

Interactive comment on “Limited production of sulfate and nitrate on front-associated dust storm particles moving from desert to distant populated areas in northwestern China” by Feng Wu et al.

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The authors have made a handful of bulk aerosol composition measurements near-source and downwind (urban) of dust storms, separated by several days. (The transit time of airmasses between the sites would be about 6 hours.) They use concentration- and elemental ratio-differences between these locations to infer the formation or uptake of nitrate and sulfate with time.

They undertake a kind of Lagrangian analysis, as if the desert dust they first sampled had moved to Xian by the time they sampled there. (It had in fact moved past the downwind sampling site several days earlier.) The increase in the NO_3/Ca ratio, in particular, is used to infer a nitrate formation or uptake rate. To compute a trend,

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one would need more samples and time-coordinated sampling. The uncertainty in the representativeness of the samples is at least as large as the apparent observed upwind/downwind differences. The high natural levels of sulfate in the dust (12%) no doubt vary, adding uncertainty to the inference of a trend.

There also aren't enough pieces of data to compute a defensible rate of ion formation on the dust. The experiment was poorly-posed to do so. Since only two sites were involved, it is impossible to infer nitrate increase over the desert vs nitrate picked up upon the dust's arrival in the urban area, based on their observations.

Line 22, Section 2: Here they argue that there should be no pollution in the samples, but in the Conclusions they suggest otherwise; indeed one cannot sample in an urban area and expect to avoid all pollution.

Typo: there is no April 31st.

Lines 12-13, P 5: Even though I have not seen the supplementary figures, I would in principal disagree that the changes in dust particles during transport would be the same for each event. That would need to be shown.

Lines 20-25, page 7: This is one of the fundamental problems with trying to interpret this data. They have no way to distinguish between sulfate from pollution and sulfate in the soil/dust itself.

Page 9, lines 19-21: "...very different from the conclusions of this study." What evidence is there that this study's "enhanced" (for purposes of discussion) nitrate was collected in transit vs from the populated area near the sampler? I believe this study's Conclusions are unsupported.

Page 9, line 30-31: Yes, prefrontal air is much more polluted than postfrontal air. But that doesn't prove that the postfrontal air is free of contamination. The postfrontal air is still moving across a landscape containing sources, especially near the sampling site in Xian. How rapidly would urban nitrate be formed, relative to the sampling interval in

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the postfrontal air?

Furthermore, since there was only bulk sampling we don't know for sure that all the nitrate was even on the coarse (dust) mode. Their observations are simply too few and too limited in type to advance our understanding of the uptake of sulfate and nitrate by desert dust.

Page 10, line 4: Briefly explain "Peak 1" or don't mention it.

I really like most of the discussion on page 10, which addresses a way of identifying urban vs desert influences on dust composition using trace metals. Unfortunately this study only measured Ca, which is present in both desert and urban dust, so their conclusions can't benefit from this discussion.

For the reasons above, I recommend this paper be declined.

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