



Mid 19th century divergence between tree-ring proxy and instrumental target data at hemispheric scales

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The development of new millennial-length chronologies enables a continuous improvement of large-scale temperature reconstructions inferred from tree-rings. Reliable reconstructions require highly synchronized proxy and instrumental time-series during their overlapping period. Here we use a recently developed network of 53 tree-ring chronologies from the Northern Hemisphere together with state-of-the-art global gridded temperature datasets (CRU TS3.2, HadCRUT4) to test the coherence between early, 19th century instrumental and proxy data. Tree-ring calibration reveals synchronous trends in the 20th century but systematically cooler reconstructed temperatures pre-1880 compared to instrumental summer temperatures. This early divergence phenomenon could be explained by several biological or statistical hypotheses. However, solely positive residuals between summer and winter temperature anomalies during this early instrumental period indicate systematic overestimation of summer warmth in 19th century observational data. Our findings suggest direct insolation effects biased the early instrumental temperatures at large, hemispheric scales. Despite multiple homogenization efforts, state-of-the-art global gridded datasets seem to still systematically overestimated 19th century summer temperatures.