Contrasting single-layer and multi-layer stratus during MPACE

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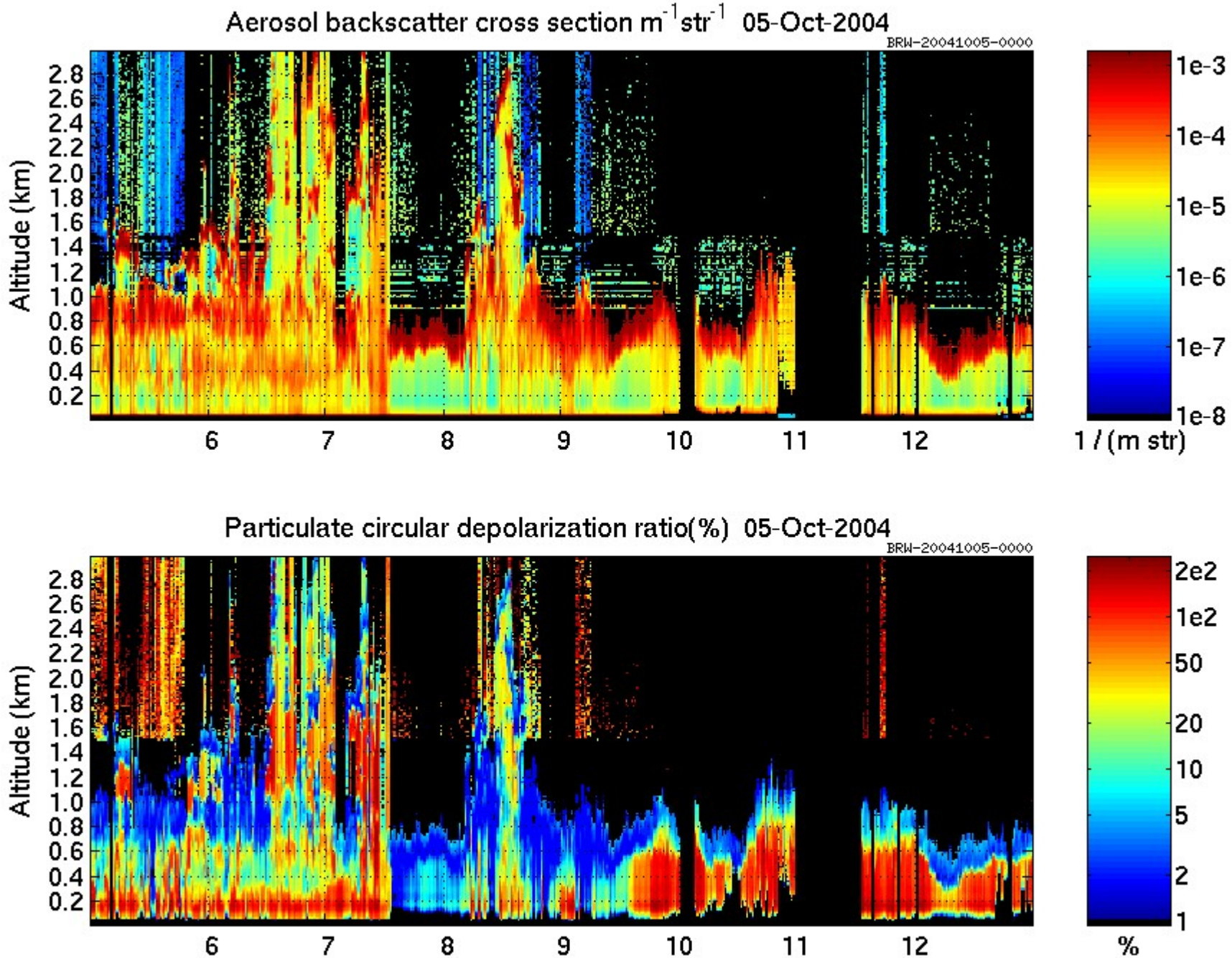
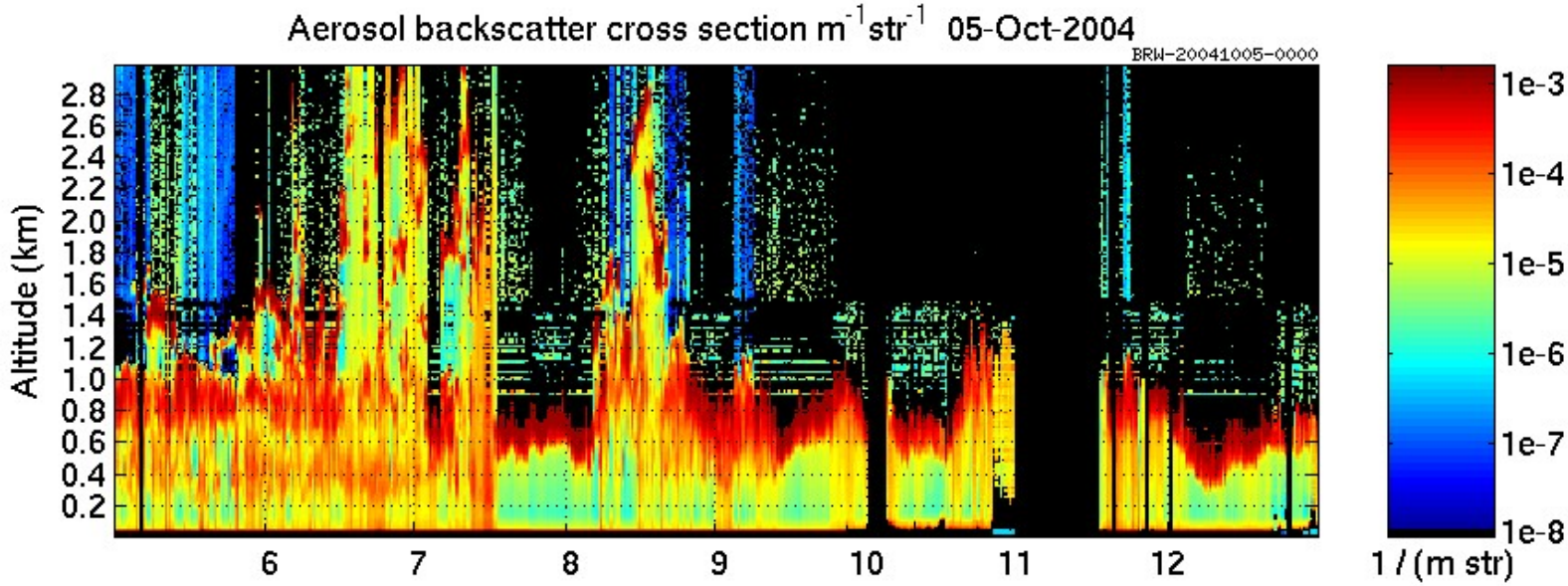
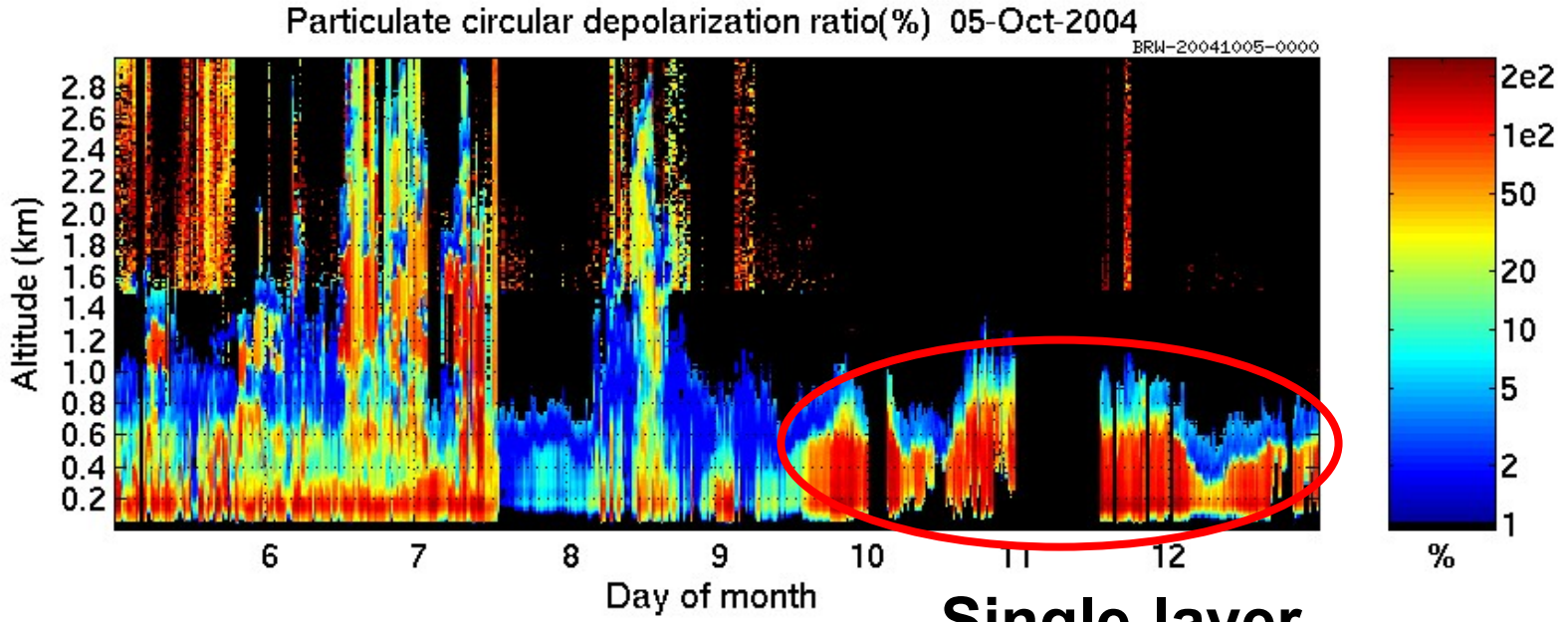


