HALO Universitäre Nutzer (HUNT)
High Altitude and Long Range Research Aircraft
HALO University Users (HAUU)

U. Platt, J.P Burrows, Susanne Crewell, U. Corsmeier, A. Engel, J. Fischer, H. Harder, J. Hill, K. Itten, S. Jones, H. Kaufmann, A. Macke, B. Mayer, J. Nieke, A. Richter, T. Ruhtz, A. Müller, T. Heege, U. Schmidt, G. Seckmeyer, I. Tegen, T. Wagner, M. Wendisch, T. Wolf, K. Pfeilsticker.

National research institutions („virtual institutes“)

- Virtual Research Centre “Ice-clouds and Dehydration in the TTL-Region”
- Virtual Institute „Atmospheric Research employing the Research Aircraft HALO“
- Collaborative Research Centre „The Tropospheric Ice-Phase – TROPICE” (SFB 614)
- ...

University researchers participate in essentially all missions proposed for HALO, but there will be no „German University Missions“.

Scientific and Technical Goals
(as formulated in the original HALO application)

1. Chemistry and transport of trace species in the troposphere and lower stratosphere
2. Ozone destruction in the stratosphere
3. Integrated investigation of the chemistry-climate-biosphere-human interaction
4. Transport and chemical transformation in convective and turbulent systems
5. Formation of precipitation and radiation transport as components of meteorology and climate research
6. Investigation of the sea ice distribution within the framework of oceanic and polar research
7. Investigation of the influence of aircraft emissions on the chemistry of the tropopause region and on aerosol and cloud formation
8. remote sensing, in particular of parameters related to the carbon cycle
9. Testing, validation and further development of existing and new remote sensing techniques

Scientific and Technical Goals

Formulated by university groups at the Heidelberg Meeting.

1. Sources, transport&chemical processing of aerosols (M. Wendisch and I. Tegen)
2. Clouds and precipitation (S. Crewell)
3. Clouds, aerosol, and radiation (K. Pfeilsticker, G. Seckmeyer, A. Macke)
4. UT/LS - transport&dynamik (A. Engel and U. Corsmeier)
5. Transport and Dynamics in the Troposphere (U. Corsmeier and S. Jones)
6. UT/LS - Photochemistry (H. Harder, A. Richter)
7. Earth surface processes (J. Nieke et al)
8. Earth and hydrology remote sensing

Presently >33 individual contributions by university researchers

Topic 1: Sources, transport&chemical processing of aerosols

(M. Wendisch and I. Tegen)

Specific Research Objectives:

1. Desert dust aerosol
2. Vertical transport of aerosol particles
3. Direct radiative effects of aerosol particles
4. Chemical composition of tropospheric aerosol particles
5. Interaction of aerosol particles and ice clouds

Topic 1: Sources, transport&chemical processing of aerosols

(M. Wendisch and I. Tegen)

Individual contributions:

A1.1 Tropical Cyclone / Saharan Air Layer Experiment, J. Dunion and Sarah Jones, IMK/Universität Karlsruhe/Forschungszentrum Karlsruhe

A1.2 Chemical Composition of the Tropospheric Aerosol, Johannes Schneider, MPI-Chemie, Mainz, Germany

A1.3 Instrument Proposal for HALO: An airborne tandem measurement platform for the characterisation of aerosol and cloud properties, M. de Reus, IPA, University of Mainz

A1.4 Instrument Proposal for HALO: CVI Coupled Single Particle Mass Spectrometry on Atmospheric Ice Nuclei, J. Curtius, IPA, University of Mainz

A1.5 A HALO mission proposal to characterize soil dust aerosol particles in the proximity and downwind of 'hot spot' source areas, I. Tegen, M. Wendisch, Leibniz-Institute for Tropospheric Research, Leipzig, Germany

A1.6 Tropical Transition Layer Characterization Experiment (TROLEX), S. Borrmann, Institute for Physics of the Atmosphere, University of Mainz

A1.7 Influence of organic compounds on the capability of aerosol particles to act as ice nuclei (SFB 641, Subproject A 4), G. Moortgat, J. Williams and R. Winterhalter, MPI Chemistry, Atmospheric Chemistry Division, Mainz

A1.8 Interaction of volatile organic compounds (VOC) with airborne ice crystals (SFB 641, Subproject B 8), Elke Fries, Wolfgang Jaeschke, Wilhelm Püttmann, University of Frankfurt

A1.9 Ice nucleus counters for HALO, E. Fries, W. Jaeschke, W. Püttmann, U.Bundke, H. Bingemer, University of Frankfurt and University of Mainz

