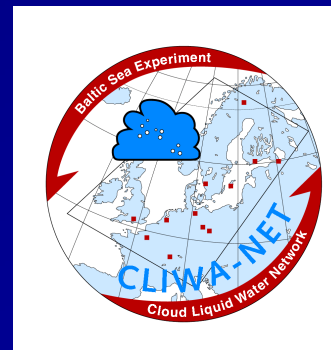
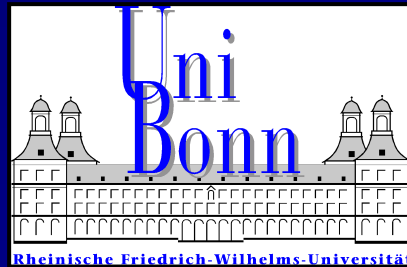


# Added value products and availability for CNNI, CNNII, and BBC

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# Overview

- **LWP** level 2c product for CNNI and CNNI (BBC to follow soon)
  - **cloud classification** product for 95 GHz cloud radar measurements (BBC Cabauw site only)
  - **LWC profiles** for single-layer, non-precip. liquid water clouds (BBC, Cabauw)
-

# LWP level 2c product

Problems with MWR LWP retrievals:

- LWP < 0 during clear sky or even low amounts LWP
- long-term LWP drifts (~1 day)
- discontinuous LWP jumps



Correct for negative LWP using LWP-offsets during clear sky

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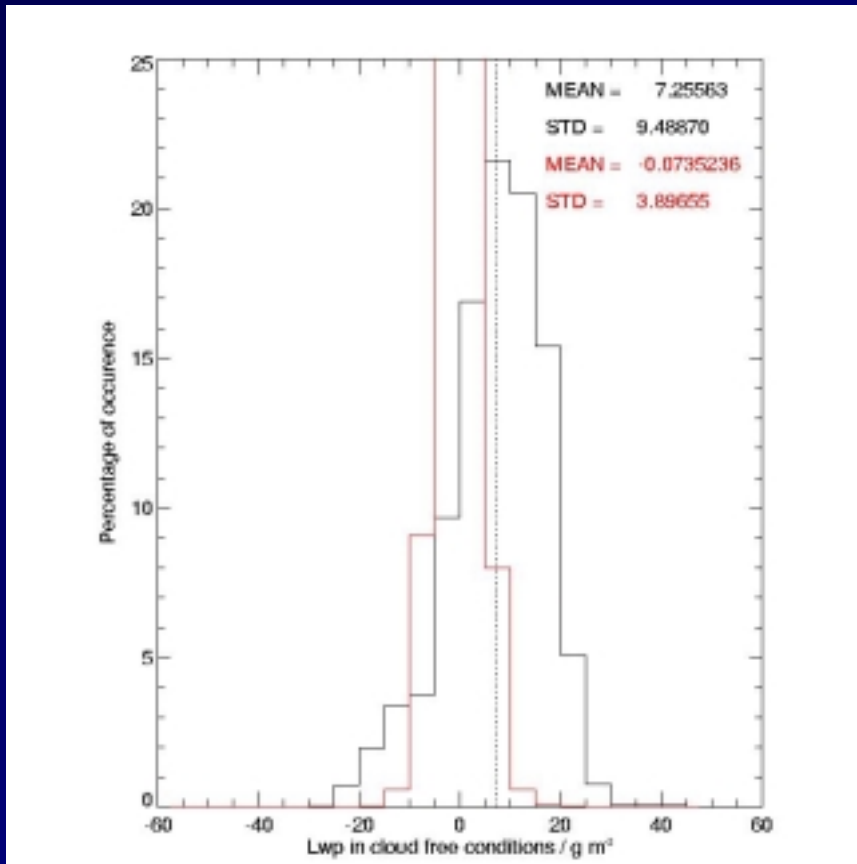
# LWP level 2c product

