Clim. Past Discuss., 8, C2024–C2026, 2012
www.clim-past-discuss.net/8/C2024/2012/

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

T. Schneider von Deimling

schneider@pik-potsdam.de

Received and published: 24 October 2012

Estimating climate sensitivity from paleo records is a fascinating research area as it could help to improve our understanding of how sensitive the Earth climate system reacts to changes in its radiative balance (especially to changes in atmospheric CO2 concentrations). At the same time paleo-based estimates of climate sensitivity should always be viewed with caution given that perfect paleo analogues for future climate warming do not exist. Technically climate sensitivity can be inferred from two different equilibrium climate states by estimating the temperature difference between the two and the radiative forcing which caused the change in temperature. Given that climate

sensitivity is a global measure of the system, its calculation requires an estimate of how strongly global mean surface temperature has changed in the past. The discussion paper presented here considers two single spots on the whole earth (i.e. two deep sea temperature proxies) for inferring an estimate of global mean surface temperature back millions of years. The result is a rather weak signal with a very narrow range of 0.4K to 1.0K for the assumed global mean temperature change. Such a narrow range is very likely to represent a gross underestimation of involved uncertainties – ranging from uncertainty in transferring proxy information into reconstructed temperatures to uncertainty from scaling local deep sea temperature estimates to global mean surface values. Furthermore, the assumption is made that the whole temperature is only caused by changes in CO2 concentrations while neglecting the potential impact of any other forcing which would alter the inferred value of climate sensitivity. The consideration of only two proxy records doesn't allow judging of how strongly the signal is influenced by local changes and thus could lead to strongly biased estimates in reconstructed global mean temperature change. Given the poor spatial coverage of proxies ranging back millions of years, meaningful reconstructions of past changes in global mean surface temperature remain a challenge. Probably the best approach is a combination of paleo proxies with climate model simulations which would avoid making questionable assumptions of a single scaling factor for inferring global mean temperature from one proxy site. The lower half of the inferred climate sensitivity range in the presented study here implies overall negative climate feedbacks in the system – which is hard to reconcile with current state of knowledge about the magnitude of individual climate feedbacks (water vapour, clouds, albedo, lapse rate). Given the potential pitfalls discussed above, I am not convinced that the presented low range of climate sensitivity in this study is an expression of variable climate feedback strength in a different climate or an indication that most of current climate sensitivity estimates are on the high side - but rather an expression of the chosen approach which is subject to making simplistic assumptions for inferring global temperature changes and underestimating involved uncertainties.

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