

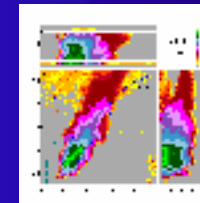
German Research Observation Systems Funded for COPS (part 1)

- Radiation-turbulence-stations & towers (energy balance stations, scintillometers,...)
- Soil moisture sensors
- Weather stations
- Rain gauges, disdrometer, tipping buckets
- GPS receivers
- Radiosonde stations, drop-up sondes

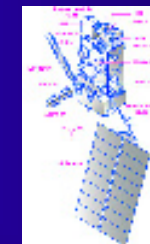


Continuously operating, fixed-mode remote sensing instruments

- Karlsruhe Radar
- Ceilometers
- FTIR & MW Radiometers
- Micro-rain-radars



Additional satellite products for COPS (e.g., MSG rapid scans)



German Research Observation Systems Funded for COPS (Part 2)

... mobile, adaptive-mode-scanning, and partly not operated continuously

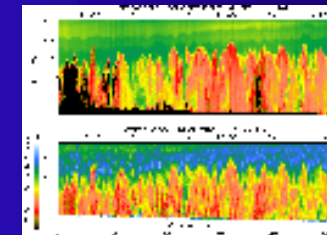
- DLR Falcon with H2O DIAL, Doppler Lidar, dropsondes
- DO 128



- Scanning UHOH H2O DIAL
- Scanning UHOH RR Temperature Lidar
- Scanning Doppler Lidars FZK WindTracer & IfT WiLi
- Multi-Wavelength Raman Lidar IfT

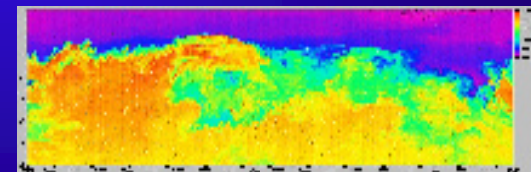


- FZK Cloud Radar
- UHH Cloud Radar



- POLDIRAD
 - 2 FZK Sodars, 1 UF Sodar
 - UB Sodar/RASS
 - FZK WTR

- Scanning MW Radiometers HATPRO & MICCY



The German instruments form the basis for additional international participation...



Foreign Research Observation Systems Funded/Requested for COPS

France

- Falcon 20 aircraft with WV DIAL LEANDREII, dropsondes, turbulence instr.
- Polarization-Doppler Radar
- Raman lidar
- X-band radar
- UHF BL radar
- GPS Receivers



UK: CATICT

- BAE 146 aircraft
- 2 Doppler lidars
- Wind profiler
- 3 sodars
- 3 radiosonde stations
- New flux masts
- 5 Energy balance st.
- Aerosol instruments

US

- ARM Mobile Facility



Italy

- UNIBAS Lidar
- CNR Radiometer

Austria

- U. Vienna instruments

The Netherlands

- TARA



Airborne platforms during COPS

✈ MPIC Learjet (max. 13 km): Chemistry + ?



✈ DLR Falcon (6 – 10 km AGL): WV DIAL, Doppler lidar (conical scanning), dropsondes, turb. fluxes

✈ SAFIRE F20 (6 – 10 km AGL): VW DIAL, dropsondes, p, T, q, u, v, w



✈ FAAM BAe 146 (max. 4 km), aerosol + cloud microphysics instrumentation

✈ Do128 (0.3 – 3 km AGL): T surface, upwelling & downwelling radiation and turb. fluxes



○ FZJ Zeppelin NT (max. 2 km): Chemistry + ?



Flight coordination & communication with Air Safety Control: Heinz Finkenzeller, DLR





DLR Falcon
 30 allocation days (weekends do not count unless IOP)
 45 flight hours
 + additional operation by EUFAR?

Reservation:
 11 June: implementation of instruments
 18 June - 29 July: COPS deployment



SAFIRE F20
 24 allocation days in July 2007 (tbd)
 35 flight hours
 + additional operation by EUFAR?
 120 dropsondes



FAAM BAe 146
 Confirmed for 3 months
 (but other commitments in between)
 2 – 3 days detachments
 60 – 80 science hours
 Stationed in Cranfield, UK



DO128
 35 allocation days
 100 flight hours
 + additional operation by EUFAR?



