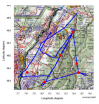

# Partenavia aircraft flight missions July 2007

**Christine Brandau (PI) and Herman Russchenberg**
Delft University of Technology, The Netherlands


The Partenavia aircraft flight missions are based on an **EUFAR** (**Eu**ropean **F**leet for **A**ircraft **R**esearch) proposal **OMAC** (**O**bservation **M**ethodologies of the First Indirect **A**erosol Effect in Water **C**louds). The main purpose of this experiment is related to microphysical measurements within water clouds simultaneous to ground-based remote sensing observations. The instrumentation of the aircraft covered water cloud microphysical targets (FSSP (top left), CIP (top right)) as well as standard avionic and meteorological parameters. Altogether four different flight missions have been operated during SOP-1a, 2 to 4 (Special Observations Periods). The predefined flight pattern is a triangle, which covered the area of the **R**hine-valley, **H**ornisgrinde and **M**urg-valley, so that several overpasses of the supersites **R**, **H** and **M** could be performed simultaneous to the continuous ground-based observations and additional lidar measurements.

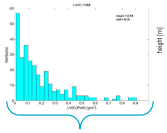
## SOP 1a: 12.07.2007 from 5:10 to 6:53 UTC

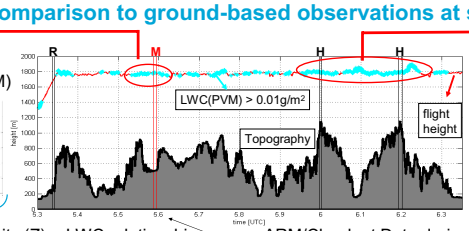


**Cloud situation**: low level water clouds, cloud base at Hornisgrinde level, incoming drier air during the flight caused mixing effects and broken clouds

### First inter-comparison to ground-based observations at supersite M

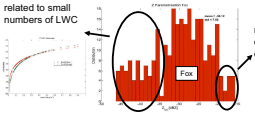
LWC in-situ (PVM)

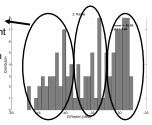





using radar reflectivity (Z) - LWC relationship

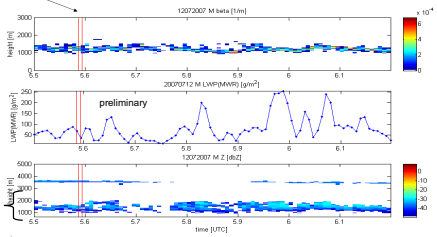
Fox: $Z\ (mm^6m^{-3}) = 0.031 \quad LWC^{1.56}$



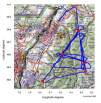

Radar reflectivity of 2 height bins (90m) due to the straight level leg:
Z > -50
Z < -17 no drizzle

ARM/Cloudnet Data during flight period



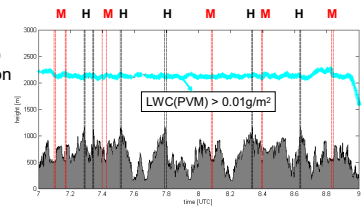

Difficult to gain a representative sample of the cloud related to the in-situ measurements at site M, because of the atmospheric conditions (mixing effects, wind shear, which results in double layer systems and broken clouds)

## SOP 4: 24.07.2007 from 6:29 to 9:15 UTC

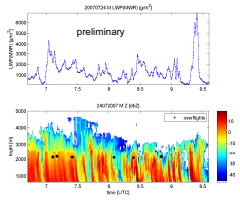


**Cloud situation**: occlusion clouds, multilayer systems, in-situ measurements of drizzle, light rain to heavy precipitation over all sites

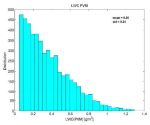
Topography and flight height




ARM/Cloudnet Data




LWC in-situ (PVM)
whole flight duration



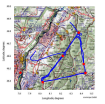
Several overpasses between supersite M and H (also slant profiles)

+

COPS area was influenced by an upper low system, which caused windy or even stormy conditions over the mountains with rain mostly of **convective** nature

**Possibility of a detailed analysis of a rain event caused by convection:**
Inter-comparison of radar reflectivity and rain-rate relationship using in-situ data
Influence of the orography on cloud development and precipitation
Validation of rain gauges measurements at the sites

