GRIP MICROPHYSICS

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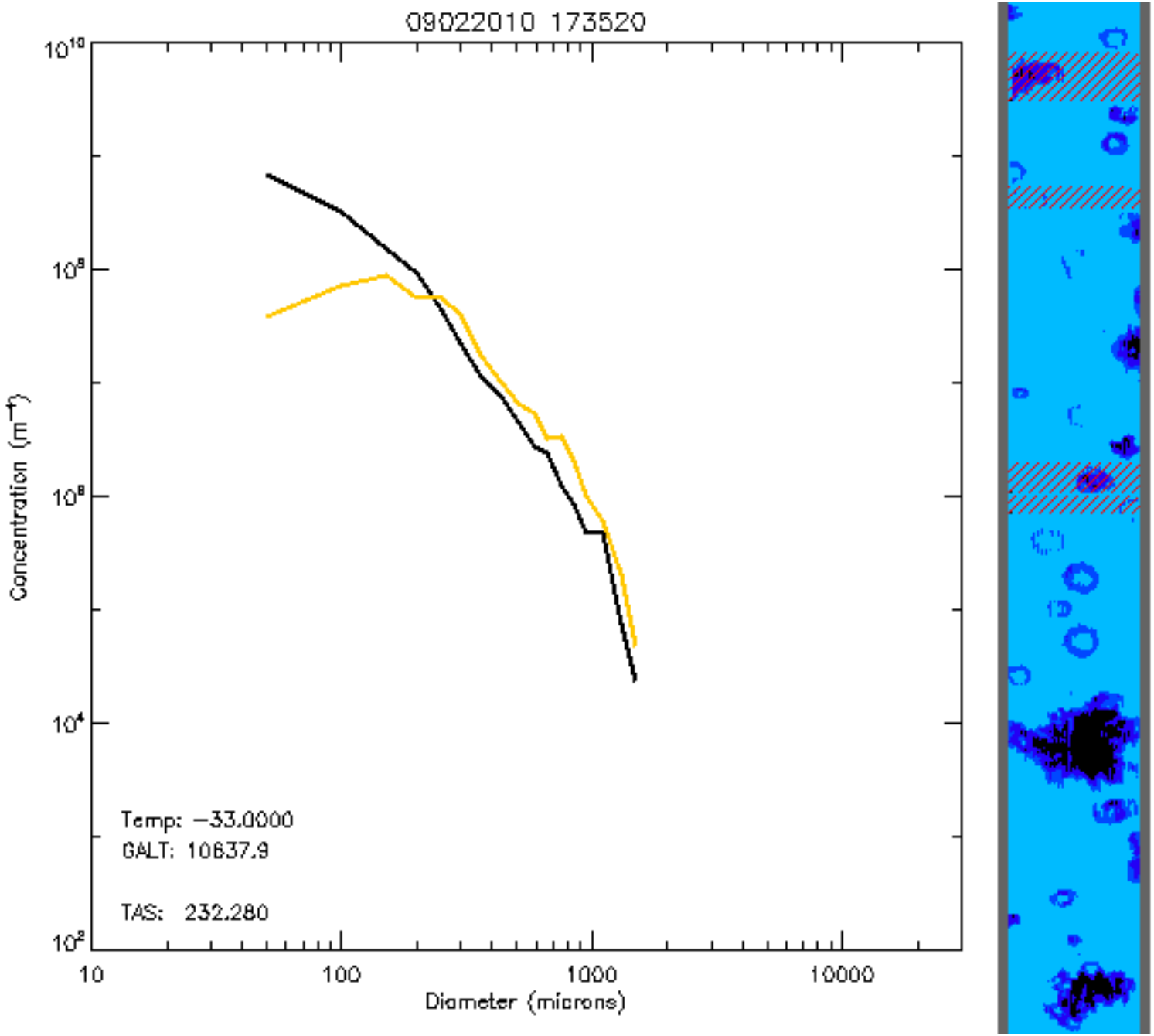
Improved Data Processing 2011-2012

- -Grey-scale CIP (100-1000 microns) images have been reprocessed at 50% grey-level rather than 25% grey-level, resulting in better handling of small particles due to fewer light diffraction problems.
- -Improved detection of artifacts due to probe data compression errors.
- -Shattering corrections have been applied to CIP data using only 50% shadowed particles.
- -CIP, PIP and CDP data look good. Recommend use of CAS only for aerosol and warm cloud due to ice crystal shattering.
- -Archive last updated in April 2012
- -Archived data are at 5-second time resolution, higher rate data are available by request
- -More complete imagery also available upon request
- -Future Improvements : Addressing the question of whether all “small” GRIP particles are real


09022010 173520
Concentration (m⁻³)
Diameter (microns)
Temp: −33.0000
GALT: 10637.9
TAS: 232.280

Examples of How Our GRIP Data Can be Used

- Graupel production in the updrafts
- Liquid water presence
- Droplet concentrations
- Aerosol studies
- GRIP microphysics parameterizations/Hurricane Modeling

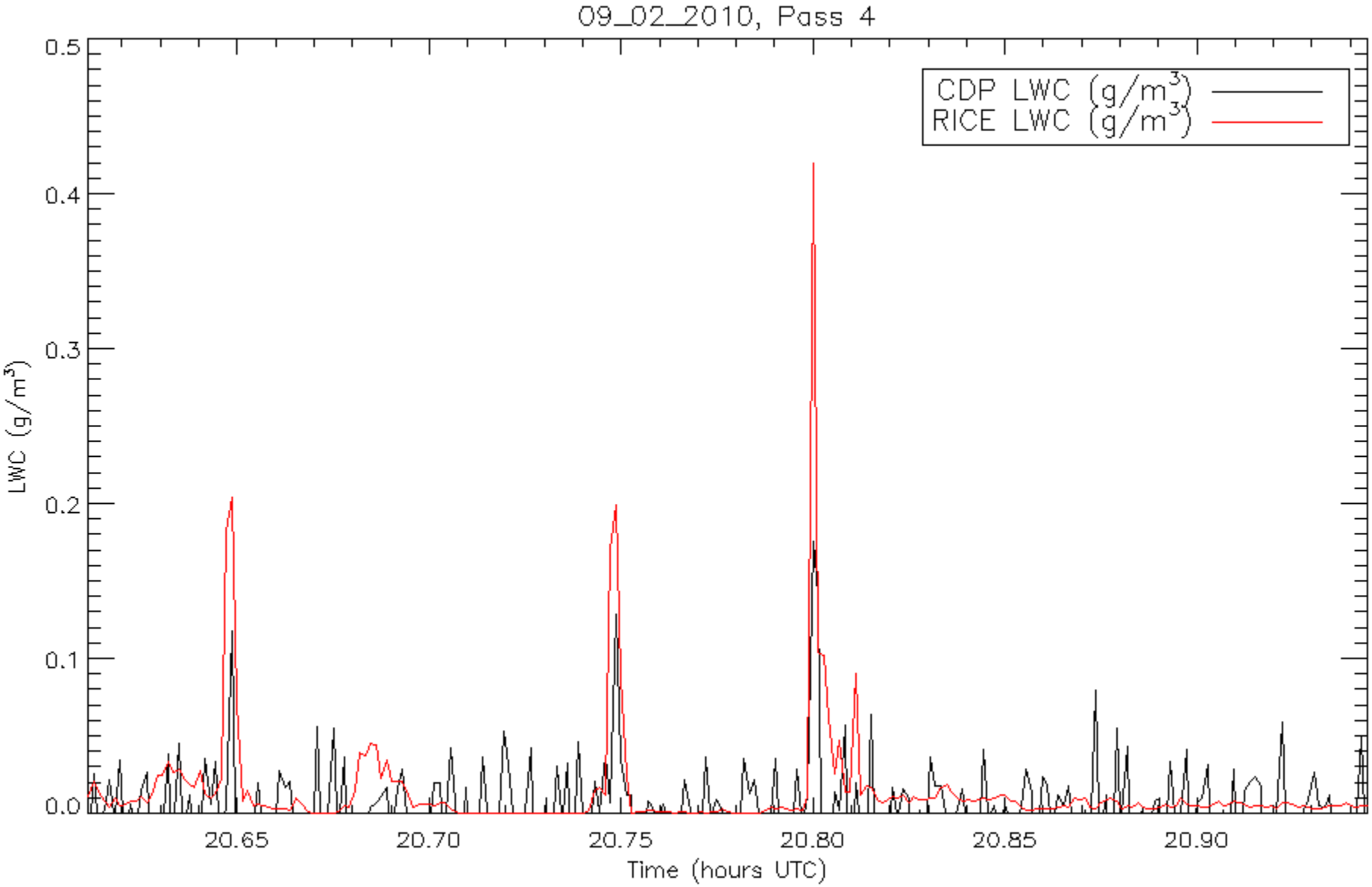
  ---Phase f(position relative to the eyewall, hurricane structure

  ----Specify ice crystal concentration f(temperature)