Observing strategy

Transect with supersites

Optimization of radar coverage

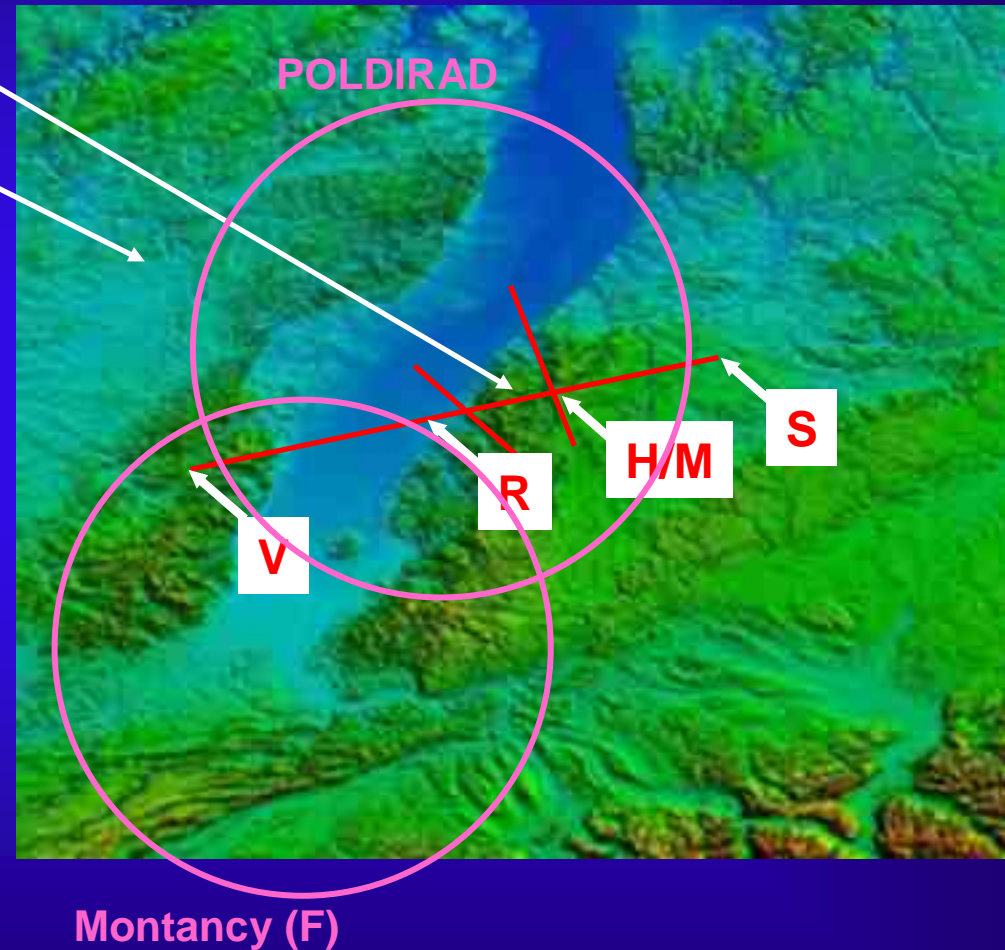
Large-scale and mesoscale observations provided by DLR Falcon aircraft.



Regional observations between supersites performed by Do-128 and Safire F20.



Cloud microphysics with UK BAE 146.



Supersites

Lidars

Cloud radars

Precip. radars

Radiometers

Radiosondes

Sodars

M

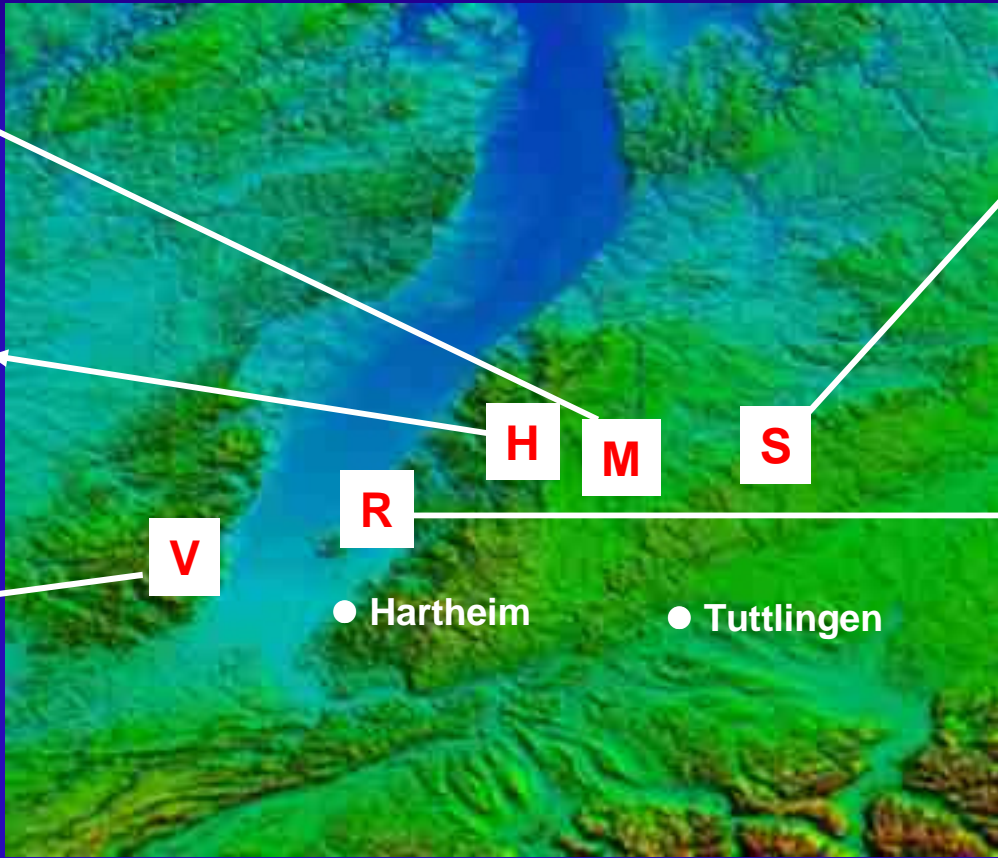
- AMF
- RS, MWR, AERI, RWP, WACR, aerosol in-situ analysis
- HATPRO
- 90/150 GHz
- IfT MWL
- IfT WILI
- UHH MRR

