

Do desert dust input and oxygen minimum zones impact the distribution of dissolved molybdenum and uranium in the Atlantic Ocean?

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The distribution of trace metals in the ocean is influenced by various sources, including dust, and physicochemical conditions in the water column, specifically oxygen concentrations. Our study examined the impact of dust from the Sahara-Sahel and Namibian deserts on dissolved molybdenum (Mo) and uranium (U) in the North-East and South-East Atlantic Oceans. Both metals usually display conservative depth profiles in the oceanic water column though deviations have been reported in anoxic basins.

Data from the GEOTRACES cruise GA11 (NE-Atlantic) revealed slightly higher Mo and U concentrations, 114.8 nmol/kg and 14.5 nmol/kg, respectively, under the Saharan dust plume trajectory (NE-Atlantic) compared to their average seawater concentrations (107 nmol/kg and 13.9 nmol/kg), which likely reflects Saharan dust as a source for both metals. The pronounced oxygen minimum zone off Mauritania did not affect the distribution of dissolved Mo and U to a measurable extent and indicating no significant reduction of Mo and U to their reduced species which might lead to a decrease in the dissolved pool. However, slightly lower than average Mo and U concentrations above the suboxic Namibian shelf (SE-Atlantic, GEOTRACES cruise GA08) can be attributed to the formation of reduced solid Mo(IV) and U(IV) species which are less soluble than Mo(VI) and U(VI) in oxic seawater, making suboxic sediments as a sink for Mo and U. Dissolved Mo and U were mainly truly dissolved ($<0.015 \mu\text{m}$) while U-complexes with sediment-released compounds may contribute to the colloidal fraction in near-bottom waters.

We included dissolved rubidium (Rb) as a truly conservative metal in this study. The concentration of Rb remained constant with depth (approx. $1.3 \mu\text{mol/kg}$) and was unaffected by regional parameters in the NE- and SE-Atlantic Ocean. This emphasizes the positive deviation in the NE-Atlantic and negative deviation in the SE-Atlantic of Mo and U from fully conservative patterns.

Our findings suggest that future climate change, leading to more extensive dust events and less oxygenated waters, may influence the distribution and isotopic signatures of Mo and U.