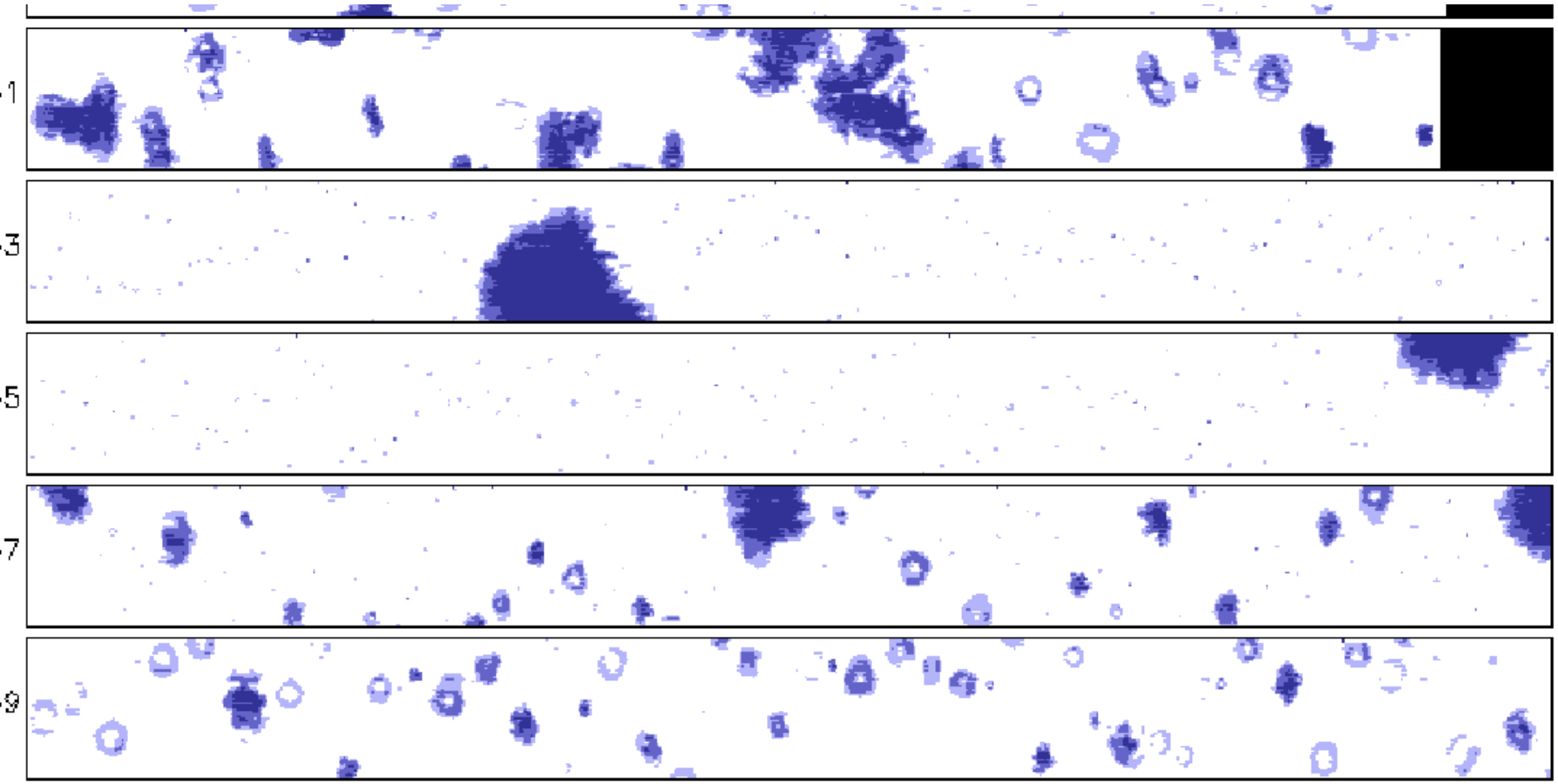
  ----PSD properties

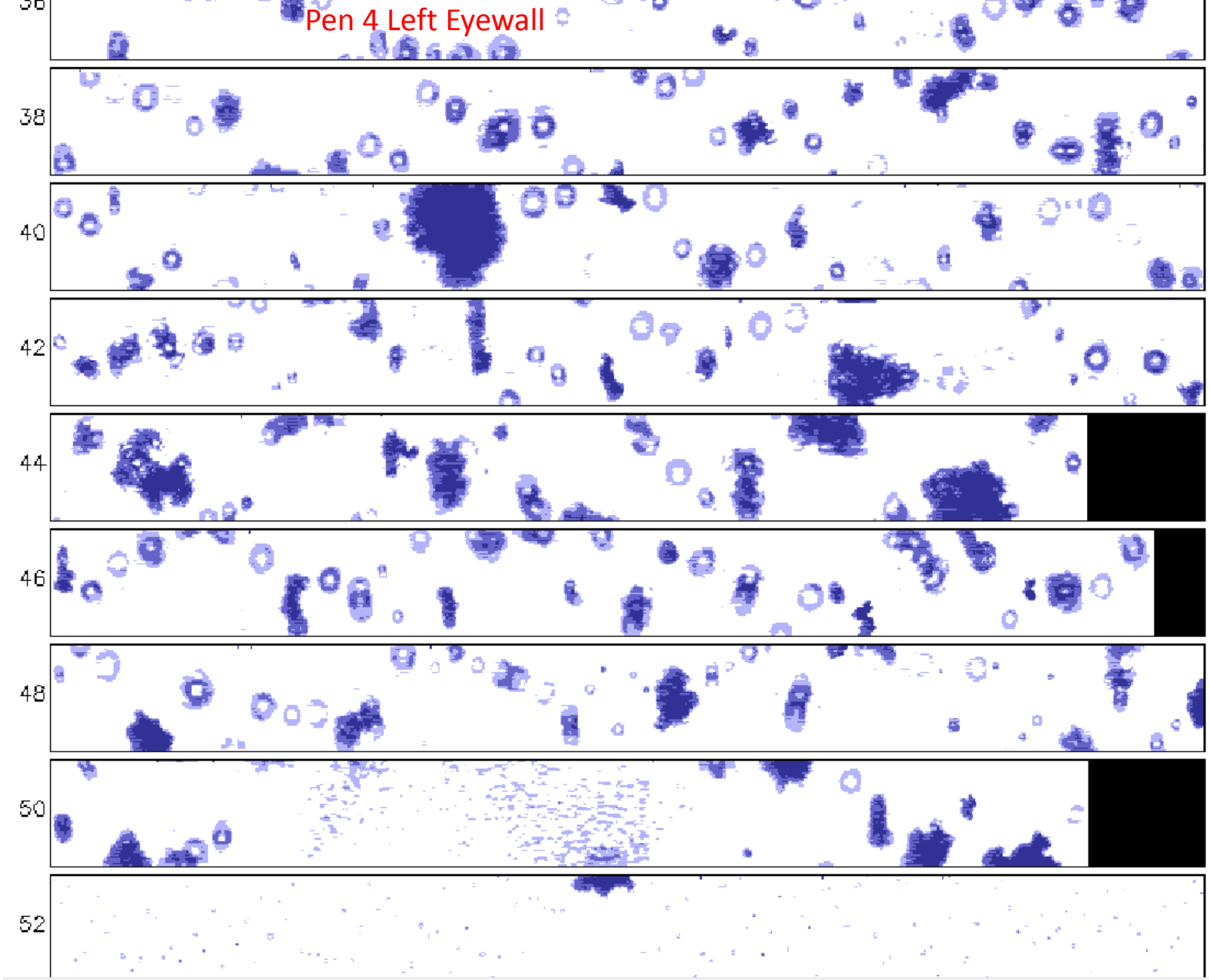
  ----Habits

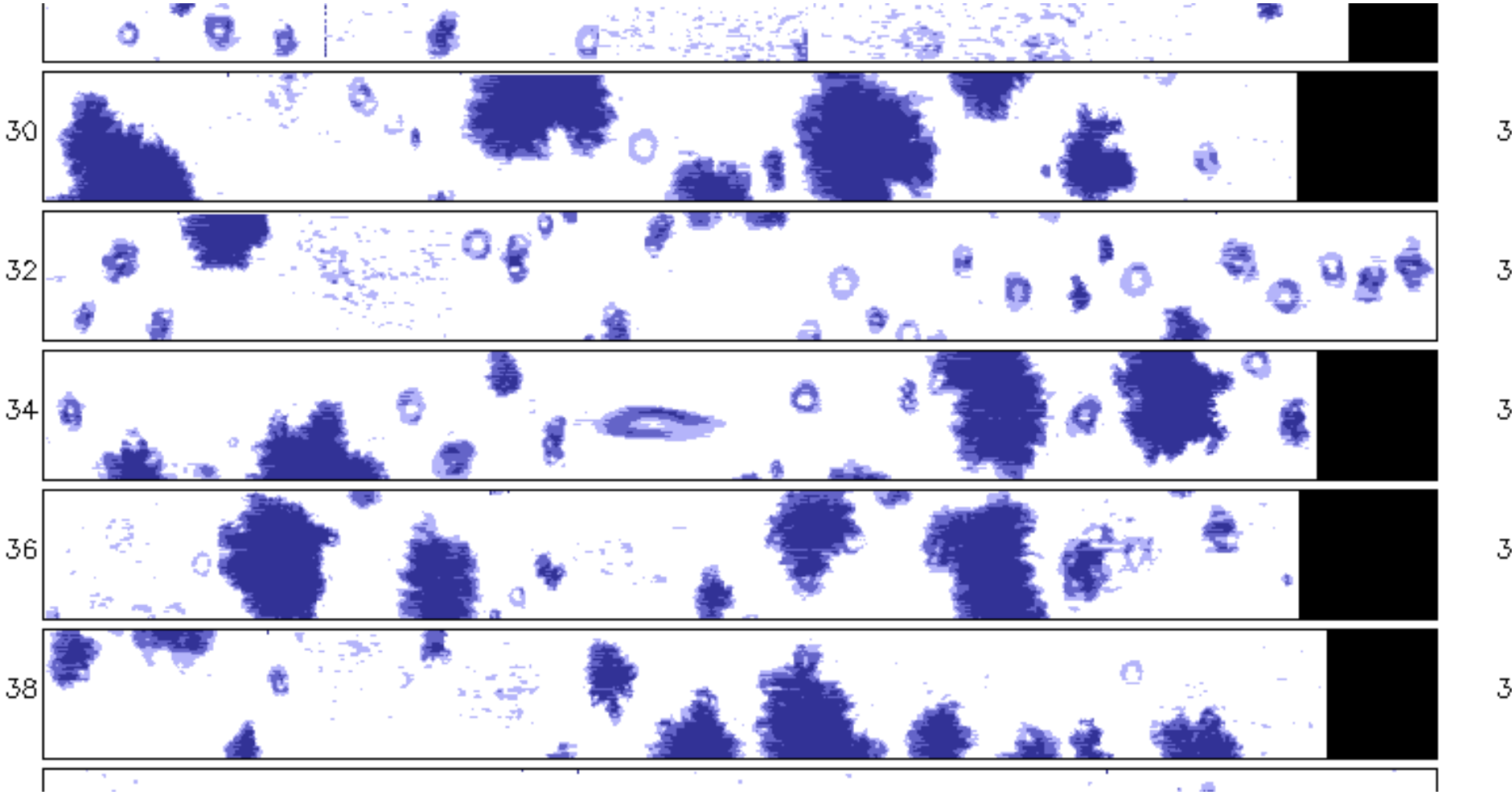
  ----Ice fallspeeds f(crystal characteristics)/precipitation rates

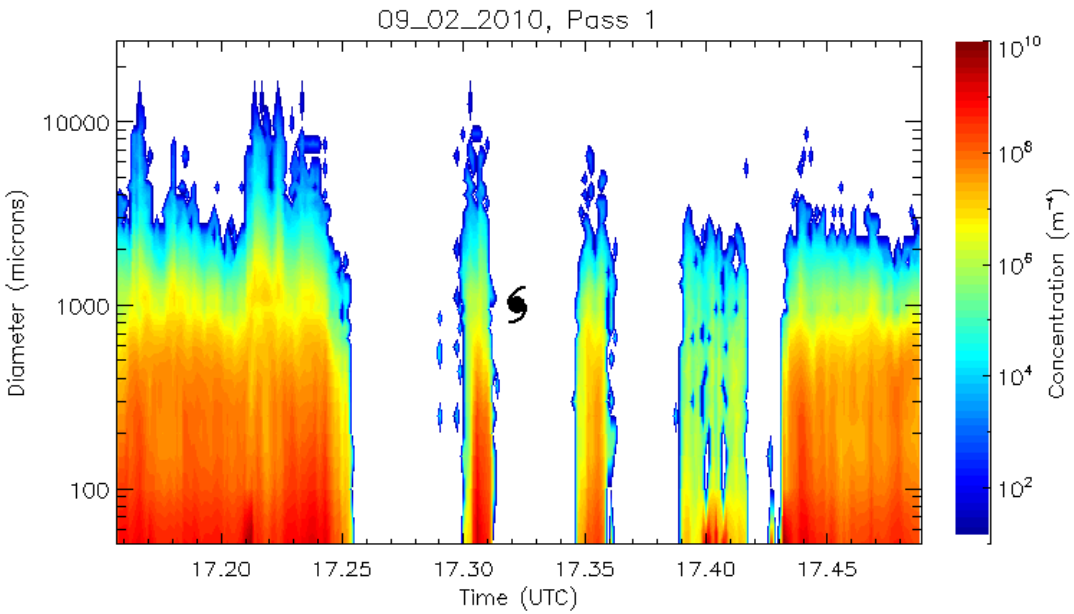

09_02_2010, Pass 4
CDP LWC (g/m3)
RICE LWC (g/m3)
LWC (g/m3)
0.0
0.1
0.2
0.3
0.4
0.5
20.65
20.70
20.75
20.80
20.85
20.90
Time (hours UTC)

