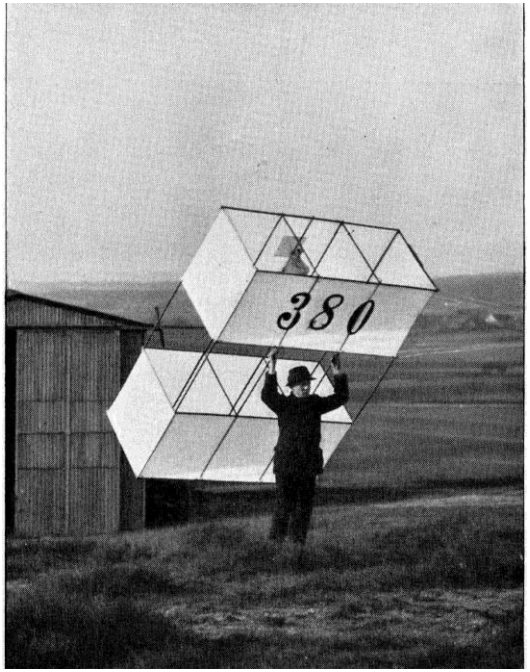
Lindenberg Meteorological Observatory – Richard Aßmann Observatory

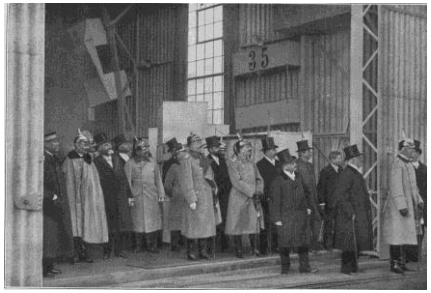
(since 1905)

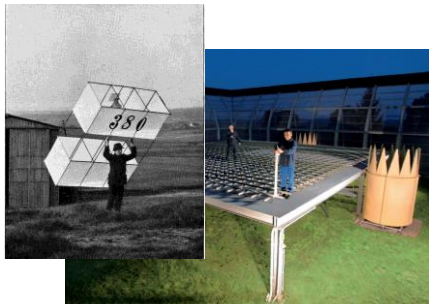


Franz H. Berger

Brief historical overview

1893	*first radiation measurements at Potsdam Observ.*
April 1905	first thetered balloons, kite
October 1905	inauguration ceremony (emporer Wilhelm II)
April 1911	introduction of a first air trafic warning system
August 1919	Kite – World record (9750m)
since 1930	developement of a radiosonde system
since 1947	routine radiosonde launches (4x daily)
since 1992	surface based remote sensing
since 1994	ABL measurements (GM Falkenberg, Kehrigker Forst)
2003	Merging of Lindenberg und Potsdam (radiation) observatories
since 2008	GRUAN Lead Centre
since 2011	WMO/CIMO Testbed





Measurements 1905-1932 at Lindenberg Aeronautical Observatory

Am Aeronautischen Observatorium Lindenberg (1914—1931) mit Fesselaufstiegen erreichte Höhen in m

Jahr	mit Drachen			mit Fesselballonen		
	Anzahl	max. Höhe	mittl. tägl. Höhe	Anzahl	max. Höhe	mittl. tägl. Höhe
1914	778	6200	3340	454	8000	3668
1915	701	5610	3517	439	5500	[illegible]
1916	755	7500	3998	400	9260*	4332
1917	720	8240	4025	360	[illegible]	4160
1918	703	[illegible]	3661	31[illegible]	3990	2869
1919	601	9750*	3811	182	5334	2484
1920	697	6700	3306	91	3950	2427
1921	711	5710	2968	30	2560	1867
1922	697	5860	2880	—	—	—
1923	630	4720	2560	55	4080	1677
1924	410	4660	2800	203	3260	2089
1925	456	4470	2488	166	4270	2462
1926	431	5403	2551	203	4788	2384
1927	461	4708	2535	222	4219	2182
1928	508	4260	2321	320	4070	2309
1929	703	5705	2308	220	4175	2567
1930	640	5865	2553	233	4421	2594
1931	609	5772	3030	142	4131	2385
1914—1931	11211			4032		

*) 1. 8. 1919 9750 m [illegible] **) 26. 9. [illegible] [illegible]

World Record

kites & balloons

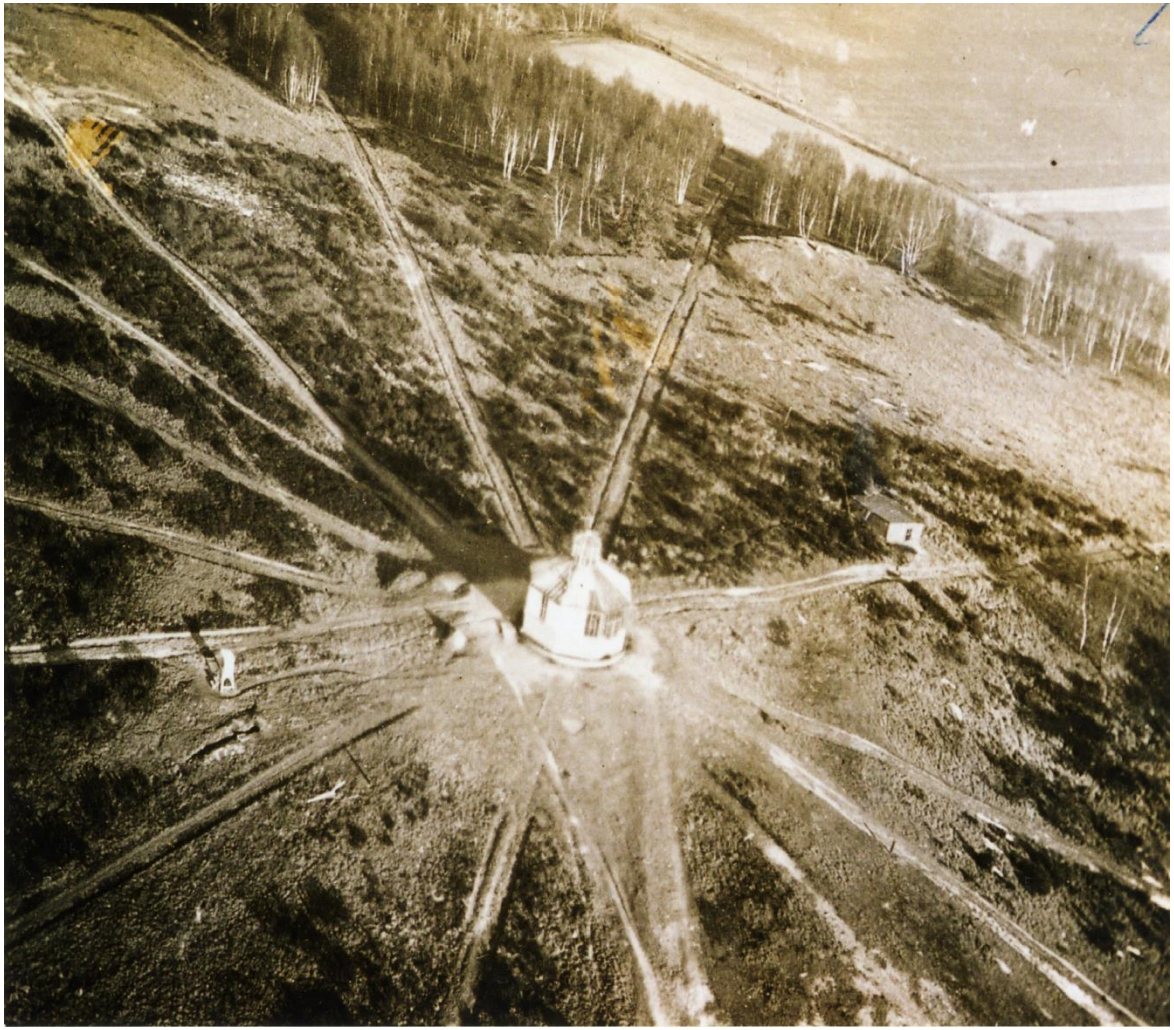
History:

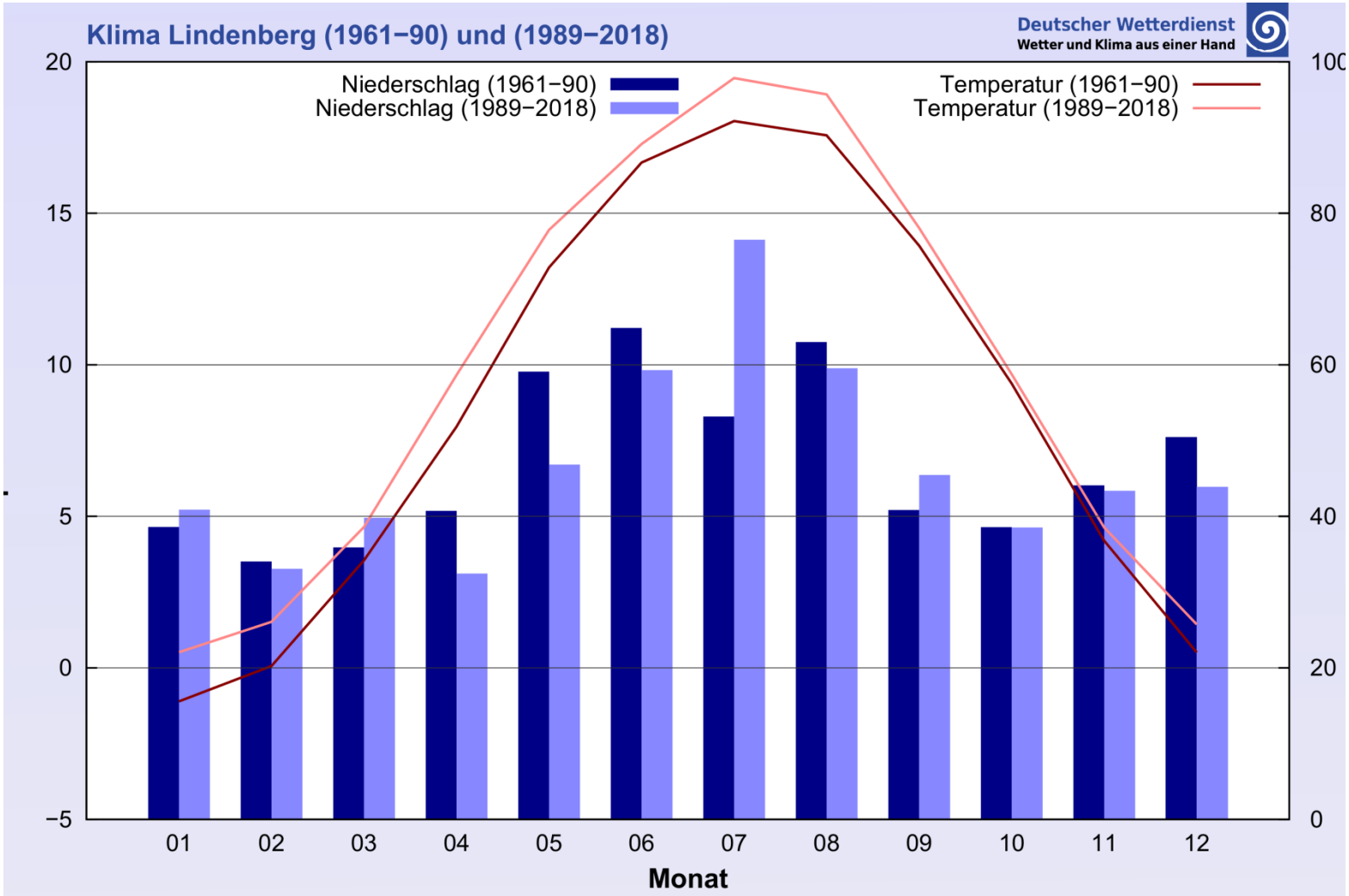
- **Radiation**
  (since 1906;
  Postdam since 1893)

- **Aerology – *in-situ***
  (since 1905)

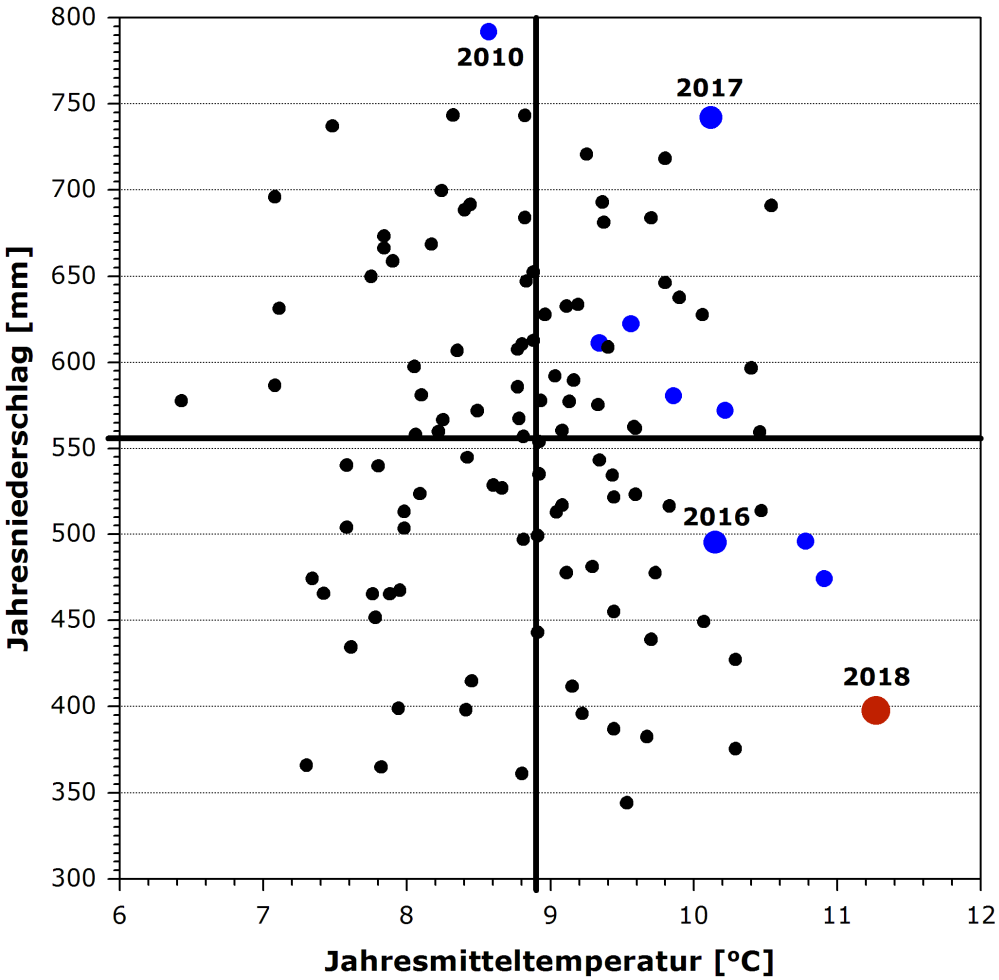
- **Ground based remote sensing**
  (since 1992)

