

# *A miniature microwave radiometer network for FESSTVaL*



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Clemens,...

# Motivation

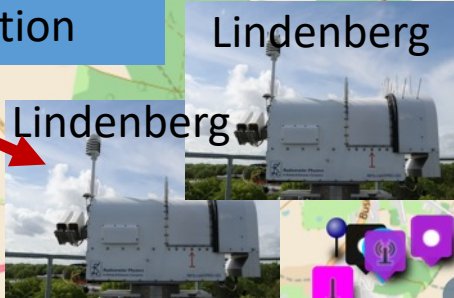
- Best continuous (~min) estimate of **cloudy vertical ABL thermodynamic structure** during FESSTVaL → complement radiosondes
- **Sub-meso-scale variability** of vertical temperature and humidity structure
- Derivation & application of common **QC/QA** (EMF "TDYN-PRO")

# Research questions

- Derive horizontal **humidity (and temperature) gradients?**
  - Cold-pool passage
  - Frontal passage
  - ABL build-up?
- Improve temperature & humidity profiling by means of **sensor synergy?**
- How to **describe error covariances of MWRs** for the assimilation into ICON?

# Instrument setup

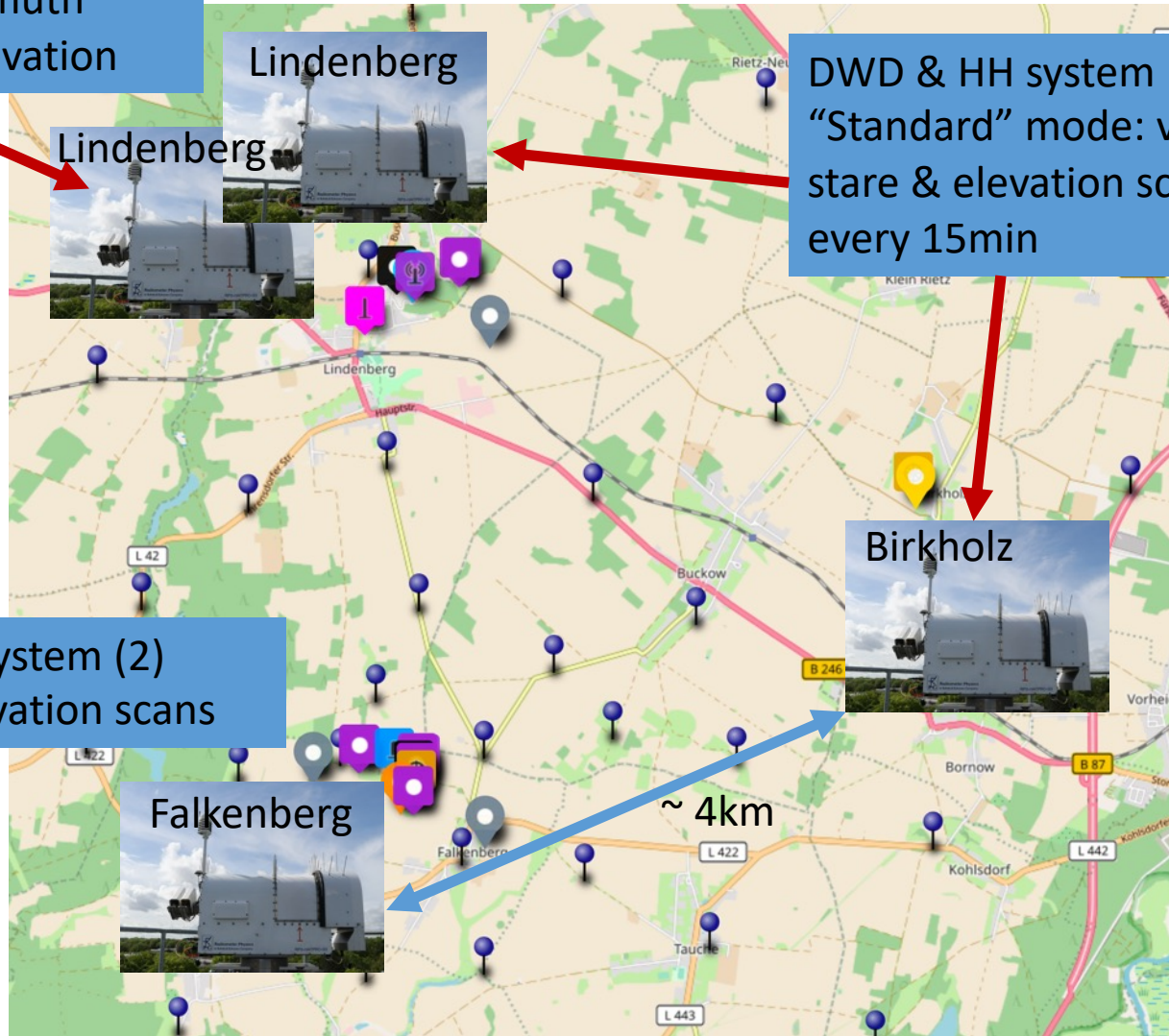
Univ. Cologne system (1)  
Continuous azimuth  
scans @ 30° elevation



