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Atmospheric Chemistry and Physics Discussions

ACPD

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Interactive Comment

Interactive comment on "Dehydration effects from contrails in a coupled contrail–climate model" *by* U. Schumann et al.

U. Schumann et al.

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We thank the reviewer for his/her comments and suggestions. We repeat the comments below (1) and then add our replies to this (2).

(1) General comments: This paper is an important contribution, presenting quantitative estimates of dehydration effects of contrails at flight levels and release of water after ice particle advection and sedimentation. Individual contrails are simulated by coupling a plume-scale contrail model with a global aerosol–climate model. Statistical contrail ensemble properties are as expected from present understanding and consistent with available observations. The radiative forcing from contrails and dehydration is estimated. Many results are new and important for understanding total effect on cli-

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mate by aircraft. The manuscript is well written and the results are clearly presented. I recommend that this paper is published with minor revisions. There are only a few suggestions for revisions as described below.

(2) We thank the reviewer you for the positive general comment.

(1) Minor points: Figs. 3 and 4: According to the manuscript, these figures are wrongly interchanged.

(2) Thank you. Corrected.

(1) Page 19573, line 14: Definition of "cirrus" cloud is ambiguous because many definitions are present in the literature. Particularly, it is not clear whether it includes sub-visual cirrus, thin and opaque cirrus clouds. Optical thickness range should be explained for clarity.

(2) We agree, the definition of cirrus cover is critical. The global model CAM computes the cover of cirrus as a function of ice supersaturation as described in Wang and Penner (2010), without reference to optical depth. Hence, we cannot specify a threshold value of optical depth for the CAM result. The observations, as summarized in Stubenrauch et al. (2013), depend strongly on the method used (passive nadir sensors give smaller coverage than limb sounders and lidar). These are important aspects, but are outside the scope of this paper, concentrating on contrails. Therefore, we rewrite the first sentence of our subsection 3.1.1.f as follows:

Figure 11 shows the annual mean global cirrus and contrail cover. The mean cirrus cover computed in these simulations by CAM is 40 %. The value of cloud cover depends critically on the method used, and is specified here as a function of assumed probability density function of supersaturation within each grid (Wang and Penner, 2010). The result is roughly consistent with a range of satellite observations of thin and opaque high-level clouds (Stubenrauch et al., 2013).

(1) Page 19573, line 22: Authors describe differences of estimated contrail cover from

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previous estimates in detail and suggest possible reasons, but it is not clear whether the 5-times larger contrail cover a better estimate than previous ones.

(2) The text says: The computed contrail cover is about 5 times larger than derived from linear contrails in satellite data (Palikonda et al., 2005; Meyer et al., 2007). The total contrail cover is, as expected, larger than the one observed for linear contrails. No change.

(1) Page 19578, Line 5: A typo, “variably”, should be “variability”

(2) Thank you. Corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 19553, 2015.

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