Intercomparison of Several Cloud Radar Microphysics Products

FASTER

Motivations

To quantify the difference between the different products

To provide some recommendation for FASTER

To identify the source of difference

Eventually to improve the cloud retrievals

Warm cloud algorithm

Microbase:

- Z ~ $LWC^{1.8}$; Nd=const ,100

$$LWC_i = LWP \frac{Z_i^{0.56}}{\sum_{j=1}^{M} Z_i^{0.56} \Delta z}.$$

Effective radius: calculated from LWC by assuming a lognormal size distribution with width 0.35

Mace:

- Z ~ LWC^2 ; Nd=const

re = 19.5 exp(0.034 dBZ),

If re>10, re=10; If colder than freezing , re=15.

$$LWC_i = LWP \frac{Z_i^{0.5}}{\sum_{j=1}^{M} Z_i^{0.5} \Delta z}.$$

Dong (Dong et al., 1998, 2003):

- LWC algorithm similar to Mace
- Re is based on radar and surface transmission measurements

Data product description

Microbase 20-minute average products (1997-2004):

20-minute average of the 10-second microbase retrievals.

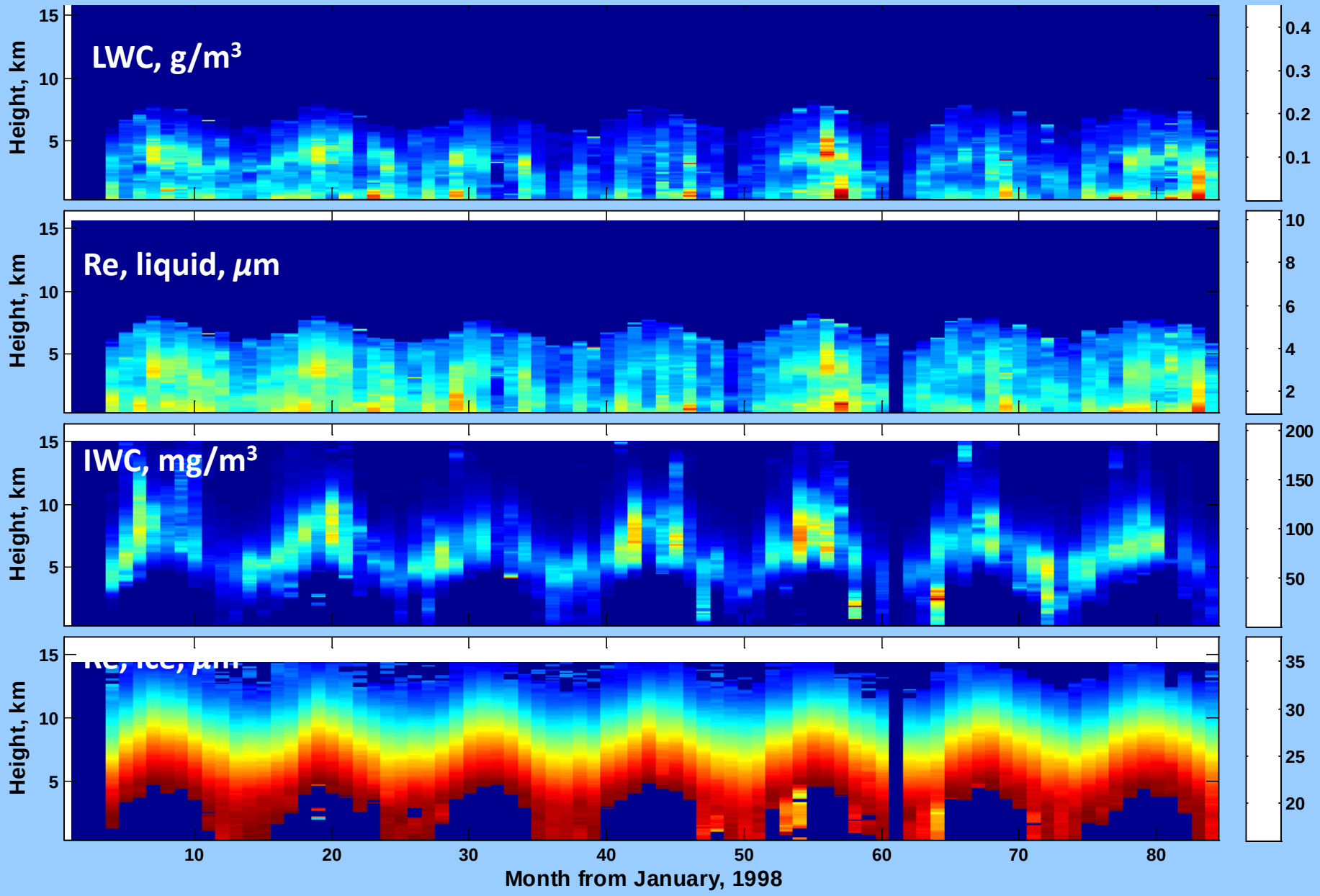
Mace 5-minute average products (1998-2007):

First average the raw radar data to 5-minute resolution, then apply the algorithms to obtain cloud retrievals. The 5-minute products are then averaged to 20-minute resolution for comparison.