DWD & HH system  
“Standard” mode: vertical  
stare & elevation scans  
every 15min

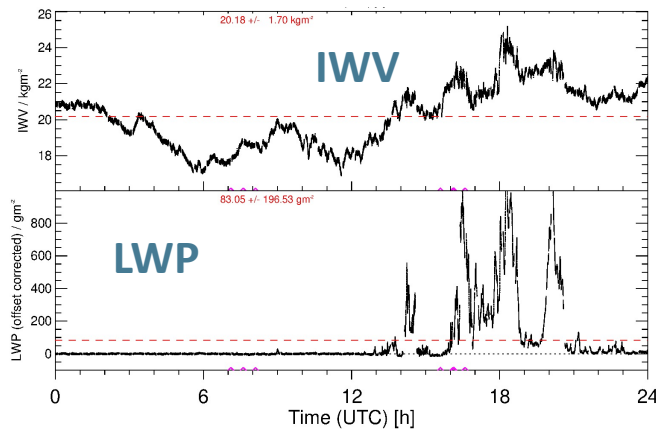


Univ. Cologne system (2)  
Continuous elevation scans

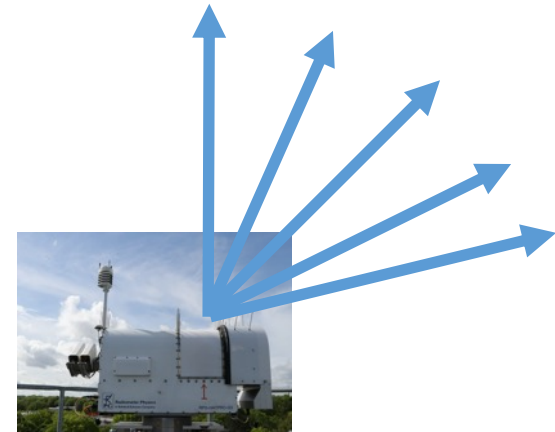


# Measurement modes & products

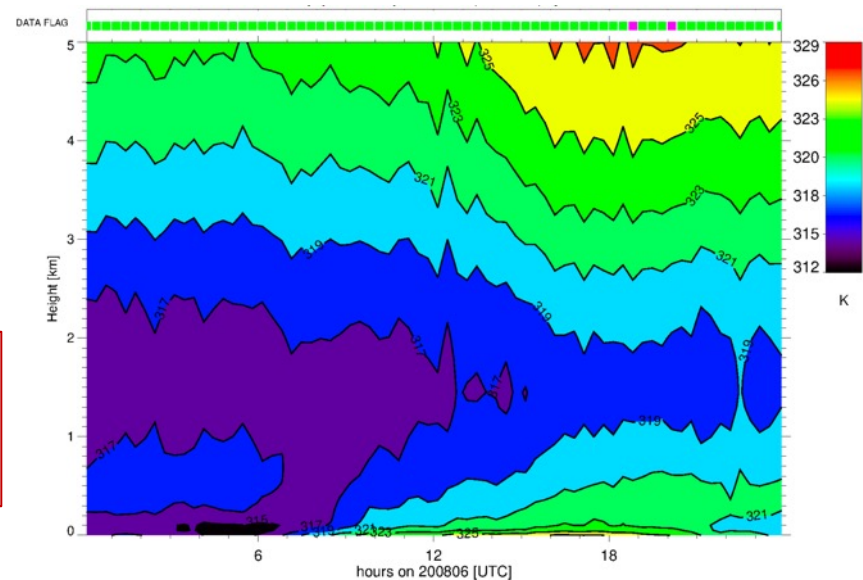
Vertical stare: Time series of LWP/IWV + crude T&WV profile  
@Lindenberg & Birkholz



