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Long-term observation of particulate barium fluxes in the subtropical Northeast Atlantic (33˚N, 22˚W)

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Particle flux material was collected with a sediment trap in 2000 m depth of the deep-sea mooring Kiel 276. The mooring is located in the oligotrophic subtropical NE Atlantic (33˚N, 22˚W), which is influenced by the Azores Current and its associated front and lithogenic particle inputs via atmospheric transport pathways.

Total barium fluxes and biogenic barium (Ba_{bio}) fluxes between 2002 and 2008, calculated on the basis of Ba amounts measured with ICP-OES (inductively coupled plasma optical emission spectrometry), are demonstrated in this study. The behavior of (biogenic) barium in the deep-sea is of great interest because it is used as a proxy for surface ocean productivity. Nevertheless, formation and transport mechanisms of particulate Ba, especially barite, in the oceans are still under debate. Especially, long-term Ba flux studies demonstrating inter and intra annual variability are missing. To fill this gap we used time-series measurements of Ba fluxes observed at Kiel 276 to demonstrate the variability of particulate Ba formation and transport. Total Ba fluxes and Ba_{bio} fluxes at the mooring are characterized by flux pattern attributed to the behavior of the total particle flux. The particle flux is highly variable with peak fluxes up to 365 mg m^{-2} d^{-1} during winter and early spring just after highest primary production (winter bloom of coccolithophores) and maximum dust concentration in the atmosphere occurred.

The Ba_{bio}flux (up to 97 % of the total Ba flux) is influenced by productivity but also by the position of the Azores Front leading to a clear reduced Ba_{bio} flux from 2005 onwards related to changes in shape and size of the catchment area of the sediment trap and reduced productivity due to lower nutrient availability. We observed a close connection of Ba_{bio} flux and Ca flux results from incorporation of Ba in biogenic $CaCO_3$ and from the formation of aggregates including Ba-bearing particles like barite and biogenic $CaCO_3$. The transport of particulate Ba seems to be mainly driven by the formation of aggregates in the water column.