

High variable humidity profiles in troposphere a challenge in observation and validation

Bernd Stiller, Franz H. Berger, DWD, Richard-Aßmann-Observatorium, Am Observatorium 12, OT Lindenberg, 15848 Tauche
email: bernd.stiller@dwd.de

History

- Observatory Lindenberg is more than 100 years old long tradition in profiling of atmospheric parameters
- Radiosoundings have been performed for > 60 years
- Recently special research has been done to improve humidity measurements by Vaisala radiosondes especially at upper altitudes
- The Richard Aßmann Observatory is since 2008 lead centre of the GCOS Upper-Air Reference Network (GRUAN) of the WMO.

Validation Campaign 2007

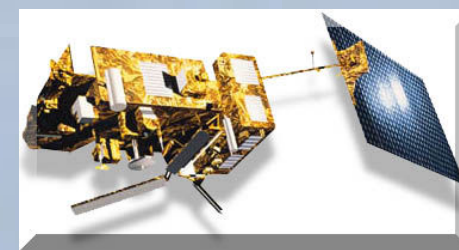
- ✓ A total of 290 radiosondes (Vaisala RS92) have been launched JJA 2007 at times given by the Metop overpasses in addition to 368 routine radiosonde ascents
- ✓ in-situ soundings were supplemented by a variety of ground-based remote sensing
- ✓ Cloud parameters were derived from measurements of a Ka-band radar and ceilometer
- 146 profilings during overpass

Campaign 2008

- ✓ focussed on clear sky sounding during overpass
- ✓ A total of 81 radiosondes were launched from Jan to Dec 2008
- ✓ Raman lidar provided profiles of water vapour with high vertical resolution at 19 overpasses
- 81 profilings during overpass

IPT

- The **I**ntegrated **P**rofilin**T**echnique (IPT) combines these measurements in an optimal estimation framework
- retrieval of the atmospheric state parameters temperature, humidity, and liquid water
- 2007: IPT implementation at RAO
- 2008: verification of IPT products and studies
- 2009: improvements (e.g. cloudlayer height), bias-free brightness temperatures are crucial!



