Title: Statistical methodologies for tree-ring research to understand the climate-growth relationships over time and space

By: E. Henry Lee, Peter A. Beedlow, Ron Waschmann, David Tingey, Charlotte Wickham

Abstract

The International Tree-Ring Database is a valuable resource for studying climate change and its effects on terrestrial ecosystems over time and space. We examine the statistical methods in current use in dendroclimatology and dendroecology to process the tree-ring data and make inferences of past climate and the spatiotemporal climate-growth relationships. The tree-ring time series are often used to reconstruct past climate from the year-to-year changes in annual ring-width and ring density. However, the climatic signal may be confounded with non-climatic signals such as disease or pest disturbances at unknown times in the past. We present a time series intervention analysis approach to extract the relevant signals in tree-ring data to either reconstruct the history of disturbance adjusting for the climatic signal or reconstruct past climate adjusting for disturbances. Signal extraction in tree-ring research is considered as a general structural time series problem with components for age-related and climate trends, climatic effects, and disturbances. We present a time series intervention analysis approach to solve this decomposition problem and present an example of the technique.