



Interactive comment on “Contrail study with ground-based cameras” by U. Schumann et al.

Anonymous Referee #1

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Summary of Paper

The authors use a small network of wide-angle and whole-sky cameras to track a distinctive set of four contrails. They develop camera models to obtain observation angles from the camera image coordinates and their inverse, and to estimate the contrails' altitude, width, and horizontal speed. The results of the camera analysis are compared to air traffic data, numerical weather prediction data, and simulations of contrail development from the CoCiP model.

General Comments

The manuscript is generally clear and well written. Although ground-based cameras have been used to observe and study contrails in the past, this paper advances the investigation of contrails via wide-angle camera imagery by developing camera models

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to determine contrail properties including altitude, width, and horizontal speed. I agree that such networks of contrail camera observations would provide a new way to test contrail development models and the accuracy of numerical weather prediction data, and I recommend publication of this manuscript after some minor revisions described below.

Specific Comments

Page 7436, lines 23 through 27: The values for the "Range for 100 m resolution (km)" in Table 1 do not appear to be consistent with the definitions presented in this paragraph (for example, how can the range for the high-resolution camera 3 be so much smaller than the low-resolution camera 4?), and also are not consistent with the view ranges in Fig. 2. I cannot find any definition for the azimuth angle range (ΔA). How is ΔA computed?

Page 7441, line 18: Why did the analysis of the contrails end at 09:09? Did they drift from the camera field of view at that time? The concluding section (page 7449, line 25) says the contrails persist "for about 40 min.". Does that mean they dissipated after 09:09?

Page 7743, line 25 through Page 7444, line 2: I am not certain of the author's intent in this paragraph. They contrast the effective altitude differences with the camera fit rms errors, but for all contrails except C2, the effective altitude difference is less than the corresponding rms error, in spite of all the possible sources of error presented here. I am probably reading too much into this paragraph, but it seems that the authors expected better agreement between the camera fit and flight level altitudes.

Page 7446, line 9: Why was a zero sedimentation rate assumed in the synthetic contrail trajectories? Would not sinking in the wake vortex phase affect the contrail trajectory? Would the comparison of the synthetic contrail trajectories improve if a non-zero sedimentation rate (including negative rates) were used?

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Page 7448, lines 11 through 13: The authors mention a lack of contrail formation between the altitudes of contrails C4 and C2 and attribute it to a drop in humidity possibly below ice supersaturation. Were there any flights within those intermediate altitudes during the time of the contrail observations that could have produced contrails? Perhaps there are no contrails at those levels because no aircraft were present to form a contrail.

Page 7449, lines 1 through 3: The atmospheric conditions for contrail C4 must be questioned. Even with a humidity at the homogeneous nucleation limit and a high propulsion efficiency, the Schmidt-Appleman temperature is barely met. Interestingly, contrail C4 is the only contrail that does not appear to be wider during the MIM observations. Is this the result of low horizontal wind shear only (it looks as though it is oriented nearly parallel to the horizontal winds), or would the lack of spreading also be a result of the extreme contrail formation conditions?

Typographical errors and minor objections

Page 7430, line 20: Change "explicitely" to "explicitly".

Page 7434, line 6: Change "determinante" to "determinant".

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 7425, 2013.

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