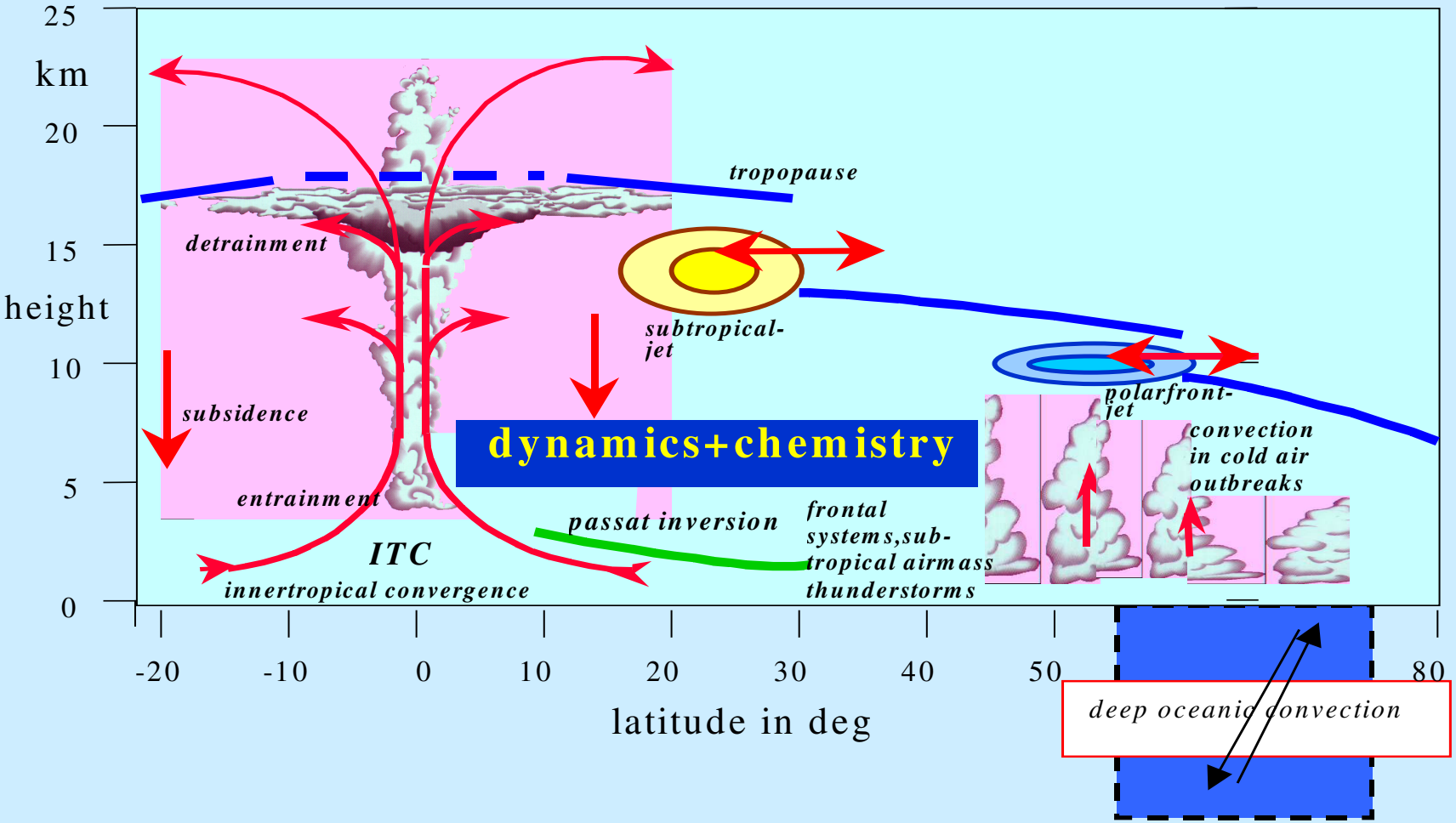
TRACKS – Transport and Chemical Conversion in Convective Systems

(Proposed by Helmholtz Centers in 2002)



TRACKS – Transport and Chemical Conversion in Convective Systems (Proposed by Helmholtz Centers in 2002)

Focus

Convective trace gas and aerosol transport

Objectives

- Transport Processes and Precipitation Formation in Convective Systems
- Influence of Deep Convection on the Budget of Climatically Active Substances (Gases and Aerosols) in the Upper Troposphere
- Influence of Convection on the Trace Gas Balance of the Atmospheric Boundary Layer

TRACKS – Transport and Chemical Conversion in Convective Systems

DLR Interests in TRACKS-COPS

- Convective Transports; Inflow of trace gases and aerosols,
- CCN, Precipitation formation
- Lightning and influence of aerosols on lightning
- Strength of convection
- Anvil properties

MPI interests

- details of trace gas transport in updrafts
- reduction of PBL pollutant concentrations by updrafts and mesoscale descending motion
- moist deposition by convective precipitation (SFB/WRF)
- lightning and Nitrous Oxides production (SFB / WRF)

FZK interests

- Turbulent gas transport measurement by airborne eddy correlation
- Proving dilution of PBL pollutants by deep convection
- Effects of mountain/valley wind systems on pollutant transport

IUP Interests in TRACKS-COPS

Mapping of one-dimensional to three-dimensional distributions of water vapour and other greenhouse gases (O_4, CO, CH_4) as well as reactive species by remote sensing of trace gases inside and outside convective systems with passive DOAS (***D****ifferential* ***O****ptical* ***A****bsorption* ***S****pectroscopy*).

