The use of ^{232}Th as a proxy for aeolian dust: A core top study from the low latitude Atlantic

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Mineral dust can have direct and indirect effects on Earth's climate by interacting with radiation in the atmosphere and by fertilizing micronutrient-limited areas of the ocean (leading to CO_2 drawdown). Thorium isotopes in marine sediment have been used to develop a proxy for dust fluxes; ^{232}Th is a proxy for continentally-derived lithogenic material, whilst ^{230}Th allows calculation of mass fluxes to the ocean floor. However, there has not been a systematic study of the assumptions made in this method for modern samples. In this study, we carried out ^{232}Th and ^{230}Th analyses on core-top sediment samples collected across a longitudinal range from 21-56ºW in the tropical Atlantic Ocean (~5-15ºN). The samples were collected on cruise JC094 in 2013 using multi-coring and Remotely Operated Vehicle to provide the most pristine core tops possible, as well as co-located seawater. ROV push coring enabled depth transects to be collected from the sides of seamounts ranging from 570 to 4565 m. The cruise transect includes locations under the high Saharan dust inputs in the east to lower inputs in the west.

Across the Atlantic our results from digestion of bulk sediment show a decrease in calculated ^{232}Th flux from east to west, as expected from the gradient in Saharan dust. However, our results also indicate that there is a dependence of calculated ^{232}Th flux on water depth. Combined with measurements of the fraction of $CaCO_3$ and a simple scavenging model these results suggest that dissolution of $CaCO_3$ with depth is at least in part responsible for the apparent trend in ^{232}Th fluxes.