



## Hydroclimate variability in southwestern Japan over the last 1500 years reconstructed from oxygen isotope ratios in tree rings

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Recent progress in isotope dendroclimatology indicates that tree-ring  $\delta^{18}\text{O}$  is a promising proxy to precisely reconstruct hydroclimate variability in monsoon Asia. Here we present a 1500-year-long tree-ring  $\delta^{18}\text{O}$  chronology constructed using living and fallen dead trees (*Cryptomeria japonica*) that were collected in Yakushima Island, southwestern Japan. Core or disc samples were cross-dated by visually matching ring-width patterns. Then, a total of 14 trees were selected for isotopic analysis. We employed the ‘plate method’ to extract cellulose directly from a 1.0-mm thick wood plate, in order to facilitate the processing of hundreds of rings simultaneously. Each annual ring of cellulose was separated using a razor blade, and its  $\delta^{18}\text{O}$  value was determined using a continuous flow isotope ratio mass spectrometer coupled to an elemental analyzer. The resultant  $\delta^{18}\text{O}$  time series were highly correlated with one another ( $R_{\text{bar}}$ : 0.66), indicating that common signals related to regional climate are preserved in all the sampled trees. Since the  $\delta^{18}\text{O}$  series did not show prominent age-related trends, all the series were simply normalized to have the same mean for the overlapping segments. The resulting series were then averaged to build the final chronology. Response analysis with ambient meteorological records for the last 50 years indicates that tree-ring  $\delta^{18}\text{O}$  is mainly controlled by summer (May–September) relative humidity. We therefore interpret our record as a proxy of hydroclimate related to East Asian summer monsoon. Overall low-frequency variations in our chronology are similar to those of a Northern Hemisphere temperature reconstruction. Specifically our record shows a relatively dry (wet) condition during the Medieval Warm Period (the Little Ice Age). Centennial-scale fluctuations of sea surface temperatures in the equatorial Pacific may play a role in modulating long-term hydroclimate changes in southwestern Japan.