

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

Michèlle van der Does et al.

mdoes@nioz.nl

Received and published: 18 May 2016

Dear Andrew Sayer,

Thank you for your interest in our paper and your comments. We hope we answered your questions adequately.

1. The term "grain size" is used in multiple places. I was wondering how specifically the "size" is defined? Length of longest axis, diameter or radius of an equivalent spherical particle, something else? I did not spot that in the paper.

The particle sizes were determined with a Beckmann-Coulter laser particle sizer LS13320 and are expressed as equivalent-sphere diameter. The grain-size distribu-

C1

tions are determined by the volume percentage of equivalent spherical particles of that size. Particle-size distributions consist of 92 logarithmic size bins, ranging from 0.375 to 2000 μm .

2. If I understand correctly, these grains were all recovered from moored traps within the sea itself at various depths. How closely are these expected to correspond to the size distribution of the dust in the atmosphere and falling on the surface? The paper (e.g. Figure 8) suggests that between the upper and lower sampling depth, there can be a difference of order a micron or so between modal sizes. Are the upper traps thought to be representative of dust in the atmosphere?

The samples from the sediment traps are indeed thought to be representative of dust travelling through- and settling from the atmosphere. We compared the dust from the traps to dust sampled from the air on filters with dust-collectors onboard ships during our research cruises, and these showed to be very similar to what we collect in the sediment traps and on the ocean seafloor. During one of these cruises (in 2015) we were very lucky to sail right through a dust event. Grain sizes from this event appeared smaller than what we found in the traps. However, this may also be the result of the fact that the dust sampled with these onboard dust-collectors is a relatively short snapshot in time (~ 24 hour sample), compared to the relatively longer sampling interval of the sediment traps (2-3 weeks). In addition, we added floating dust-collectors to the transect, at stations M3 and M4. These buoys collect dust on filters on a rotating carousel similar to the sediment traps, sampling suspended dust directly from the atmosphere. We obtained the first successful filters from these buoys last month, but have not analyzed these yet. However, accumulative samples (1 year) of a passive air sampler (MWAC-sampler, see e.g., Goossens et al., 2000) attached to the buoys shows almost identical grain-size distributions to the sediment trap samples below, confirming again that the dust we find in the sediment traps is representative of the atmospheric dust.

3. When calculating optical properties, due to the complex shapes of mineral dust grains, we typically model them as mixtures of ellipsoids of various sizes and with a dis-

C2

tribution of different particle aspect ratios. The shape affects their scattering/absorption properties. I was wondering if you had any done any analyses of the particle shapes as well as the sizes?

Particle-shape analysis was performed on other samples previously, but not yet for these samples. The analyses were done using a Sympatec QicPic, which works with a (2D) image analysis method and primarily measures the contour of a particle. The samples analyzed were from short sediment cores (multi-core sampler), recovered at the same stations M1-M5 of the transect. The the top centimeter was analyzed at every station, which showed the highest aspect ratio (highest symmetry of the particle) for the sediment at M1, closest to the African source, which was also the coarsest sample. The samples from M2-M5 showed lower, but similar to each other, aspect ratios. This could mean that close to the source, more (and more symmetrical) quartz particles are deposited, and at greater distances platy (clay) minerals with low symmetry are deposited. From the grain-size distributions as shown in the paper we could already see that more platy mica particles are deposited predominantly in spring. Furthermore, within each of the seafloor samples, it showed that the coarser particles have a lower aspect ratio than smaller particles, meaning that larger particles are less symmetrical than smaller particles.

With kind regards, Michèlle van der Does and co-authors

Cited reference Goossens, D., Offer, Z., London, G., 2000. Wind tunnel and field calibration of five aeolian sand traps. *Geomorphology* 35, 233-252.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-344, 2016.