Geophysical Research Abstracts
Vol. 17, EGU2015-11941-2, 2015
EGU General Assembly 2015

Constraining the terrigenous sediment input in the Pacific sector of the Southern Ocean during the Quaternary: insights from grain size data

Marc Wengler (1), Frank Lamy (1), Rainer Gersonde (1), Gerhard Kuhn (1), Gisela Winckler (2), and Ralf Tiedemann (1)

(1) Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany, (2) Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, USA

Studying atmosphere-ocean interactions is crucial to understand process and feedback mechanisms in the Southern Ocean (SO) since these interactions are considered to play a key role in past atmospheric CO_2 variability. The Antarctic Circumpolar Current (ACC) is the world′s largest current system and its strength and expansion as well as other parameters (e.g upwelling of deep-water masses and the back-flow of intermediate waters to the tropics) are primarily controlled by the prevailing westerly wind belt and its atmospheric forcing in the high and mid latitudes.

Here, we present grain size data from three sediment cores located across the subantarctic Pacific Southern Ocean in order to reconstruct changes in the strength of the ACC and variations of atmospheric circulation patterns (westerly wind belt). The data illustrate a distinct glacial-interglacial pattern with finer grain sizes in the glacial periods and coarser grain sizes in the interglacial periods. The sortable silt fraction (10-63 μm) is a valuable tool to infer bottom current speeds since this fraction shows non-cohesive behaviour. The results of the sortable silt fraction indicate weaker bottom current speeds in the glacial periods compared to the interglacial periods. We interpret this observation as a combination of weakened westerly winds over the subantarctic ACC and extended sea-ice cover during glacial periods. Both, weaker westerly winds and extended sea-ice cover are expected to lower the effect of the westerly winds on the ACC and subsequently the strength of the bottom currents. We consider the clay and fine silt fraction (1-10 μm) as representative for atmospheric dust and observe the deposition of finer dust particles in glacial periods accompanied by higher lithogenic mass accumulation rates (corrected for sediment focussing) and dust percent rates exceeding the interglacial values. This might be a result of changed source area characteristics in Australia including expanded arid areas allowing for increased dust export to the SO. Finer dust grain sizes are consistent with weaker westerly winds in the subantarctic Southern Ocean as suggested by the finer mean sortable silt grain size indicating reduced glacial ACC strength.