Products to FESSTVaL DB



Elevation scanning:  
Temperature profile up to 5km  
@Falkenberg

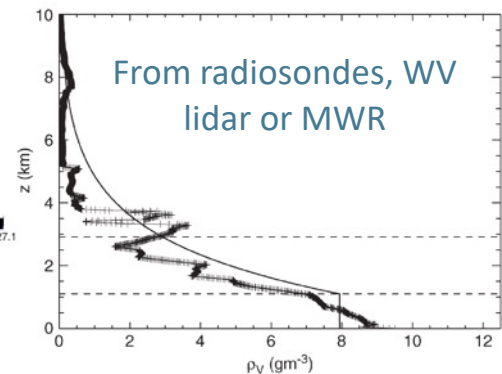
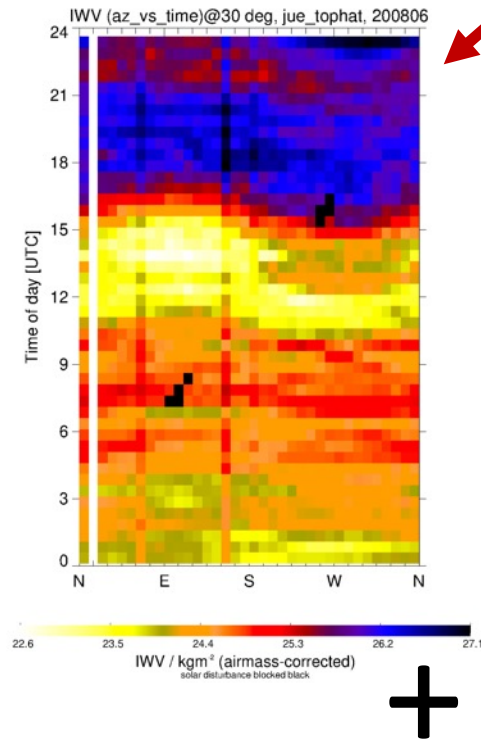
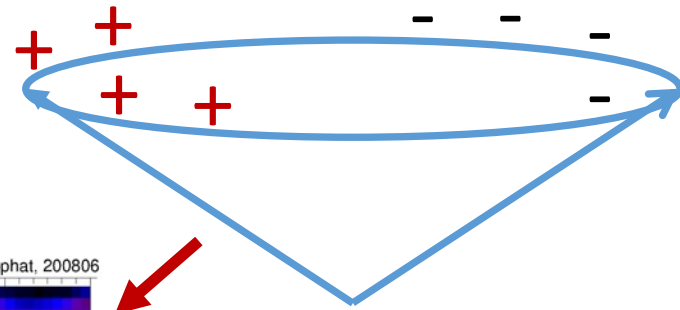


# Azimuth scanning

Horizontal humidity gradient

- Continuous azimuth scans could provide gradients every ~3 min
- Representative of ~10 km radius
- Need: path integrated WV and assumption on vertical humidity structure (Schween et al., 2011)
- More challenging: temperature gradients

@Lindenberg



Strength and gradient of horizontal humidity gradient

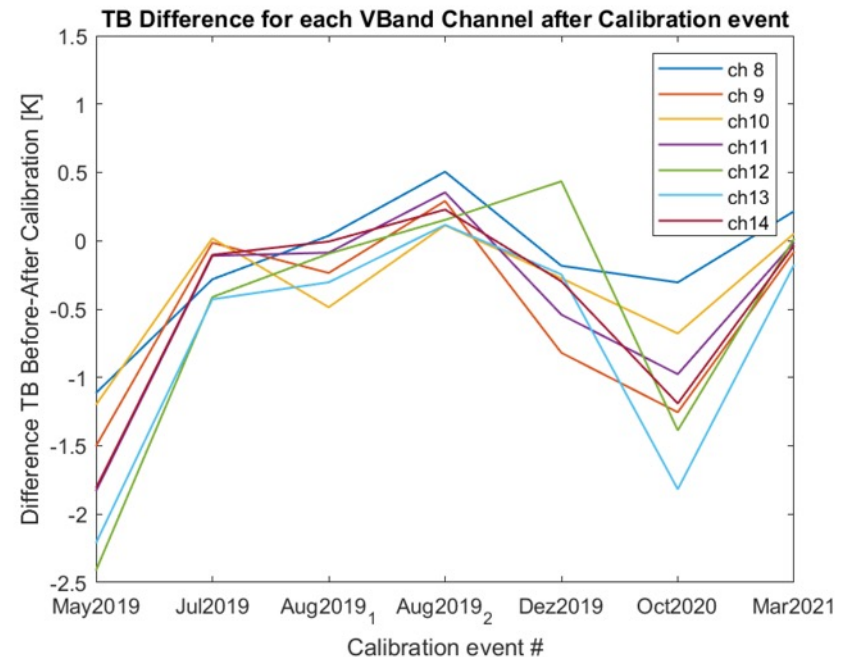
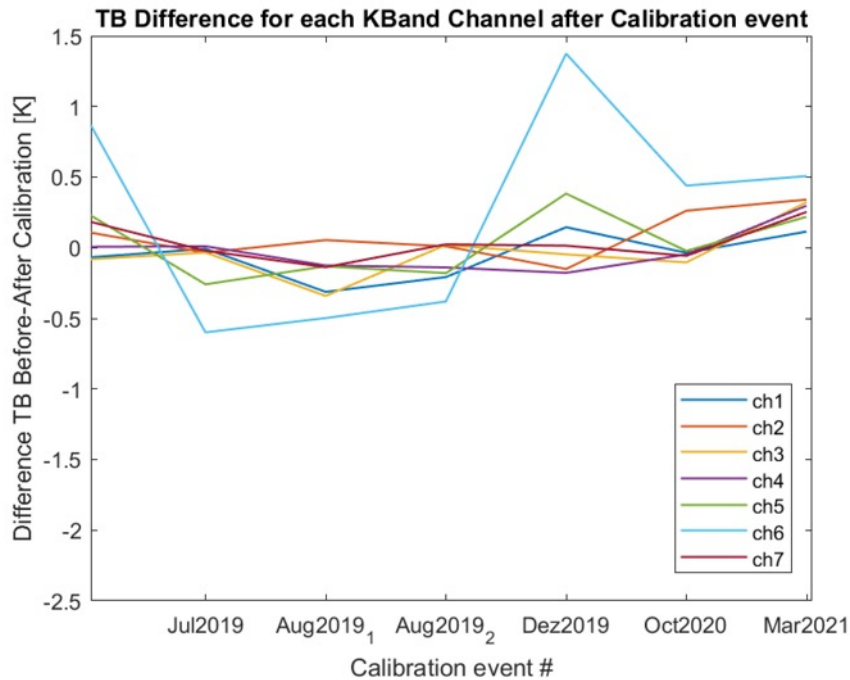
**Back-up slides**