Lindenberg RAO

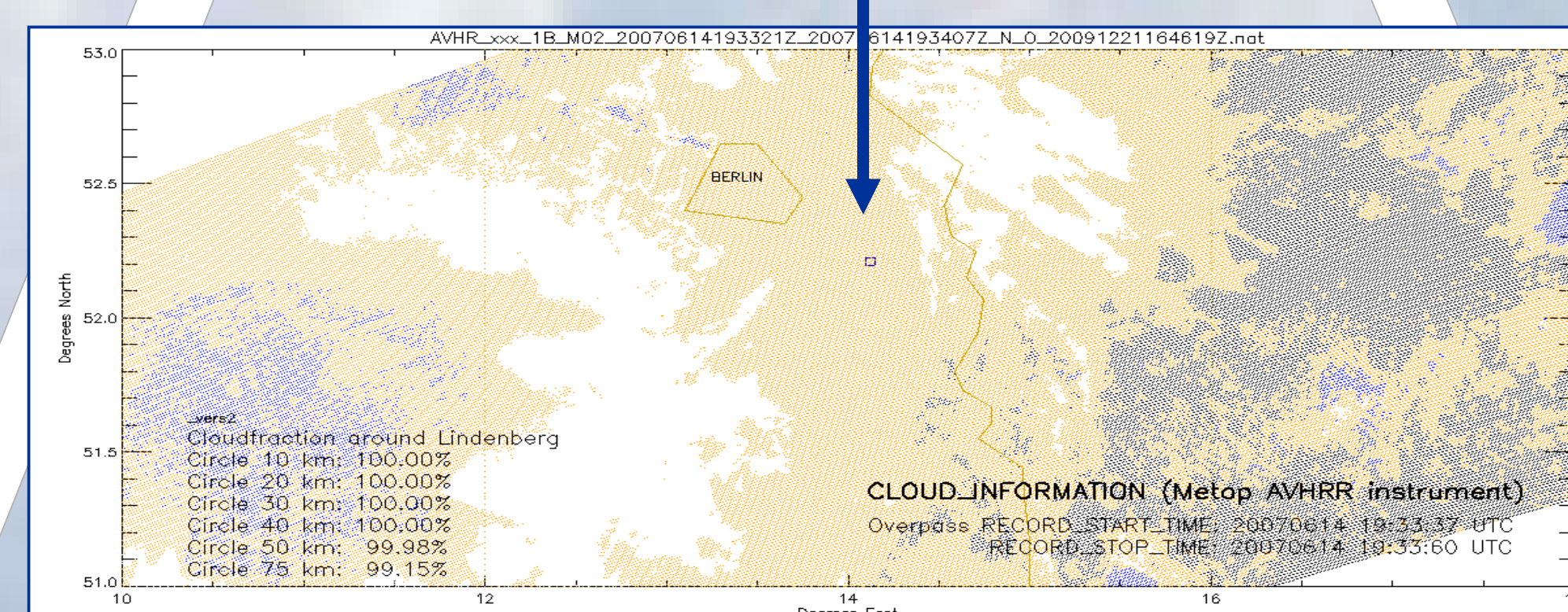


Fig. 1: A Plot of AVHRR CLOUD_INFORMATION field with a CCM Code (Clear, Cloudy, Mixed) focussed to Lindenberg. Colors: white - cloudy, yellow - mixed, black/blue: clear (Date: 14-06-2007). „Clear“ assignment in this analysis requests the pass of not less than 3 tests („T4-T5 test b“ — „T4-T3 test b“ — „T3-T5 test b“ or „Uniformity test b“). Additional all SCENE_RADIANCES (channels 1-5) were always plotted (here not shown).

