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Aerosol Measurements on IAGOS Aircraft

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The natural variability of aerosol particles both in space and time is still one of the largest sources of uncertainty in global climate models. While there exist well developed ground-based networks for in-situ measurements (EUSAAR; www.eusaar.net) and for lidar measurements (EARLINET; www.earlinet.org), no comparable infrastructure is available for in-situ measurements of aerosol properties in the upper troposphere and lowermost stratosphere (UTLS).

In the framework of IAGOS (In-situ Aircraft for a Global Observing System), a robust instrument for routine measurements aboard longhaul in-service aircraft of the aerosol particle size distribution and the integral numbers of particles and for non-volatile particle cores is developed. The aerosol size information for the so-called accumulation mode covers the range of particles available for the formation of liquid water and ice clouds. The total number concentration provides information on gas-to-particle conversion and particle nucleation at flight altitude level. The number concentration of the non-volatile particle cores yields complementary information on the anthropogenic contribution to the atmospheric aerosol burden. Also, non-volatile soot particles emitted by aircraft are thought to play a role in the indirect aerosol effect on climate by acting as condensation nuclei for cirrus particles.

The aerosol package is designed for automated, low-maintenance operation. It contains one instrument for measuring particles of the aerosol accumulation mode by light scattering techniques (optical particle counter OPC: > 250 nm in diameter), and a two-channel instrument for the measurement of particle number concentrations down to the nm scale by means of condensation particle counters (CPC: > 5 nm in diameter). The dual-channel set-up permits the separation of total aerosol particles and non-volatile aerosol particles by applying a thermal denuder. The set-up of the aerosol package will be presented including results from instrument tests and evaluations.