Atmos. Meas. Tech. Discuss., 4, C750–C754, 2011
www.atmos-meas-tech-discuss.net/4/C750/2011/

Atmospheric Measurement Techniques Discussions

Interactive comment on "First correlated measurements of the shape and scattering properties of cloud particles using the new Particle Habit Imaging and Polar Scattering (PHIPS) probe" *by* A. Abdelmonem et al.

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Received and published: 31 May 2011

Referee #1 wrote: "End of section 5.2 and Fig. 14. The scattering angle at 115° is strongly underestimated compared with theory. The theoretical model should used with small variations of the Euler angles in order to evaluate the sensitivity of the results."

Authors reply:

We have actually investigated the (theta, phi) scattering plot (where theta is the zenith angle and phi the elevation angle) for the particle orientation determined from the

PHIPS images and have been able to associate the different scattering arcs with particular ray paths. The peak which has its maximum at 110° in Fig. 14 is associated with rays entering through a basal plane, being reflected at the opposite basal plane towards a prism facet, at which they are totally internally reflected before leaving the crystal through the same basal facet through which they had entered. Due to the nature of this interaction (low number of ray interactions with facets, total internal reflection), the corresponding peak has a high intensity. The peak at 78° is caused by ray paths involving the same facets as the 110° peak, but including at least four more internal reflections between the basal facets, resulting in a lower intensity. The ray path for the peak at 62° includes also interaction with a prism facet. Since the smaller dimension of a prism facet is just 5.16 μm, it is very likely that a large proportion of the facet will be rounded, or the plate might be rough or contain hollow sections, e.g. bubbles. This could result in reduction of peak height and increase of peak width, and even in different ray paths. Such effects have not been considered in the calculation. The attached graph shows calculated angular intensity distribution for slightly different phi-angles for the same particle orientation (i.e. Euler angles). (The graphs are slightly smoother than in the original Fig. 14 due to an increased number of rays (6x109 instead of 5x108)). The two peaks move towards to or away from each other, when phi is increased or decreased, respectively. The standard deviation between measured and calculated intensities for scattering angles larger than 5° is smallest for phi=0°, therefore this graph is shown in Fig. 14.

The sentence in page 2907 line 15:

"This figure shows a comparison between the experimentally obtained polar scattering signals and, correspondingly, p11+p12 modeled using RTDF."

will be replaced by:

"This figure shows a comparison between the experimentally obtained polar scattering signals and, correspondingly, p11+p12 modeled using RTDF (6x109 rays). The polar scattering signal has been investigated for small variations of the azimuthal angle around φ=0°, and it has been confirmed that the standard deviation between measured and calculated intensities for scattering angles larger than 5° is smallest for φ=0°.

Note two Graphs are attached: 1- The influence of small variations of the Euler angles on results. 2- A new version of Figure 14.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 2883, 2011.

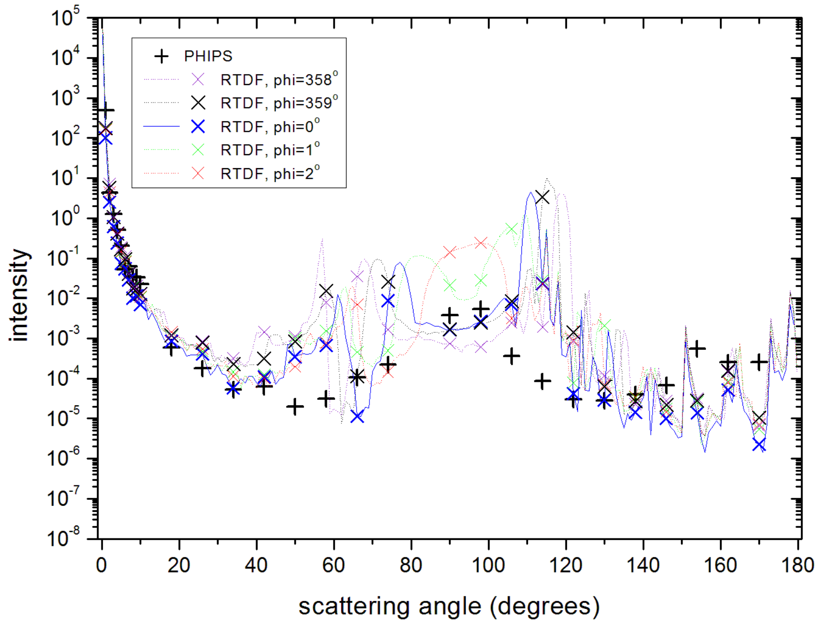
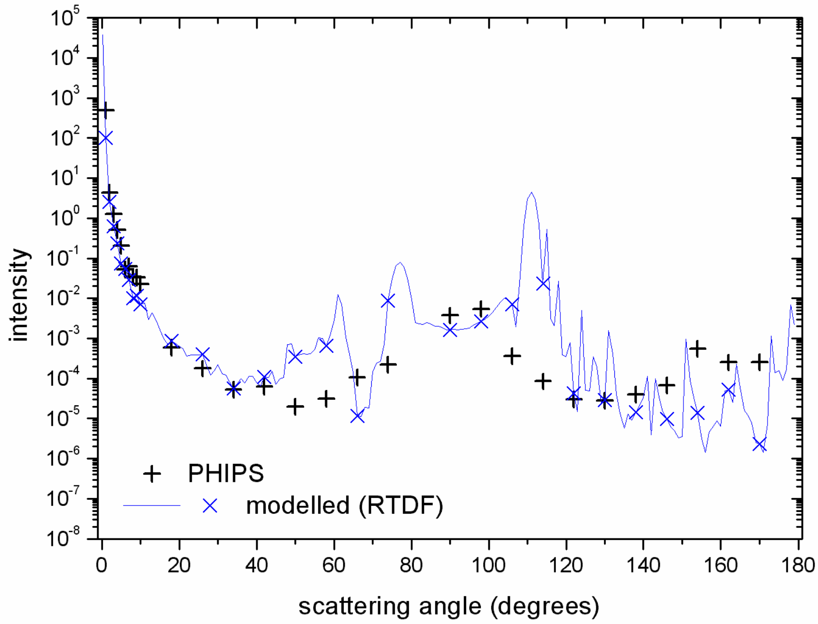


Fig. 1.



intensity
10^5
10^4
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
PHIPS
modelled (RTDF)
0
20
40
60
80
100
120
140
160
180
scattering angle (degrees)

Fig. 2.