H

- UHOH WV DIAL (scanning)
- UHOH RR Lidar (scanning)
- FZK WindTracer (scanning)
- FZK Cloud Radar (45° scan)
- UHOH X-Band (vertical)
- UK Radiosondes
- UK aerosol in-situ analysis

V

- CNRS WV Raman lidar
- CNRS TRESS =
Aerosol Raman Lidar
IR radiometer, sun ph.
- LaMP X-Band (scanning)
- LaMP K-Band (vertical)
- MF Radiosondes
- MF Surf. Flux Stations (3)
- MF soil moisture (1-3)
- MF UHF prof., sodar



S

- FZK WTR
- UV MRR
- UV Radiosondes
- UV Tethersonde
- CNS MW radiometer (or at V?)
- UK Doppler (or at V?)

R

- UNIBAS Raman lidar
- UK Doppler lidar
- UK radiometer
- UHH cloud radar
- TARA
- UK Radiosondes
- UK sodar

Black-Forest valley entrances

- FZK and UBT Sodars (entrance of Murg and Kinzig V.)
- UF Sodar (entrance of Rench V.)
- 2 UK sodars (entrance of Nagold V., center of Murg V.)

Transect of MRRs from E to W (UHH)

Between S1 and S3

- FZK RS station (mobile)

Rhine valley

- FZK RS station (mobile)



Turbulence Network

Coordination: Thomas Foken

Building up of at least 3 Main Sites at convection generating area's
(at least 2 in valleys, 1 in the mountains and single measurements in between)

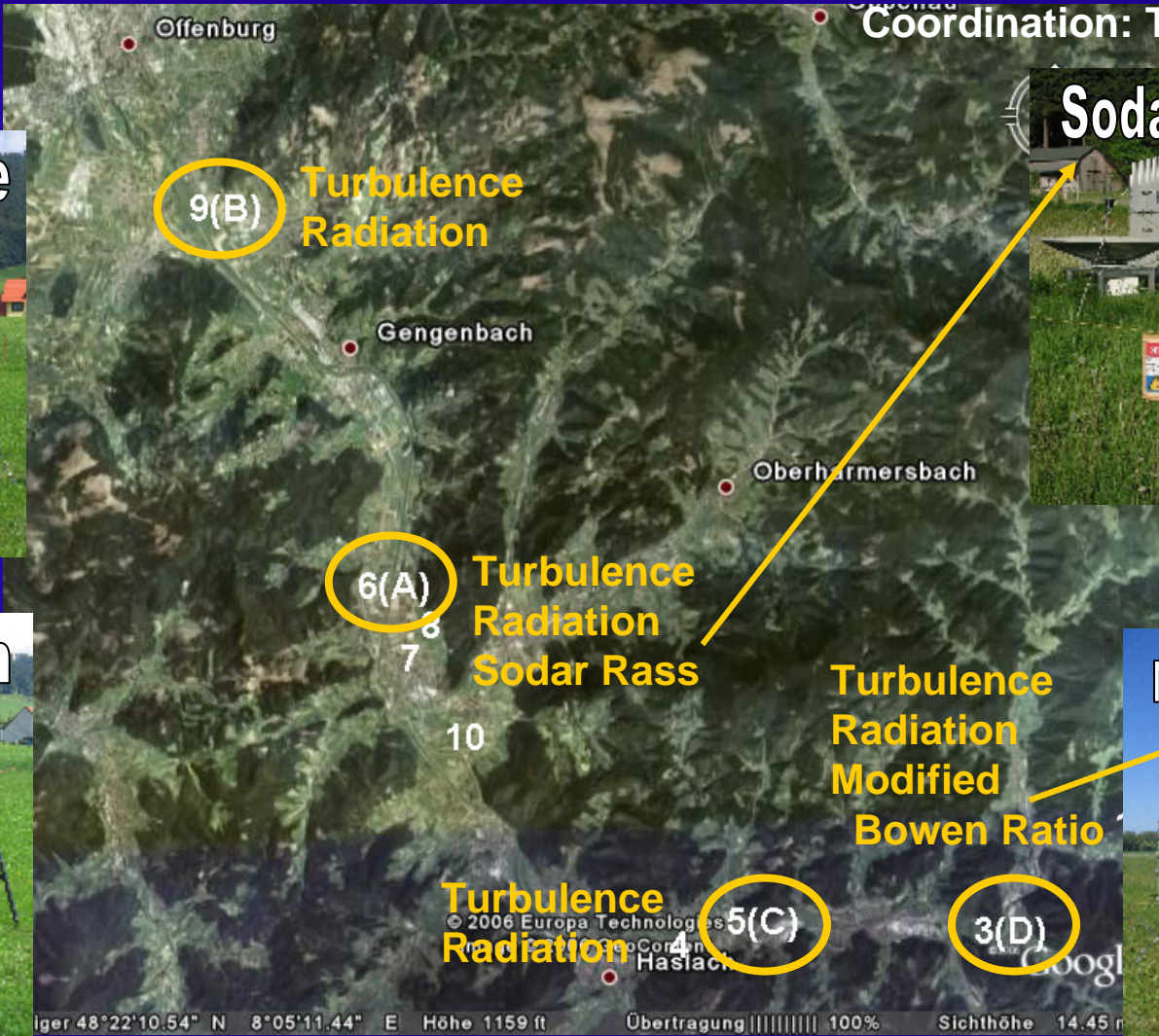
- Sodar, energy balance and turbulent flux complexes of the Research Centre Karlsruhe
-> in the Northern Black Forest (Murg valley and Hornisgrinde)
- Sodar-RASS, energy balance and turbulent flux complexes of the University of Bayreuth
-> in the Middle Schwarzwald (Kinzig valley)
- Permanent stations at Hartheim and Tuttlingen of the University of Freiburg with additional tower measurements