FZJ Interests in TRACKS-COPS

Photochemical development of a city plume

Pseudo-Lagrangian experiment on photochemical conversion of pollutants (VOC + Nox -> O3, HCOH, PAN, Particles

IPM Interests in TRACKS-COPS

High resolution water vapour distribution in the PBL

Turbulent fluxes from Lidar

Data assimilation

FZJ – Airborne
Zeppelin NT, *HO_x-measurements, UV actinic flux, meteorology, MAX-DOAS (U Heidelberg)*

Zeppelin NT – airship characteristics

- Engine-driven, near-equilibrium, steerable aircraft
  - High manoeuvrability due to swivelling engines

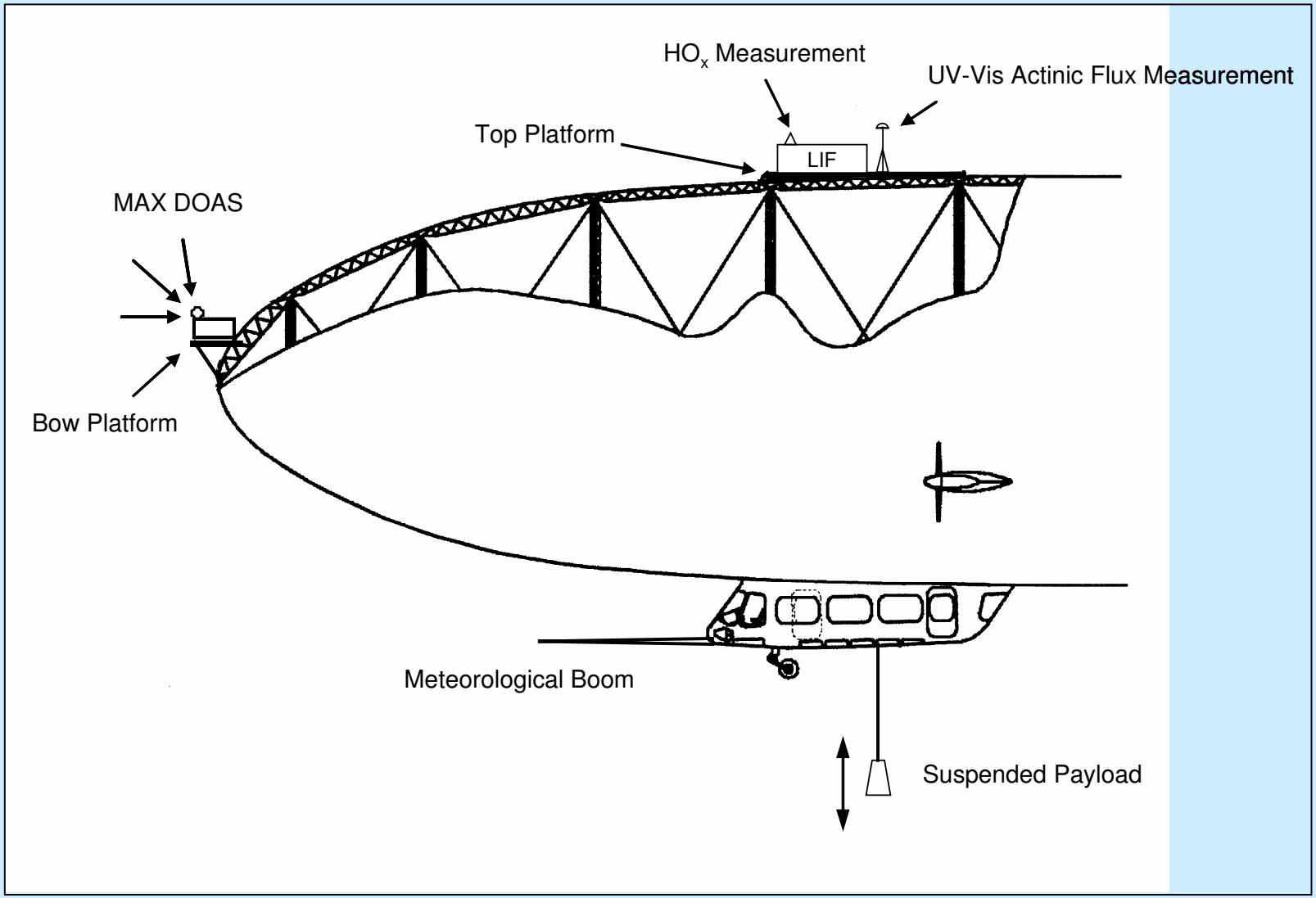
- Consists of a rigid framework
  - support of cabin, engines and exp. platforms
- Permission for instrumental flight
  - Night time and cloud missions are possible
- Takeoff and landing requirements
  - airfield of 300m diameter + 3 ground people

