

Tree-ring latewood width based July–August SPEI reconstruction in South China since AD 1888 and its possible connection with ENSO

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Our understanding of the long-term hydroclimate variations in South China is prohibited by the shortness of meteorological records. Paleoclimatic proxies, such as tree-rings, can be pursued to extend the meteorological records back for centuries to help us better understand hydroclimatic conditions. In this study, we reconstructed the July–August Standardized Precipitation–Evapotranspiration Index ($\text{SPEI}_{\text{Jul–Aug}}$) based on a newly developed 127-year adjusted latewood width chronology from *Tsuga longibracteata*, South China. In specific, the latewood width chronology was regressed on the earlywood width chronology using a simple linear regression, and the residuals plus a constant 1.0 were defined as the adjusted latewood width chronology. The chronology explained 40% of the actual $\text{SPEI}_{\text{Jul–Aug}}$ variance in the period 1953–2014. The reconstructed $\text{SPEI}_{\text{Jul–Aug}}$ can represent large-scale July–August SPEI variations over South China, including northern Guangxi, Hunan, and Guizhou provinces. From the perspective of the past 127 years, the extreme summer drought in 2013 was not unusual because more extreme drought events occurred in the first half of the 20th century. A significant 2.0–3.6-year hydroclimatic cycle existed in the reconstruction, which indicated that the $\text{SPEI}_{\text{Jul–Aug}}$ might be driven by El Niño–Southern Oscillation (ENSO). We further checked the time-dependency of the relationship between $\text{SPEI}_{\text{Jul–Aug}}$ and ENSO and found that it was unstable. Their relationship was weak before the 1950s, became significant from the 1950s to early 1990s, and then dropped to be weak again and even out of phase since the early 1990s, which may be attributable to the significant westward extension of the western Pacific subtropical high. This study indicates that summer hydroclimate in South China can be reconstructed based on adjusted latewood width, and will be better understood when more and longer adjusted latewood width chronologies are obtained in the near future.