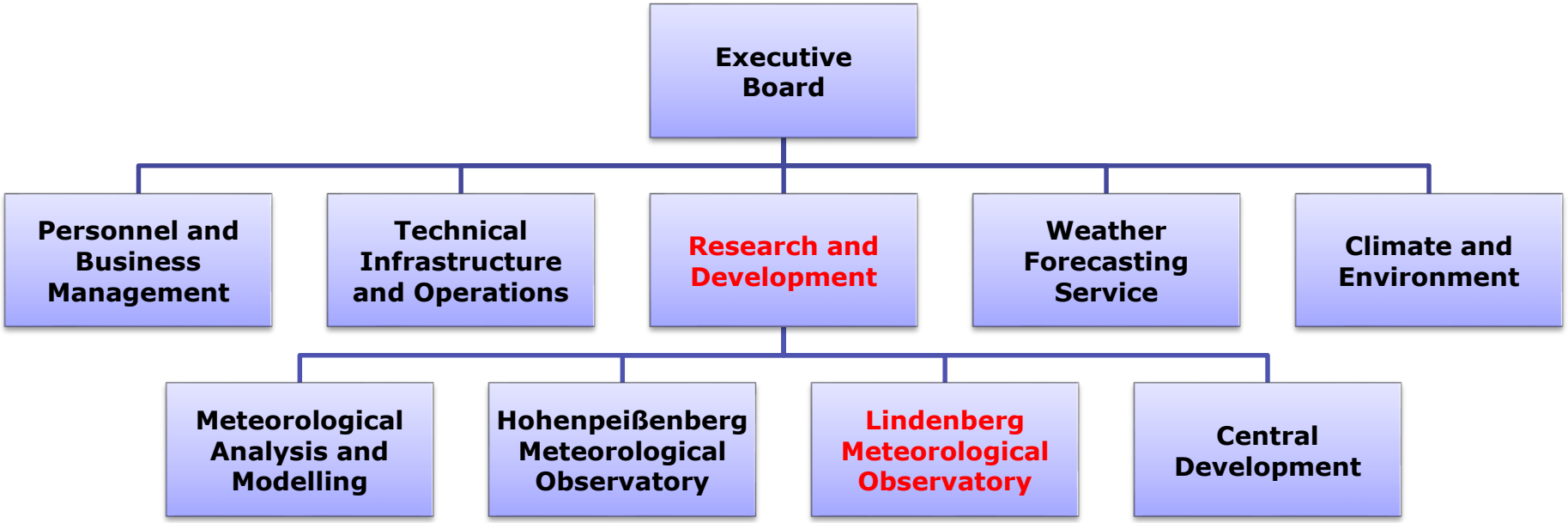
- **Energyflux / ABL measurements**
  (since 1995)





20 : Klimadiagramm Lindenberg (1961–1990) und (1989–2018)
werden die mittleren monatlichen Werte der Temperatur und des Niederschlags für die beiden Perioden 1961–90 (Normalperiode) und 1989–2018 dargestellt. Die
peraturmittelwerte 1989–2018 lagen im gesamten Jahr über den Mittelwerten der Normalperiode, wobei im Herbst die Erwärmung nicht so stark ausgeprägt ist.


2010
2017
2016
2018
Jahresniederschlag [mm]
Jahresmitteltemperatur [°C]
800
750
700
650
600
550
500
450
400
350
300
6
7
8
9
10
11
12



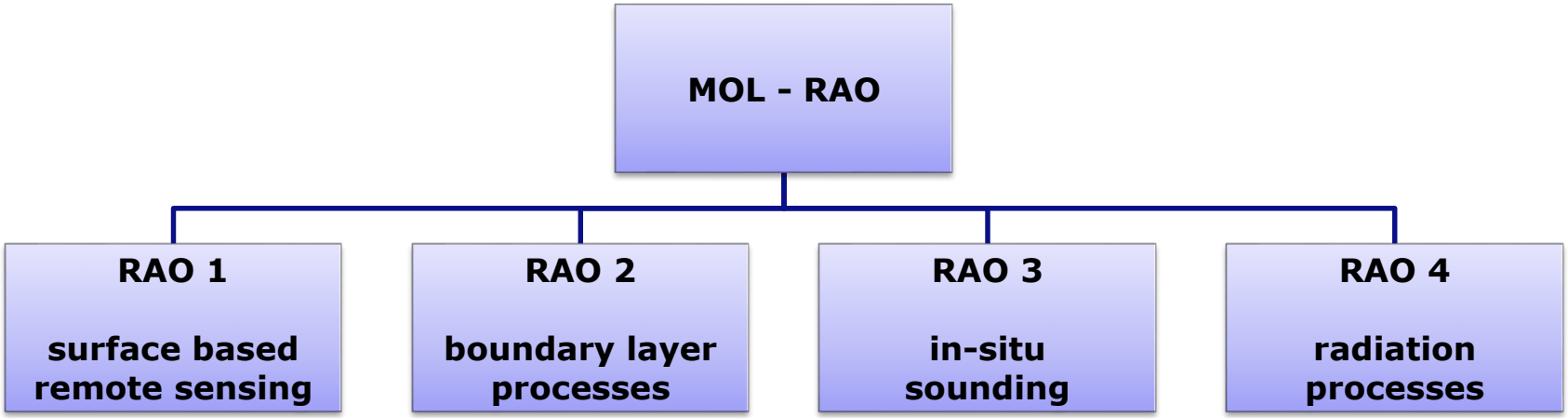
DWD - organigram

Lindenberg Meteor. Obs.

*Main Task: Monitoring of **physical** atmospheric processes*

Hohenpeißenberg Meteor. Obs.

*Main Task: Monitoring of **chemical** atmospheric processes*



Furthermore, MOL-RAO is a reference climate site & has 24 hours weather station

1. **operation / maintenance of various instruments**
2. **instrument calibration**
3. **quality assurance / quality control**
4. **updating & application of improved measuring techniques**
5. **data analysis and interpretation**

24 scientists, 5 engineers, 40 technicians

Our Mission

Reference-observation of atmospheric, physical processes

- **Routine Monitoring Programme**

  Longtermmonitoring (**24/7**) of atmospheric state parameters and atmosperic processes incl. detailled QA/QC – both for weather and climate (scale dependence)

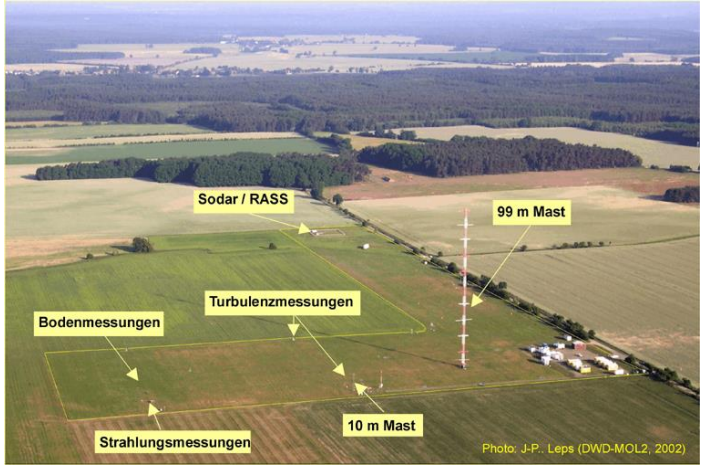
- **Research and development**

  - instrument technology, measurement techniques
  - network concepts
  - analysis techniques (measurement uncertainties) and
  - various studies on atmospheric processes

MOL-RAO 24/7 Measurement Programme:

