Geophysical Research Abstracts
Vol. 21, EGU2019-11460, 2019
EGU General Assembly 2019

The Influence of the Deep Western Boundary Current on ^{231}Pa and ^{230}Th in the Northwest Atlantic

Paul Lerner (1), Olivier Marchal (2), Phoebe Lam (3), Wilford Gardner (4), Mary-Jo Richardson (5), and Alexey Mishonov (6)

(1) Goddard Institute for Space Studies, New York City, USA (plerner@whoi.edu), (2) Woods Hole Oceanographic Institution, Woods Hole, USA (omarchal@whoi.edu), (3) Department of Ocean Sciences, U. California, Santa Cruz, USA (pjlam@ucsc.edu), (4) Department of Oceanography, Texas A & M U., USA (wgardner@ocean.tamu.edu), (5) Department of Oceanography, Texas A & M U., USA (mrichardson@ocean.tamu.edu), (6) Earth System Science Interdisciplinary Center, U. Maryland, USA (alexey.mishonov@noaa.gov)

The radioisotope ratio ^{231}Pa/^{230}Th in Atlantic bulk sediments is commonly used as a proxy for ocean circulation in the geologic past, particularly during the last (de)glacial periods. The ability for these particle-reactive isotopes to constrain circulation requires, among other assumptions, that ^{231}Pa is primarily affected by the flow, while ^{230}Th is primarily affected by scavenging onto sinking particles. Deep oceanic regions of intense currents may violate this assumption, as these currents may prevent ^{230}Th from reaching a reversible exchange equilibrium with settling particles, which is estimated to occur on a time scale of the order of 10 yr at abyssal depths. Indeed, 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 activities of both isotopes. In our presentation, we will address the following question: to what extent can transport of ^{231}Pa and ^{230}Th by the DWBC explain water column observations of both radioisotopes in the Northwest Atlantic. This question will be tackled by comparing the distribution of ^{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 gathered during (pre-)GEOTRACES cruises. The circulation component of the model is constrained from (i) a 1/4-degree resolution hydrographic climatology used to force the model via surface restoring, (ii) estimates of DWBC and Gulf Stream inflows and outflows derived from various oceanographic programs, and (iii) surface wind stresses deduced from satellite altimetry. The scavenging component of the model assumes that Pa and Th exchange reversibly with slowly settling particles. In this description, adsorption of both metals onto particles is governed by a prescribed distribution of particulate matter which is derived from a compilation of nephelometer and transmissometer data. In our presentation, the sensitivity of modeled ^{231}Pa and ^{230}Th to changes in the volume transport of the DWBC will be examined. Model results will be compared to (pre-)GEOTRACES ^{231}Pa and ^{230}Th data in order to provide an estimate of the effects of DWBC on the activities of both radionuclides along the continental slope and in the abyssal basins offshore.