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Climate of the Past Discussions

Interactive comment on "Oxygen isotopic analyses of individual planktic foraminifera species: implications for seasonality in the western Arabian Sea" *by* P. D. Naidu et al.

P. D. Naidu et al.

divakar@nio.org

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Reviewer 1 We thank reviewer for his comments on our paper, I would like to respond to his/her comments point wise: We have explained the strategy of our approach clearly, not sure what the reviewer meant "the method needs to be discussed in depth" We have not weighed the individual shells of G. sacculifer and N. dutertrei, we have considered only size range The external reproducibility given is 1 sigma, at Shizuoka University Prof. Nobuaki Niitsuma has designed special micro-inlet system wherein better reproducibility on a small quantity of sample is achievable (see Niitsuma et al., 1991; cited in the paper). It is highly efficient inlet for the small quantity of carbonate sample

analyses. At each interval 20 individual specimens of G. sacculifer and 8 individual specimens of N, dutertrei were analyzed. Based on the 20 individual analyses one can obtain significant standard deviation. However, 8 individual analyses of N. dutertrei may not sufficient to derive meaningful statistics, hence we do not attach much importance in this paper on the inter shell ïĄď18O variability of N. dutertrei. Just we would like to make a point that the thermocline dwelling species also document greater inter shell ïĄď18O variability during deglaciation, however, we have not quantified the SST and SSS variations based on N. dutertrei analyses for obvious reasons. We agree that larger batches of individual analyses >50, >100, >1000 may provide better statistic significance than 20 individual specimens. However, based on 20 individuals we obtained standard deviation which is statistically significant. Therefore, we assume that the inter shell ïĄď18O variations documented in this paper would not be biased by productivity changes of foraminifera. I disagree with reviewer on this point, the mean SST difference between summer (June to September) and winter (November to February) at the ODP site 723 is <1°C (please see the figure 1). The maximum SST at this site is noticed during April and May before the onset of SW monsoon and Minimum SST is noticed during upwelling season i.e during July to September. Therefore, the SST difference of 4°C you have mentioned is not the Winter and Summer difference. The minimum SST difference during from 9 kyr to 0.4 kyr was primarily caused due to the intense upwelling during SW monsoon, which causes a decrease in summer SST and makes them more or less similar to the range of the winter SST. Modern SST data derived from Levitus et al., 2004 also represent minimum SST difference between winter and summer SST at the location of ODP Site723. Ganssen et al., 2012 have demonstrated very clearly that upwelling and non upwelling seasonality by the individual shell analyses of G. ruber and G. bulloides. As upwelling was stronger during Holocene the inter shell ïĄď18O was greater during Holocene than the last glacial period. The seasonal ranges of temperature and salinity, we presented in this paper are summer and winter seasons. Whereas Ganssen et al. (2012) SST ranges represents upwelling and non-upwelling seasons hence these two data sets express different seasonal temperatures

ranges during Holocene and last glacial period. The modern empirical equation to convert ïĄď18Ow into salinity by Rostek et al., (1993) have been used here because core top salinity values obtained are very close to the modern values at this site. However, we do not have more evidence to say that this equation can be used confidently entire 0-20 kyr. Please note here the emphasis is made on the seasonal SSS contrast not on the absolute SSS values. Our strategy to interpret the inter shell ïĄď18O variations in terms of seasonality is explained under section 6 under discussion, therefore we will not elaborate on that point here. ODP Site 723 is just sitting in the vicinity of the OMZ i.e 808m water depth, all published work from the Arabian Sea do not provide any evidence that any time (during Quaternary) OMZ depth was shallower than 800m, therefore, fluctuation of OMZ would not affect the role of bioturbation at this site, therefore bioturbation effect on the inter shell variations of ïĄď18O may be negligible.
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