The Influence of the Deep Western Boundary Current on $^{231}Pa/^{230}Th$ in the Middle Atlantic Bight

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The radioisotope ratio $^{231}Pa/^{230}Th$ in bulk sediments is commonly used to as a proxy for ocean circulation in the geologic past. The ability for these particle-reactive radioisotopes to constrain circulation requires, among others, the assumption that ^{231}Pa is primarily affected by the flow, while ^{230}Th is primarily affected by scavenging by sinking particles. Deep oceanic regions of intense currents may violate this assumption, as these currents may prevent ^{230}Th to reach a reversible exchange equilibrium with settling particles, which is estimated to be of O(10 years) at abyssal depths. Previous studies have shown that the Deep Western Boundary Current (DWBC) ventilates deep layers in the western North Atlantic on decadal time scales with Labrador Sea Water, characterized by particularly low activites of both isotopes. The unprecedented GEOTRACES dataset, which includes water column ^{231}Pa and ^{230}Th data from stations crossing the DWBC, allows us to test the aforementioned assumption for the paleoceanographic application of ^{231}Pa and ^{230}Th.

In our poster, we will address the key question: to what extent can transport of ^{231}Pa and ^{230}Th by the DWBC explain water column observations of both radioactive isotopes in the Middle Atlantic Bight. This question will be tackled by comparing the distribution of dissolved ^{231}Pa and ^{230}Th simulated by a regional ocean circulation model (the Princeton Ocean Model) with water column ^{231}Pa and ^{230}Th data. The ocean circulation will be obtained from a diagnostic calculation based on (i) a high-resolution (1/4° to 1/10°) climatology of Northwest Atlantic hydrography, (ii) estimates of DWBC and Gulf Stream inflows and outflows derived from oceanographic cruises, and (iii) surface wind stresses deduced from satellite altimetry. Transfer between dissolved and particulate ^{231}Pa and ^{230}Th in the model will follow a simple reversible exchange. Model results will be compared to GEOTRACES and historical water column ^{231}Pa and ^{230}Th data in order to provide an estimate of the effects of DWBC volume transport and composition on the activities of the two radionuclides along the continental slope and in the abyssal basin offshore.