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Seasonal hydroclimate recorded in high resolution, intra-ring $\delta^{18}O$ profiles from longleaf pines growing in a coastal savanna of southwest Louisiana, USA

William E. Lukens[1], Robert T. Narmour[2], Brian A. Schubert[2]

[1] Department of Geology and Environmental Science, James Madison University
[2] School of Geosciences, University of Louisiana at Lafayette

Rainfall amount and intensity are increasing under anthropogenic climate change, but many instrument records span less than a century. The oxygen isotopic composition of tree-ring cellulose ($\delta^{18}O$) reflects local source water, climate, and tree physiology. The patterns of $\delta^{18}O$ within tree-rings has the potential to extend pre-instrument climate records with subannual resolution, but the influences on intra-ring $\delta^{18}O$ profiles are unexplored in many settings. In this study, high-resolution $\delta^{18}O$ profiles were analyzed on three longleaf pine trees growing in a native savanna in southwestern Louisiana, United States. The time series covers a wide range of rainfall conditions from 2001-2008 C.E., including five tropical storm strikes within 150 km of the study site. The $\delta^{18}O$ values ($n = 421$) are well correlated within and between trees ($r = 0.71$-0.78). We used principal components analysis and *k*-means clustering to differentiate $\delta^{18}O$ profiles into two groupings: symmetrical $\delta^{18}O$ profiles versus asymmetrical profiles that have depressed latewood $\delta^{18}O$ values. The slope of latewood $\delta^{18}O$ profiles is best explained by the amount effect, namely that higher seasonal precipitation results in lower latewood $\delta^{18}O$ values. We hypothesize that poorly drained soils in the study area mediate the influence of any individual storm event: in dry years, ^{18}O-depleted signals from convective storms are erased by subsequent evaporative enrichment of standing water, whereas in wet years, increased humidity and frequent re-supply of ^{18}O-depleted water overrides evaporative enrichment effects, resulting in low $\delta^{18}O$ of latewood. These results suggest that $\delta^{18}O$ proxies for tropical storm occurrence need to account for soil conditions at the site of tree growth.