Testing Models of Chemical Scavenging using Th and particle data from GEOTRACES

[1]P. E. LERNER , [1]O. MARCHAL, [1]P.J. LAM , K. [1]BUESSELER, [2]C. HAYES, [3]K.-F. HUANG AND [4]Y. LU

[1]Woods Hole Oceanographic Institution, Woods Hole, MA,02543, USA (plerner@whoi.edu,omarchal@whoi.edu, pjlam@whoi.edu, kbuesseler@whoi.edu)

[2]Massachusetts Institute of Technology, Cambridge, MA 02139, USA (cthayes@mit.edu)

[3]Institute of Earth Sciences, Academia Sinica, Taiwan(kfhuang@earth.sinica.edu.tw)

[4]University of Minnesota, Minneapolis, MN 55455, USA (luxxx862@umn.edu)

Thorium is an important tracer for the cycling of marine particles and of their chemical constituents, including carbon, nitrogen, and phosphorous. It is thought to be removed ("scavenged") from the ocean through a reversible exchange with settling particles. In the 1990s R. Murnane and colleagues pioneered the use of inverse methods to analyze Th and particle data on oceanic samples in terms of particle processes, such as (dis)aggregation, remineralization, and sinking. Recently we have applied such a method (the algorithm of total inversion or ATI) to explore the potential of Th and particle data from GEOTRACE to further our understanding of these processes in the ocean.

Here the ATI is used to test four different models of chemical scavenging from an unprecedented dataset collected at oligotrophic station USGT11-22 of the U.S. GEOTRACES North Atlantic Zonal Section. The data used in this work consist of ^{230,234}Th activity and particle concentration in different size classes (<0.45 μm, 0.8-51 μm, and >51 μm) below a depth of 100 m. The models assume one or two classes of particles and uniform or non-uniform rate constants. They are tested by determining the deviations in the data which are needed in order for them to satisfy the model equations perfectly and by comparing these deviations to the estimated data errors (analysis of residuals).

In our presentation we will report on the results of our tests. Among our preliminary findings is the indication that a model with one class of particles and uniform rate constants, a popular description of Th and particle cycling in the ocean, is not compatible with station USGT11-22 data. This result should hold for any plausible combination of the rate constants.