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A 2'500-year long temperature-sensitive tree-ring record in far north-eastern Eurasia

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We have developed a more than 2,500-year long temperature-sensitive tree-ring record in far north-eastern Eurasia, at the center of the largest longitudinal sector of the Arctic lacking such a record. This record is based on material from a network of sites in the Indigurka coastal region, and is well replicated through almost all of its length. During the course of collecting material for this chronology, the oldest known tree in the Russian Federation was found (1104 years). A number of the trees we used have more than 700 rings, improving the chances of capturing multi-decadal to century-scale variability. The widths of annual rings of larch trees from this region contain a remarkably clear and strong summer temperature signal. 66% of the variance of early summer (6/6 through 7/17) temperature is accounted for by the tree-ring width index series, 60% in cross-validation. The record is characterized by variability on several time scales, including a twentieth century that is significantly warmer than any other period of similar length, a clear indication of the effect of large explosive volcanic eruptions on summer conditions in the Arctic, and a sharp cooling after 1976. While many of the 20 coolest early summers in the reconstruction since AD 1400 occur within a few years after major explosive eruptions from low-latitude volcanoes, several of the 20 warmest early summers followed major explosive eruptions from high-latitude volcanoes. We found no evidence to support the suggestion that these reconstructed warm summers represented a rebound in tree growth from volcano-induced cold conditions. Useful information on the climate effects of volcanic eruptions may not be limited to years with unusually cool summers, but may also be extracted from reconstructed unusually warm summers. One of the most notable features of the record is a series of very small or missing rings implying a period of several very cold summers commencing in AD 536. This is also seen approximately 2000 km to the West on the Taimyr Peninsula (Nuarzbaev and Vaganov 1999). It also coincides with a number of other meteorological events, sometimes collectively called 'the A.D. 536 dust veil event' (Baillie 1994). In the case of our material, growth was so disrupted that several of the trees sampled lack clear ring structure for several years. Our results confirm that this was a very unusual event whose human consequences would be severe were it to recur in modern conditions. It is, therefore, worthy of further study.

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regional network, regional chronology, temperature, temperature anomalies, Indigurka, Russia

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