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Seasonality of bottom water temperature in the northern North Sea reconstructed from the oxygen isotope composition of the bivalve Arctica islandica

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The seasonality of temperature changes is an important characteristic of climate. However, observational data for the ocean are only available for the last 150 year from a limited number of locations. Prior to 18th century information is only available from proxy reconstructions. The vast majority of such reconstructions depend on land-based archives, primarily from dendrochronology. Established marine proxy records for the ocean, especially at high latitudes, are both sparsely distributed and poorly resolved in time. Therefore, the identification and development of proxies for studying key ocean processes at sub-annual resolution that can extend the marine instrumental record is a clear priority in marine climate science.
In this study, we have developed a record of early Holocene seasonal variability of bottom water temperature from the Viking Bank in the northern most North Sea. This area is of a particular interest since the hydrography is controlled by the inflow of Atlantic water. The reconstruction is based on the oxygen isotope composition of the growth increments in two sub-fossil shells of Arctica islandica (Bivalvia), dated to 9600-9335 cal. yr BP. By combining radiocarbon dating and sclerochronological techniques a floating chronology spanning over 200 years was constructed. Using the chronology as an age model, oxygen isotope measurements from 2 shells were combined into a 22-years long record. The results from this oxygen isotope record are compared with stable oxygen isotope profiles from modern shells to estimate changes in the mean state and seasonality between present and early Holocene. Shell-derived oxygen isotope values together with ice-volume corrected oxygen isotope values for the seawater were used to calculate bottom-water temperatures on a sub-annual time-scale. Preliminary results of the reconstructed early Holocene bottom water temperature indicate higher seasonality and lower minimum temperature compared to the present.