+ international partners



Turbulence setup in the Kinzig Valley

Coordination: Thomas Foken



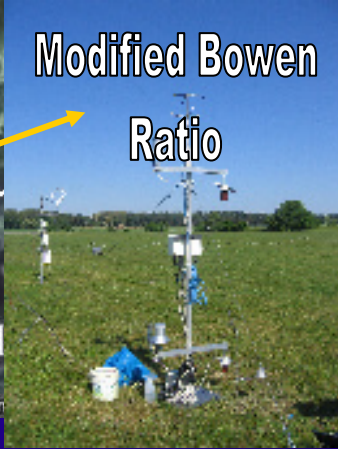
Turbulence



Sodar/RASS



Radiation

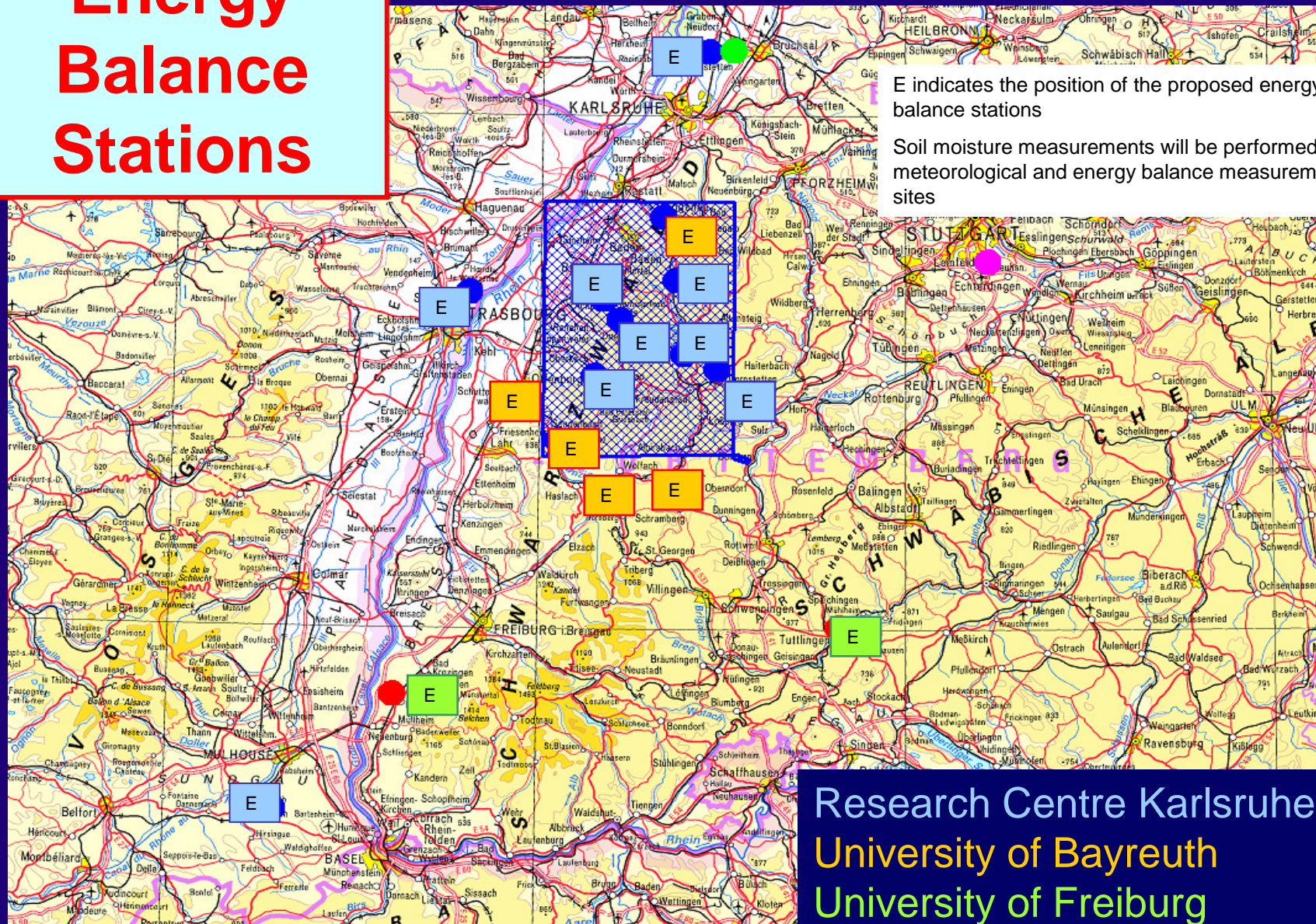


Modified Bowen Ratio



Energy Balance Stations

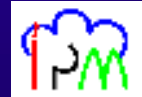
Coordination: Norbert Kalthoff



E indicates the position of the proposed energy balance stations

