

Integrated ground-based retrievals in Darwin during TWP-ICE (preliminary data available)



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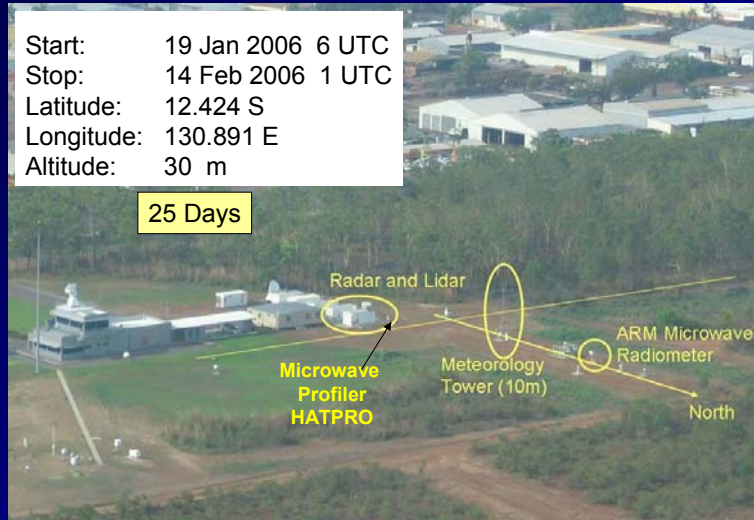
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Continuous profiling of temperature, humidity and liquid water content at the Darwin airport from Jan19-Feb13

HATPRO-Measurements at Darwin

Start: 19 Jan 2006 6 UTC
Stop: 14 Feb 2006 1 UTC
Latitude: 12.424 S
Longitude: 130.891 E
Altitude: 30 m

25 Days



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HATPRO Meteorological Station

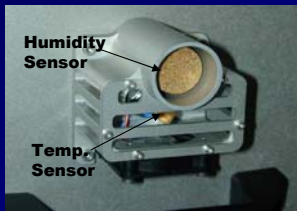
Weather station and time reference :



Rain Sensor: Provides rain flag for measurement documentation, control of super blower system

GPS-Clock: Provides time reference standard for synchronization

Humidity Sensor: Provides control of super blower system, documentation



Temperature Sensor: Documentation of surface temperature

Pressure Sensor: Documentation of barometric pressure, LN-target calibration

Algorithm Philosophy

Statistical:

- Linear regression between TB and atmospheric parameters
- **Trained by a large number of radiosondes**

+ easy to apply, good overview

+ "robust"

o accuracy

- site-dependent

- no LWC profile

Integrated(physical):

- **Match measurements to retrieved atmospheric parameters**
- **Combine HATPRO, cloud radar, ceilometer & a priori information**

+ physically consistent

+ accuracy, error estimates

o rely cloud classification

- time-intensive application

- lower availability

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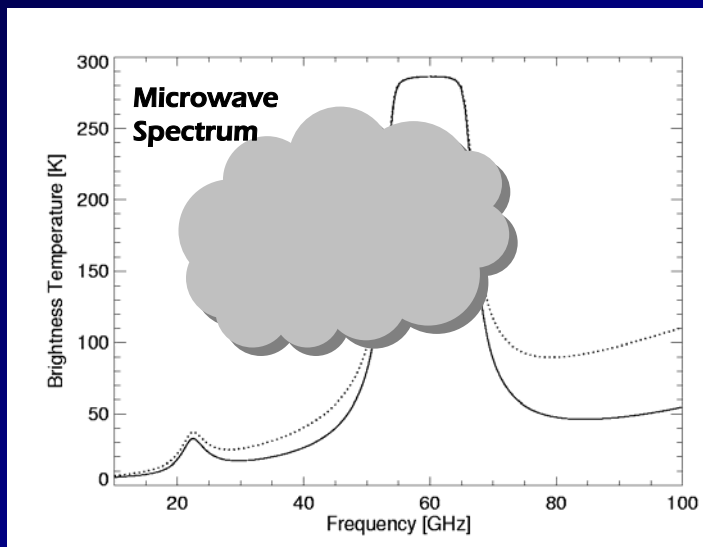
Both types of retrievals will be made available