## Correction procedure:

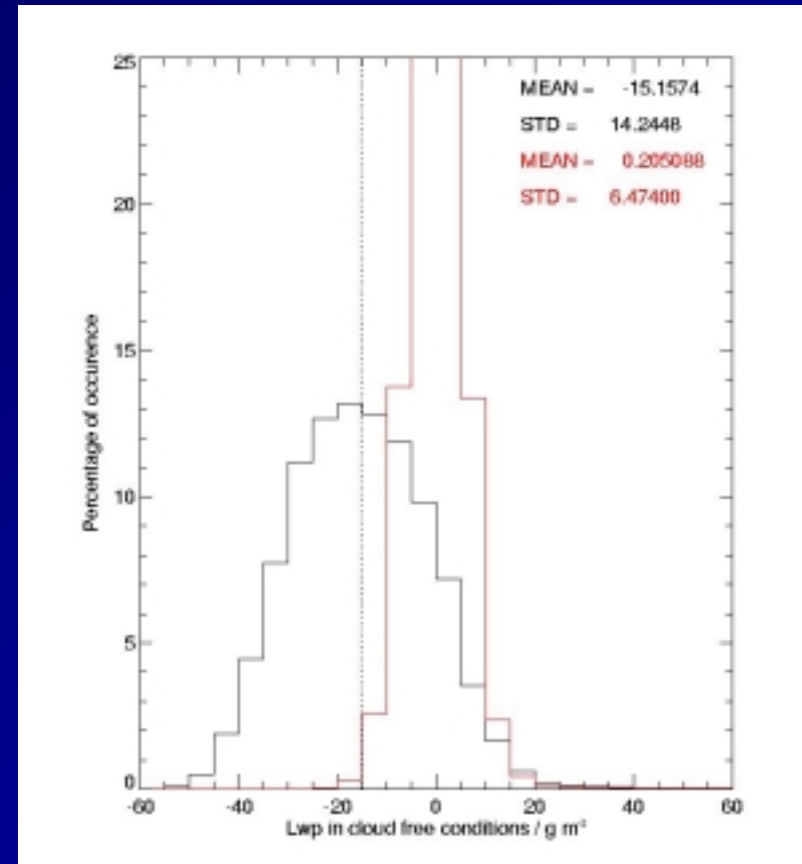
1. Calculate **mean LWP offset** during cloud free cases for each campaign and subtract from LWP values
    - CNNI :  $6.9 \pm 9.4 \text{ g m}^{-2}$
    - CNNII :  $7.3 \pm 9.5 \text{ g m}^{-2}$
    - BBC :  $7.1 \pm 9.5 \text{ g m}^{-2}$(cloud free determination via IR/ceilometer)
  2. For each LWP measurement: search cloud free cases in a **time window of  $\pm 5\text{h}$**
  3. **Gaussian weighting** of each LWP measurement by considering the cloud free cases ( $\text{LWP} = 0$ ) in the  $\pm 5 \text{ h}$  area of influence
-