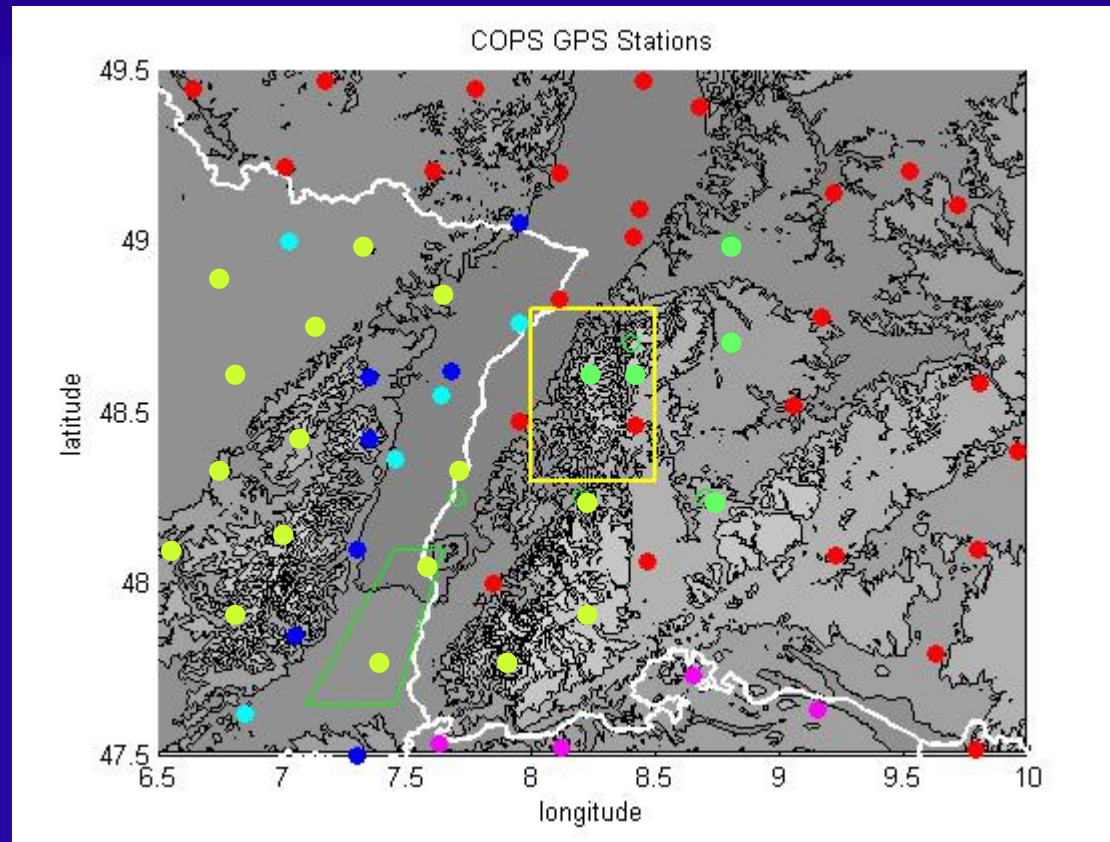
Soil moisture measurements will be performed at meteorological and energy balance measurement sites

Research Centre Karlsruhe
University of Bayreuth
University of Freiburg



GPS Network

Coordination: Joël van Baelen, Galina Dick



German permanent stations

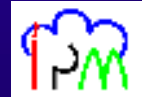
French near real time permanent stations

