Geophysical Research Abstracts,
Vol. 11, EGU2009-9279, 2009
EGU General Assembly 2009

Modeling the Nd Oceanic Cycle Using a Fully Prognostic Dynamical/Biogeochemical Coupled Model

T Arsouze (1), J-C Dutay (1), F Lacan (2), and C Jeandel (2)

(1) CEA-CNRS-UVSQ, LSCE, gif sur yvette, France (dutay@cea.fr), (2) Universite de Toulouse ; UPS (OMP-PCA) ; LEGOS

The "Nd paradox" refers to the decoupling of Nd isotopic composition (hereafter refered as epsNd) and Nd concentration in the ocean. While epsNd is commonly used as a conservative water-mass tracer in the ocean interior far from any lithogenic inputs, Nd concentration increases with depth and along the thermohaline circulation, resembling typical non-conservative patterns of nutrients that are affected by vertical scavenging. Also, Nd oceanic budgets inferred from traditional sources (aeolian dusts and riverine discharge) cannot account for both epsNd and Nd concentration (Tachikawa et al., 2003). Recently, "Boundary Exchange" (BE, i.e. process of boundary scavenging compensated by inputs from the sediments along the continental margin) has been proposed as an important source/sink term of Nd that could solve the "Nd paradox". Here, we simulate the oceanic epsNd and Nd concentrations using the coupled dynamical/biogeochemical ocean general circulation model NEMO/PISCES. A reversible scavenging model has been parameterized to reproduce vertical cycling and dissolved/particulate interactions. Sources taken into consideration are partial dissolution of sediment (source of the BE process), atmospheric dust and dissolved riverine discharge. Some discrepancies in modeled particle fields create too pronounced vertical gradients in Nd concentrations and may lead to an overestimated role of the reversible scavenging. However, results show that: 1) the reversible scavenging is a necessary component to reproduce both epsNd and Nd concentration distributions and thus explain the "Nd paradox", and 2) BE is the predominant Nd source to the ocean (1.0E+10 g(Nd)/year) with fluxes as large as 25 times those of other sources (4.0E+8 g(Nd)/year). Hence it likely represents the missing flux necessary to reconcile Nd and Nd concentration budgets. Nevertheless, dust inputs are necessary to constrain epsNd values in surface waters.

Tachikawa, K., Athias, V., and Jeandel, C.: Neodymium budget in the ocean and paleoceanographic implications, Journ. Geophys.Res., 108, 3254 doi:3210.1029/1999JC000285, 2003.