Aerosol, Cloud, and Precipitation Properties and Interactions in Convective Cloud Systems (INTERCON)

MPIC, U Mainz, HUJ, DLR,
U Frankfurt, U Darmstadt, IfT Leipzig,
…
(M. O. Andreae)

Potential Partners

- MPIC (Biogeochemistry, Air Chemistry, Cloud Physics/Chemistry)
- Hebrew University of Jerusalem
- DLR (Atmospheric Physics)
- University of Mainz (Atmospheric Physics/Meteorology, SFB)
- University of Frankfurt (Atmospheric Physics/Meteorology, SFB)
- University of Darmstadt (Electron Microscopy, SFB)
- IfT Leipzig

Aims

- Comprehensive characterization of aerosol, cloud and precipitation properties (composition, CCN-ability, IN-ability; microphysical and dynamical properties of the clouds) in convective cloud systems (aircraft + satellite +radar).
- Quantitative description of aerosol-cloud interactions and precipitation formation by assimilation of the measurements in models at a hierarchy of scales (particle, cloud, regional, global circulation and climate)
- Determination of human influence by comparison of cloud systems in polluted and unpolluted air of otherwise identical thermodynamic characteristics (aircraft + modeling)
- Introducing of these processes into models for improving forecasts ranging from nowcasting of severe storms, numerical weather prediction and climate prediction, including global warming.

Aircraft measurements

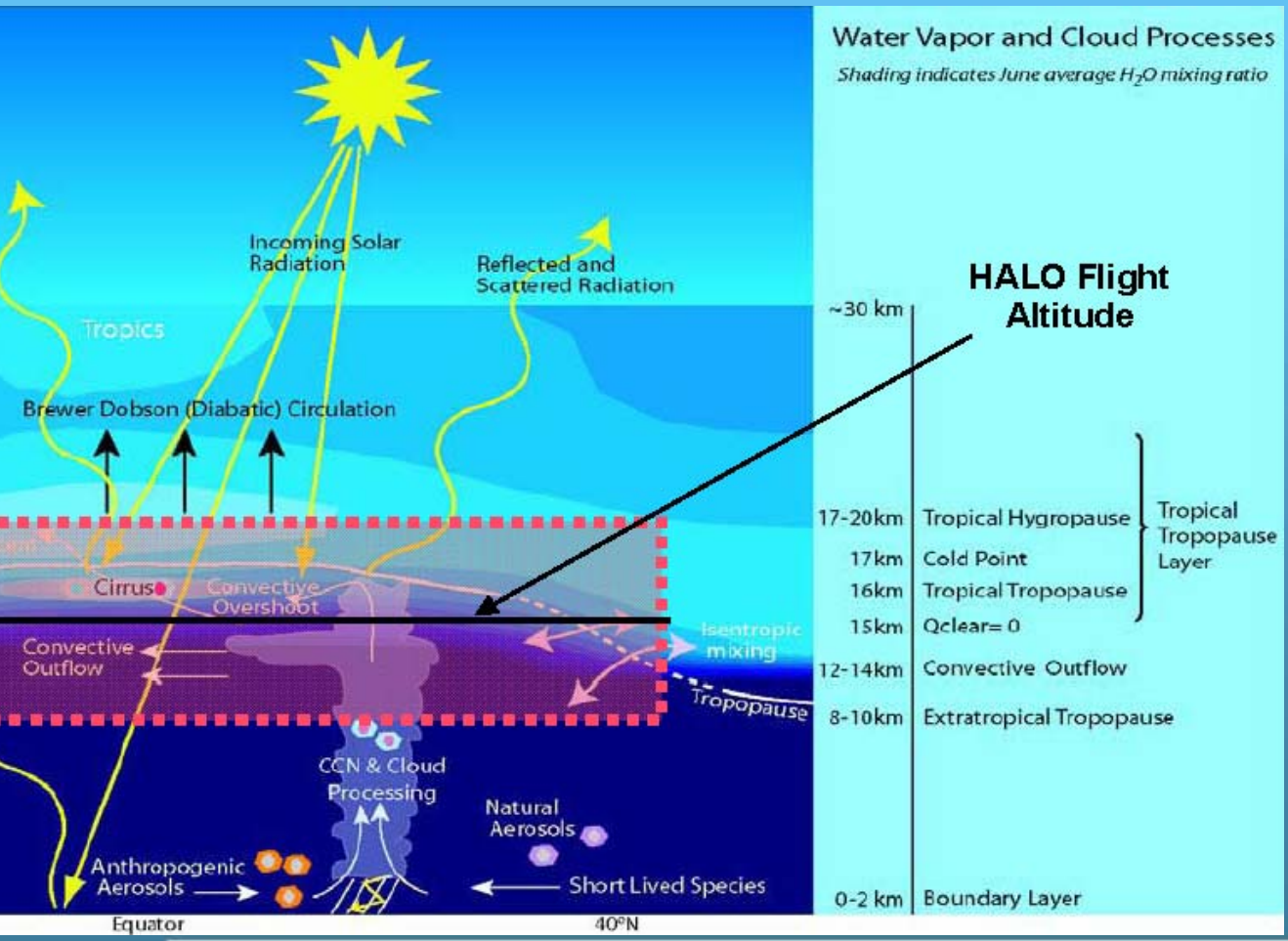
- Measurement region(s)
  - In region, where originally clean air receives significant amounts of pollution from regional sources, and where fairly intensive convective activity can be expected, e.g. Iberian Peninsula, or biomass burning regions in otherwise unpolluted tropical regions (Amazon). Flights probing the interior of convective clouds as well as their inflow and outflow regions should be conducted in clean and adjacent polluted air masses.

Aircraft measurements

- Measurements
  - Aerosol particles: number concentration and size distribution, size-resolved chemical composition (AMS, samplers), optical properties, CCN & IN ability, isokinetic sampling for large aerosol, cloud and precipitation particles. CVI sampling system for identification of the particles that served as CCN and the interstitial aerosols separately.
  - Cloud and precipitation particles: number concentration and size distribution, phase (liquid/solid)
  - Dynamics: 3-D winds with emphasis on in-cloud updraft velocity and turbulence intensity. On-board radar for identifying large hydrometeors in clouds.
  - Gas phase: H_2O, O_3, nitrogen oxides, CO, volatile organic compounds (PTR-MS)

Related Issues

- Water transport to UTLS
- Pollutant transport to UTLS
- Formation and properties of cirrus
- Prediction of severe storms


Water Vapor and Cloud Processes
Shading indicates June average H_2O mixing ratio
Incoming Solar Radiation
Reflected and Scattered Radiation
Tropics
Brewer Dobson (Diabatic) Circulation
Cirrus
Convective Overshoot
Convective Outflow
Isentropic mixing
Tropopause
CCN & Cloud Processing
Natural Aerosols
Anthropogenic Aerosols
Short Lived Species
Equator
40°N
HALO Flight Altitude
~30 km
17-20km Tropical Hygropause
17km Cold Point
16km Tropical Tropopause
15km Qclear= 0
Tropical Tropopause Layer
12-14km Convective Outflow
8-10km Extratropical Tropopause
0-2 km Boundary Layer