Topic 2: Clouds and Precipitation: Scientific challenges for HALO

(S. Crewell and M. Wendisch)

Specific Research Objectives:

1. Validation of satellite estimates of cloud properties and precipitation
2. Process studies on cloud and precipitation
3. Life Cycle of Convective Cloud Systems
4. Study of cloud formation processes in mixed phase clouds
5. Water vapour within and around cirrus clouds

Topic 2: Clouds and Precipitation: Scientific challenges for HALO

(S. Crewell and M. Wendisch)

Individual contributions:

A2.1 Cirrus Exploration using Submillimeter Radiometry among other Implements (CESUR), H. Küllmann, S. Bühler, G. Heygster, H. Bremer, J. Notholt, Institute of Environmental Physics, University of Bremen

A2.2 Life Cycle of Convective Cloud Systems, M. Wendisch, B. Mayer, and the 4D-Clouds Community

A2.3 In situ holographic recording of cloud volumes to measure the spatial distributions of mixed phase and iced hydrometeors (HALOHOLO), Hermann-Josef Vössing, IPA, University of Mainz

A2.4 Study of cloud formation processes in mixed phase clouds, O. Stetzer, and U. Lohmann, ETH Zürich

A2.5 Partikel und Wasser in- und ausserhalb kalter Zirren, M. Krämer, FZ Jülich,

A2.6 The Water Budget of North Atlantic Cyclones, Graßl, H., Klepp, C., Peters, G., Bakan, S. Meteorologisches Institut, Universität Hamburg and Max-Planck Institut für Meteorologie

A2.7 Water vapour, precipitation and cloud liquid water, C. Jacobi, Institut für Meteorologie, Uni Leipzig (LIM)

Topic 3: Clouds, Aerosols and Radiation

(K. Pfeilsticker, A. Macke, B. Mayer, G. Seckmeyer, and M. Wendisch)

Specific Research Objectives:

1. Clouds and Radiation:
    - the life cycle of clouds
    - convective cloud systems in the tropics
    - the balance of net radiative fluxes
    - the RT budget of the UT/LS
2. Aerosol particles and radiation
    - to assess the source strength
    - to quantify the optical properties
    - interactions of aerosols and clouds
3. The interaction of radiation with the surface
    - to quantify the changes in spectral albedo
    - to investigate the spectral albedo of snow and ice
    - to study the change in the spectral albedo due to land use changes

Topic 3: Clouds, Aerosols and Radiation

(K. Pfeilsticker, A. Macke, B. Mayer, G. Seckmeyer, and M. Wendisch)

Individual contributions:

A3.1 Spectral radiance in the upper troposphere und lower stratosphere, G. Seckmeyer, Institute of Meteorology und Climatology, University of Hannover

A3.2 The UV/vis/near IR radiative transfer of the UT/LS region: Mie scattering by aerosols and cirrus clouds and the gaseous, liquid and solid H_2O concentrations, K. Pfeilsticker, IUP, Universität Heidelberg

Topic 4: Transport and Dynamics in the Lower and Lowermost Stratosphere

(A. Engel)

Specific Research Objectives:

1. to characterize the latitudinal distribution of reactive halogen oxides in the UT/LS from the equator to high latitudes
2. to identify and quantify suspected source regions for halogen compounds such as frost flower covered areas in polar spring, degassing volcanoes, coastal regions with large biological activity and ocean areas with strong upwelling
3. to study the spatial and temporal variability of bromine oxide release during polar spring bromine explosions
4. to quantify the tropospheric background

Topic 4: Transport and Dynamics in the Lower and Lowermost Stratosphere

(A. Engel)

Individual contributions:

A4.1 Missionsvorschlag zu einer HALO Mission in der unteren und untersten Stratosphäre, A. Engel, C. Schiller, A. Zahn, M. Riese, H. Schlager, G. Ehret, H. Fischer, M. Volk, U. Schmidt, Thomas Röckmann und Hermann Oelhaf, Institut für Atmosphäre und Umwelt, J. W. Goethe-Universität, Frankfurt

A4.2 SPECTRALOGGER: An ultra-compact tunable diode laser spectrometer for automated field use, W. Gurlit, Institute of Environmental Physics, University of Bremen, Germany

A4.3 Regional tropopause height, C. Jacobi, Institut für Meteorologie, Uni Leipzig (LIM)

Topic 5: Transport and Dynamics in the Troposphere

(U. Corsmeier and S. Jones)

Specific Research Objectives:

1. Mediterranean Sea cyclogenesis
2. Dead Sea haze formation
3. Predictability of high impact weather
4. Interaction of tropical cyclones with the Saharan Air Layer
5. Tropical cyclone – mid-latitude interaction experiment
6. initiation of convection

Topic 5: Transport and Dynamics in the Troposphere

(U. Corsmeier and S. Jones)

Individual contributions:

A5.1 Tropical Cyclone-Midlatitude Interaction Experiment, S. Jones, S. Aberson, J. Abraham, P. Harr, C. Velden IMK and Universität Karlsruhe

A5.2 Predictability of High Impact Weather,Targeted Observations, A. Dörnbrack,S. Rahm, and S. Jones, DLR/IPA and Institute für Meteorologie und Klimaforschung Universität Karlsruhe

A5.3 The western Mediterranean as a sensitive region for cyclone formation causing heavy-rain events, NEPTUN, C. Kottmeier, U. Corsmeier and N. Kalthoff, Institute of Meteorology and Climate Research, IMK Universität Karlsruhe

A5.4 The secrets of the initiation of convection uncovered with HALO, V. Wulfmeyer, University of Hohenheim

A5.5 A synergy of the next generation of remote sensing systems for HALO and their access for research centers via the first German deployment pool, V. Wulfmeyer, University of Hohenheim

Topic 6: Photochemistry of the UT/LS region

(A. Richter, H. Harder, T. Wagner and J.P Burrows)

Specific Research Objectives:

1. to characterize the latitudinal distribution of reactive halogen oxides in the UT/LS from the equator to high latitudes
2. to identify and quantify suspected source regions for halogen compounds such as frost flower covered areas in polar spring, degassing volcanoes, coastal regions with large biological activity and ocean areas with strong upwelling
3. to study the spatial and temporal variability of bromine oxide release during polar spring bromine explosions
4. to quantify the tropospheric bromine background

Topic 6: Photochemistry of the UT/LS region

(A. Richter, H. Harder, T. Wagner and J.P Burrows)

Individual contributions:

A5.1 The Polar Stratosphere in a Changing Climate (POLSTRACC), C.E. Blom, H. Oelhaf, R. Ruhnke, A. Zahn and H. Fischer, IMK, Universität Karlsruhe/Forschungszentrum Karlsruhe

A5.2 Studies of the Effects of Air Pollution on the Formation of the Haze in the Dead Sea Area, C. Kottmeier, H.-J. Panitz, U. Corsmeier, N. Kalthoff, and U.Schumann, IMK, Universität Karlsruhe/Forschungszentrum Karlsruhe, and DLR, Institut für Physik der Atmosphäre, Oberpfaffenhofen

A5.3 The Asian SUmmer MOnsoon (SUMO): Survey of the most polluted region in the UTLS, A. Zahn, H. Oelhaf, C. Blom, and H. Fischer, Universität Karlsruhe/Forschungszentrum Karlsruhe

A5.4 High Spatially Resolved Trace Gas Measurements from the HALO – Platform, U. Platt, C. Kern, K. Pfeilsticker, T. Wagner, IUP-Universität Heidelberg

A5.5 Trace gas observations in the UTLS region with the AMAX-DOAS instrument, A. Richter, J.P. Burrows, U. Platt, C. Kern, K. Pfeilsticker, T. Wagner, IUP-Universität Heidelberg, IUP-Universität Bremen

A5.6 Klaus U. Grossmann, Peter Knieling, Friedhelm Olschewski, CRISTA-NF auf HALO, Bergische Universität Wuppertal

A5.7 Halogen radicals (BrO, OClO, IO, and OIO) in the UT/LS region; their sources, chemical activation and ozone destruction potential, Klaus Pfeilsticker, IUP, Universität Heidelberg, Heidelberg

Topic 7: Earth Surface Processes

(J. Nieke et al.,)

Specific Research Objectives:

1. Earth observation (EO) in multi-dimensional scales
2. EO for hydrodynamic 3-D models of coastal and in-land water regions
3. EO for CO_2 modeling and climatology
4. EO for desertification models
5. EO for precise TOA radiance product generation
6. EO for air pollution detection in regional scale
7. Sub-pixel validation of atmosphere-observing space sensors

Individual Contributions:

Missing (15. 3. 2005)

Topic 8: Earth and hydrology remote sensing

(K. Roth)

Specific Research Objectives:

1. detection of soil moisture
2. detection of permafrost

Individual Contributions:

Missing (15. 3. 2005)

To Do List

Lead authors:

- Complete, correct....your cluster contribution as early as possible (by March 21) !
- Call-in missing and/or further individual contributions, ASAP

University groups:

- Submit your individual proposal to respective lead authors and us (by March 21) !