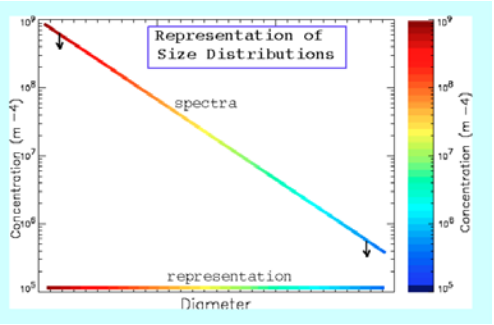
Pen 4 Left Eyewall

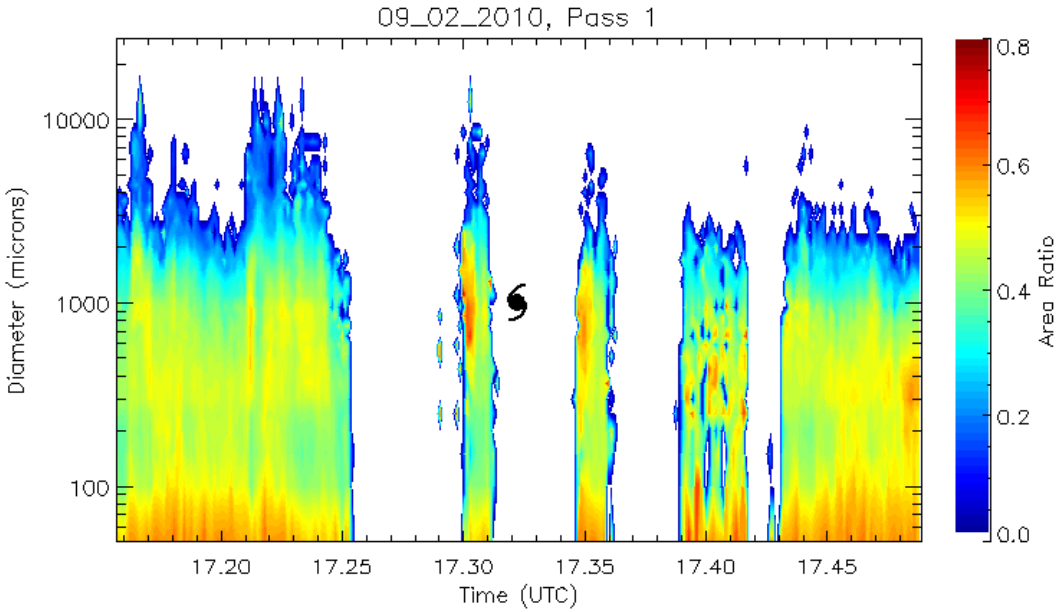


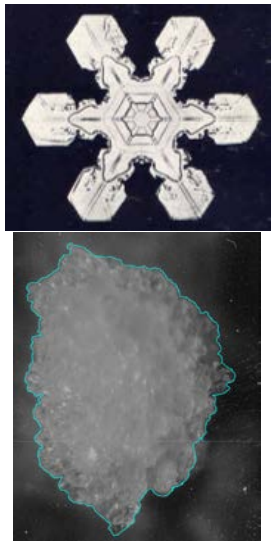

Pen 4 Left Eyewall
36
38
40
42
44
46
48
50
52

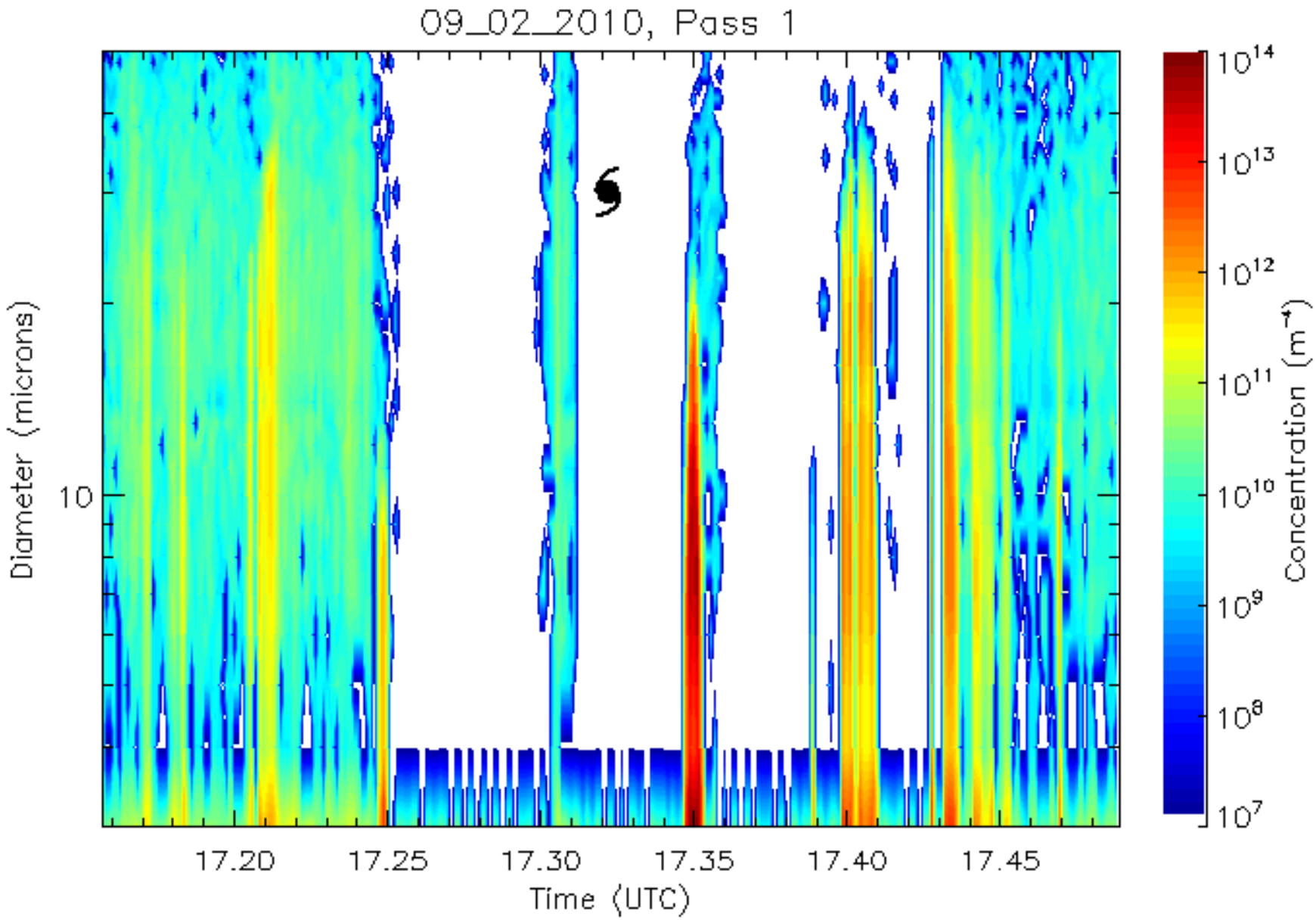

30
32
34
36
38

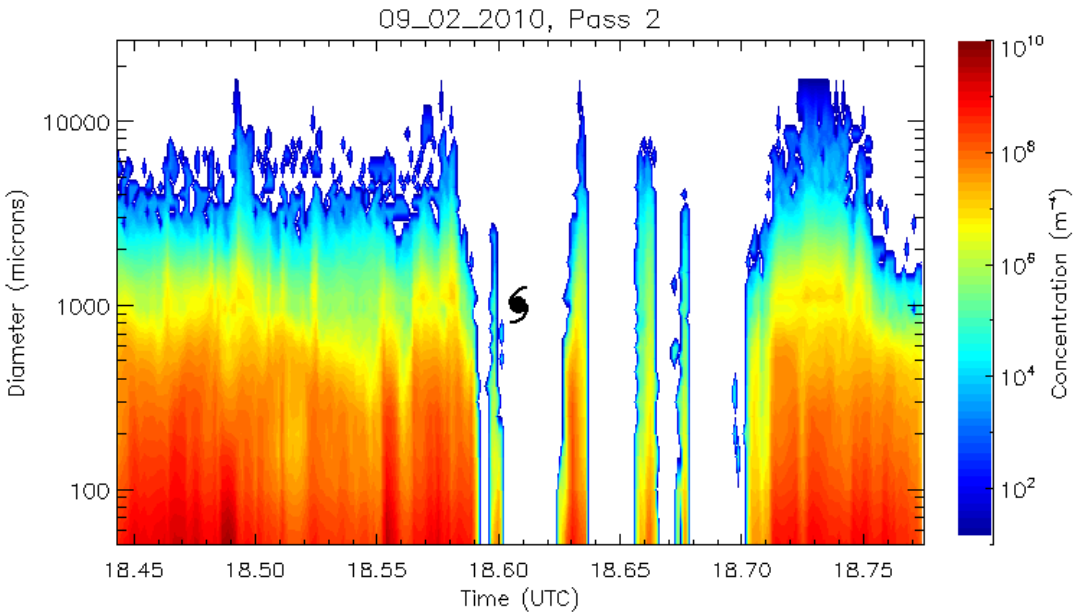

09_02_2010, Pass 1
Diameter (microns)
10000
1000
100
17.20
17.25
17.30
17.35
17.40
17.45
Time (UTC)
10^{10}
10^{8}
10^{6}
10^{4}
10^{2}
Concentration (m^{-1})

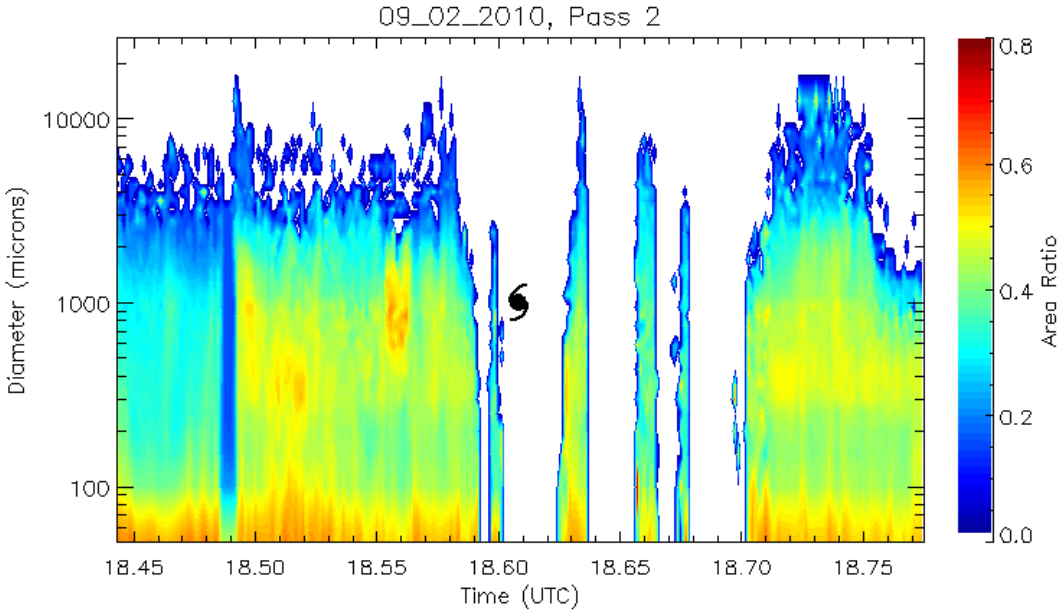

Representation of
Size Distributions
spectra
representation
Concentration (m -4)
Diameter

