

# **Synoptic Dendroclimatology: A Process-Based Approach for Linking Tree-Ring Information to Atmospheric Circulation over the Pacific and Western North America**

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Katherine K. Hirschboeck, Fenbiao Ni,  
Michelle L. Wood, Connie A. Woodhouse

## **Abstract**

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Synoptic dendroclimatology uses dated tree rings to study and reconstruct climate from the viewpoint of the climate's weather components and their relationship to atmospheric circulation. This approach defines a connection between large-scale circulation and ring-width variation at local sites using correlation fields, composite maps, indexing, and other circulation-based methodologies. Correlation fields between ring widths at a site and gridded geopotential heights represent "circulation response patterns" (CRPs). Composite circulation maps of individual high or low growth "signature" years can be compared with CRPs. We constructed CRPs and circulation composite maps for two tree-ring localities in the western United States that have a sensitivity to winter climate: a chronology from central Oregon, and a regional average chronology from northern New Mexico. Results show that high and low tree growth at the two sites are associated with two totally different large-scale prior-winter circulation patterns. In Oregon, growth is enhanced by lower-than-normal 500-mb pressure heights over the Gulf of Alaska. The composite map for high-growth years depicts the same pattern, while the composite for low-growth years is an inverse of the CRP. The correlation and composite maps for northern New Mexico depict a circulation relationship that is completely different from the Oregon site. High growth is correlated with a belt of North Pacific Ocean lower-than-normal 500-mb heights that extends into the southwest. Low-growth years are dominated by a strong ridge over the lower southwest.