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Subpolar gyre and radiative forcings moderate sea surface temperatures of the Norwegian Sea during the mid-Piacenzian

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The mid-Piacenzian age (ca. 3.3-3.0 Ma) of the Pliocene epoch has been proposed as a possible reference for future warm climate states. We have developed a new set of orbital-resolution alkenone-based sea surface temperature (SST) and ice rafted debris (IRD) records from the Norwegian Sea. SSTs in the Norwegian Sea were 2-3°C warmer in the mid-Piacenzian compared to the Holocene average. There is notable orbital-scale SST variability with a range of 4°C. The most likely cause of the average long-term warmth is a higher atmospheric CO_2 concentration. A correlation of SST variability with the presence of Greenland-sourced IRD suggests a common climate forcing acting across the Nordic Seas region. The orbital-scale variability was in part caused by interplay of obliquity and precession, as low SSTs coincide with times of low northern summer insolation. Changes of the SST gradient between the Norwegian Sea and North Atlantic sites suggest that the subpolar gyre was at least of comparable strength as during the Holocene. The North Atlantic Current (NAC) influence on the Norwegian Sea SSTs does not appear to have been stronger than during the Holocene.