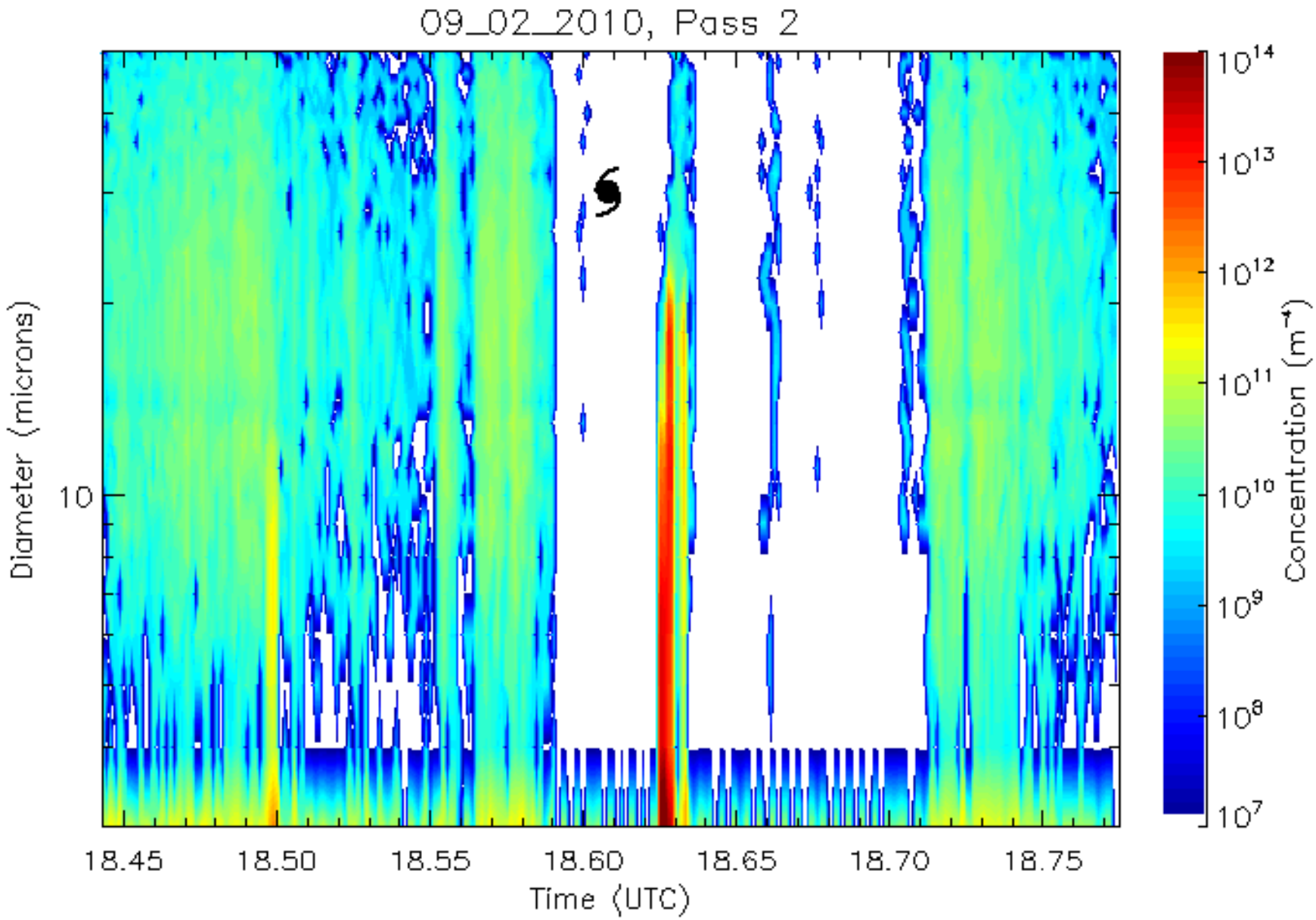

09_02_2010, Pass 1
Diameter (microns)
10000
1000
100
17.20
17.25
17.30
17.35
17.40
17.45
Time (UTC)
0.8
0.6
0.4
0.2
0.0
Area Ratio

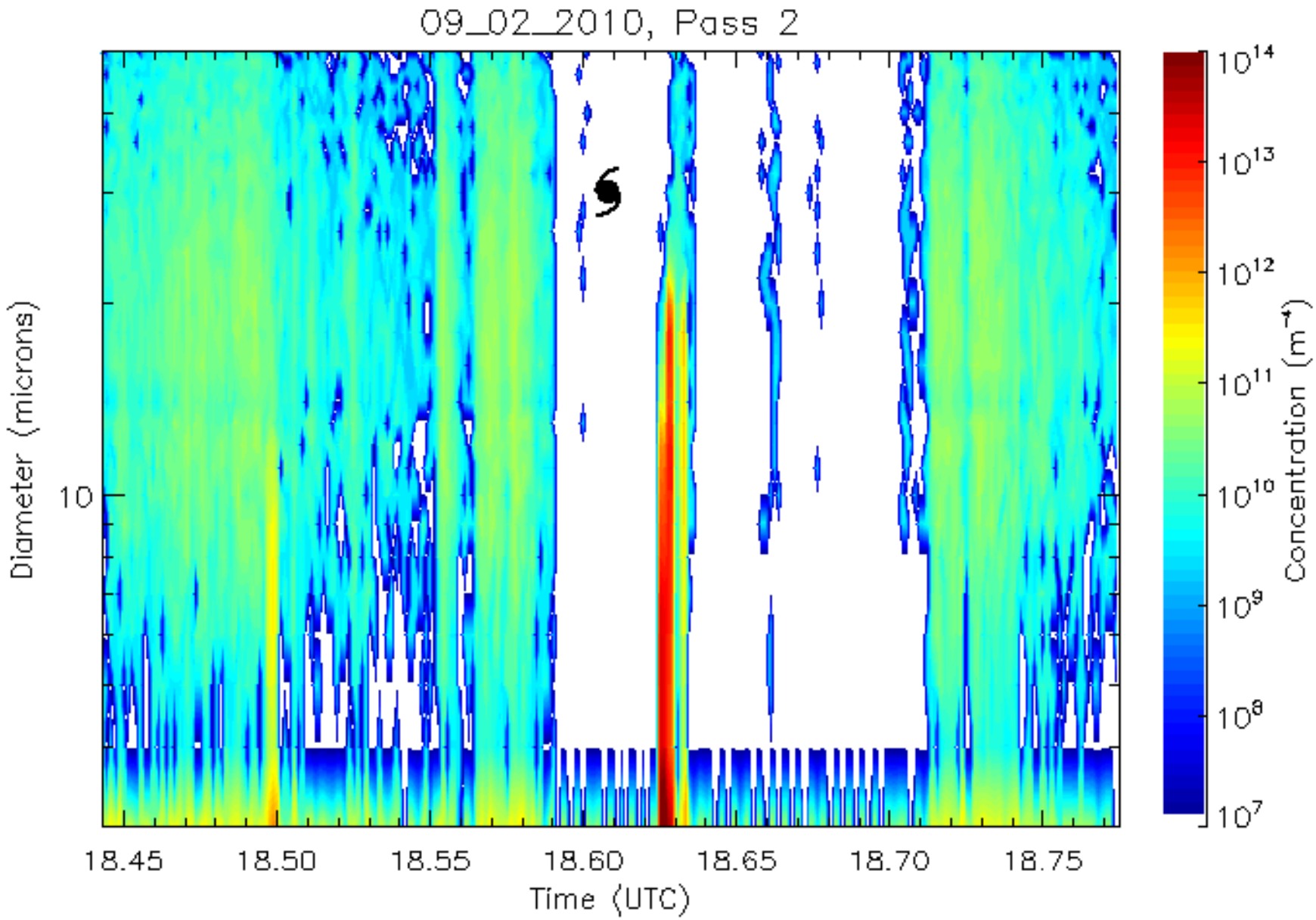


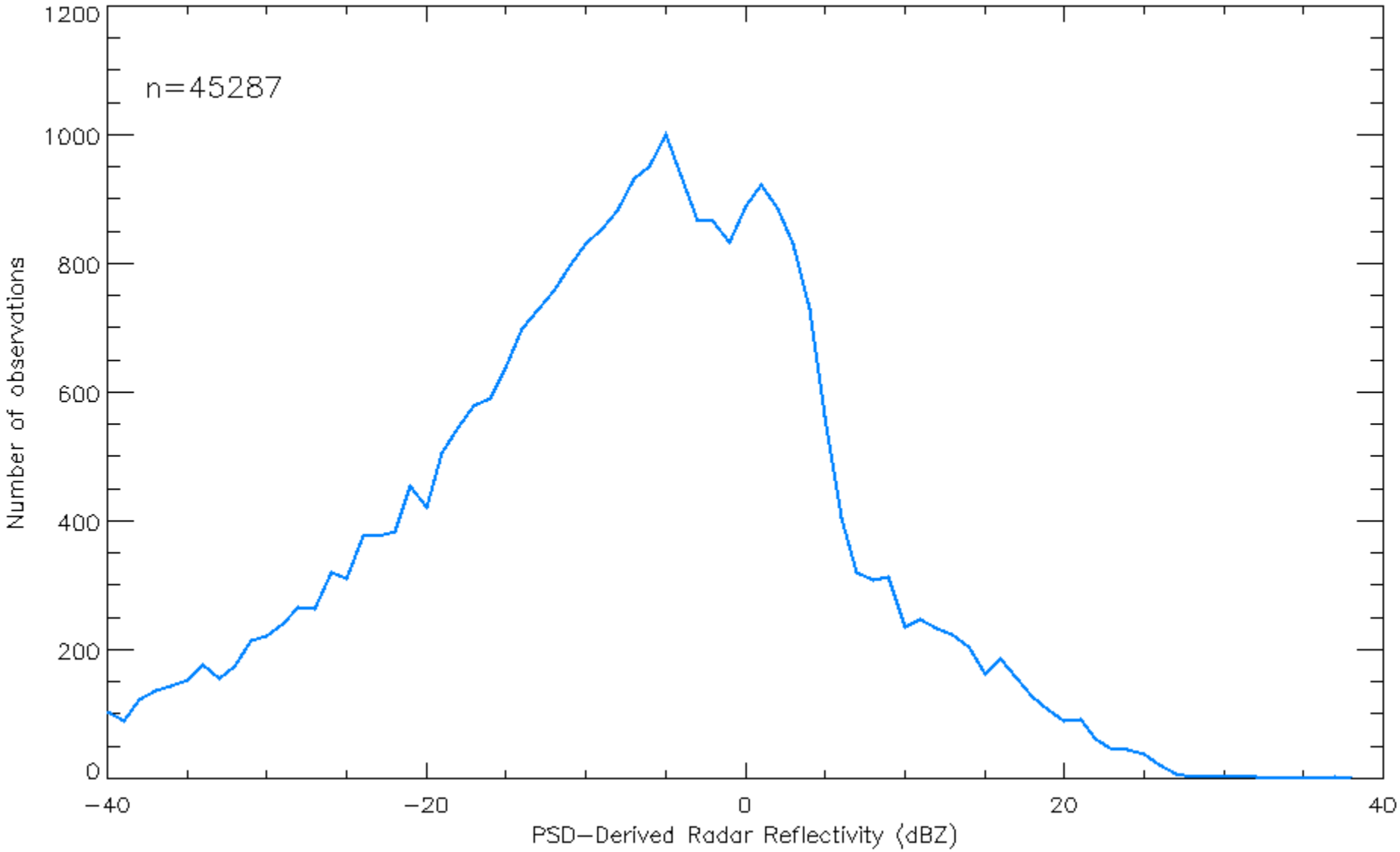

09_02_2010, Pass 1
Diameter (microns)
10
17.20
17.25
17.30
17.35
17.40
17.45
Time (UTC)
10^{14}
10^{13}
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
Concentration (m^{-4})