Zeppelin NT – performance data

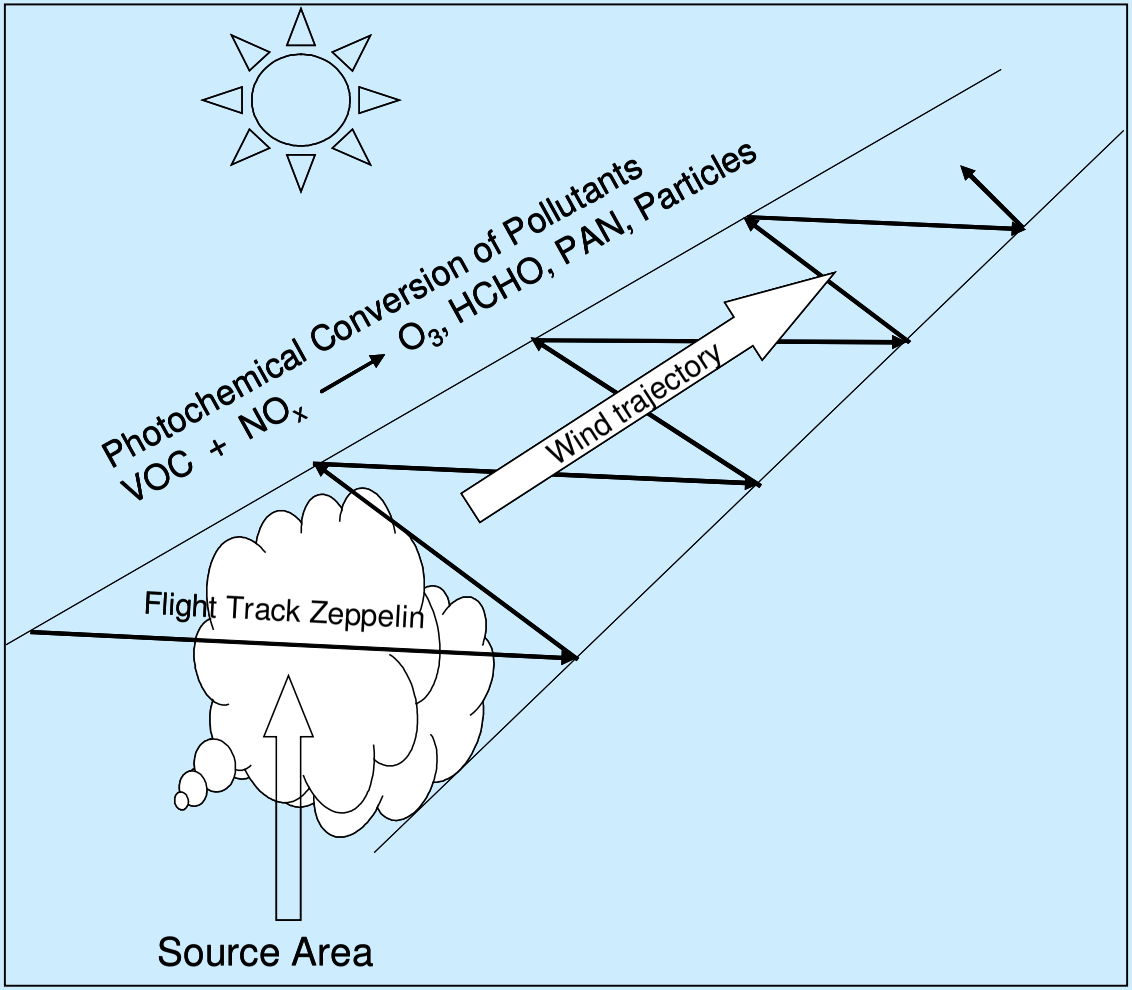
- Scientific payload up to 1000 kg

- Flight speed 0 – 115 km/h
- Operating altitude: 20 – 2600 m
- Range: 1100 km
- Available electrical power: 6 kW (28 VDC)

Zeppelin NT – experimental platforms



Pseudo-Lagrangian experiment: Photochemical developement of a city plume



FZJ – Airborne
***Zeppelin NT**, HO_x-measurements, UV actinic flux, meteorology, MAX-DOAS (U Heidelberg)*

FZK - Airborne
***Dornier 128**; CO, H2O, CO2, NO, NOx, O3, turbulence, pyranometers, pyrgeometers, dropsondes*

