**Climate
of the Past**
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Discussions

# Interactive comment on "Variability of sulfate signal in ice-core records based on five replicate cores" *by* E. Gautier et al.

E. Gautier et al.

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General comments

This paper by E. Gautier and co-authors presents an interesting study of local scale variability of sulfate records achieved in a low accumulation site (Dome C, Antarctica), in order to assess the representativeness of a single ice core record for such reconstruction. One of the main outcome of this study is an intra-site variability larger than the one reported in literature for inter-site studies for most of the largest volcanic eruptionsof the last 2 kyr. The most surprising result is the absence of the Tambora signature in 2/3 cores out of the 5 drilled and analysed in this work. The increasing

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interest in the last years in extracting information about climate forcing induced by volcanic eruptions recorded in ice cores makes this paper a good piece of science that deserves publication in "Climate of the Past" after few minor revisions.

From a methodological point of view, the authors use a new method with respect to recent literature to identify the volcanic spikes along each sulfate profile. The method is based on the calculation of a background non-volcanic level above which volcanic spikes are detected using a "moving window" in the depth profile. In my opinion it would be better to calculate the running mean in a constant temporal range (and not a constant depth range) but I think that to the purpose of this study it should not make a big difference in the obtained results.

–> We agree with the reviewer that a time window should be used in general to treat time series but on the field it was decided to use a constant depth window for simplicity (no datation was available at the time of the drilling) in selecting the ice core sections to be retrograded to France (for isotopic analysis). As mentioned by the reviewer, the difference between the two approaches should not produce a bias in the analysis, as one sample is equivalent to approx. 4 months for top and 7 months for bottom samples.

Minor comments. As concerning the Tambora eruption, in the text you write that 2 out of 5 cores don't show the sulfate peak while in the caption of figure 8 you write that 3 cores out of 5 don't show this signature. Correct the text according to what we can see from figure 8 (it seems to me that just 2 of the 5 cores show the sulfate peak and that there is no "intermediate" peak as written in the text).

–> The correct statement is that 2 cores out of 5 do not show the sulphate peak. The caption of the figure 8 is corrected accordingly. The peak was detected in core 1, 4 and 5, with peaks of 455, 188 and 307 ppb respectively. Even if the peak in core 4 is not obvious in figure 8 (especially compared with the high concentrations in core 1), it was detected by the algorithm.

P. 3985 line 19 and following : : :.Change "Maximums" in maxima.

–> Thank you, the correction was made.

It would be interesting to have a new table 2 showing two more columns: the mean volcanic flux and the corresponding SD; this would allow a direct comparison with the fluxes and uncertainties calculated in other papers dealing with this topic.

–> That is right, these two columns are added in the revised version, caption is modified accordingly. We also added Castellano's data for similar volcanic peaks, (Castellano et al., 2005) for comparison.

There is no mention in the paper to the uncertainty of the IC measurements, but I believe that part of the differences in the maximum concentration of sulfate when a volcanic event is detected can be ascribed to the error associated to the measurement.

–> The uncertainty (relative standard deviation) of the IC measurement is below 4%, (based on standards runs). Therefore the uncertainty associated with the quantification represents only a small portion of the variability recorded and commented below.

Can you give an estimate of how big is this uncertainty with respect to the "real" uncertainty in the amount of sulfate deposition?

–> The relative error on the flux (estimated as 10%) takes into account the IC measurement relative standard deviation (below 4% based on standards runs), the error on firn density (relative error estimated as 2%) and the error on samples time length (10%) (Information added in table 2 caption).

For future works it would be important to know a few details of the sampling site (i.e. the approx. distance of the 5 cores from the FIRETRACC ice core and, above all, from the EDC96 and EDC99 drilling sites).

–> The drilling site was located between Concordia station and EDC drilling tent, 300m west of the EDC drilling tent, the information is now added in the text.

P.3990 line 8. Check the reference Sigl et al. that seems to be not correct.

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–> Right, thank you, the correction was made.

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