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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aircraft measurements of wave cloud" *by* Z. Cui et al.

A. Heymsfield (Referee)

heyms1@ucar.edu

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Review of Aircraft measurements of wave cloud, by Cui, Blyth, Bower, Crosier, and Choularton.

This is a very nicely prepared article that presents observations in relatively shallow wave clouds where the temperatures are evidently too warm for ice nucleation to occur. The focus of the study is more on dynamics than microphysics. In that connection, the Introduction is beautifully written and very informative. Although the microphysics data are presented, it is not emphasized nor interpreted. I think this should be clearly stated at the end of the introduction section.

If the focus is on the dynamics, I suggest that the authors add additional calculations. I would like to see the calculation of latent heat release and warming by the growing droplets in the upwind part of the cloud and the cooling in the evaporative part. This

could influence the dynamics, obviously. Also, it is important to look at whether there is drop survival between successive wave clouds to see whether this might explain the large drizzle-size drops that are observed with the 2DS.

If the focus is also on the microphysics, I suggest a few additions. Can the liquid water contents be explained from the observations, and which one of the three LWCs are reliable; the JW, Nevzorov, or CDP. The first two agree fairly well, the third one not. Can you account for the large drizzle drops. Are there CCN measurements; given the drop concentrations and updrafts, can we account for the drop concentrations?

Specific comments appear below.

Pg. 13339, line 9. Three reasons, the third being instrument evaluation which would have been nice to have done in your study. line 14. Heymsfield and Miloshevich (1995) studied the ice production in wave clouds. And, a number of recent papers in JAS about the ICE-L experiment-Heymsfield et al. and Field et al. And, a number of recent papers in JAS about the ICE-L experiment-Heymsfield et al. and Field et al. (2012).

Pg. 13340, line 8. I don't understand the 90% rather than 100%.

Line 20. These were wave clouds, not cirrus.

Line 23. The maximum RH in that case was governed by homogeneous ice nucleation.

Pg. 13341, last sentence first paragraph. Weren't such measurements made in the T-REX project over the Sierra in 2006?

Section 2.1. Suggest including only those instruments you used in this study.

Pg. 13342, line 11. "Well-defined". This is subjective and unfounded. Perhaps well-studied or something like that.

Line 15. I absolutely do not buy into the idea that phase can be readily/accurately determined from the 2D-S. In fact, you need to include some examples to demonstrate this.

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lines 15 and thereafter. Were there anti-shattering (Korolev) type tips on any of these probes?

Pg. 13343, Fig. 4. Why is there such a mismatch between the LWC measurements? Can you estimate the "true" LWC from your upwind RH data and examine the discrepancy?

Pg. 13344, line 4. Also, see: Heymsfield, A. J., J. E. Dye, and C. J. Biter, 1979: Overestimates of entrainment from wetting of aircraft temperature sensors in cloud. J. Appl Meteor., 18, 92–95.

Last paragraph. The overlap between the CDP and 2DS PSDs compare favorably. You may want to point this out.

Pg. 13345, line 7. Well, this is clearly what is expected. It would be a problem is you did not find this result.

Pg. 13347, lines 2-3. The sentence needs restructuring.

Lines 10-12. Is their droplet survival between clouds? This should be checked from the 2DS data and it could be important for explaining the large, 2DS-size drops.

Pg. 13348, line 2. Are you able to estimate the contribution of latent heating by cloud droplets to the upshear side and the relative contribution of evaporation to the downdrafts on the downwind side?

Line 5. Wave clouds also have been used to test and evaluate instrument performance. It would be interesting to briefly mention whether the LWCs measured by the different probes are consistent with the LWC estimated for cloud base conditions or on the leading edge of the cloud.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 13337, 2012.