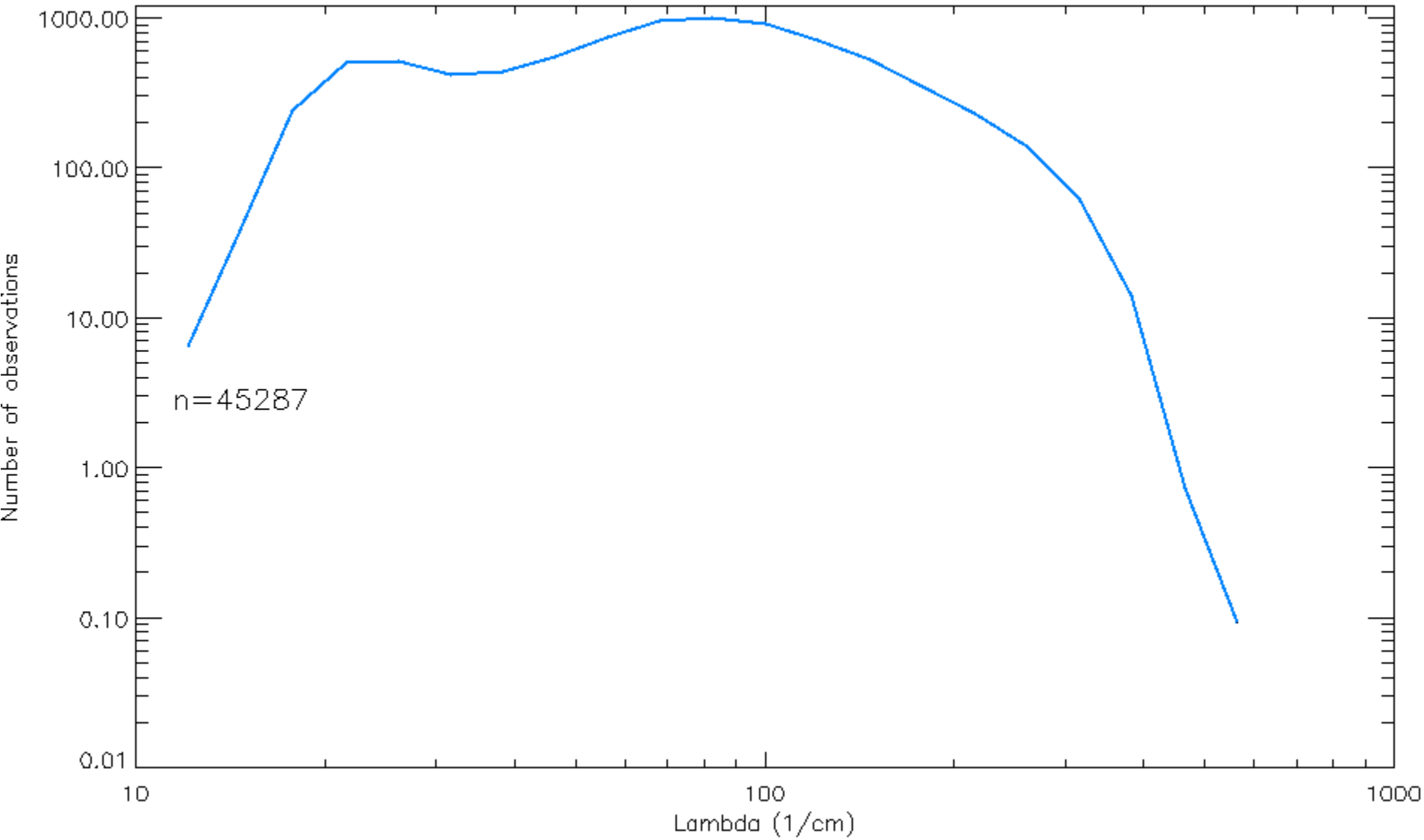

09_02_2010, Pass 2
Diameter (microns)
10000
1000
100
18.45
18.50
18.55
18.60
18.65
18.70
18.75
Time (UTC)
Concentration (m⁻⁴)
10¹⁰
10⁸
10⁶
10⁴
10²

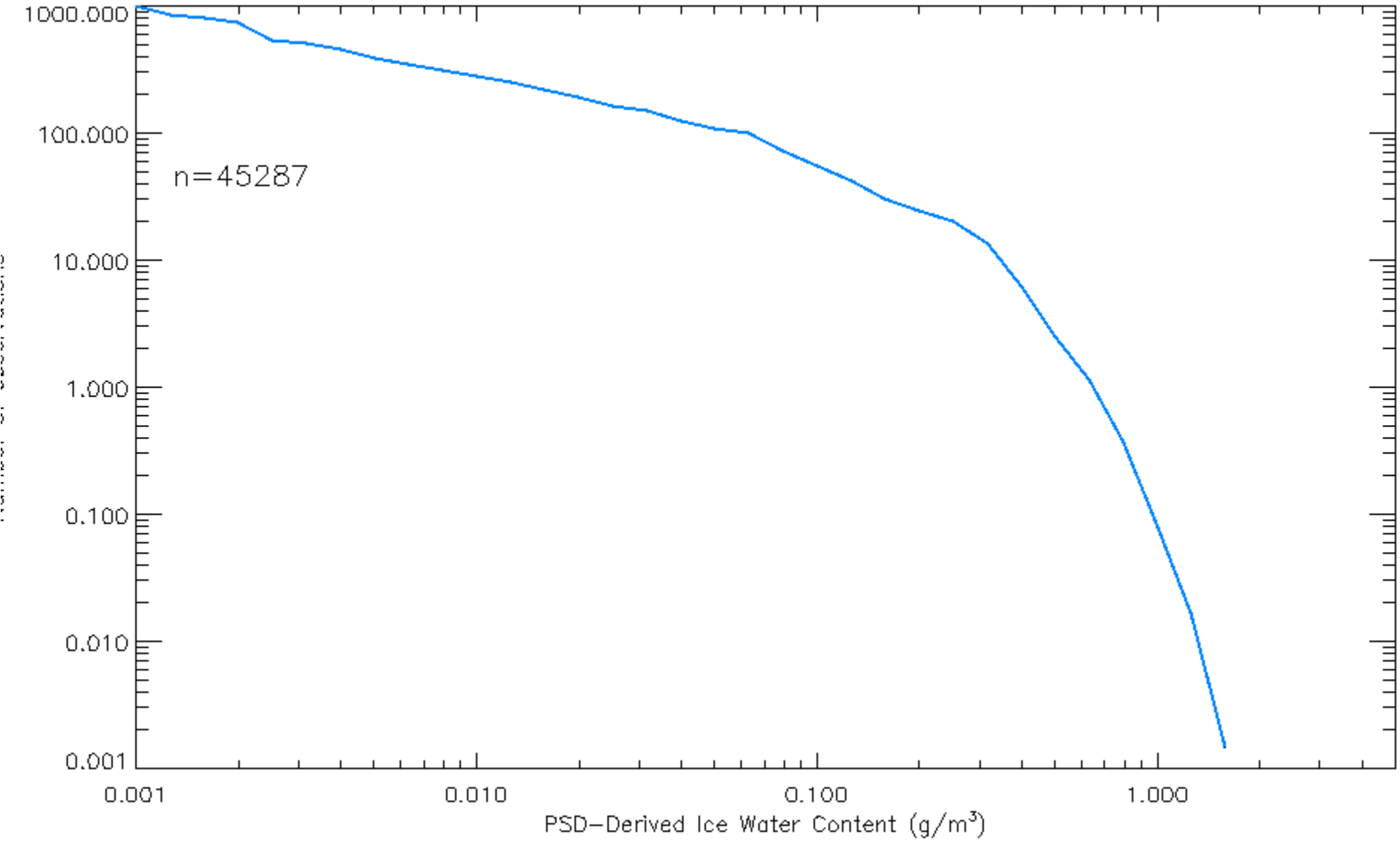

09_02_2010, Pass 2
Diameter (microns)
10000
1000
100
18.45
18.50
18.55
18.60
18.65
18.70
18.75
Time (UTC)
Area Ratio
0.8
0.6
0.4
0.2
0.0

