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The effect of dust on dissolved organic carbon in the surface ocean

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Dust inputs are an important source of nutrients in the ocean and promote primary production. In addition, dust particles are associated with the preservation efficiency of particulate organic carbon (POC), as they act as ballast in aggregates, accelerating their sinking in the water column. However, little is known about the direct effects of dust on dissolved organic carbon (DOC), the second largest bioavailable carbon pool in the ocean and a key component of natural organic matter. In our previous study, we investigated the effects of dust on the DOC concentration in seawater, focussing on sorption processes. We added various amounts of mineral dust (grainsize <63 µm), taken from dry riverbeds in Namibia, to a solution of artificial seawater and ^{13}C-labelled dissolved organic matter. Based on DOC and $^{13}C/^{12}C$ isotope ratios measurements, we found that three processes are relevant for the carbon cycle when dust comes in contact with seawater: 1) release of DOC and presumably POC from dust into the aqueous solution, 2) adsorption of DOC on dust particles, and 3) microbial conversion of DOC and likely POC into dissolved inorganic carbon (DIC). Our results show that the net uptake of DOC on dust depends on the interactions of these three processes. Furthermore, we found that the release of DOC can become the dominant process if organic carbon components are initially present on the dust and the dust/seawater ratio is comparatively high. In this scenario, dust can act as a temporary source rather than a sink for organic carbon in surface waters. Our goal now is to quantify these processes and to validate them with other dust sources for other marine areas. To this end, we are expanding our investigations to include dust from dunes and sabkhas in NW Africa, which has different properties in terms of specific surface area, organic carbon content and elemental composition compared to the samples from Namibia used so far. Initial results support our hypothesis that these differences affect the relative importance of the previously described dust-seawater processes.