A 152-year summer precipitation record reconstructed from tree-ring oxygen isotopes from southern Korea

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Climate reconstructions using tree-ring width are limited in temperate and/or humid regions of Asia because ecological factors such as competition with neighboring trees significantly contribute to tree growth. On the other hand, tree-ring oxygen isotopes are known to be less influenced by ecological factors, but be mainly controlled by relative humidity and oxygen isotopes in source water. Recent advances in measurement technology of tree-ring oxygen isotopes lead to a number of hydroclimate reconstructions in monsoon Asia. Here we developed a 152-year tree-ring chronology from southern Korea to reconstruct hydroclimate variability in this region, and compared it with other tree-ring oxygen isotope chronologies developed in Japan.

In this study, we collected 5mm core samples from three species (*Abies koreana*, *Pinus koraiensis*, and *Taxus cuspidata*) in Mt. Jiri, southern Korea. Cross-dating was conducted using pattern-matching of ring-width variations among different cores. Then, four core samples for each species were selected for isotopic analysis. Cellulose was extracted from 1mm thick tree-ring laths using the standard chemical protocol. Each ring of the cellulose laths was manually separated using a blade under a microscope. Oxygen isotope ratio ($\delta^{18}O$) of each ring was then determined by an isotope ratio mass spectrometer connected to a pyrolysis-type elementary analyzer. The measurements were performed on tree rings over the last 152 (50) years for *Taxus cuspidata* (*Abies koreana* and *Pinus koraiensis*).

The tree-ring $\delta^{18}O$ series were highly correlated with one another within the same species. In addition, three mean chronologies derived by averaging four $\delta^{18}O$ series for each species were also strongly correlated with one another, indicating that tree-ring $\delta^{18}O$ was not dependent on tree species. Correlation analysis between tree-ring $\delta^{18}O$ and meteorological data indicated that tree-ring $\delta^{18}O$ was mainly governed by June–July precipitation. In addition, the tree-ring $\delta^{18}O$ showed significant correlations with summer precipitation over southwestern Japan, indicating that moisture source signals were preserved in the chronology. Comparison of our data with other tree-ring $\delta^{18}O$ chronologies from Japan indicated that the highest correlation was found in the Tateyama site, which is located at the same latitude of the Korean site. This result points out that the Meiyu-Baiu frontal activity plays a role in determining the spatial correlations.

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