Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-32-SC1, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Radiative properties of mid-latitude cirrus clouds derived by automatic evaluation of lidar measurements" *by* Erika Kienast-Sjögren et al.

U. Schumann

ulrich.schumann@dlr.de

Received and published: 6 February 2016

This is a nice study of thin cirrus over 3 stations in the Alps and Northern Germany.

I have a few questions/comments/suggestions:

1) Which fraction of the thin cirrus originates from contrail cirrus? Liou et al. [1990], e.g., noted a strong increase of thin cirrus over Salt Lake City since about the late 1960's in correlation with increases in jet traffic. The stations are located in regions where line-shaped contrails are ubiquitous [Mannstein et al., 1999; Meyer et al., 2002]. The stations are located near the routes from London to the Near East or the routes from or across Paris to the Far East etc. (see contrail cover results and major traffic

Full screen / Esc

Printer-friendly version

Discussion paper

routes in Fig. 7 in [Schumann, 2005]). Often aged contrail cirrus might have gotten advected from, e.g., the routes over Lyon to the central Alps. The observed optical depth is fully consistent with optical depth for contrail cirrus from other sources [Immler et al., 2008; Iwabuchi et al., 2012; Vázquez-Navarro et al., 2015]. The computed cover and RF values are consistent with contrail cirrus calculations [Schumann et al., 2015]. Hence, it is very likely that contrails contributed a large fraction to the observed thin cirrus. So far, your nice paper, not even mentions this possibility. I think, at least that needs to be changed.

2) How important for longwave radiative forcing (RF) from thin cirrus for otherwise clear sky is the water vapor in the atmosphere below the cirrus? The longwave RF of thin cirrus correlates far better with the brightness temperature of the atmosphere than with surface temperature, see Fig. 15.4 in [Schumann et al., 2012a].The brightness temperature is related to the outgoing longwave radiation (OLR) at top of the atmosphere, as available, e.g., from Numerical Weather Prediction(NWP) data, e.g. from COSMOS. Also: how important is the difference between Earth surface albedo and effective albedo of the Earth-Atmosphere system, e.g. when clouds are nearby the location of observations or when the mountains are snow covered or when there is any dust or haze (derivable from known solar direct radiation and from reflected shortwave radiation, RSR, also available from NWP data), as discussed in these papers? Perhaps you can quantify these effects?

3) Why not to test the differences between the nice and simple Corti&Peter parametrization and that which we developed in parallel (see my comment of May 2009 on the ACPD paper by Corti and Peter and [Schumann et al., 2012b])? The input needed (OLR and RSR) is available form COSMO and other NWP models. The model could be used to test the influence of various assumptions on particle habits and particle sizes [Markowicz and Witek, 2011]. The quantitative results may well change by 50 %, and hence change your conclusions.

4) Does the Lidar signal (e,g., depolarization) allow to discriminate, perhaps together

with other data, contrails from cirrus? Perhaps there are some ideas which could fit into your outlook?

References.

Immler, F., R. Treffeisen, D. Engelbart, K. Krüger, and O. Schrems (2008), Cirrus, contrails, and ice supersaturated regions in high pressure systems at northern mid latitudes, Atmos. Chem. Phys., 8, 1689–1699, doi:10.5194/acp-8-1689-2008.

Iwabuchi, H., P. Yang, K. N. Liou, and P. Minnis (2012), Physical and optical properties of persistent contrails: Climatology and interpretation, J. Geophys. Res., 117, D06215, doi:10.1029/2011JD017020.

Liou, K. N., S. C. Ou, and G. Koenig (1990), An investigation of the climatic effect of contrail cirrus. In: Air Traffic and the Environment – Background, Tendencies and Potential Global Atmospheric Effects. U. Schumann (Ed.), Lecture Notes in Engineering, Springer Berlin, 154-169.

Mannstein, H., R. Meyer, and P. Wendling (1999), Operational detection of contrails from NOAA-AVHRR data, Int. J. Remote Sensing, 20, 1641-1660, doi: 10.1080/014311699212650.

Markowicz, K. M., and M. Witek (2011), Sensitivity study of global contrail radiative forcing due to particle shape, J. Geophys. Res., 116, D23203, doi:10.1029/2011JD016345.

Meyer, R., H. Mannstein, R. Meerkötter, U. Schumann, and P. Wendling (2002), Regional radiative forcing by line-shaped contrails derived from satellite data, J. Geophys. Res., 107, ACL 17-11 - ACL 17-15, 10.1029/2001jd000426.

Schumann, U. (2005), Formation, properties and climate effects of contrails, Compt. Rend. Phys., 6, 549 - 565.

Schumann, U., K. Graf, H. Mannstein, and B. Mayer (2012a), Contrails: Visible aviation

induced climate impact, in Atmospheric Physics – Background - Methods - Trends, edited by U. Schumann, pp. 239-257, Springer, Berlin, Heidelberg, DOI: 10.1007/978-3-642-30183-4_15.

Schumann, U., B. Mayer, K. Graf, and H. Mannstein (2012b), A parametric radiative forcing model for contrail cirrus, J. Appl. Meteorol. Clim., 51, 1391-1406, doi: 10.1175/JAMC-D-11-0242.1.

Schumann, U., J. E. Penner, Y. Chen, C. Zhou, and K. Graf (2015), Dehydration effects from contrails in a coupled contrail-climate model, Atmos. Chem. Phys., 15, 11179-11199, doi:10.5194/acp-15-11179-2015.

Vázquez-Navarro, M., H. Mannstein, and S. Kox (2015), Contrail life cycle and properties from 1 year of MSG/SEVIRI rapid-scan images, Atmos. Chem. Phys., 15, 8739-8749, doi:10.5194/acp-15-8739-2015.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-32, 2016.