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Southern Ocean surface temperature and sea ice fields during the Last Interglacial

Oliver Esper and Rainer Gersonde

Alfred Wegener Institute for Polar and Marine Research, Marine Geology and Paleontology, Bremerhaven, Germany (oliver.esper@awi.de)

Diatom assemblages preserved in 16 sediment cores recovered in the eastern Indian, Atlantic and Pacific sectors of the Southern Ocean are used for the reconstruction of the variability of summer sea surface temperature (SSST) and sea ice concentration during the Last Interglacial (LIG) or Marine Isotope Stage 5 (MIS 5). The large coverage of the core sites allows for reconstructions on latitudinal and longitudinal transects across the Southern Ocean and thus for the comparison of the environmental signal evolution in different sedimentary basins of the Southern Ocean. Such information is crucial for the understanding of climate signal propagation in the Southern Ocean and on inter-hemispheric scale. The quantitative temperature and sea ice records are derived with newly established diatom-based transfer functions at millennial to centennial resolution. Stratigraphic age assignment relies on a combination of oxygen isotope stratigraphy, biostratigraphy, core-core correlation using physical, geochemical and microfossil abundance pattern together with a tuning of sediment core signals with climate records in Antarctic ice cores. All records display a rapid transition from glacial (MIS 6) to MIS 5 conditions to reach maximum temperatures in the latest MIS 6/MIS 5 transition (Termination II) and the early LIG attributed to MIS 5.5. The amplitude of the SSST change is up to 5°C, with generally smaller values in the Pacific sector. During this period Southern Ocean temperature may exceed modern surface temperatures by up to 3°C and the winter sea ice edge is located south of the modern ice edge. Higher resolution cores display short-term temperature rebounds during the Termination II warming. Such cold rebounds are not discerned in the ice core records. The Southern Ocean warming could be triggered by precessional changes influencing high latitude summer insolation and potentially be accelerated by feedback mechanisms such as the reduction of surface albedo (sea ice), CO_2 outgassing of the Southern Ocean and changes in meridional overturning circulation. The new set of data fills a gap in information in the global evolution of Earth climate during the Last Interglacial and will be useful for the testing of numerical modeling results of the last distinctly warmer and higher sea level than present climate period.