# LWP level 2c product

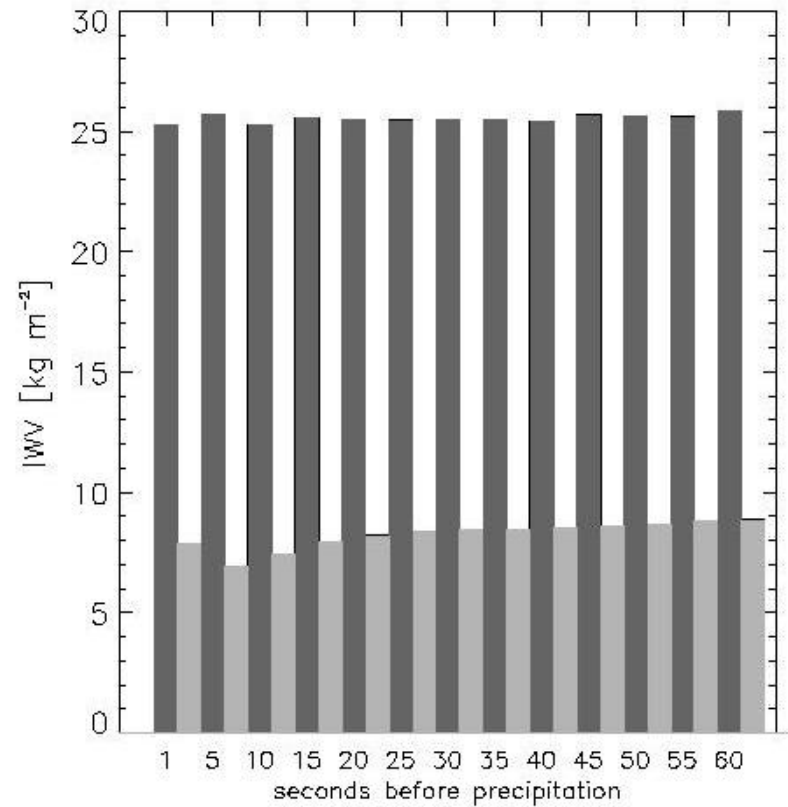
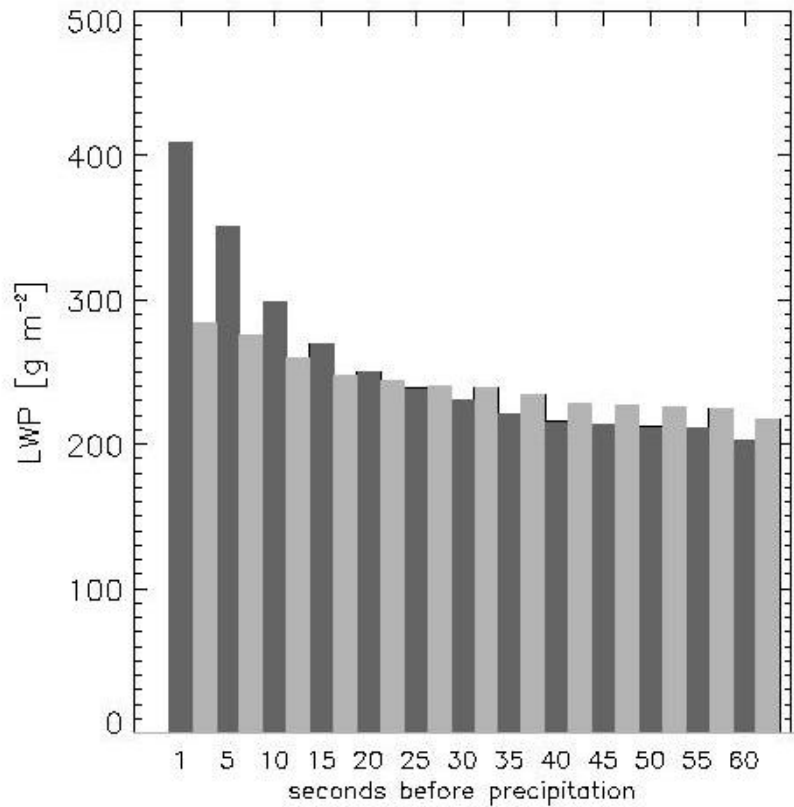
Example 1: Cabauw, CNNII:



Example 2: Potsdam, CNNI



# Example: LWP rain threshold



# LWP level 2c product

Availability:

<ftp://cliwaftp.uni-bonn.de>

CNNI and CNNII data at

*/cliwanet/pub/out/cnnx/level2c/stationname/LWPC*

BBC data (only MICCY, regional network)

*/cliwanet/pub/out/bbc/level2c/cabauw/LWPC*

... rest will follow soon ...

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# Cloud classification product

Simple classification of 5 different phases/regimes using

- 95 GHz cloud radar
  - lidar-ceilometer (CT75)
  - radiosonde (6h, DeBilt)
  - LWP from MICCY
- (classification for each radar pixel)

Classify into:

