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Climate of the Past Discussions

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

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Interactive comment on "Variability of sulfate signal in ice-core records based on five replicate cores" by E. Gautier et al. EW Wolff (Editor) ew428@cam.ac.uk Received and published: 27 October 2015

Page 3980, line 6. If a peak has to pass the threshold in 3 consecutive points that means it has to be most probably 6 cm wide. At the bottom (of the studied section this would mean the peak must span more than 2 years. Such a threshold is likley to exclude some genuine peaks. Please comment on this. I wonder also if some of the cases where you see a peak in only 2,3,or 4 of the cores are ones whwere a peak is present but not across 3 samples. While this is technically a "no peak detected" it is

probably not what the reader imagines when they read this. Please comment.

–> This choice of 3 consecutive data points is a compromise to avoid detecting noises instead of volcanic peaks. Volcanic peaks detected in ice cores tend to be wider than expected if a typical 1-3 years-long fallout is considered, especially at high depth (Wolff et al. 2005). The widening has been attributed to diffusional effects on sulfate in the ice, by Barnes et al. (2003). Following their assessment, Castellano et al. (2004) estimated that the peak broadening during the holocene was close to 2 cm. In the bottom of the core, 6 cm wide represents more than two years, but considering the typical fallout time as well as the peak widening, it seems improbable that a volcanic eruption will be imprinted in less than 3 consecutive data points for any of the 5 cores. . Regarding the second comment, the algorithm disregards peaks not made of 3 consecutive samples in any given ice core. These "sharp" peaks are simply no treated and not retained. It is therefore possible that a volcanic peak is found in less than 5 cores because of such selection criteria. However, for both comments above, the reader should understand that to build a more reliable volcanic record, peaks shape must also be considered. As a result, after the algorithm treatment, the last step is a visual inspection across all the profiles. For the sake of the objectivity of the statistical assessment, no visual sorting was applied in the present paper. In the main text it is now clearly mentioned that a final visual inspection must be performed to build a more accomplished volcanic record, also based on peaks shape.

I found the mathematical description from lines 3-12 very hard to follow. Could you also explain it in simpler terms.

–> We agree with this comment and have simplified the text as follows, which summarizes the procedure with the same rigor as the discussion paper : After correcting the depth shift between cores, a composite profile was built by summing all the peaks identified in the 5 cores. In this composite, sulfate peaks from different cores are associated to a same event as soon as their respective depth (corresponding to the maximum concentration) are included in a 20cm depth window. This level of tolerance is consistent

with the dispersion in width and shape of peaks observed. A number of occurrences is then attributed to each sulfate peak, reflecting the number of time it has been detected in the 5 cores dataset (Figure 4).

Fig 3. These are both examples where the peak is seen in all cores. I would like also to see some examples where the peak is only seen in fewer cores. I know there is one in Fig 8 but I suggest to expand Fig 3 to include 2 such events.

–> We agree with this comment, the figure 3 was modified as illustrated in fig.1 of this answer.

Fig 4 and elsewhere. I am not sure I know how you made the average when the peak is, for example, seen only in 3 cores. Is the value shown for sulfate the sum of peak heights divided by 3 or by 5? Or is it something different?

–> If detected in 3 cores, the sum is divided by 3. The average is calculated on detected peaks. The paper first comments the fact that peaks are not always detected, and that even when they are, there is still a variability in sulfate concentration. (Table 2 caption was modified accordingly)

Interactive comment on Clim. Past Discuss., 11, 3973, 2015.

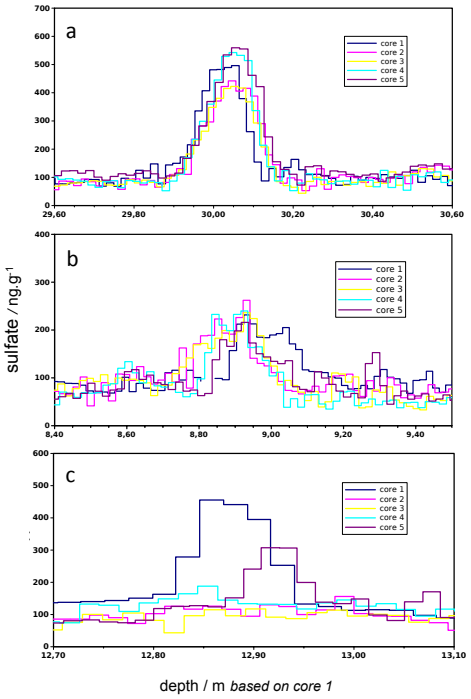

Fig. 1. New figure 3