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Author(s):

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Tree-ring radiocarbon reveals reduced solar activity during Younger Dryas cooling

Adam Sookdeo^{1,2}, Bernd Kromer³, Florian Adolphi^{4,5}, Jürg Beer⁶, Nicolas Brehm², Ulf Büntgen^{7,8,9}, Marcus Christl², Timothy Eglinton¹⁰, Micheal Friedrich^{3,11}, Giulia Guidobaldi², Gerd Helle¹², Raimund Muscheler⁵, Daniel Nievergelt⁸, Maren Pauly¹³, Frederick Reinig^{8,14}, Willy Tegel¹⁵, Kerstin Treydte⁸, Chris Turney^{2,16}, Hans-Arno Synal², and Lukas Wacker²

¹UNSW, Analytical Chemistry, Chronos 14Carbon-Cycle Facility, Sydney, Australia (a.sookdeo@unsw.edu.au)

²ETH-Zürich, Laboratory of Ion Beam Physics, Zürich, Switzerland

³Heidelberg University, Institute of Environmental Physics, Heidelberg, Germany

⁴University of Bern, Climate and Environmental Physics & Oeschger Center for Climate Change Research, Bern, Switzerland

⁵Lund University, Department of Geology-Quaternary Sciences, Lund, Sweden

⁶Swiss Federal Institute of Aquatic Science and Technology EAWAG, Zürich, Switzerland

⁷Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

⁸University of Cambridge, Department of Geography, Cambridge, UK

⁹University Brno, Global Change Research Institute CAS and Masaryk, Brno, Czech Republic

¹⁰ETH-Zurich, Carbon Cycle Biogeoscience, Zürich, Switzerland

¹¹Hohenheim University, Institute of Botany, Stuttgart, Germany

¹²GFZ German Research Centre for Geosciences, Potsdam, Germany

¹³Bath Spa University, School of Science, Bath, UK

¹⁴University Mainz, Department of Geography, Johannes Gutenberg, Germany

¹⁵Albert-Ludwigs University of Freiburg, Freiburg, Germany

¹⁶Palaeontology, Geobiology and Earth Archives Research Centre (PANGAEA), University of New South Wales, Sydney, Australia

The Younger Dryas stadial (YD) was a return to glacial-like conditions in the North Atlantic region that interrupted deglacial warming around 12900 cal BP (before 1950 AD). Terrestrial and marine records suggest this event was initiated by the interruption of deep-water formation arising from North American freshwater runoff, but the causes of the millennia-long duration remain unclear. To investigate the solar activity, a possible YD driver, we exploit the cosmic production signals of tree-ring radiocarbon (^{14}C) and ice-core beryllium-10 (^{10}Be). Here we present the highest temporally resolved dataset of ^{14}C measurements ($n = 1558$) derived from European tree rings that have been accurately extended back to 14226 cal BP (± 8 , 2σ), allowing precise alignment of ice-core records across this period. We identify a substantial increase in ^{14}C and ^{10}Be production starting at 12780 cal BP is comparable in magnitude to the historic Little Ice Age, being a clear sign of grand solar minima. We hypothesize the timing of the grand solar minima provides a significant amplifying factor leading to the harsh sustained glacial-like conditions seen in the YD.