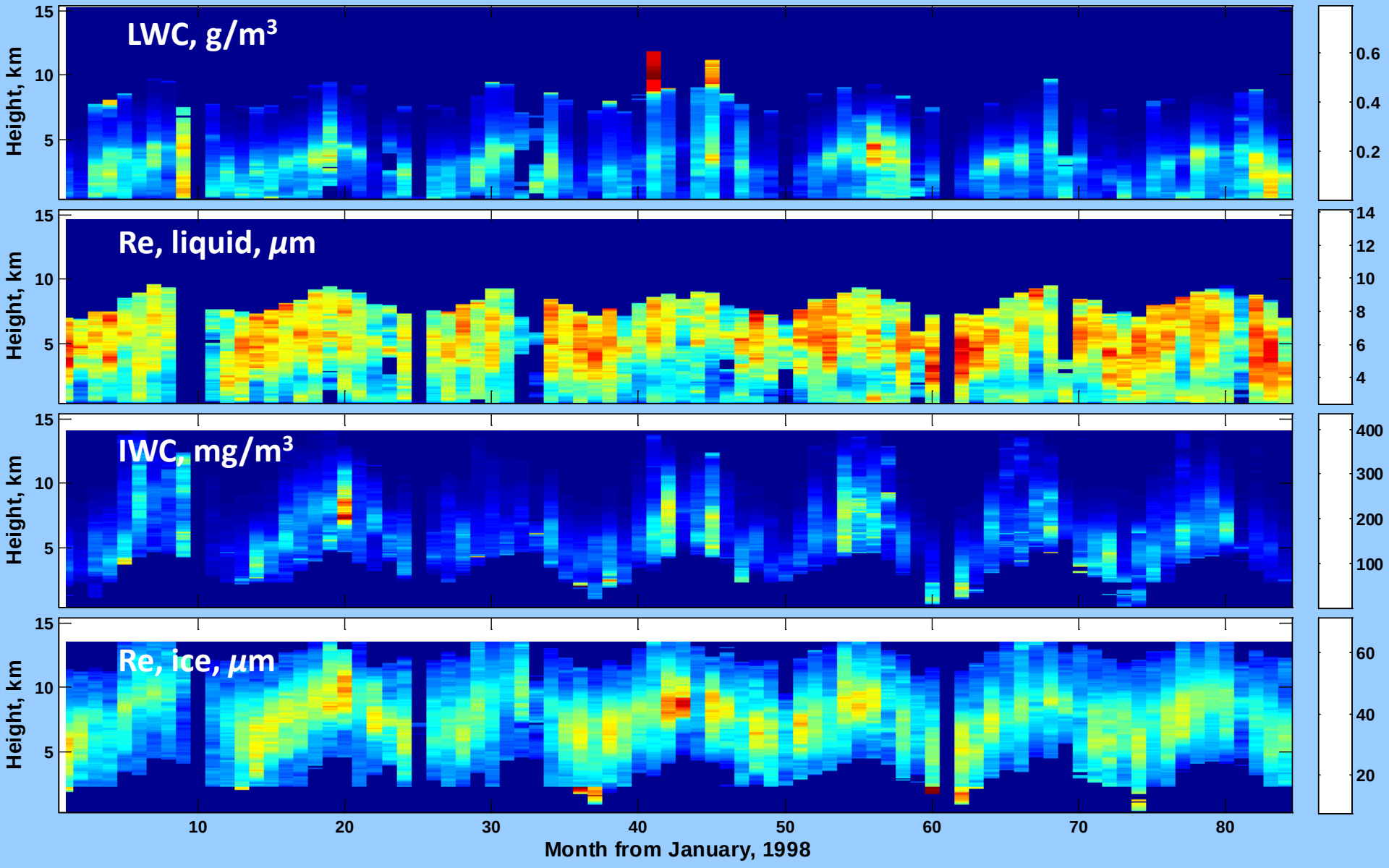
Dong cloud products (March 2000):

Similar to Mace products, original resolution is 5-minute. Dong products have only warm cloud retrievals.

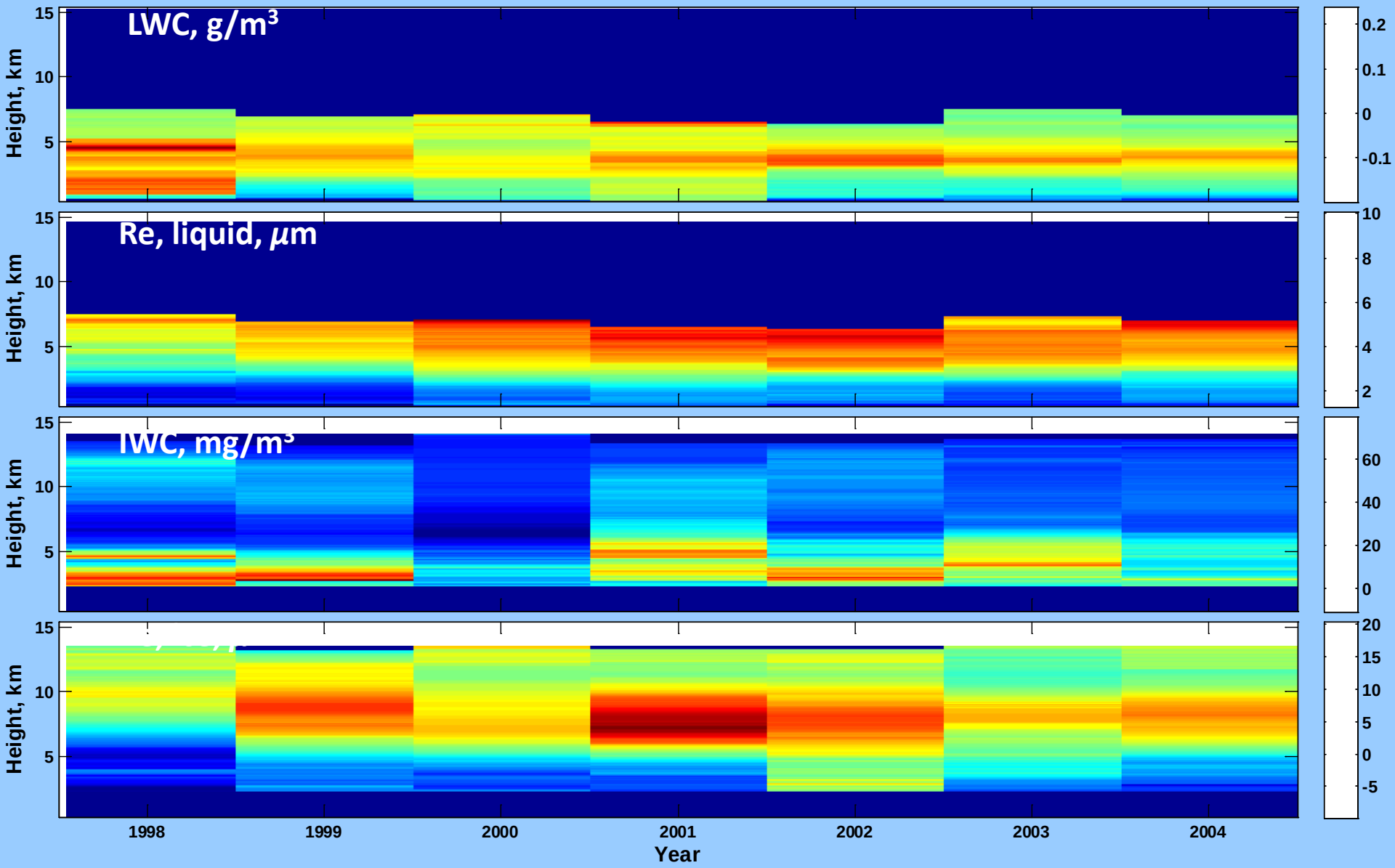
Microbase monthly average, with cloud mask



