

Interactive comment on “Comment on “Aerosol radiative forcing and climate sensitivity deduced from the Last Glacial Maximum to Holocene transition”, by P. Chylek and U. Lohmann, Geophys. Res. Lett., 2008” by J. C. Hargreaves and J. D. Annan

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Overview:

We are pleased that Professors Chylek and Lohmann were able to comment on our manuscript. They suggest that we misunderstood their calculation, which, according to the description in CL08, used a range of temperature estimates derived from the Vostok core data, rather than one single value. The description of our method we employed was not written fully in the original submission since we used the method identical to

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that described in CL08. We will further expand on our method in our revised manuscript to make this clear. We repeated the calculation in exactly the way described in the CL08 paper, using a range of temperatures, derived from the Vostok core, in exactly the same way as in CL08.

Detailed points:

We find it impossible to reconcile their claim that the Vostok data “never enter into our calculation” with their earlier paper CL08, as the very first sentence of CL08 makes precisely this claim:

“We use the temperature, carbon dioxide, methane, and dust concentration record from the Vostok ice core to deduce the aerosol radiative forcing during the Last Glacial Maximum (LGM) to Holocene transition and the climate sensitivity.”

Furthermore, as a basis for their calculations, CL08 claim the polar temperature changes to be “about twice as large as the global temperature” (we do not dispute this ratio as a rough estimate) and then use three ratios of 50%, 45% and 40% to estimate the global temperature changes. Quoting from CL08 once more:

“The global temperature change between the warm maximum near 42 KYBP and the LGM is set to be 2.4 K (half of the observed difference at the Vostok site) and then the difference is decreased to 2.16 and 1.93 K, keeping the ratio of the temperature difference between the two considered climate transitions (LGM to Holocene and the warm period 42 KYBP to LGM) constant.”

This above sentence explicitly describes how the Vostok temperature data were used to generate these temperatures. The data for dust and greenhouse gas forcing were also taken directly from the Vostok core. Of course we recognise that CL08 did not use a single value for the *global temperature difference* in their calculation. Indeed, the three values used (for both intervals) are clearly presented in that paper. Our main criticism is rather that these three values were for each interval based on *single unrepresentative*

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data points from the Vostok core. It is easy to verify that the points used for dust and temperature must have been the extremal ones indicated on our Figure, and Professor Chylek also confirmed this directly by email several months ago.

It seems that we did not describe our calculations in sufficient detail in our manuscript, and we will expand this in the revision. In fact we used exactly the same methodology as CL08, adopting their three ratios of 50%, 45% and 40% for the global to local temperature difference. We could therefore replicate the original results of CL08 based on their selection of Vostok data points, but when different single data points were used as the basis for the calculation (as indicated in our Figure) the results are remarkably different with in particular the estimate for dust forcing being wholly incompatible with that obtained by the original calculation, even having the wrong sign. It is for this reason that we conclude that their analysis is unreliable. As a further check, we also tested the alternative of retaining the original global LGM-to-Holocene temperature differences of 4.1-5.1K which, with the different Vostok data points selected, implies a range of global to local temperature ratio of 48-64%. However, this barely affected the results. Of course we do not present these calculations as a serious attempt to estimate climate sensitivity, merely as a demonstration that the method is invalid.

Interactive comment on Clim. Past Discuss., 4, 1319, 2008.

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