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

Deutsche Forschungsgemeinschaft DFG

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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

Location

- 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)

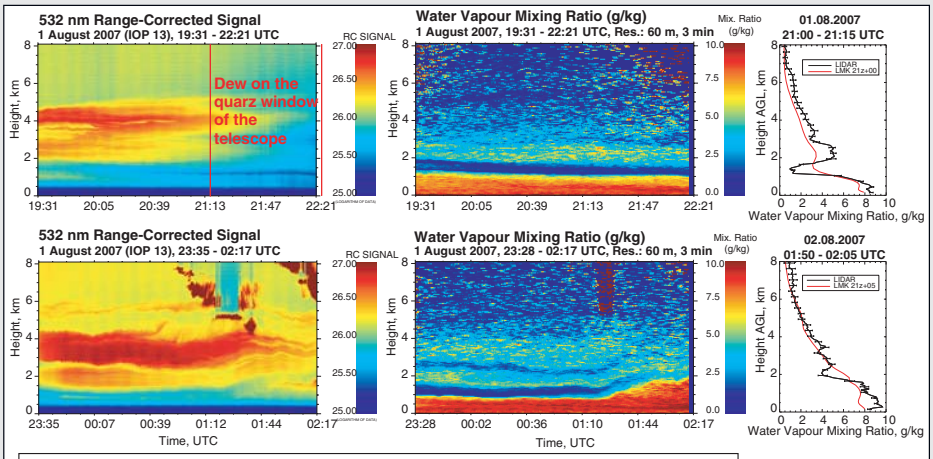
2,02 µm Doppler lidar

- Line-of-Sight Wind Speed

→ Mostly pointed to the zenith to measure vertical wind speed

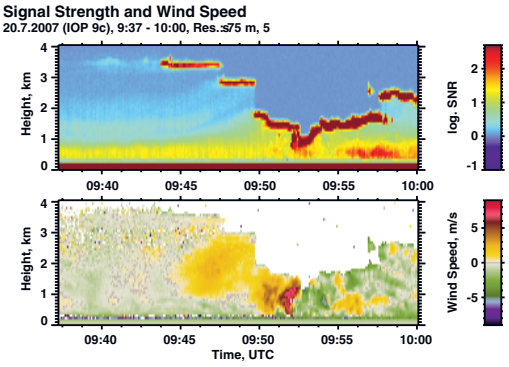
→ Half-hourly vertical profiles of horizontal wind speed and direction and of along-the-valley winds

3. Measurements of water vapour mixing ratio



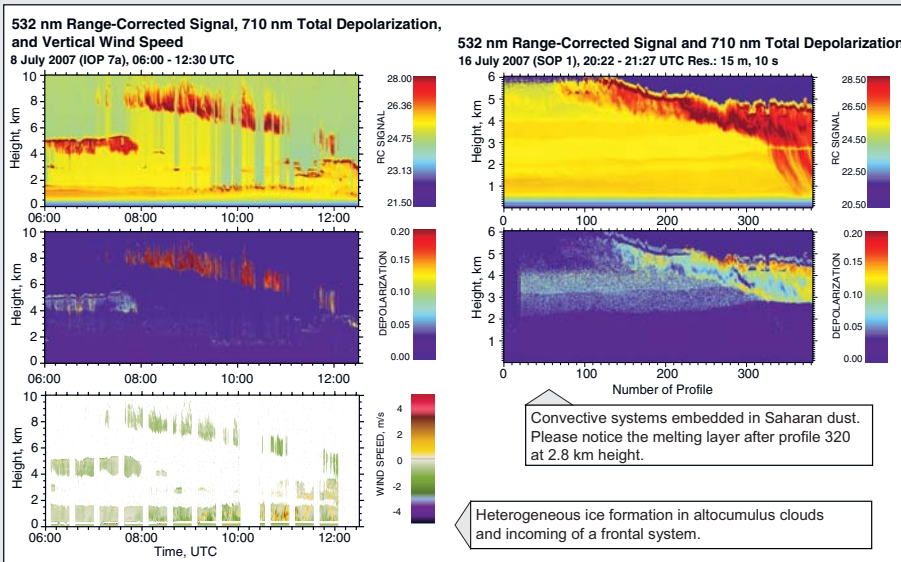
- Case study of water vapour mixing ratio on 1st and 2nd August 2007 before a through passed the site
- Comparioson with model data from LMK run 01.08.2007 21:00 UTC at grid point 8.41 °E 48.56 °N
- All available water vapour data was already analyzed and uploaded to the COPS database

4. Vertical Velocity Profiling



- Example measurement (IOP 9c) 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

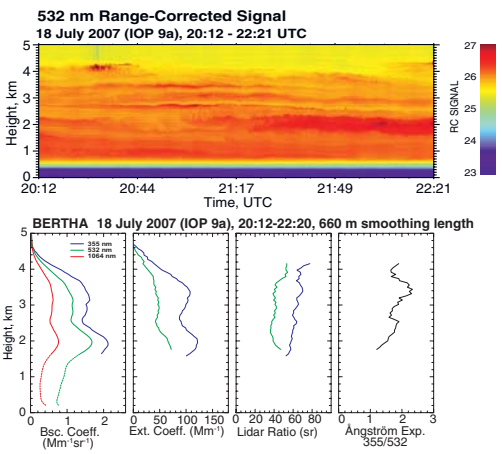
5. Clouds and aerosols observed with aerosol/Raman and wind lidar



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 incoming of a frontal system.

6. Aerosol Optical Properties



- 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 optical aerosol properties