Spectral Information

Radiative transfer
based on
standard atmosphere

temperature profile
band
water vapour profile
band

liquid water path
 $LWP=250 \text{ gm}^{-2}$



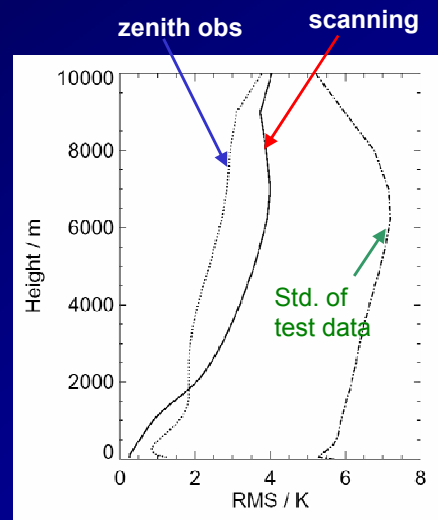
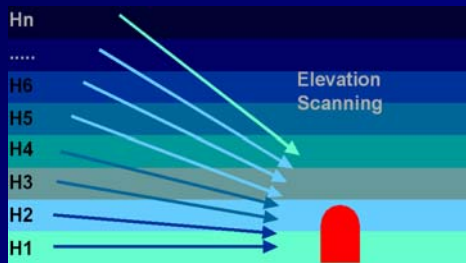
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Microwave profiler information content for temperature and humidity profiles contained in the spectrum

Angular Information

Assumption of horizontal homogeneity:
→ additional information for BL
T-profile

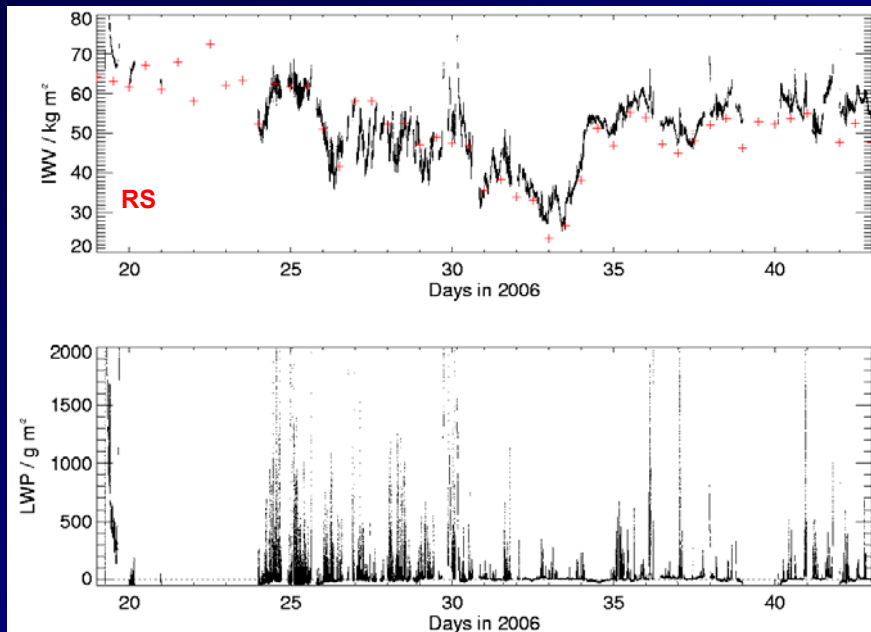
- high receiver stability
- low noise level
- variations between 5° - 90°
- small antenna beam (2° HPBW)



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More information content is contained in the angular measurements, i.e. elevation scans were performed every 15 minutes during TWP-ICE. Temperature-inversions and their temporal development in the boundary layer are captured with good accuracy