FZK

	Aerodata Humicap, Taupunktspiegel
	Lyman-alpha Hygrometer
	PT 100 Temperatur Sensor, verglast
	PT 100 Temperatur Sensor, offen
	5-Loch-Sonde; GPS und INS
	5-Loch-Sonde; GPS und INS
...um	Kipp & Zonen Pyranometer
Infrarotstrahlung, oberer und unterer Halbraum	Kipp & Zonen Pyrgeometer
Ozonkonzentration	Environment O_3 41M (UV-Absorption)
Turbulente Ozonschwankungen	Güsten Ozon Sensor (Chemilumineszens)
NO	NOxTOy-Sensor mit C_rO_3-Katalysator (Luminol-Chemilumineszens)
NO_2	NOxTOy-Sensor (Luminol-Chemilumineszens)
NO_y	NOxTOy-Sensor mit Mo/C_rO_3 Katalysator (Luminol-Chemilumimeszens)
PAN	NOxTOy-Sensor mit C_rO_3 Katalysator und Heizung (Luminol-Chemilumineszens)
CO	Aero Laser 5001 (Resonanzfluoreszens)
CO_2	LI-COR 6252 (IR-Absorption)
Luftprobenahme	Lufteinlass Kabinendach, bis zu 30 Proben
	AWI Spektral-Linescanner (3 Kanäle)
Reflektivität der Erdoberfläche	JVC CCD-Kamera
Oberflächentemperatur der Erde	Heitronics Radiometer KT19, abtastend

