



High resolution paleotemperatures for the last 2000 years from the northern Norwegian continental margin

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Four marine sediment records have been investigated for stable oxygen isotopes measured on benthic foraminifera. Three of the records are from fjords in North Norway, including Malangen, Vestfjorden and Sagfjorden. One record is from the open oceanic shelf, Andfjorden. Today, all these sites are heavily influenced by the inflow of warm Atlantic Water by the Norwegian Current; which is an important heat conveyor to the Nordic Seas and Arctic Ocean. The records are dated by ^{210}Pb and ^{14}C indicating annual to biannual stratigraphic resolution during the last 100 years, decreasing to decadal and multi-decadal resolution further back in time.

The benthic oxygen isotopic records have been converted to bottom water temperature by: 1) Using the Shackleton paleotemperature equation; 2) Using a fixed (measured) $\delta^{18}\text{O}_{\text{water}}$ for each location, implying a constant salinity and no major changes in the water mass sources, and 3) Assuming no species related isotopic disequilibrium effects.

The reconstructed temperatures show a good correlation for the last 20-100 years with instrumental temperature records at or nearby the core sites reflecting the temperature variations in the Norwegian Current. This supports the oxygen isotope records as good indicators of temperature changes in the Norwegian Current, and can be used to extend the instrumental records back in time.

The two longest records (Andfjorden and Malangen) show a long-term cooling trend of c. 1 °C from 0 AD, culminating during the Little Ice Age (ca. 1750-1900 AD). A subsequent warming over the last 200-300 years of >1 °C appears to start at different times in the investigated records, but a major rise in temperatures begins in the late 19th or early 20th century in all records. The last two decades stand out as the warmest

ever during the last 2000 years. Superimposed on the long term trends are cooler or warmer periods of sub-decadal to multi-decadal duration. Examples are the enhanced coolings around 500 AD, 900 AD and at the beginning of the LIA ca. 1350 AD.