

# Generation of a Cirrus Retrieval Data Base

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# Introduction



- ▶ Cirrus clouds are ice clouds
- ▶ Uncertainties of cirrus microphysical properties
- ▶ Cirrus retrieval database
  - ▶ atmospheric and cloud parameters profiles
  - ▶ simulated radiances
- ▶ Use for training inversions
  - ▶ Monte Carlo integration
  - ▶ Neural nets

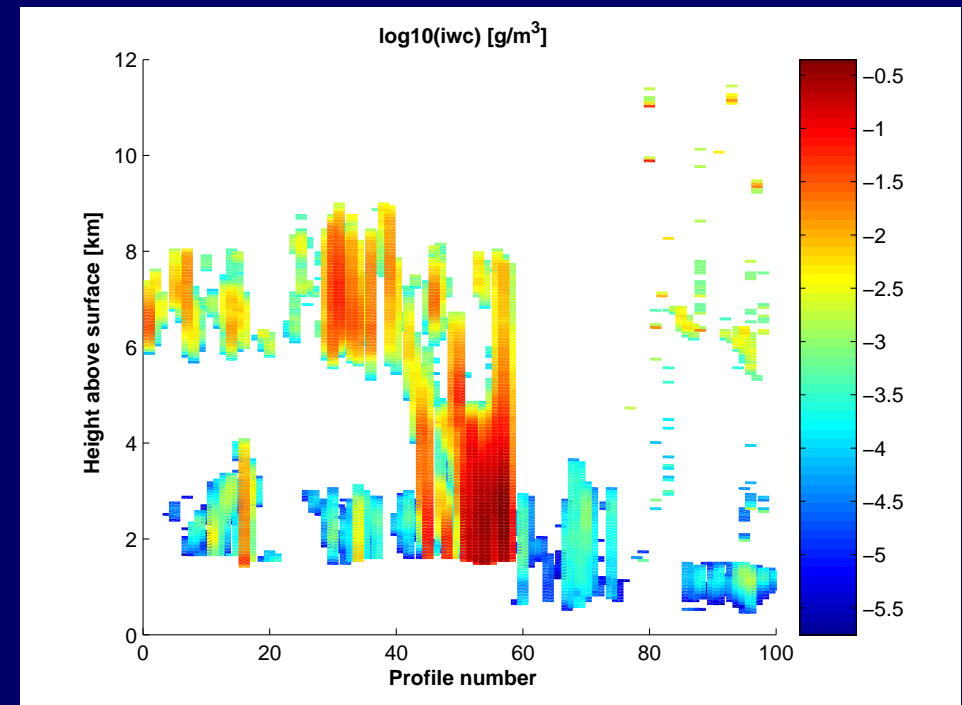
# Database content

- ▶ ~100 000 cloud case
- ▶ The statistics should mimic reality
  - ▶ Particle size/ shape distribution parameters
  - ▶ Atmospheric/ cloud profiles
- ▶ Simulated radiances
- ▶ Retrieval parameters
  - ▶ Column ice water content
  - ▶ Ice water content profiles
  - ▶ Size parameter
    - ▶ Mean mass diameter
    - ▶ Median mass diameter
    - ▶  $\langle D^6 \rangle^{1/6}$
  - ▶ Shape information

