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Pliocene climate at high Northern latitudes: Comparing data and model results

Bjørg Risebrobakken (1), Zhang Zhongshi (1), Kerim Nisancioglu (1), Carin Andersson (1,2)

(1) Bjerknes Centre for Climate Research, Uni Research, Bergen, Norway (bjorg.risebrobakken@uni.no), (2) Department of Earth Science, UIB, Bergen, Norway

The Pliocene is the last time Earth's climate was in equilibrium with a greenhouse gas forcing similar to the present. Global sea level and temperature were significantly higher than today. The role of the Nordic Seas, connecting the North Atlantic and the Arctic, is important for determining the latitudinal temperature gradient and the role of Polar amplification during the Pliocene.

Preliminary results from a study of the Pliocene section of ODP Site 642B (Eastern Nordic Seas, 1286 m water depth) will be presented. The site is located underneath the present pathway of the Norwegian Atlantic Current towards the Arctic. Even though major changes are seen during the Pliocene, some general characteristics can be given. Planktic and benthic oxygen isotopes were higher than at present during most of the Pliocene, indicating colder and or saltier conditions. Presently, the bottom water at the site is almost as cold as it gets; therefore, bottom water salinity must have been significantly higher than at present during most of the Pliocene. The difference between benthic and planktic oxygen isotopes were generally lower than at present, indicating reduced stratification between subsurface and bottom water at the site. Benthic carbon isotopes indicate less ventilated bottom water than presently during Zanclean, and conditions comparable to the present during Piacenzian. Strong gas exchange with the atmosphere and/or high organic production are indicated for most of the Pliocene, based on planktic carbon isotopes. In general, the oceanographic conditions in the Norwegian Sea were distinctly different from the present. Supplementary information from other proxies will be added to detect the degree of stratification of the water column and the state of the Nordic Seas ocean circulation.

The proxy data from Site 642B will be compared with simulations of the Pliocene carried out with the MITgcm and NorESM (Norwegian Earth System Model) climate models. These simulations use the boundary conditions agreed on within PlioMIP (Pliocene Paleoclimate Modeling Intercomparison Project). Preliminary results from the simulations indicate weaker overturning than at present, and no indications of extreme warmth at high northern latitudes.