Review in normal type, response in *italic*:

The manuscript presents a 200 ka long volcanic record based on a detailed sulfate record from the Antarctic EDC ice core. To my knowledge, it is the first time a continuous volcanic ice-core record of this duration and quality is being published. Despite being based on a single ice core, the record is very valuable, as it provides a homogeneous, long-term record of major global volcanism. The authors are convincingly demonstrating from sulfur isotopic measurements that the majority of the large sulfate spikes in the record have been injected into the stratosphere and thus have a global impact. Furthermore, the peak shape of the sulfate spikes in the ice core record is fairly 'well preserved' as the diffusion of the sulfate ions in the ice is almost compensated by annual layer thickness thinning. The record is most valuable for better estimating the frequency and magnitude of past volcanism as well as for better assessing the likelihood of major volcanic eruptions in the future. The paper is well written, well referenced and clearly illustrated with figures.

I have just a few suggestion for the authors to consider:

The authors do a comparison to well-known, recent, low-latitude volcanic eruptions to make an estimate of the VEI-sulfate deposition relationship (Table 1). Then they move on to discuss the dependence of latitude of the eruptions for the magnitude of the sulfate deposition in Antarctica/EDC. For reference, it may also be relevant to provide an example of a well-known NH high-latitude eruption such as the Okmok 44 BC eruption, if it has an imprint I EDC? Alternatively, a large Icelandic eruption? Or a statement that none of the well-known NH high-latitude eruption can be detected in the EDC record. An example of the imprint of a 'local' Antarctic eruption would also be illustrative. What about a large eruption from Mt Berlin, Mount Moulton, or Mount Takahe? In particular, if one of the larger peaks in the EDC record were related to local volcanism, it would be good to mention, as an analogy to the Icelandic volcanic imprint in Greenland?

Thank you for this suggestion. The intention of the table was only to give an approximate idea of how sulfate deposited at Dome C scales with size (in terms of magnitude of eruption and estimated emissions) for the tropical eruptions that probably dominate the record. As you suggest, it can already be seen from Sigl (2013) that the eruptions that show up very strongly in Greenland but that originate from high latitude (such as Laki) are not identified above background in Antarctica. The eruption at 44 BCE, recently identified by McConnell et al (2020) as Okmok, is identified in Antarctica by Sigl (2013), but as having a relatively small deposition flux to Antarctica. We will add paragraph to the text to give this context. Proposed added text:

"It was already noted (Sigl et al., 2013; Sigl et al., 2015) that most Icelandic eruptions (such as Laki in 1783 CE and Eldgja in 939 CE) that give large depositions in Greenland cannot be identified in Antarctic cores. Furthermore, these eruptions are estimated to be below the magnitude we would associate with depositions above our chosen threshold of 20 mg m^{-2}. An eruption at 44 BCE, which is prominent in Greenland records, was recently identified with the Alaskan Okmok eruption (McConnell et al., 2020), which has been assigned a magnitude of 6.7. The most likely candidate for this eruption in our EDC record has a deposition of 15 mg m^{-2}, identical to the value previously noted for this eruption in Antarctica (Sigl et al., 2015). It is therefore likely that for eruptions at high northern latitudes our threshold is closer to M>7."

In the case of Antarctic volcanoes the only case we are aware of where an identified Antarctic volcano has been identified in the chemistry (as opposed to the tephra) record is the 17.7 ka extended period of volcanism identified as Takahe by McConnell et al (2017). While this eruption has been identified in the fluoride record from EPICA Dome C, none of the sulfate peaks within the period of high fluoride exceed our threshold. We do not think it helps the narrative to discuss this in the text.

It is quite remarkable, that one of the largest known volcanic eruptions of the last glacial cycle, the Oruanui, Taupo, eruption occurring close to 25.5 ka, is not pronounced in Fig. 5. This eruption that is identified with tephra in the WD ice core (Dunbar et al., 2017) and that is associated with very large sulfate deposition in both WD and EDML is classified as a VEI-8 eruption. How come that this very large SH eruption only leaves a weak sulfate imprint in EDC? Likewise, the largest spike in Fig. 6 occurring around 45 ka is much less pronounced in both the EDML and WD ice cores (Lin et al., 2022) questioning its significance.

Yes, you are emphasising the point that we also make, that the deposition at a single site for a single eruption is not a reliable indicator of the sulfate loading. This point was well-made in the spatial studies carried out at Dome C (e.g. Gautier et al., 2016), and indeed is shown for Oranui in the supplementary tables of Lin et al (2022) who cite a value of only 7 kg km^{-2} for Oranui at EDC (though there is a peak just above 20 kg km^{-2} within 50 cm of that which might more likely be the Oranui peak in EDC).

With this in mind, the question is how representative the EDC sulfate record is in terms of quantifying global volcanism. For example, I am not convinced that we based on the EDC sulfate record alone can conclude that the Toba 74 ka eruption was not (among) the most significant volcanic climate forcing events of the investigated period, just because it does not show up among the largest spikes in this record. As the authors mention, the sulfate signal of individual eruptions in a single core is subject to great uncertainty.

You are right to question the level of certainty in our statement about Toba. Proposed revised text:

"This raises questions as to whether, in terms of global dispersion of sulfate aerosol, Toba was the most significant volcanic climate forcing event of the past 200 kyr. However additional data from other deep ice cores covering this time period are needed to determine this more certainly."

Clearly, the authors have no direct way to work around this issue, but it illustrates the need to obtain multiple long-term volcanic records from Antarctica. The Dome Fuji ice core or the Vostok ice core should be good candidates for providing additional information about large volcanic eruptions on this time scale. Could also be that the EDC sulfur isotopic results could provide some additional information?

The S isotope data for these events has of course been explored in some detail by Crick et al (2021). There is no clear way to derive magnitude of S emissions from those data at present however.

Figure 8 is very interesting. It is good to know that the majority of the large sulfate spikes we see in the EDC sulfate record are associated with large global/stratospheric volcanic eruptions. We are, however, not being provided with much interpretation of the D33S parameter, except that it is a stratospheric injection indicator. Does it mean anything if the parameter is positive or negative? Does the amplitude of the signal have any significance? There seems to be a few extreme values at around 74 ka and 80 ka. Are those related to specific events? I hope we will learn more are about the interpretation of this dataset, if not in the present MS then in a future publication?

Indeed these data will be discussed in more detail in a paper in preparation. However we agree we have been too hasty in our description of the S isotope data, so we will add this proposed text:

"Mass-independent fractionation of S occurs when sulfur dioxide is oxidised above the ozone layer, producing positive values of $\Delta^{33}S$, followed by (for reasons of mass balance) negative values, so that non-zero values of either sign indicate material that has reached the stratosphere."

Minor comments:

In the introduction, DEP and ECM are mentioned, but what about the use of liquid conductivity or acidity profiles as indicators of volcanism in ice cores?

Acidity itself is challenging to measure in the ice, so has not been used in a routine way. We agree that in some cores liquid conductivity, though less specific for acid than the solid methods, could be used to identify volcanic peaks but we do not feel that its use is so widespread (or desirable) that we should add it here.

Would it be possible to include the EDC isotope curve in Fig. 5. to make a reference to climate?

This is a nice suggestion. We will do this. Proposed new caption:

"Figure 5. The deposition flux of sulfate for events with deposition more than 20 mg m^{-2} over the last 200 kyr (blue, left axis). Antarctic δD is shown in red (right axis) to indicate the climatic context.."

Proposed new figure: