Priority Program SPP 1167 of the DFG

Quantitative Precipitation Forecast

Exploiting the Synergy of Remote Sensing Data to Analyse Convective Initiation Processes in Complex Terrain

Andreas Behrendt and Volker Wulfmeyer

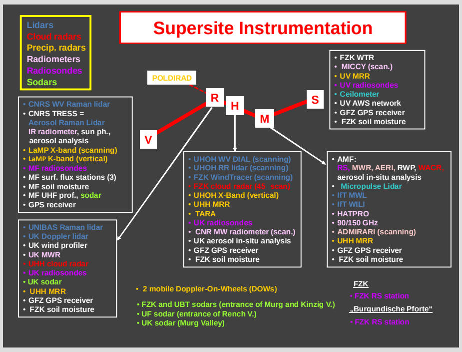
Institute of Physics and Meteorology, University of Hohenheim

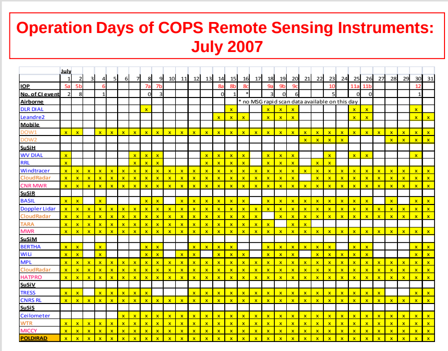
Summary

Within COPS a set of high-quality high-resolution 4D data of the entire evolution of convective precipitation events has been collected. In total 13 platforms with 17 different types of lidar systems alone have been operated successfully – groundbased and airborne, scanning and vertical pointing.

Within a project funded by the German Research Foundation (DFG) we plan to exploit the COPS remote sensing data with the aim to analyse why convection initiation (CI) took place at a certain location and time and apply the findings to improve cumulus parameterization schemes.

Our goal is a cooperation of all PIs of remote sensing instruments in order to process the data in comparable fashion and to derive new synergetic data products relevant for CI process studies at all supersites. .



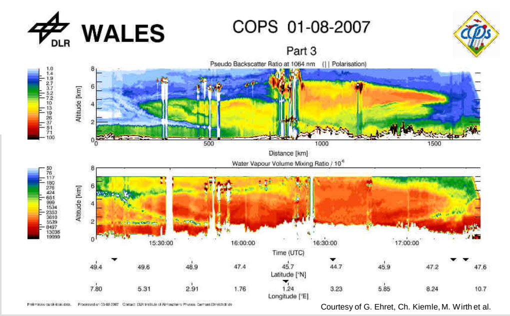


Initiation of Convection Process Studies

Strategy:

- **Investigate the comprehensive, 4D, high-resolution remote sensing data set of COPS in detail**
- **Derive new synergetic data products which are relevant to CI process studies**
- **Compare the observations with corresponding conceptional theories on cumulus parametrization in complex terrain**

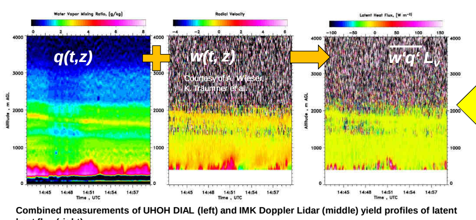
Work Package (WP) 1:
Intercomparison of COPS water vapor data, derive bias and RMS errors (in cooperation with P. Di Girolamo and involved instrument PIs)



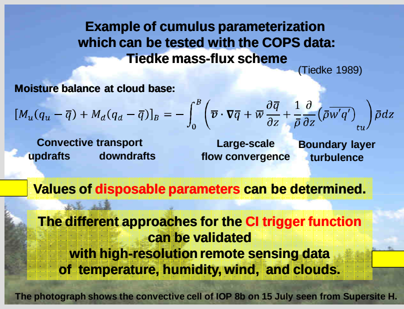
WP2:
Priority list of IOPs for CI case studies

WP3:
Apply higher-order corrections to water vapor lidar data in oder to reach better than 5 % accuracy

WP4:
Analyse the diurnal cycle of boundary layer variables and relate the result to QPF deficiencies , see also WP7.

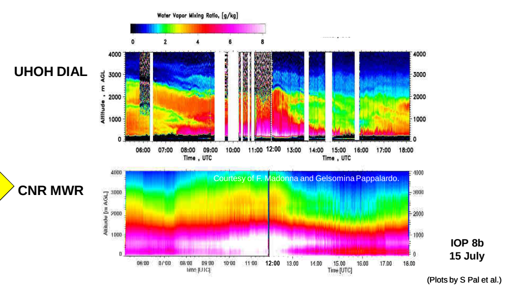


Combined measurements of UHOH DIAL (left) and IMK Doppler Lidar (middle) yield profiles of latent heat flux (right). (Plots by S Pal et al.)



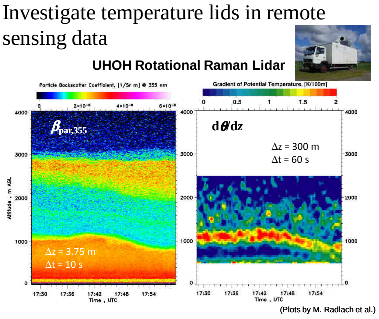
$$[M_u(q_u-\bar{q})+M_d(q_d-\bar{q})]_B = -\int_0^B \left(\bar{v}\cdot\nabla\bar{q}+\bar{w}\frac{\partial\bar{q}}{\partial z}+\frac{1}{\bar{\rho}}\frac{\partial}{\partial z}(\bar{\rho}\overline{w'q'})_{tu}\right)\bar{\rho}\,dz$$

WP8:
Investigate the small scale heterogeneity of water vapor, temperature, wind, clouds, aerosols and their relation to CI



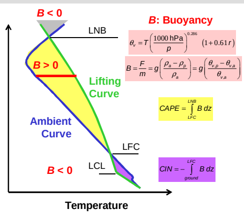
(Plots by S Pal et al.)

WP5:
Investigate temperature lids in remote sensing data



(Plots by M. Radlach et al.)

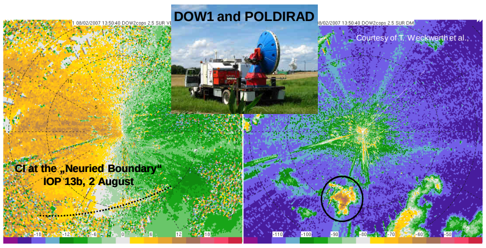
WP9:
Combine simultaneous scanning data of water vapor and temperature: RH, θ, θ_v, dθ/dz, $d\theta_v/dz$, buoyancy, CAPE, CIN



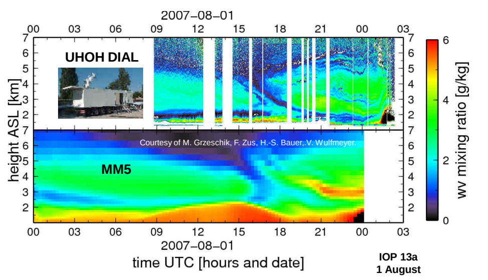
WP11:
Detailed case studies of CI events and comparison with parametrization concepts

WP6:
Quantify gravity waves by remote sensing data

WP10:
Employ clear-air echos of DOWs and POLDIRAD for CI



WP12:
Compare case study results with D-PHASE model simulations, COPS-GRID re-analyses, and hybrid convection schemes in cooperation with the respective projects



WP7:
Derive sensible and latent heat fluxes by collocated lidars at all Supersites