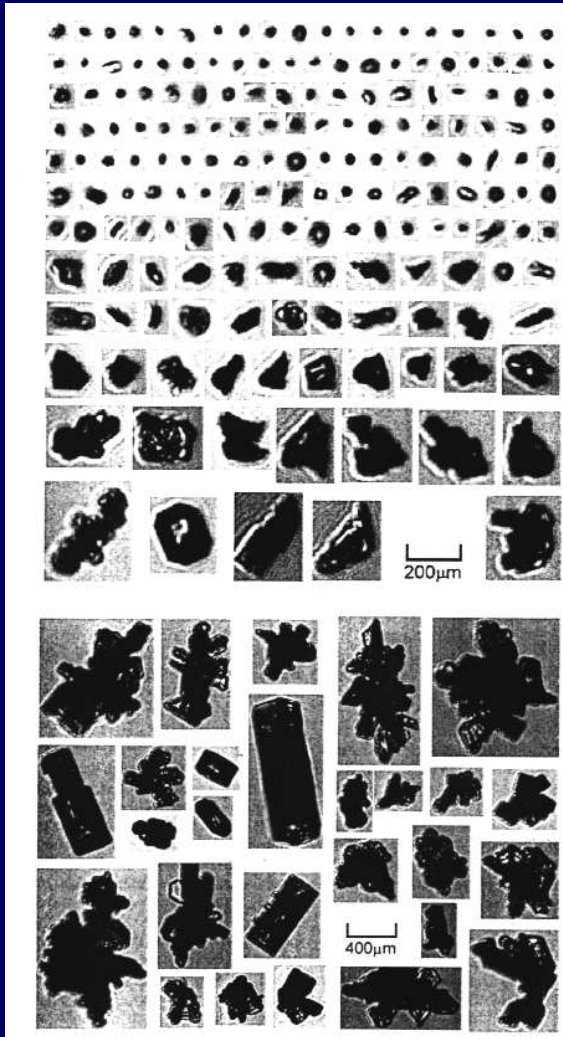
# Cloudnet radar data

- ▶ 3 cloud observing stations
  - ▶ Chilbolton, UK
  - ▶ Palaiseau, France
  - ▶ Cabauw, The Netherlands
- ▶ Products
  - ▶ Cloudnet (60 m vertical resolution)
    - ▶ Radar reflectivity factor
    - ▶ Inverted IWC and LWC
  - ▶ ECMWF
    - ▶ Pressure
    - ▶ Temperature
    - ▶ Specific humidity
    - ▶ Windspeed