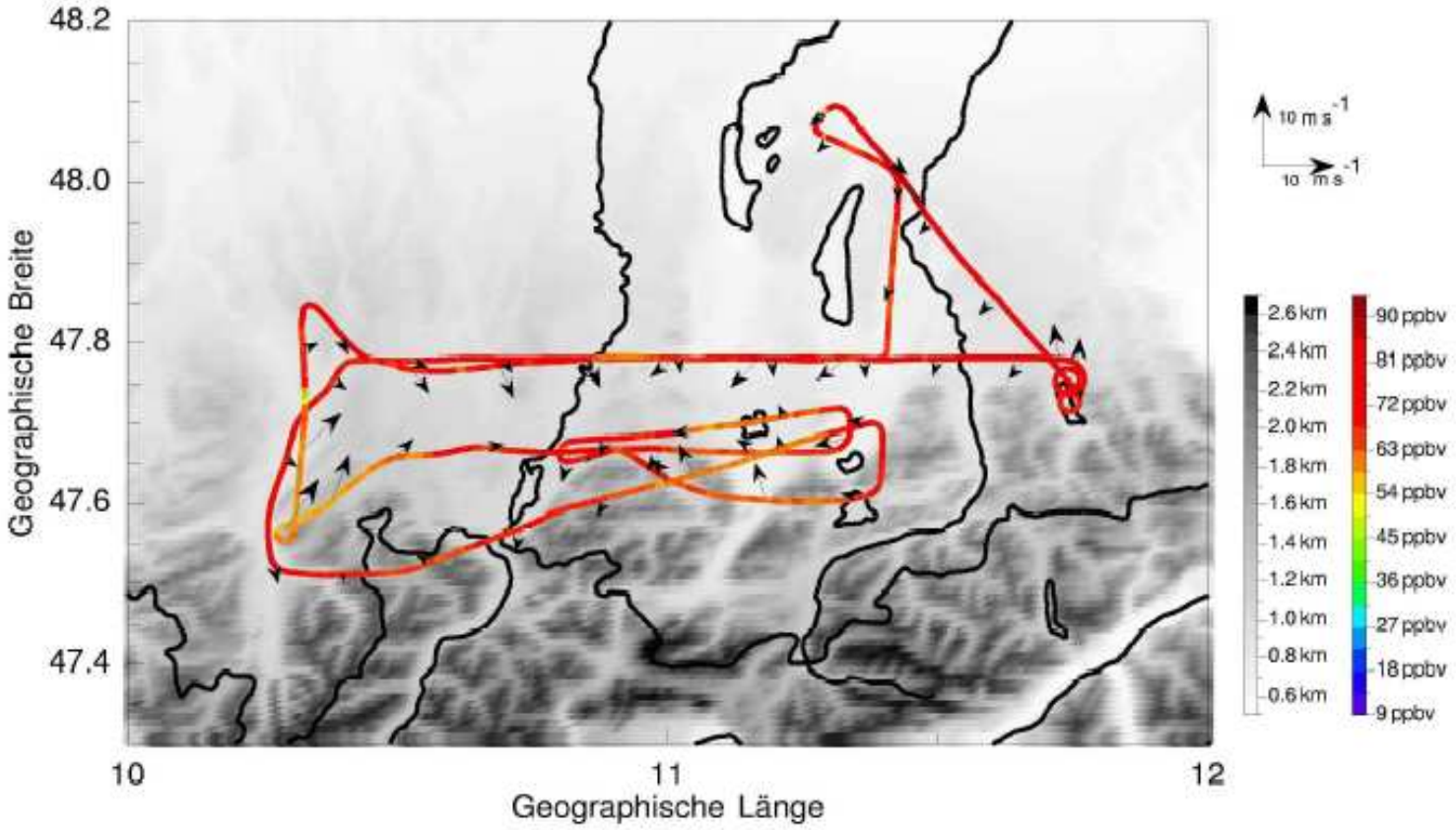
Do128 measurements

FZK

VERTIKATOR-Alpen: Transporte an der Wolken

Flugzeug: Dornier 128
Dargestellte Größe: O_3

09. Juli 2002; Flugnr. 2

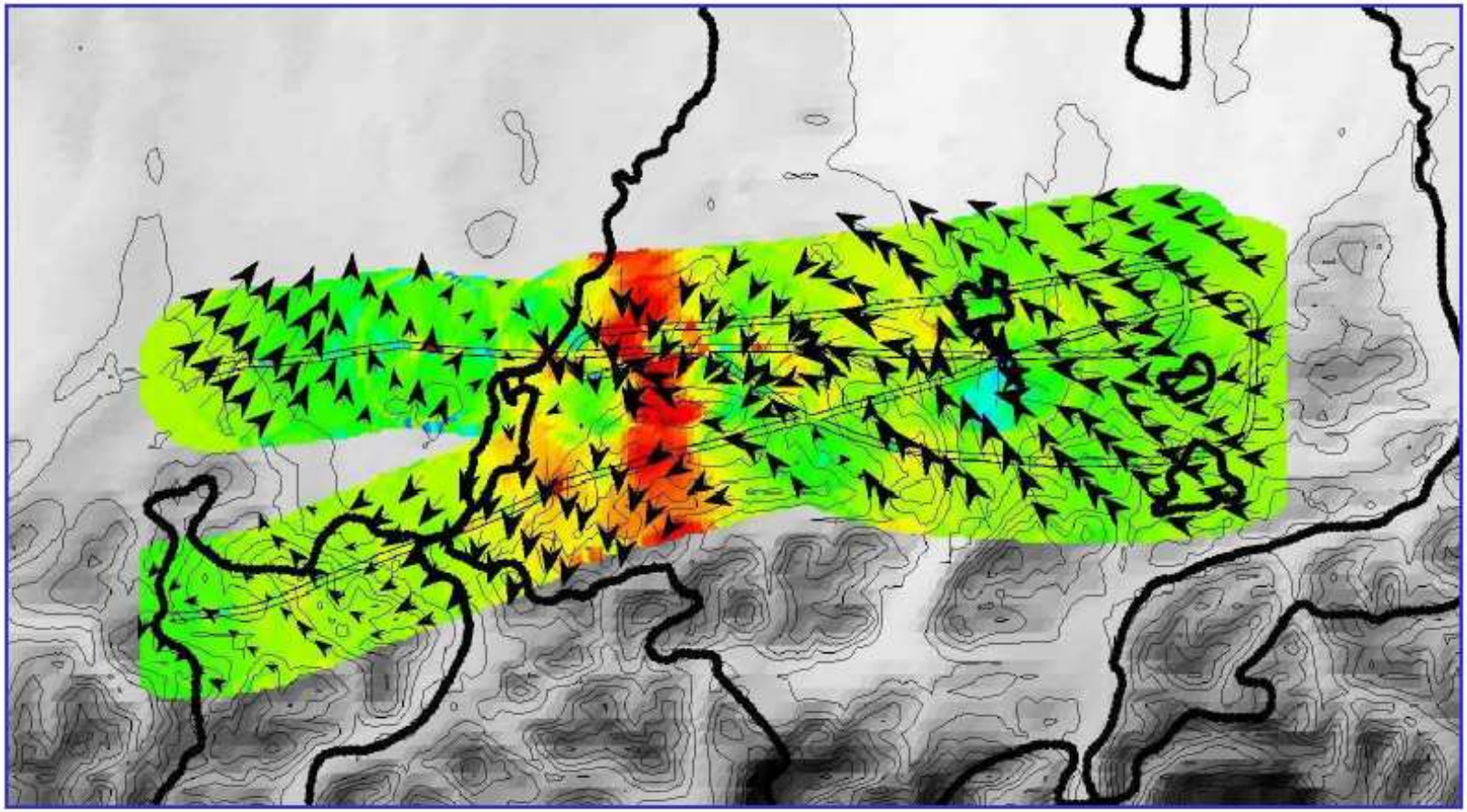


FZK


Unterfliegung der Zelle, Höhe ca. 2350 m
Gebiet um Füssen, Blick nach Süden, Westkurs

FZK

VERTIKATOR-Alpen: Transporte an der Wolkenbasis

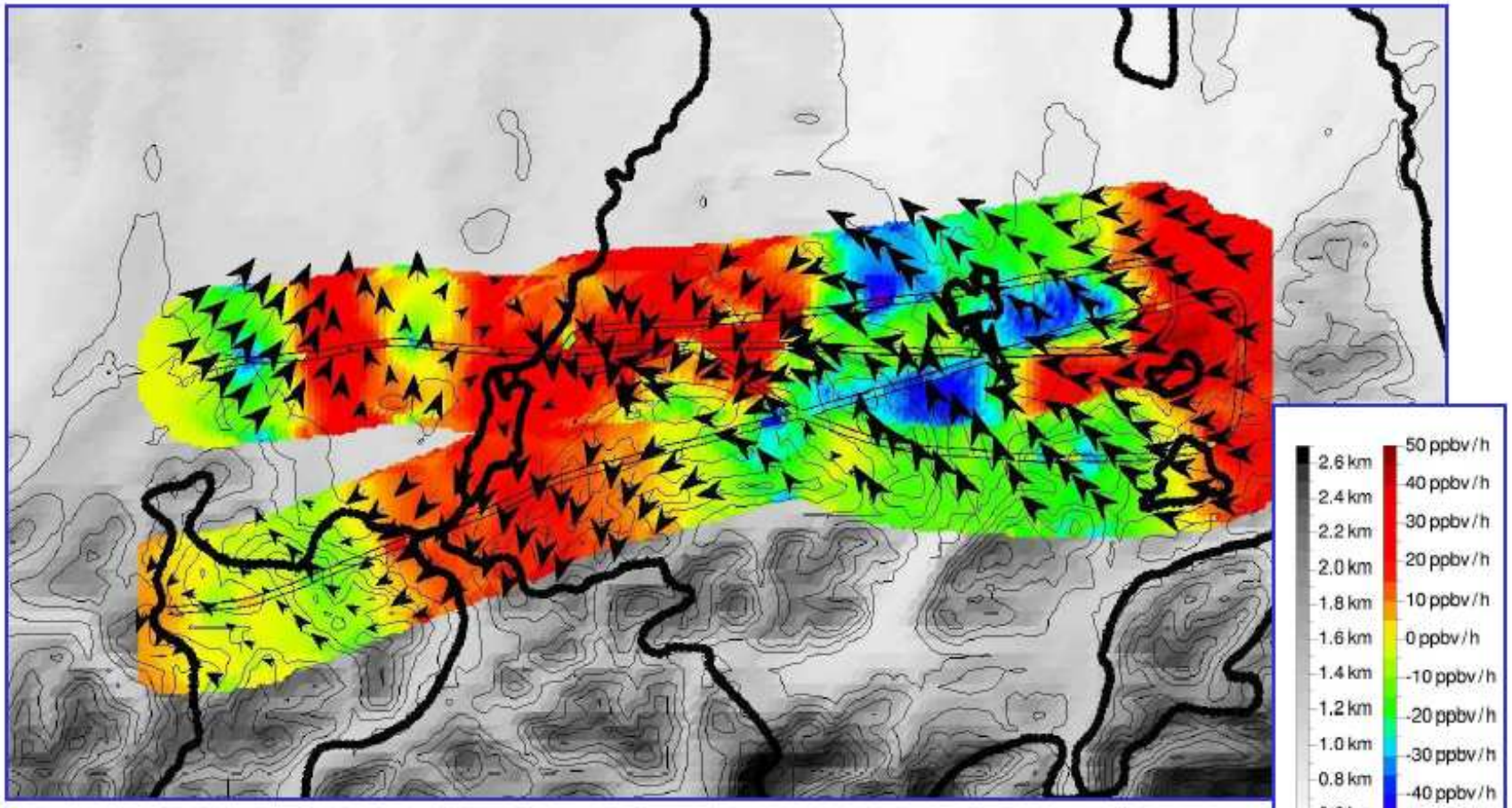


Vertikalwind: Farbcode

Horizontalwind: Pfeile

FZK

VERTIKATOR-Alpen: Transporte an der Wolkenbasis



Ozon: Farbcode

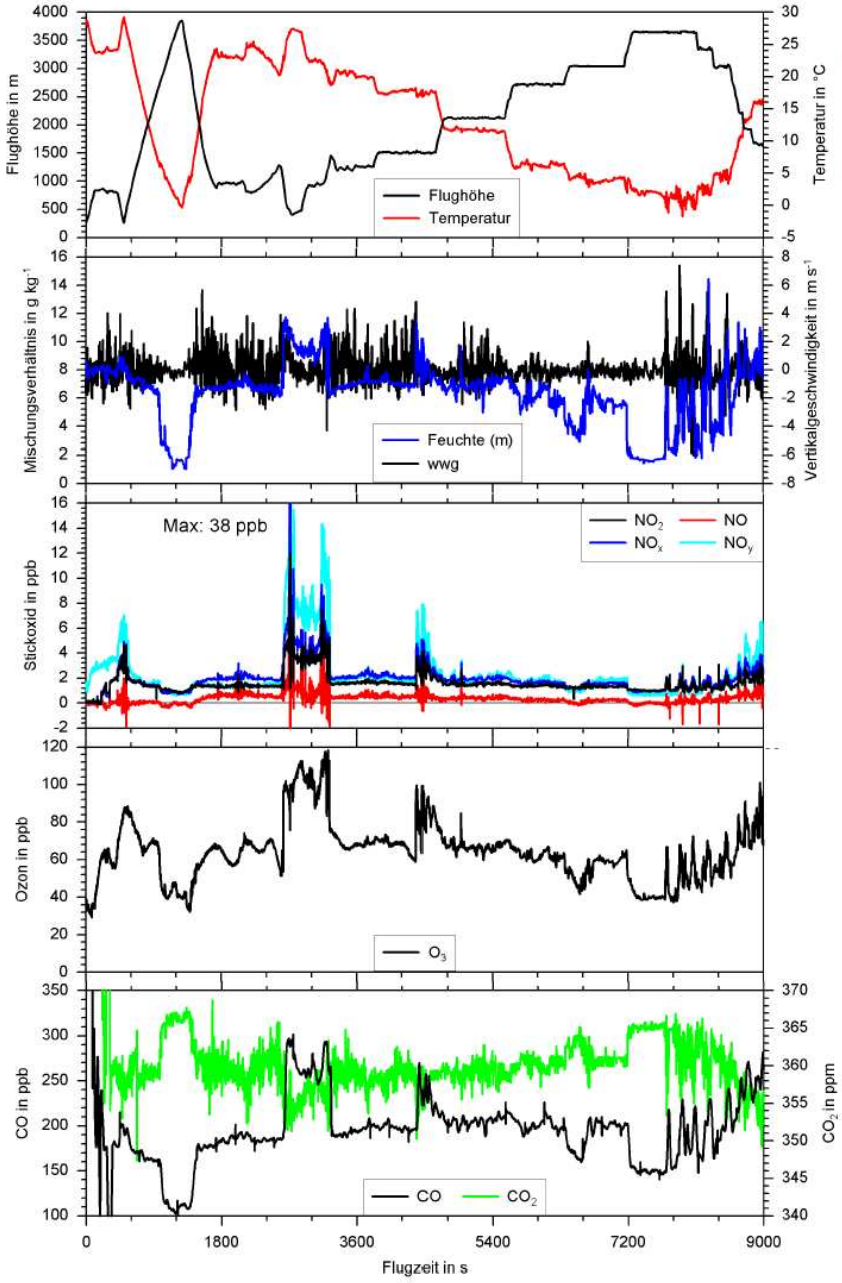
Horizontalwind: Pfeile

