Geophysical Research Abstracts,
Vol. 11, EGU2009-10412-1, 2009
EGU General Assembly 2009

Climate effects related to melting and refreezing of ice in the south-western Barents Sea

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The Holocene section of the marine sediment core PSh-5159N, located in the Ingøydjupet depression in the south-western Barents Sea, has been studied at high resolution with a multi-proxy approach. Planktic and benthic isotopes, planktic and benthic foraminiferal counts, alkenone based records, X-ray diffraction (XRD) and grain size analysis has been used to study the Holocene climate development of the south-western Barents Sea. The main focus of the study is on two periods, one in the early Holocene (11-9.8 ka BP) and another in the late Holocene (2-1 ka BP), which shows conditions that distinguish them from what has been recorded through the rest of the Holocene. Based on the evidences from our multi-proxy records the following interpretations have been made: Intensified melting of ice and related strong fresh water influence is indicated initially for both periods. A strong stratification of the water column is established and probably maintained due to melting of ice during warm summers and refreezing during cold winters. The sea ice and fresh water layer shielded the ocean from the atmosphere, hampering the interaction between the two realms. Both the gas and the heat exchange with the atmosphere were reduced due to this shielding, and this resulted in strongly depleted carbon isotopes and increased bottom water temperatures. The Polar Front was shifted compared to the present day location. The establishment and maintenance of the climate regime proposed for the 11-9.8 ka BP and 2-1 ka BP intervals were probably related to the existence of a predominant high-pressure system over the Nordic Seas and the Arctic Ocean. The late Holocene interval has a more episodic character and a reduced amplitude of change compared to the early Holocene interval. These dissimilarities were probably due to changes in the boundary conditions due to different external forcing and background climate. The early Holocene period coincide with the northern Hemisphere summer insolation maximum while the late Holocene interval occur close to the Holocene minimum in summer insolation at high northern latitudes. Further, the early Holocene interval occurred at a time when the area probably still experienced an influence from the deglaciation while the late Holocene interval occurred when interglacial conditions were well established.