Radiation measurements

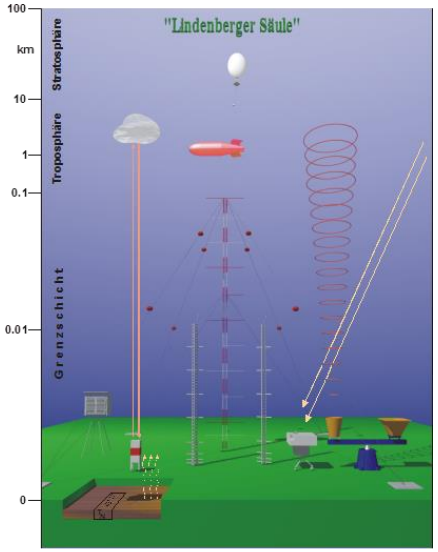
ABL measurements



in-situ observation

surface based remote sensing

3D/4D Lindenberg column



Lindenberger Säule - Meßsystem
bestehend aus : Bodenbeobachtungen, aerologischen Messungen, aktiven und passiven Fernerkundungsmethoden

until 2020: best possible profiles

from 2021/22: all available data/products

- level 0 (raw data) to level 3 (merged products)
- including QA/QC, measurement uncertainties and natural variablities (pdfs)
- available for all users/communities (assistance in data/product analysis and interpretation)

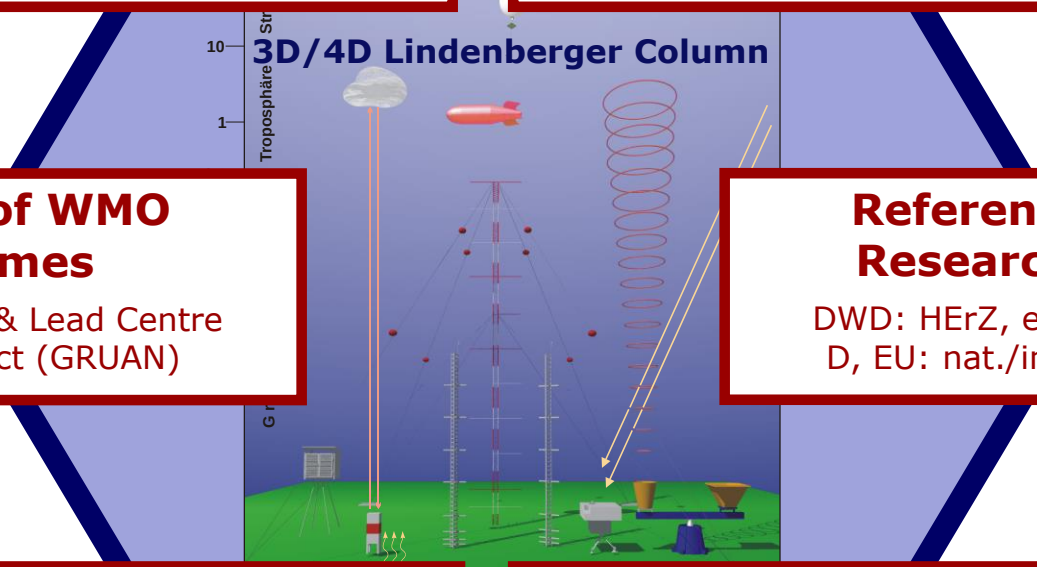
MOL-RAO 24/7 Measurement Programme:

Longterm Monitoring of Physical Processes

GCOS: GRUAN, GUAN, GSN, BSRN

Evaluation of Satellite Products

ESA: ADM-Aeolus, EarthCARE
Eumetsat: MetOp IASI, CM-SAF, GERB



Assistance of WMO Programmes

WMO/CIMO Testbed & Lead Centre
WIGOS Pilot Project (GRUAN)

Reference Data for Research Activities

DWD: HErZ, extramural Research
D, EU: nat./intern. Programmes

Evaluation of Model Parametrization

NWP: ICON/COSMO, ECMWF IFS
and various RCMs

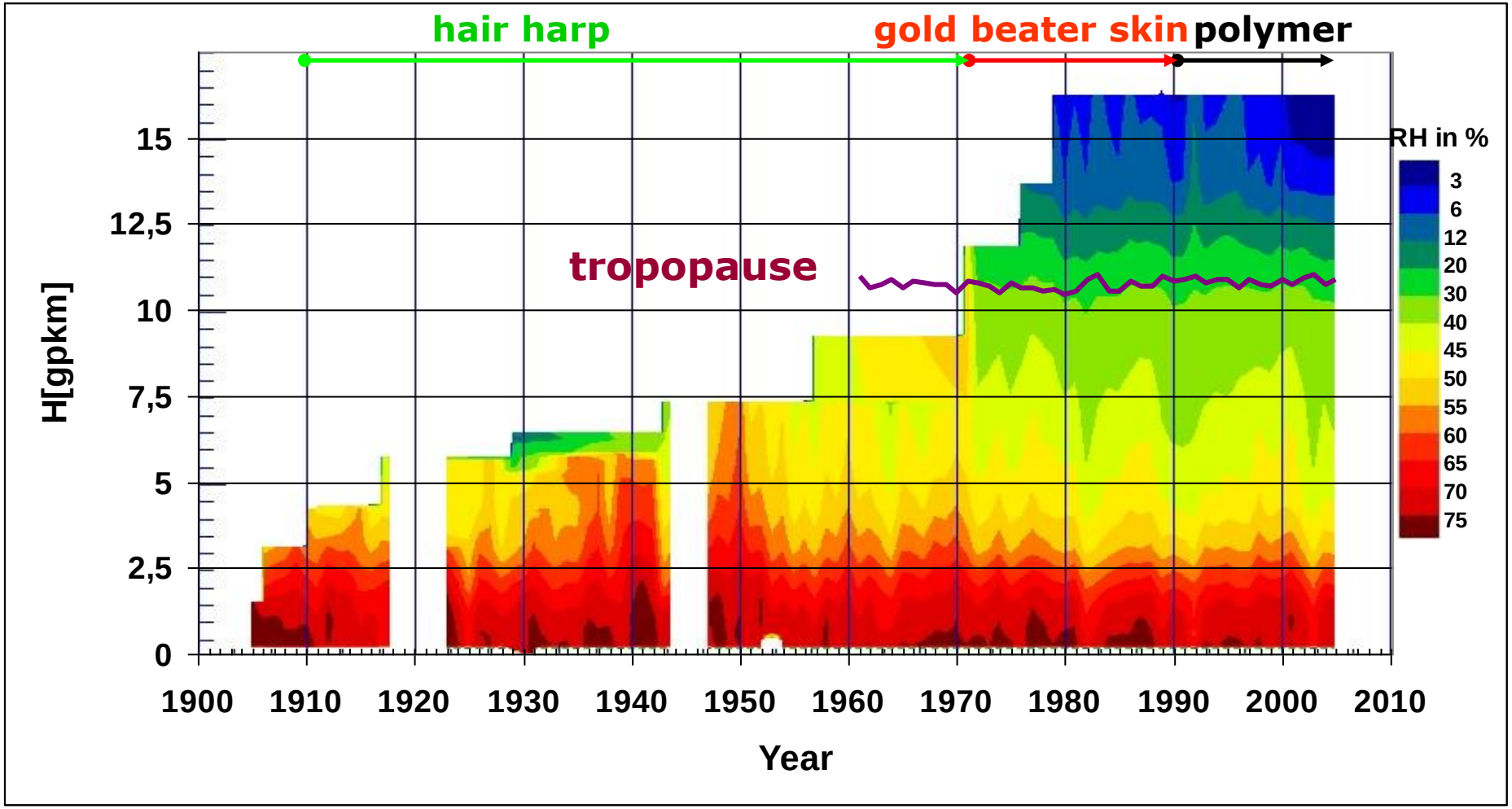
Reference Data for real-time data assimilation