University institutions:

- Provide letter of support

Financing of HALO Activities

Given the financial situation of university research providing the funds to operate a research aircraft is clearly a challenge. At present there are several models under discussion, which must ensure that the following conditions are met:

- That the German universities will be able to use HALO in proportion to their capabilities.
- That the universities will be guaranteed a sufficiently large fraction of HALO flight hours.
- That continuous funding is available for the operation of HALO, since there is a substantial fraction of fixed cost (e.g. salaries of the crew) involved.

Financing models ...

„Meteor Model“

Financing of HALO - Based Research

Funding instruments?

Targeted Research Program (Schwerpunktprogramm) for Instrument development ...

Großer Dank an alle Autorinnen und Autoren !

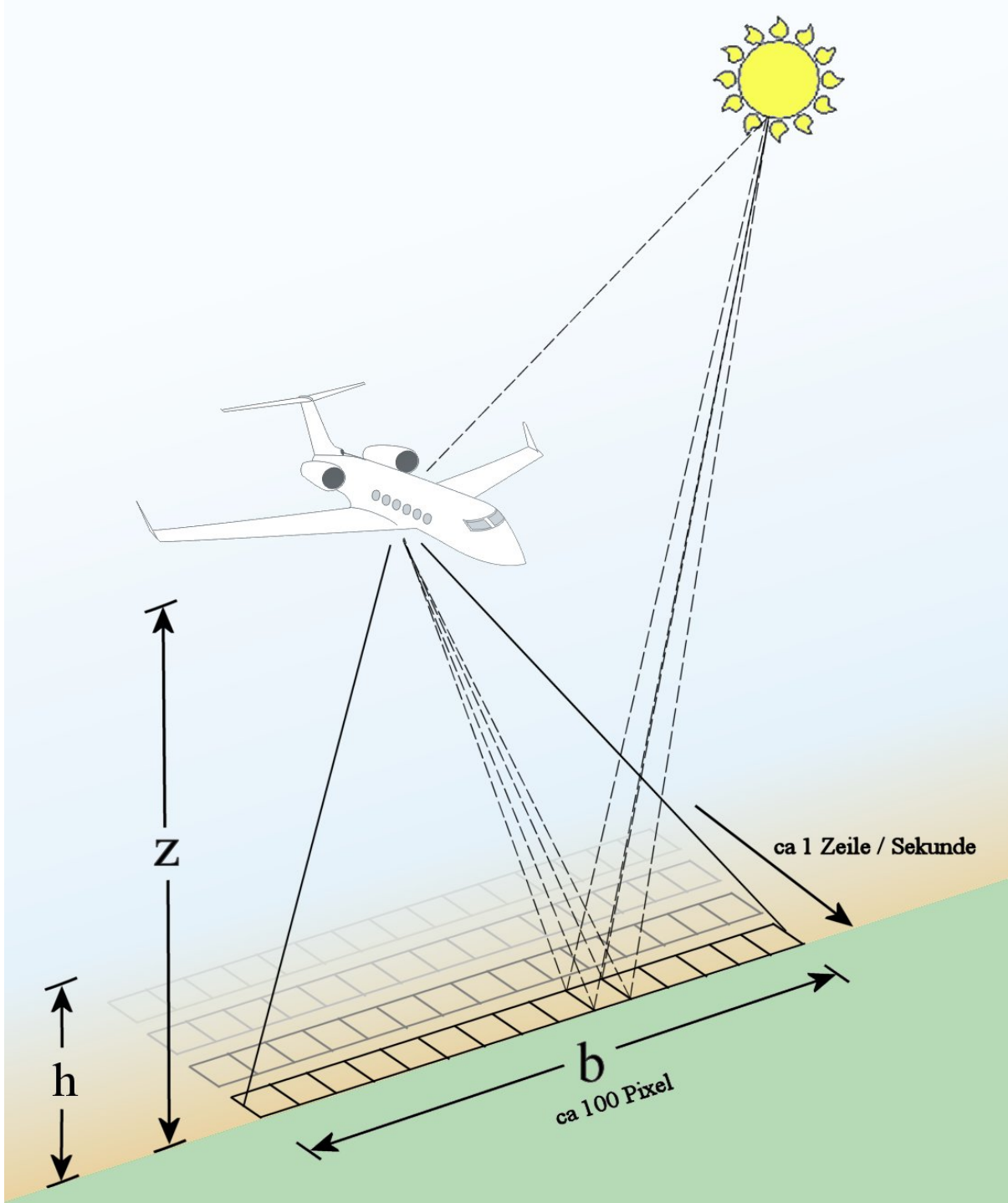
Large-Area Mapping of Trace Gases

- Models have several 10000 to millions of grid-points.
- Are compared to typically handful of measurements
- And thus „validated“ (?)
- Propose: Make several 10000 to 100000 measurements within short time interval