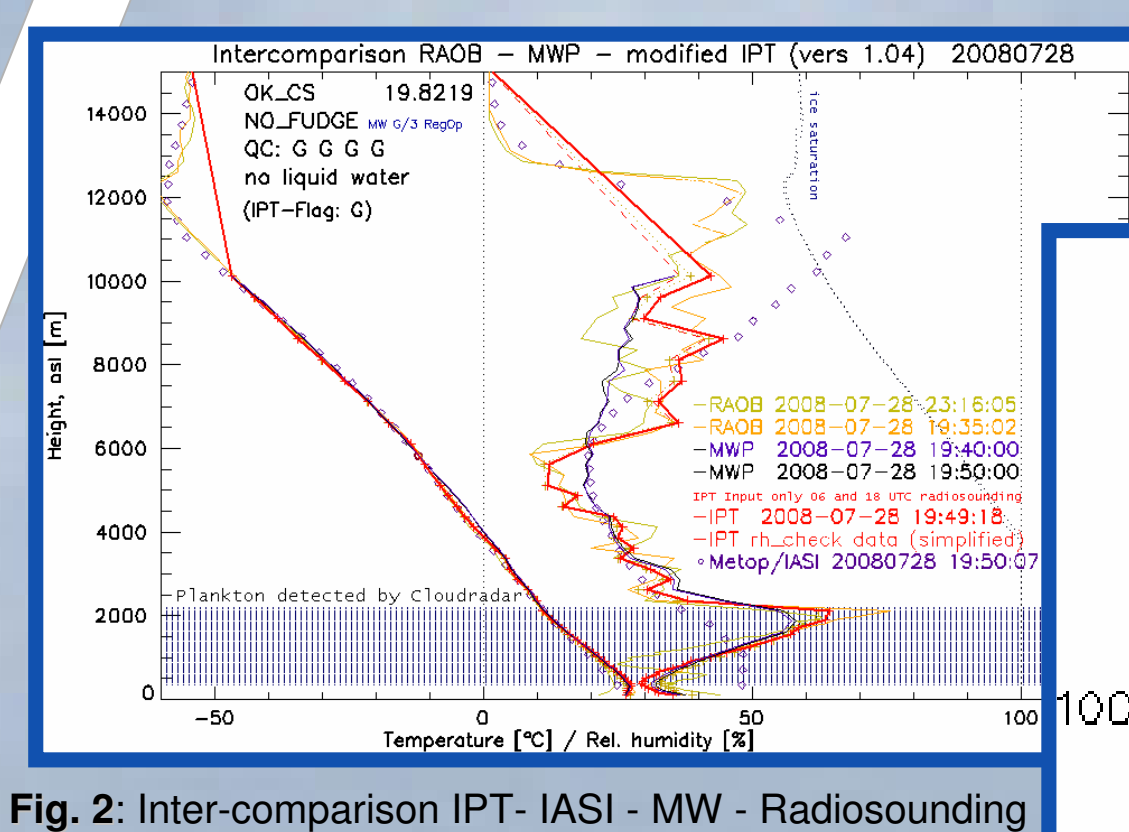
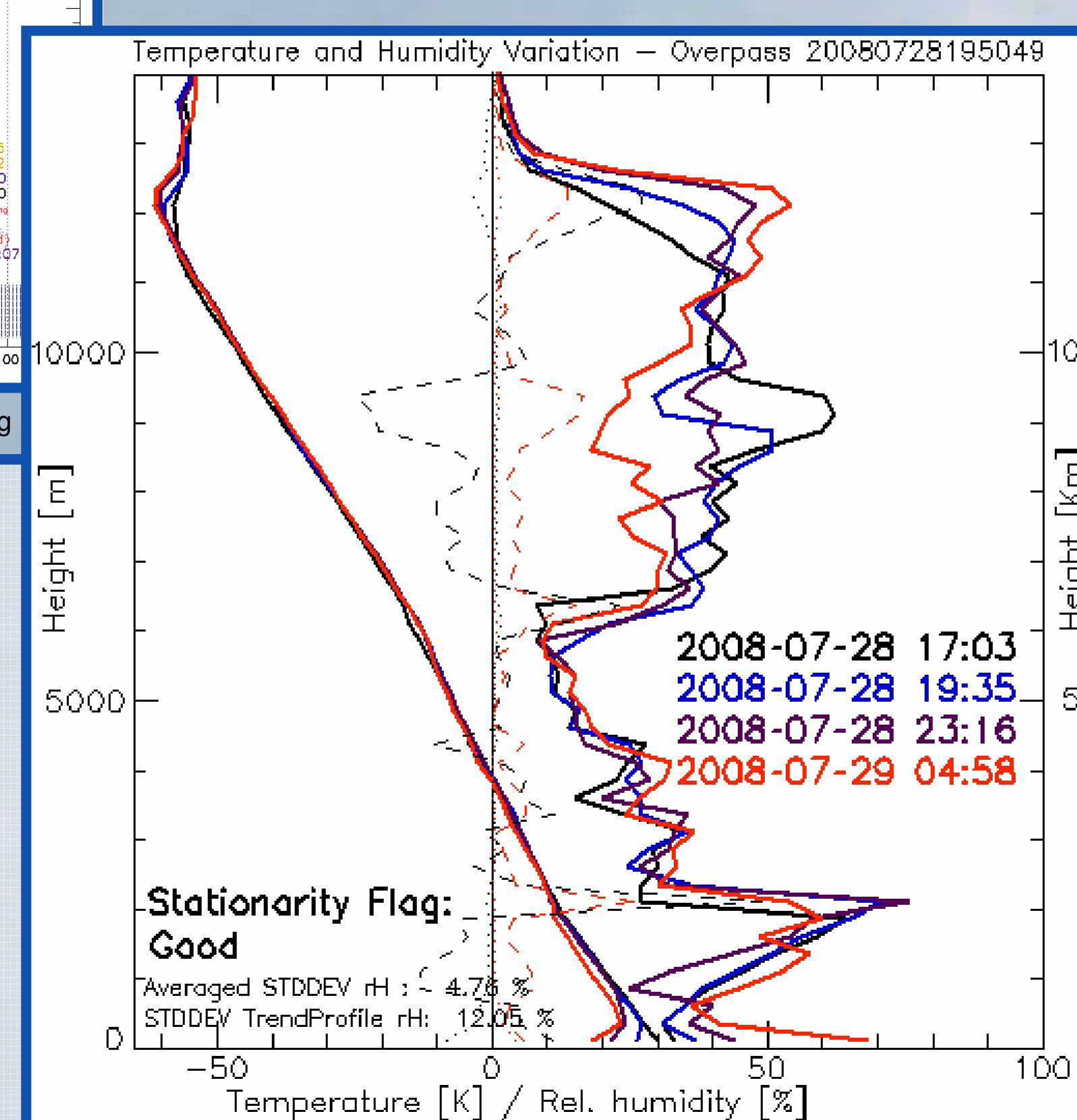