French permanent stations NOT real time

Swiss permanent stations

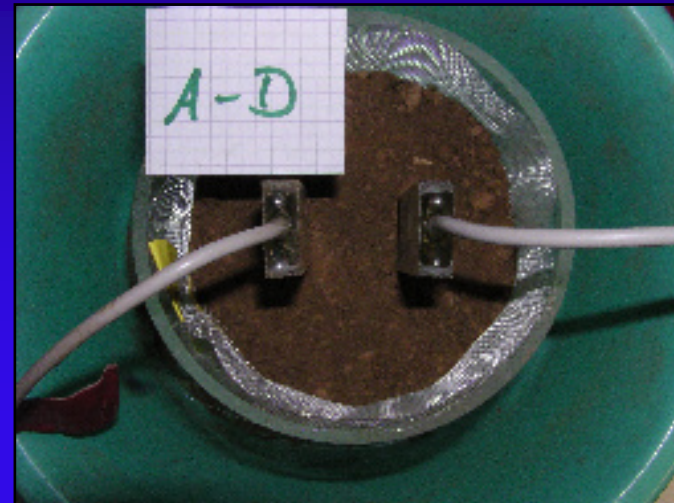
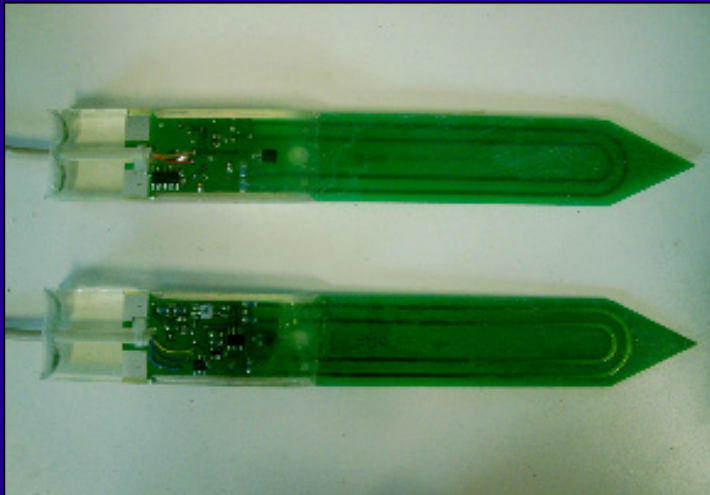
5 additional GFZ stations, real-time

**16 additional French stations,
NOT real-time**



Soil Moisture Network

Coordination: Christian Hauck



Soil moisture sensors: SISOMOP (Simplified Soil Moisture Probe)

150 sensors at 50 stations

(a) 3 sensors at different depths OR (b) 3 - 4 sensors at surface

Coarse-grid network COPS region (operational March 2007)

High-resolution network

Northern Black Forest (operational during COPS)
coupled to energy balance and turbulence stations

French Activities

Instrumentation / Modelling / Assimilation

- LA (CNRS, Toulouse) – **E. Richard**
 - Overall scientific coordination
 - Numerical simulations – case studies
- CNRM (Météo-France, Toulouse) – **F. Bouttier**
 - Assimilation (AROME)
 - Supersite instrumentation (4-M)
- IPSL (CNRS, Palaiseau) – **C. Flamant**
 - Overall coordination of ground-based and airborne COPS-FRA experimental contribution
 - operation of LEANDRE 2 on SAFIRE/F20
 - Supersite instrumentation (TReSS & Raman lidar)
 - Upstream site (SIRTA)
- LaMP (CNRS, Clermont-Ferrand) – **J. Van Baelen**
 - Supersite instrumentation (radars)
 - Coordination GPS network effort over eastern France



French Instruments

Falcon 20

- WV DIAL LEANDRE 2
- Dropsondes



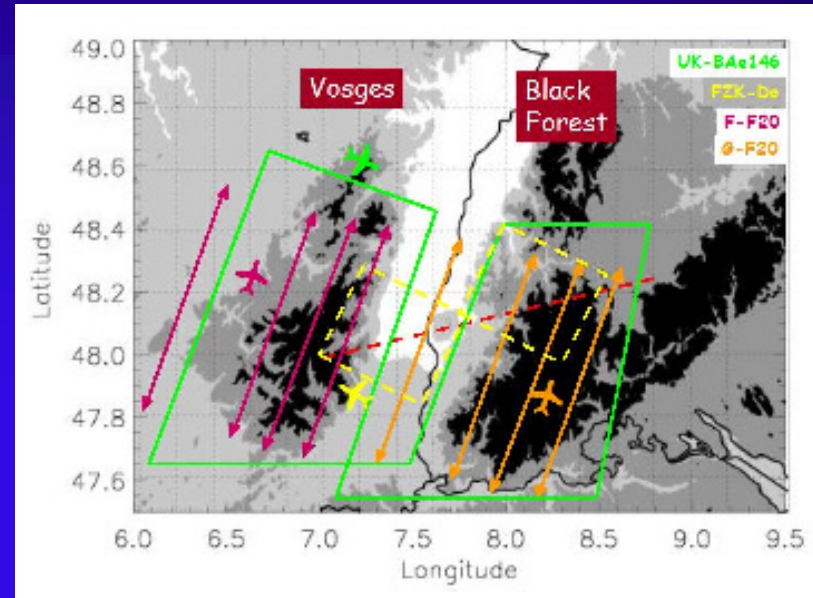
- 24 days of July 2007
- 35 flight hours
- 120 dropsondes

