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Climate of the Past Discussions

Interactive comment on "Estimate of climate sensitivity from carbonate microfossils dated near the Eocene-Oligocene global cooling" *by* M. W. Asten

Anonymous Referee #1

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In this paper, the author uses two geochemical datasets for estimating Earth climate sensitivity. Pearson et al. have published the first datasets in 2009. In their Tanzanian outcrops, they measured several d11B on carbonate microfossils which, given several hypothesis, can be used to constrain paleo-atmospheric CO2 levels. Zachos et al. have published the second datasets, which is the d180 of benthic foraminifera. I must say that I am very skeptical concerning studies working on Earth's sensitivity with past records. Indeed, we do not measure the temperature nor the atmospheric CO2 level in the past (before the first million of years), we just use proxies with a lot of uncertainties associated to each. However, I must admit that some studies have already been published on this subject; most of them are referred in the paper of Asten.

The paper is clearly written and relatively well organized. The scientific method is well described and the main uncertainties are listed. The author finds a very low sensitivity (around 1°C !) which appears very low when compared to other studies such as the one of Pagani or the one by Lunt. While I do not think that this paper must be rejected, I have some comments that I have listed below:

1) Atmospheric CO2 estimates. I know that Pagani has recently updated its own CO2 estimates, why does the author ignore this datasets? Is it due to the time resolution? In a more general sense, to be fair, the author should discuss about the accuracy of the CO2 proxies. For example, are the other CO2 proxies telling us the same story during the E-O time interval? Why is the author using a 66 % confidence interval? From the comment of Pearson et al., it seems that the author would find a larger Earth sensitivity value with 95 % confident interval. It is a very important issue! The author has to discuss all these points before the paper can be published.

2) Meaning of benthic d180 as a global temperature record. I did not understand why the author has not used the DSDP 522 record from its paper. Indeed, the record is shown but the author states that the number of points for each time interval is small. Ok, but do we see the same trend? And why do you show this record if it is not for using it (what is the mathematical basis to reject it). In a more general way, this will reinforce the paper if the author gathers the other potential deep-sea records to show what happens in those one and if the DSDP 744 core is representative of the whole deep ocean. In fact, this should not be so difficult to do and this will make the cause of the author stronger. Once the author has shown that the DSDP 744 is representative of the whole deep ocean. The question of the link between the deep-sea temperature and the mean global surface temperature will remain. The author suggests an answer in their paper by referring to quaternary studies. Other will find the inverse, i.e. deep-sea temperatures do not reflect the surface. I think it is fair to leave the author using the deep-sea record as being representative of the mean global Earth temperature in some ways. Indeed, the "temperature" curve (the stack by Zachos) used by most scientists

working on Cenozoic has been built using d18O measured on benthic foraminifera.

3) I would like to see at the end of the paper a paragraph stating that the very low Earth sensitivity value found by the author may also be the result of the uncertainties existing for both geochemical datasets.

Interactive comment on Clim. Past Discuss., 8, 4923, 2012.