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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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You state (on page 7577 line 22 ff.) that scattering at 13.8° to 16° angle and 635 nm wavelength is due to diffraction and thus the scattered intensity is independent with regard to the nature (refractive index) of the particle. This statement is wrong for particles larger than about 2–4 micrometers.

There is apparently a misunderstanding, and we shall try to make the concerned paragraph clearer. Generally speaking, your remark is of course valid, but on page 7577 line 22, we are talking of the precise case of rough particulates seen at a small angle *and under a small aperture, not the case of spherical particulates.*

Using Mie and diffraction algorithms, it can be verified that the diffraction contribution at 13.8°–16° is below 20% for spherical particles with sizes between 10 and 100 micrometers (and $m = 1.59 + 0i$).

This number is correct, but you state yourself that this is the percentage for large spherical particles. Given the fact that we show that for rough and large particulates, the diffraction part of the scattered signal is preponderant, the 20% figure you are pointing out is in accordance with the one-decade discrepancy found between the theory for spherical particles and our measurements/simulations for rough particulates.

Unfortunately, your theory is described as being independent of particle nature (page 7570 line 8 ff.). In my opinion, this should to be corrected throughout the paper.

Unless we are mistaken, at no point we state that the theory used is independent on the particulate nature: the classical Mie calculations include the index m. What we are only asserting is that our results show — at least for a roughness exceeding the saturation limit — an independence with respect to the particulates' nature.

The imaginary part of the refractive index has significant impact on the scattering intensity around 15°. The weaker scattering by some particles compared to Mie particles, which is illustrated in Fig. 8, could be due to non-considered absorption. Have you considered the effect of the imaginary part in your study? Or can you verify that all your particles are nonabsorbing?

There would of course be an effect induced by the refractive index if we were comparing a perfectly spherical transparent particulate to a perfectly spherical absorbing particulate (this effect, though present, would nonetheless be less marked at 15° than at greater angles). However, this is not our domain of concern: the particulates we study are rough, and our measurements show that for large irregular particulates, at 15°, the refractive index, and thus its imaginary part, have no longer an effect on the *scattered intensities (the roughness effect takes over). If we performed the simulations taking into account an imaginary part (for instance for a carbon particle), the classical Mie solution for spherical particles would of course be lower than it is on Fig. 8; nevertheless, the simulations for rough particulates would show the same kind of saturation behaviour as in Fig. 8.*

Furthermore, I find your result that the roughness reduces the scattered intensity at 15° by more than one order of magnitude for large particles (Fig. 8) quite surprising. If this is really a roughness effect, it should be possible to add some kind of validation and/or references to literature data.

The authors do not wholly understand the remark, as far as their measurements constitute in themselves a validation of the proposed theoretical explanation. As for existing literature, there is to our knowledge no real published work dealing with the case of large irregular particulates scattering at a small angle.

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