Supersite in the Vosges / Rhine valley

- Radiosonde station
- UHF + sodar
- Surface flux stations (3)
- Soil moisture station (1-3)
- TReSS (Mini-Lidar + CIMEL)
- Raman Lidar
- X- and K- band radars
- Disdrometers & rain gauges

→ 1 month (tbd July or August 2007)

→ together with SAFIRE F20 operations



16+ GPS Stations

Upstream Operations at SIRTAs

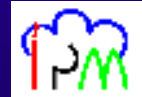
Routine Obs. of Météo France



UK Instruments: FAAM BAe 146

Instrument	Measurement
FFSSP	Cloud Droplets
2D-C	Large cloud particles (25-800 μm)
2D-P	Precip (200 μm – 6.4 mm)
Cloud Particle Imager	Small cloud particles (10 μm – 5 mm)
Small Ice Detector	Small spheres vs non-spheres (2 μm min)
PCASP	Aerosols (0.1 – 10 μm)
Aerosol Mass Spec	Size & composition of some aerosols
Filters	Size & composition of aerosols
CCN	Cloud Condensation Nuclei
INstrument	Ice Nuclei
Johnson-Williams	Cloud liquid water content
Nevzerov Probe	Cloud & total water
Turbulence Probe	3D winds
Rosemount Temperature	In-cloud temperature
Hygrometer	Water vapour

Confirmed.
 For 3 months
 (but other commitments
 in between)
 2 – 3 days detachments
 60 – 80 science hours
 Stationed in Cranfield, UK



UK Instruments, cont.

Instrument	Measurement	Group	Location
Wind Profiler	3D Winds	Mcr	SV2
Ozone DIAL	Ozone	Mcr	SV2
Radiosonde stations	T, T _d , winds	Lds, Mcr, Rdg	SV1, 2, 3
3 (2) Doppler Lidars	Winds, Aerosol backscatter	Slf, Rdg	SH, SV1
Radiometer	T, RH	Slf	SV1
Cessna	T, RH, winds, turb, aerosol, NO _x , O ₃	Mcr	SV1-3
3 Sodars	Winds	Lds	L1, L2
5 (2) towers	3D winds, turb & rad fluxes	Lds, Rdg	SH, SV1-3, S1
GB aerosol, chem	Volatility, size & conc, opt thick, O ₃	Mcr, Lds	SV1-3, SH
Tethered balloon	T, RH, O ₃ , aerosol size & conc, VOC	Lds, Yrk	SV1
10 AWS	T, RH, Winds	Lds	L1, L2

Clear, possible, no longer available



The Black Forest AMF Site

AMF Core instruments	
SKY Rads	Radiometer
SKY IRT	IR Therm
GRD Rads	Radiometer
GRD IRT	IR Therm
MFRSR	Radiometer
SMET WD	Anemometer
SMET T/RH	Temp/humid
SMET BAR	Barometer
SMETORG(815)	Rain gage
PWD	Present Weather Detector
TSI	Camera
ECOR	Eddy Correlation
BBSS Digi/Ant	Up air sonde
CEIL	Lidar
MPL	Lidar
MWR	Radiometer
MWRP	Radiometer
NFOV	Radiometer
AERI	Interferometer
WACR (94Ghz)	Radar
CIMEL	Photometer
RWP (1290Mhz)	Radar Wind Profiler
CIMEL	Sun Photometer



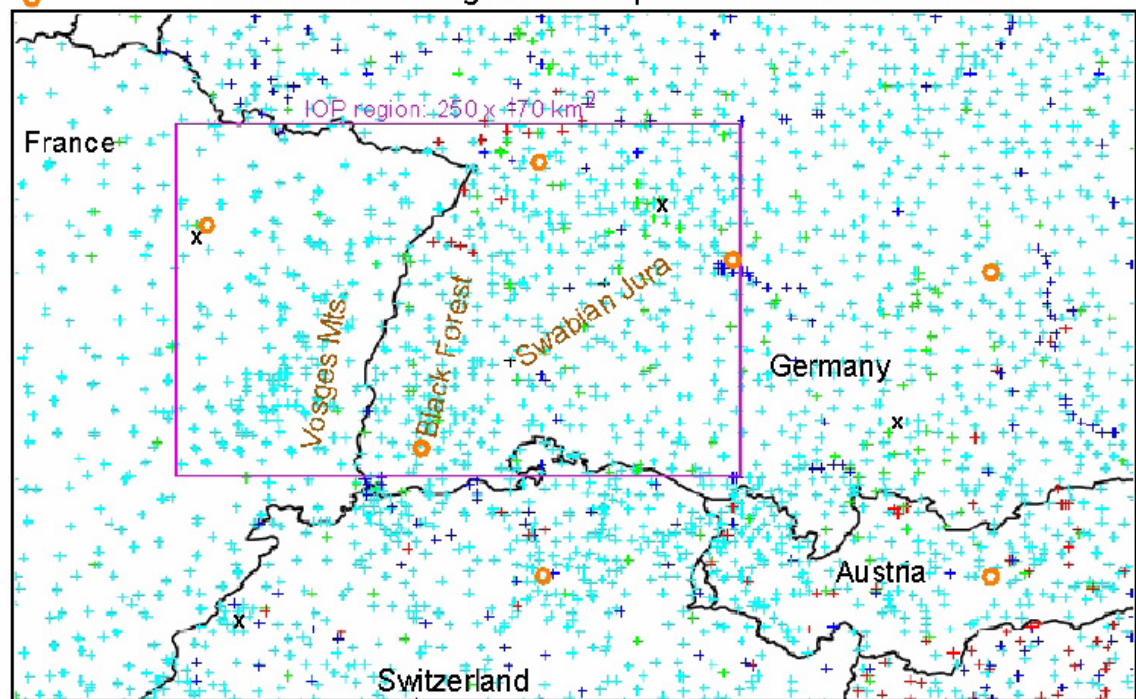
AOS Core Instruments	Aerosols
TSI neph x 2 Dry	TSI 3563 Nephelometer at low RH
TSI neph + humidograph	Nephelometer + humidograph system for scanning RH
RR PSAP	Radiance Research 3 wavelength Particle soot absorption photometer
CPC (or CNC?) CPC=CNC	TSI 3010 Condensation nuclei counter
CCNC	DMT Cloud condensation nuclei counter