## ▶ Integrated radar profiles

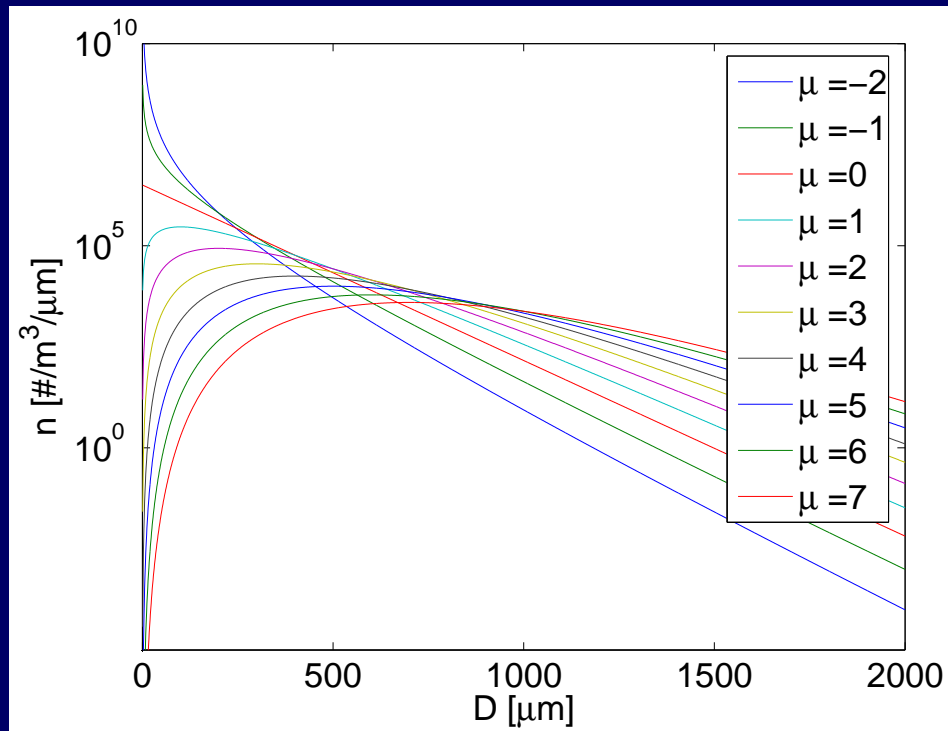


# Microphysical assumptions



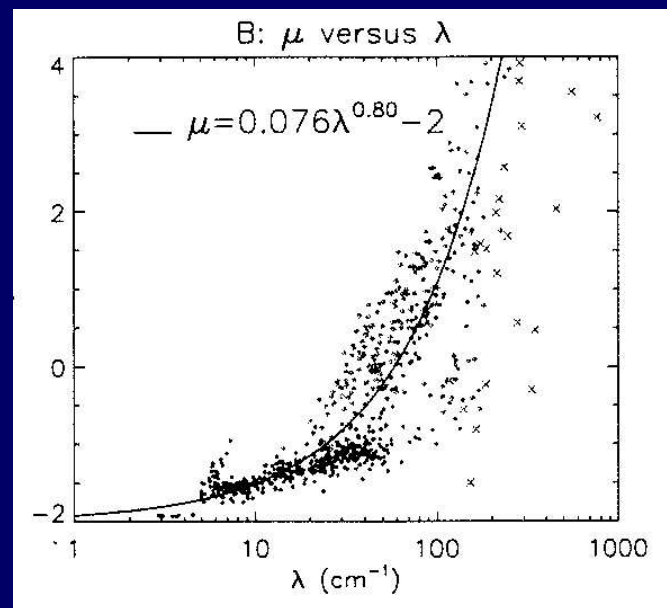
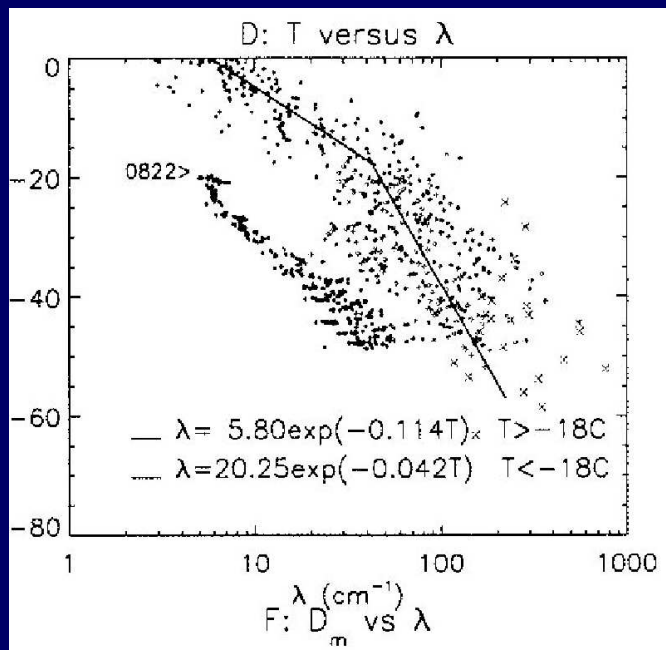
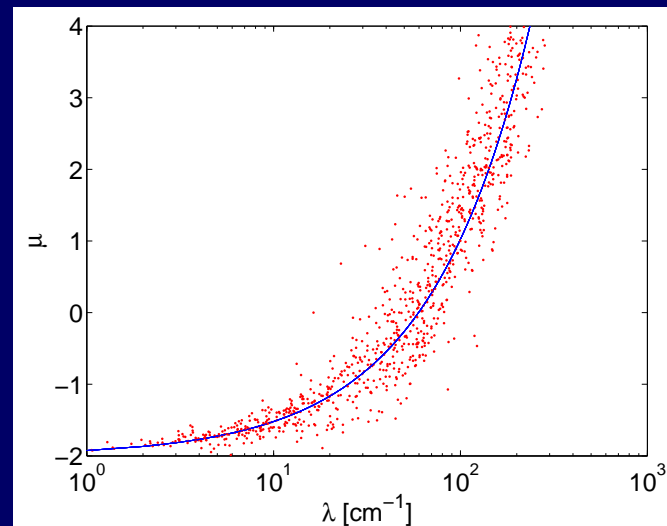
