

Interactive comment on “Size resolved dust emission fluxes measured in Niger during 3 dust storms of the AMMA experiment” by M. Sow et al.

M. Sow et al.

sowmomo2003@yahoo.fr

Received and published: 9 March 2009

First we would like to thank the Reviewer for his useful comments that will help us improve our paper. Our answers to his specific concerns are the following:

1) ‘The residence time of particles of 20 μm is about 1 day. Only particles smaller than 3 μm could be suspended for several days and transported very far from their source’

It is true that the theory of transport (and deposition) implies that the farther away from the source, the less coarse particles must be observed. However, our own data (Rajot et al. 2008) showed that in the dry season a significant amount of particles with a 10 μm diameter and originating from Saharan sources (located hundreds of kilometres downwind, in Niger) can be observed in Banizoumbou. This suggests that the

C20

deposition velocities might be overestimated in the models. This assumption is further supported by several papers in the literature that have reported the presence of ‘giant’ particles (> 62.5 μm) at great (>1000 km) distances of their sources (Middleton et al., 2001: Long-range transport of “giant” aeolian quartz. ...). Another reason for speaking of 20 μm particles is that this value is a ‘reference’ cut-off size used in quite extensive body of studies.

2) Page 5552, “The mass of PM20 present ...” - this phrase reflects only the view of a soil scientist. Atmospheric scientists see it more complicated.

We agree that when isolated this particular sentence might be too general to reflect all the complexity of the problem, but the rest of the text goes into more details and is more explicit.

3) Page 5554, “If the direction of squall lines is usually centred around 90°N” – To me this phrase remains cloudy.

We only mean by this that, unlike the Monsoon flux that blows from the south/south-west, squall lines generally move from east to west.

4) Page 5557, if both instruments are not reliable and cannot be compared, than use only one of them for indicating the onset of saltation.

The instruments have not been working in parallel but successively. The saltiphone used in 2006 broke down at the end of the measuring period and was replaced by the Sensit during the 2007 campaign.

5) Page 5557, “Assuming that PM20 dust particles are light enough to follow air movement perfectly” – This phrase shows how important wording is. 20 μm particles (those are included in the term PM20) are impacted easily and do are not light enough to follow the air movement easily. Instead 0.3 μm particles (they are also included in the term PM20) do follow easily the air movement.

This is right. As for the deposition speed discussed above, there is no abrupt cut-off but

C21

rather a gradient in the ability of particles to follow the air streams. However, according to Gillette et al.,(1972) aerosols of radius $\leq 10 \mu\text{m}$ have a terminal velocity much lower than the vertical velocity fluctuations. In turn, this legitimates for them the use of the approximation K_A (coefficient of exchange for aerosol) = K_M (the eddy viscosity).

6) Averaging over 15 minutes. The whole timing needs careful considerations. Is the averaging time short enough for the calculations of the vertical flux?

The 15' value for the averaging time is a minimum inherent to the gradient method itself. Indeed, the computation of the vertical flux according to equation 2 involves u^* that cannot be computed over durations shorter than 15'. We are aware that this is rather long as compared to the typical response time of sand movements to wind fluctuations but to this day there is no other validated method than the gradient one.

7) One of your main questions is the change of the size distributions with changing wind velocity. So please show size distributions!

Fig. 7 shows these size-distributions averaged for each event.

8) Fig. 2 – That Figure could be omitted. The correlation is very low, as indicated in the text. Since the instruments are used only for qualitative determination of the beginning of a dust storm, one instrument is sufficient.

As reminded above, the instruments have not been working simultaneously but successively. The purpose of this figure is not to show any correlation between the measurements. One of its main interests is rather that the wind directions associated with erosion events were the same in 2006 and 2007.

9) Fig. 3 – The events are too short to give sensible data within 15 min average. This refers to my question above about the timing. We are aware of this problem, and this is why we discarded in our study the events with durations less than 30'.

10) Technical Corrections a) Fig. 6 – It is irritating in having directions (in degree) on a 0 – 750 scale, despite directions only could be 0 – 360°.

C22

We have modified the axes on Fig.6 to take the Reviewer's remark into account.

b) Page 5564, "105 particles/m2/s". Use same units as in the Figure referred to: #/cm2/s This problem has been addressed in the new version of the paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5549, 2009.

Figure 6 :

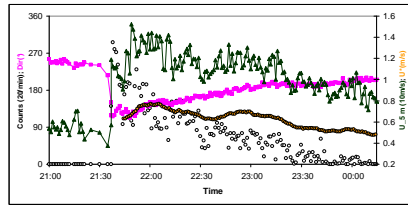


Fig. 1.

C24