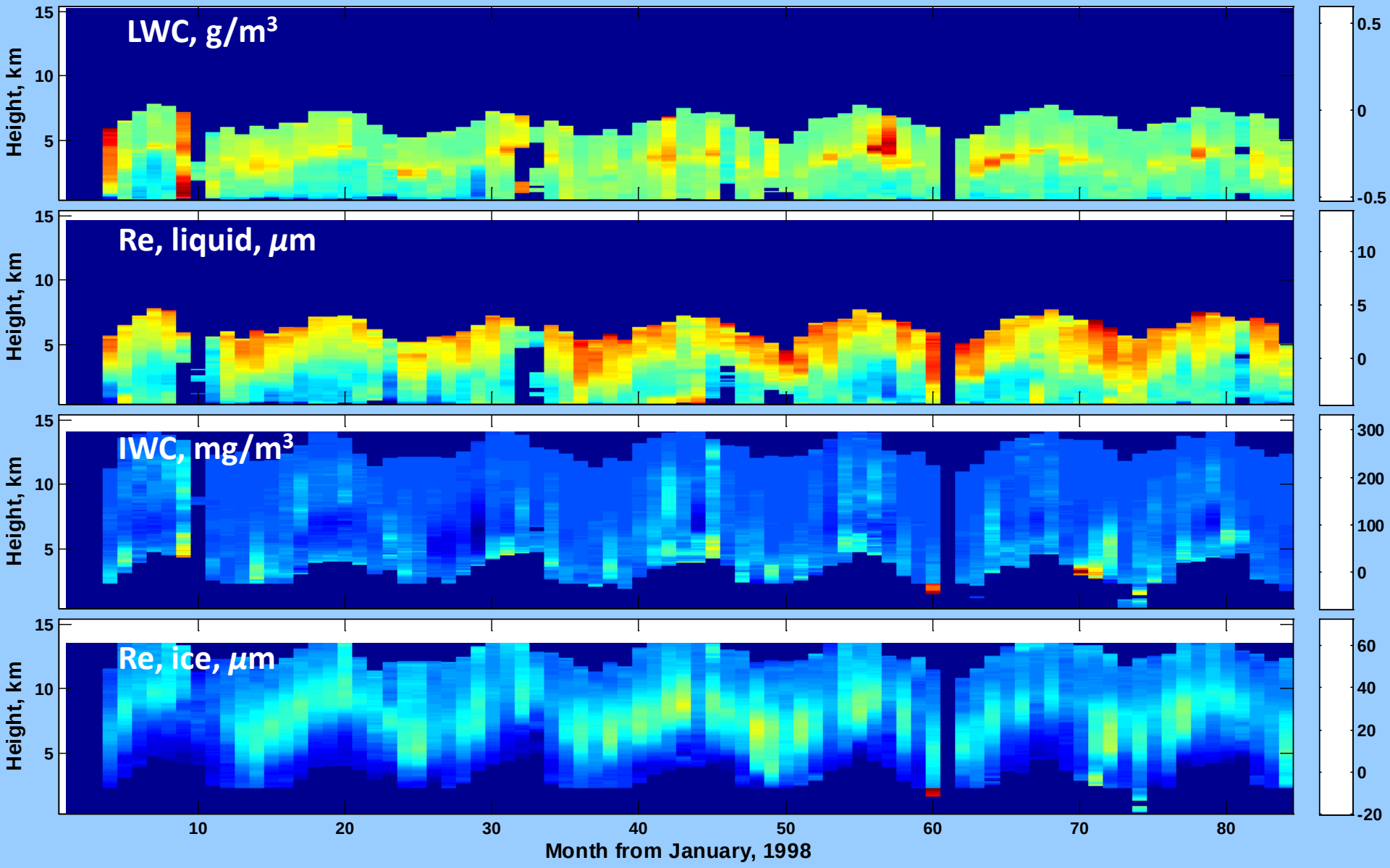
Mace monthly average, with cloud mask



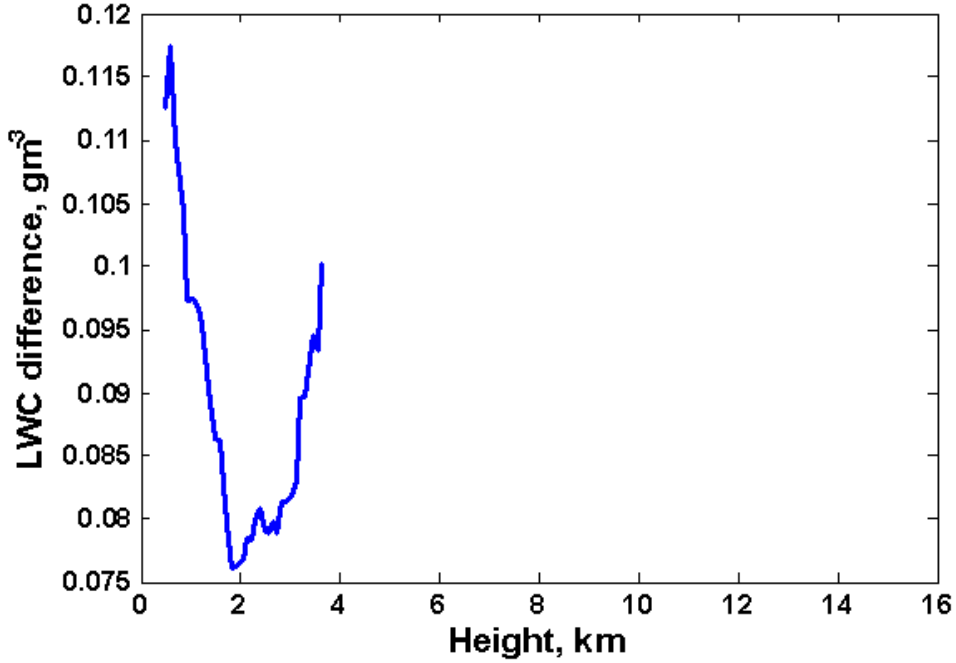
Mace-MB, yearly average

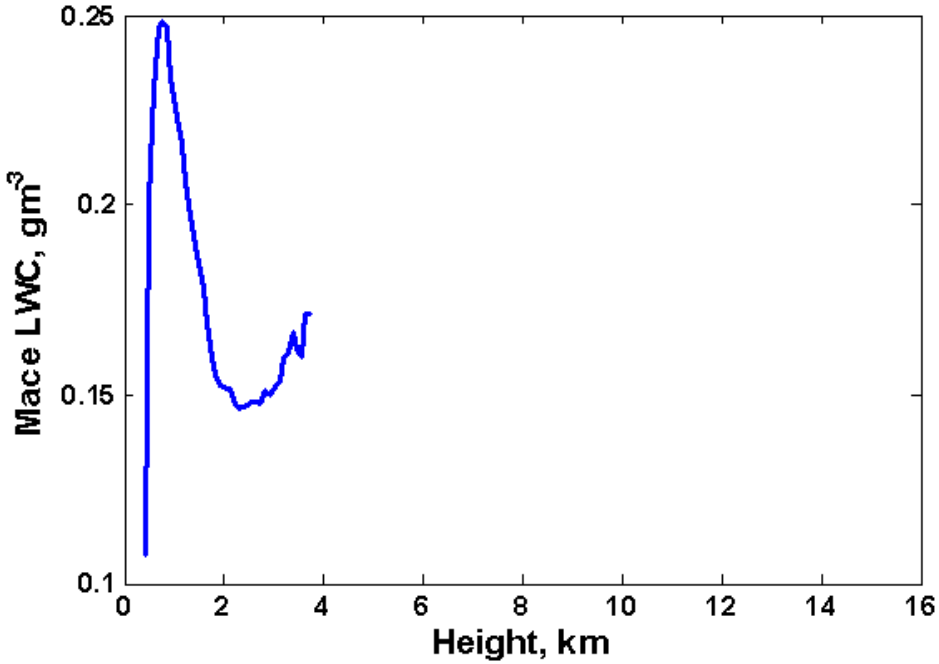


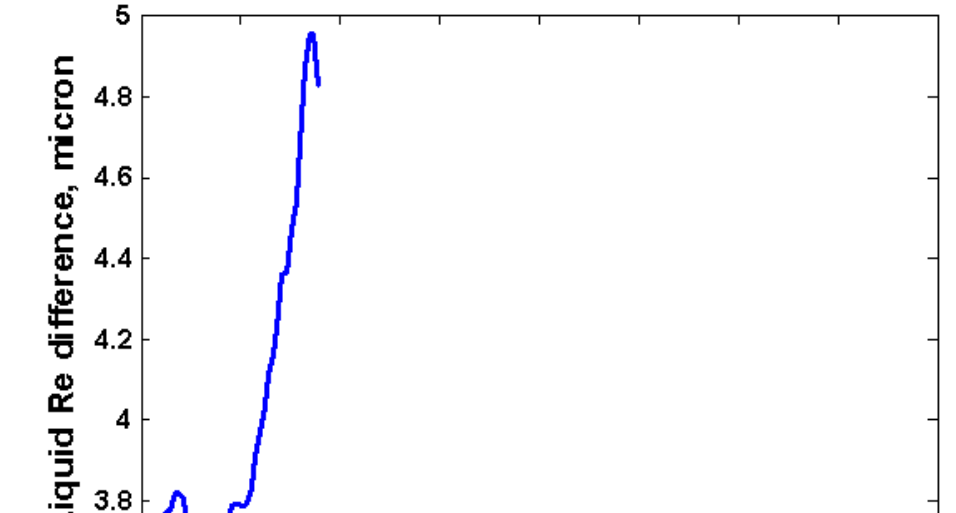
Mace-MB, monthly average

