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A global perspective on Glacial- to Interglacial variability change

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Changes in climate variability are more important for society than changes in the mean state alone. While we will be facing a large-scale shift of the mean climate in the future, its implications for climate variability are not well constrained. Here we quantify changes in temperature variability as climate shifted from the Last Glacial cold to the Holocene warm period. Greenland ice core oxygen isotope records provide evidence of this climatic shift, and are used as reference datasets in many palaeoclimate studies worldwide. A striking feature in these records is pronounced millennial variability in the Glacial, and a distinct reduction in variance in the Holocene.

We present quantitative estimates of the change in variability on 500- to 1500-year timescales based on a global compilation of high-resolution proxy records for temperature which span both the Glacial and the Holocene. The estimates are derived based on power spectral analysis, and corrected using estimates of the proxy signal-to-noise ratios.

We show that, on a global scale, variability at the Glacial maximum is five times higher than during the Holocene, with a possible range of ∼3-10 times. The spatial pattern of the variability change is latitude-dependent. While the tropics show no changes in variability, mid-latitude changes are higher. A slight overall reduction in variability in the centennial to millennial range is found in Antarctica. The variability decrease in the Greenland ice core oxygen isotope records is larger than in any other proxy dataset. These results therefore contradict the view of a globally quiescent Holocene following the instable Glacial, and imply that, in terms of centennial to millennial temperature variability, the two states may be more similar than previously thought.