Interactive comment on “Spectral optical layer properties of cirrus from collocated airborne measurements – a feasibility study” by F. Finger et al.

Anonymous Referee #1

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Review of Finger et al., ACPD 2015

General comments

The study titled “Spectral optical layer properties of Cirrus from Collocated Airborne Measurements – A Feasibility Study” by F. Finger et al. describes vertically-collocated spectral solar radiation measurements above and below cirrus using a towing sonde attached to a research aircraft. These are the first measurements of this kind for cirrus clouds. From these measurements, cirrus spectral optical layer properties were derived and discussed in detail for one case study. 1D radiative transfer simulations were made using different settings to estimate the influence of ice particle shape, effective radius, and optical thickness on the cirrus layer properties. Also, the impact of an observed low level cloud on the cirrus layer properties is discussed. The new aspect – vertically collocated aircraft-borne spectral solar radiation measurements above and below cirrus cloud with the help of a towing sonde – should be emphasized more clearly.

Specific comments

Abstract Line 18-21: Clearly, the quantification of effects of a low level cloud on the cirrus layer optical properties depend on the optical thickness/altitude of the low level cloud. – Mention the optical thickness of the low level cloud and say that the found differences in cirrus properties are only true for a low level cloud with these properties. Maybe add how an optically thicker/thinner and geometrically lower/higher low cloud changes the found impact.

p.19047 Line 10ff: cirrus inhomogeneities are described in the motivation – where do you analyze their impact on layer properties?

p.19047 Line 15ff: Here you describe impact of ice crystal size and shape on remote sensing retrievals – make extra paragraph to distinguish from impact of cirrus inhomogeneities.

p.19048 Line 10: If I understand correctly, you are presenting the first collocated spectral radiation measurements above and below cirrus with a towing sonde to derive optical layer properties here? – Highlight here that this is the new contribution of this paper!

p.19049 Line 7ff: Explain why you assure horizontal stabilization of the irradiance sensor mounted on top of the aircraft to measure downwelling irradiances but not of the sensor measuring upward irradiances mounted on the wingpod.

p.19053 Line 8ff: Describe Fig.6 more in detail – strong variations of mean particle diameter are obvious, comment on them, they represent cloud inhomogeneities.

p.19058 Line 1: Explain why you choose this measured particle number size distrib-
tion and not a different one.

p.19058 Line 26: Radiative forcing of Solid Columns and Droxtals is strongest (not lowest!), they exhibit the strongest negative forcing. Be careful in describing your results properly.

p.19060 Line 2: Choosing a water cloud with tau = 45 at 1.5-1.75km comes a bit out of the blue. – Where do you take those values from? A 250m thick water cloud with tau = 45 seems unrealistic.

p.19060 Line 21f: Clarify that the “overestimation of the cooling effect of the cirrus” refers to the single-layer cirrus case. How often do we have conditions of cirrus with underlying clouds? – Quantify. Also comment on if previous studies in which cirrus radiative forcing was estimated paid attention to single-layer only cirrus or if they potentially overestimated the cooling effect by not excluding multi-layer conditions.

Technical corrections


Interactive comment on Atmos. Chem. Phys. Discuss., 15, 19045, 2015.