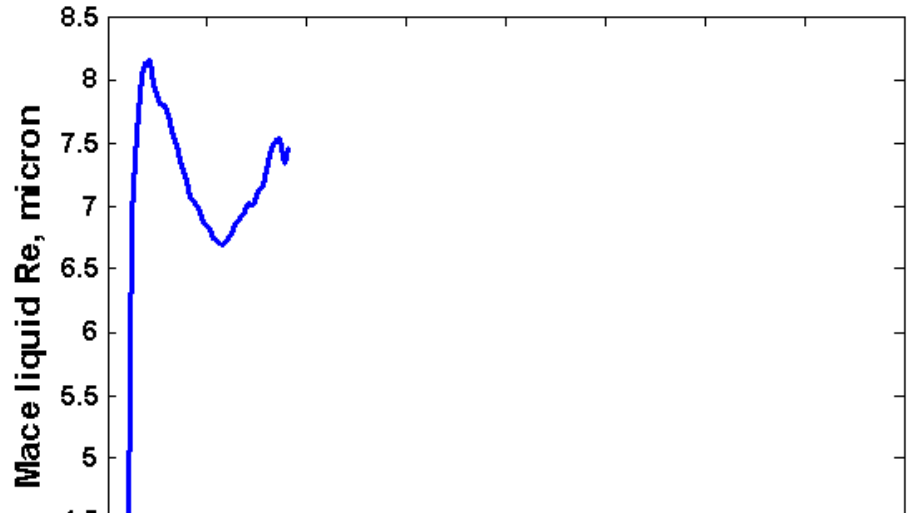


Mace-MB as a function of height

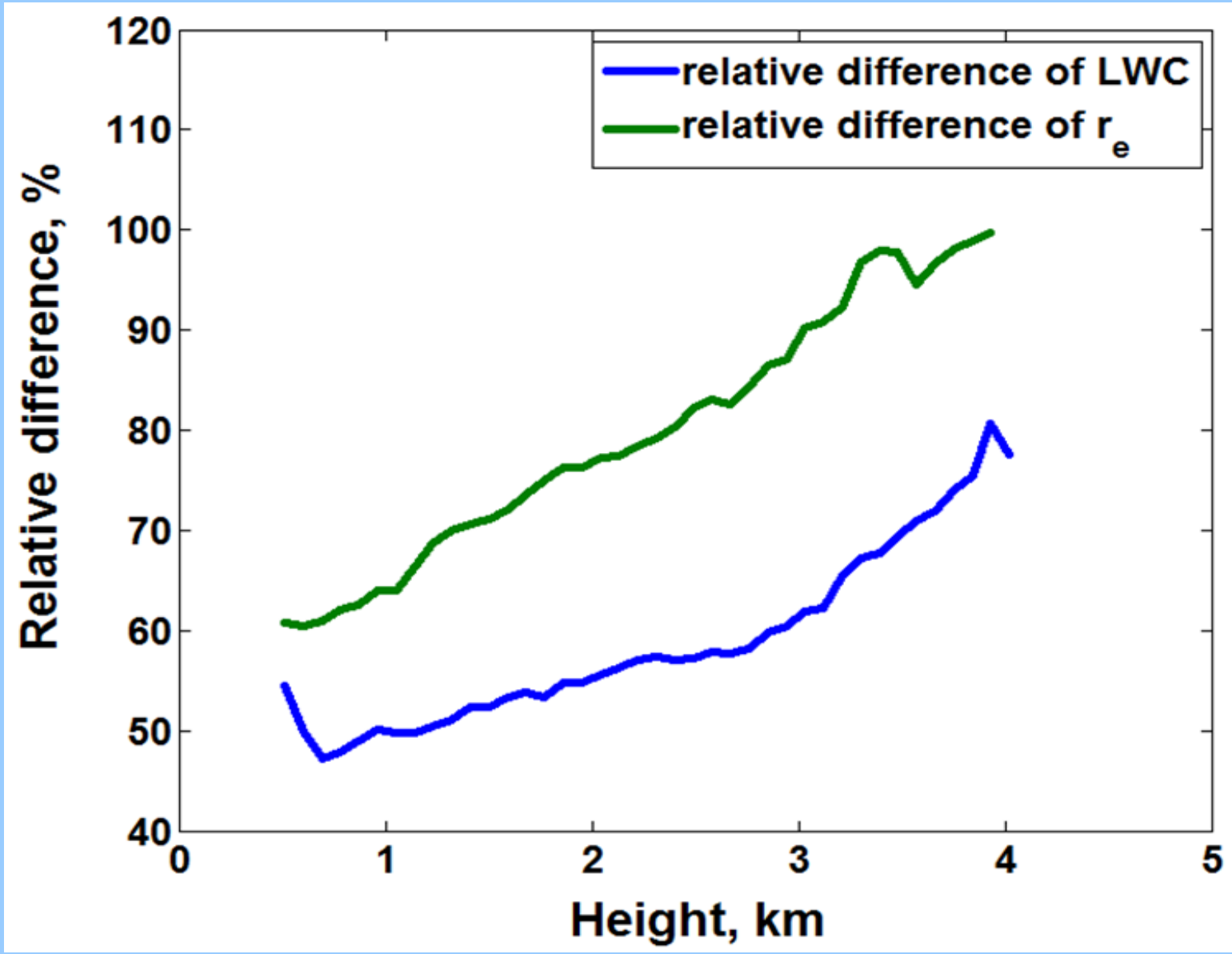




