Late Holocene sea surface temperature reconstruction from the Conrad Rise, Southern Ocean

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Abstract

Future climate simulations predict that the Southern Westerly Winds (SWW) will be stronger and poleward, causing a corresponding southward shift of the Antarctic Circumpolar Current (ACC). These changes may influence Agulhas leakage (the amount of warm, saline water passing from the Indian Ocean to the Atlantic around the southern tip of Africa) and therefore the strength of the Atlantic Meridional Overturning Circulation. However understanding of the role of the Southern Ocean in the earth system is compromised by limited observational data from the Southern Ocean prior to the 1970's. Comparison of palaeoclimate reconstructions of the SWW with those reflecting ocean circulation can improve our understanding of the ocean-atmosphere interactions.

The OCTEL project (Ocean-sea-ice-atmosphere teleconnections between the Southern Ocean and North Atlantic during the Holocene) aims to investigate the ocean, atmosphere and sea-ice teleconnections for the Holocene using new, high resolution records from both the Southern Ocean and North Atlantic. We here present the results of a quantitative sea surface temperature (SST) reconstruction based on diatom analysis of a sediment core from the Southern Ocean, sampled from the Conrad Rise (54°16.04'S, 39°45.98'W). The record spans the last 3600 years with a resolution of approximately 50 years and shows temperatures were on average 4°C through most of this period. The most prominent feature of the record is a cold period at 1.5 to 1 ka yrs BP, during which the SST abruptly decreased to 2.5 °C before gradually recovering, and there were also shorter cold intervals at 3.1, 2.6 and 0.3 ka yrs BP. As the reconstruction is from a key location beneath the Polar Front and south of Africa it can be used to assess SWW-driven changes in the ACC and potentially the SWW influence on Agulhas leakage.

Keywords

Sea surface temperature, Holocene, Southern Ocean, Southern Westerly Winds