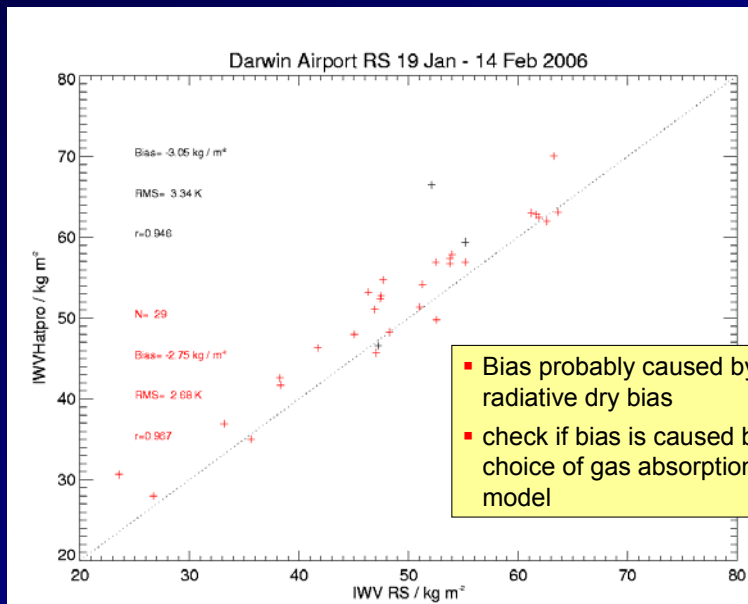
IWV & LWP (statistical)



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Times series of integrated water vapor and liquid water content over the full TWP-ICE period

IWV: HATPRO vs. RS



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Integrated Profiling Technique (IPT)

INPUT

14 HATPRO brightness
temperatures (TB)

cloud radar reflectivity
(Z) profiles

a priori information on T, q,
LWC

**OPTIMAL
ESTIMATION**
(*Newton-
Iteration*)

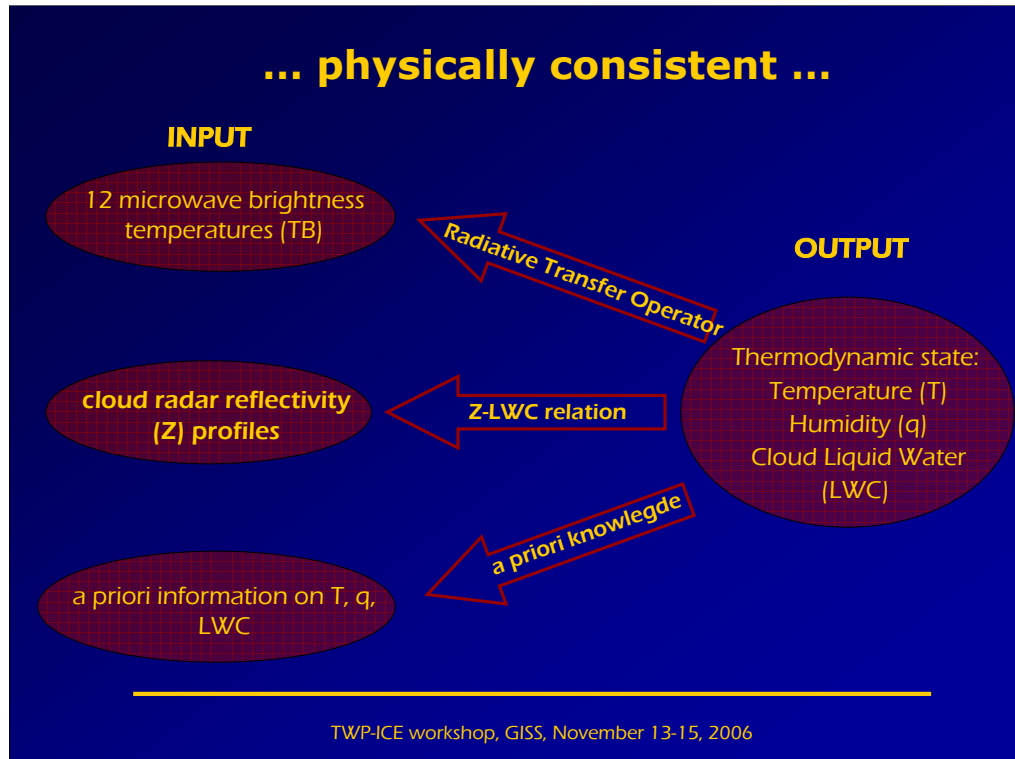
OUTPUT

Thermodynamic state:
Temperature (T)
Humidity (q)
Cloud Liquid Water
(LWC)