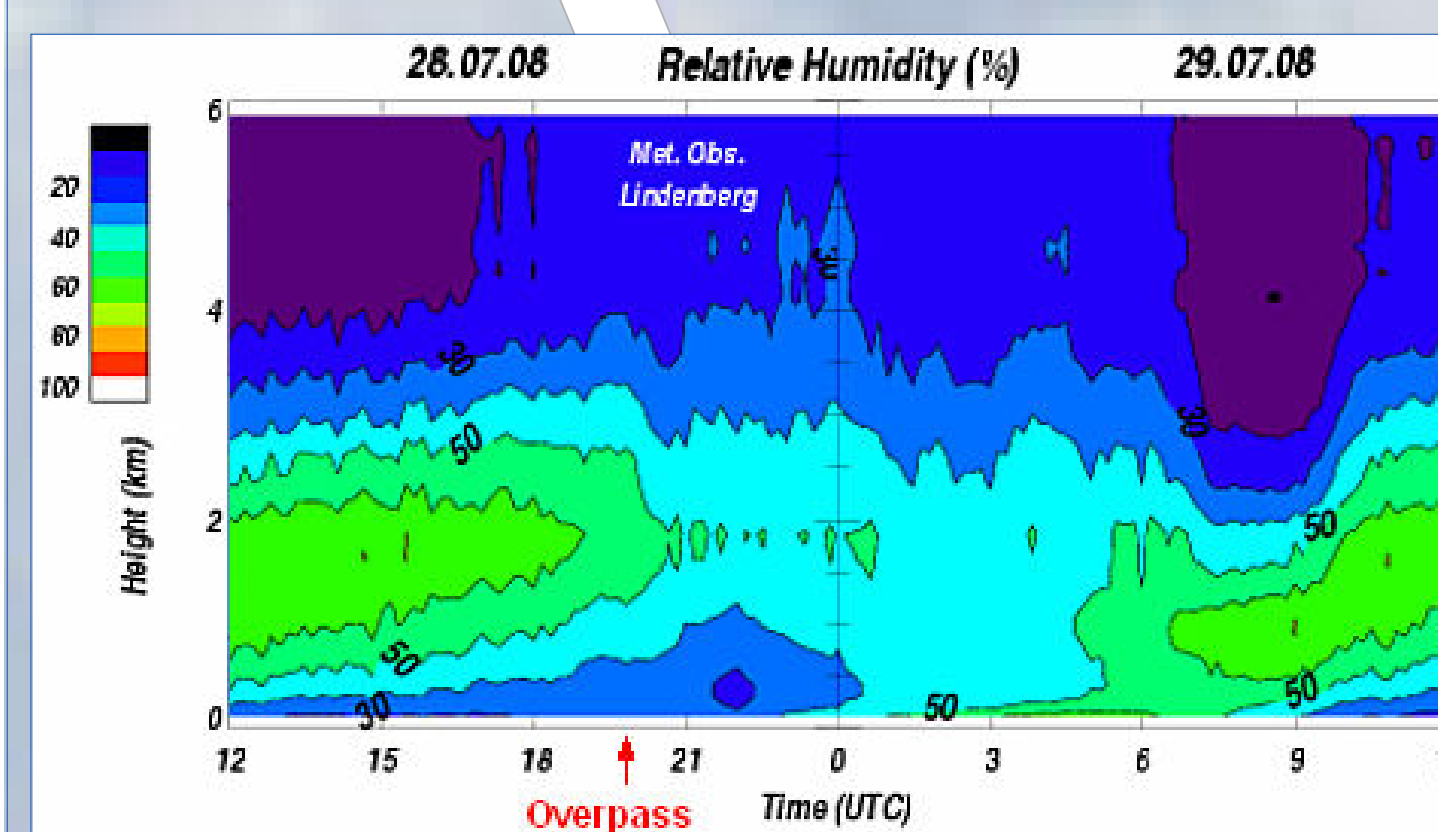
Fig. 2: Inter-comparison IPT - IASI - MW - Radiosounding



