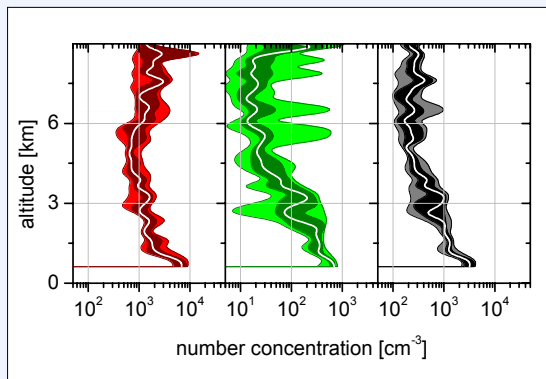


Aerosol Measurements on IAGOS Aircraft

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Needs for continuous aerosol measurements using instrumented civil aircraft

- Global aerosol distribution is highly variable in space and time.
- Aerosol impacts on climate still cause largest uncertainties in climate modelling.
- High priority for measurement of number concentration and size information profiles for complementing ground-based network data.
- Global coverage possible only by advanced active remote sensing from space-borne platforms or from in-situ measurements using instrumented civil aircraft.

Example: Vertical profiles of number concentration of particles in diameter larger 0.01 μm (red), accumulation mode number concentration (particle diameter > 0.1 μm; green), number concentration of non-volatile (250 °C) particles (particle diameter > 0.01 μm; black). Each vertical profile contains P10, P25, median, P75, and P95 values. Observations were performed above South Germany in May 2008 (by courtesy of Th. Hamburger, 2010).

Applied Techniques

Dual-Channel Condensation Particle Counter based on GRIMM 5.410

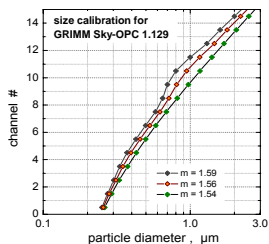
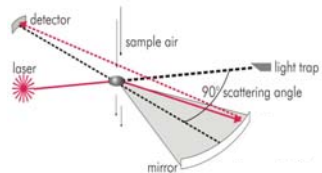
Measurement of particle number concentrations for the size range $d_p > 10$ nm using particle growth by condensation followed by the optical counting of droplets. Separation of volatile and non-volatile particle components by heating one channel to 250°C.

Applied working fluid: n-butanol.
Size range: $10 \text{ nm} < d_p < 3 \text{ μm}$.



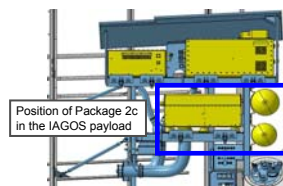
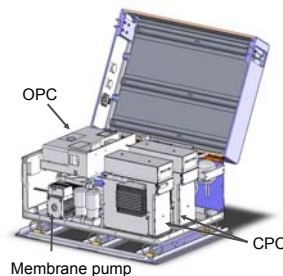
Optical Particle Counter GRIMM 1.129

Technique: Light scattered by particles ($\lambda = 683 \text{ nm}$).
Size range: $d_p = 0.25 - 20 \text{ μm}$.

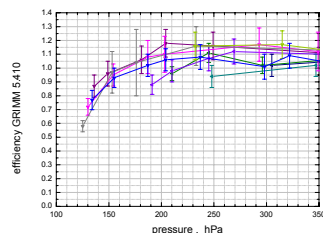
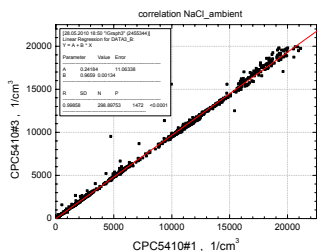


IAGOS Package 2c - Aerosols

- **Robust instrument for routine measurements from in-service aircraft**
 - particle size distribution (0.25 - 3.0 μm)
 - integral number of particles (0.01 - 3.0 μm)
 - non-volatile particle cores (0.01 - 3.0 μm)
- **OPC ($d_p > 250 \text{ nm}$) and two CPC ($d_p > 10 \text{ nm}$)**
 - particles available for the formation of water and ice clouds
 - volcanic ash & mineral dust particles
- **Thermodenuder ($T = 250 \text{ °C}$):**
 - information on non-volatile particles, e.g.: soot particles emitted by aircraft, volcanic ash and mineral dust particles, or biomass burning products
 - Information on gas-to-particle conversion and particle nucleation
- **Inlet for particle sampling ($d_{p, \text{max}} \approx 3.0 \text{ μm}$)**
 - Rosemount inlet footprint



Instrument Features

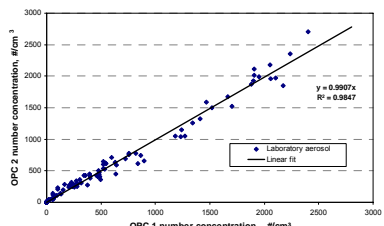


TOP

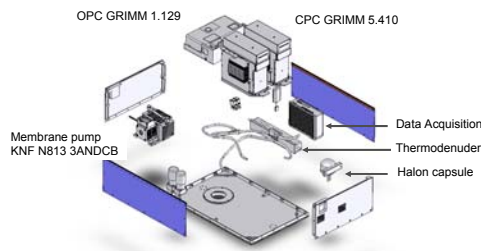
Left: Precision of two CPC 5.410 instruments at laboratory conditions.
Right: CPC counting efficiency at reduced pressures related to standard conditions.

BOTTOM

Ratio of total counts of aerosol particles measured by two GRIMM Model 1.129 Sky-OPC instruments using laboratory test aerosols.



Components of Package 2c - Aerosols



Aerosol Inlet Position on IAGOS Flange