FZK

Konvex 2000

09.06.2000

15:48 bis 17:08 MESZ



Messflug bei Sommersmog-bedingungen

Ost-West-Traversen zwischen Schwarzwald und Rheingraben

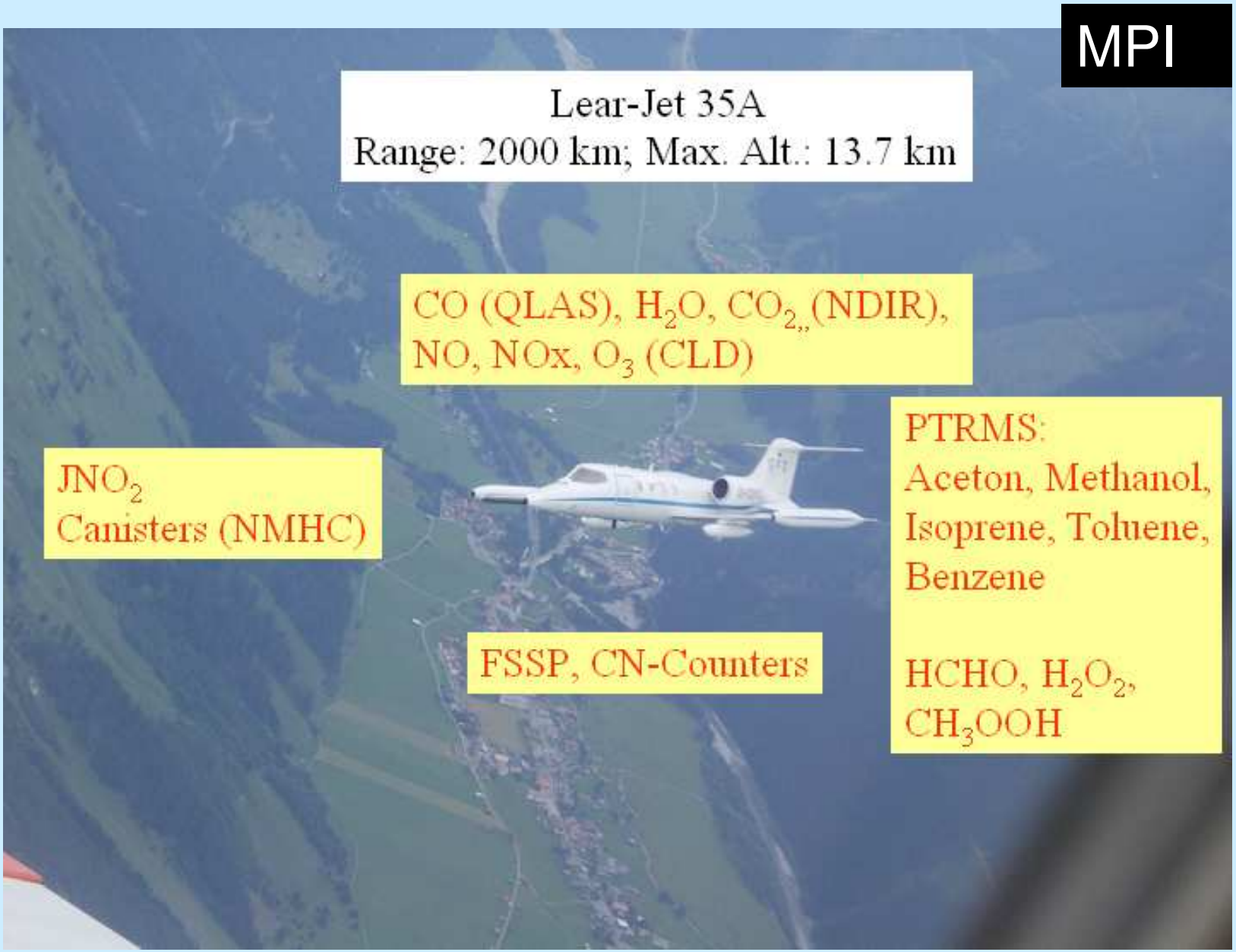
Mehrfacher Durchflug einer hochreichenden Konvektionswolke am Ende des Fluges

