

# Observations of the spatial distribution of integrated water vapour and liquid water path in the Murg valley with a scanning microwave radiometer

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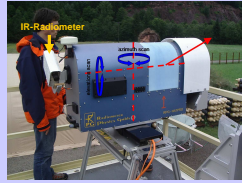
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## Objectives

- The 14-channel Microwave Radiometer **HATPRO** (Humidity And Temperature PROfiler) was deployed at the supersite M in the Murg valley from April to December 2007.
- Integrated Water Vapour **IWV**, Liquid Water Path **LWP** and vertical profiles of humidity and temperature were derived from the microwave emission observed at 14 frequency channels.
- In order to investigate spatial inhomogeneities HATPRO performed regular **elevation and azimuth scans**.
- An **infrared (IR)-Radiometer** (8-12  $\mu\text{m}$ ) was attached to HATPRO. Due to its high sensitivity to water and ice clouds it provides information on cloud base temperature. Furthermore, water vapour shows noticeable emission and gives independent information about its distribution.



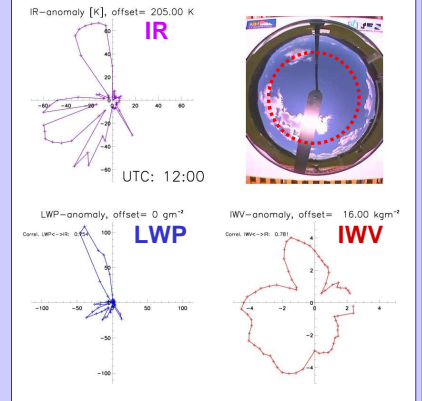
HATPRO & IR-Radiometer (left)



AMF-supersite in the Murg valley

## Strategy

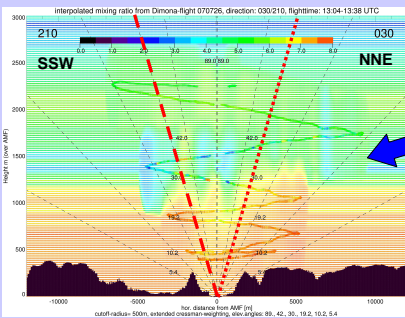
- Azimuthscans** of IR, LWP and IWV were performed with fixed **30° elevation angle** (dotted red circle) every 15 min from 6 July until 28 August.
- The polar plots of the anomalies together with the picture from **AMF's Total Sky Imager** show the temporal and spatial variability.



**30 July 2007, 12:00 UTC:**  
Variations of sky-temperature (IR), liquid water path (LWP) and integrated water vapour content (IWV) in the surrounding of a convective cloud field.

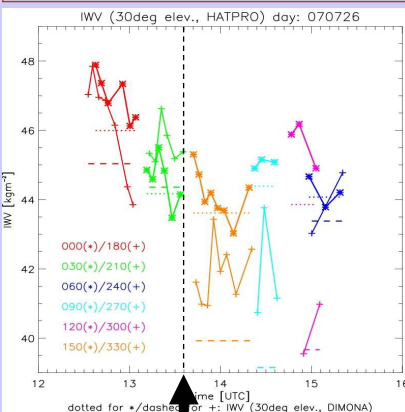
## Evaluation using aircraft data

In situ measurements from the MetAir Dimona on 26 July and 1 August 2007

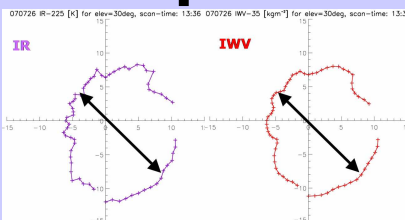


**26 July 2007:**  
Aircraft measurements and radiosonde data were used to interpolate a humidity field.

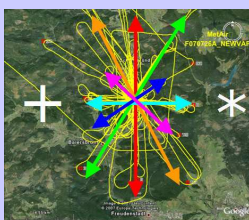
IWV from HATPRO, 30° elevation, different azimuth directions:



- 6 azimuth directions** were flown in 30° steps.
- For every ascent/descent the aircraft flew in the same azimuth direction.
- At the same time HATPRO measured in the azimuth direction according to the flight direction (different colours).
- IWV measured with HATPRO shows **similar dependence on azimuth direction** like the calculated IWV from the interpolated humidity fields (horizontal lines).
- Differences in IWV could originate from uncertainties in the interpolated field.

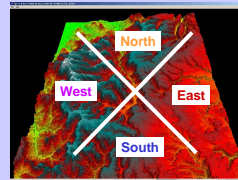


- Azimuthscan at 13:36 UTC** shows **drier air in the north-west** which differs from the south-east by 4  $\text{kg}/\text{m}^2$ .
- IWV and IR show very similar anomalies!
- Differences in sky-temperature due to spatial water vapour inhomogeneity up to 6 K.

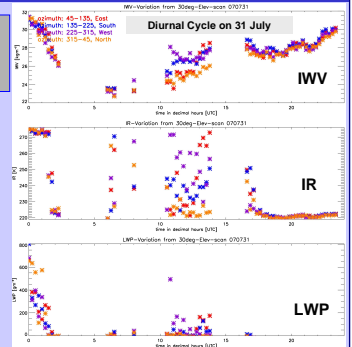


The evaluation with aircraft measurements show that HATPRO's different scan-modi allow to measure spatial and temporal humidity structures.

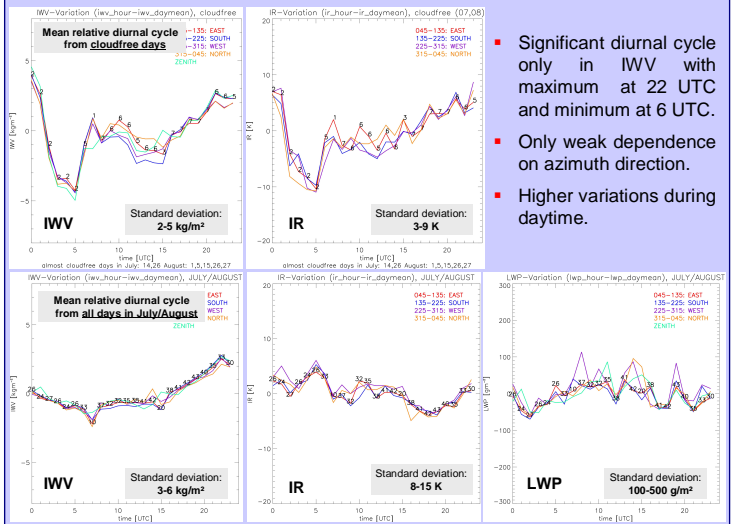
## Long-term analysis



Spatial averaging of azimuth scans in 4 sectors

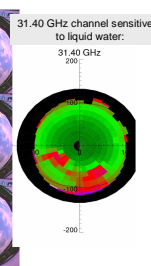


- 1h-time averaging** and subtraction of the daily mean gives the **relative diurnal cycle** of IWV, IR and LWP.
- Analysis of the mean relative diurnal cycle for different months and weather classifications.



- Significant diurnal cycle only in IWV with maximum at 22 UTC and minimum at 6 UTC.
- Only weak dependence on azimuth direction.
- Higher variations during daytime.

## Outlook and Acknowledgements



- From 28 August to December 2007 full hemispheric scans of IWV and LWP with 10° resolution in the azimuth and 10.8° in the elevation angle.

We thank the DFG for funding the project, the ARM/AMF for the possibility to install the instruments at the supersite and EUFAR for funding the evaluation flights.