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Atmospheric Measurement Techniques Discussions

Interactive comment on "Light scattering at small angles by atmospheric irregular particles: modelling and laboratory measurements" *by* T. Lurton et al.

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The study case is interesting, measuring the size of aerosol particles by scattering at forward angles, and improving the Mie modelling. Being able to see so large range of sizes, starting with so small size is nice. I am convinced that the experiment and modelling are in principle OK, but that is not becomming clear enough in the text.

Before publication, I would like to see several improvements:

-the text contains typically many long and difficult to follow sentences. Make shorter and more clear throughout. Any sentence in 3 lines is too long, first sentence of para-

graph even shorter.

We took this remark into consideration and made shorter sentences in various places of the text.

-define the particle shape model better, now remains far too vague, How comparable to many stochastic models used by other modelleres, e.g. Muinonen, Penttilä, etc?

We shall mention in the revised version of the article some references to other models. However, we do not believe it is useful to compare Drossart's model (that we use) to more mathematically precise models (e.g. Muinonen's) for the following reason: our goal in the article is ultimately to yield a level of roughness beyond which a saturation process occurs, i.e. no further influence of the particle's nature and roughness is sensible over the scattered fluxes (in our precise geometrical set-up). In that respect, Drossart's model allows us to model the saturation process quite well, whilst staying relatively simple in its parametrisation. It would be overkill to use a more detailled mathematical model, if it was only to prove the final saturation phenomenon. Regarding Pentillä's model, we believe the comparison with Drossart's roughness model is not very opportune: in Pentillä's model (Pentillä 2003, that we cite), the average shape of particulates was determined starting from microscope images; then a ray-tracing model was applied. Such a model is only valid for large particles (in the present case, 45 μm and 88 μm).

-Describe the scattering model better. Mie model with randomized phases? Why?

The underlying idea in Drossart's model is a separation between a coherent signal, which is the regular scattered intensity, and an incoherent one due to the roughness of the particle. The link between the random aspect of the particle and its effect upon the coherent/incoherent weighting is described in the article. We shall add further explanation in the text, whilst keeping it succinct in order not to paraphrase Drossart's article.

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-what is meant by particulates nature?

By "particulate's nature", we refer to its physical composition, i.e. sand as opposed to carbon as opposed to glass, etc. It does not imply any assumption on the roughness of the particulate (for instance, a glass bead can be smooth, whereas a glass shard can be rough). We shall make this point clearer in the revised version of the text.

-Describe the instrument and measurements more, what is mV telling to a reader?

The measurement given in mV is the output of the photodiode measuring the scattered light at the angle of interest. This voltage is strictly proportional to the light flux, and therefore it has to be taken as an arbitrary unit to represent the scattered light intensity.

-"Perfect agreements" with only one observed scattering angle, wavelength, and state of polarisation is not a convincing proof of model goodness. How many parameters you have to make a fit?

We have to fit only the trend intensity of light scattered vs. size of the particles. The "perfect agreement" only concerns this trend. Measurements for scattering angle larger than $\approx 20^\circ$ *are sensitive to the refractive index of the particles; thus the model cannot be applied to such angles with particles having different indices.*

-what is saturation limit in P 7577?

As the degree of roughness grows, the scattered intensities tend to lower for large sizes of particulates (in the precise case of our angular set-up). The saturation limit is the particulate's degree of roughness beyond which this effect is no more present; past that limit, one can consider that we have a preponderant part of the diffraction of the rough particulate over the scattered light intensity.

-all figure captions need more explanations, what measurements are shown, why, what are axis, etc..

We shall improve the legends.

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-references to both measurements and modelling are tight. I thought there are many more measurements to mention, and more modelling aspects to discuss.

We disagree with the reviewer. To our knowledge, there are not so much papers on the modelling and measurements of light scattered by irregular grains at small scattering angles and their evolution with size from tenths to tens of micrometers.

-rethink also all the discussion objects raised, they are all valid, but it sounds a bit, that you want to explain them out.

We shall improve the discussion section with more points added.

I encourage the authors to submit an improved version of the manuscript.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 7565, 2013.