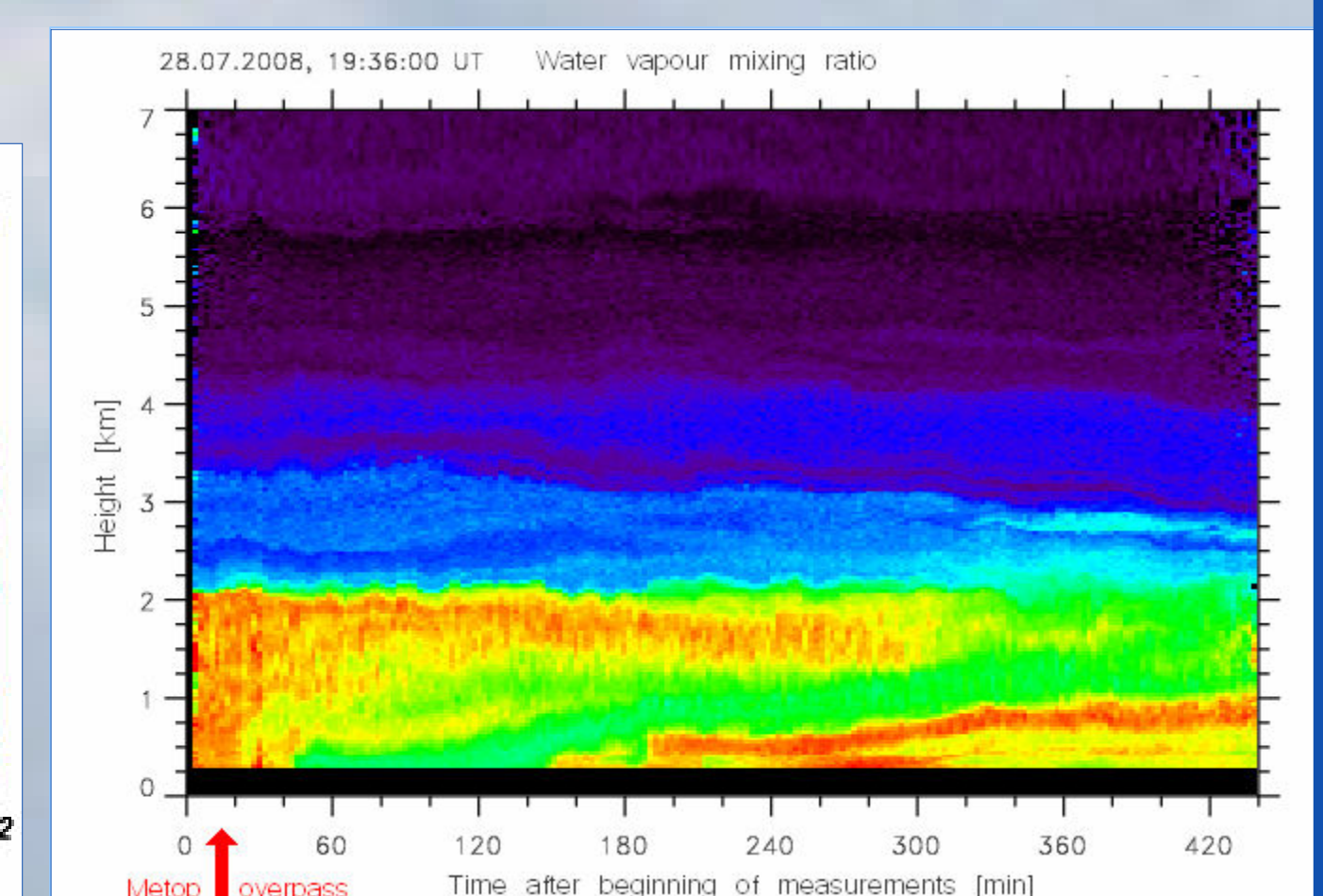
Radiosounding
Temperature and relative humidity profiles show only small variations (overpass time 19:35 Z)

Example 28-07-2008: low change of tropospheric humidity

A quality flag of the radiosonde temperature and humidity measurements were generated from an analysis of the time rate of change of radiosounding profiles and microwave observations.



Microwave profiling
The radiometer detects humidity structure satisfactorily (LT: wet, MT: dry) but lacks in vertical resolution



Lidar measurements
Lidar mixing ratio measurements showing pronounced changes of humidity in the lower troposphere and a vertical displacement of a dry layer

Observations and measurements for IASI-validation 2007/08



Operational and additional radiosounding (+ reference sounding)

Microwave profiling TP 3001 (Radiometrics)

Cloud radar MIRA36 Ka-Band Radar (METEK)

Ceilometer LD40 (Vaisala)

GPS antenna (> IWV)

Brewer spectrometer MK2 (> integrated ozone)

Precision Filter Radiometer (PFR) (> AOD)

Whole Sky Imager (> Cloud fraction)

Raman LIDAR (Kayser-Threde, Munich)

other / new instruments

Not operational in 2007



Ceilometer CHM 15k (Jenoptik)

Fourier Transform Infrared (FTIR) spectrometer EISAR

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