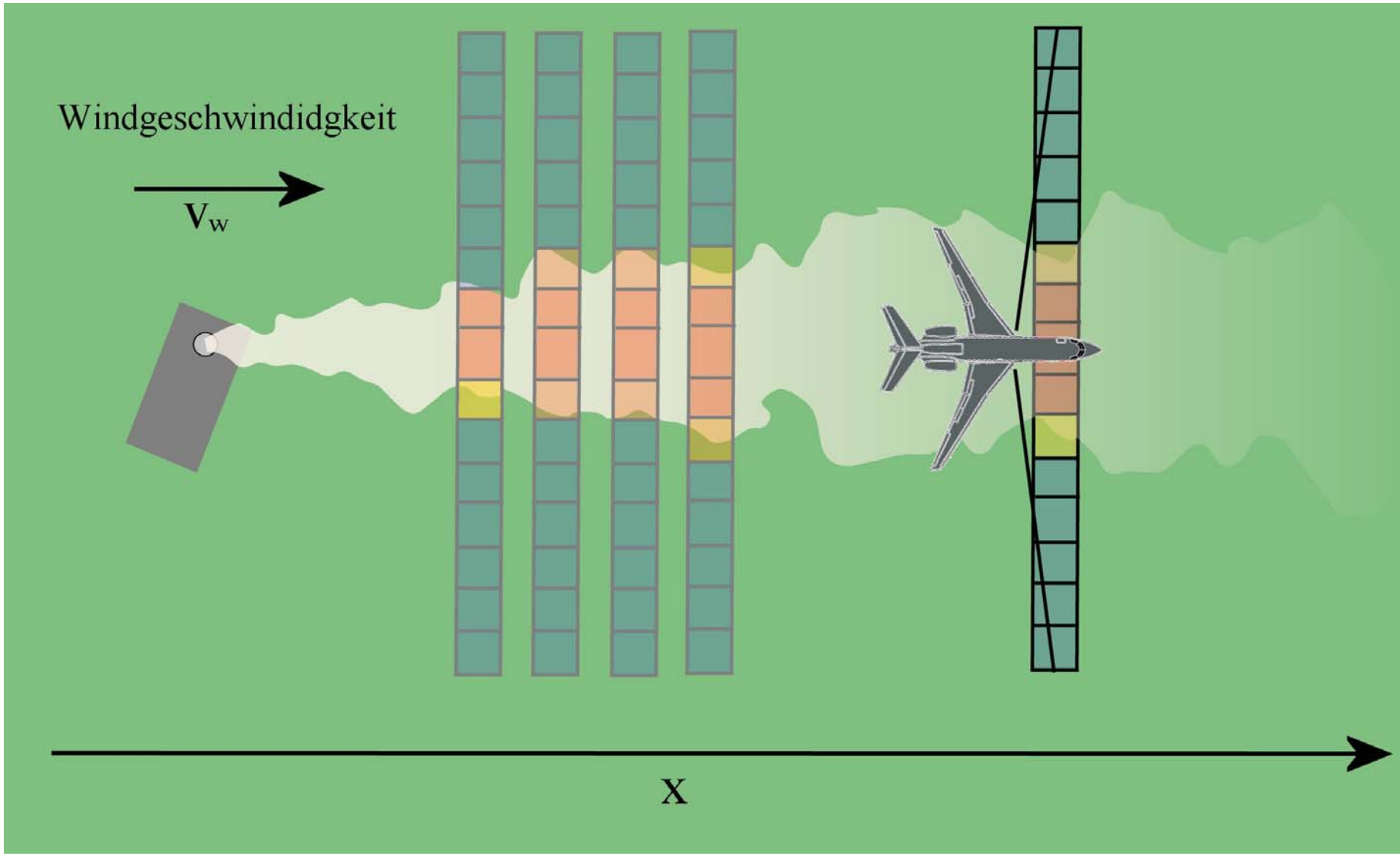
Study

- Air pollution (NO_2, CH_2O, SO_2, CO ...)
- Emission
- Evolution of plumes
- Point sources
- ...