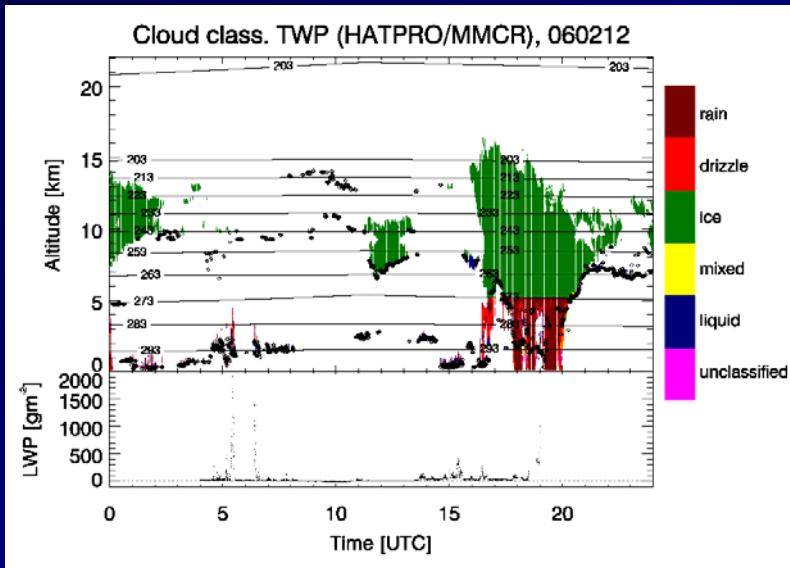
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Graphical description of the integrated (physical) retrieval method

... physically consistent ...



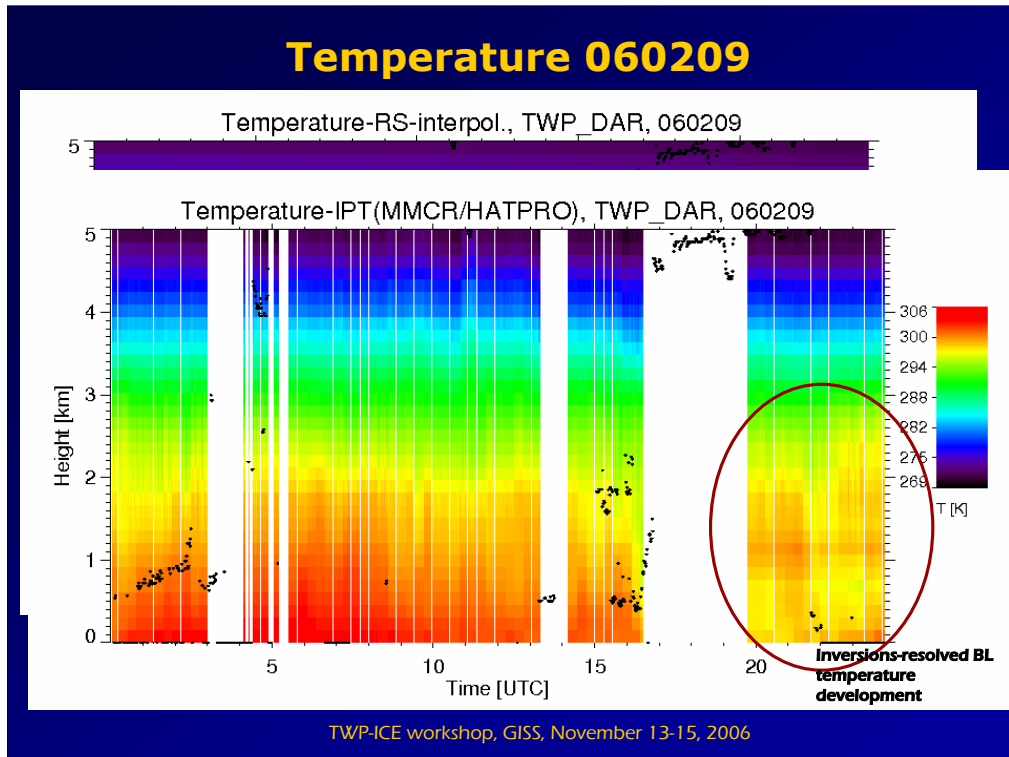
Cloud Classification



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Cloud classification necessary for physical retrieval application; data and quicklooks will be made available

