

Interactive comment on “Particle size traces modern Saharan dust transport and deposition across the equatorial North Atlantic” by Michèle van der Does et al.

J. Schwarz (Editor)

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Dear Dr. Van der Does and co-authors -

Thank you for your detailed response to the reviewers, and your improved manuscript. As you point out in the response, this manuscript represents a marriage across disciplines. Given that ACP is focused on the atmospheric issues addressed here, my sense is that a little bit more concession to the target community is called for.

For example, the widely raised question from the reviewers about potential biological sources of the lithogenic particles; I imagine that they were thinking (as I did) of the marine organisms that contribute their shells to limestone in the form of calcium car-

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bonate. Could you more directly address this issue?

Other basic questions are still focused on the transport of dust from the surface downwards. Simple calculations of particle sedimentation rates (in the absence of any water currents) indicates that the short transport time between the 1200 m and 3500 m traps cannot be explained simply by particle setting. For example, for a 10 μm particle of density 2700 kg/m^3 , a distance of only ~ 200 m would be traversed in a \sim few weeks. Since 10 μm is close to the mass-modal diameter, it's clear that something else must be going on. Hence the interest in currents, I imagine, which the atmospheric community does not have any intuition about. Adding information about the rate and direction of currents will be very helpful. This is also relevant to the apparent discontinuity in results at the lower traps and at the ocean floor; why would transport be very speedy from 1200 m to 3000m, but then essentially disappear in the lowest 1 - 2 km?

Addressing these questions will help the atmospheric community contextualize the potential scale of any assumptions and uncertainties, and will help it grasp the significance of this manuscript as a step in achieving closure between atmospheric transport of mineral dust, and its removal from the atmosphere by dry and wet deposition.

As I had some concern that some portions of the reviewers' comments may not have been fully considered (these are the questions I reformed here; perhaps I am mistaken!), I have asked them, also, to comment on the response.

Thank you very much for working through this review process with ACPD; I have high expectations for the value of your technique and findings to contribute meaningfully to understanding and quantifying total and size-dependent dust transport and removal from the atmosphere.

PS - Minor additional comments:

It would be helpful to use clearer wording to describe the size distribution information throughout the paper. I found myself repeatedly questioning whether number or mass

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average values were being presented. For example, in the caption of Figure 3, the “average modal grain size” is presented. I think this is the average modal-mass grain size ? ; in Figure 4 the caption is for “average grain-size distributions” , but these represent average grain-volume distributions? Page 19 ,lines 3-7 : “. . .with modal particle diameters ranging. . .” could perhaps be more clearly stated “. . . with mass-modal particle diameters ranging. . .”? And so on.

On Figure 4, I'd also suggest a clarification of the vertical axis legend. As it looks like the width of the bins of the histogram are not one size in linear space, but one size in log-space, it is standard practice in the atmospheric community to specify the volume fraction as scaled by the log-space bin width ($dV/d\log(D)$, the differential volume per horizontal step in log space). I imagine that this is what is shown already.

Finally, my own elementary question reflecting lack of familiarity with your water-centric techniques: are the sampling volumes closed when not sampling/during recovery? Is there any chance that some vials sampled substantially longer times than others? If these are non-issues, that will be helpful to know.

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