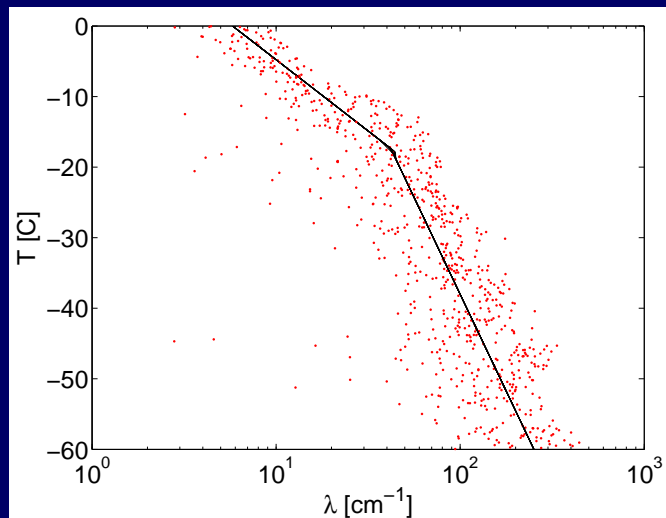
- ▶ Shape distributions
  - ▶ T-matrix code in PyARTS
    - ▶ spheres
    - ▶ ellipsoids
    - ▶ cylinders
  - ▶ Random mixture of these shapes in each cloud

