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CARIBIC passenger aircraft (2005-2010): What we have learnt so far from the trace gas distributions in the UTLS

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As of May 2005 the CARIBIC passenger aircraft (Airbus A340-600 by Lufthansa) measures regularly $\sim$100 trace gases and aerosol parameters at 9-12 km altitude during four long-distance flights per month. The measurements are done using a well-equipped flying laboratory installed in the Airbus' cargo bay. Flight destinations are from Germany to North/South America, South-East Asia, and South Africa. Tropospheric and stratospheric air is sampled with fractions of $\sim$60% and $\sim$40%, respectively. The stratospheric flight sections largely occur in the extra-tropical tropopause (transition) layer (exTL). Besides the observations, detailed meteorological information (including back-trajectories) along the flight tracks is available.

One unrivalled power of CARIBIC is the interference of representative distributions and seasonal variations of many trace gases in the upper troposphere and lower stratosphere (UTLS). As the measured trace gases have different sources and sinks and thus different atmospheric lifetimes and seasonal variations, their distributions reflect different atmospheric processes and therefore can be utilized to better understand and quantify the controlling processes. Here, examples of trace gas distributions collected since the year 2005 are presented and discussed, e.g. of the long-lived greenhouse gases CO_2, CH_4, N_2O, and SF_6 and of the more variable trace gases H_2O and acetone. Distributions relative to the tropopause are for instance interpreted to conclude on the transport and its seasonal variation of tropospheric air into the lowermost stratosphere. In spring the trace gas gradients across the tropopause are particularly strong, in autumn however, the gradients minimize so that the chemical tropopause almost vanishes.