WMO-CIMO Testbed, Lindenberg Meteorological Observatory – Richard-Aßmann-Observatory (Lindenberg, Germany)

General Site Information

For more than 100 years, the Lindenberg Meteorological Observatory (MOL) has been a permanent observing site in a rural landscape with the main focus on vertical profiling of the atmosphere. Today, research activities at MOL are focused on:
• the operational assessment and development of modern ground-based remote sensing techniques,
• the comprehensive quality characterization of radiosonde measurements,
• atmospheric boundary layer and radiation process studies.

Operational measurements carried out in these fields provide comprehensive data sets to characterize the physical state and processes of the atmosphere above Lindenberg, the so-called "Lindenberg Column".

The observatory
• is a climate reference site of the Deutscher Wetterdienst (DWD)
• operates a 24/7 routine weather station including routine radio soundings every six hours
• hosts the GCOS Reference Upper–Air Network (GRUAN) Lead Center
• contributes to different WMO programs within GCOS and WCRP.

Testbed location:	52.209°N 14.118°E
Climate type:	Cfb (maritime temperate, all year wet climate)
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Main activities

Areas of research

The main task of the Lindenberg Testbed is to test and to evaluate ground-based remote sensing instruments under operational conditions. One particular area of interest is the characterization of small-scale physical processes in the atmosphere over a heterogeneous landscape, including a derivation and description of their measurement uncertainties. Activities are focused on measurement techniques to determine vertical profiles of thermodynamic parameters (wind, temperature, humidity) and of relevant properties of suspended particles (clouds, aerosol) across the whole troposphere (and partly the lower stratosphere) as well as of turbulence and radiation in the atmospheric boundary layer.

Facilities

MOL runs a comprehensive measurement program on an operational basis (24/7), the details are given in the Table below. National and international research groups are welcome to join the scientists and technicians at the observatory for testing and assessment of atmospheric measurement devices. MOL has available a wide range of logistic capabilities to install and to run additional instrumentation for testing and inter-comparison, including

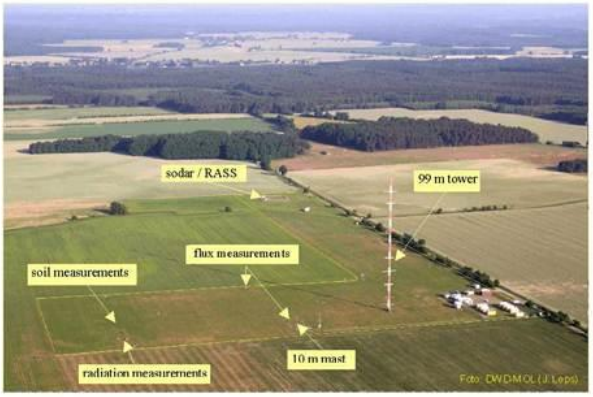
- the remote sensing field site
- a lidar laboratory building with roof platform
- a radiation laboratory building with roof platform
- a large balloon barn
- the boundary-layer grassland field site with its 99m tower

Measurements	Sensors / Systems	Measured / Derived Atmospheric Variables	(Typical) Height Range
in-situ aerological soundings	operational radiosondes (Vaisala RS92, Graw)	horizontal wind vector, temperature, humidity, pressure	0 – 35 km
	research radiosondes (CFH, SnowWhite, Flash)	horizontal wind vector, temperature, humidity, pressure	0 – 35 km
	ozone sonde (ECC)	ozone mixing ratio	0 – 35 km
ground-based remote sensing	482 MHz radar wind profiler / RASS	horizontal wind vector virtual temperature	0.5 – 16 km (0.5 – 3 km)
	Sodar / RASS	horizontal wind vector virtual temperature	0.05 – 0.5 km (0.05 – 0.2 km)
	IR Doppler lidar	horizontal wind vector	0.05 – 2 km
	Raman lidar	water vapour mixing ratio, temperature, aerosol and cloud parameters (e.g., backscatter / extinction coefficients)	0.1 – 16 km
	35.5 GHz cloud radar	reflectivity, Doppler	0.2 – 15 km

		velocity, LDR (CLOUDNET standard products)	
	microwave radiometer profiler	temperature, humidity, liquid water path	0 – 10 km
	laser ceilometer	cloud base height, aerosol layer heights	0.05 – 12 km
	GPS receiver	Column-integrated water vapour content	
micrometeorological and boundary layer measurement techniques and sensors	in-situ sensors on a 10m mast and 99m tower	horizontal wind vector, temperature, humidity	0.5 – 100 m
	sonic + IR gas analyser	turbulence variables (variances, fluxes, …)	2 – 90 m
	soil sensors	soil temperature, soil moisture, soil heat flux	- 0.5 – - 1.0 m
	scintillometers	regional-scale turbulent fluxes	sfc
radiation measurements	broadband radiometers	broadband shortwave / longwave radiative fluxes	sfc
	precision filter radiometers	aerosol optical depth in 8 spectral bands (412 nm – 1024 nm)	sfc
	star photometer	aerosol optical depth in 17 spectral bands (400 nm – 1050 nm)	sfc
	precision spectral radiometer	direct solar irradiance at high resolution (300 nm – 1024 nm)	sfc
	UV spectral radiometers	UV radiation fluxes	sfc
	whole sky imager	macroscopic cloud characteristics	sfc
	broadband radiometers carried by tethered balloon	broadband shortwave / longwave radiative fluxes	sfc – 1.0 km

The remote sensing field with the 482 MHz wind profiler

The lidar laboratory building with the roof platform



The Falkenberg boundary layer field site

The roof platform of the radiation laboratory building

Ongoing and planned projects

2014-2018

- Operational use and further improvement of UHF wind profiler radar systems (quality issues of the European windprofiler network, Cal/Val activities for ADM-Aeolus mission, participation in establishment of an ISO guideline, participation in EUMETFREQ activities to ensure sustainable availability of relevant frequency bands)
- Laboratory experiments (climate chamber, reference humidity, radiation chamber) and simultaneous soundings with reference sondes to characterize radiosondes from different manufacturers (e.g. Graw, Meisei, MODEM)

2014-2016

- Assessment of the new Vaisala RS41 radiosonde according to the GRUAN procedures
- Assessment of long-term operational capabilities of IR Doppler (wind) lidars
- Assessment of the Nubiscope

2016-2018

- Studies into the operational capabilities of different types of ceilometers to derive quantitative information on aerosol and cloud parameters
- Testing of operational capabilities of a microwave scintillometer

Publication list

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