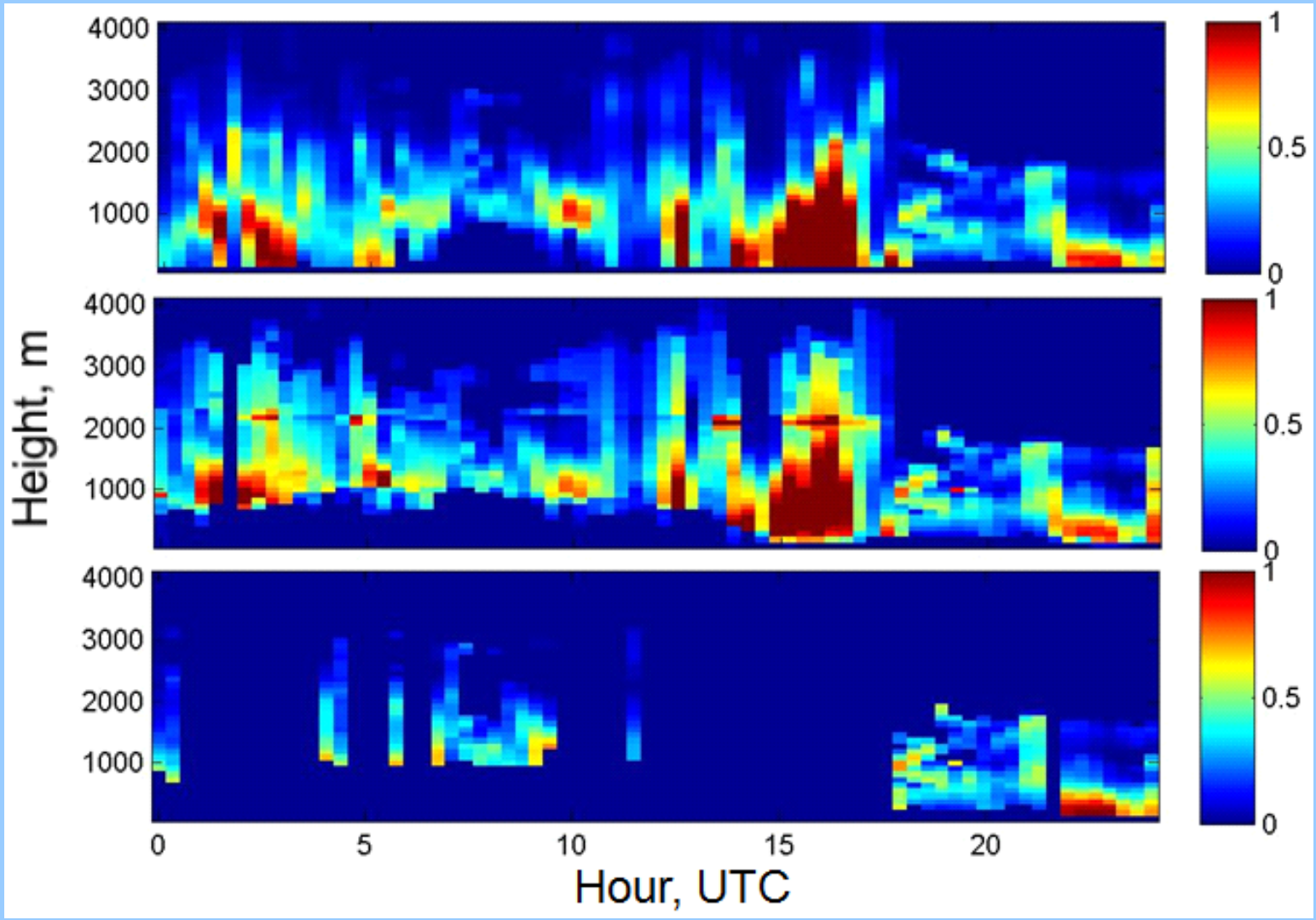




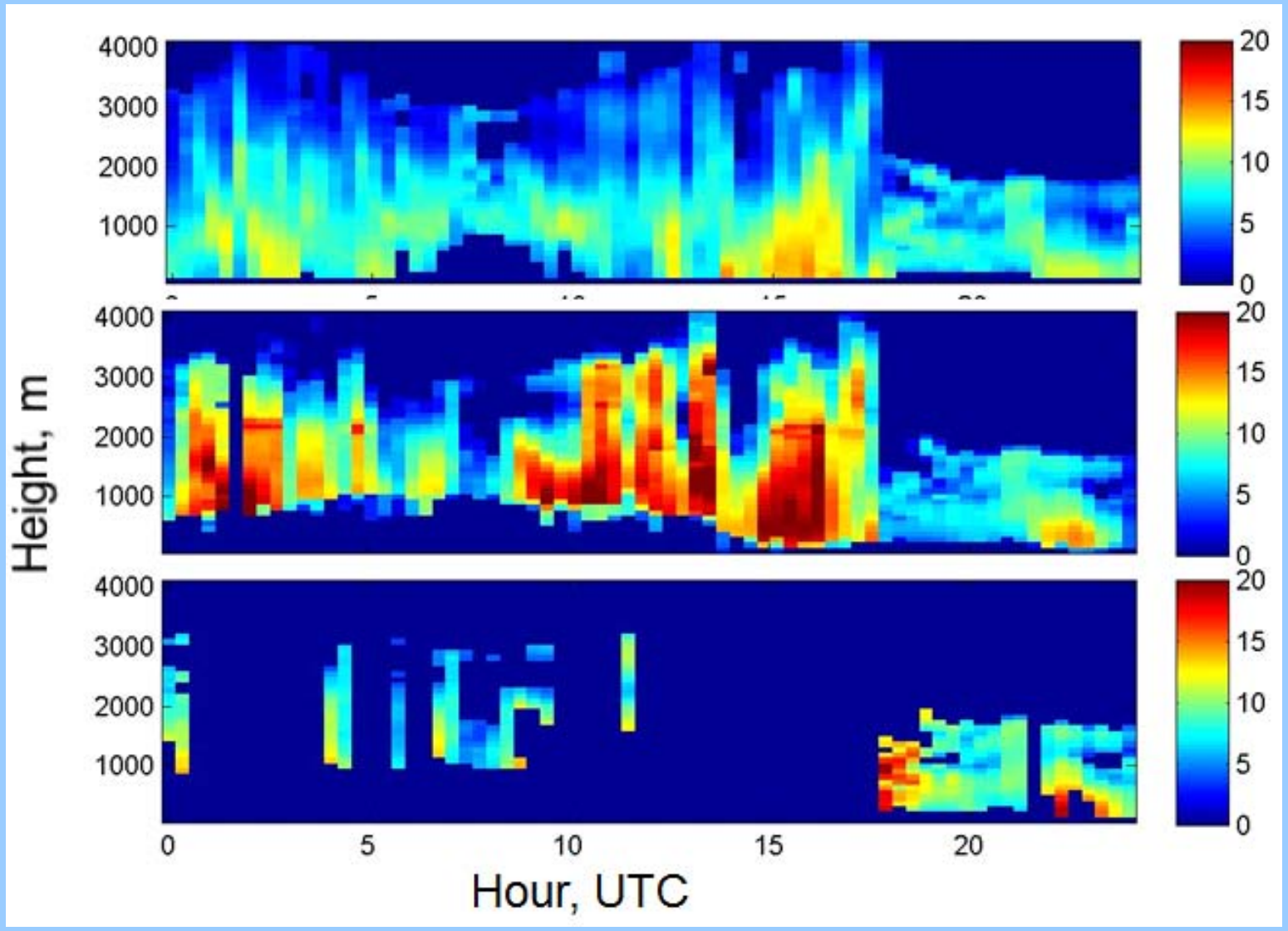
Relative difference as a function of height

