Aerosol, humidity, and vertical–velocity profiling
and cloud glaciation observations
during COPS

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1. Scientific goals (in the framework of SPP 1167)

- Aerosol characterization
  - Obtaining geometrical, optical, and microphysical properties of aerosols and clouds
  - Obtaining profiles of water vapour mixing ratio and temperature
- Vertical wind observations
  - Characterization of the development of the planetary boundary layer (PBL) and its convective state.
  - Statistical analysis of vertical wind conditions as a function of height for different scenarios (cloud free air columns, regions in and below clouds and aerosol layers).
- Comparing flat terrain (Leipzig) vs. orographically pronounced terrain (COPS)
- Characterize the impact of orography on convection during COPS
- Studies of heterogeneous ice formation
  - Investigating the effect of aerosol particles and meteorological conditions on cloud glaciation.

- Preparation of analyzed data for the COPS database
  - Deriving profiles of water vapour mixing ratio, temperature, aerosol optical properties, and vertical wind velocity for publication in the COPS database

2. Location and Instrumentation

- Our instruments were located at Supersite M in the Murg valley on the area of the ARM mobile facility.
- The measurement period was from 03/06/2007 - 28/08/2007

Multi-Wavelength Raman lidar

- Aerosol backscatter: 355, 400, 532, 800, and 1064 nm
- Aerosol extinction: 387, 607 nm
- Aerosol depolarization: 710 nm (cross + co polarized)
- Water vapour: 407 nm
- Temperature: 532 nm (rot)

6. Aerosol Optical Properties

- Line-of-Sight Wind Speed
  - Mostly pointed to the zenith to measure vertical wind speed
  - Half-hourly vertical profiles of horizontal wind speed and direction and of along-the-valley winds

3. Measurements of water vapour mixing ratio

- 3 August 2007 (IOP 13), 23:35 - 02:17 UTC
- Case study of 3 August 2007 before a through passed the site
- All available water vapour data was already analyzed and uploaded to the COPS database
- Comparison with model data from LMK run 01.08.2007 21:00 UTC at grid point 8.41 °E 48.56 °N
- Case study of water vapour mixing ratio on 1st and 2nd August 2007 before a through passed the site
- Free air columns, regions in and below clouds and aerosol layers.
- Obtaining profiles of water vapour mixing ratio and temperature
- Obtaining geometrical, optical, and microphysical properties of aerosols and clouds
- Vertical wind observations
- Characterization of the development of the planetary boundary layer (PBL) and its convective state.
- Statistical analysis of vertical wind conditions as a function of height for different scenarios (cloud free air columns, regions in and below clouds and aerosol layers).
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4. Vertical Velocity Profiling

- Example measurement (IOP 8c) of signal strength and vertical wind velocity during the passage of a convective system with gust front
- All available vertical wind velocity data was evaluated and uploaded to the COPS database
- Time-height plot of the 532 nm range-corrected signal and wind speed.

5. Clouds and aerosols observed with aerosol/Raman and wind lidar

- Case study of 19 July 2007 (IOP 9a), 20:12-22:21
- Time-height plot of the 532 nm range-corrected signal and vertical profiles of horizontal wind speed

- Convective systems embedded in Saharan dust. Please notice the melting layer after profile 320 at 2.8 km height.
- Heterogeneous ice formation in altocumulus clouds and incipient of a frontal system.

- Example measurement (IOP 9c) of signal strength and vertical wind speed.
- Half-hourly vertical profiles of horizontal wind speed and direction and of along-the-valley winds

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