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**Determination of Past and Present Seasonal Temperatures in Arctic Siberia Using High-Resolution Intra-Ring Oxygen Isotopic Measurements across Annual Tree Rings**

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Siberian ecosystems experience some of the greatest differences between summer and winter temperatures of anywhere on the planet (~50 °C). Previous work has shown that rising CO<sub>2</sub> levels are causing average temperatures in this region to warm at a rate that is nearly four times the global average, a phenomenon known as “Arctic amplification,” however, data at the seasonal scale are lacking. Here, we present 265 oxygen isotope measurements on two Siberian pines growing in far northeastern Siberia to test a model for determining past summer and winter temperatures in this Arctic environment. We find the calculated summer and winter temperatures correlated strongly with temperatures measured at a nearby weather station, indicating that oxygen isotope values of cellulose can be used as a tool to determine past Arctic temperature seasonality. Application of this work to fossil wood from a past warm interval of Earth history revealed warmer winters, lower temperature seasonality, and longer growing seasons under elevated levels of CO<sub>2</sub>. Together, these results demonstrate the ability for oxygen isotope values of tree rings to be used to determine past summer and winter temperatures within remote Arctic regions and improve our understanding of the effects of CO<sub>2</sub> levels on temperature seasonality.