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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Statistics of vertical backscatter profile of cirrus clouds" *by* P. Veglio and T. Maestri

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The manuscript presents a study of the statistics of vertical backscatter profiles (BSP) of optically thin (optical thickness < 2.0) cirrus clouds based on CALIPSO observations. It was found that the shape of the normalized BSP has a strong dependence on the geometrical thickness of cirrus cloud, with the center of the normalized BSP shifting toward cloud base with increasing cloud geometrical thickness. This dependence was interpreted as an indication of increasing IWC toward cloud base with increasing cloud geometrical thickness. The implications of the shape of BSP and therefore IWC for radiative transfer simulation were discussed.

The topic of this paper is important and suitable for ACP. The manuscript is very well organized. I recommend it accepted for publication as is.

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Interactive Discussion

Discussion Paper

Actually, I reviewed this paper once before for some other journal. At that time, my major concern was the potential influence of cloud horizontal inhomogeneity on the profile BSP. To obtain high signal-to-noise ratio that allows realizable inversion, the CALIOP observations are first averaged horizontally, for example to 5km resolution that is used in this study. Note that cirrus cloud may have significant horizontal variations within 5km. Consider a simple case, in which half of the 5-km grid box is covered by vertically homogeneous cloud with vertical geometry from 10∼12km and the other half is covered by cloud with vertical geometry from 11∼13km. Such case would make the interpretation of BSP ambiguous.

In this manuscript, the authors have accounted for this potential impact by screen out those horizontally inhomogeneous pixels, as described in section 2.2.1. They found that, "The number of profiles contained in the RD and discarded after applying the requirement on the horizontal homogeneity is sensible and corresponds to about 75% at ML and 83% at tropics, revealing that, on a 5 km horizontal resolution scale, less than one-fourth of cirrus clouds show homogeneous geometrical features". This homogenization step makes the current manuscript more solid than the previous version.

In my opinion the manuscript can be accepted for publication as is.

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