Geophysical Research Abstracts
Vol. 18, EGU2016-1478, 2016
EGU General Assembly 2016

Climate variability of Late Pleistocene deglaciation in the North American midcontinent derived from tree rings

Irina P. Panyushkina (1), Valerie N. Livina (2), Steve W. Leavitt (1), and William N. Mode (3)

(1) Laboratory of Tree-Ring Research, University of Arizona, USA (ipanyush@email.arizona.edu, sleavitt@ltrr.arizona.edu), (2) National Physical Laboratory, Teddington, UK (valerie.livina@npl.co.uk), (3) Department of Geology, University of Wisconsin-Oshkosh, USA (mode@uwosh.edu)

High-resolution climatic proxies, such as tree rings spanning millennia, have excellent potential to describe high- and low-frequency variability of climate. In practice, however, although the number of Holocene millennium-length tree-ring records is still rather limited, they are especially rare for the Late Pleistocene warming period following the Last Glacial Maximum. Furthermore, detection of climatic variability in tree-ring data is hindered due to intricate methodology of chronology development that transforms changes in tree geometry and a variety of environmental responses of tree growth to a climatic signal.

Following meticulous derivation of a new tree-ring chronology, we propose a novel approach to analyze annual, decadal, multi-decadal and centennial climate-related variability of floating tree rings dated back near the end of the Pleistocene.

We have developed a 1400-year tree-ring width chronology of spruce from the Green Bay area (Wisconsin) dated from 14.5 ka to 13.1ka cal BP. This new North American midcontinent record is composed of 10 overlapped site chronologies and has two short gaps filled with linear interpolation. The Green Bay chronology covers most of the warm and moist Bølling-Allerød interstadial (14.7 ka -12.7 ka BP). Within the Bølling-Allerød interstadial, there were several abrupt and brief cooling excursions such as the Older Dryas with full-glacial-like temperature conditions. We have applied tipping point analysis to detect the changes of climate-system states during these turbulent times and obtained early warning signals in the tree-ring variance.

The analysis detected four short-term bifurcations dated ca. 14,450 cal BP, 14,000 cal BP, 13,750-13,600 cal BP and 13,180-13,100 cal BP. The bifurcation events of the tree-ring record correspond well to the abrupt and short cooling temperature excursions of the Bølling-Allerød interstadial documented in $\delta^{18}O$ and Ca of GRIP ice-core records, and the Laurentide ice sheet dynamics (Green Bay ice lobe re-advance). We discuss how the detected bifurcation events in tree-ring data track a reversing temperature regime from warming to cooling as reported at regional (North American midcontinent) and northern hemispheric scales.

The study contributes greatly to exploring the potential of Late Glacial tree rings to unveil the dynamics of regional to hemispheric temperatures of the Bølling-Allerød interstadial.

References: [1] Panyushkina & Leavitt, CJFR 2013; [2] Livina & Lenton, GRL 2007; [3] Livina et al, Climate of the Past 2010; [4] Livina et al, Physica A 2013.