

Interactive comment on “Equatorward dispersion of high-latitude volcanic plume and its relation to the Asian summer monsoon: a case study of the Sarychev eruption in 2009” by Xue Wu et al.

Anonymous Referee #3

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Fundamentally, this paper is about transport of a small amount of Sarychev aerosol into the tropics in the summer of 2009. This is not a new result, and that there is an anticyclone over the Asian summer monsoon that could have provided the circulation that did this, but would not do so in winter, is also quite obvious and well-known. I cannot understand the units the authors use. 4% of what? Of what parcels? And is this small amount significant? What is the error associated with the calculation of this number? If more than 95% of the aerosols did NOT go to the tropics, isn't that the conventional standard to prove that they did not go to the tropics?

In other words, what is the error bar on this 4%? What is the mass of aerosols that

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went into the tropics? What difference did they make for the radiative forcing and for the climate response? How important was it? The discussion on p. 9 is confusing. The authors claim that there was 0.07 Tg S added, but to what? And they claim that there is a 4-7% annual increase, but of what and where? They spelled Hofmann wrong. And clearly this value is not a long-term amount, and Hofmann et al. measured it for a short period of time and a different period than Sarychev.

The paper has a large number of errors and confusing statements. And I am not sure the results are new or interesting. I recommend that the paper either be rejected or sent back to the authors for major revision, clearing up all these issues.

In section 4.2 there are many results about the circulation presented, but the authors never say where they got the data and how they did the calculations. What models or reanalyses were used. The technique of using parcels and trajectories is also quite confusing and not clearly explained.

The authors should use continuous numbering of lines for the entire, and number every one. It is much harder for the reviewer to use page number and line number, and count the numbers and scroll to the top or bottom of the page to find out which line. This annoys reviewers. Make it easier for them!

p. 3, lines 27-28: Emission rates of what? I don't understand how you can use measurements of upper tropospheric SO₂ to measure emission rates of SO₂ from a volcanic eruption. You have to know what is happening at the volcanic vent, and sample it more often than once or twice a day. And the units in the figure do not make sense to me. You have to explain this.

Even though the emission calculation is explained at the top of p. 5, I do not understand. You have fixed the number of parcels at 100,000 in each column. So how can the number be proportional to the SO₂ amount?

The authors seem to confuse emission and injection. Emission is from the volcanic

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vent. Injection is where the emissions end up in the atmosphere. The way the paper is written, discussion of emissions and emission rates is very confusing.

There are a number of acronyms that are never defined, like UTLS, TTL, and AIRS.

The paper mixes UK and US spelling. Choose one and use it consistently.

The references are not in alphabetical order.

I do not understand Fig. 2. How can there be emissions of SO₂ in the stratosphere? And I also do not understand the units used for emission.

The figures have many errors, with missing sources of the data, missing units, and confusing labeling. See the comments on the attached annotated manuscript.

For example, for Fig. 10 since the unit is % for many figures, yet the shading goes from 0 to 0.007, does this mean all the numbers are « 0.01 %. This is such a small number, why is it even given?

For Fig. 10 and in section 4.2, the data are “above 400 K.” What does this mean? There is no temperature above 400 K in the atmosphere. Is this potential temperature? Is it values of potential temperature above 400 K? Is it altitude above the 400 K potential temperature level? The authors have to be very clear with what they mean.

There are multiple English errors.

Please address all of the 101 comments in the attached annotated manuscript.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/acp-2017-425/acp-2017-425-RC3-supplement.pdf>

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-425>, 2017.