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Biogeosciences Discussions

# *Interactive comment on* "Glacial-Interglacial changes and Holocene variations in Arabian Sea denitrification" *by* Birgit Gaye et al.

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Reply to reviewer 2:

Thank you very much for taking the time for your detailed comments which will help us to make the ms. more readable. As you suggest we will add a chapter on water masses in the Arabian Sea which will meet a number of your specific comments.

Abstract

In the abstract and throughout the ms. we will check and add the correct timings of glacial and Holocene events, times etc..

Introduction



We will include variations in sea level and atmospheric circulation as drivers of changes in nutrient inventories.

Materials and Methods

Page 6/7: A paragraph on water masses will be added describing their characteristics. We will also describe the water depth of oxygen deficit and denitrification in more detail. We will add the ages of the Holocene boundaries and a few lines on the times of millennial scale oscillations. The hiatus was identified by a facies shift. This will be described in detail. The results of Anand et al. (2008) will be included and discussed. These data can also be used for a comparison of alkenone and Mg/Ca SST of NIOP 905 (see reply to reviewer 1).

Results

Ages and precise and consistent terminologies will be used. An increase of d15N around 7-9 ka BP can be observed in all cores from the eastern Arabian Sea (including MD 131). As Möbius et al. (2011) showed that there is a diagenetic increase of d15N in deep cores which may change the absolute values but will change the general trend only if diagenesis is extremely variable with time. If this is not the case the trends will still be visible. We intended to minimize such differences in diagenesis by our normalization procedure. Yes, we will point out the similarity with the GISP record.

Discussion

P 13: We will add more details on the exchange of water masses between the Bay of Bengal and Arabian Sea and the seasonal changes. The possible role of the Western Ghats will also be mentioned.

P14/15: We believe that upwelling was shut down during the period we studied (See Böll et al., 2015) because there is hardly any SST difference between the present upwelling areas and the northern AS. We further believe that exceptions are the interstadials defined in the GISP core which were shown to coincide with TOC peaks

(Schulze et al., 1998) and d15N peaks (Altabet et al., 1995, 2002; Möbius et al., 2011) in cores with high resolution. These peaks can be explained with short intervals of upwelling. SST records of high resolution show that IS 2 ($\sim$22-23 ka) was a cold period in upwelling areas in the western Arabian Sea. The eastern AS records to not show this minimum. We will try to make this clearer in the revised ms.

P17 we will indicate the exact times.

P 17/18/21: the discussion of water masses (see above) will also include the possible ventilation by AAIW during Heinrich events and check especially the situation in the eastern Arabian Sea.

A short detailed introduction to the use of d15N as an indicator of N-cycling processes will be added (see comments to reviewer 1). The processes influencing d15N will also be discussed.

Minor comments

References, figures, tables and captions will be rechecked. References will be added were required, more information on water mass structure will be included.

We feel that there is not enough information so that we cannot present a deep circulation of the Arabian Sea but will check in the literature if this is feasible.

Anand et al. 2008 will be included (see above).

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