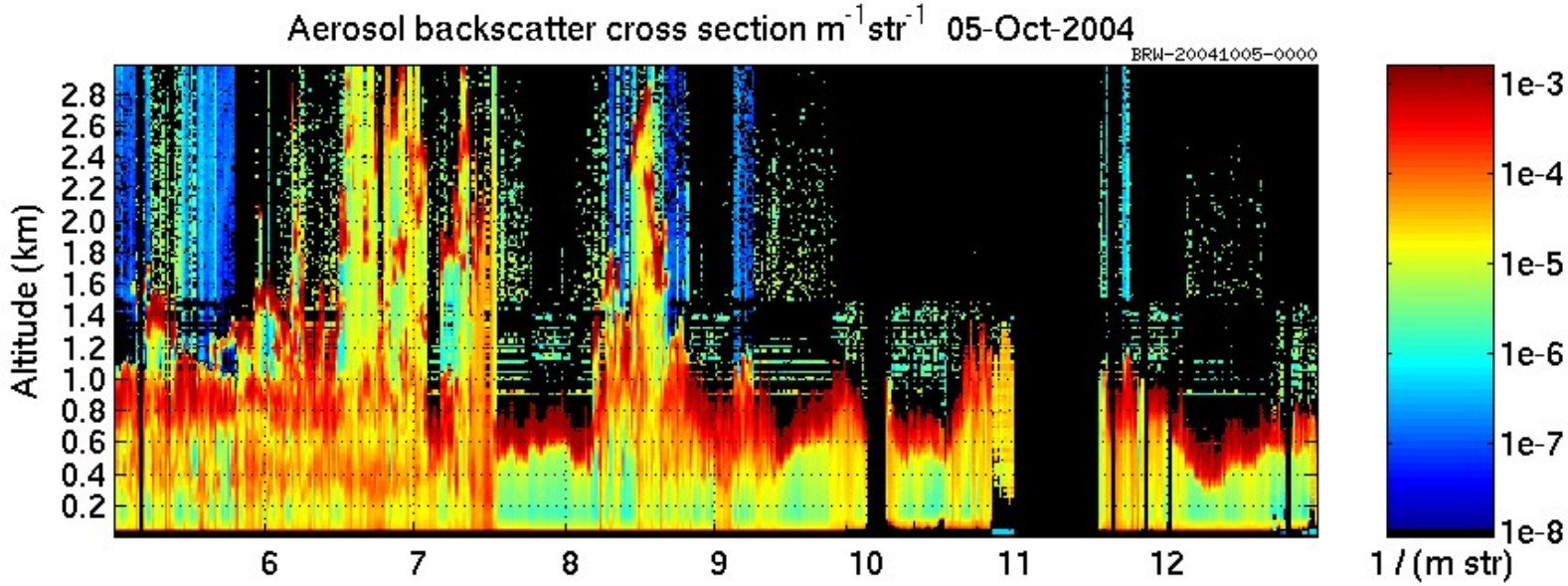
Wisconsin lidar group

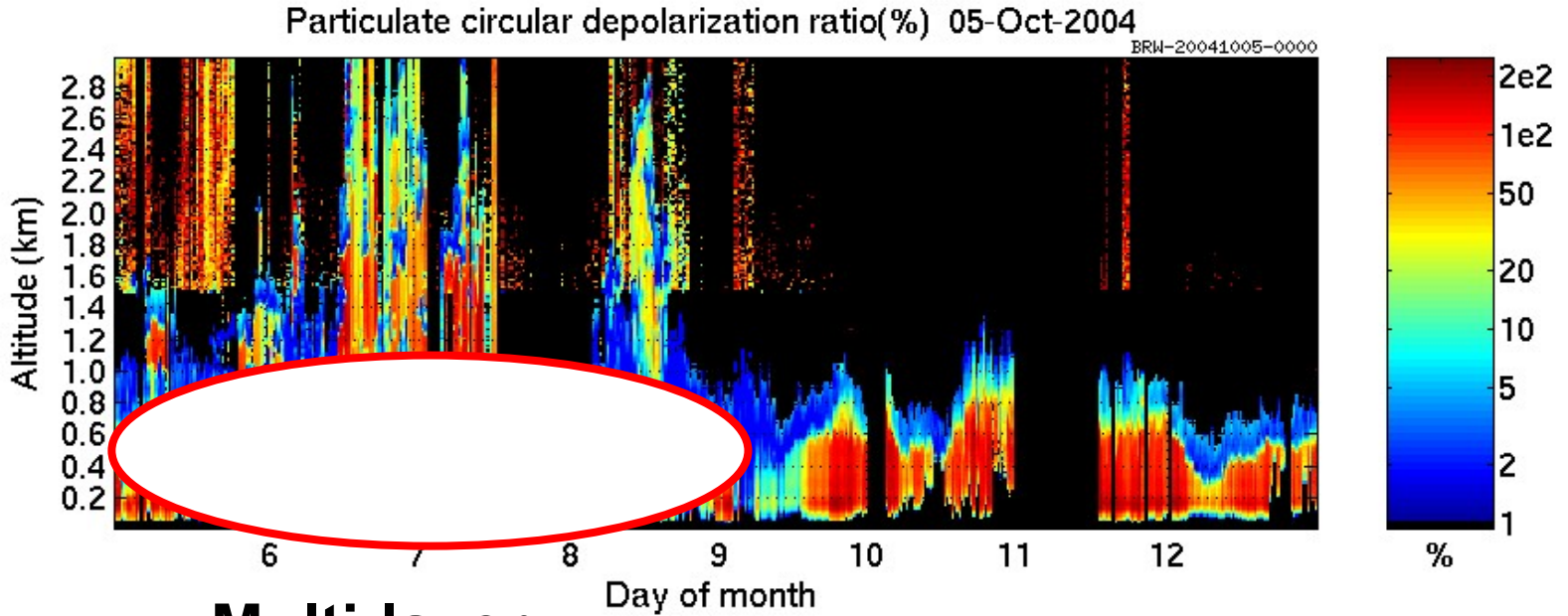




Single-layer

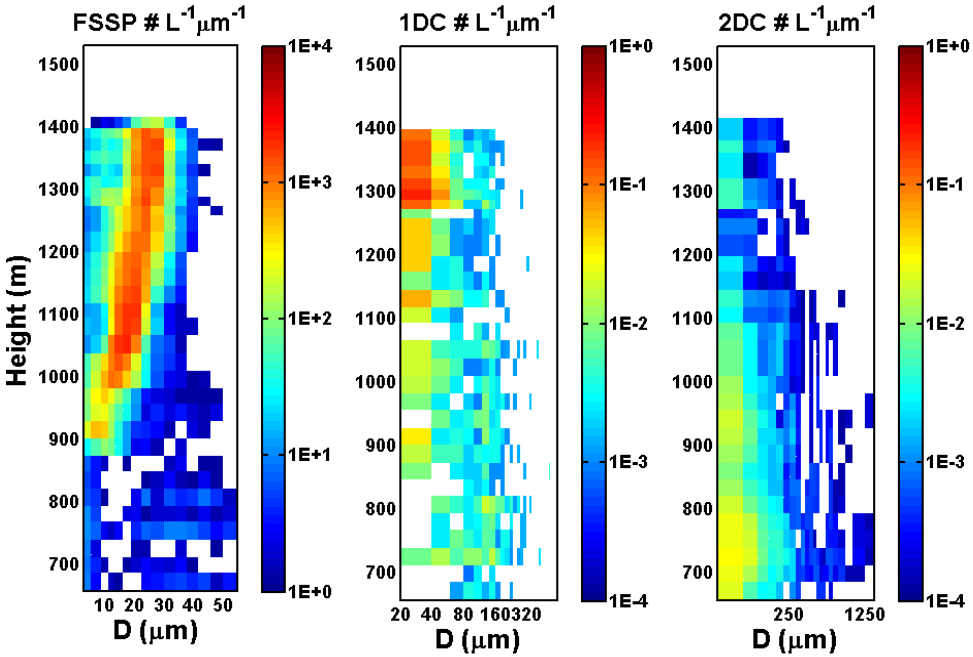
