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Atmospheric Chemistry and Physics Discussions

Interactive comment on "African volcanic emissions influencing atmospheric aerosol particles over the Amazon rain forest" *by* Jorge Saturno et al.

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General comments

The paper presents an interesting novel dataset of atmospheric measurements from the Amazon rain forest, combining ground-based measurements from a long-term monitoring station and airborne measurements from a research aircraft campaign. The paper also presents results from the OMI satellite and air mass trajectory modelling. The main conclusion is that the enhanced sulphate observed over the Amazon rain forest is sourced from two active volcanoes in Central Africa ∼10.000 km away. In my opinion, while the dataset is good, the main conclusion is not sufficiently well supported

by it. The reasons for this are outlined in Specific comments. The manuscript is well written, easy to follow, and the figures are generally well made with few relatively minor exceptions (see Technical comments)

Specific comments

1. Source of SO2: The Nyamuragira & Nyiragongo volcanoes are concluded to be the source of the observed sulphate due to their supposedly high SO2 flux. However, it isn't mentioned anywhere in the manuscript how much SO2 they actually emit. It is only mentioned that the emission is either 'high' or 'enhanced' during certain time periods. Therefore it is very hard to judge whether it is credible that these volcanoes emit enough SO2 for the plume to be detectable ∼10.000 km away. This is a problem that is easily fixed but it undermined the credibility of the conclusions, as it did not demonstrate that the authors investigated a very basic source term.

2. Trajectory modelling: There are no direct observations to show that the plume from the Nyamuragira & Nyiragongo volcanoes reaches the monitoring station in the Amazon. The SO2 plume can only be traced by OMI as far as the mid-Atlantic. This is understandable because SO2 eventually becomes too dilute or completely converted into sulphate and therefore undetectable by OMI. Therefore, the conclusion that the volcanic emissions from these two volcanoes can reach the Amazon monitoring station is based on forward- and backward trajectory modelling by HYSPLIT. The following comment is made with the caveat that I am not a modelling specialist, but to me the trajectories do not look sufficiently convincing. For example, the modelled source for the most accurate of the backward trajectories is ∼2000 km away from the actual position of the volcanoes (Fig S6). Therefore I was left unconvinced that Nyamuragira & Nyiragongo emissions can reach the Amazon. Could the authors strengthen their results with e.g. other types of models, or by improving the performance of HYSPLIT?

3. Direct observations: In addition to the trajectory modelling the main conclusion is based on ground- and aircraft measurements that show enhanced sulphate over the

Amazon. While I think the data show convincingly that the sulphate was indeed enhanced, the conclusion that it comes from Nyamuragira & Nyiragongo needs more data behind it. The conclusion is based on a very short time period, approx. 5 September – 10 October 2014, within which there is apparently only one volcanic-sulphate event (21 Sept – 1 Oct). This is essentially one data point. Considering the extremely large distances between source and measurement locations, and the high degree of uncertainty in the trajectory modelling it would have been better to consider a much longer time series so that we can be convinced that these sulphate-enhancement events can be repeatedly traced to Nyamuragira & Nyiragongo volcanoes. It wasn't clear to me why this wasn't done already, as the monitoring station has been in operation since 2012. Nyamuragira has been degassing strongly since 2012 (e.g. Campion, R. (2014), New lava lake at Nyamuragira volcano revealed by combined ASTER and OMI SO2 measurements, Geophys. Res. Lett., 41, 7485–7492, doi:10.1002/2014GL061808) so I suggest the authors consider looking further back in time and try to identify more than one volcanic-sulphate event.

4. I would like to see more in-depth discussion about why the observed sulphate is conclusively of volcanic origin.

Technical comments

Added as notes to the pdf file.

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2017-1152/acp-2017-1152-RC1-supplement.pdf

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