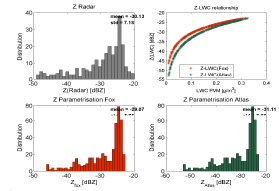
## SOP 2: 21.07.2007 from 6:10 to 8:11 UTC



**Cloud situation**: widespread of cloud types, low-level water clouds, multilayer mixed phased clouds in the upper part of atmosphere, rain events

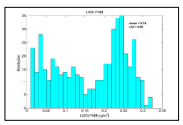
### Low level water cloud analysis

Radar reflectivity (Z) - LWC relationship



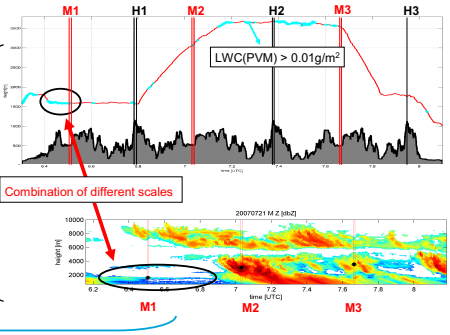

representative sample of the cloud using in-situ and ground-based observations possible using Fox/Illingworth Z-LWC relationship

LWC in-situ (PVM)



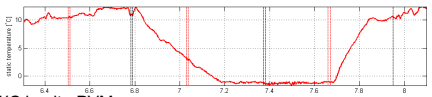
Radar reflectivity of 5 height bins due to changes in flight level
Z > -50
Z < -17 no drizzle

Topography and flight height

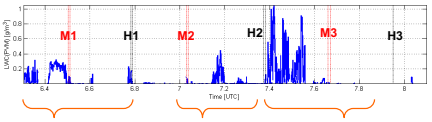



### Mixed-phase cloud analysis

Temperature in-situ during flight

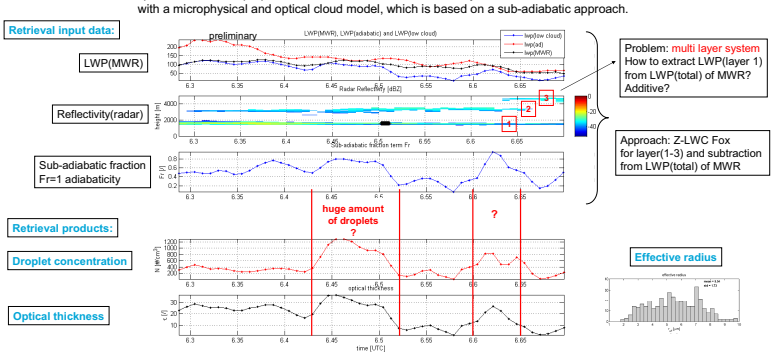


LWC in-situ PVM



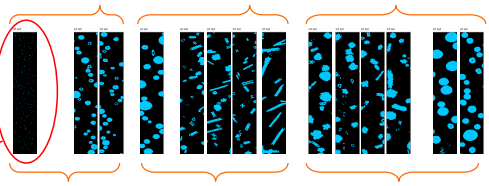

### Application of water cloud retrieval technique for validation purposes

The retrieval technique of water cloud properties combines cloud radar reflectivity and microwave radiometer LWP measurements with a microphysical and optical cloud model, which is based on a sub-adiabatic approach.




Validation of retrieval products by using FSSP data (concentration, effective radius) is planned, but so far the data are not available yet

CIP (Cloud Imaging Probe):
**W. Frey, H. Voessing,**
Institute for Atmospheric Physics
Johannes Gutenberg University Mainz



Improvement of applicability of water cloud retrieval technique at M1

small water cloud droplets at M1, larger ones at H2
Seeding or orographically induced?
No radar data at H

with decreasing temperature (slant profile to 3700m) formation of ice crystals: columns and aggregates

presence of graupel, rimed particles (collision ice crystals and drops) and with increasing temperature (lower flight height) large rain droplets
Seeding/orography?

**broad spectra of in-situ observations simultaneous to ground-based measurements**

Detailed analysis of microphysical properties in different height levels related to the atmospheric conditions and to the orography are planned

Aircraft Coordinator:
Dieter Schell (enviscope) in cooperation with University of Mainz

Corresponding Author: c.l.brandau@tudelft.nl