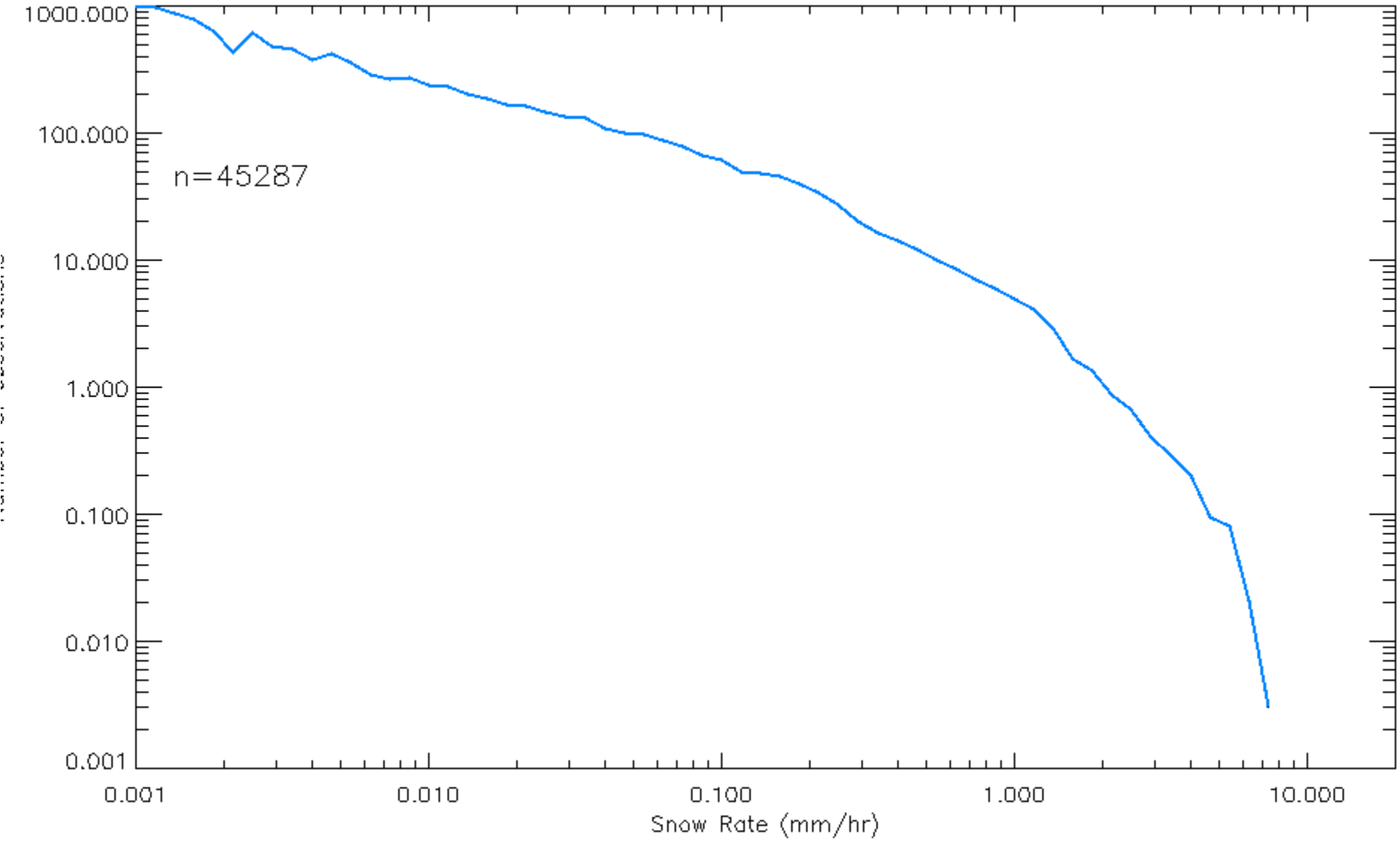

09_02_2010, Pass 2
Diameter (microns)
10
18.45
18.50
18.55
18.60
18.65
18.70
18.75
Time (UTC)
10^{14}
10^{13}
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
Concentration (m^{-4})

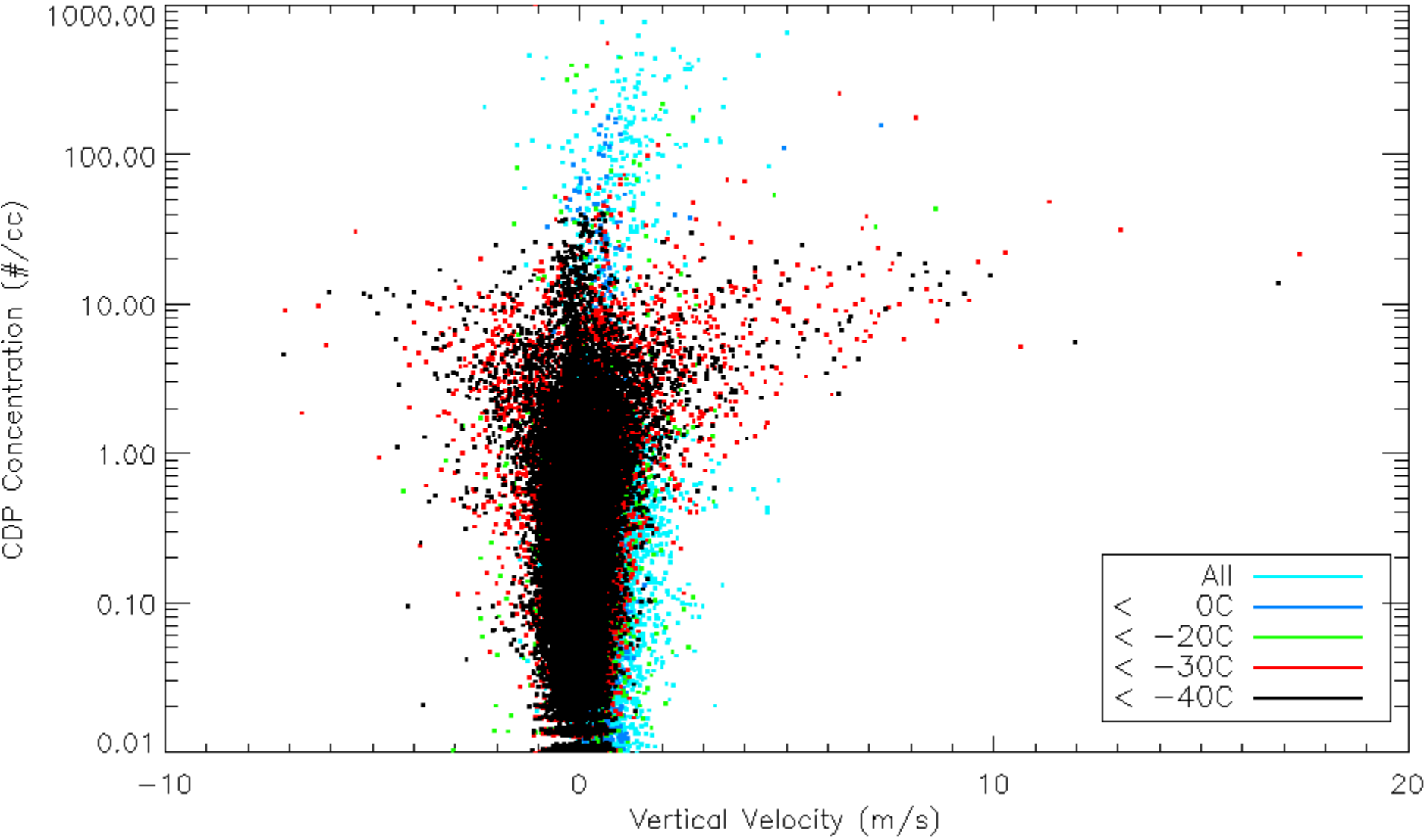

09_02_2010, Pass 2
Diameter (microns)
10
18.45
18.50
18.55
18.60
18.65
18.70
18.75
Time (UTC)
10^{14}
10^{13}
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
Concentration (m^{-4})

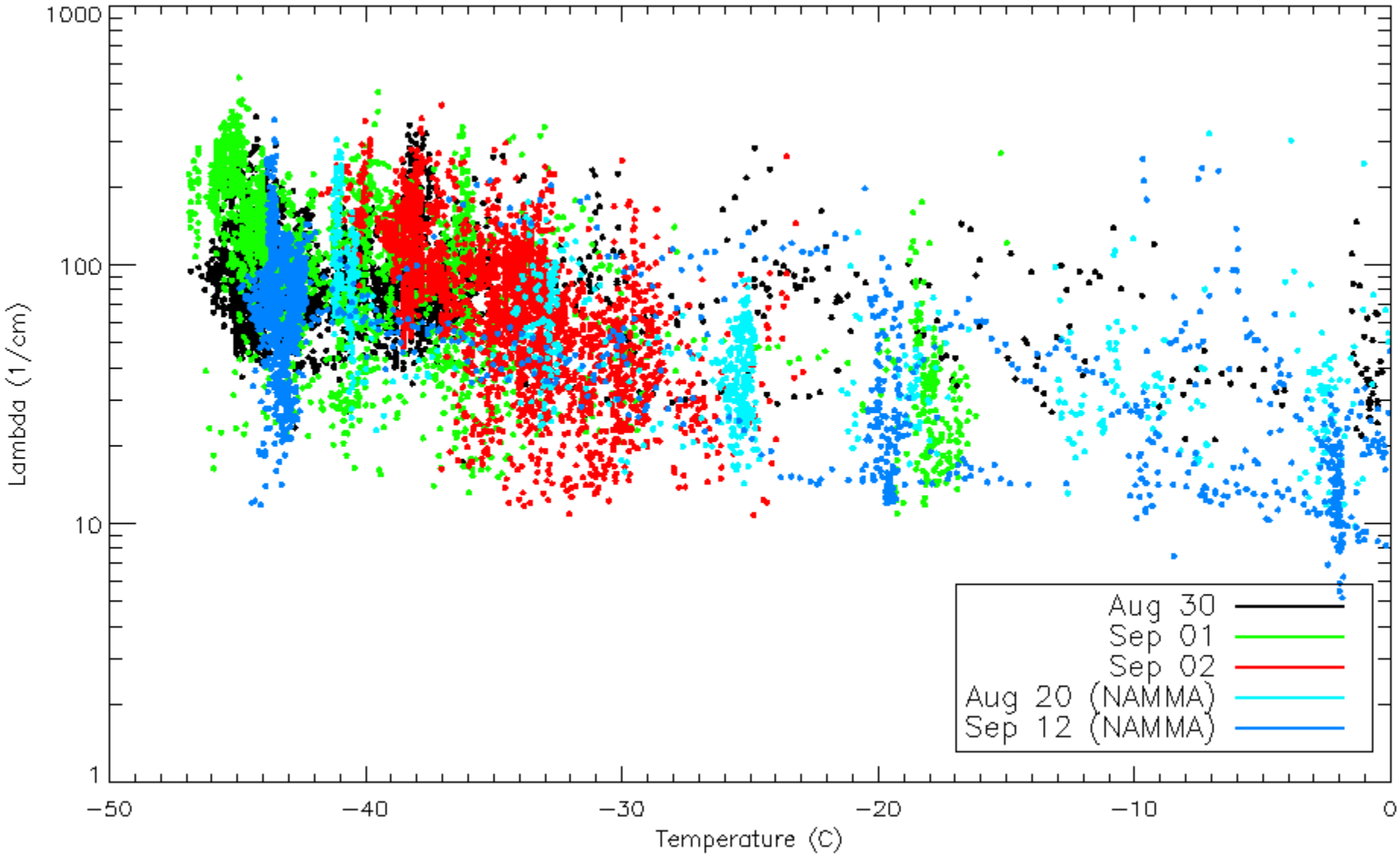

n=45287
Number of observations
PSD−Derived Radar Reflectivity (dBZ)
0
200
400
600
800
1000
1200
−40
−20
0
20
40

