

First results from the high resolution air sampler (HIRES) installed in the CARIBIC observatory

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In May 2010 the CARIBIC instrument container (Civil Aircraft for the Regular Investigation of the atmosphere Based on an Instrument Container; www.caribic-atmospheric.com) was upgraded to include a new high resolution air sampler, HIRES. This new sampler consists of 88 1L stainless steel sampling flasks, supplementing the existing 2 units with 14 2.5L glass flasks each, increasing the CARIBIC sampling capacity to 116 whole air samples collected using a single pumping unit having two metal bellow pumps in series. The CARIBIC project involves the monthly deployment of a fully automated instrument container equipped to make atmospheric measurements from aboard a commercial airliner, and has operated since 2005 onboard a Lufthansa Airbus 340-600. Measurements from the container include in-situ trace gas and aerosol analyses and the collection of aerosol and whole air samples for post-flight laboratory analysis. Measurements made from the sampling flasks include greenhouse gas (GHG) and nonmethane hydrocarbon (NMHC) analysis.

The first deployment of HIRES for a CARIBIC flight was in June 2010, and it has been in routine monthly operation since, making a total of 1188 HIRES air samples collected as of July 2011 (from a total of 1566 CARIBIC air samples). The ability of CARIBIC to observe the atmosphere at aircraft cruising altitudes (9-12 km) provides the opportunity to regularly measure the composition of the upper troposphere/lowermost stratosphere (UT/LS), and increased sampling resolution has provided invaluable long-term observations of GHG and NMHC gradients across the tropopause which are unique to CARIBIC. Here we provide a detailed description of the collection system itself, and give first results from the inaugural year of HIRES, which include detailed observations of pollution plumes over eastern Asia, tropical convection over continental Africa, and trace gas gradients in the tropopause at high northern latitudes.