

## First measurements of aerosols on a ZEPPELIN airship

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In summer 2007 and autumn 2008 the airship ZEPPELIN NT was equipped with a suite of instruments to measure the distribution of different trace gases, short-lived radicals and aerosols in the planetary boundary layer together with radiation fluxes and meteorological parameters. A condensation particle counter (CPC, TSI Inc.) and a scanning mobility particle sizer (SMPS, TSI Inc.) were used to measure the total number concentration of atmospheric aerosols and their number size distribution. The measurements were carried out over forested, rural and urban areas in southern Germany as well as over Lake Constance. The performed flight patterns were vertical profiles above selected areas (e.g. figure 1) and regional flight tracks within a defined height above the ground (e.g. figure 2).

Height resolved measurements of aerosol number concentrations show predominately that aerosol concentration decreases with height independent of the area investigated. Since primary aerosols and precursors of secondary aerosols have their sources near the surface, aerosol concentrations are expected normally to be lower at higher altitudes.

As an example figure 1 presents the flight profiles above the city of Ravensburg and a forested area nearby as observed in autumn 2008. Above the forest (green shaded part) at altitudes below 700 m - 100 m above the ground and within the planetary boundary layer - high particle number concentrations  $> 5000 \text{ cm}^{-3}$  were observed. The concentrations well above the planetary boundary layer at altitudes between 800 and 1150 m were overall stable around  $2000 \text{ cm}^{-3}$ . Shaded in red presents data measured over the city of Ravensburg 10 km south of the forest. The lowest flight height was about 350 m above ground. The observed number concentrations were in the same range as over the forested area above the planetary boundary layer.

Figure 2 presents particle number concentrations measured in a height of 230 - 400 m above the ground in the region of Lake Constance. Particle number concentrations up to  $15000 \text{ cm}^{-3}$  were observed at the eastern part of the flight track presumably dominated by anthropogenic emissions e.g. a nearby motorway. During the remaining time of the flight number concentrations were mostly  $< 6000 \text{ cm}^{-3}$ .

In general the observed aerosol number concentration during the two campaign periods covers a range between 500 and  $40000 \text{ cm}^{-3}$ . Results of the SMPS-measurements show bi- and tri-modal

aerosol size distributions in a particle diameter range of 13 - 750 nm.

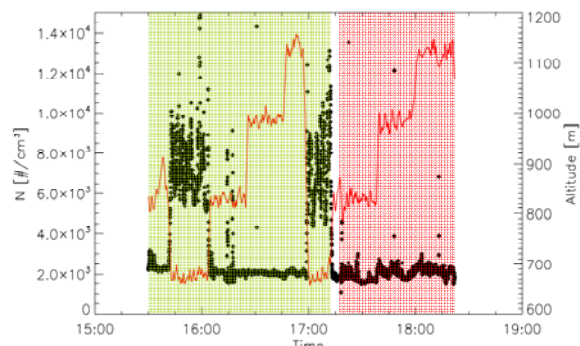


Figure 1. Flight profiles above a forested area (green shade) and the city of Ravensburg (red shade). The particle number concentration is presented as black dots, the altitude of the measurement as a red line.

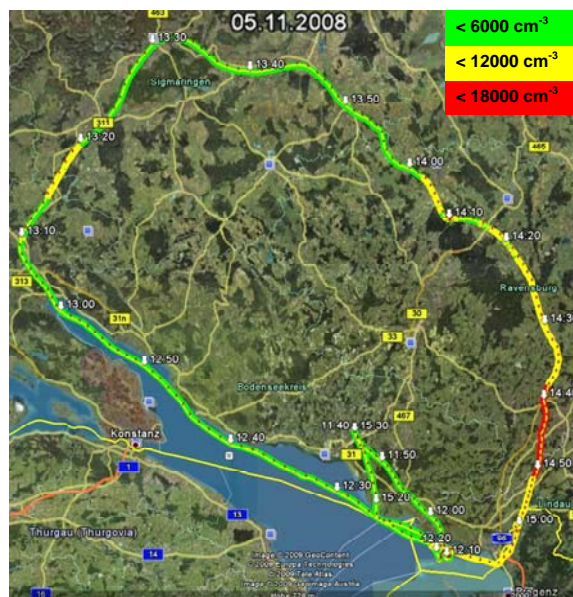


Figure 2. Particle number concentrations measured on the flight track of the ZEPPELIN in November 2008. During most time of the flight the height was within a range of 230 - 400 m above the ground. Particle concentrations along the flight track are indicated by colors.

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