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Temporally and spatially stable ε_{Nd} gradient in the Atlantic Ocean

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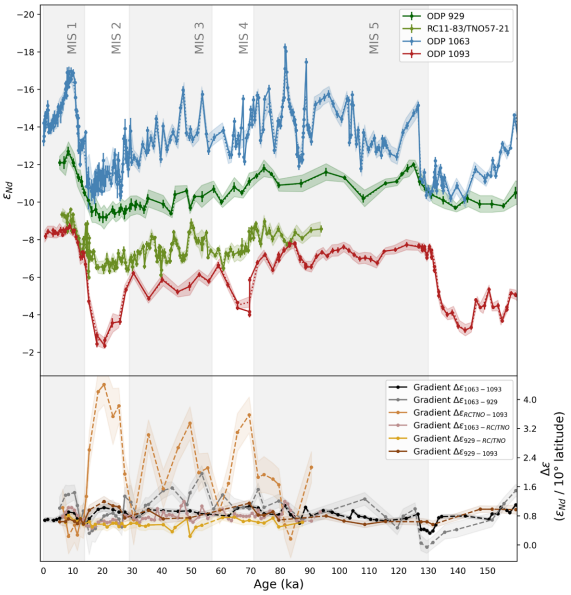
The deep Southern Ocean circulation is of major significance for the understanding of the ocean's impact on Earth's climate as uptake and release of CO_2 strongly depend on the redistribution of well and poorly ventilated water masses.

Here, we present new authigenic neodymium isotope data (ε_{Nd}) of the deep sea sediment at site ODP1093 in the Southern Atlantic near Bouvet Island in comparison with further existing ε_{Nd} records across the Atlantic Ocean. The ε_{Nd} values of ODP1093 have constantly the most radiogenic signature and show a strong glacial-interglacial oscillation by approximately 6 ε-units similar to ODP1063[1-4] from the Bermuda Rise. The ε_{Nd} records from site ODP929[5] in the Central Atlantic and RC11-83/TNO57-21[6,7] from the Cape Basin reflect a smoothed oscillation pattern in between.

The gradient Δε is defined as the North-South difference in ε_{Nd} per 10° latitude and is a measure for the sensitivity to changes in ε_{Nd} signature over a given distance. The two closest sites ODP1093 and RC11-83/TNO57-21, show a gradient variability between 0 and 4.1 ε-units/10° latitude that may reflect local gradients caused by depth and E-W differences. In contrast, all gradients between the other cores, are not only showing almost no variability over the past 150 ka but are independent of the considered locations. Thus, the mean gradient for the Atlantic Ocean is approximately 0.89 ε-units/10° latitude. Together with the ε_{Nd} record at ODP1093 as southern boundary the neodymium isotopic signature of the Atlantic Ocean at any given site up to ODP1063 becomes theoretically predictable. This suggests, that the changes in ocean circulation during glacial-interglacial transitions are not purely induced by the Northern Hemisphere currents but rather strongly influenced by equally strong changes of the Southern Ocean circulation. This reinforces the importance of the Southern Ocean in past and future climate changes.



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