

Interactive comment on “Direct observations of the atmospheric processing of Asian mineral dust” by R. C. Sullivan et al.

Anonymous Referee #1

Received and published: 11 July 2006

General remarks:

This is an interesting paper paper giving an in-depth analysis of the ship-born measurements performed during ACE-Asia.

Observations of single particles indicate different regimes for the mixing of nitrate, chloride, ammonium, and sulphate with dust. After leaving the continent sulfate particles seem to be more internally mixed with dust than assumed in many analyses. New is also the demonstration of mixing of ammonium/sec acids with dust.

The analysis of mineralogical composition going along with preference for sulphate or nitrate may be useful; but should not be overinterpreted, because there may as well be a meteorological explanation working together with emissions from different source

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regions that can explain certain combinations of anorganic components with dust.

Likewise, I see several spots in the papers, that present fairly likely explanations for the observed mixing state but it could be more accompanied with some healthy doubts.

Overall I enjoyed reading the paper, and its extensive overview of the literature. However the vast number of citations is perhaps excessive. 7 pages out of 31 is too many for an original work I suggest to focus on the important ones.

The material is very rich. On the other hand the manuscript is very lengthy and the discussion detailed, and it is fairly hard to keep track of the story. The storyline should be a bit clearer. Now it is difficult for the reader to follow it and get the 'juice' out of the text.

I recommend to try to move some parts to an Appendix to improve readability. I think it would be good if each section could finish with a phrase stating what was concluded from this section; and then placing it in the context in the conclusions section.

I would also propose to have a section (4.6 or in 5): How do our measurements challenge current parameterisations in models?

E.g. models predict more external mixture of sulfate with dust than seen in these measurements.

Do your measurements indicate that models should use thermodynamic partitioning with dust just as a carrier material?

Detailed comments:

Figure 1: Showing an average mass spectrum of all dust particles does not make much sense in the context of this article, where you focus and work out different types of dust particles that underwent different reactions in the atmosphere. Replace this figure with one or two (average) mass spectra of different types of dust, or leave it out completely.

p. 4110 Discussion NO_y,g and volcanic SO₂. Why so much attention in abstract and

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relatively little in manuscript

p. 4127 hard to distill what exactly is concluded from this

p. 4123 A table summarizing all the statistics would help.

p. 4132 I think we should not exclude the possibility that a certain amount of SO_4 was already present in the source region as gypsum.

p. 4133 I.6 Diffusion limited? This seems hard to believe. What is the reference for this? It would imply a very high gamma value, is that measured?

P. 4114, line 1: Why is this reference made in a footnote and not in the reference list? Look also at the footnote indication on successive references to this planned paper, e.g. P. 4135, l. 15.

P. 4115, l. 23 ff.: Reference is made to ATOFMS experiments producing reference mass spectra from dust directly taken from Asian desert regions, but no such mass spectrum is shown in a figure. To make the story with atmospherically changed dust particles more convincing, it would be better to include at least one (average) dust mass spectrum from one source to this article. And if an article describing those mass spectra exists, it should be cited here.

P. 4118, paragraph 3.2.: The description and explanation of 'filtering the mass spectra' to only evaluate dust particles belongs to paragraph 2, 'methods and instrumentation'. Then the reader also understands what is meant with 'filtered mineral dust particles' on p. 4116, l.3

P. 4116, l. 10 ff: This statement can certainly not be drawn just from looking at the average over all mass spectra taken as shown in figure 1. Restate this.

P. 4116, l. 27: CO_3^{2-} would show up at $m/z = -30$ and thus not interfere with SiO_2^- , etc. Make your statement clearer.

P. 4118, l. 2; p. 4125, l. 8; p. 4126, l. 2; p. 4129 l. 9: On several occasions, references

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to results are made that are 'not shown'. It not elusive to include such 'results' to an article. Either present or make a reference to these results or leave them out!

P. 4118, I. 23: Explain this >5000 criterion a bit more precisely. Such criterions are used later as well and it would be illuminative for the reader to understand this criterion. Suggestion: As it is a peak area, maybe state the minimum value needed to be considered as a peak and the maximum value for a (highly) saturated peak.

P. 4123, I. 4 ff: Make it clearer why you didn't use the method presented in this paper in the Arimoto 2006 paper. Otherwise it is quite confusing why your team presents different findings on the same topic, especially within such a short time.

P. 4126, I. 12: How can you draw that conclusion from an average mass spectrum? A mass spectrum with NH_4 and dust only will definitely be disguised in the average mass spectrum. This is actually the feature of averaging. Restate this!

P. 4130, I. 25ff: It's misleading to talk about "first report " and in the very next sentence "these results were presented ". State clearly what makes them first as compared to the previously published results!

P. 4131, I. 24ff: The comparison of soot and mineral dust behaviour is very speculative! You might want to consider taking this out.

P. 4144, I.27: Update the citation with reference to the article!

P. 4158, table 1: Explain >5000 in the table or leave it out. What this means must be clear without reading the whole article.

P. 4160, F. 1: What's a "digital mass spectrum"? Rephrase and explain what you want to say!

P. 4160, F. 1: What are the other mass peaks in this spectrum; especially $m/z = 8, 9, \dots$ Instrument noise, ?

P. 4163, F. 4a: the 3 scatter plots are too small to be read on a printout. Furthermore,

they don't give additional insight to the ternary plot, so leave them out.

P. 4166, F. 6: The insets are not recognisable on a printout! Enlarge them or leave them out.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 4109, 2006.

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