

Interactive comment on “Mid-depth South Atlantic ocean circulation and chemical stratification during MIS-10 to 12: implications for atmospheric CO₂” by A. J. Dickson et al.

Anonymous Referee #1

Received and published: 18 July 2008

General comments

The interglacial MIS 11 is seen to provide information on the type and magnitude of climate variability most similar to the Holocene. But so far, only a few detailed records of deepwater variability of this particular period have been produced, and those are mostly located in the North Atlantic. Dickson and co-authors present a new high-resolution benthic isotope record from the intermediate SE Atlantic which is ment to record the variability in the advection of Northern source intermediate and deep water masses to the eastern South Atlantic on millennial timescales. The consequences for the ventilation of the deep ocean and changes in atmospheric greenhouse gas con-

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centrations are discussed.

In general it is a well organized and presented paper. The figures are fine except for minor changes suggested below. The data presented in this manuscript are of high quality (apart from minor reservations, see specific comments below) and merit publication. However, the given interpretations are not always supported by the data, and the following considerations may help to improve the paper:

Much of the discussion on millennial scale variability in deepwater advection is based on very small scale changes in $\delta^{13}\text{C}$ (0.1 to 0.3 ‰), which is close to the 0.2 ‰ noise usually cited in late Pleistocene benthic carbon isotope studies. It is important to know, therefore, what the magnitude of the single specimen variance in at least some of the samples would be. Furthermore, abrupt increases in $\delta^{13}\text{C}$ superimposed on the glacial-interglacial longterm trend are only seen for two events (starting at 376 and 361 ka, respectively), all others are more gradual. A significant decrease in foraminifer fragmentation is only seen in the same two events, belonging to the MIS 11 - 10 transition. The question is, why millennial scale drop downs in NADW supply are expected during interglacials? As already discussed at the end of subchapter 5.4.1, some climate parameters like IRD records would tend to argue against changes in NADW production during warm climates. And the cited evidence for regional cooling in the Southern Ocean (page 677 line 27) occurs at a time of only small scale changes in $\delta^{13}\text{C}$ gradients. However, assuming the carbon isotope data are correct, what mechanism the authors would suggest for an interglacial variability in NADW supply? Furthermore, is it possible to give an estimation for the amount of NADW reduction necessary to produce to the observed changes in $\delta^{13}\text{C}$? What about small scale changes in air-sea fractionation in the source regions of the northern component water masses? In subchapter 5.4.1 a strong 41 000 periodicity in the deepwater proxy is related to the modulation of intermediate-depth ventilation by changes in highlatitude sea-surface temperatures and sea-ice in response to obliquity. This should be explained in more detail, and the coherence of the proxy record with the orbital parameter should be checked.

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Specific comments

TITLE Could be more concise to better reflect the millennial scale variability of deepwater circulation

METHODS 671 line 1 please give number of picked specimens for isotope measurements 671 line 11 as has been stated in many previous publications, the correction of *Uvigerina* $\delta^{13}\text{C}$ values to equilibrium is problematic with respect to changing organic matter supply. The authors should provide a supplementary figure with the 43 paired measurements of *Cibs/Uvi*

DISCUSSION

672 line 22 phytodetritus effect (not photodetritus) 675 line 27 ODP 1063 $\delta^{18}\text{O}$ record should be better aligned to that of LRS04, especially at the termination of MIS 12.

TABLES Table 2 Why are the age control points for the given sites are not chosen at same ages? That would make the stratigraphy more consistent.

FIGURES Figure 1 The schematic arrows for the deep water masses are misleading, better introduce a more realistic pattern. Figure 3 *C. wuellerstorfi* and *Uvigerina* data points are not distinguishable. Please use larger symbols. The isotope records contain several outliers - have those been checked by repeated measurements?

Figure 4a The oxygen isotope records should be offset by 1‰; each for clarity. Figure 4c Please add a obliquity curve to the $\Delta\delta^{13}\text{C}$ (980-1085) record.

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