ICON/COSMO (+new network approach!),
ECMWF IFS

MOL-RAO research topics

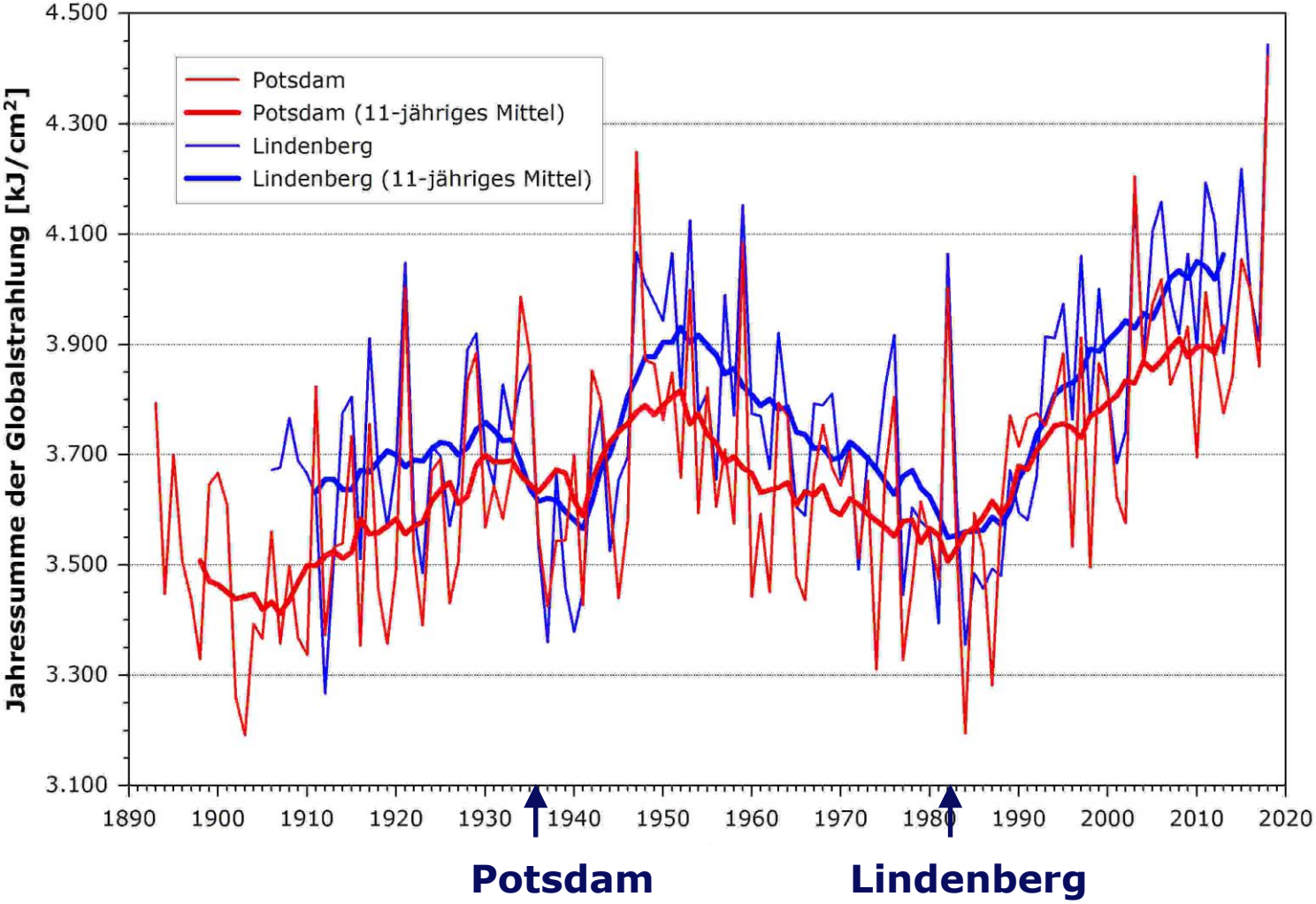
- **Atmospheric processes** (dynamics, cloud-aerosol-radiation, …)
- **Boundary layer processes** (turbulence, energy balance, …)
- **Radiation processes** (cloud-aerosol-radiation, radiation flux profiles, …)
- **Climate diagnostics/processes** (GRUAN, GUAN, BSRN, …)

Humidity profiles - Lindenberg / corrected:

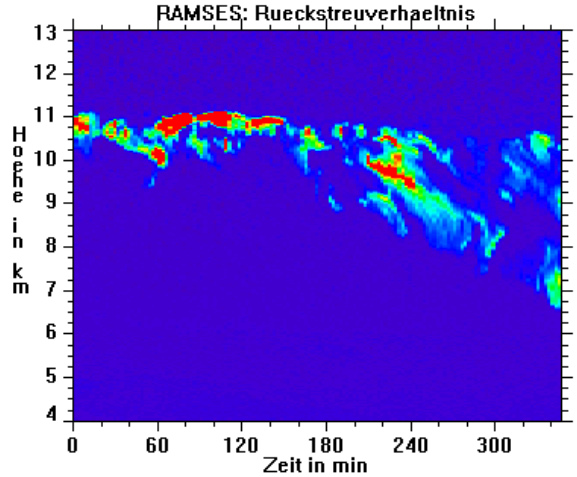


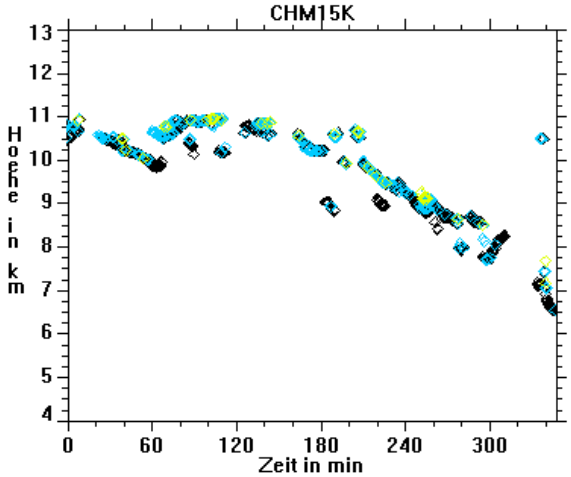
Global Radiation

Potsdam and Lindenberg (1893/1906-2020)

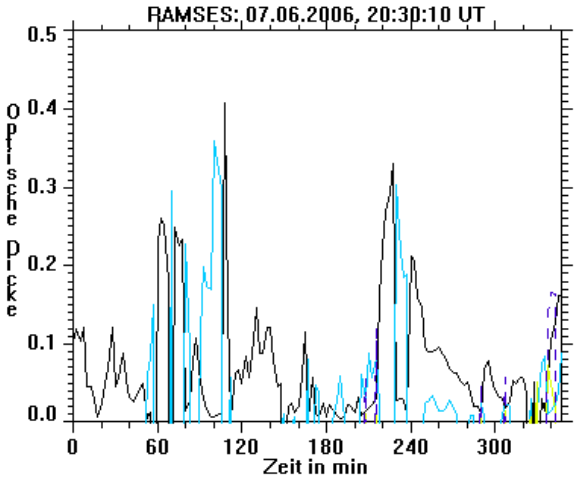


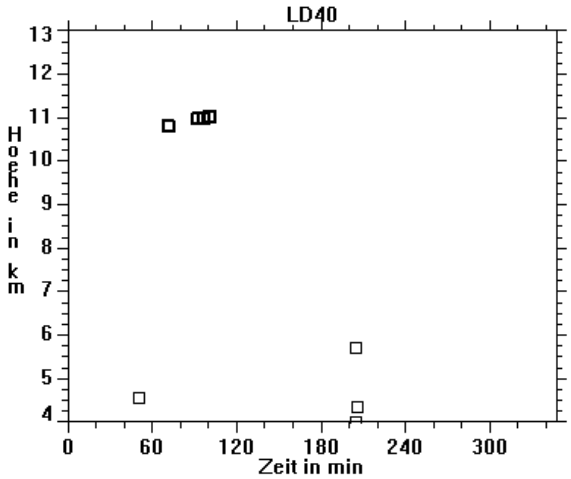
Cloud Base Height / Ice Clouds: 7.6.2006



