

Answers to Referee report 1

We thank the Anonymous Referee 1 for his/her careful review and valuable suggestions.

General comments:

- 1) Due to mysterious reasons and my mild inability to use the “latexdiff” package, the compilation of the pdf of the marked-up manuscript crashed when text differences were found in captions. So we separately marked those differences in a dummy-proof word file, then pdf-zed it and merged it to the latex one, exclusively for the purpose of marking changes. Unfortunately, in that “homemade” document, figure numbers are missing from the manuscript text. We apologize for this inconvenience that now it seems I have resolved, although I still could not explain how.
- 2) The Authors thank the Reviewer for this remarks that allows us to explicitly clarify a possible misunderstanding. In fact, in the figure 6, as well as in the figures 8 and 9, the data reported are the experimental points, i.e. 10-min average over an altitude interval of 30 m. In fig. 7 instead, the reported values of depolarization are averages over the cloud extent.

We don't seem to see inconsistencies between fig. 6, 8 and 9. It might be an impression due to colour scales, which we now have modified to improve the readability of the plots: where possible, the figures now shares the same colour scale, see answer 3).

- 3) As explained in point 2) above, in figs 6, 8 and 9 only experimental points are reported, i.e. 10-min average over an altitude interval of 30 m. In fig. 7 instead, the depolarization values are averages inside the cloud. We have tried to make clearer this point in the manuscript changing lines 294-295 to: “... between the cloud averaged value of the particle depolarization δ_a and optical thickness...” and fig. 7 caption as: “Distribution of cloud averaged values of particle depolarization vs optical thickness. The thick black line reports the optical thickness threshold value for SVC. ”. For what concerns the colour codes, the colour is not normalized, i.e. the bin colour represents the actual number of data points in the bin. Since the total number of data points in figure 6, 8, 9 is different (as different are the y axes), the figure colours cannot be compared. However to improve readability, we have replotted fig.9, which in fact accommodates the same dataset of fig. 8, with the same colour scale (i.e. we corrected “Only data from clouds within 2500 m from the CPT are reported.” to “Only data of clouds from 2500 m below to 500 m above the CPT are reported.”, as now read the modified fig. 9 caption.) and the same number of bins. Similarly, figs. 4, 5 and 7 whose dataset has the same dimensions, have been homogenized in terms of bin numbers and color scales.

In the histograms' captions, where missing, a sentence has been added: “The colours code the number of data points falling inside the bin.”

- 4) Supplementary material now hosts a Depolarization vs Temperature plot as Figure 1, there commented as: “Figure 1 reports the trend of particle depolarization with decreasing temperature, It shows a compact linear relationship, with a progressive increase of particle depolarization from 40% to 60% as temperature gets colder. Noticeable, in the range 200-190K, the presence of low depolarizing clouds, a behavior that deviates from the main trend, with the probability of observing low values of depolarization which seems to increase as temperature decreases.” In the Manuscript, line 283 now reads “... i.e. with decreasing temperature (see Figure 1 in Supplementary Material)....” Line 290 now read “particle depolarization values below 20% start to appear when temperature drops below 200 K and at temperatures around 190 K reach values as low as 10%, which are atypically low for cirrus clouds, have been observed in association with the lowest values β_a . Very low values of δ_a can be observed in presence of large oriented crystals in clouds, typically planar crystals with their main faces aligned horizontally, (Platt et al., 1977; Noel et al., 2005).” The

quotation of the possibility of low depolarization due to oriented crystals is now added, thanks to the editor's suggestion.

- 5) Page 10, Line 292 now read "We have estimated that these inaccuracies are no greater than the 50% of the reported value for the aerosol depolarization. This is an upper limit, as the inaccuracy uncertainty greatly reduces for aerosol depolarization values accompanied by high backscattering."

Specific comments:

We have corrected the typos on page 8 line 247, line 251. Thank you.