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Modeling absolute temperature during the last glaciation to constrain the magnitude of abrupt climate shifts

Content

Water isotopes serve as a useful proxy for past climate conditions at ice core sites and their respective moisture sources. Here we present the application of a novel numerical model to reconstruct absolute surface temperature, condensation temperature, and source-region evaporation temperature for all publicly accessible Greenland ice core records that yield the necessary data. We apply this analysis to the last glacial period, which was punctuated by a series of rapid climate oscillations–records of which are particularly well-defined in Greenland ice cores. We pair this analysis with investigation into the influence of seawater isotope ratios on the Greenland ice core isotope record. A latitudinal gradient of water isotope ratios naturally exists within surface ocean water that is broadly characterized by decreasing δ18O and δD toward the poles. We model the influence of this spatial gradient in δ18O and δD on the final water isotope signature of Greenland precipitation. This gradient has the possibility of amplifying the isotopic signature of shifts in moisture sources, which implicates investigation into the degree of climatic variability during the last glaciation. This combined modeling approach allows us to more accurately constrain the magnitude of the abrupt climatic shifts that marked the last ice age.

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