Scientists Establish China's Longest Tree-ring Chronology

The sequence of tree-ring chronologies from *Sabina przewalskii Kom*, recording climate change information over the past 4,600 years in the northeast of the Qinghai-Tibetan Plateau, has been recently revealed by scientists from China and the United Kingdom.

Prof. YANG Bao from the Cold and Arid Regions Environmental and Engineering Research Institute and his collaborators from the UK have obtained the sequence by using the improved Regional Curve Standardization method (Fig. 1).

Tree-ring is an approach to analyze historical climate changes and reveal the interaction between human activities

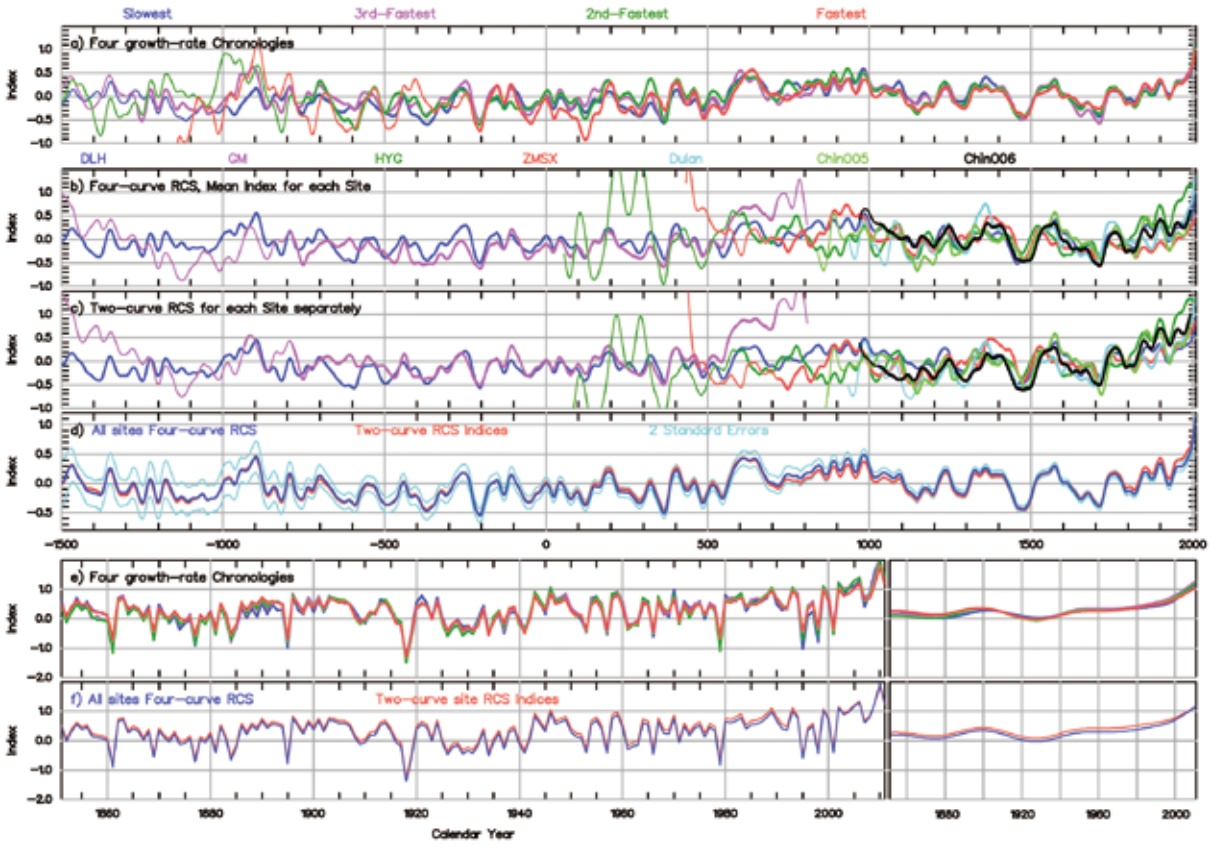

Fig. 1. Consistency between subsets of tree-ring data. Chronologies formed by averaging tree indices (i.e. standardised tree-ring width) across different subsets of trees and using different SF RCS standardisation approaches. (A) Four growth-rate chronologies (an equal number of trees are assigned to each set, grouped according to their mean growth rate) each standardised with a separate SF RCS curve. (B) Seven site chronologies, each the average of indices obtained using the four overall growth-rate SF RCS curves. (C) Seven site chronologies, where each site dataset was standardised using two growth-rate SF RCS curves. (D) Overall QLS chronologies formed from either the four growth-rate chronologies (blue; with ±2 chronology standard errors in light blue) or the seven site chronologies (red). All chronologies are smoothed with a 50-year spline (end values are more uncertain) and sections comprising less than 6 trees are shown as thinner lines. Chronology values after 1850 are repeated with (right panels) and without (left panels) smoothing in (E) for the four growth-rate chronologies and (F) for the two overall QLS chronologies.