FZJ – Airborne
***Zeppelin NT**, HO_x-measurements, UV actinic flux, meteorology, MAX-DOAS (U Heidelberg)*

FZK - Airborne
***Dornier 128**; CO, H2O, CO2, NO, NOx, O3, turbulence, pyranometers, pyrgeometers, dropsondes*

IUP - Airborne
*MAX-DOAS, I-DOAS on Zeppelin NT; opt. on other aircraft, H2O + in UV/VIS range (**O_3, O_4, NO_2, NO_3, CH_2O, SO_2**) and infrared (**CO, CH_4**)*

MPI - Airborne
Learjet 35A (see figure)


MPI
Lear-Jet 35A
Range: 2000 km; Max. Alt.: 13.7 km
CO (QLAS), H_2O, CO_2,, (NDIR),
NO, NOx, O_3 (CLD)
JNO_2
Canisters (NMHC)
FSSP, CN-Counters
PTRMS:
Aceton, Methanol,
Isoprene, Toluene,
Benzene
HCHO, H_2O_2,
CH_3OOH

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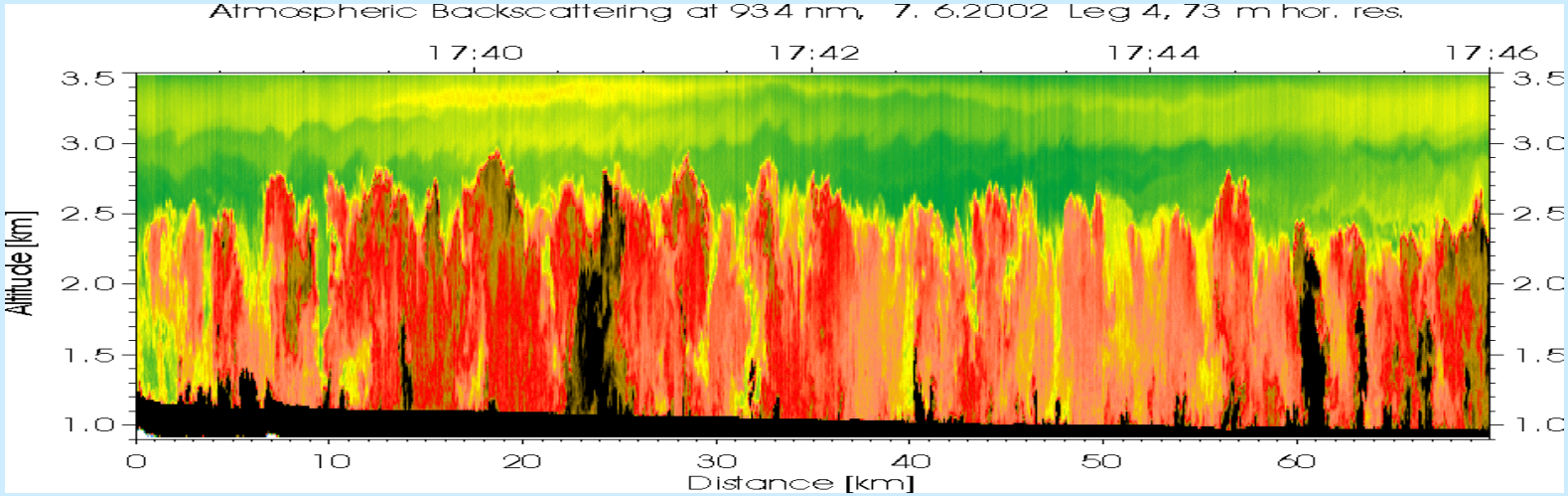
MPI - Airborne
Learjet 35A (see figure)

DLR - Airborne
Falcon with DIAL and wind-Lidar; opt. For some air chemistry



Aerosol and water vapor DIAL measurements during IHOP showing structures in the PBL.