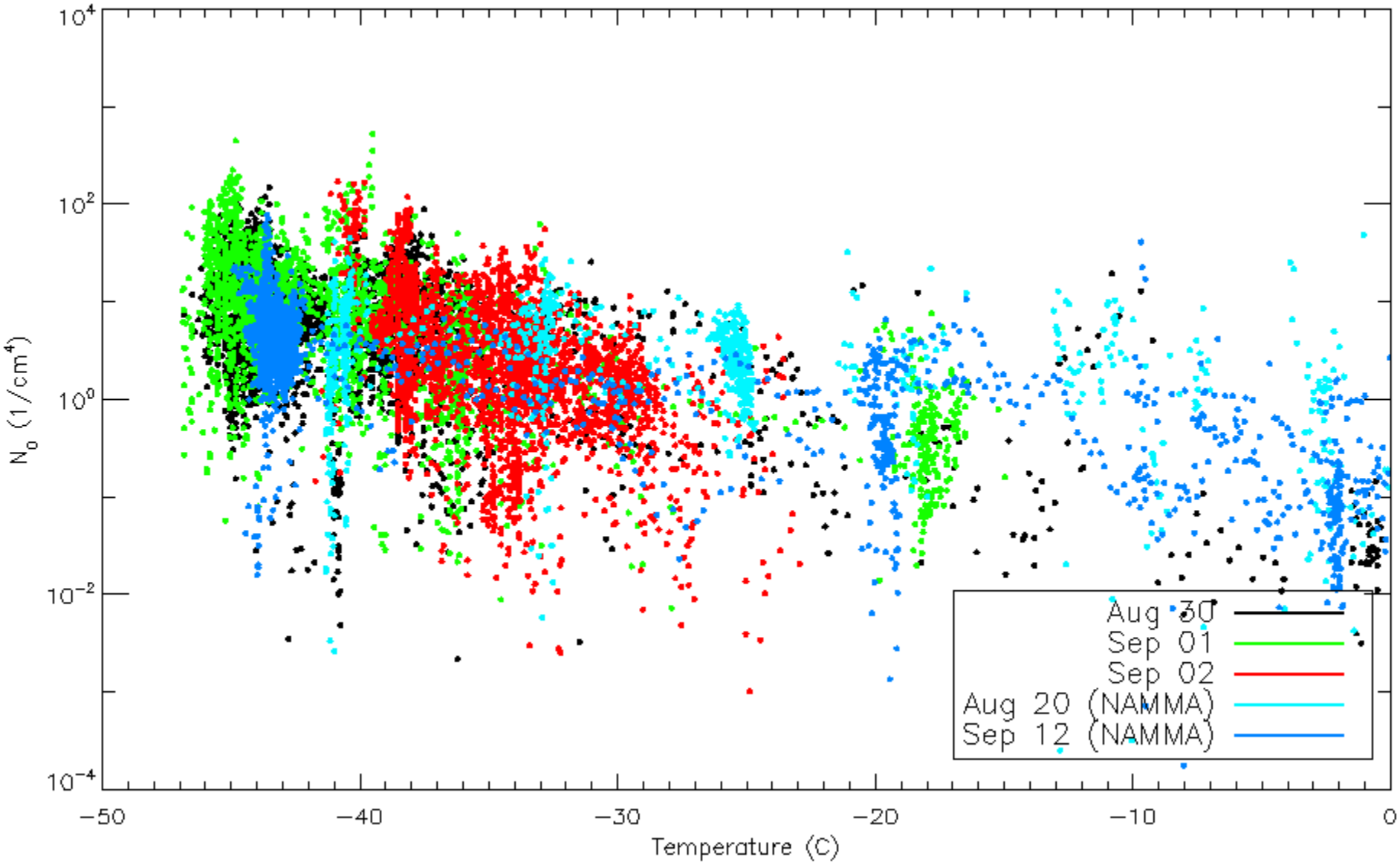

1000.00
100.00
10.00
1.00
0.10
0.01
Number of observations
n=45287
10
100
1000
Lambda (1/cm)

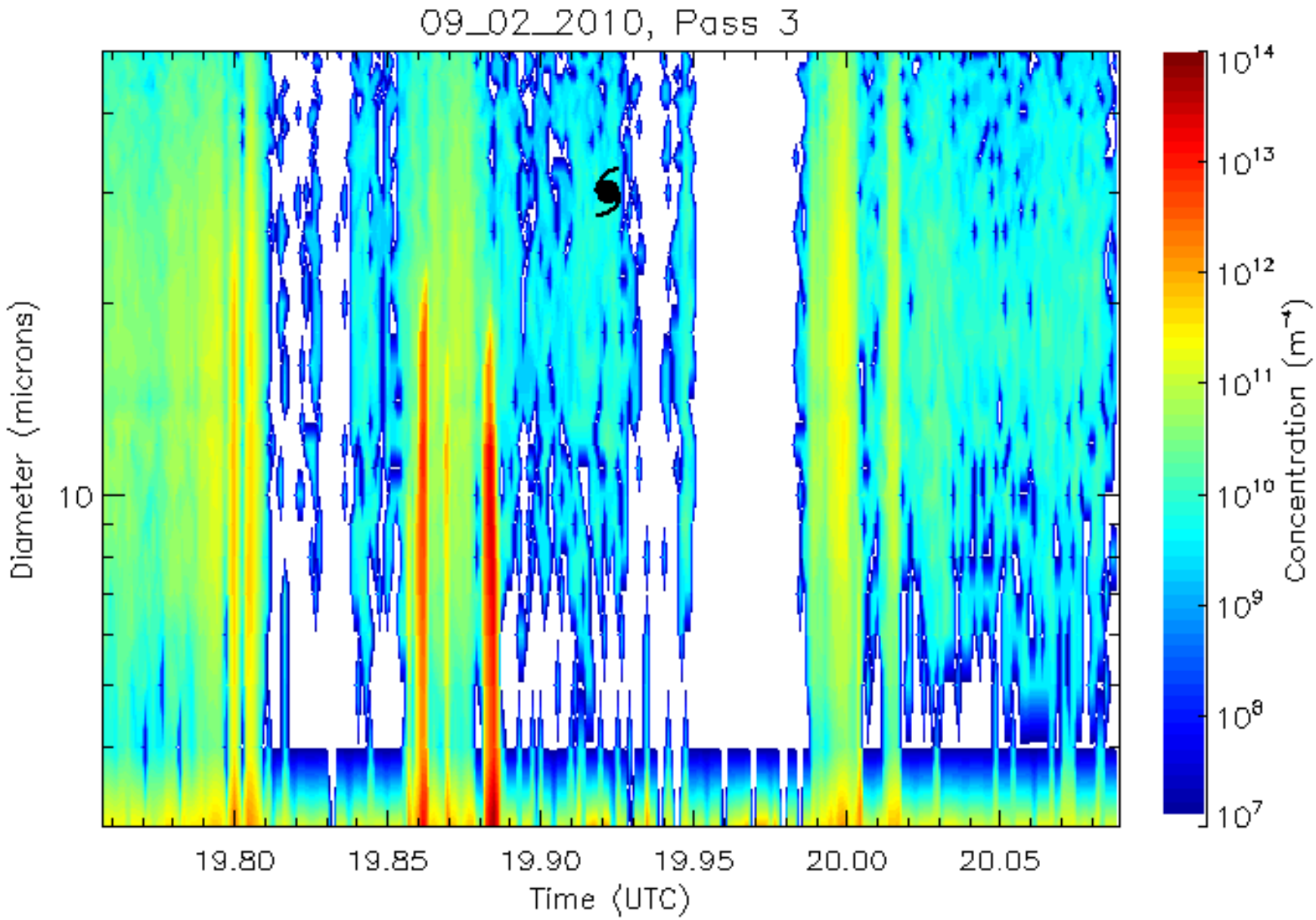

1000.000
100.000
10.000
1.000
0.100
0.010
0.001
n=45287
0.001
0.010
0.100
1.000
PSD−Derived Ice Water Content (g/m³)

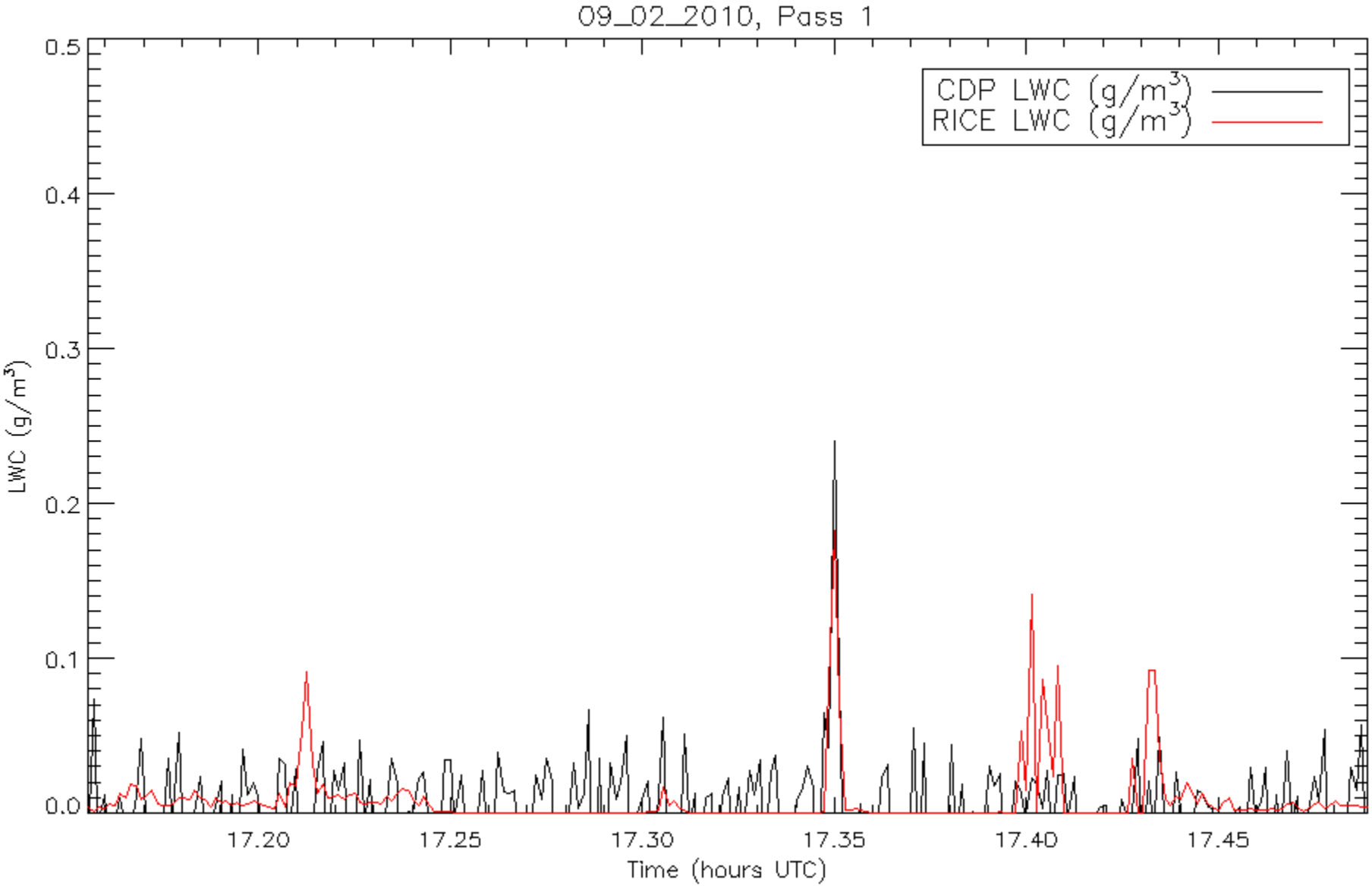

1000.000
100.000
10.000
1.000
0.100
0.010
0.001
n=45287
0.001
0.010
0.100
1.000
10.000
Snow Rate (mm/hr)

