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Shifts in Greenland interannual variability lead Dansgaard-Oeschger abrupt warming by hundreds of years

Content

Records of δD and δ18O from EGRIP (East Greenland Ice Core Project), acquired in 2019 to ~50 ka bp, are the first ultra-high resolution (1 mm sampling) ice core isotope records to be collected from Northeastern Greenland. These records allow first order paleo-temperature to be inferred on interannual to millennial scales and, in turn, facilitate analyses of climate variability on similar time scales. Using spectral analysis, we analyze how the strength of variability in the 7-15 year band changes through time. On average, the last glacial period (LGP) is twice as variable as the Holocene and within the context of the LGP, cold stadial periods consistently exhibit greater variability than warm interstadial periods. We also find that reductions in the amplitude of the 7-15 year band lead abrupt warming associated with Dansgaard-Oeschger Events by hundreds of years. This is a surprising result, as prior research has shown annual-to-decadal offsets between different climate variables in Greenland ice cores, such as temperature, source conditions, and dust. We present conceptual ideas about what may cause this centennial-scale phase offset, focusing on a hypothesis of sea ice variability in the Norwegian Sea as recorded in ocean sediment cores. We then provide results from the second-order parameter deuterium excess to determine if additional information about interannual-to-decadal scale variability can be extracted. Initial results suggest deuterium excess is even more sensitive to the physical processes affecting the water isotopes, and in particular, we see evidence for substantial millennial-scale variability that persisted from 23 -15 thousand years before present when no Dansgaard-Oeschger Events occur.

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