# EMF project: TDYN-PRO

Integration von bodengebundenen „Profilern“ in das DWD-Vorhersagesystem

Goal: direct assimilation of TBs with KENDA

## Assessment of TB calibration drifts



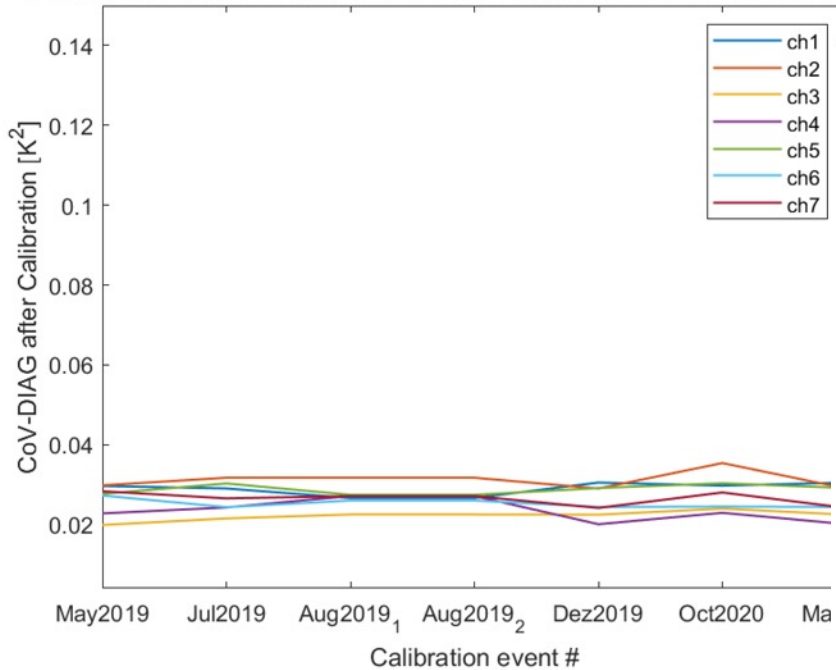
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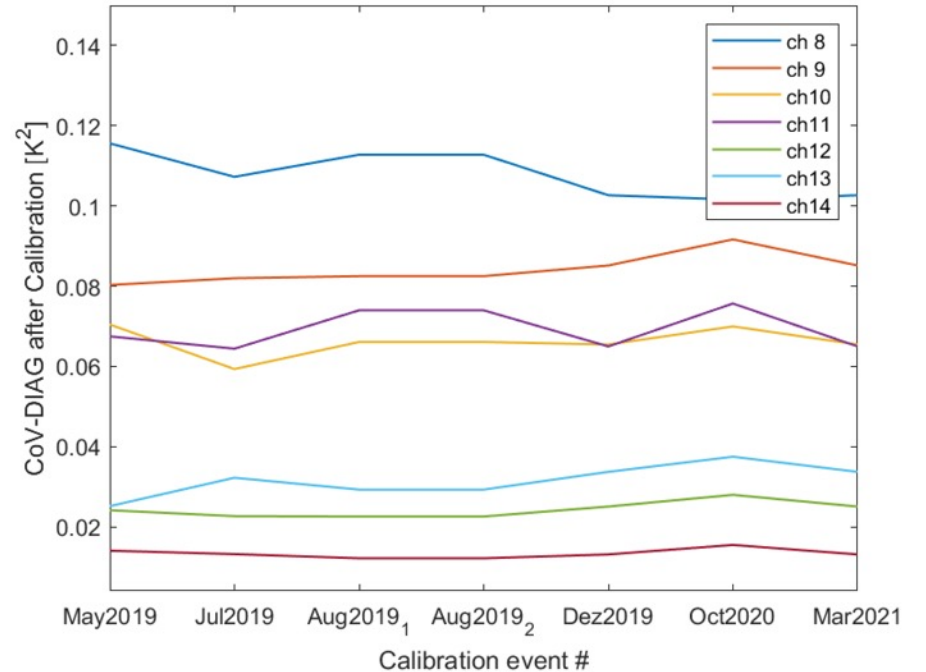
Goal: direct assimilation of TBs with KENDA

## Assessment of TB uncertainty

CoV-DIAG for each KBand Channel after Calibration event HOTLOAD 10min



CoV-DIAG for each VBand Channel after Calibration event HOTLOAD 10min



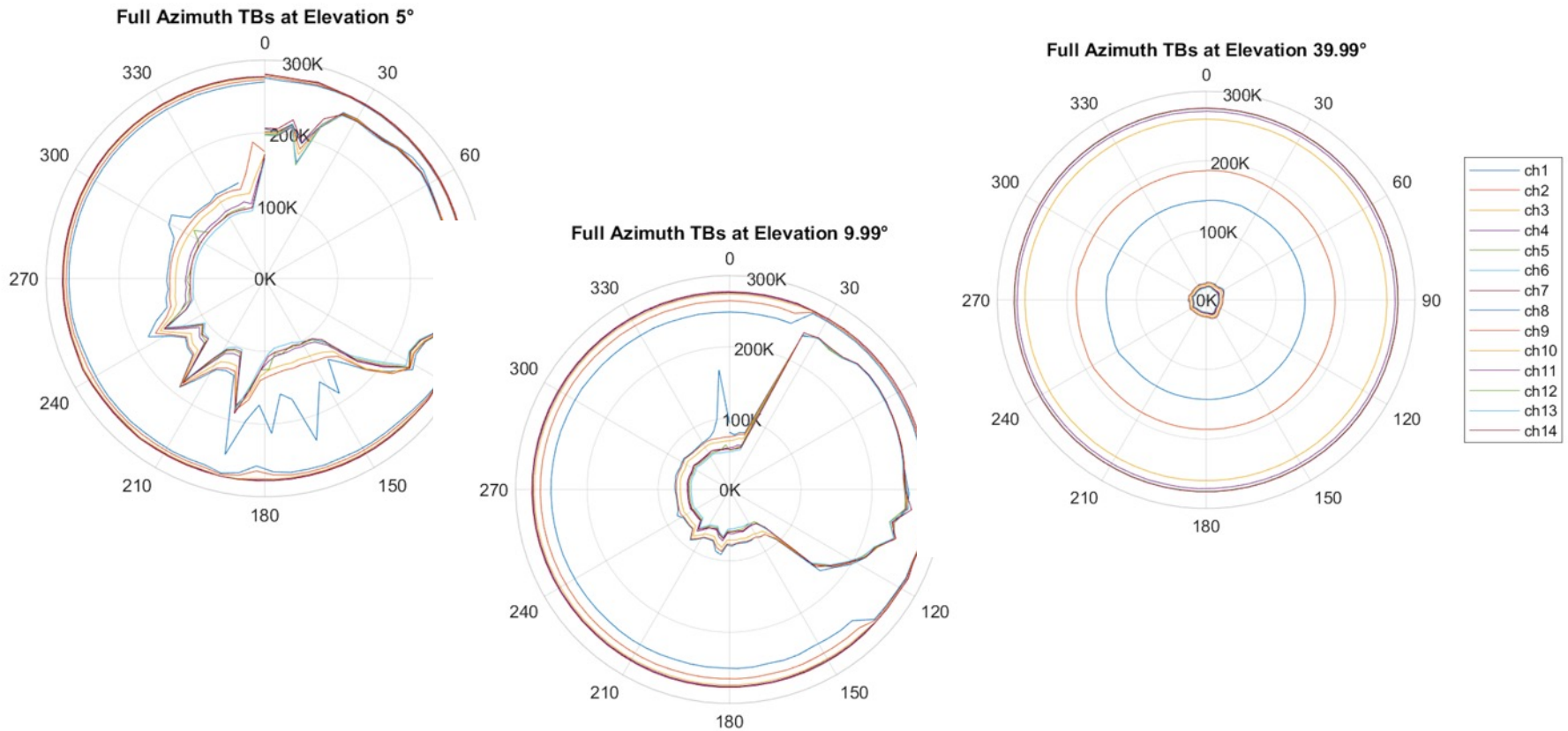


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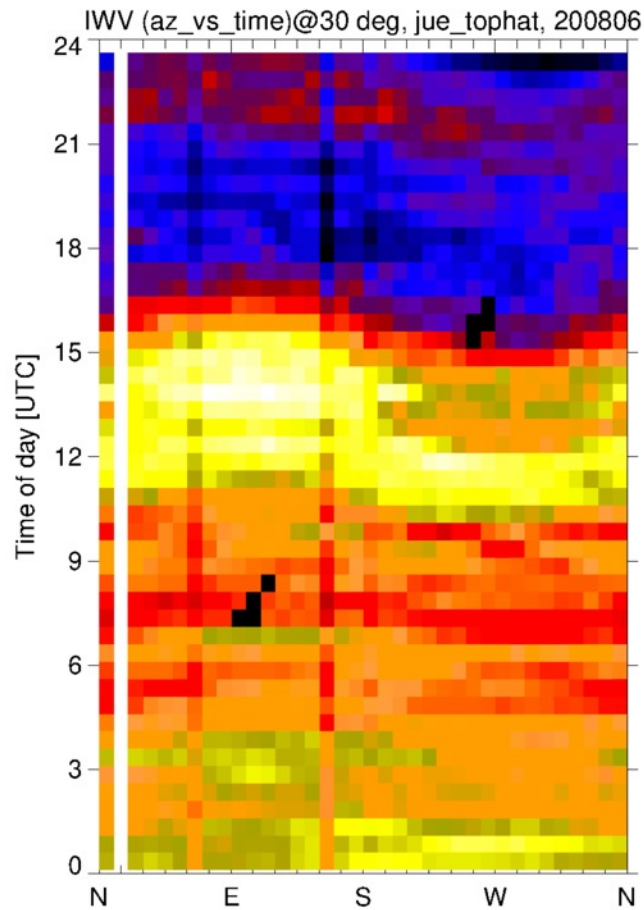
Procedures for QA: measurement setup