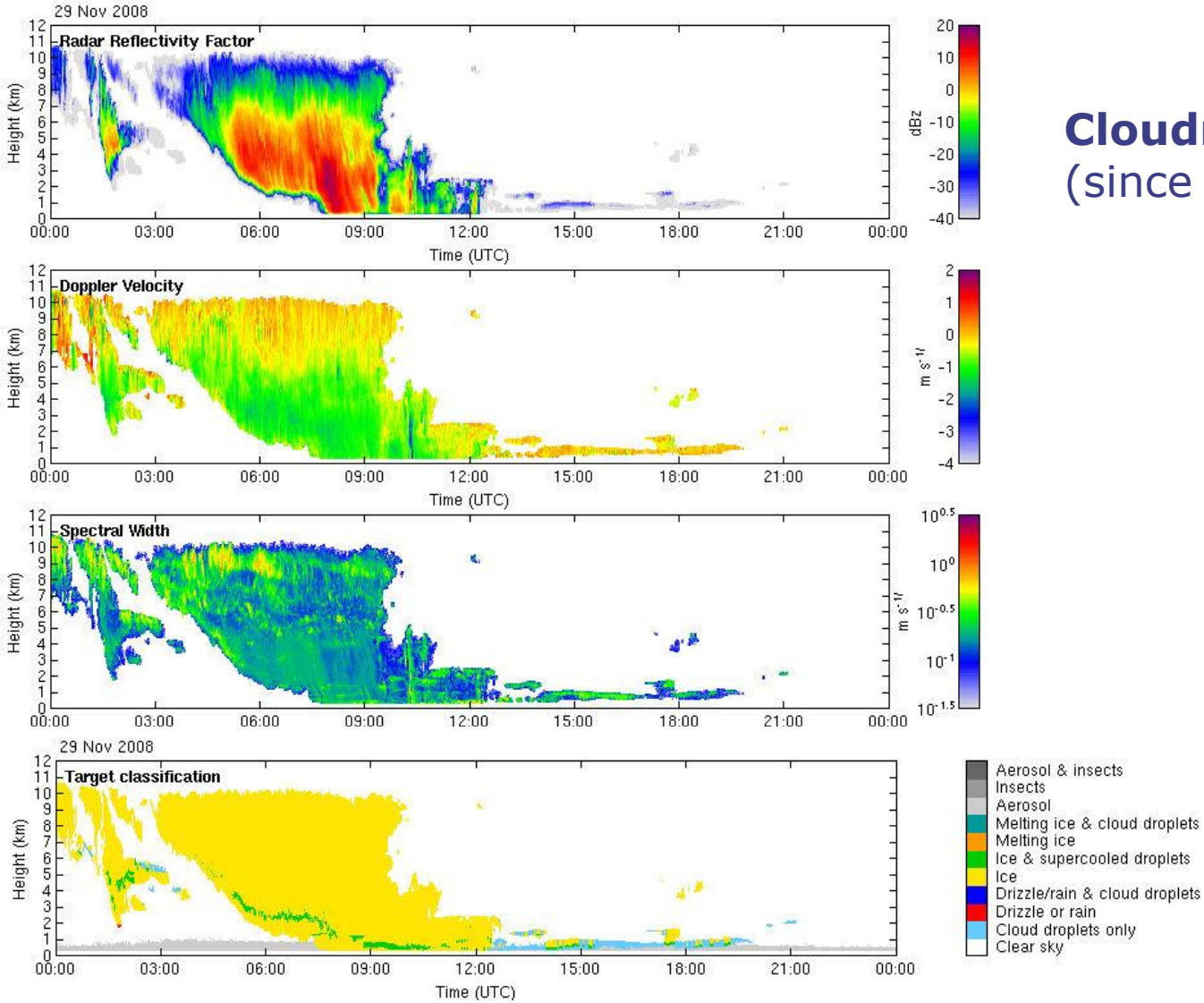


CHM 15k



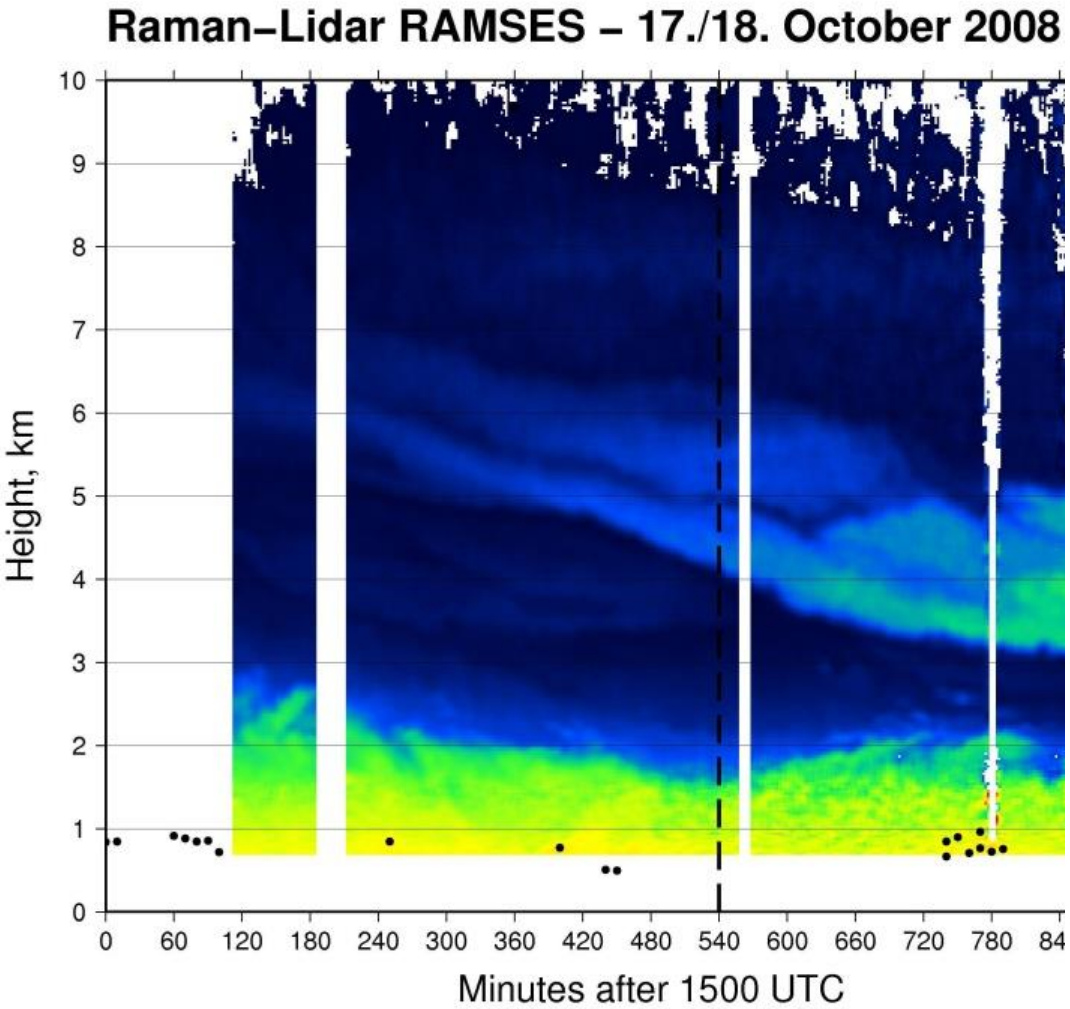


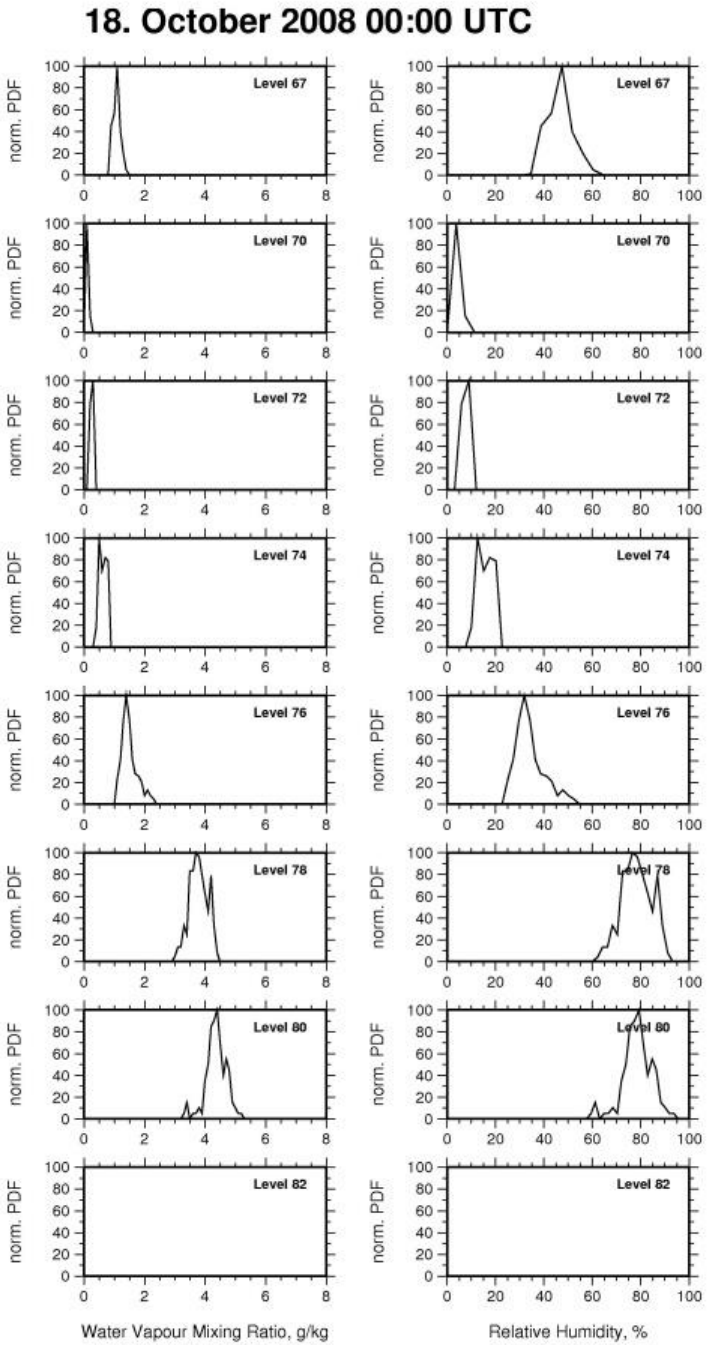
LD-40

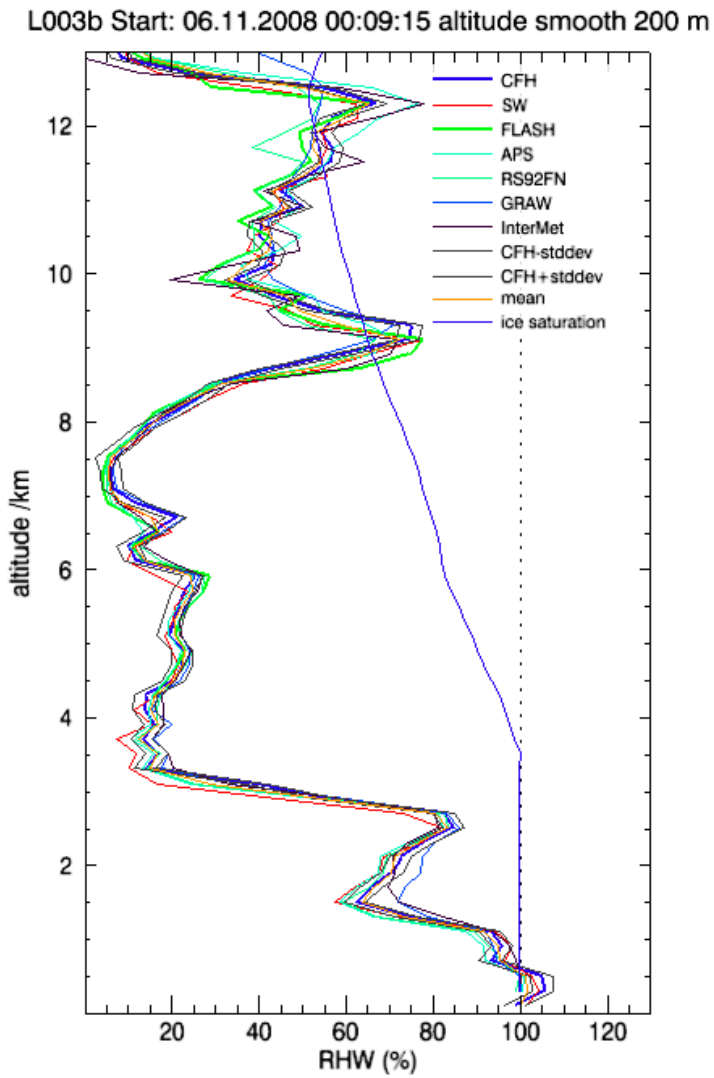


Cloudradar MIRA
(since 2002)

www.cloud-net.org

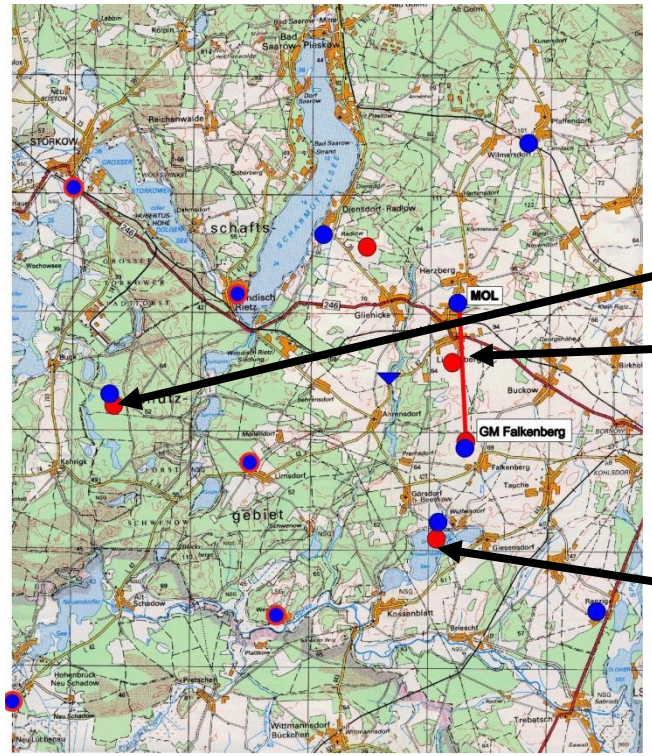

Raman–Lidar RAMSES – 17./18. October 2008
Height, km
Minutes after 1500 UTC

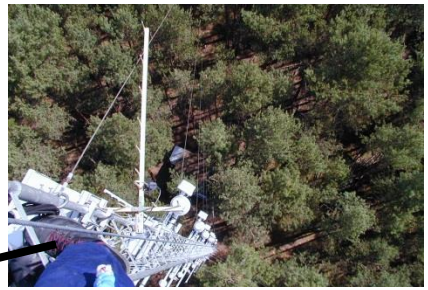

18. October 2008 00:00 UTC
norm. PDF
Level 67
Level 70
Level 72
Level 74
Level 76
Level 78
Level 80
Level 82
Water Vapour Mixing Ratio, g/kg
Relative Humidity, %

