Shuman et al.

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Because I read through this article as part of the PAGES Data Review process, I thought I would also weigh in on another issue that caught my attention.

In the abstract and the Introduction, the authors note that tree-ring records are known to exhibit an upper-limit to their frequency response when used as a hydroclimatic proxy. Due to that limitation, tree-ring reconstructions of past drought often exhibit less low-frequency variance than other lower-resolution proxies at decadal or centennial timescales.

I don't take issue with you pointing out that tree rings have known limitations as hy-

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droclimatic proxies. But given that you're arguing that proxies from lakes, caves, bogs and ice can provide useful information about longer-term changes, I think it's also necessary to acknowledge the limitations of those archives. As you point out in Section 2.1.2, many of the proxies included in this compilation reflect aspects of hydrology - lake level, water depth, salinity, run-off - that are strongly influenced by hydrological storage. And because storage imparts long-term memory, it's reasonable to assume that these proxies will exhibit more variance at low frequencies than a proxy like tree rings, which is going to be more closely tuned to precipitation or soil moisture.

Kathleen Huybers and colleagues published a nice paper in *Climate Dynamics* last year (<http://link.springer.com/article/10.1007/s00382-015-2798-4>) showing that, even if a watershed is forced with random climate, because lakes integrate those fluctuations over time, interannual climate variations by themselves can cause substantial decadal or multidecadal swings in lake level. Obviously the relative importance of storage is going to vary across this large and diverse dataset. But if you're going to point out the limits of one proxy, it's only fair that you consider the potential issues or confounding effects inherent to the records that are included in this compilation.

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