Ice, mixed/unsure, liquid, drizzle,  
significant precipitation

Drizzle :  $1 \text{ m s}^{-1} < VD < 3 \text{ m s}^{-1}$

Sig. precip. :  $VD > 3 \text{ m s}^{-1}$

---



# Cloud classification product

> 7 km

$T < 253 \text{ K}$  : Ice

$T > 253 \text{ K}$

LWP~0 : Ice

LWP > 0 : UM

7.0 km

$T < 233 \text{ K}$  : Ice

$T > 233 \text{ K}$

LWP~0 : Ice

LWP > 0 : UM

3.5 km

$T < 253 \text{ K}$  : UM

$T > 253 \text{ K}$

No base or base > 3.5 km  
or base > z(pixel): UM

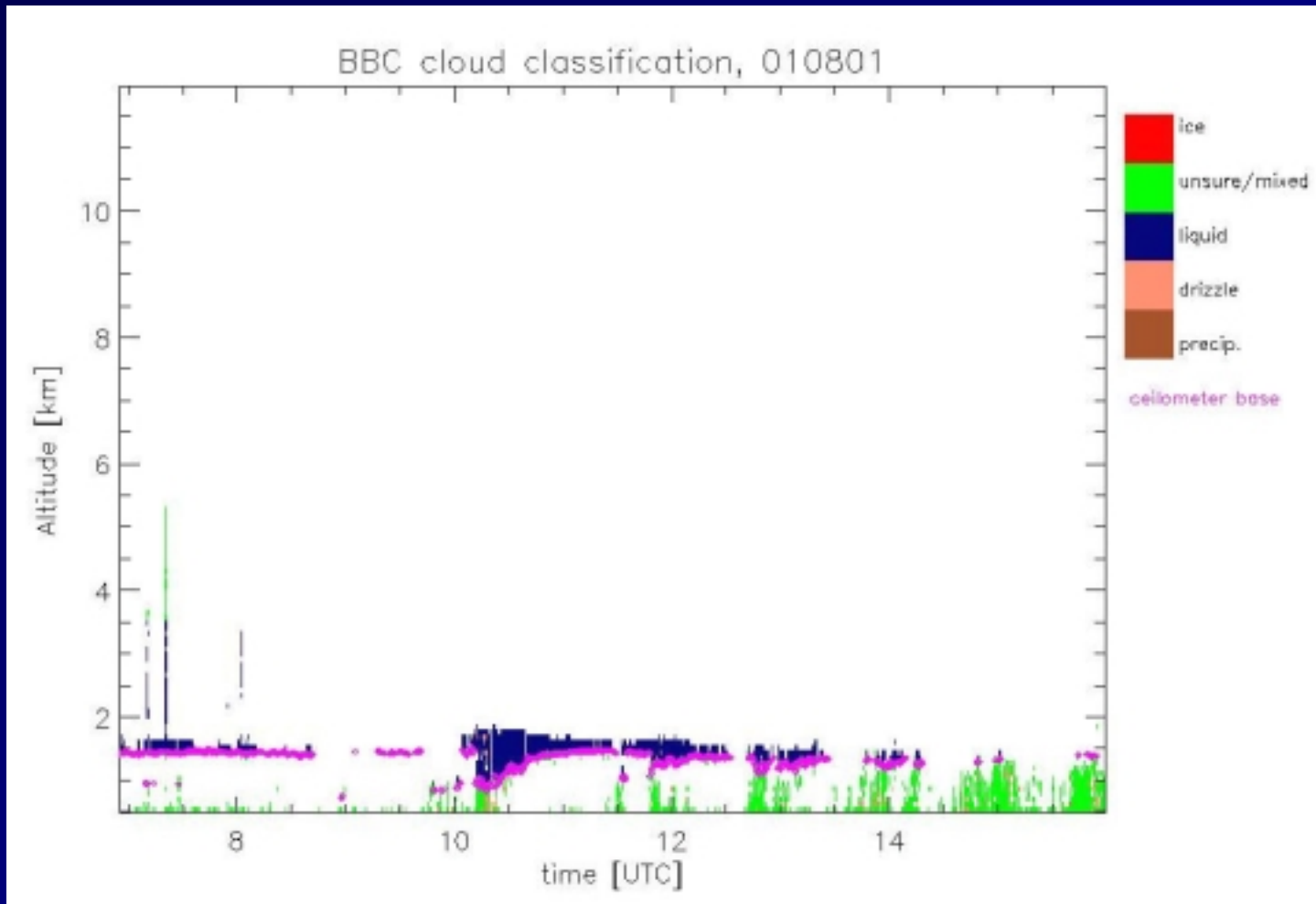
$0 \text{ km} < \text{base} < 3.5 \text{ km}$

