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Holocene paleotemperature signals based on polar firn water isotope diffusion studies from two Greenland ice cores.

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Polar ice cores provide a wealth of paleoclimatic information that is characterised by high temporal resolution and continuity, with water isotopic ratios of polar precipitation $\left(\delta^{18}\mathrm{O}, \delta\mathrm{D}\right)$ being one of the most prominent proxies for past temperatures. In particular, ice cores from Greenland, record the series of abrupt stadial - interstadial transitions during the last Glacial, pinpointing in time, abrupt temperature transitions adjoined by similar accumulation trends. While the signal to noise ratio of the isotopic signal clearly allows the observation of sizable climate changes during the Glacial, the situation differs considerably when one looks into the Holocene. With the exception of the 8.2ky event, the signal to noise ratio of $\delta^{18}\mathrm{O}$ over the Holocene is extremely low, suggesting negligible temperature changes during this period. This is contrary to signals obtained by other proxies from marine and terrestrial records from high latitudes.

In this study we bypass the discussion that deals with the various processes that can negatively affect paleotemperature reconstructions based on the $\delta^{18}\mathrm{O}$ proxy from ice cores. Based on two ultra-high resolution and high precision isotopic records covering the last 20,000 years from the NorthGRIP and NEEM ice cores we make use of the available spectral information to infer polar firn paleotemperatures using a coupled densification - firn water isotope diffusion model. The processes involved in the densification of firn and the diffusion of water isotopes that takes place after deposition and until the pore close-off are temperature-dependent and do not present the limitations of the normal $\delta^{18}\mathrm{O}$ thermometer. We show here how this approach reveals significant temperature changes over the Holocene. We compare the signals of the two records and pay particular attention to the indications of a mid-Holocene climatic shift towards colder temperatures that is apparent in both temperature reconstructions.