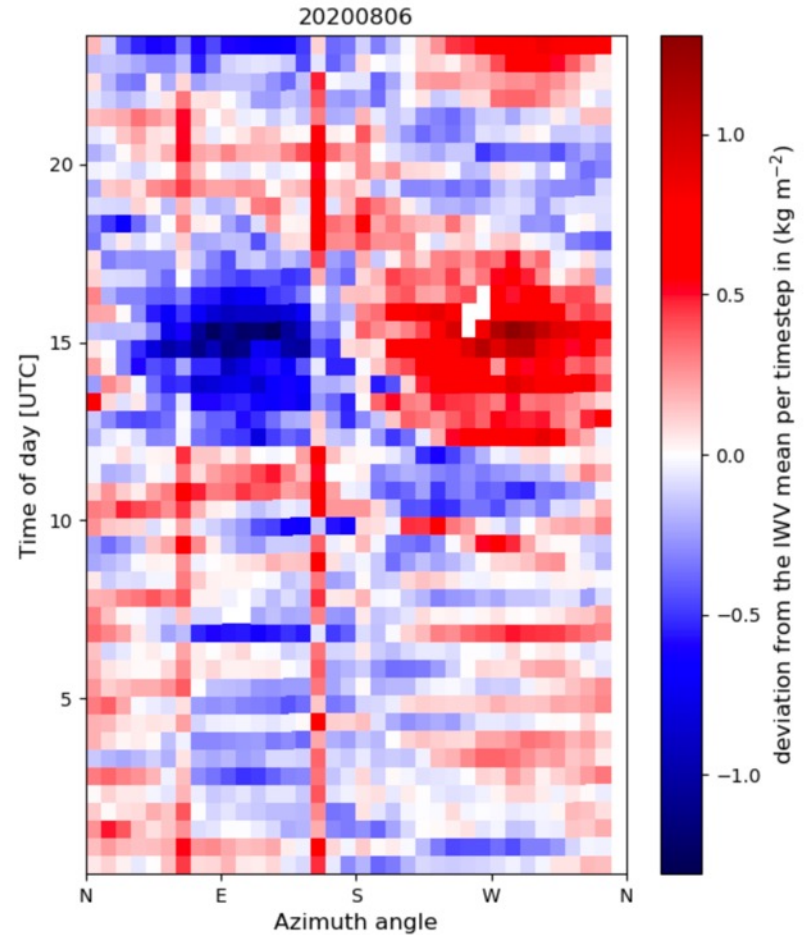
# Measurement modes & products

Azimuth scans IWV@30° elevation: spatial WV inhomogeneity

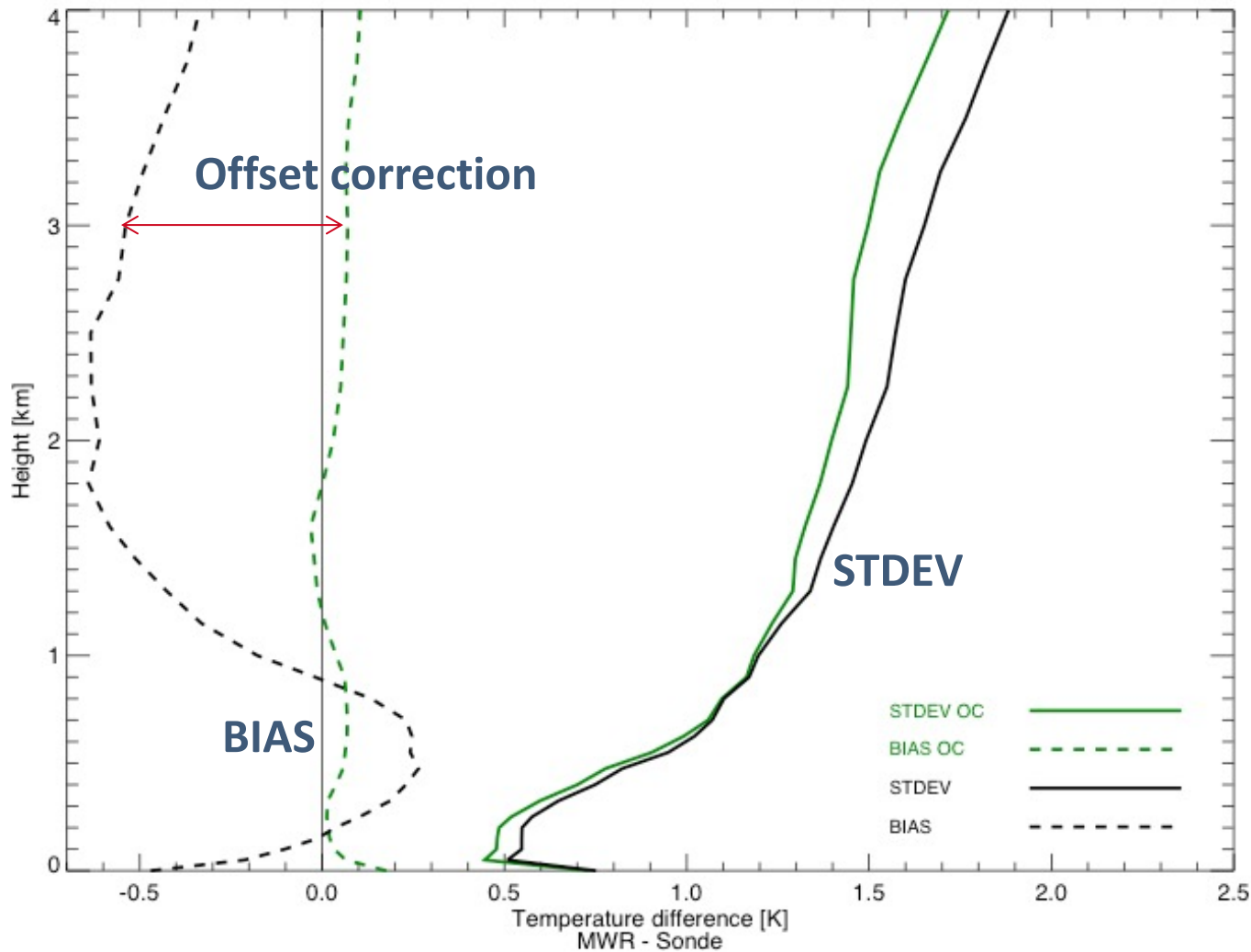
Absolute value



Deviation from scan minimum

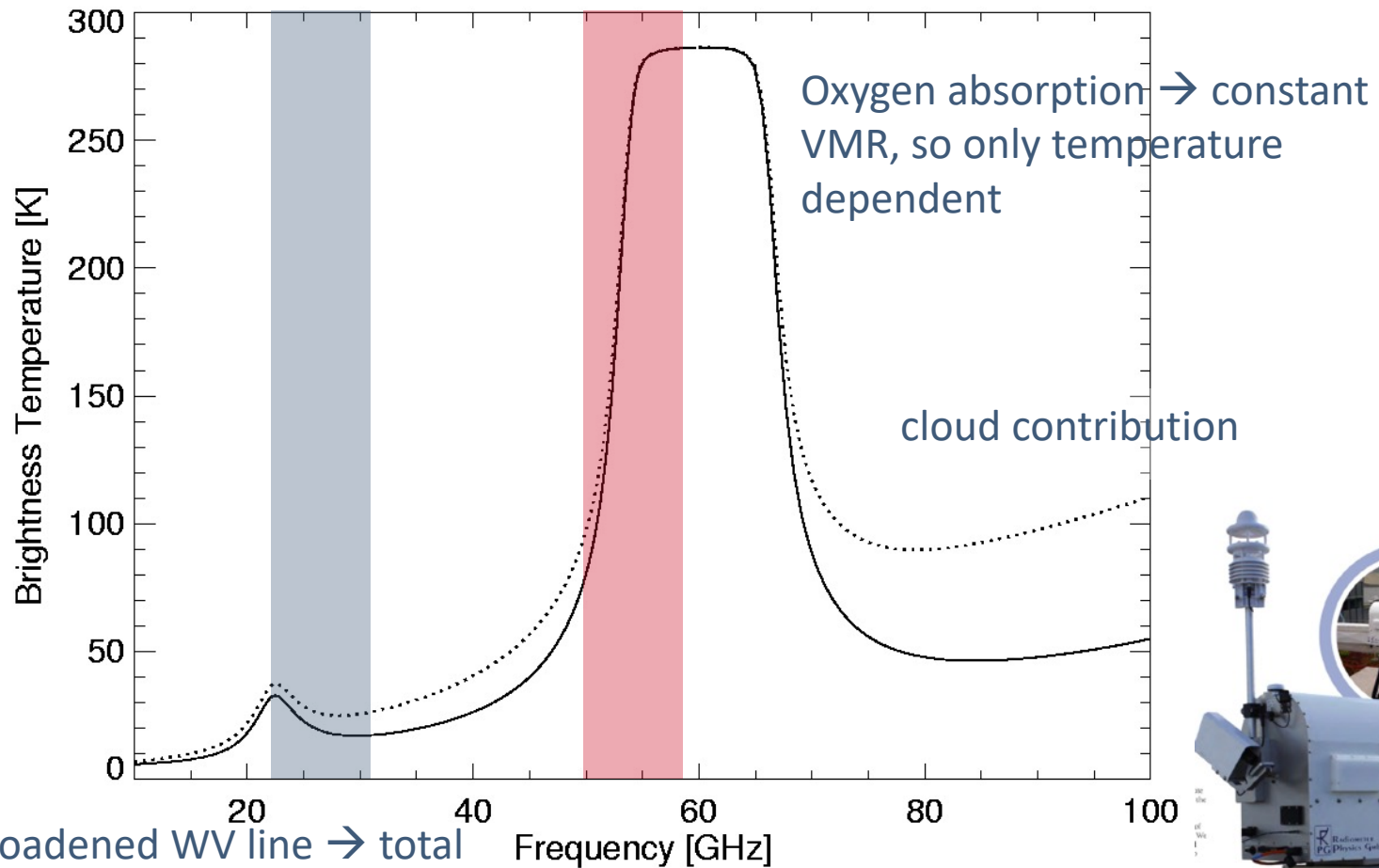


# Temperature profiling accuracies (radiosonde reference)



- BIAS issue: improved calibration loads
- STDEV: better instrument stability

