

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

Anonymous Referee #3

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van der Does et al. present observations of what is thought to be Saharan dust along the trans-Atlantic transport pathway over the course of roughly a year. Their observations cover a wide lateral range across the Atlantic Ocean and demonstrate the decrease in particle size with increasing distance from the source. Additionally the paper is well written. Although these observations are interesting and worthy of representation in the literature, there are a few major concerns I express in the below review that should be addressed prior to final publication.

Major concerns

The assumption that the particles collected in the traps are all mineral dust from the Sahara seems like an over-interpretation of the results. First, there could still be inter-

ference from biological particles. The authors did carryout chemical degradation and deactivation techniques to denature biological constituents. However, these types of methods do not remove all of the viable cells; they simply kill them off while leaving behind a particle. They do not completely disintegrate under these methods. How did the authors account for leftover, dead cells or biological particles such as pollen or marine microorganisms, which can easily fall within the size range of what was measured? Second, there could also be contribution from sea salt particles or non-viable organic material from the ocean surface microlayer. How did the authors eliminate these other types of particles as potential candidates for what was sized? Third, the dearth of chemical or mineralogical analysis also forces me to question the conclusion that most of what was observed was dust. This could easily alleviate the issue by imaging and/or determining the composition of the particles in the samples. The authors do show one image of a dust particle, but was this conducted for all samples and multiple particles per sample? Maybe SEM/EDX, XRF, and/or XRD were conducted? Surely it may be too late to conduct such analyses, and if the authors decide to proceed with publication with the current methods only, should very clearly state the assumptions made regarding what the particles are and perhaps provide more background from previous work demonstrating dust observations in the Atlantic Ocean to support their assumptions. As a suggestion, it might be beneficial to look at salinity and surface chlorophyll concentrations of the domain over which the particles were transported to show possible sources of particles other than dust (or partially eliminate these as contributing sources).

How representative are the lower and sea floor traps of the observations of particle deposition and sedimentation during the study time period? Especially the sea floor, could these particles result from years of sedimentation and ocean circulation/currents introducing particles from all over the ocean system? It seems as if the ocean floor would be even more of a hodgepodge of all types of particles; this is where some sort of compositional information on the particles in the samples would be useful. Along these lines, I am not convinced that the smaller particles observed on the sea floor are



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simply due to the fact that larger particle emission has occurred over time based on the methodology and observations presented.

Although it is generally understood that the SAL is transported westward over the Atlantic, the authors draw many conclusions of the seasonal altitude dependence of air mass transport and at only one trap location (M1). What would strengthen the argument regarding the impact of transport conditions and seasonal climate patterns on particle deposition/size is an ensemble or cluster analysis of HYSPLIT trajectories. The authors do state, "However, backward trajectories calculated over the entire sampling period do not suggest this..." which indicates that more trajectories were simulated. It would be helpful to show these to clearly show the seasonal variability. It would also be useful to conduct HYSPLIT analyses at all of the trap locations to better connect the sites and perhaps show that transport over the trap farthest from Africa does not experience as much transport as the trap closest.

General comments

The figures present data from a number of sources (i.e., MODIS and particle imaging). Although the captions to these figures briefly describe these data sources, they should be more comprehensively described in the methods section. As an example, what instrument was used to image the particles? How many images were acquired? Was this conducted for all samples? With respect to MODIS, provide at the very least a brief description of the satellite and how the data were acquired. For the precipitation, was this acquired from TRMM? Over what domain?

Specific comments

Page 2, line 19: Most people know what CALIPSO is, but do define the acronym.

Page 9, line 23: Only sand can be this size? What about large minerals? This seems like a vague definition without any measurements of the mineralogy.

