

## Summer monsoon variability over the past 400 years in Tateyama, Japan, as reconstructed from tree-ring oxygen isotope data

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With its high sensitivity to hydroclimate variability, tree-ring oxygen isotope composition has been widely used for dendroclimatology over monsoon Asia in recent years. Here we built a 400-year tree-ring oxygen isotope chronology from Tateyama, Japan to reconstruct summer hydroclimate in the region, and compared it with other tree-ring data to explore spatio-temporal variations in hydroclimate. We collected tree-ring core samples from *Pinus parviflora* var. *pentaphylla* at an altitude of 1500 m above sea level in 2016 and 2017 in Tateyama, Japan. After cross-dating each ring of the sampled cores based on ring-width patterns, a total of 5 trees were selected for isotopic analysis. Cellulose was extracted directly from 1 mm thick plates using the standard methodology. Each annual ring was separated using a blade under microscope. Oxygen isotope ratio of each ring was then measured using an isotope ratio mass spectrometer. The resultant 5 tree-ring oxygen isotope series were highly correlated with each other, indicating that the oxygen isotope ratio was governed by common climatic factors. Climatic response analysis revealed that the oxygen isotope ratio was primarily controlled by relative humidity in the early summer season (April–June), with a highest correlation appearing in June. Therefore, the tree-ring chronology can be considered to be a proxy of hydroclimate related to Meiyu-Baiu variability. The oxygen isotope data in our chronology showed an overall positive correlation with those in a tree-ring oxygen isotope record from Yakushima island, southwestern Japan. However, the correlations often became lower or negative during the positive PDO phases, implying that the PDO played a role in modulating spatial patterns of hydroclimate in the early summer season over western Japan.

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