Wisconsin lidar group





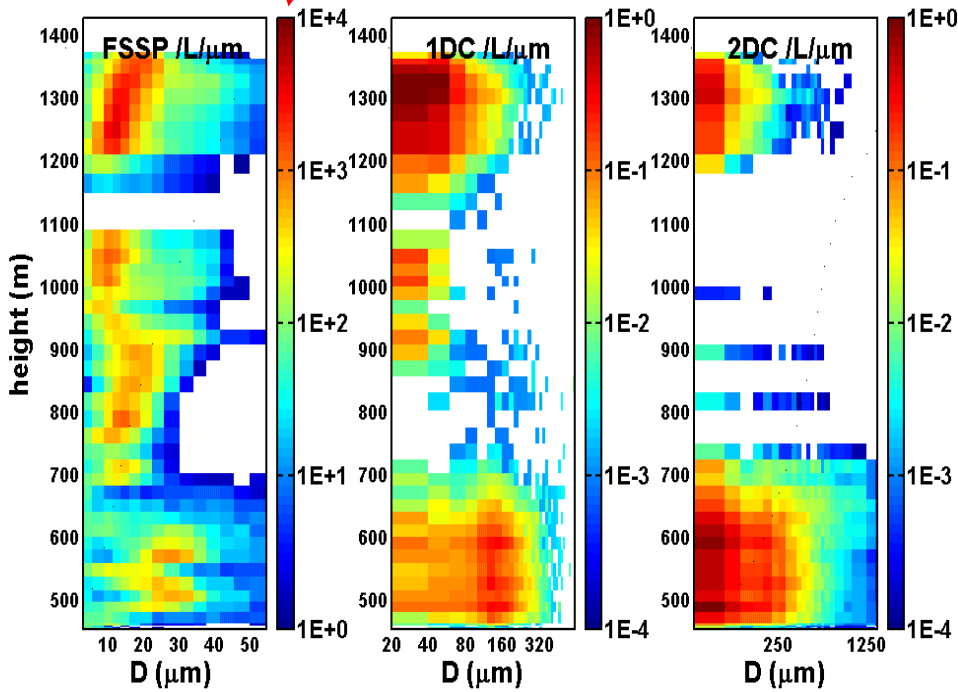
Multi-layer

Wisconsin lidar group



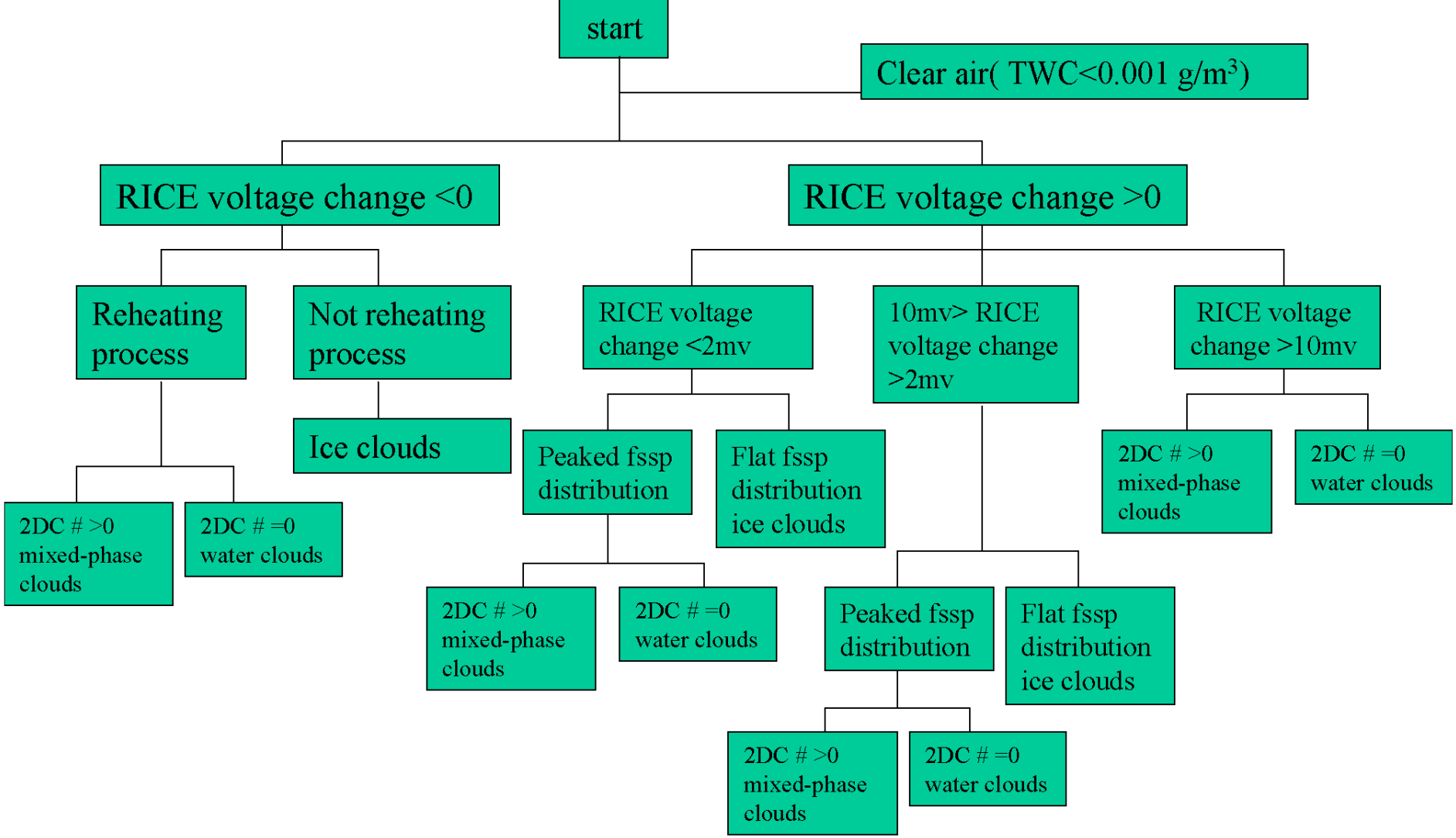
Single-layer

Multi-layer

