Clim. Past Discuss., 9, C1281–C1283, 2013
www.clim-past-discuss.net/9/C1281/2013/

Climate of the Past Discussions

Interactive comment on "Paleo Agulhas rings enter the subtropical gyre during the penultimate deglaciation" *by* P. Scussolini and E. van Sebille

P. Scussolini and E. van Sebille

p.scussolini@vu.nl

Received and published: 28 June 2013

We respond to the kind and poignant comment of the reviewer, whom we intend to acknowledge for the important considerations about our choice of model. Such comments and suggestions have led to substantial changes in our study, and we proceed to outline how we changed our work in the light of the reviewer's remarks.

The reviewer is right in the observation that ECCO2 does not have a particularly skillful Agulhas ring path. Largely because of this lack in skill, we have decided to redo the full model analysis in a model that is more skillful in the Agulhas region.

In the revised manuscript, we have chosen to use the INALT01 model developed at Geomar, Kiel (Durgadoo et al., 2013). INALT01 is an update to the AG01 model, with

the most important difference that the region of high resolution extends all through the South Atlantic Ocean. INALT01 has a higher resolution than ECCO2 (1/10 vs 1/4 degrees) and much more realistic ring variability and pathways. In the Methods of our revised manuscript, we provide extensive elucidation of the technicalities and merits of the INALT01 model.

With the map in Figure 1 we did not mean primarily to show that the site is on the ring path, which is indeed assessed by the observation studies that we (and the reviewer) cite, but rather to illustrate that the model simulates the rings path realistically, and that rings (SSH) correspond to density anomaly at the thermocline. In this sense, we have reworded our explanation, making it clearer in the light of the appropriate remark. However, we can not use observational data only, as no information is there available on the vertical structure of the rings. This is essential for this manuscript. Therefore, we opted to use a model (INALT01) that represents the Agulhas system with most fidelity to the observed variability of the region. The ring path across the Walvis Ridge is realistically represented. The use of INALT01 now enables a more realistic analysis of the impact of Agulhas rings on the density structure at the core location.

As for the suggestion of producing a quantitative comparison of model and paleo analysis, we believe the results of such analysis would be extremely speculative. The δ18O of foraminifera responds to density via the effect of temperature and salinity, in proportions that are not quantifiable without an explicit paleo salinity reconstruction. Analysing individual shells for temperature would require the estimation of their Mg/Ca ratio by means of Laser Ablation ICP-OES, a technique that is just in its early development phases (e.g., Sadekov et al., 2009) and thus still plagued by vast uncertainties as to its correct application. In addition, foraminifera have not lived over the core site where their shells settled, but likely in a quite vast area about it, and thus might have recorded their signal in the most diverse combinations of cyclonic/anticyclonic/streamer/background situations. Ultimately, the absolute values and the extent of the peaks and troughs we see in the present day time-series were in all likelihood different under other climatic

frameworks. We reemphasize anyway that all such considerations do not bear on the validity of our qualitative link between thermocline variability recorded in our samples and the AL influence.

Additional references

Durgadoo J.V, B. R. L., C.J.C. Reason, P. Penven, A. Biastoch: Agulhas leakage predominantly responds to the southern hemisphere westerlies, Journal of Physical Oceanography, 2013.

Sadekov, A., Eggins, S. M., De Deckker, P., Ninnemann, U., Kuhnt, W., and Bassinot, F.: Surface and subsurface seawater temperature reconstruction using mg/ca microanalysis of planktonic foraminifera globigerinoides ruber, globigerinoides sacculifer, and pulleniatina obliquiloculata, Paleoceanography, 24, PA3201, 2009.

Interactive comment on Clim. Past Discuss., 9, 2095, 2013.