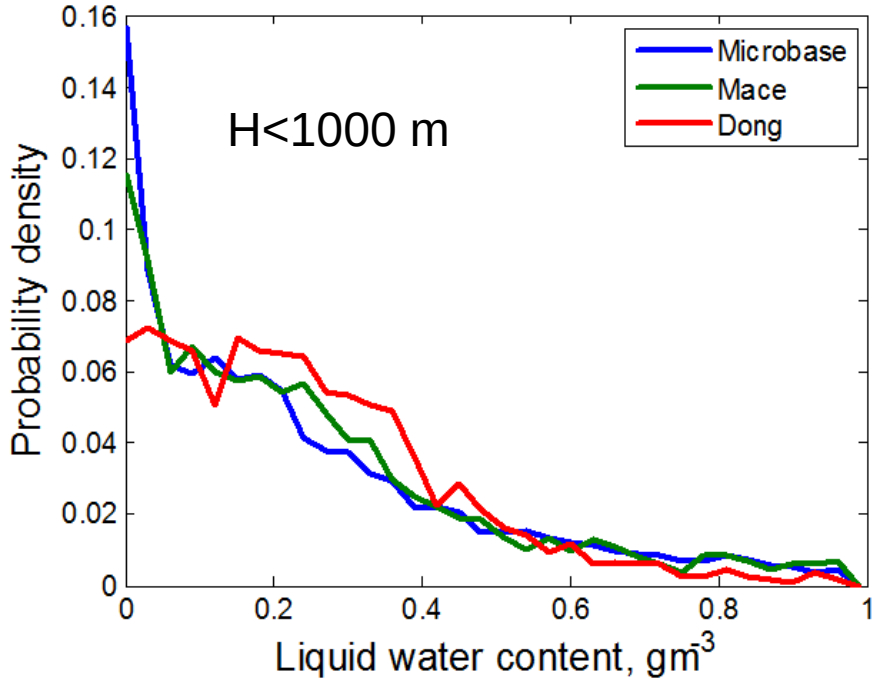


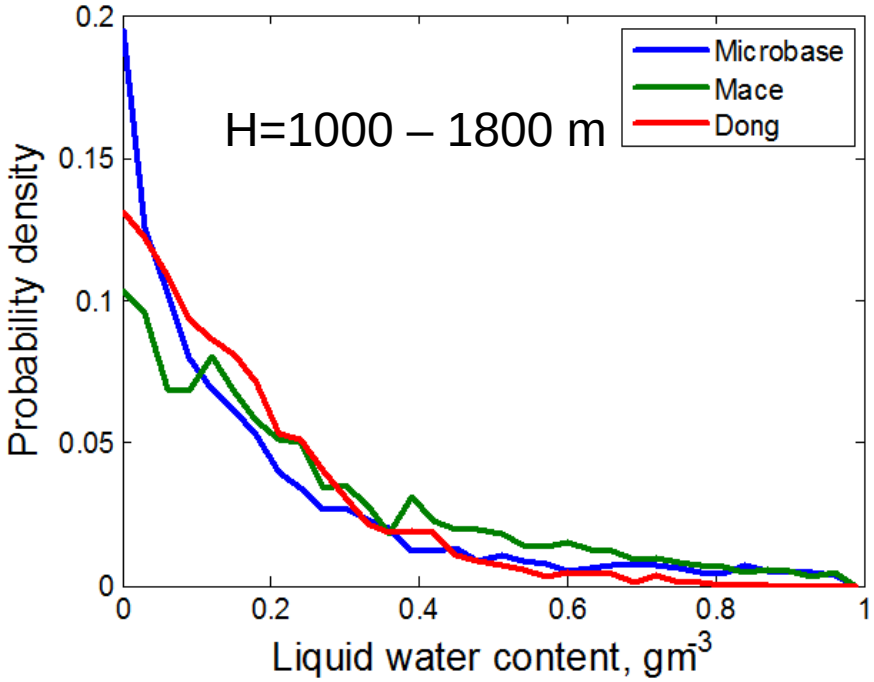
LWC retrievals on 03/17/2000

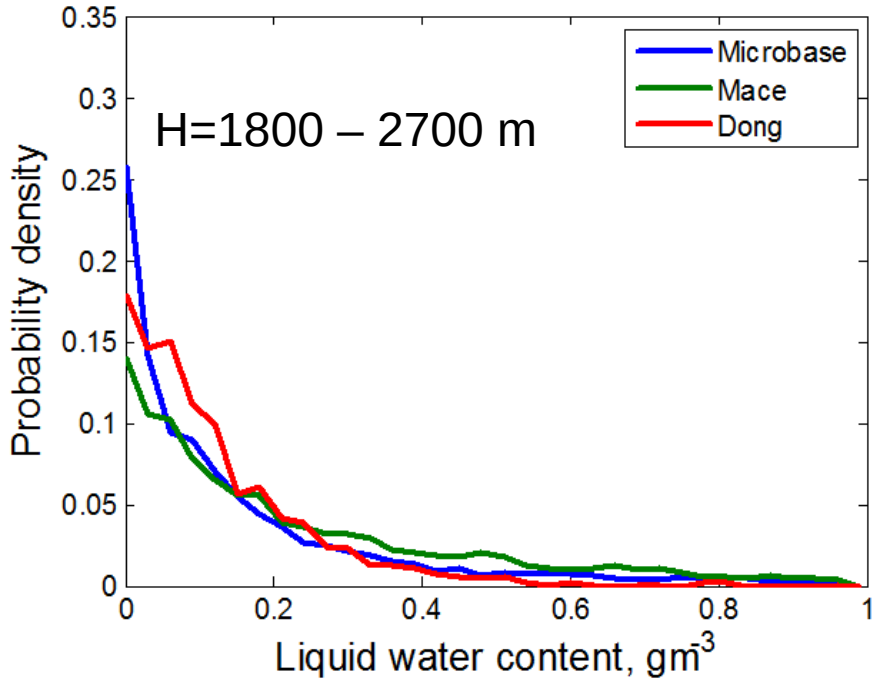


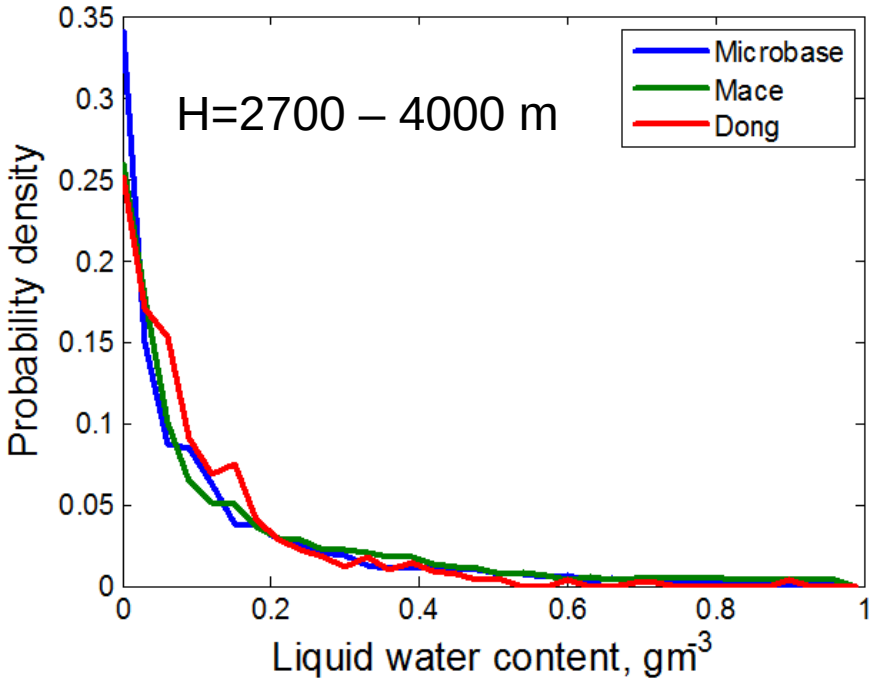
Effective radius retrievals on 03/17/2000




H<1000 m
Microbase
Mace
Dong
Probability density
Liquid water content, gm-3
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
0.2
0.4
0.6
0.8
1

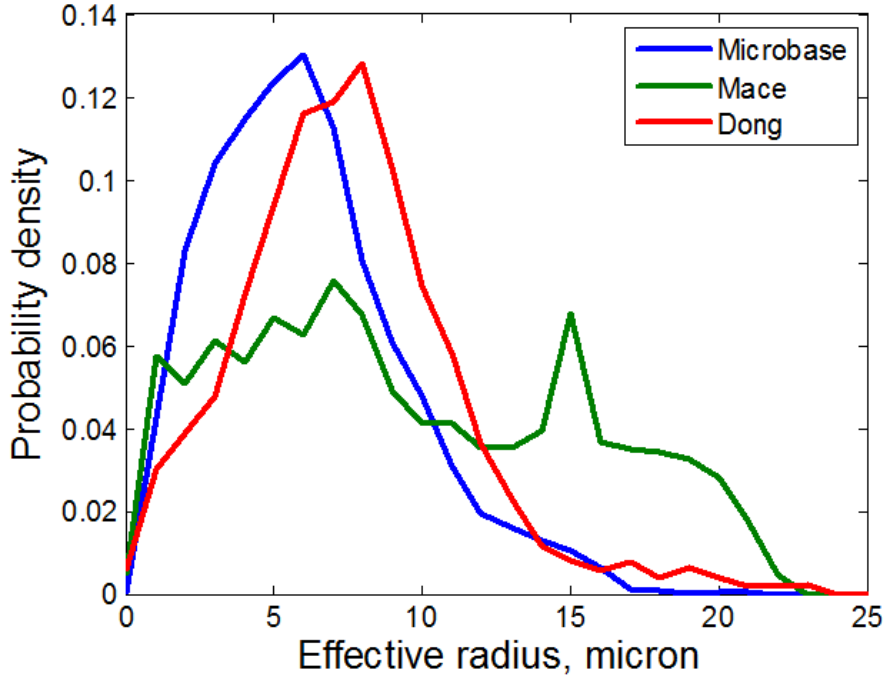

H=1000 – 1800 m
Microbase
Mace
Dong
Probability density
Liquid water content, gm-3
0.2
0.15
0.1
0.05
0
0
0.2
0.4
0.6
0.8
1


H=1800 – 2700 m
Microbase
Mace
Dong
Probability density
Liquid water content, gm-3
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.2
