We thank Valery Shcherbakov for his valuable comments to improve the quality of the manuscript. Below we will give a point-by-point answer to the individual comments. The answers are highlighted in blue.

Specific comments:

1) Please, provide estimations of uncertainties or relative uncertainties (at least of the backscattering signals and the depolarization ratio) using the standard “JCGM 100:2008” [2, Ch.5].

We have determined the relative uncertainties of the backscattering signals from the scattering target adjustment cycle shown in Fig. 5. We then used these values to calculate the combined relative uncertainty of the depolarization ratio. We added the following sentence to the end of Section 2.1: “The adjustment cycles are also used to deduce the relative uncertainties $\Delta I = 1.3\%$ and $\Delta\delta = 1.4\%$ of the backscattering signals and the depolarisation ratios.”

2) Figure 5. It is difficult to understand why the random noise is so large (about ±0.03) in the most favorable conditions of measurements (signals from a special scattering target). It could be hypothesized that the coherence length of the laser light is so large that an interference pattern (speckle structure) affected the measurements. If this is the case then the light source (Sapphire 488LP) should be replaced in the future because the same level of the random noise is seen in Figs. 8 - 10. For example, high-power multimode laser-diodes are compact and have good operating characteristics.

Indeed the Sapphire 488LP is a single-mode laser with a coherence length of at least 10 meters that produces a speckle structure. This might at least partly be the reason for the observed noise in our data and we will give the suggestion of the reviewer a serious thought. Certainly a part of the noise can be attributed to the temperature fluctuations within the chamber and especially towards the heated windows of the instrument. These fluctuations cause air density fluctuations and, consequently, schlieren that skew the laser beam and the detection apertures, so that the background stray light signal is not constant.

3) Page 15464, lines 16 - 18. The ratio S22/S11 can be deduced from SIMONE measurements. Please, underscore that it is deduced for the scattering angle of 178.2 (not of 180).

We have added the following sentence after Eq. (13) (Eq. (13) will become Eq. (14) in the revised manuscript): “It is important to note here that the ratio given in Eq. (13) is only valid for the SIMONE detection angle, i.e. 178°, and can be different from the ratio at 180°.”

4) Page 15469, Figures 6 and 8. The residual depolarization ratio of 0.02 - 0.03 for the cases of a supercooled liquid cloud and cloud droplets give impression of a systematic bias that also affects the other reported experimental data. This leaves some doubts about the accuracy of the modeling and the values of the actual detection angles because, generally speaking, systematic biases may affect crucially retrieval results when an inverse problem is illposed.

As stated on page 15469, lines 4-8, the residual depolarization is a result of a systematic cross-sensitivity between the two backscattering channels which is provoked by the laser polarization ratio, the cross talk in the Glan-Laser prism, and slight misalignment of the optical components. This results in a combined inaccuracy of 2-3% in the polarization state of the incident and scattered light. We agree with the referee that this small inaccuracy can be amplified in an ill-posed inverse problem. However, the unknown values of our inverse problem, i.e. the two actual scattering angles and the photomultiplier gain differences, are well constrained. Moreover, the fact that the interference feature in the scattering ratio of the droplet growth experiment (Fig. 6) is nicely reproduced by the fitting results, gives us confidence that the deduced instrument parameters are not more erroneous than the measured quantities.

5) Page 15469, line 2. Please, provide the definition of the term “scattering ratio”, which is largely used in the text and the figures.

We agree with the referee that a definition of the term “scattering ratio” is missing in the manuscript. Therefore, we have inserted the following paragraph on page 15469, between lines 8 and 9:

“From the three intensity measurements $I_f$, $I_{\parallel}$, and $I_{\perp}$ the scattering ratio

$$\rho = \frac{I_f}{I_{\parallel} + I_{\perp}}$$

is then calculated.”

6) Panel (f) in figures 9 - 10. There are time intervals where the modeled depolarization ratios are largely different from the measured absolute values.

The extinction spectroscopy (FTIR retrievals) is mainly sensitive to the spectral dependence of the refractive index and to the averaged projection area of particles. Variations of the exact shape of particles, the roughness of their surface, and internal inclusions practically do not affect FTIR data.

To the contrary, phase functions and polarization parameters are very sensitive to the listed above characteristics. I believe that AIDA retrievals can be improved in the future by using more sophisticated algorithms like [3] when experimental data from different types of sensors are taken into account.

We agree with the referee at this point and added the following sentence to final paragraph of Section 5:

“Yet, the use of a shape distribution, as constrained from e.g. SID3 single particle measurements, will likely further improve the fit result.”

Further, we slightly modified the last sentence of Section 5 to emphasize the necessity of a shape distribution (in addition to the use of a hexagonal particle shape) in future modeling of the SIMONE scattering data.

“Based on these results, it can be speculated that an optical particle model assuming a size and shape distribution of hexagonal ice particles is necessary in order to match both the observed depolarisation ratios and the scattering intensities at the same time.”

References.

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2. JCGM 100:2008. Evaluation of measurement data - A Guide to the expression of uncertainty in measurement. (see URL: http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf last access: July 2012)

3. Dubovik, O., A. Sinyuk,T. Lapyonok, B. N. Holben, M. Mishchenko, P. Yang, T. F. Eck, H. Volten, O. Muñoz, B. Veihelmann, W. J. van der Zande, J-F Leon, M. Sorokin, and I. Slutsker: Application of spheroid models to account for aerosol particle nonsphericity in

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