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Climate of the Past Discussions

Interactive comment on "Does δ^{18}O of O_2 record meridional shifts in tropical rainfall?" *by* Alan M. Seltzer et al.

Anonymous Referee #1

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Seltzer et al. measured δ18O of occluded air in an ice core drilled on the West Antarctic Ice Sheet Divide (WD). The reported record spans the past 50 ka and is of extreme high quality worthy of publication by its own right. The exceptional precision and high temporal resolution make it possible to de-convolute the integrated record of atmospheric signal and calculate a record of variations in terrestrial fractionation. The new WD record almost perfectly correlates with the previously published one for the Siple Dome ice core, thus demonstrating the robustness of both. The above was possible by meticulous care given to all the difficult mass spectrometric measurements. As well, the reported results were carefully corrected for isotope effects of gas loss, gravity and thermal diffusion by using the ratios of nitrogen isotopes, and the ratios of oxygen and argon to nitrogen. There is no question that the substantial data set in the manuscript

is of superb quality. In a further step the records were carefully dated by numerous control points of known ages. This made it possible to relate the atmospheric records of methane and terrestrial fractionation to the records of inferred strength of the SW Asian Monsoon and Heinrich Events (Fig. 3).

In addition, the authors have made an analysis of present day controls over the isotopic composition of air oxygen. They are aware of the complex nature of the combined biospheric and hydro-climate system. They have derived a plausible scheme showing the response of atmospheric composition to seasonal shifts in rain belts and then used it for interpreting the record of terrestrial fractionation. It shows that southern shifts in the terrestrial oxygenesis equator, and perhaps weakening of respiratory fractionation in tropical soils, match quite well the strength of the SW Asian monsoon. They also discuss the correspondence of terrestrial fractionation and atmospheric methane and the underlying controlling factors. This discussion however, lacks clarity and so are the derived conclusions. For example, in the abstract they state that maxima in terrestrial fractionation are synchronous with methane peaks. This is opposite to what they show in Fig. 3 where methane peaks lag behind terrestrial fractionation maxima. This requires clarification perhaps by stating that the maxima in terrestrial fractionation correspond to secondary methane rises. Regardless of the clarification, it appears that terrestrial fractionation is a better recorder of low latitude variations in rain. In conclusion, I am impressed by the high quality of the research described in the manuscript and recommend its publication after the discussion is revised. In addition, I suggest rewriting the abstract and introduction using simpler and less technical terminology thus making them more appealing to broader audience.

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