LDR > -33 dB : UM

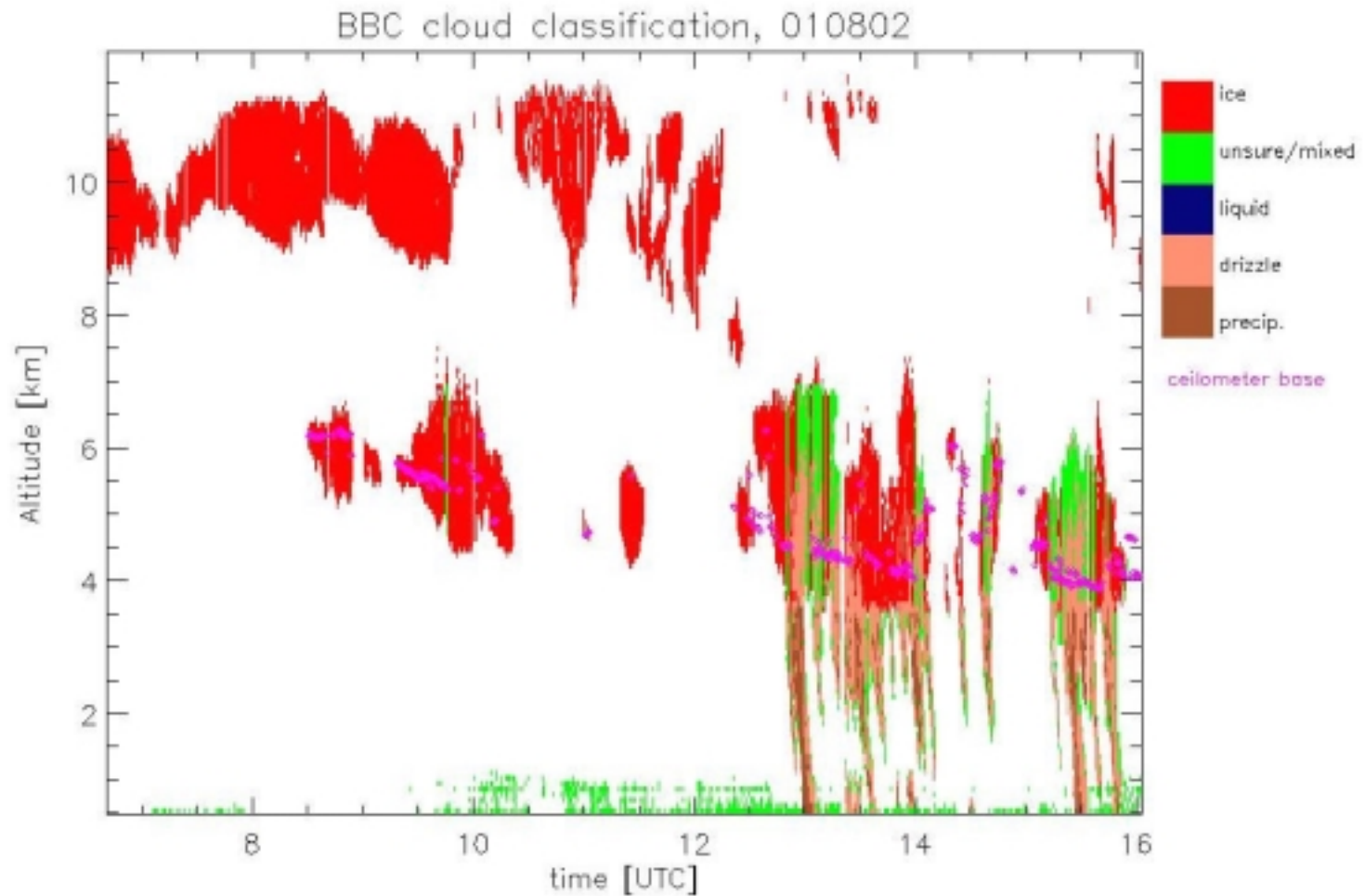
LDR < -33 dB : L

0.5 km

# Cloud classification product



# Cloud classification product



# Cloud classification product

Availability:

<ftp://bbc.knmi.nl>

/BBC/cabauw/microwaves/ubonn/daily/cloud\_class

(CLIWA-NET format and quicklooks)

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# LWC profile product

- Apply optimal estimation algorithm to liquid, single-layer, non-precipitating case during BBC
- vertical resolution : 250 m
- extended to radar pixel resolution (~82.5 m)



