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) → D04**
  b) European domain (9 km resolution) → 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)**

Sensor Synergy / COST-720 (01/2001 – 12/2005)

→ **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

(eventually)

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**)

→ ***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)

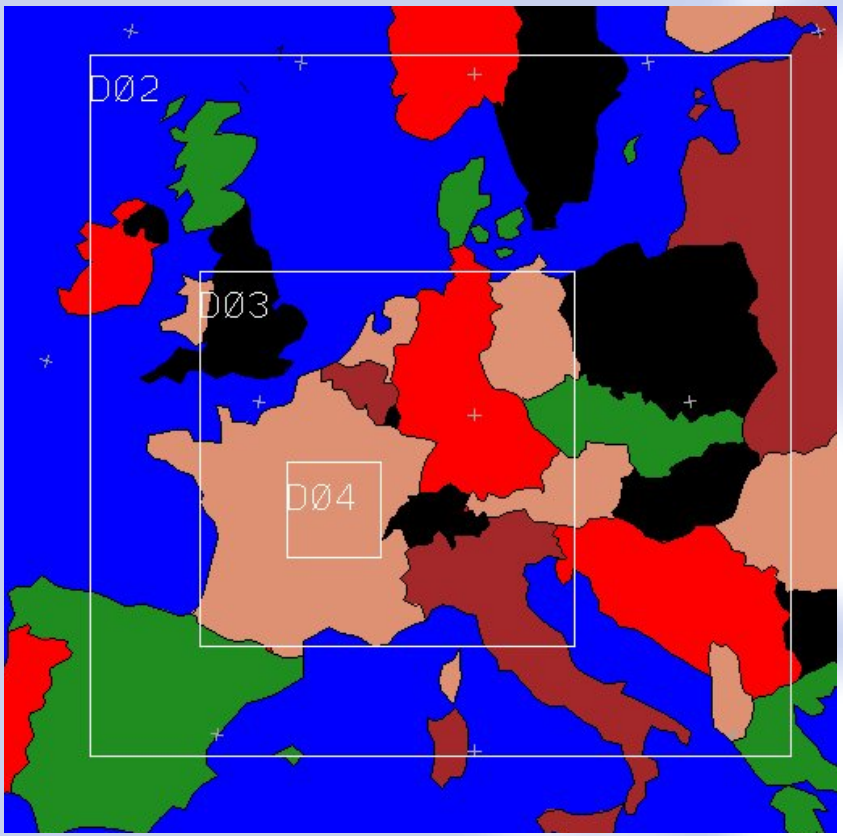
2 GPS receiver

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*

System	Provider	Parameters	Comments
Lidar systems – Domain D04 (humidity)			
WV-Raman-Lidar	DWD-MOL	Humidity	
WV-DIAL	MPI-MET Hamburg	Humidity	
WV-DIAL	Univ. Hohenheim	Humidity	
6-λ Raman Lidar	Inst. f. troposph.research, Leipzig	Humidity, T, clouds	
WV-Raman Lidar	IPSL-Palaiseau, France / A. Protat	Humidity	To be confirmed
6-channel Lidar	LM-Univers. Munich / M. Wiegner	Aerosol, clouds	no humidity
WV-Raman Lidar "MARL"	AWI-Bremerhaven	Humidity	To be confirmed

Lidars in D04

Microwave radiometers – Domain D04 (humidity)			
12-channel profiler	DWD-MOL	Humidity, T, LWC profile	
2-channel radiometer	DWD-MOL	WV column content	
12-channel profiler	?? UK-MetOffice ?? Tim Hewison	Humidity, T, LWC profile	To be confirmed
12-channel profiler	I.M.A.A. – CNR, Potenza / G. Pappalardo	Humidity, T, LWC profile	
12-channel profiler	KNMI / R. Boers	Humidity, T, LWC profile	To be confirmed
Multi-λ microwave Profiler	Radiometer-Physics GmbH	Humidity, T, LWC profile	(to be confirmed)
12-channel profiler	LM Univ. Munich / S. Crewell	Humidity, T, LWC profile	

MWPs in D04

Participating Systems

(1-b) *Lindenberg Domain - Cloud Parameters*

Cloud radar systems / MicroRainRadars / 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-Karlsuhe / 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*

Lidar systems – Domain D02 (humidity) in addition to domain D04			
WV-Raman Lidar	I.M.A.A. – CNR, Potenza / G. Pappalardo	Humidity, T, RH	
WV-Raman Lidar	? L'Aquila / F. Marzano?	Humidity	To be confirmed
WV Raman Lidar	Chilbolton / J. Agnew	Humidity	
Cloud Radar	Chilbolton	Cloud parameters	To be confirmed
Cloud Radar	IPSL-Palaiseau / France	Cloud parameters	To be confirmed
Airborne equipm. (Lidar ??)	MetOffice /P. Brown	Humidity	
Airborne Lidar systems	DLR / G. Ehret	Humidity, wind	To be confirmed
Microwave radiometers – Domain D02 (humidity) in addition to domain D04			
2-channel radiometer	IPSL-Palaiseau, France / A. Protat	WV column content	

Experimental Period

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**