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New tree-ring chronologies from northeastern USA reveal decadal climate variability in the North Atlantic during the Last Glacial Maximum

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High-resolution records of climate variability during the Last Glacial Maximum (LGM) are necessary to understand the structure of the climate system. Here we report a 414-year annual tree-ring chronology derived from 32 Picea spp. logs preserved in spruce forests overrun by the Laurentide Ice Sheet in southern Ohio, USA, and spanning ice rafting Heinrich Event 2 (HE2). The placement of our tree-ring chronology is supported by matching the spruce 14C sequence to ice-core 10Be records from Greenland via the common cosmogenic production signal, which indicates a position of the tree-ring sequence on the ice core timescale at ∼23,560 GICC05 years b2k. Spectral analysis on ring-width series reveals significant power at 3 to 6 years, 14 to 16 years, and 25-50 years; the most significant of which is a ∼15-year oscillation. In particular, this decadal mode of variability closely matches periodicities typical of modern high-latitude North Atlantic climate manifested in the poleward propagation of ocean heat anomalies and its associated atmospheric response. Evidence of the characteristic 15-year timescale of climate variability during HE2 is further confirmed by a number of LGM climate model simulations. These findings lend support to the idea that a decadal-scale mode of oceanic variability may be a persistent feature of the North Atlantic system regardless of the background climate state and the impact of freshwater forcing on thermohaline circulation.