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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of cloud statistics from spaceborne lidar systems" *by* S. Berthier et al.

S. Berthier et al.

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Section 2.1.

Question: More discussion of equation (1) and its application is required. What value of n is used? Or, alternately, what is the vertical interval considered? Is the same value of n always used, or does it vary?

Answer of the Author : This equation as yet been given and explicated in [Chazette et al., 2001], given as a reference in the text in the section 2.1. Each component of the equation is explained in the text following the equation.

The symbol of the parameter in the equation has been modified, for a better understanding, and a better coherence with the text.

Indeed, the value of n is not given in the article and it is a mistake. The value of n used

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is 3, which mean a window size of 2n+1=7 pixels i.e. 105 m. To clarify the text, we added the following comment in the explanation: "In this work, we use a constant size for the windows, with n equal to 3, which correspond to a window size equivalent to 7 pixels. The size of the filtering window has been selected to obtain SNR at the bottom of the cloud larger than 6 after filtering."; In Chazette et al. (2001) a study has been performed about the detection of vertical structures of scattering layers against n.

Question: I assume \" lidar signal \" means the calibrated, attenuated backscatter signal. Is this correct? Answer of the Author: The reviewer is right. Modification has been done in the text.

Question: The authors say the \"value of F depends on the signal noise\;. Do they mean the value of F that they choose depends on the signal noise? Answer of the Author: The reviewer is right. The value of the threshold is proportional to the variance of the noise sigmaN, retrieved between 19 to 20 km height, where only noise is expected. The line "The value of F depends on the signal noise", has been removed, and replaced by " The value of F is proportional on the signal noise and must be adjusted against the lidar signal characteristics";

Question: They say only noise is expected to be present below 19 and 20 km. Do they mean \"between 19 and 20 km\" ? Answer of the Author: The Reviewer is right. The author mean between 19 and 20 km, and not below. The modification has been done in the text.

Question: I don't understand how Figure 1 was derived. Where do the two overlapping sets of curves come from? Are these test data sets where regions of noise and cloud have been determined? Answer of the Author: For each values of the threshold F, we search the mean value of the geometrical thickness of scattered layer. Such a value has been determined after the application of the threshold method to the GLAS backscatter profiles. Following this method, two types of structure can be retrieved: for lower value of F, we will retrieve a mix between cloud and noise structures. For

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higher value of F, only cloud structure will be retrieved but some cloud structures could be not detected. We search by this way to minimize the probabilities of false alarm (Pf) and no detection (Pn). We observe an inflexion point in the obtained distribution, corresponding to the differentiation between the expected noise and cloud thickness distribution. The optimal threshold is determined by this way and the two distributions are separated and given in the Figure 1. This permits to minimize the error probability given by (Pf + Pn - Pf x Pn) as explained in Chazette et al. (2001).

Question: The text mentions LITE and GLAS prototype algorithms for separating aerosol and cloud. The algorithm which is then described is the GLAS algorithm. In the LITE studies which are cited in the references, a very simple threshold technique was used to discriminate between aerosol and cloud. Layers saturating the LITE digitizer when the receiver was set to high gain were assumed to be clouds. Layers which did not saturate the digitizer were assumed to be aerosol. Answer of the Author: The Reviewer is right. We make a mistake. We should mention only about the GLAS prototype algorithm. With our knowledge, and after research for our part, no prototype algorithm has been proposed about LITE data to differentiate between the cloud and the aerosols layers. Indeed, we delete inside the text of the article the mention about the LITE prototype algorithm. Nevertheless, we have used a similar approach that the one of GLAS to the LITE data to separate clouds and aerosols. We mention this now in the text of the article in the section 2.1.

Section 2.2.

Question: LITE data were acquired and archived at single shot (0.1 second) resolution. Are the LITE results here based on 10-second averages? Answer of the Author: The reviewer is right. The LITE are obviously acquired and archived at single shot (0.1 second) resolution. There is a mistake in the text. The work has been done correctly, at 10 Hz pulse repetition rate. The correction has been made inside the article, by changing "of 10-s 5 averaged atmospheric backscatter data" to: "with a pulse repetition rate of 10 Hz"

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Interactive Comment

Section 4.

Question: The CPDF curves in Figs 4 and 5 are useful for judging the consistency between different datasets, but it is difficult to determine where the inconsistencies are coming from. Adding PDFs would give more insight into the relative strengths and weaknesses. Answer of the Author: The reviewer is right. We have cancelled this curve from the initial version of the article, judging this making a number of figures inside the article too important. We have added these figures again under the same figures number (Figure 4a&b, and Figure 5a & b, where a is for PDF and b for CPDF).

Question: Unlike one of the other reviewers, I don't think the limited, or \" targeted \", sampling of LITE has much effect on the shape of the derived CPDF curve. It would be an interesting exercise to take CALIPSO observations, sample them in a way similar to LITE and compare the CPDF of the full set of CALIPSO observations vs. the subset.

Answer of the Author: Like the reviewer, we don't think that the limited 10 days corresponding to the LITE mission have an important effect considering the CPDF.

We have yet analysed this point in a previous study, and present you here the result.

(To obtain the figure, get the pdf file, at the following location: https://mywebspace.wisc.edu/sberthier/web/REVIEW/FigureforREVIEW.pdf)

The following figure 1 and 2 give respectively the PDF and the CPDF of the cloud structure as given by the operational algorithm for the CALIPSO data. The different colour corresponds to the different months of the year, between June 2006 to March 2007. As you can notice, the variability of each of this distribution is very little. Indeed, we could expect no more difference on a 10 day basis, corresponding to the sampling of LITE.

To finish this analysis, we have compared the PDF (see the figure 3) for a week of GLAS measurements (between the 8th of October 2003 and the 14th of October 2003), with one obtained considering of the period of measurements (8th of October 2003 to the

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14th November 2003). Note that in this figure, all the structure inside the atmospheric column are considered, and not only the highest one. Nevertheless, we can easily remark that very little dispersion is observed between each of the pdf, confirming this very little variability of the PDF and the CPDF.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 5269, 2008.