0.4
0.6
0.8
1

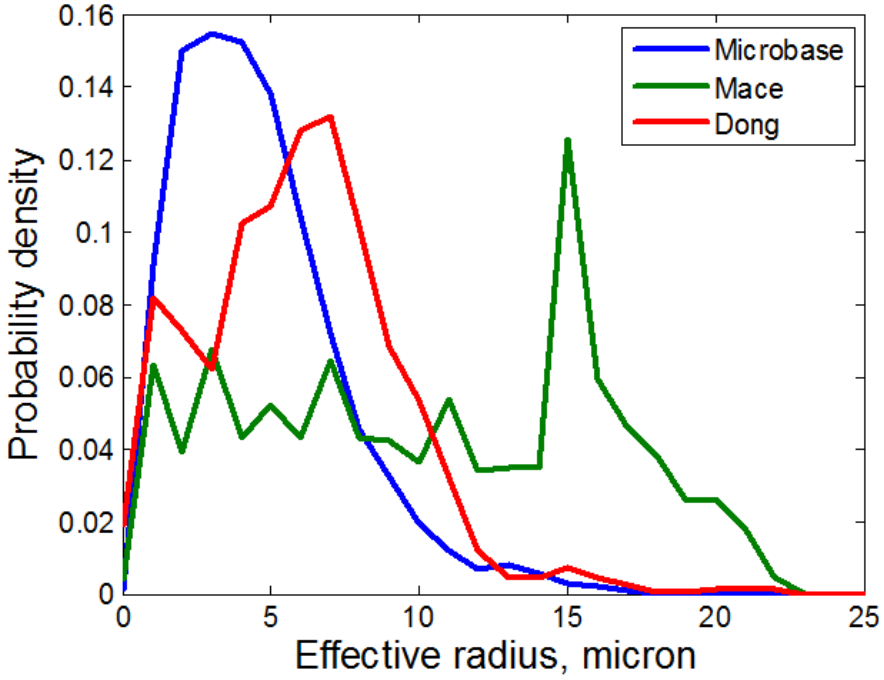

H=2700 – 4000 m
Microbase
Mace
Dong
Probability density
Liquid water content, gm-3
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.2
0.4
0.6
0.8
1

PDFs of effective radius retrievals on 03/17/2000

H<1800 m



H=1800 – 4000 m



Summary

- **Microbase and Mace cloud microphysics retrievals show similar monthly and annual patterns.**
- **The point-by-point difference between various products is alarmingly large, although they are generated using similar algorithms.**
- **PDFs of the LWC retrievals are very similar.**
- **Effective radius retrievals do not converge in either way.**