# Microphysical assumptions



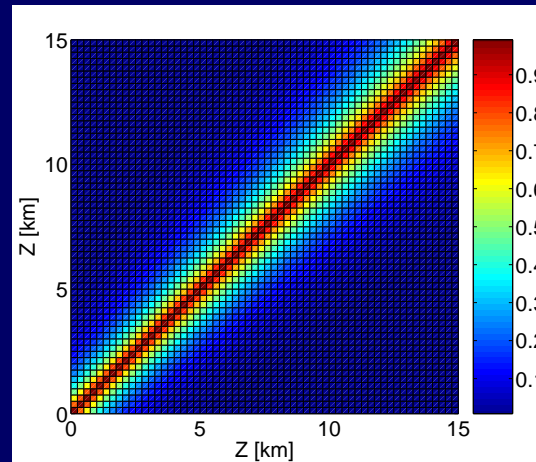
- ▶ Particle size distribution
  - ▶ Gamma distribution
$$N(D) = ND^\mu \exp(-\lambda D)$$
    - ▶  $\mu$  is the width of the distribution
    - ▶  $\lambda$  is a size parameter
    - ▶  $N$  is a scaling factor

# $\lambda$ and $\mu$ statistics from Heymsfield 2003

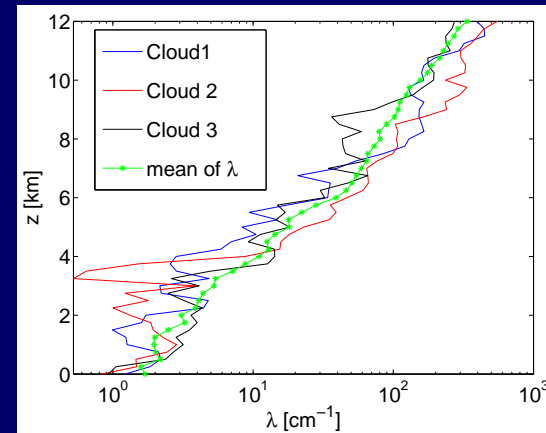


# Generation of Temperature, $\lambda$ , and $\mu$ profiles

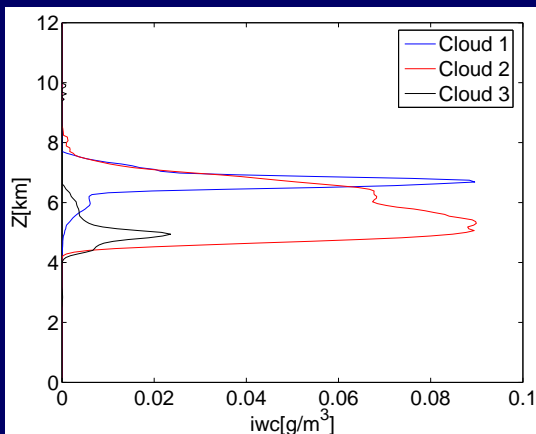
► Correlation



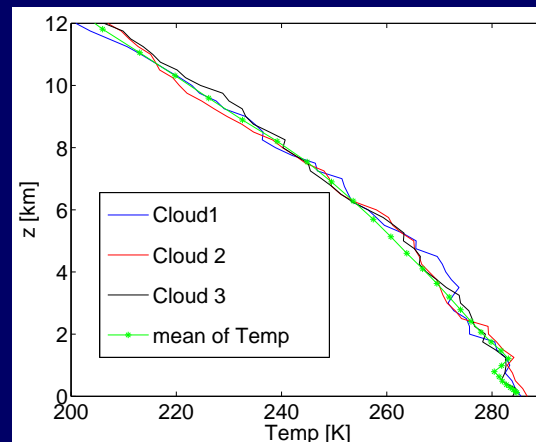
►  $\lambda$  profiles



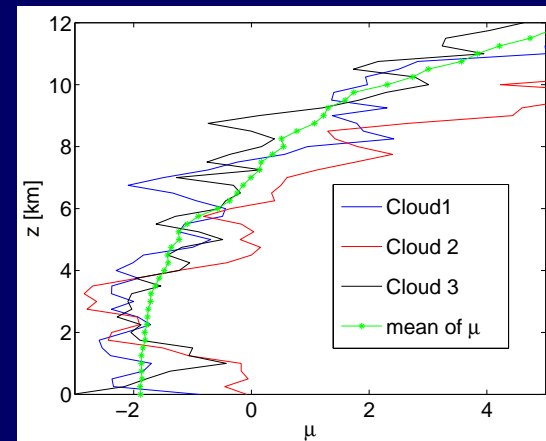
► IWC profiles



► Temperature

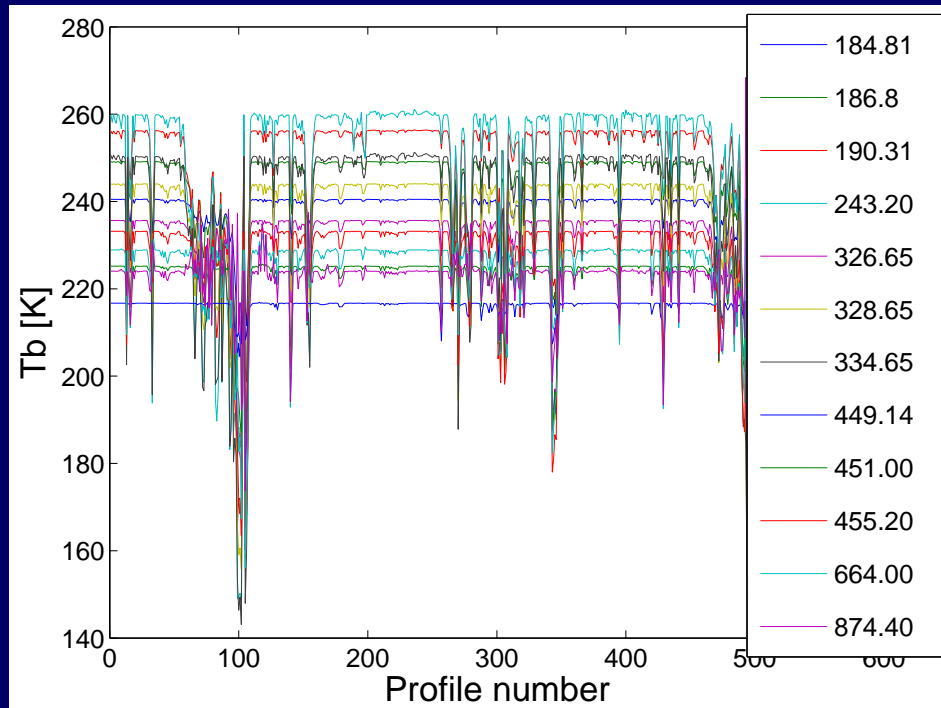


►  $\mu$  profiles





# Simulations



▶ ARTS DOIT 1-D

▶ CIWSIR

▶ Frequencies(GHz)

184.81 186.81 190.31  
243.20 326.65 328.65  
334.65 449.14 451.00  
455.20 664.00 874.40

▶ Zenith angle  $135^{\circ}$

# Conclusions and future work

- ▶ A cirrus retrieval database is under construction
- ▶ Cirrus size distribution based on radar measurements and paper from Heymsfield
- ▶ Shape distribution based on crude assumptions and accessibility on program code
- ▶ Simulations using the Ciwsir setup will be performed
- ▶ Retrieve iwc from dBZ profiles