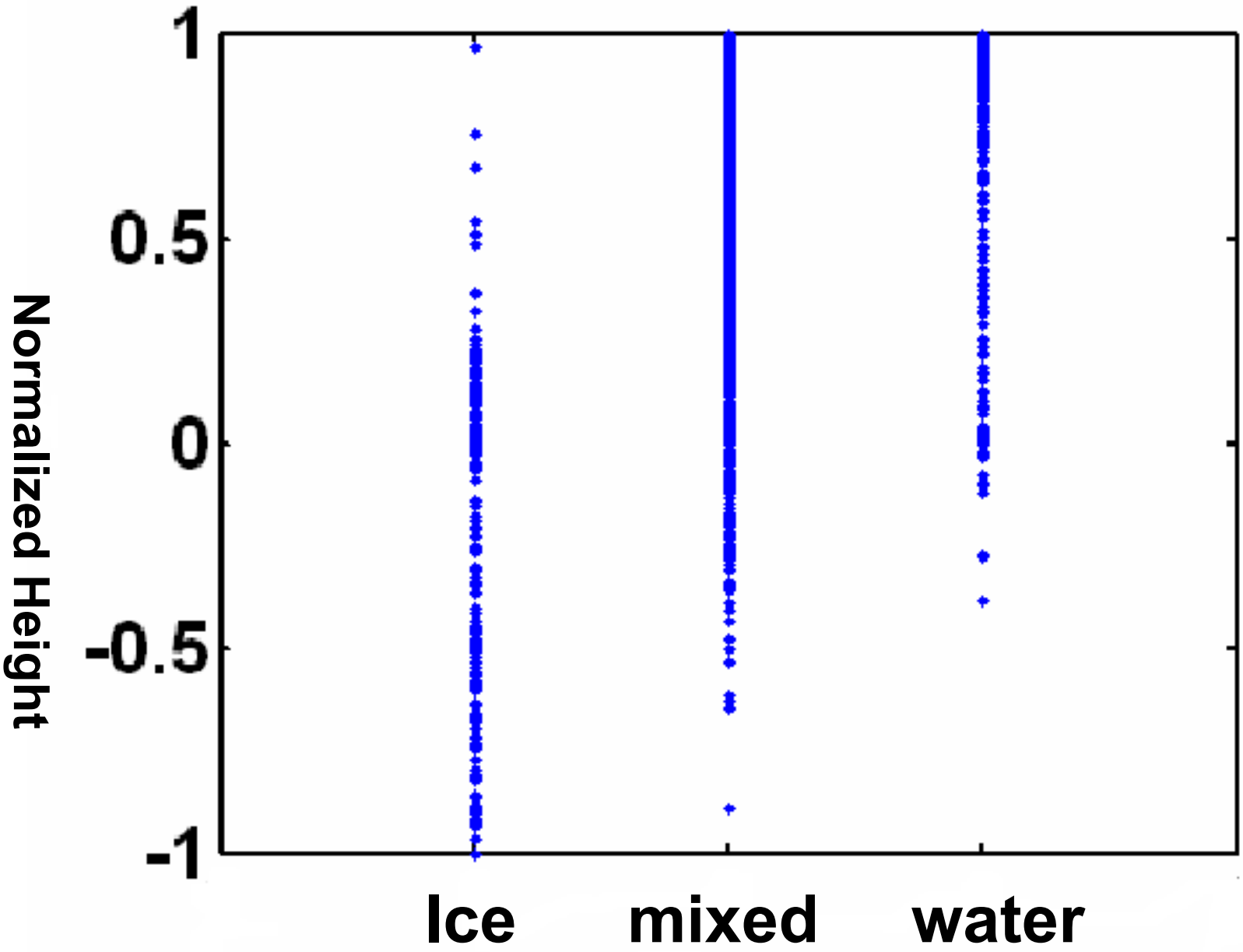


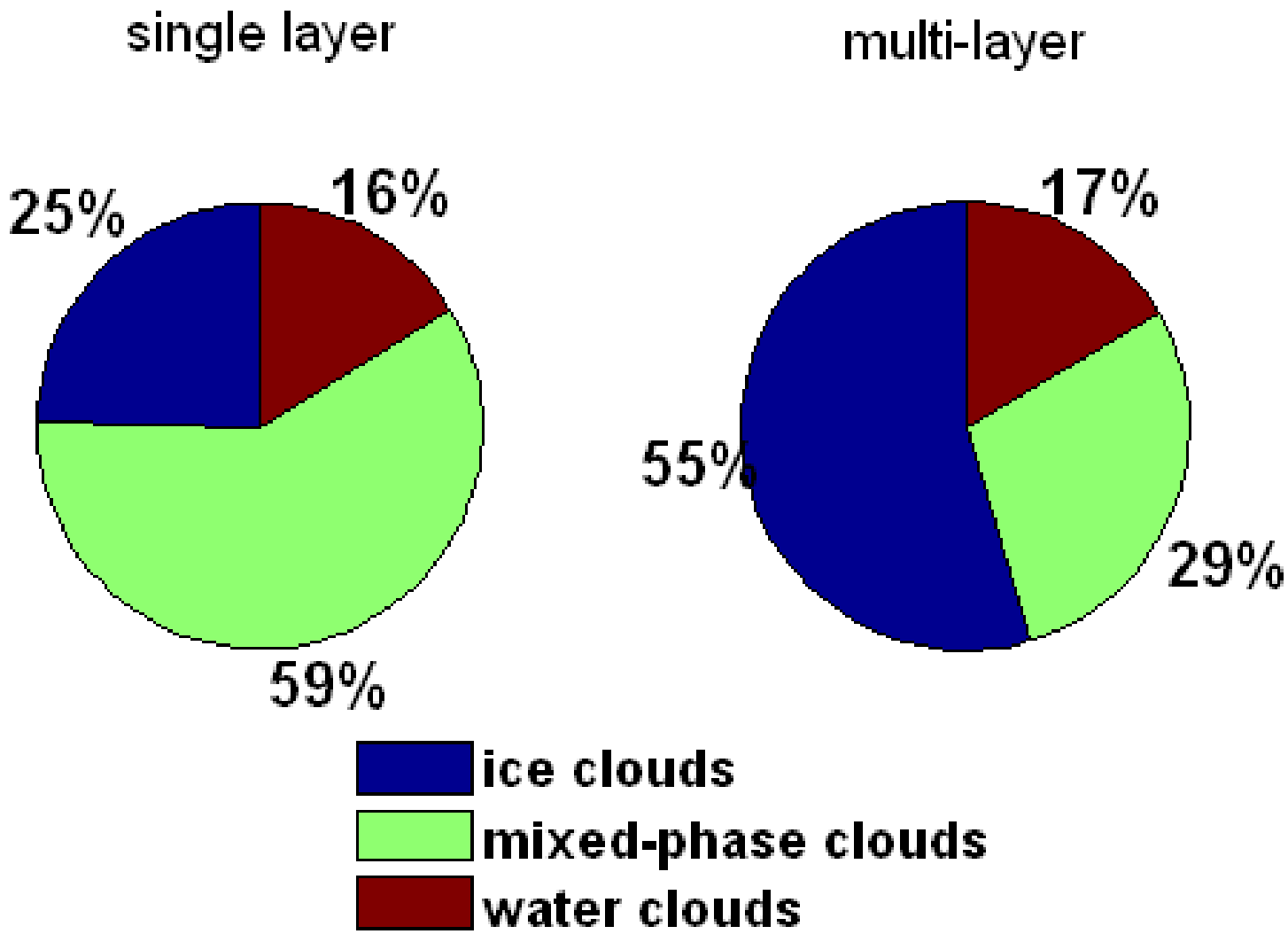
Any difference in microphysical properties?

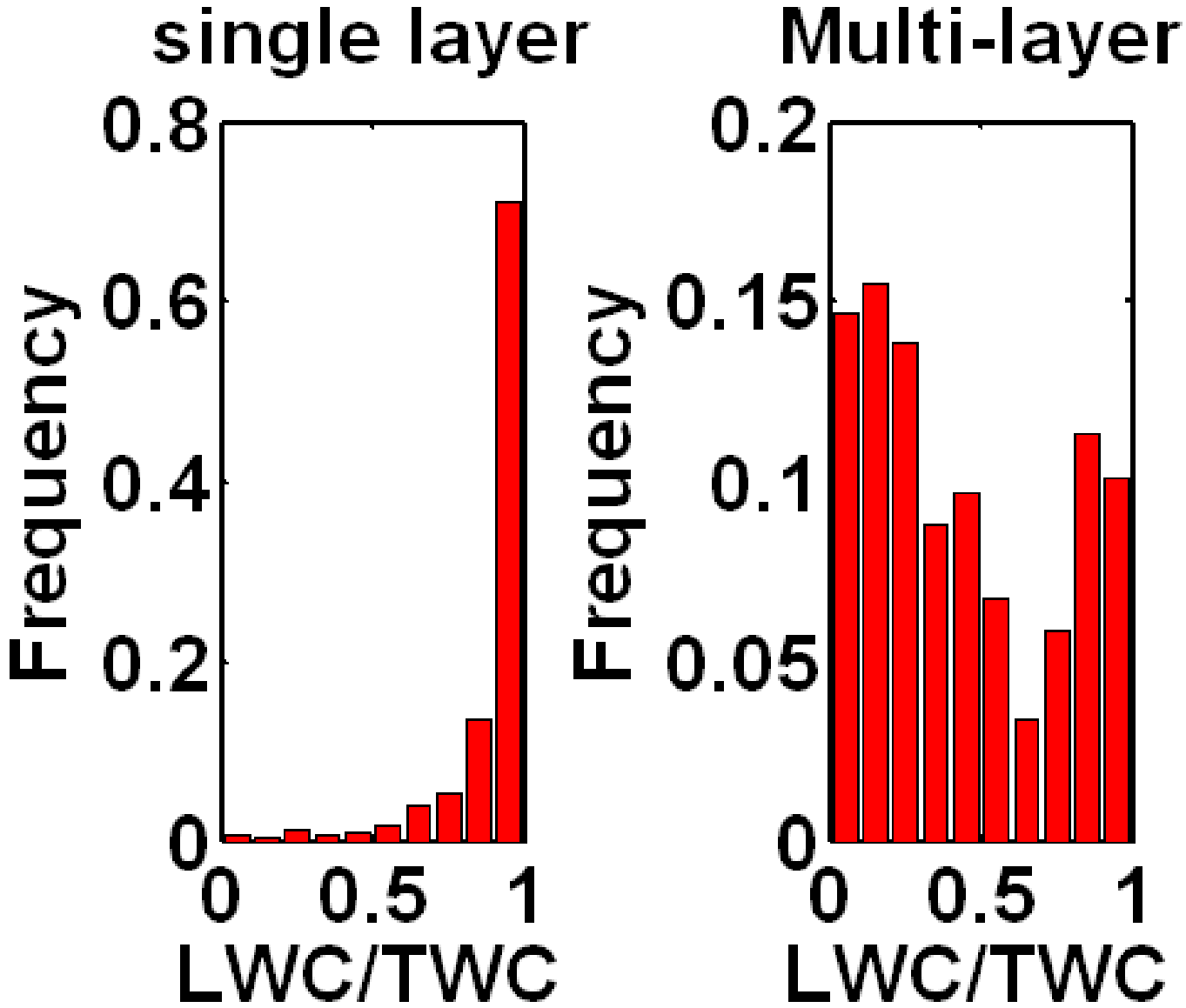
10/05	Multi-layer
10/06	Multi-layer
10/08	Multi-layer
10/09	Single layer
10/10 first flight	Single layer
10/10 second flight	Single layer
10/12	Single layer