Main instruments:  
(measurements must be  
simultaneously available)

95 GHz cloud radar MIRACLE (GKSS)

Microwave radiometer MICCY (Bonn)

Laser-Ceilometer CT75

(KNMI)

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# LWC profile product

2m tower observations (T, q)

19 brightness temperatures (TB)

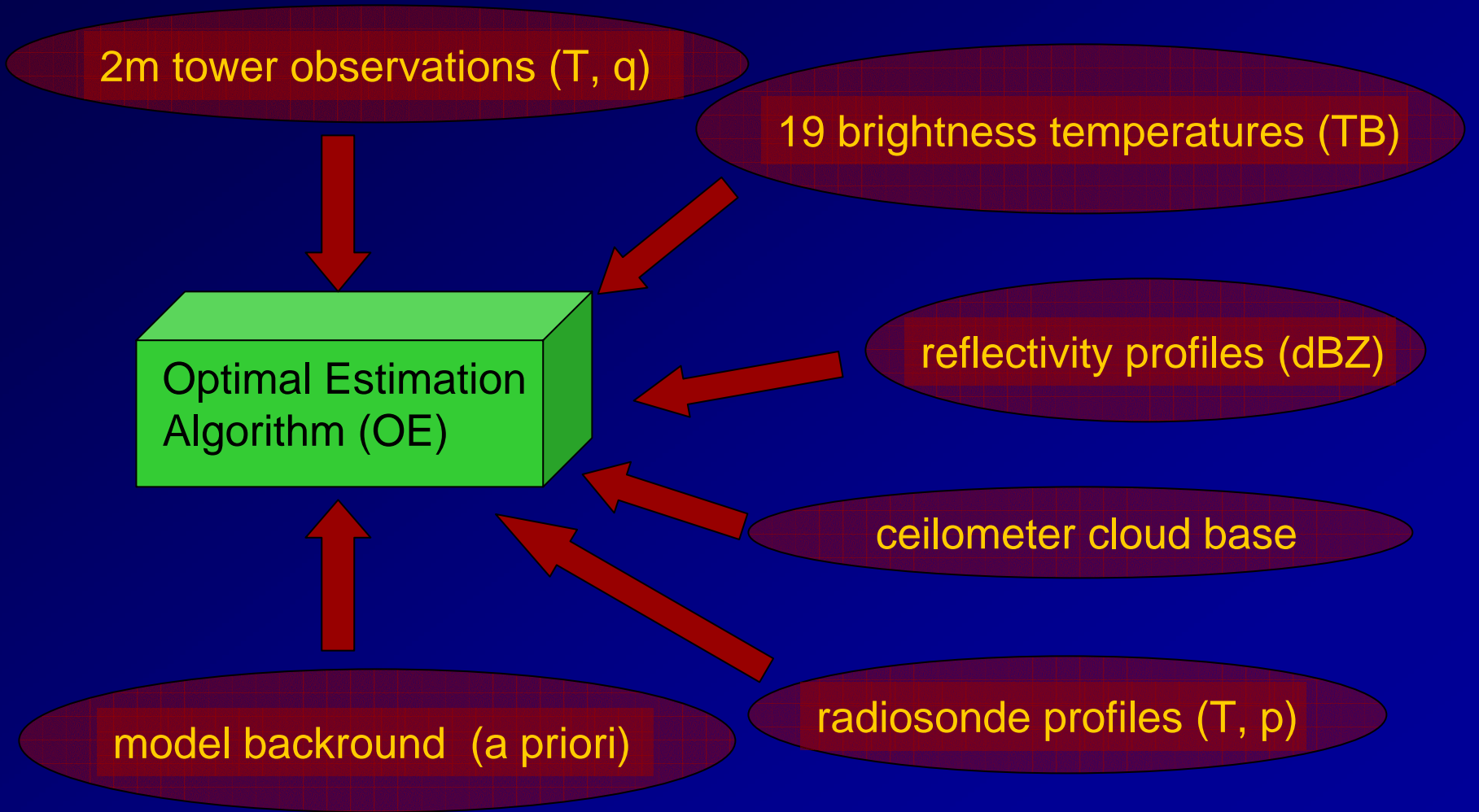
Optimal Estimation  
Algorithm (OE)

reflectivity profiles (dBZ)

