Lidar and cloud radar

Observations of lidar and cloud radar at TROPOS

Remote-sensing techniques are applied at TROPOS to continuously measure the distribution of aerosol particles and clouds in the atmospheric column above Leipzig.

Lidar observations

Lidar (light detection and ranging) observations provide detailed insights into the distribution of aerosol particles in the atmospheric column above Leipzig. At TROPOS, such measurements are continually done with the lidar system Polly\textsuperscript{XT}.

A full overview on the worldwide measurements of Polly\textsuperscript{XT} can be found here.

![Recent lidar measurement of Polly-XT at TROPOS. Dark/bluish colors depict rather low aerosol concentrations, whereas yellow and red colors are an indication for aerosol and cloud layers, respectively. Homogeneous blue areas denote periods when the lidar could not measure due to rain or fog.](image)

Cloud radar observations

The radiowaves emitted by the cloud radar run at TROPOS have a wavelength of 8 mm and are thus efficiently scattered at cloud droplets, ice crystals, and rain drops. In turn, aerosol particles are not detected due to their small size compared to the wavelength. That is the reason why lidars, that emit light waves at a wavelength of around 1 µm, are used to observe aerosol particles.

The cloud radar measurement presented below provides thus a detailed overview on the development and distribution of cloud layers above Leipzig.
Recent cloud radar observation at TROPOS Leipzig. The reflectivity (radar reflectivity factor) provides information about number and size of the detected particles. High values either denote a high number or very large particles, whereas low values depict a low number or rather small particles. The vertical velocity (Doppler velocity) yields information about the fall velocity of particles or on the strength of vertical atmospheric motions (vertical winds). The spectral width increases with increasing variation of the particle sizes and with increasing atmospheric turbulence. From the linear depolarization ratio one can estimate the non-sphericity of the observed particles. Droplets produce low depolarization whereas ice crystals and snow produce rather high depolarization. A constant line of increased depolarization ratio denotes the melting layer in a precipitating cloud where snow melts and turns into liquid.