# MW-profiling: How does it work theoretically?



pressure broadened WV line → total water vapor & weak profile information



# Ground-based microwave radiometers

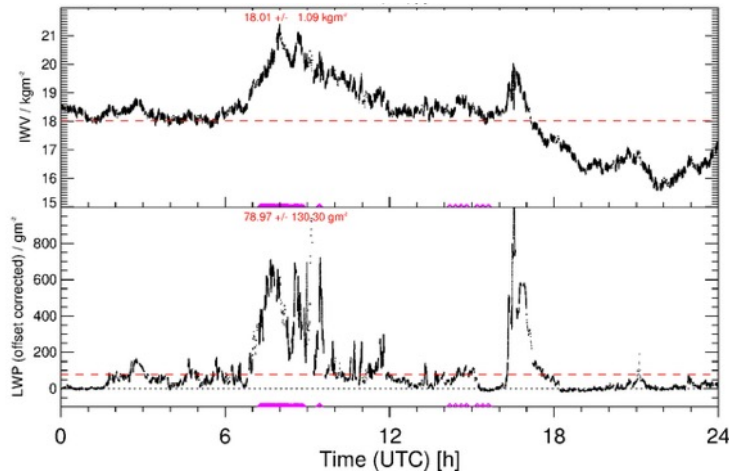
Low resolution **water vapor profile**, but excellent path-integrated values

Continuous data in all-sky conditions: resolution of seconds to minutes

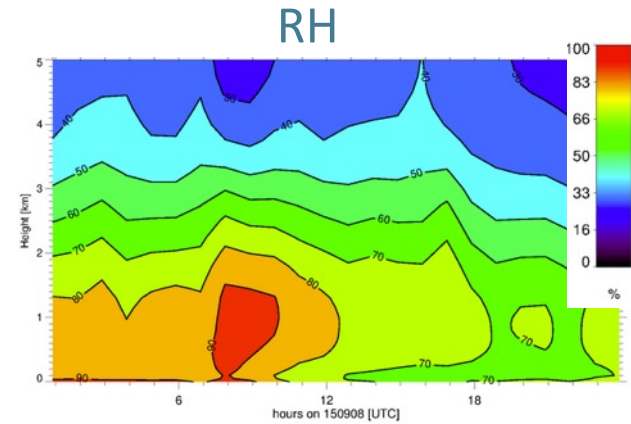
**Measurement focus: ABL**



Temperature profile of the ABL, low resolution profile above



Path-integrated **cloud liquid water** (unique)



# Evolving networks



*European Research Infrastructure for the observation of Aerosol, Clouds, and Trace gases (on ESFRI roadmap)*



## Research

*ACTRIS Cloud Remote Sensing Center*

- **Research data:** clouds, thermodynamics, and wind profiling
- **Access to methods & platforms**



**EUMETNET**

## Operational

*Observations Capability Area E-PROFILE*

Provide centrally data to the European Weather Services