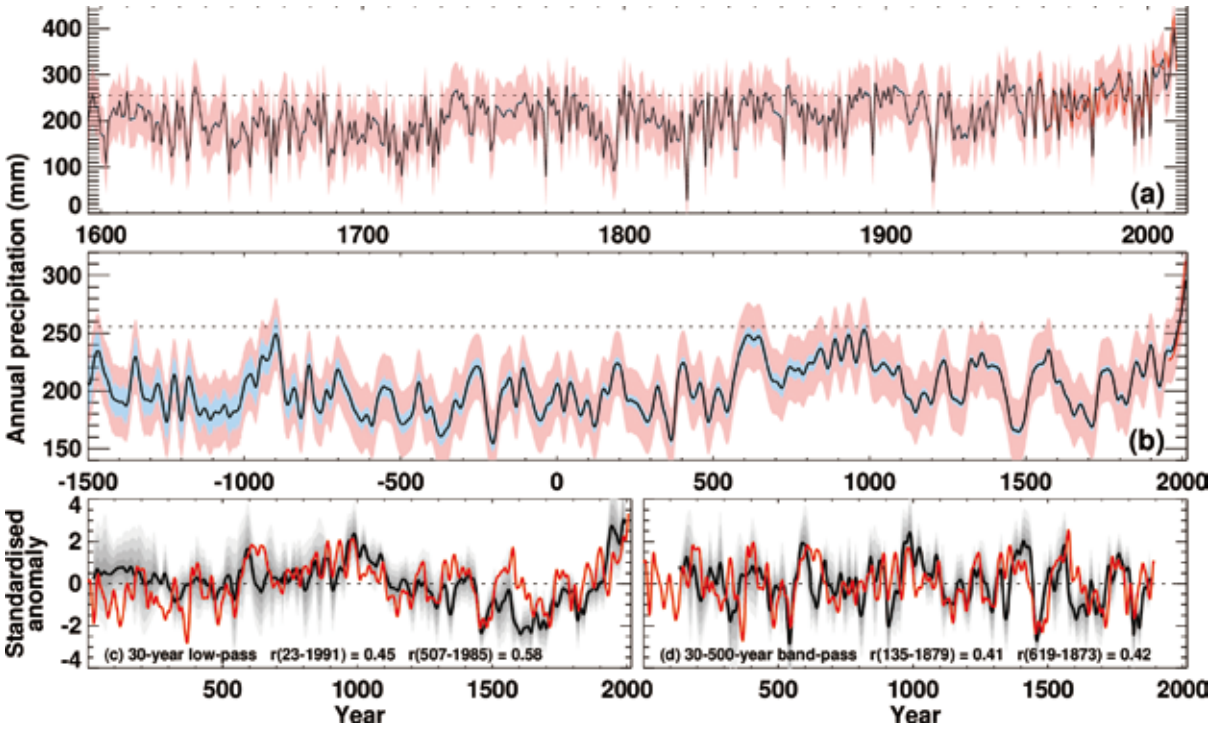

Fig. 2. Reconstructed annual precipitation for the north-eastern Tibetan Plateau and comparison with a composite NH temperature reconstruction. (A) Estimates of annual precipitation from the calibrated QLS chronology, showing yearly values since 1595, together with the total uncertainty (pale red) and the part of the uncertainty arising from chronology uncertainty (pale blue), and the observed regional precipitation since 1957 (red). The horizontal dotted line indicates the mean precipitation over the calibration period (1957–2011). Note that the calibration residuals show that the estimated values somewhat exaggerate the dryness in some dry years (e.g. 1978 and 1998) and this should be borne in mind when interpreting extremely dry years in the reconstruction. (B) As (A), except the data are shown for the period since –1500 with 50-year smoothing. (C) Comparison of the precipitation reconstruction (red) with a composite of NH temperature reconstructions (black line: composite mean; four levels of grey shading: composite mean ± 0.5, 1.0, 1.5, 2.0 composite SDs). All series have been normalised to have zero mean and unit SD over the common overlap period and smoothed with a 30-year low-pass Gaussian-weighted filter, truncated 7 values from each end to reduce the influence of filter end effects. Correlations between the precipitation and composite-mean temperature reconstructions are indicated on the panel for the full overlap period and the shorter period when at least 6 NH temperature reconstructions are available. (D) As (C), except that all series have been band-pass filtered to retain variance on timescales between 30 and 500 years, and the truncation is extended to 119 values from each end because the end effects of a 500-year filter are much greater.

and natural factors. Tree-ring records provide evidence in near-tree-line regions at high-elevation or high-latitude sites, as well as the changes in moisture and precipitation in typical arid to semi-arid regions.

Prof. YANG's group established a sequence of chronology covering the time period of 2637 BC to 2011 AD. Their research indicated that the last 10, 25 and 50-year periods appear to be the most humid periods of the northeast Qinghai-Tibetan Plateau during the past 3,500 years, while the obvious arid stages occurred in the 4th century BCE and the latter half of the 15th century (Fig.2).

They also found a significant correlation between their research results and the millennium temperature sequence of the Northern Hemisphere. "If the temperature of the Northern Hemisphere continues to rise, this region might receive more abundant rainfall," Prof. YANG said.

Meanwhile, the method used in this study is different from the traditional standardized method. "We used the grouping and detrending method in different growth rates", Prof. YANG explained. "This method can objectively retain the low frequency climate signal, which is recorded by the tree ring. It has great potential to be applied in dendroclimatology."

Their research has appeared in a recent issue of the *Proceedings of the National Academy of Sciences*.