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Bipolar impact and phasing of Heinrich-type variability

Content

During the last ice age, the Laurentide ice sheet underwent periods of extreme iceberg discharge into the North Atlantic. These so-called Heinrich Events are associated with far-reaching climate impacts, like disruptions to tropical hydrology and monsoon systems. They occurred during Heinrich Stadials, cold periods with weakened Atlantic overturning circulation. Despite their global prominence, Heinrich events are not associated with changes in the well-known Greenland temperature proxies from ice cores, nor are Heinrich stadials meaningfully distinguished from DO stadials. This apparent lack of a Greenland signal complicates efforts to assess their regional climate impact and phasing against Antarctic climate c hange. Here we use high-resolution Greenland records of methane and nitrogen isotopic composition, a sensitive temperature proxy, to characterize the impact of Heinrich-type variability on Greenland climate and its bipolar phasing with Antarctic climate. New GISP2 CH4 and d15N-N2 data covers the period from 10-50ka with a median age resolution of 30 years. Our results confirm that Heinrich Events 1-5 show no detectable abrupt Greenland temperature signal, despite strong impacts in the far-field. We also show accelerated warming in Antarctic ice cores at the times of Heinrich Events, indicative of an atmospheric teleconnection. In contrast to Heinrich Events, the onset of some Heinrich Stadials coincide with cooling trends - most notably an abrupt ~3C cooling at the onset of Heinrich stadial 1 (18 kaBP) that leads Antarctic warming by ~300 years, suggesting propagation via an oceanic teleconnection. This confirms that the bipolar seesaw is functioning during the deglaciation. These results motivate further investigation into the mechanisms by which Greenland remains unperturbed by these events, and motivates the recognition of Heinrich Stadials as unique climatic periods in Greenland ice core stratigraphy.

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