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Climate of the Past Discussions

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Interactive Comment

Interactive comment on "Anomalously high Arabian Sea productivity conditions during MIS 13" *by* M. Ziegler et al.

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This topic is of significant scientific relevance, interpretation of the MIS13 climate anomaly in the Arabian Sea region during the Mid-Pleistocene transition (MPT). Essentially two views exist, one interprets changes in MIS13 proxy data as reflecting a strengthened summer monsoon circulation based on evidence from the Chinese Loess Plateau (Yin et al 2008), the equatorial Indian ocean, (Bassinot et al 94) and the Mediterranean (Rossignol-Strick et al 1998), while the other (this manuscript) finds evidence for increased meridional overturning circulation (MOC) leading to enhanced nutrients in the deep waters and to enhanced Arabian Sea productivity.

The MOC interpretation is sound, novel, and worthy of publication as a potential driver of the proxy data presented (Ba XRF counts and shell normalized weight). The

MOC interpretation is internally consistent with broader global-scale dynamics taking place during MIS 13. However, the evidence presented to dismiss the possibility of a strengthened summer monsoon is not strong. Thus, the authors might consider both as potential explanations for Indo-Asian anomalies during MIS 13.

Specific comments

1. 1991 lines 10-15. presents the loess, equatorial Indian, and Mediterranean evidence for strengthened MIS 13 summer monsoons and immediately dismisses these as having occurred during MIS 14 and therefore of different origin. This is not the case as illustrated in the attached figures 1 and 2; both anomalies are within MIS 13 and thus, difficult to dismiss.

2. 1994 lines 3-5. Authors might consider a discussion of closed-sum issues surrounding use of raw counts.

3. 2000 lines 21-24. The Kutzbach 1981 model result is interpreted as '...indicating that tropical monsoons respond primarily to changes in Northern Hemisphere summer insolation on orbital time scales'. This is a significant misinterpretation of this reference. The only forcing present in the Kutzbach 1981 model run was insolation forcing. Thus, it is not surprising that the model monsoon responded primarily to insolation forcing. Kutzbach's elegant experiment was designed to see IF insolation changes at the orbital scale were sufficient to drive climate change. This insolation-only experiment cannot be interpreted to indicate that insolation is the primary driver at orbital time scales nor what the phase of the summer monsoon is relative to insolation forcing. Time-dependent experiments using realistic global ice volume and other lower boundary conditions (e.g. greenhouse gasses) are necessary in this regard.

4. 2001 lines 4-8. This text indicates that manuscript figure 4 shows that the summer monsoon indicators (Ba and shell normalized weight; SNW) are consistent with the methane record and the CLIMBER-2 monsoon precipitation results from which they '..conclude that the productivity changes in the Arabian Sea primarily reflect changes

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in summer monsoon upwelling. . .'. Here a significant contradiction arises. The CH4 record is taken as a paleo indicator of summer monsoon strength as is the CLIMBER-2 model result. The contradiction is that maxima in the Ba (and SNW) summer monsoon proxy peaks are clearly out of phase with maxima in the monsoon model result and CH4 (attached figure 3). The timing of Ba and SNW maxima are consistent with the timing observed in a wide variety of summer monsoon proxies from other cores in the Arabian Sea indicating the possibility that the model results and CH4 maxima do not reflect the timing of summer monsoon maxima. This is not necessarily surprising for CH4 given that it has a great number of high- and low-latitude sources that are not driven by monsoon processes at orbital timescales. The CLIMBER-2 model is not sufficiently described to assess why it might not have the same timing as the proxy data. In any case, this contradiction requires attention.

Technical corrections 1992 line 1 – 'recovered' as opposed to 'drilled'?

Interactive comment on Clim. Past Discuss., 5, 1989, 2009.

