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New insights into the properties of contrail cirrus and their impact on climate from airborne experiments

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Current growth rates in aviation demand a profound scientific data base of contrail cirrus properties in order to accurately assess their climate impact. In particular, the differentiation of contrail cirrus in natural cirrus fields is challenging. Direct observations of contrail cirrus throughout their life cycle are scarce and therefore limit our understanding of the climate effects from contrail cirrus.

Here, we give new insights into the growth, life-cycle and climate impact from contrail cirrus based on results from suite of aircraft experiments. NASA's ACCESSII mission focused on the detection of aircraft emissions and initial contrail stages. Nascent contrails were detected at cruise altitudes at 100 m distance to the engine exit. Contrail growth to 10-min contrail age was investigated during DLR's CONCERT campaigns. Finally, the objective of the ML-CIRRUS experiment was to study the life cycle and climate impact of contrail cirrus. The contrail measurements are related to previous observations and discussed in the context of recent developments in contrail modeling. Highlights include the quantification of the effects of aircraft type on contrail microphysics, the analysis of ice particle shapes and the quantitative distinction of contrail cirrus and natural cirrus.