LAUNCH-2005
International Lindenberg Campaign for Assessment of Humidity- and Cloud-Profiling Systems and its Impact on High-Resolution Modelling

Concept

- Objectives
- Basic Techniques and Algorithms
- Experimental Domains
  - Remote-sens. equipment in D04
  - Remote-sens. equipment in D02
- OSE concept
  - Lidar
  - Passive systems
- Participants & Period

The winch house at Lindenberg Observatory: Technical monument for the operational launch of meteorol. kites in the last century
2005 Campaign at Lindenberg Observatory

- **Motivation:**
  "To assess for the first time the impact of 4D-VAR data assimilation into an high-resolution weather forecasting model from a network of stationary, ground-based water-vapor Lidars in comparison to microwave profilers"

- **Method:**
  - NWP experiment on base of data from a special campaign in Sep./Oct 2005
  - Different model domains: a) Lindenberg domain (1 km resolution) \( \rightarrow D04 \)
    b) European domain (9 km resolution) \( \rightarrow D02 \)
  - Comparison of impacts from Lidar and MRP humidity profiles

- **Campaign:**
  - Mesoscale campaign for supply of OSE data
  - Period 29th Aug – 16th Oct, 2005
  - Ab. 5 profiling stations in the small-scale domain around MOL
  - As much as possible stations in the European model domain !!!
    (COST-720 activity + GEWEX-CAP activity)

  - 4D-VAR assimilation for the MM5/ECMWF system at Hohenheim, using the operators of the Hohenheim Univers. group (H.-S. Bauer)

→ **Objective:**

„Development of ground-based, integrated rem.-sensing station for atmospheric profiling“

- 2 WGs: I) Basic techniques and algorithms
  II) Integration
  III) Data assimilation

- Concentration on basic parameters (v, T, u + clouds)

→ **Status**

- realization + evaluation of the big internat. campaign TUC-2003 in PAY (CH)
- emphasis on determin. of LWC profiles and cloud boundaries
Objectives of LAUNCH-2005

(1) Impact Studies:

Impacts shall be assessed for:

a) High-precision / high-resolution humidity-profiling systems
   - from a network of humidity profiling Lidars and (alternatively)
   - from a network of microwave profilers (MWP), and

(b) Measurements of cloud liquid water and cloud ice water content,
   - supplied by a network of integrated systems consisting of cloud radars /
     Micro-Rain-Radars(MRR), Lidar (ceilometer), and MWP in conjunction with a
     radiosonde.

   - proposed technique for system integration acc.to Löhnert et al., JAM, Sep.2004
     (core instrumentation: MRP + ceilometer + cloud radar)
Objectives – II

(2) Assessment of „Basic Techniques and Algorithms“

Basic techniques:

(a) Assessment of ground-based humidity, temperature, and wind profiling systems:
   (1) Water vapour Lidar systems (Raman Lidar and DIAL)
   (2) Rotational Raman Temperature Lidar
   (3) MWP systems
   (4) FTIR spectrometer
   (5) Doppler wind Lidar system with scanning capabilities.

(b) Assessment of satellite-derived humidity profiles (Univers. Berlin) vs. ground-based profile data

(c) ADM/Aeolus ground validation campaign of the European Space Agency (ESA):
    Assessment of the wind lidar system vs. WPR at Lindenberg Observat.

Basic algorithms:

Existing algorithms for determination of operational cloud parameters:

(a) Test of an algorithm for minimization of disturbances (e.g. clutter, noise, echoes from clear-air PBL) to cloud radar data
(b) Determination of cloud base and top
(c) Algorithms for cloud profiling (LWC, LWP, IWC, and cloud fraction)

\( \rightarrow \) feasibility test for the supply of cloud parameters using integrated systems in compliance with COST-720 WG-2
Aerological „hardware“ at Lindenberg Observatory

**RS systems at MOL**

- 2 WPR/RASS
- Sodar/RASS
- **LIDAR** (Aug. 2005)
- Ka-band cloud radar (36 GHz)
- 1.3 GHz MRR
- Microwave profiler + MWR

**Systems for validation**

- FTIR
- 4 - radiosondes / day
- 4 Laser-Ceilometer
- 6-sonde tethered-balloon systems (ff,dd,T,q, p, z)
- 2 GPS receiver
- Sun- and star-photometer

[ 99m tower  (dx = 5km) ]

different spectrometers (e.g. 3 Brewer Sp.)
Experimental Domains / Systems

**Systems in D04**

Currently 5 Lidar systems (4 WV systems)
- 3 MWP systems (+1 MW radiometer)
- 3 (4) cloud radars
- 2 MRR
- 4 Ceilometers

**Systems in D02**

Currently 3 Lidar systems
- 1 MW radiometer
- 2 cloud radars
- ?? Ceilometers

1 (2) airborne systems
### Participating Systems (1-a) Lindenberg Domain - Humidity