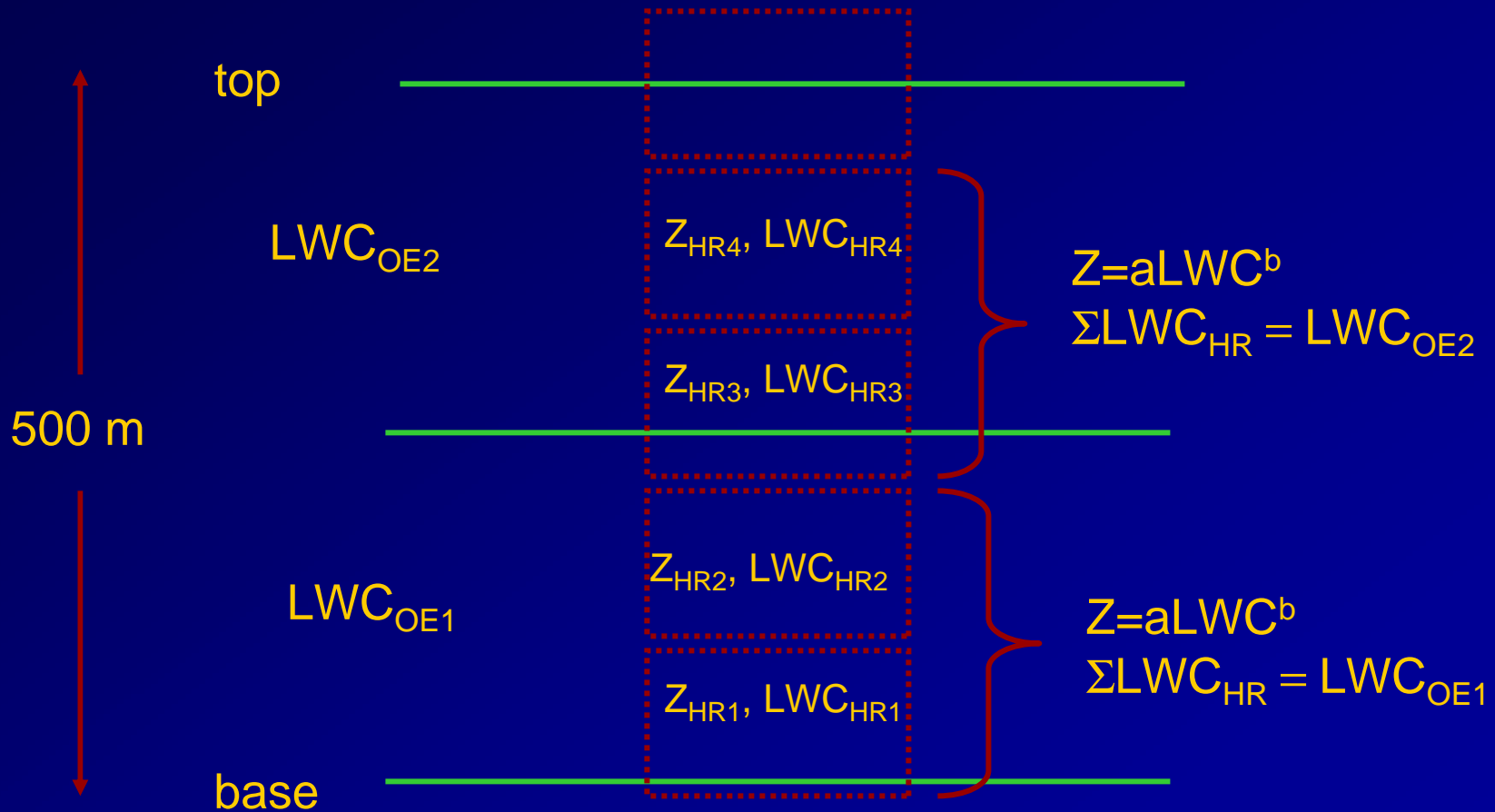
ceilometer cloud base

model background (a priori)