Hohenheim, 25 – 26 September 2006



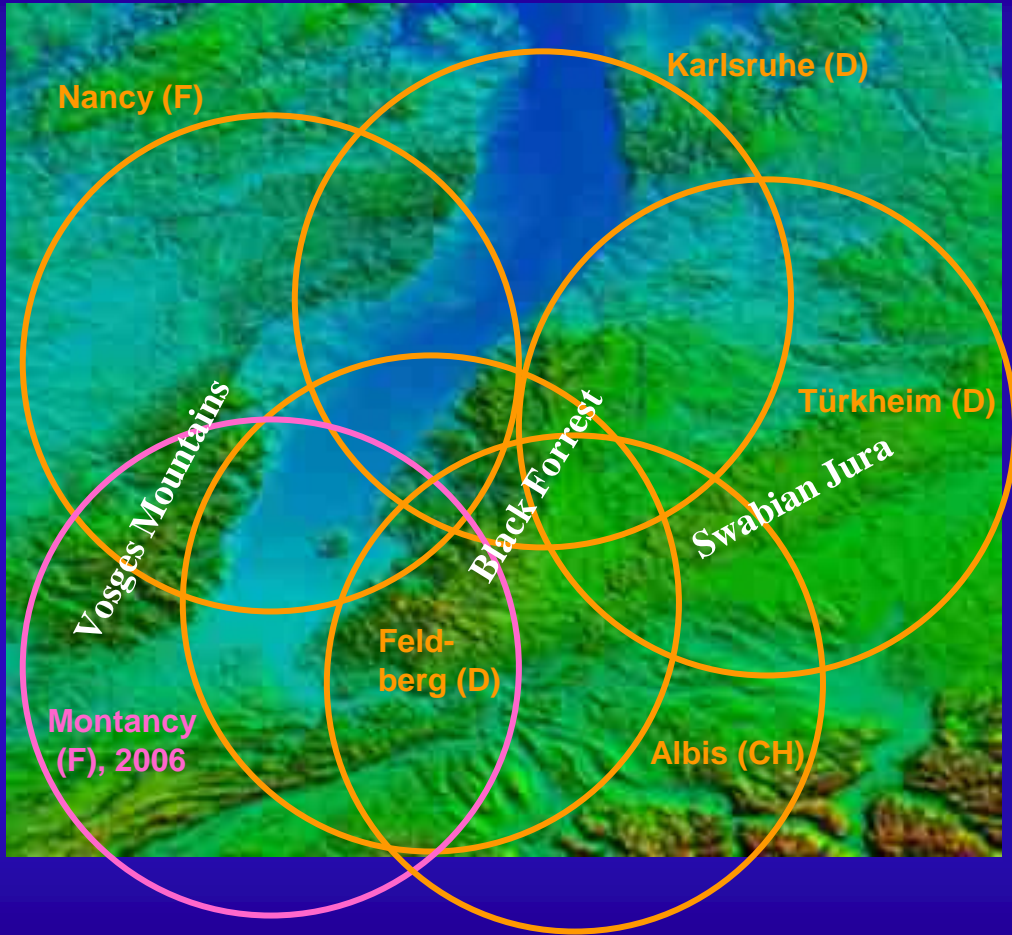
COPS medium-range domain: operational weather networks



- + rain gauge stations (Frei and Schar 1998)
(blue: daily; green and red: hourly)
- C-band radars (www.chmi.cz/OPERA/)
- x radiosondes (www.metoffice.com)

Network	Quantity	Frequency
DWD surface stations	50	hourly
DWD raingauges	34	10-min
European raingauges	700	daily
Radiosondes	5	6-hourly
Lightning detection network	Dense array	Continuous
C-Band radars	4	Continuous

Operational Weather Radars



Weather radar, polarized

Weather radar, unpolarized