#### Lidars in D04

<table>
<thead>
<tr>
<th>System</th>
<th>Provider</th>
<th>Parameters</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>WV-Raman-Lidar</td>
<td>DWD-MOL</td>
<td>Humidity</td>
<td></td>
</tr>
<tr>
<td>WV-DIAL</td>
<td>MPI-MET Hamburg</td>
<td>Humidity</td>
<td></td>
</tr>
<tr>
<td>WV-DIAL</td>
<td>Univ. Hohenheim</td>
<td>Humidity</td>
<td></td>
</tr>
<tr>
<td>6-λ Raman Lidar</td>
<td>Inst. f. troposph. research, Leipzig</td>
<td>Humidity, T,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>clouds</td>
<td></td>
</tr>
<tr>
<td>WV-Raman Lidar</td>
<td>IPSL-Palaiseau, France / A. Protat</td>
<td>Humidity</td>
<td>To be confirmed</td>
</tr>
<tr>
<td>6-channel Lidar</td>
<td>LM-Univers. Munich / M. Wiegner</td>
<td>Aerosol, clouds</td>
<td>no humidity</td>
</tr>
<tr>
<td>WV-Raman Lidar “MARL”</td>
<td>AWI-Bremerhaven</td>
<td>Humidity</td>
<td>To be confirmed</td>
</tr>
</tbody>
</table>

#### Microwave radiometers – Domain D04 (humidity)

<table>
<thead>
<tr>
<th>System</th>
<th>Provider</th>
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<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-channel profiler</td>
<td>DWD-MOL</td>
<td>Humidity, T,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LWC profile</td>
<td></td>
</tr>
<tr>
<td>2-channel radiometer</td>
<td>DWD-MOL</td>
<td>WV column</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>content</td>
<td></td>
</tr>
<tr>
<td>12-channel profiler</td>
<td>?? UK-MetOffice ?? Tim Hewison</td>
<td>Humidity, T,</td>
<td>To be confirmed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LWC profile</td>
<td></td>
</tr>
<tr>
<td>12-channel profiler</td>
<td>I.M.A.A. – CNR, Potenza / G. Pappalardo</td>
<td>Humidity, T,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LWC profile</td>
<td></td>
</tr>
<tr>
<td>12-channel profiler</td>
<td>KNMI / R. Boers</td>
<td>Humidity, T,</td>
<td>To be confirmed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LWC profile</td>
<td></td>
</tr>
<tr>
<td>Multi-λ microwave Profiler</td>
<td>Radiometer-Physics GmbH</td>
<td>Humidity, T,</td>
<td>(to be confirmed)</td>
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<tr>
<td></td>
<td></td>
<td>LWC profile</td>
<td></td>
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<tr>
<td>12-channel profiler</td>
<td>LM Univ. Munich / S. Crewell</td>
<td>Humidity, T,</td>
<td></td>
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<td>LWC profile</td>
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</table>

### MWPs in D04

- **Lidar systems – Domain D04 (humidity)**
- **Microwave radiometers – Domain D04 (humidity)**

Lindenberg Observatory
### Participating Systems

**Lindenberg Domain - Cloud Parameters**

| Cloud radar systems / MicroRainRadar / ceilometers – Domain D04 (cloud parameters) |
|---|---|---|
| 35.5 GHz cloud radar | DWD-MOL | Cloud parameters → synerg.profiling |
| 94 GHz cloud radar | GKSS / M. Quante | Cloud parameters → synerg.profiling | To be confirmed |
| 35.5 GHz cloud radar | MPI-MET Hamburg / G. Peters | Cloud parameters → synerg.profiling | To be confirmed |
| 1290 MHz MRR (Micro-Rain-Radar) | DWD-MOL | Rain parameters → synerg.profiling |
| 1290 MHz MRR (Micro-Rain-Radar) | METEK / H.-J. Kirtzel | Rain parameters → synerg.profiling | To be confirmed |
| 35.5 GHz cloud radar | FZ-Karlsruhe / Chr. Kottmeier | Cloud parameters → synerg.profiling | To be confirmed |
| 4 Ceilometers LD-40 (“Tropopauser”) | Vaisala / DWD-MOL | Cloud base → synergetic profiling |
| 2 WPR/RASS (482 MHz and 1290Mhz) | DWD-MOL | U, V, W, SNR, moments |

**Cloud radars etc. in D04**
### Participating Systems

**2) European Domain - Humidity + Clouds**

<table>
<thead>
<tr>
<th>Lidar systems – Domain D02 (humidity) in addition to domain D04</th>
</tr>
</thead>
<tbody>
<tr>
<td>WV-Raman Lidar</td>
</tr>
<tr>
<td>WV Raman Lidar</td>
</tr>
<tr>
<td>Cloud Radar</td>
</tr>
<tr>
<td>Cloud Radar</td>
</tr>
<tr>
<td>Airborne equipm. (Lidar ??)</td>
</tr>
<tr>
<td>Airborne Lidar systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Microwave radiometers – Domain D02 (humidity) in addition to domain D04</th>
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</thead>
<tbody>
<tr>
<td>2-channel radiometer</td>
</tr>
</tbody>
</table>
Lindenberg Domain:

(1) System installation, adjustment, and testing → Aug. 14 – Aug. 28
(2) Intercomparison period → Aug. 29 – Sep. 12
(3) Operational period at the network locations → Sep. 12 – Oct. 16, 2005

European Domain:

Operational period at network locations → Aug. 29 – Oct. 16, 2005