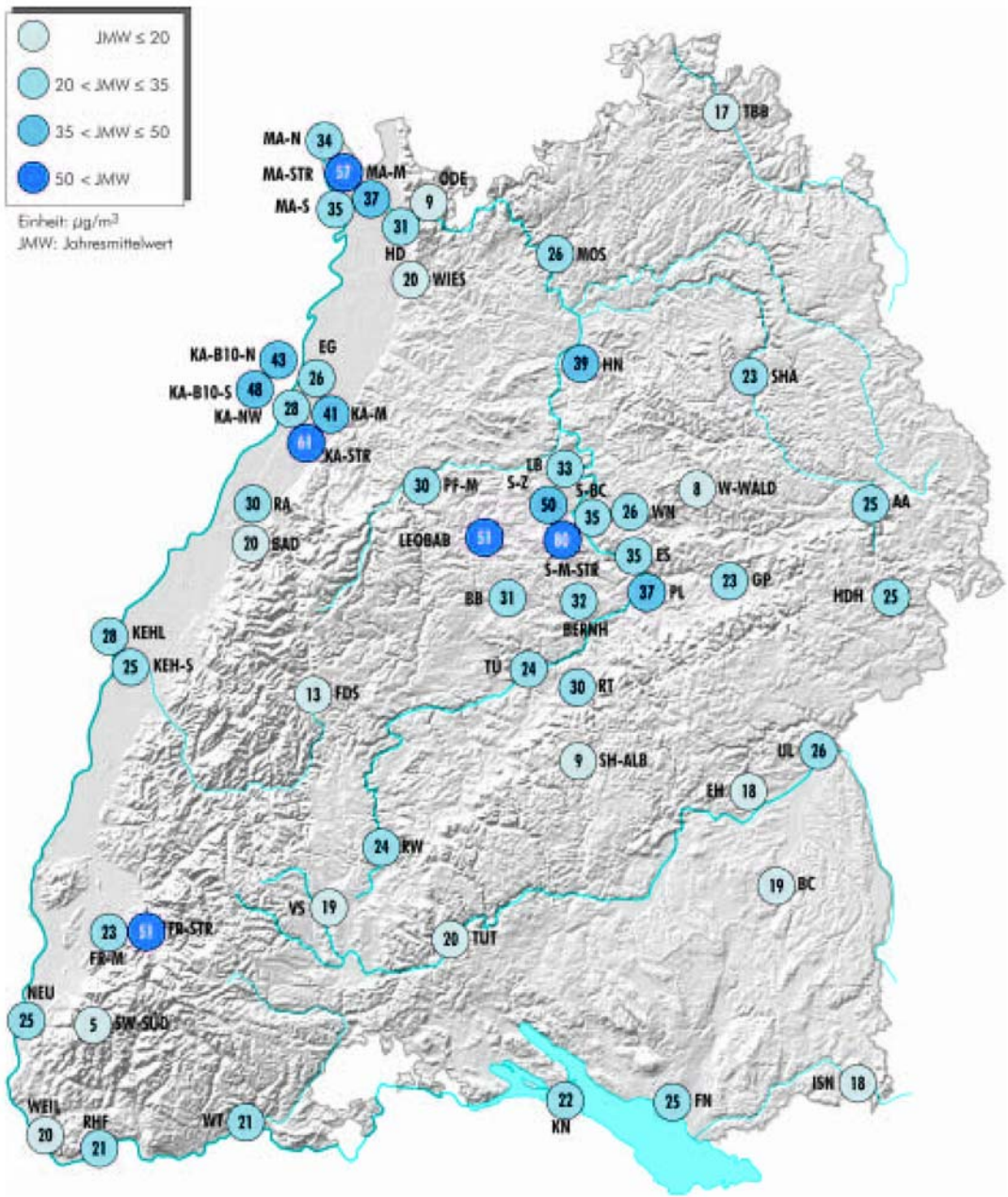
Messgeometrie des Flugzeuggestützten Imaging-DOAS



