

Interactive comment on “A comparison of light backscattering and particle size distribution measurements in tropical cirrus clouds” by F. Cairo et al.

Anonymous Referee #3

Received and published: 16 November 2010

General comments :

This paper focuses on the comparison between in-situ measured backscattering coefficients of cirrus cloud ice particles and ones computed from measured particle size distributions. The originality of the paper is that the measurement of the backscattering coefficient is performed by a backscattersonde mounted on the plane at a distance close to the FSSP used for microphysical measurements. The analysis is performed on a fairly comprehensive dataset that includes measurements of different campaigns that have not yet been analyzed as a whole. The last part of the paper explores the

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possibility of determining the bulk microphysical properties of cirrus clouds from the measurement of the backscattering coefficient by lidar but further analysis is not done. At a minimum, authors should describe what the differences are expected between the backscattersonde measurement and that performed by a ground-based or an airborne lidar. The subject of this paper is appropriate to AMT journal and the principal results are clearly presented in the abstract that can be understood without reading the paper first.

Therefore, I recommend that this paper be accepted for publication after revisions along the lines outlined above and below.

Specific comments :

The authors mention that the backscattersonde allows to measure the backscattering coefficient and depolarization ratio at two wavelengths, as with a ground lidar system, but all parameters is not used here to compare to those that can be derived from microphysical measurements. Why? Is it because the authors use the approximation of spherical particles that becomes irrelevant to simulate the depolarization ratio of complex particles ?

The paper focuses on the analysis of cirrus cloud particles but the authors use the “aerosol” term throughout the paper and in the figure captions and legend axis (for instance in Fig. 3, Fig. 4, Fig 5 etc. . .). Is there a particular reason ? This is confusing and I suggest to change “aerosol” by “particle” or “cloud particle”.

p.4066, l.20 : Explain how are fitted the measured size distribution. What is (are) the constraint(s) ?

p.4067 and p.4068 : The approximation of spherical particles underestimates the backscattering coefficient and the measurement uncertainties, including the undetected particles, lead to an overestimation of the coefficient. Does this not create a fortuitous error compensation that should be analyzed more precisely in the text ?

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p.4068, l.3 : To increase of 1 micron the radius of large particles seems to small considering the dimension of large particle observed in cirrus clouds (see for example Baran, JQSRT, 2009).

p.4069, l.22 and 23 : “horizontal” and “vertical” are not coherent with the caption of Fig.5. Please check this point.

p.4071, l.5 : Are Fig. 6-9 for a typical observation or all of the observations ?

p.4071 and Fig. 6-9 : The text states that it shows the measured backscattering coefficient while the figures show the calculated one (from FSSP). It is a major mistake that you must check and correct - if it is a mistake - because it is not really surprising that the calculated coefficient is linearly related to the other bulk microphysical parameters.

p.4071, l.19 : “...although more scattered”. It is not clear on the figures.

p.4072, l.7 : Authors should also argue “to what extend measurements with backscattering sonde are similar or close to that performed with a ground-based or airborne lidar system ?”

Technical corrections

p.4061, l.18 : “peak at 10 microns,...”, please precise radius or diameter

p.4061, l.22 : same remark

p.4065, l.21 : typo “variabilities”

p.4067, l.25 : 1.35 microns and 15.5 microns, ... add “radius” in order to be coherent with table 1.

p.4069, l.4 : change 0.85 by 0.35

p.4070, l.13 : typo “small”

p.4072, l.3 : typo “parameters”

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p.4072, l.7 : typo “answer”

p.4079, l.1 : typo “cm-3”

p.4080, l.2 : typo “expressed”

p.4081 : characters in figure panels are too small

p.4082, Fig. 2 : indicate the labels (A-F) on each diagram.

p.4085 : complete figure caption to explain right part.

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 4059, 2010.

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