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Short-term Holocene climate variability in coastal mid-Norway - the terrestrial response to the North Atlantic climate

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Coastal areas are known to be susceptible to maritime climate variations, especially where prevailing wind directions provide humidity and latent heat to the land masses. Temperature reconstructions from the eastern North Atlantic, and from northern and western Norway show simultaneous changes on millennial to centennial scales during the Holocene. However also latitudinal climatic differences occur during the Holocene. These indicate a more complex system along the Norwegian coast with regional temperature variations depending on more than only North Atlantic's climate. Climate sensitive archives such as lake sediments in coastal mid-Norway provide the opportunity to study the influence of and the terrestrial response to climate variations mediated by the North Atlantic and allow the extension of our knowledge about regional peculiarities along the Norwegian coast.

Lake Blomstertjønna, a small lake outside Trondheim at 427 m a.s.l., enables a detailed study of climatic and environmental variations during the Holocene. The entire succession is 590 cm long and is composed of minerogenic sediments at the bottom and dominating biogenic sediments in the upper 495 cm. Radiocarbon dating of macrofossils aided by tephra identification reveal a lake history that started after deglaciation at about 12 kyr BP and shifted to a biogenic productive lake with overall uniform sedimentation rates at about 11 kyr BP. Biogeochemical proxies like total organic carbon and total sulphur and geophysical parameters show a weak, i.e. more even response to climatic variations in the gyttja-rich section and indicate that temperature was not a limiting factor for the lake productivity. In contrast, geochemical elemental ratios from XRF scanning reveal a pronounced long- and short-term variability of elemental composition. The long-term trend of selected elemental ratios reflects the general Holocene temperature evolution with higher values during the Holocene Thermal Maximum and a decreasing trend towards modern times. High-resolution elemental ratios fluctuate on centennial to decadal time scales and show a comparable pattern as in sea-surface temperature reconstructions from marine records off the Norwegian coast and are comparable with lake bioproductivity records from central Scandinavia. Comparison of selected elemental ratios with precipitation proxies from Greenland ice cores indicates that apart from catchment input also precipitation governed by the North Atlantic climate influenced to some extent the lake and its environment.

The results from Lake Blomstertjønna demonstrate the sensitivity of coastal lakes in mid-Norway to climatic variability mediated by the North Atlantic surface water temperature changes and extend the reliable linkage of marine and terrestrial records further inland to the Scandinavian mountains.