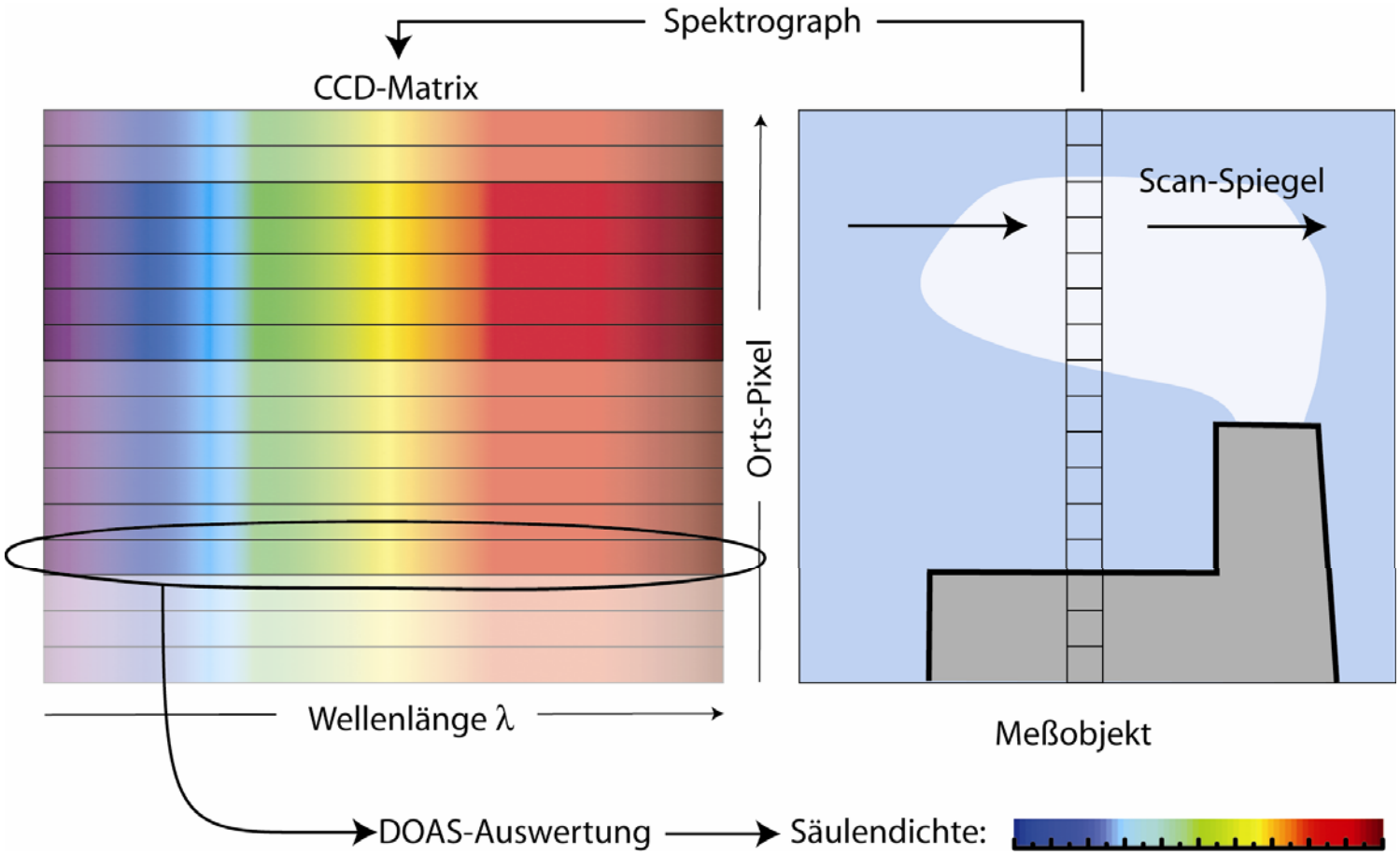
Bestimmung der Quellstärke einer Punktquelle und Spurengas -Lebensdauer in der Atmosphäre.