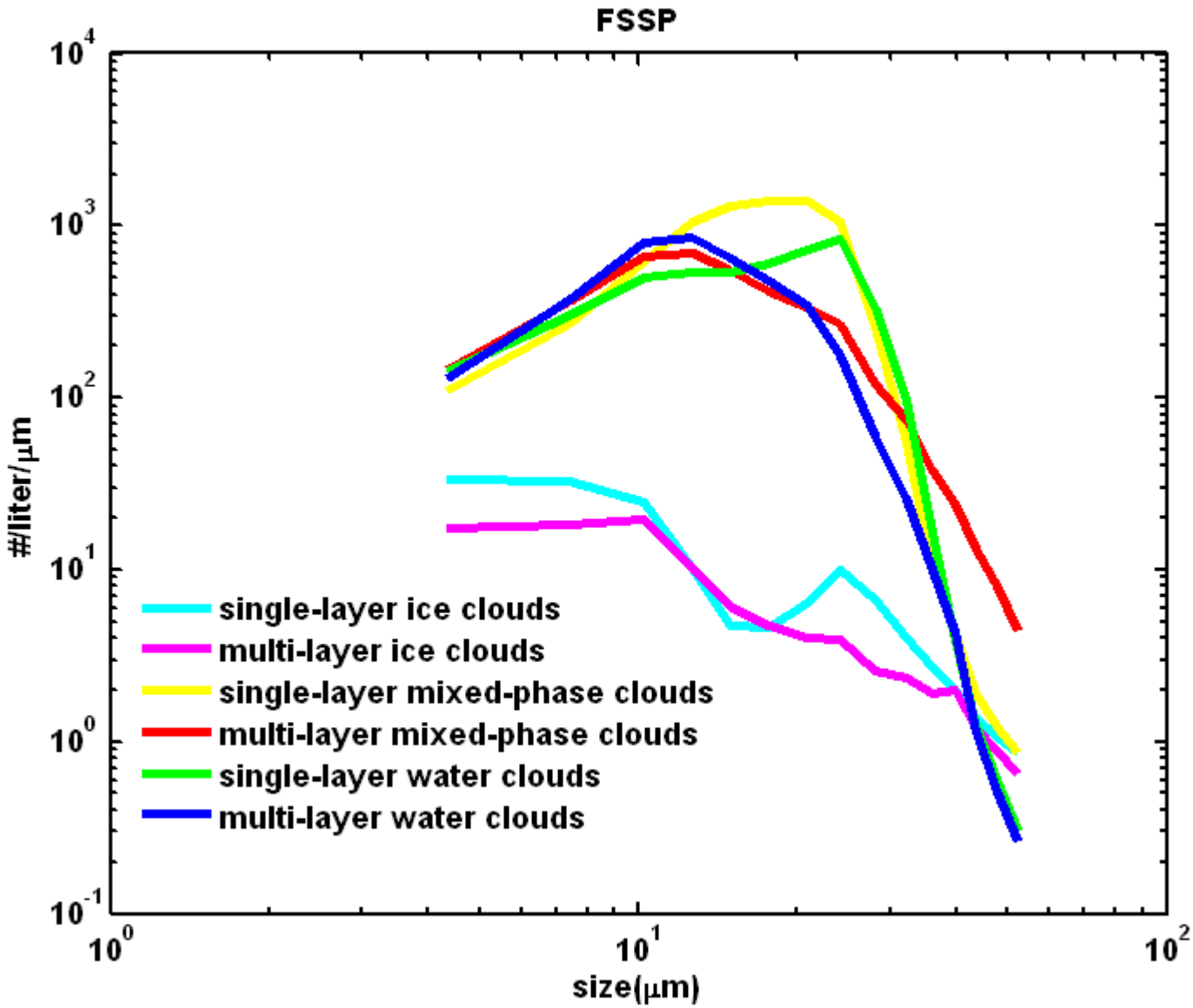


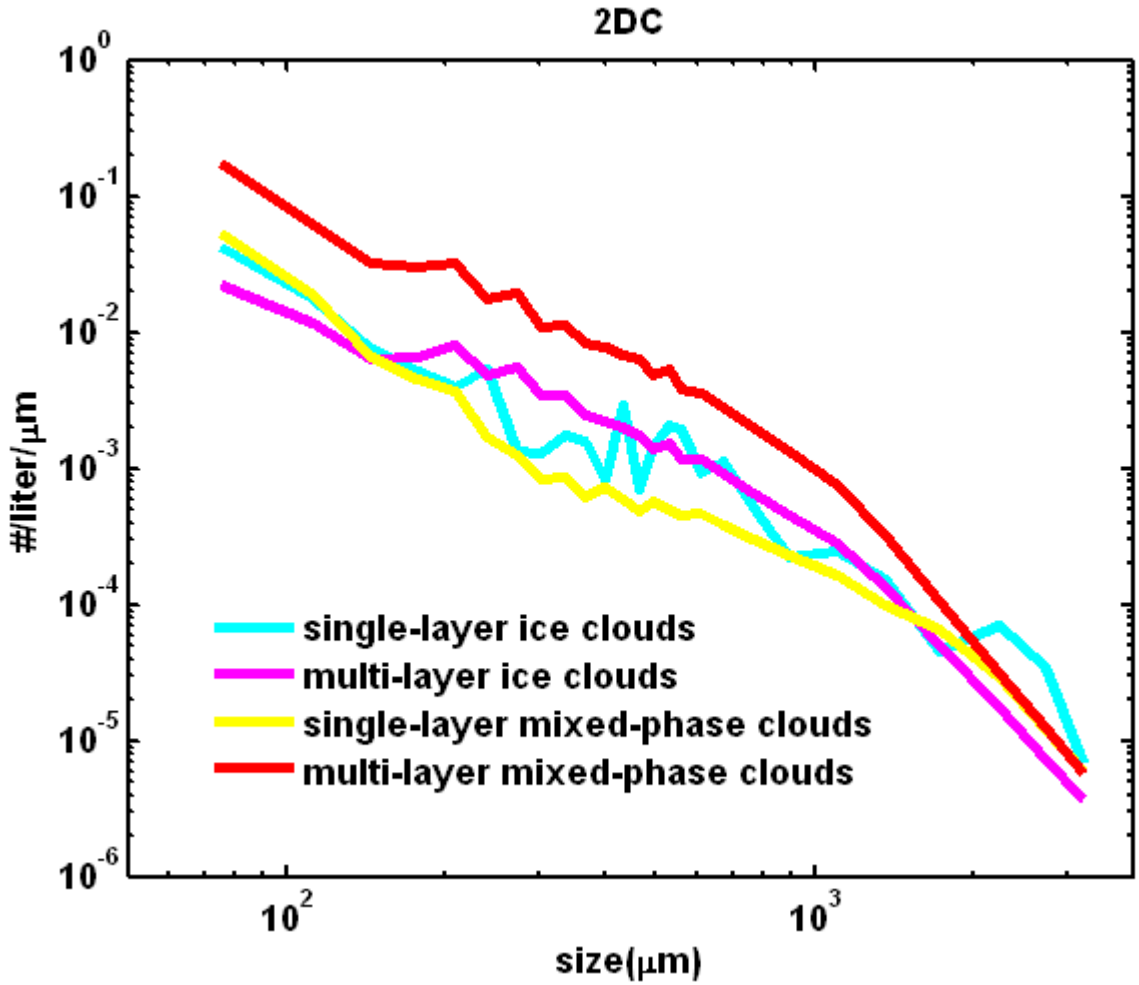
M-PACE phase identification scheme


1
0.5
0
-0.5
-1
Normalized Height
Ice
mixed
water

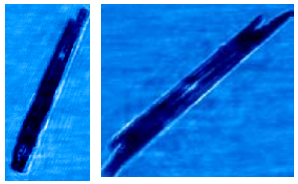

single layer
multi-layer
25%
16%
59%
55%
17%
29%
ice clouds
mixed-phase clouds
water clouds


single layer
Multi-layer
Frequency
Frequency
0.8
0.6
0.4
0.2
0
0.2
0.15
0.1
0.05
0
0
0.5
1
0
0.5
1
LWC/TWC
LWC/TWC

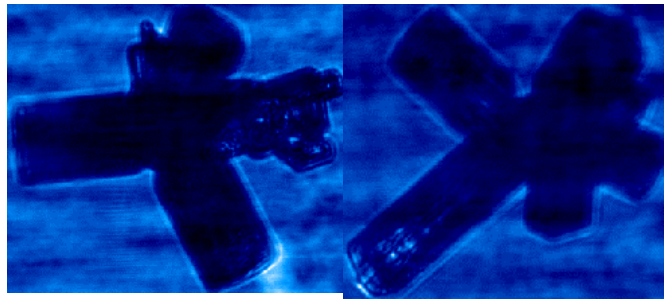

FSSP
10^4
10^3
10^2
10^1
10^0
10^{-1}
#/liter/μm
10^0
10^1
10^2
size(μm)
single-layer ice clouds
multi-layer ice clouds
single-layer mixed-phase clouds
multi-layer mixed-phase clouds
single-layer water clouds
multi-layer water clouds


2DC
#/liter/μm
size(μm)
single-layer ice clouds
multi-layer ice clouds
single-layer mixed-phase clouds
multi-layer mixed-phase clouds

