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Ocean Science Discussions

Interactive comment on "^{15}N enrichment in the surface Particulate Organic Nitrogen of the north-eastern Arabian Sea from the middle to the waning phase of the winter monsoon: possible causes" *by* S. Kumar and R. Ramesh

Anonymous Referee #3

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15N enrichment in the surface Particulate Organic Nitrogen of the north-eastern Arabian Sea from the middle to the waning phase of the winter monsoon: possible causes

General comments:

The authors present a dataset of particulate organic nitrogen (PON) concentration and the d15N of particles collected on GF/F filters during two cruises in the NE Arabian Sea. The primary conclusions of the paper are that there was an increase in d15N and nitrogen content of some stations between cruises, and that the increase can be attributed

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to either a change in the d15N of nitrate delivered to the euphotic zone or a change in the growth properties of the phytoplankton assemblage that ultimately influences the d15N of PON. Unfortunately, this paper does not meet the primary requirements of the Ocean Science journal, particularly that there are no substantiated conclusions, the data is too few and too incomplete, many recent publications have been ignored in the discussion, and there are several unsubstantiated assumptions that are not supported by the data presented here or elsewhere.

It's important to acknowledge that there exist many different mechanisms in a typical environment that can influence the d15N of PON. The authors identified some of these mechanisms, but there are others as well. Trophic level effects, changes in phytoplankton species composition, availability of ammonium or urea, N2 fixation, and physical mixing processes are some examples of potential variables that influence d15N of PON. While some variables can be easily eliminated from some ecosystems, the authors do not have this luxury in the NE Arabian Sea. Also, while time intervals of sufficient length can help to remove some short term variability in natural abundance stable isotopes, a period of one-two months is definitely not long enough, particularly when climate and oceanic conditions are changing with the season. In particular, N2 fixation, denitrification, ammonium availability, and species composition of the collected PON can cause short term variability in samples. In addition, the spatial coverage of the study is relatively large, and variability in some of the above factors is expected from different environments. Given the potential for variability, the authors need a much better dataset for their proposed mechanisms to holdup to scientific scrutiny. It appears from Table 1 that there is only one sample per station. Either replicate samples or a depth profile of PON would have made for a much more confident interpretation of the data.

The difference between the two time periods for a few of the open ocean stations may indeed be real, however there are no statistical ways to prove this. If indeed the increase of about 5 permil occurred between the two time points, there are numerous

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explanations. It is difficult to interpret the authors' logic for the arguments that were chosen. For example: 1) The presence of N2 fixers increased between January and March - according to the authors - but later they argue that N2 fixation had a bigger effect on d15N of PN in January. 2) The biological data referred to by the authors on page 251 (Parab et al 2006) is not useful because that paper refers to a cruise in February and March of 2004, not 2003. 3) If nitrate drawdown occurred slowly between the January and the March time point, the simplest explanation is that the PON and d15N of PON increased due to closed system Rayleigh fractionation kinetics. There is no surprise here, only that the PN increased from one time point to the next despite the increase in the abundance of N2 fixers in the region.

Variables that must be measured in the approach to quantifying d15N dynamics of any oceanic ecosystem are: ammonium concentration, urea concentration, nitrate concentration, the d15N of nitrate, the d15N of size fractionated primary producers, and a thorough examination of the primary productivity rates and nitrogen fixation rates that span the measurement period - at least. Our understanding of the variability that exists in d15N measurements demands that these measurements are made. It is not acceptable to publish a few d15N measurements and speculate on the possible causes. It is confusing to students and it does not help advance the use of natural abundance stable isotope distributions as a tool in the eyes of non-specialized scientists.

Interactive comment on Ocean Sci. Discuss., 4, 245, 2007.

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