Anwendungsbeispiel: Oberrheingraben



Imaging DOAS (I-DOAS), the Principle



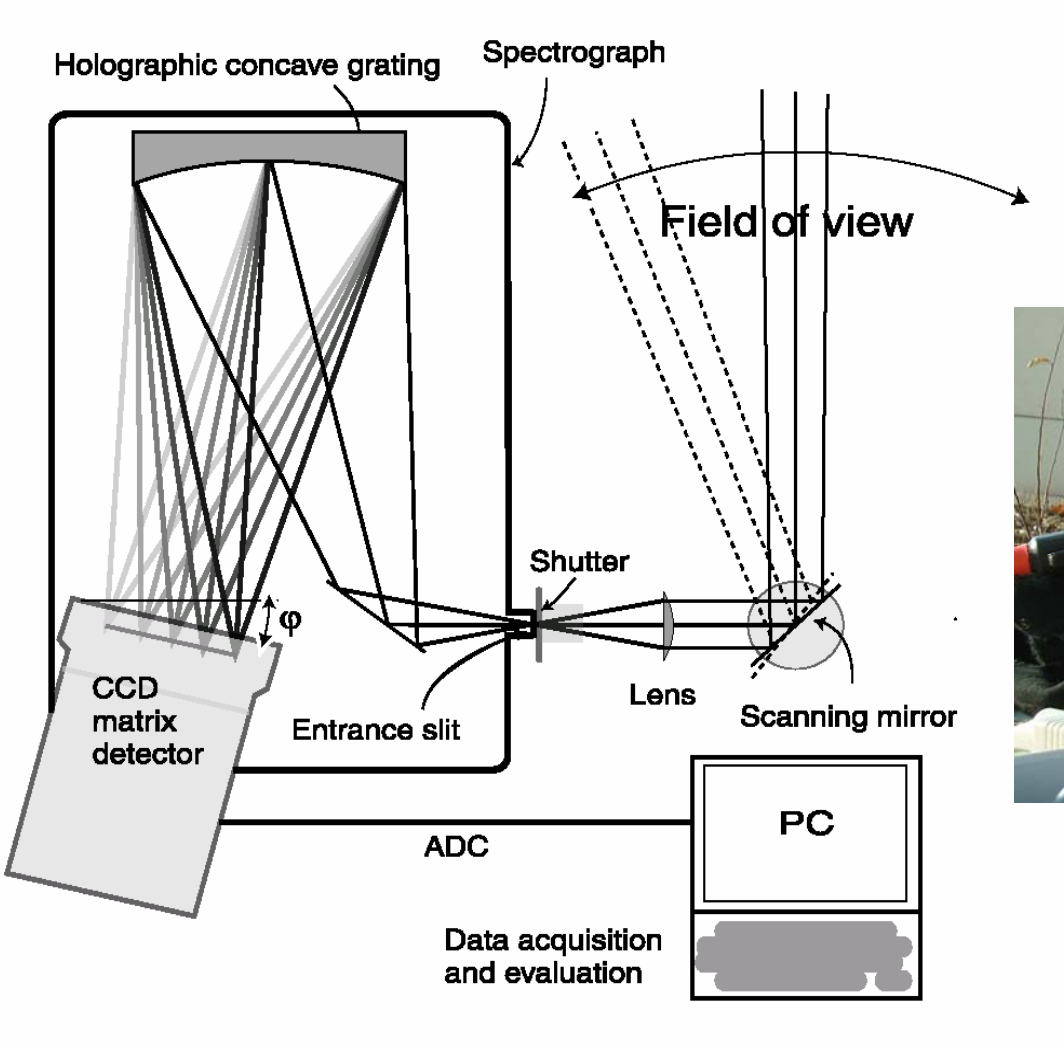
F. Lohberger

Diploma Thesis,

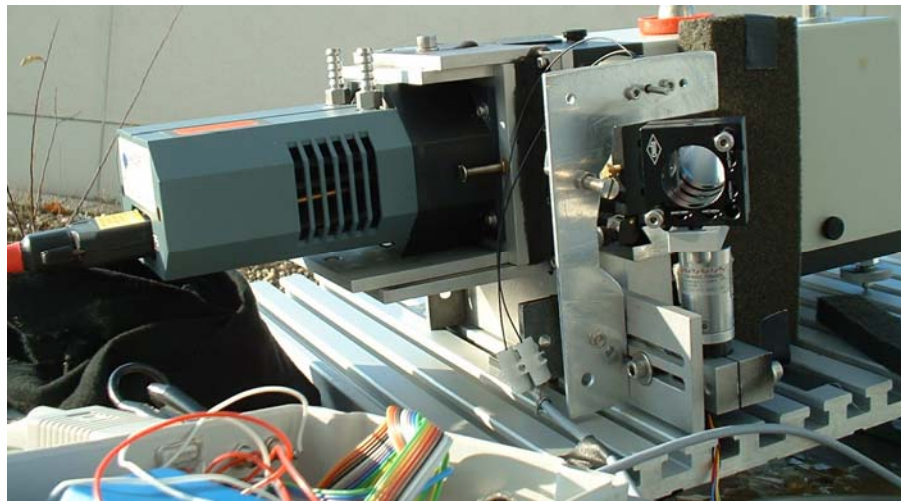
University of Heidelberg, 2003

- Simultaneous recording of spectra in a column of the image (100 - 500 pixels)
- Scanning of the entire image by rotating mirror (100 - 500 columns)
- DOAS-evaluation of Spectra yields column density for each pixel

Imaging DOAS (I-DOAS), Instrumental Setup



Size: ca. 50 x 50 x 20 cm³ plus PC



F. Lohberger

Diploma Thesis,

Univ. Heidelberg, 2003

Lohberger et al., Applied Optics 2004