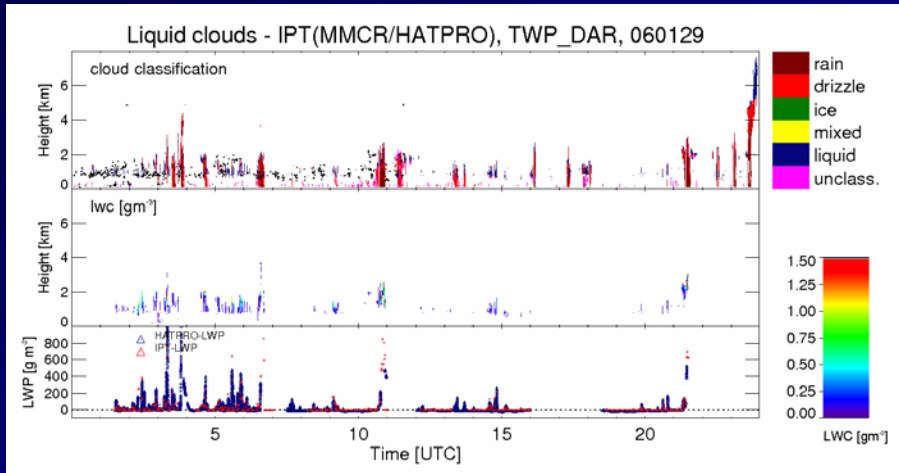
Temperature 060209



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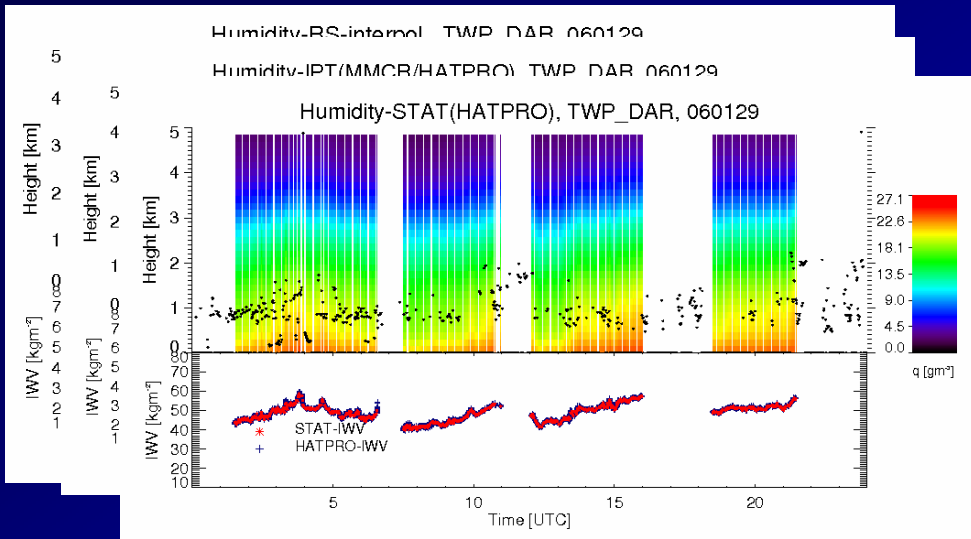
Temperature-IPT: integrated retrieval of temperature; blanks indicate times when instruments were wet due to rain

LWC 060129



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Humidity 060129



■ evaluate profiles against sondes

TO DO

- Evaluate profiles against sondes, microphysics against aircraft (?)
- Focus on special days, optimize IPT
- Use CLOUD-NET categorization scheme (O'Connor, Hogan)
- BL development analysis, compare different algorithms & models
- Calculate stability indices → temporal evolution
- ...