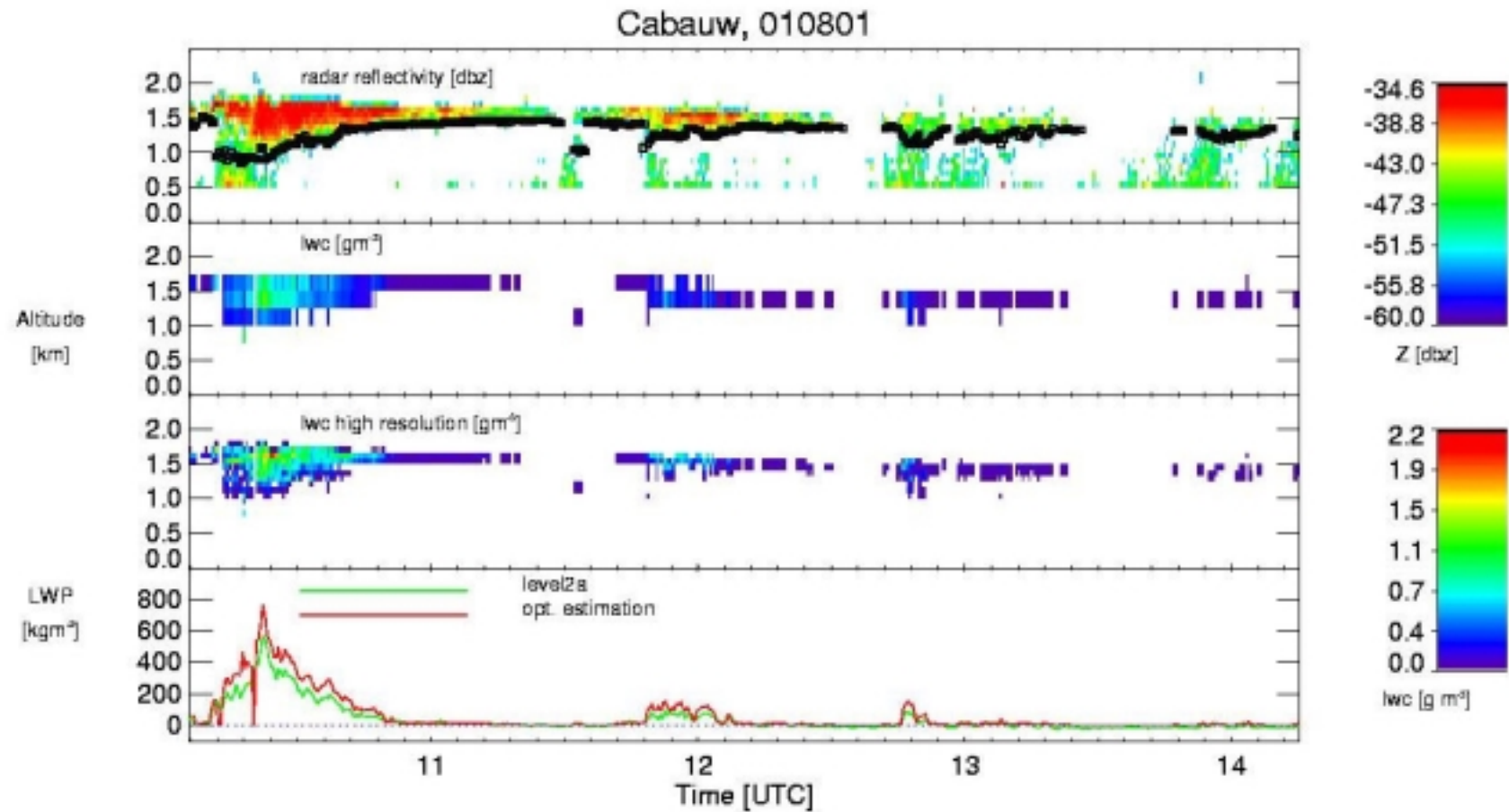
radiosonde profiles (T, p)



# LWC profile product



# Retrieval Example, LWC Profiles





# LWC profile product

Availability:

<ftp://cliwaftp.uni-bonn.de>

BBC data only

*/BBC/cabauw/microwaves/ubonn/daily/level2a/*

and

*/BBC/cabauw/microwaves/ubonn/daily/quicklooks/*

... high resolution data will follow soon ...

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# Overview

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