Geophysical Research Abstracts
Vol. 19, EGU2017-18935, 2017
EGU General Assembly 2017

A multi-approach to the optical depth of a contrail cirrus cluster

Margarita Vazquez-Navarro, Luca Bugliaro, Ulrich Schumann, Johan Strandgren, Martin Wirth, and Christiane Voigt

Institut für Physik der Atmosphäre, DLR, Oberpfaffenhofen, Germany (margarita.vazquez@dlr.de)

Amongst the individual aviation emissions, contrail cirrus contribute the largest fraction to the aviation effects on climate. To investigate the optical depth from contrail cirrus, we selected a cirrus and contrail cloud outbreak on the 10th April 2014 between the North Sea and Switzerland detected during the ML-CIRRUS experiment (Voigt et al., 2017). The outbreak was not forecast by weather prediction models. We describe its origin and evolution using a combination of in-situ measurements, remote sensing approaches and contrail prediction model prognosis.

The in-situ and lidar measurements were carried out with the HALO aircraft, where the cirrus was first identified. Model predictions from the contrail prediction model CoCiP (Schumann et al., 2012) point to an anthropogenic origin. The satellite pictures from the SEVIRI imager on MSG combined with the use of a contrail cluster tracking algorithm enable the automatic assessment of the origin, displacement and growth of the cloud and the correct labeling of cluster pixels. The evolution of the optical depth and particle size of the selected cluster pixels were derived using the CiPS algorithm, a neural network primarily based on SEVIRI images. The CoCiP forecast of the cluster compared to the actual cluster tracking show that the model correctly predicts the occurrence of the cluster and its advection direction although the cluster spreads faster than simulated. The optical depth derived from CiPS and from the airborne high spectral resolution lidar WALES are compared and show a remarkably good agreement. This confirms that the new CiPS algorithm is a very powerful tool for the assessment of the optical depth of even optically thinner cirrus clouds.

References:

Schumann, U.: A contrail cirrus prediction model, Geosci. Model Dev., 5, 543–580, doi: 10.5194/gmd-5-543-2012, 2012.

Voigt, C., Schumann, U., Minikin, A., Abdelmonem, A., Afchine, A., Borrmann, S., Boettcher, M., Buchholz, B., Bugliaro, L., Costa, A., Curtius, J., Dollner, M., Dörnbrack, A., Dreiling, V., Ebert, V., Ehrlich, A., Fix, A., Forster, L., Frank, F., Fütterer, D., Giez, A., Graf, K., Grooß, J.-U., Groß, S., Heimerl, K., Heinold, B., Hüneke, T., Järvinen, E., Jurkat, T., Kaufmann, S., Kenntner, M., Klingebiel, M., Klimach, T., Kohl, R., Krämer, M., Krisna, T. C., Luebke, A., Mayer, B., Mertes, S., Molleker, S., Petzold, A., Pfeilsticker, K., Port, M., Rapp, M., Reutter, P., Rolf, C., Rose, D., Sauer, D., Schäfler, A., Schlage, R., Schnaiter, M., Schneider, J., Spelten, N., Spichtinger, P., Stock, P., Walser, A., Weigel, R., Weinzierl, B., Wendisch, M., Werner, F., Wernli, H., Wirth, M., Zahn, A., Ziereis, H., and Zöger, M.: ML-CIRRUS - The airborne experiment on natural cirrus and contrail cirrus with the high-altitude long-range research aircraft HALO, Bull. Amer. Meteorol. Soc., in press, doi: 10.1175/BAMS-D-15-00213.1, 2017.