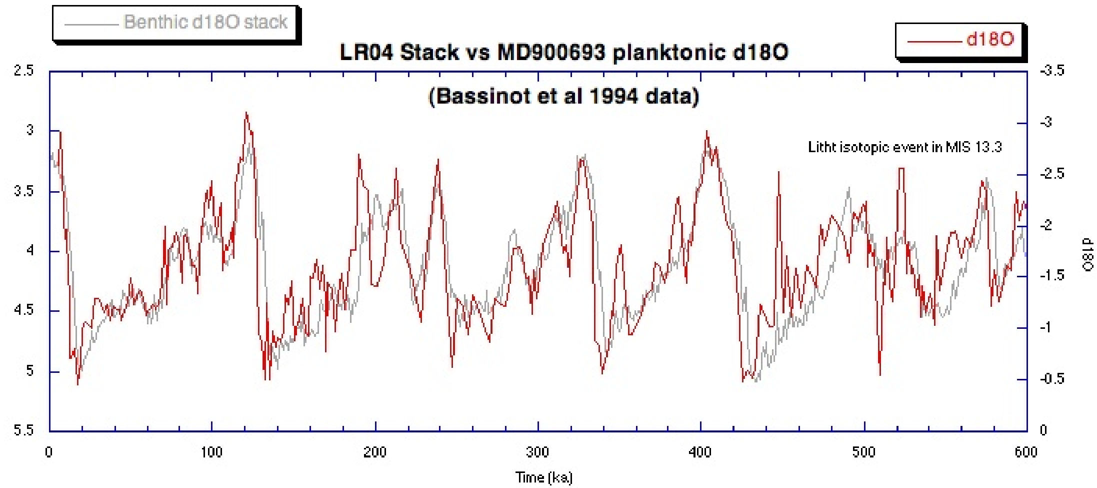

Fig. 1. MIS 13 light planktonic isotope event

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Interactive Discussion

Discussion Paper

30 Q. Z. Yin and Z. T. Guo: Monsoon MIS-13

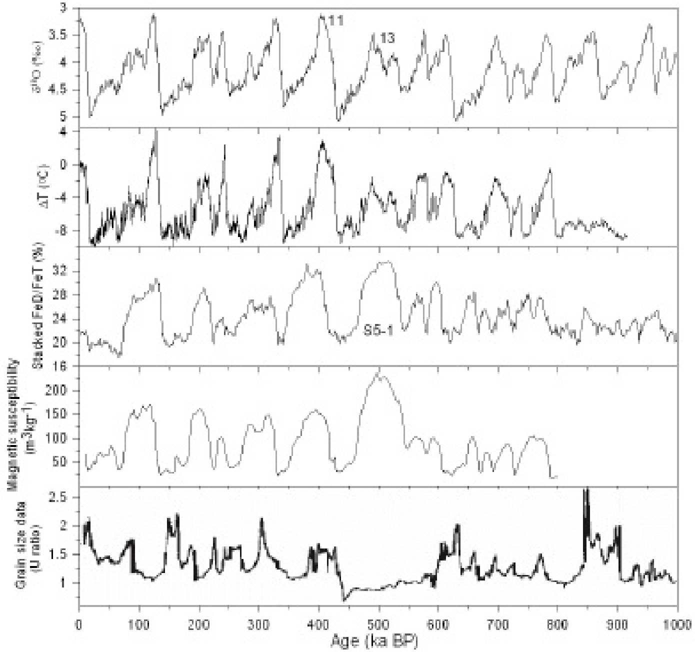

Fig. 1. Comparison of the loess proxy data with marine benthic $\delta^{18}O$ and Antarctic deuterium temperature records. From the top to the bottom panel, the curves are the benthic $\delta^{18}O$ stack (Lisiecki and Raymo, 2005), EPICA Dome C ice core temperature anomaly (Jouzel et al., 2007), the stacked FeD/FeT ratio (Guo et al., 2000), magnetic susceptibility (Kukla, 1987) and grain size data (Vandenberghe et al., 1997) of the loess.

Fig. 2. MIS 13 Loess event

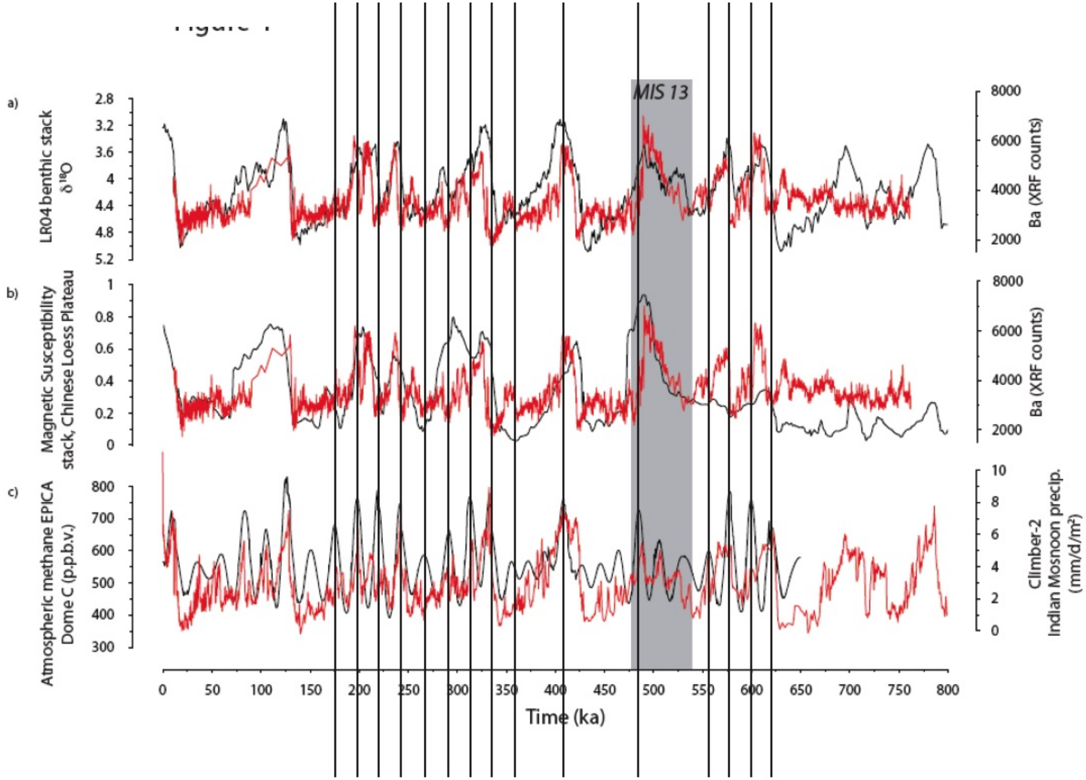

Fig. 3. Monsoon proxies are out of phase with model results and CH4