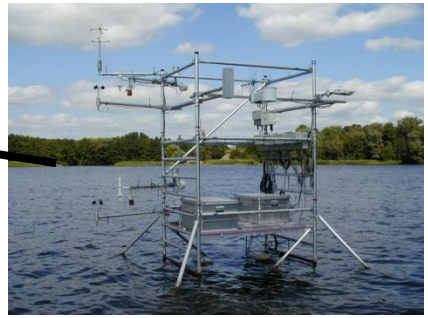

L003b Start: 06.11.2008 00:09:15 altitude smooth 200 m
CFH
SW
FLASH
APS
RS92FN
GRAW
InterMet
CFH-stddev
CFH+stddev
mean
ice saturation
altitude /km
12
10
8
6
4
2
20
40
60
80
100
120
RHW (%)

local network for energy flux measurements

micrometeorological sites

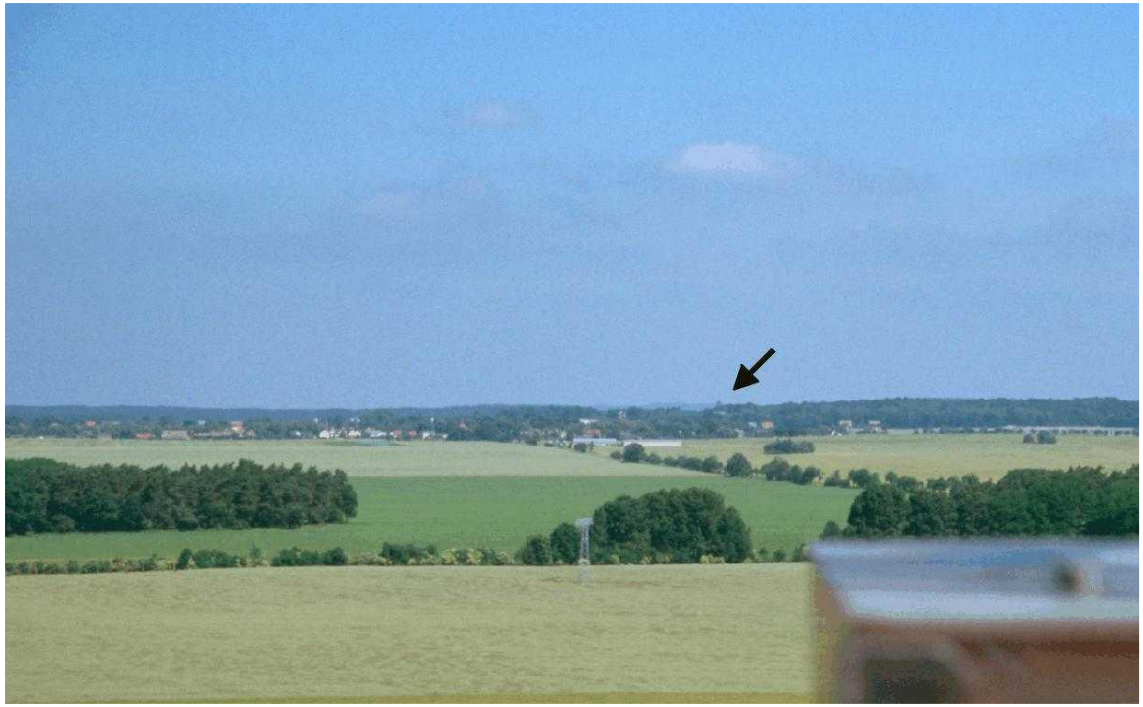






path integrated measurements

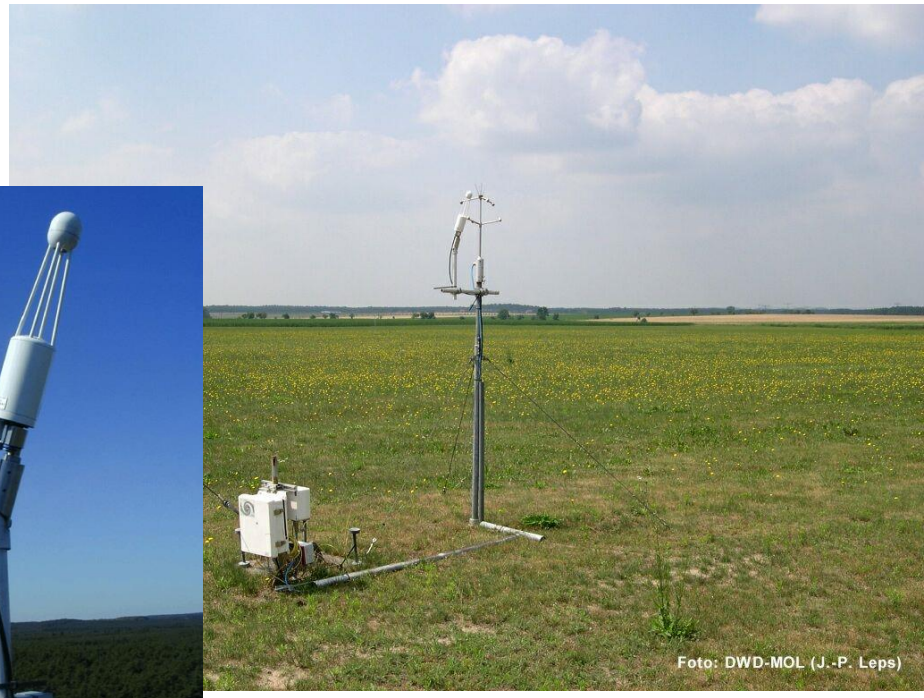
scintillometer



B_i, (r) ➔ C_N^2, (l_0) ➔ C_T^2, (ε) ➔ H, (u_*)

turbulent flux measurements

momentum, sensible and latent heat fluxes
based on Eddy- Covariance - method



Thank you!

MOL-RAO highlights (12/2020)

- 115 years of vertical profiling (kites/balloons, radiosondes, remote sensing)
- since 1919: world record holder reaching an altitude of 9750 m with meteorological kites
- 115 years of radiation measurements (117 years in Potsdam)
- 73 years of radiosounding (daily / more than 97500 sondes)
- 46 years of ozone sounding (weekly / about 2500 sondes in total)
- 34 years of aerosol optical depth (continuous)
- 27 years of tropospheric windprofiling (continuous)
- 25 years of ABL measurements (continuous)
- 22 years of microwave profiling (continuous)
- 18 years of cloud radar use (continuous)
- 14 years of Raman-lidar observations

➔ **www.dwd.de/mol**