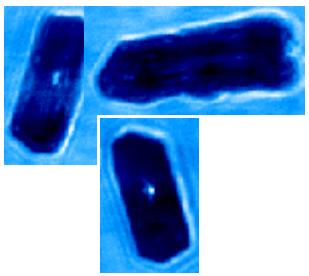
needle



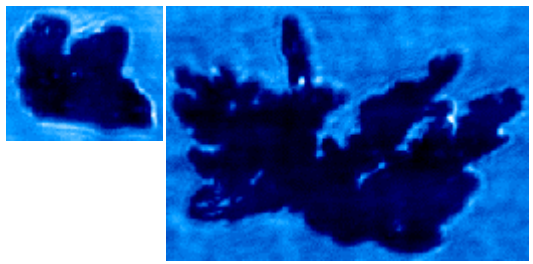
rosette



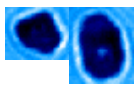
column



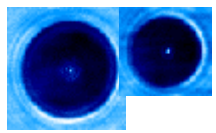
irregular

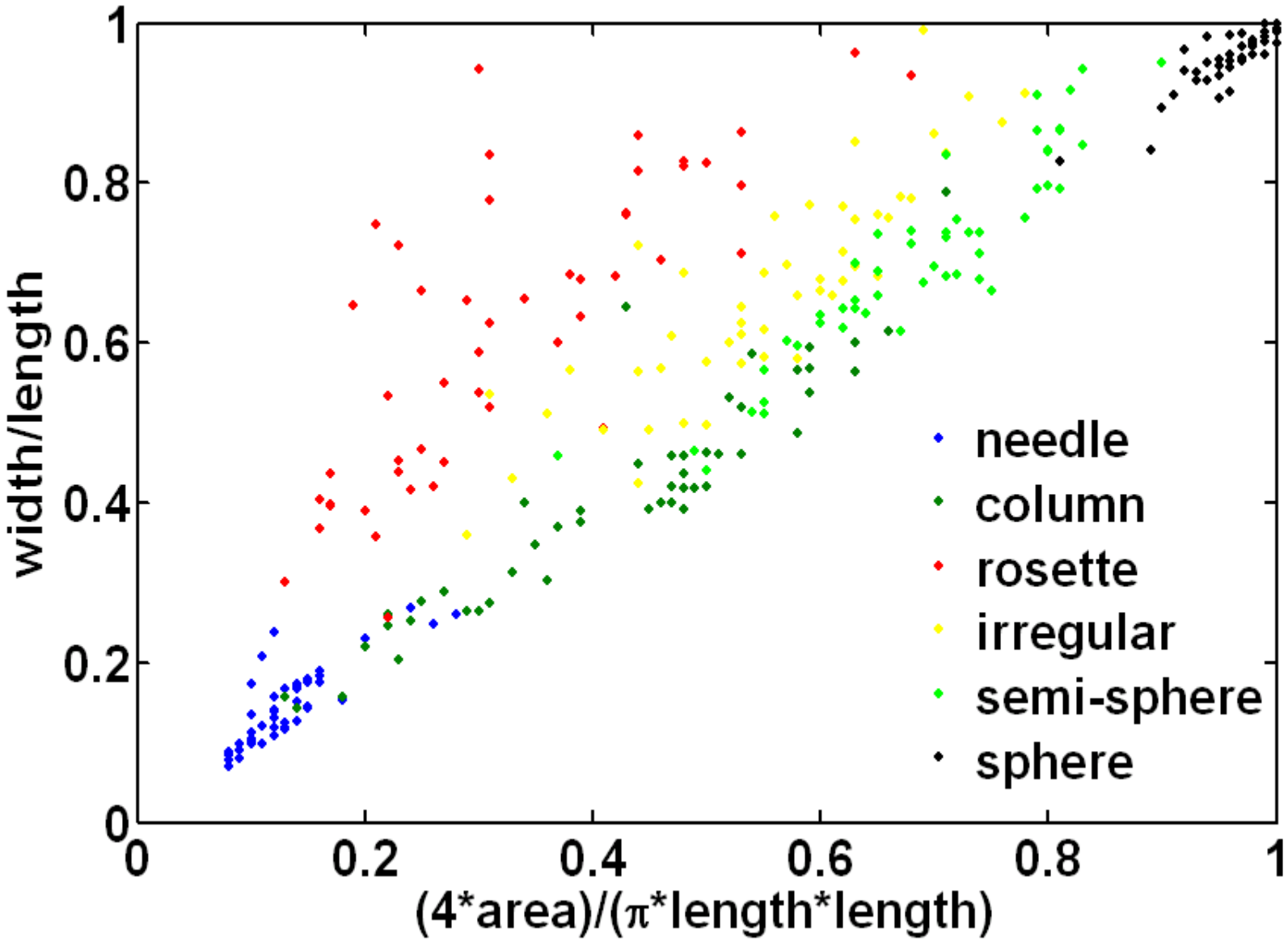


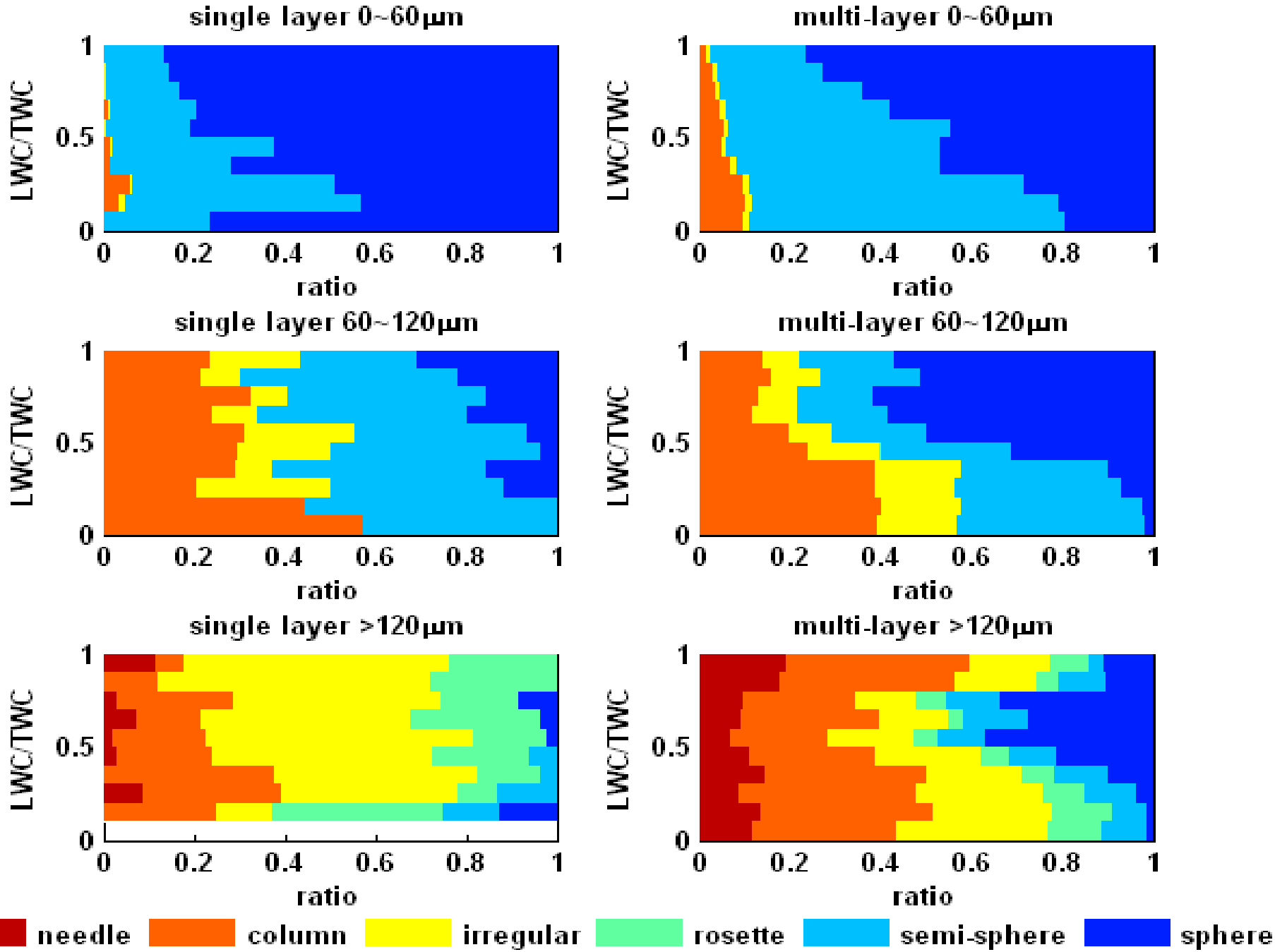
Semi-sphere



sphere




1
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1
width/length
(4*area)/(π*length*length)
needle
column
rosette
irregular
semi-sphere
sphere


single layer 0~60μm
multi-layer 0~60μm
single layer 60~120μm
multi-layer 60~120μm
single layer >120μm
multi-layer >120μm
LWC/TWC
ratio
0
0.5
1
0.2
0.4
0.6
0.8
needle
column
irregular
rosette
semi-sphere
sphere

Conclusions

	Single-layer	Multi-layer
Phase	More mixed-phase clouds	More ice clouds
Frequency of LWC/TWC	More water contributions	More ice contributions
FSSP	Bigger size	Smaller size
2DC	smaller # for mixed-phase	bigger # for mixed-phase
Shape(0<D<60 μ m)	More spherical particle	More semi-spherical particle
Shape (D>120 μ m)	More irregular	More needle

More super-cooled water influence in single-layer than in multi-laye