Geological Society of America, Denver, Colorado, USA, October 9–12, 2022

Determination of past and present seasonal temperature in Arctic Siberia using high-resolution intra-ring oxygen isotope measurements across tree rings

Danielle R. Noto[1], Brian A. Schubert[1], Bárbara Almeida[1], William E. Lukens[2], A. Hope Jahren[3], Sergei P. Davydov[4]

[1]*School of Geosciences, University of Louisiana at Lafayette, USA*
[2]*Department of Geology and Environmental Science, James Madison University, USA*
[3]*Centre for Earth Evolution and Dynamics, University of Oslo, Norway*
[4]*Pacific Geographical Institute, Far East Branch of Russian Academy of Sciences, North-East Science Station, Cherskiy, Russia*

Siberia experiences some of the greatest swings in temperature from summer to winter of anywhere on the planet, with differences between warm and cold month mean temperatures exceeding 50 °C. Mean annual temperatures in northern regions of Siberia are warming at ~2x the global average, a phenomenon known as "Arctic amplification." Temperature seasonality, however, is of greater importance to this region for assessing changes to ecosystems, hydrology, and carbon cycling, yet few proxies are able to resolve temperature seasonality at annual resolution. Our previous work produced a model for quantifying long-term, mean-seasonal temperature using high-resolution intra-annual oxygen isotope measurements across annual tree rings. Here we present 109 new oxygen isotope measurements made on cellulose chemically extracted from annual rings of *Pinus pumila* growing in Cherskiy, Sakha Republic, Russia to test this model's ability to resolve year-to-year changes in seasonal temperature at a highly seasonal Arctic site. We find good agreement ($r = 0.7$) between modeled and measured seasonal temperatures, confirming intra-ring oxygen isotope measurements as a powerful tool for quantifying seasonal temperature variability within past Arctic environments. Application of this method to Miocene-age fossil wood from this site revealed temperature seasonality half as large and ~120 additional days with mean daily temperatures > 0 ^{o}C during the late Miocene compared with the present day. We will discuss likely drivers, as well as implications, of this change including: longer growing seasons, irregular rainfall patterns, and enhanced permafrost thaw in response to rising atmospheric CO_2 and diminishing sea ice coverage.