EGU21-6470, updated on 28 Jul 2021
https://doi.org/10.5194/egusphere-egu21-6470
EGU General Assembly 2021


# High-resolution air-quality observations onboard commercial Zeppelin flights in Germany

**Ralf Tillmann**[1], Franz Rohrer[1], Georgios I. Gkatzelis[1], Benjamin Winter[1], Christian Wesolek[1], Tobias Schuldt[1], Morten Hundt[2], Oleg Aseev[2], and Astrid Kiendler-Scharr[1]

[1]Institute of Energy and Climate Research, IEK-8: Troposphere, Forschungszentrum Jülich GmbH, Jülich, Germany
[2]MIRO Analytical AG, Wallisellen, 8304, Switzerland

A Zeppelin NT airship has been used as a platform for in-situ measurement of greenhouse gases and air pollutants in the planetary boundary layer (PBL). The Zeppelin especially with its long flight endurance, low air speed and potential high payload fills a gap between stationary ground based and remote sensing measurements, payload limited UAV based air monitoring, long range-high-altitude aircraft, and satellite observations. Its flight properties render unique applications for the observation of PBL dynamics and air quality monitoring. Highly resolved spatial and temporal trace gas measurements provide input required for modelling of air pollution and validation of emission inventories.

The core instrument deployed was a novel Quantum Cascade Laser (QCL) based multi-compound gas analyzer (MIRO Analytical AG) to measure in-situ concentrations of 10 greenhouse gases and air pollutants simultaneously. The analyzer measured $CO_2$, $N_2O$, $H_2O$ and $CH_4$, and the pollutants CO, NO, $NO_2$, $O_3$, $SO_2$ and $NH_3$ with high precision and a measurement rate of 1 Hz. The instrument was operated remotely without the need of on-site personnel. The instrument package was complemented by electrochemical sensors for NO, $NO_2$, $O_x$ and CO (alphasense), an optical particle counter (alphasense), temperature, humidity, altitude and position monitoring. Three campaigns of two weeks each were conducted in 2020 comprising unattended operation during commercial passenger flights.

The acquired data set will be discussed in regard to (1) diurnal height profiles of trace gases such as $NO_2$, (2) a detailed source attribution by fingerprinting, and (3) a comparison to observations from ground-based monitoring stations. The results demonstrate the QCL spectrometer as an all-in-one solution for air-borne trace gas monitoring. By measuring 10 compounds at once it helps to greatly reduce payload, space requirements and power consumption.