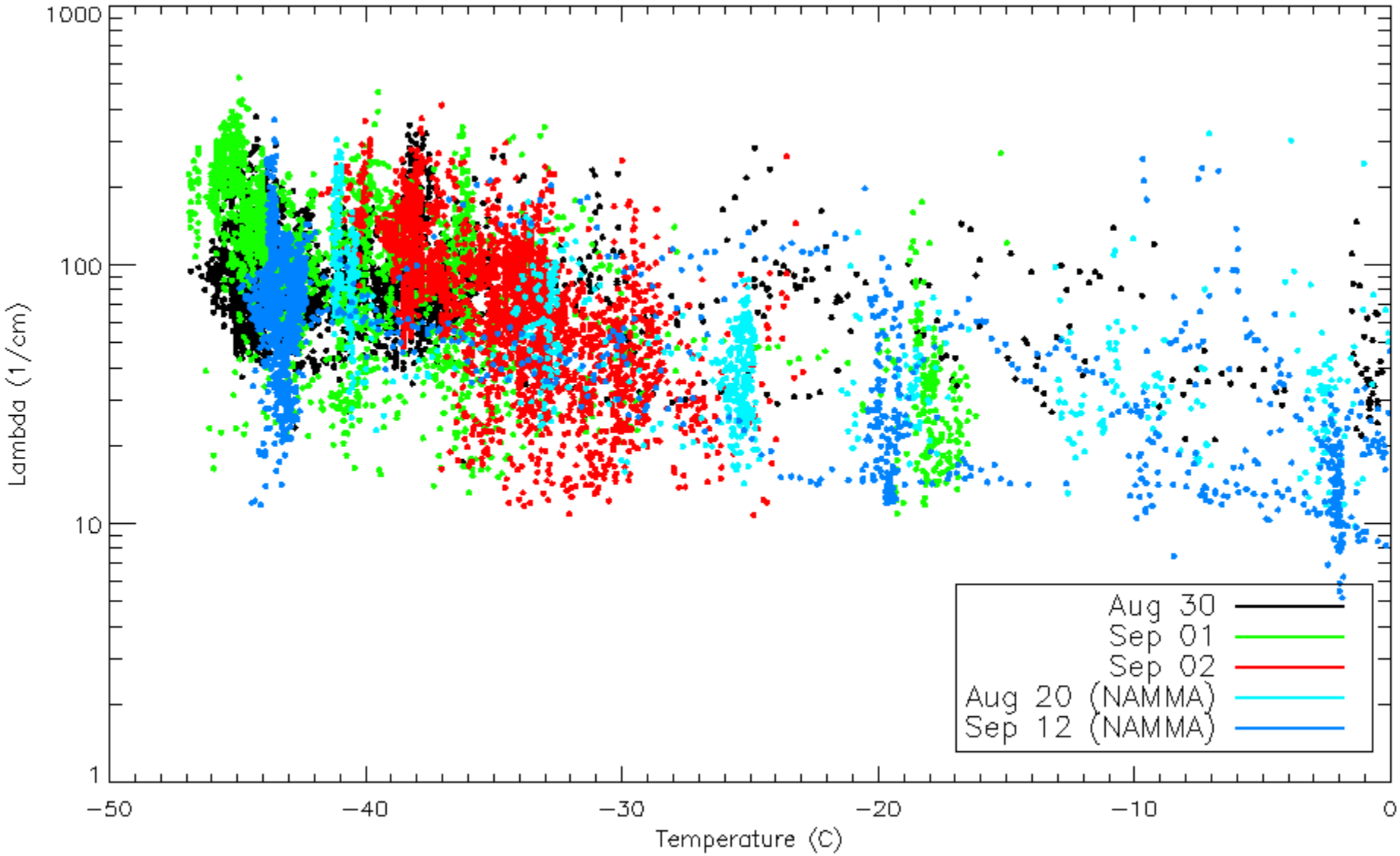

1000.00
100.00
10.00
1.00
0.10
0.01
CDP Concentration (#/cc)
−10
0
10
20
Vertical Velocity (m/s)
All
< 0C
< −20C
< −30C
< −40C

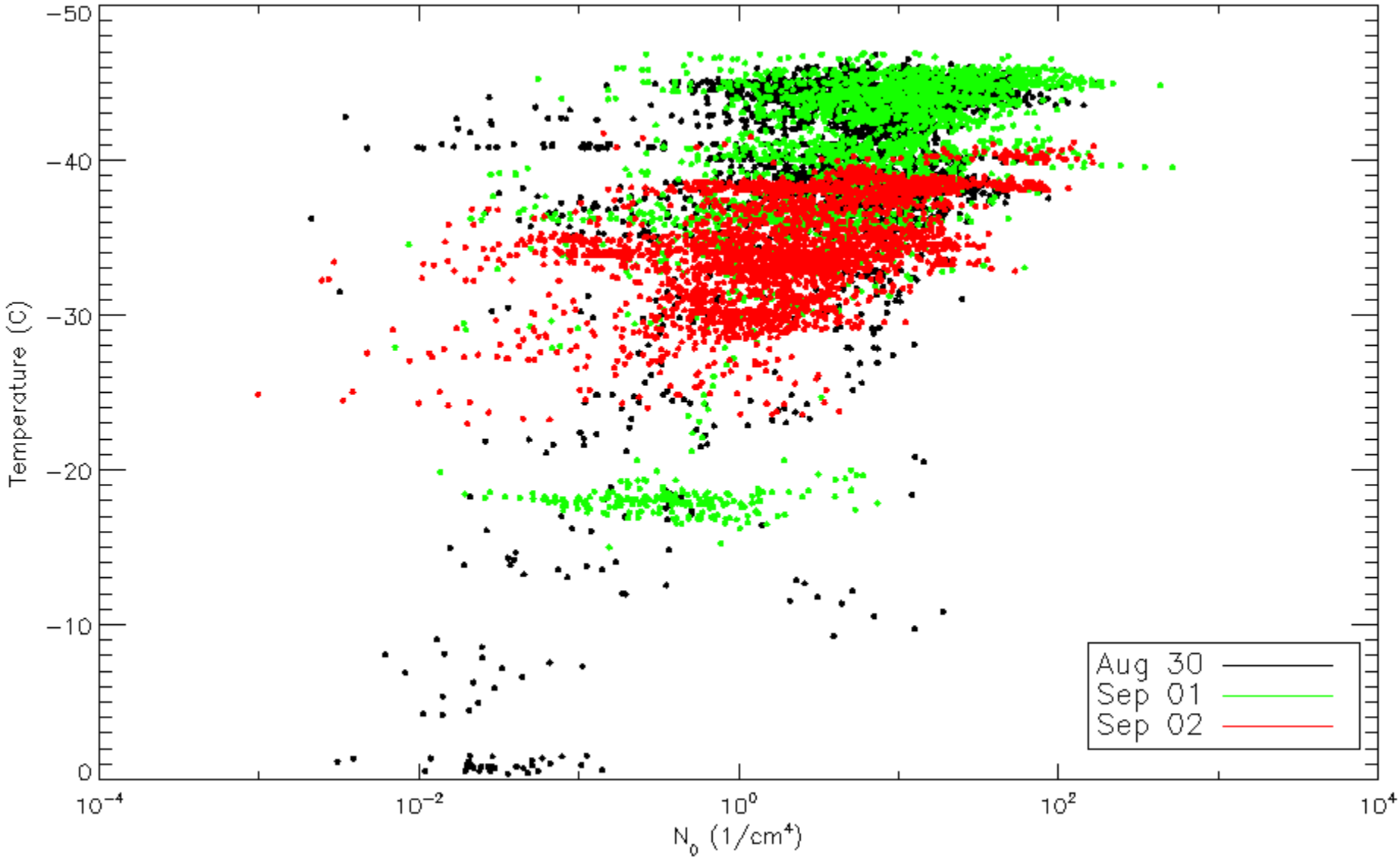

1000
100
10
1
Lambda (1/cm)
−50
−40
−30
−20
−10
0
Temperature (C)
Aug 30
Sep 01
Sep 02
Aug 20 (NAMMA)
Sep 12 (NAMMA)

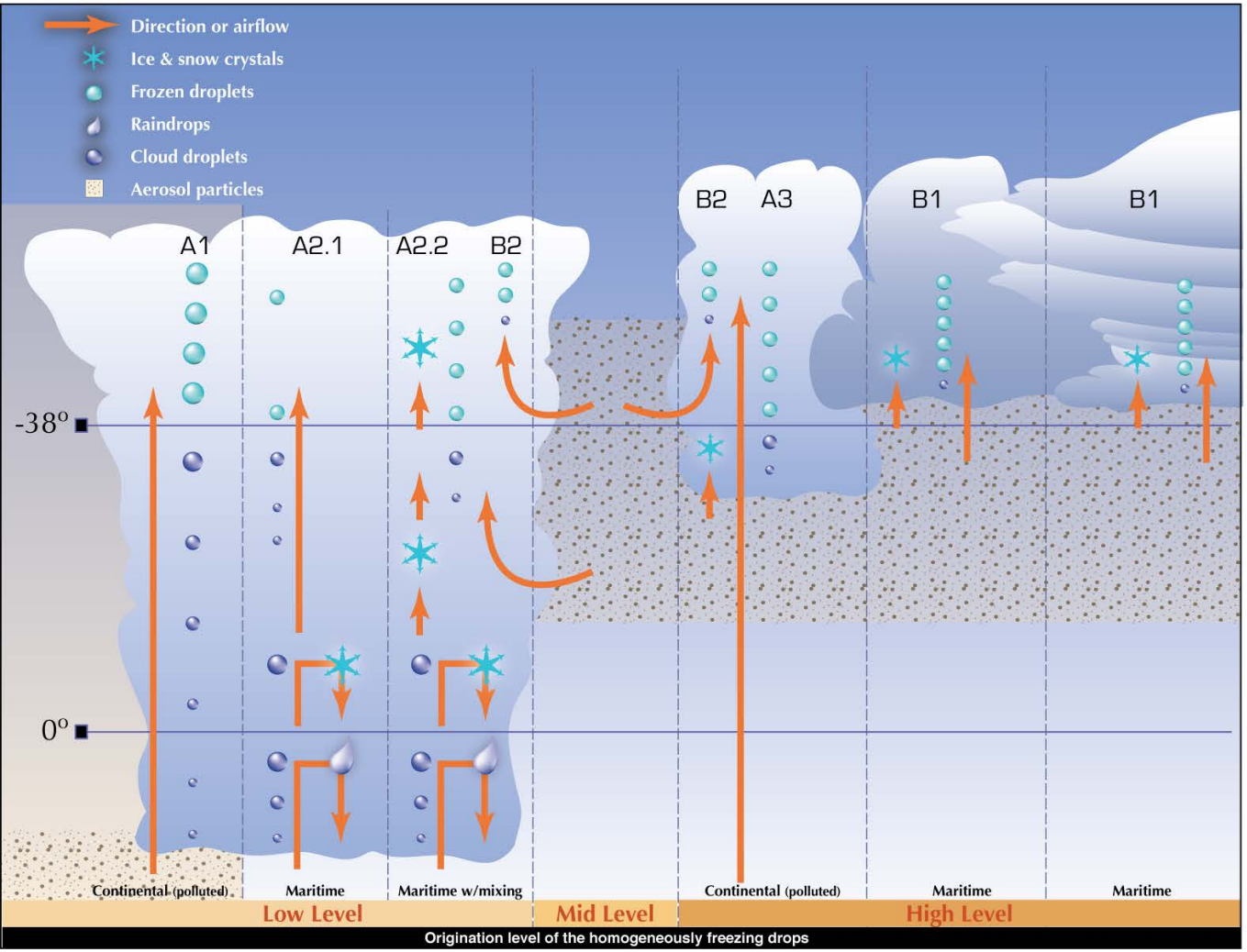

10^4
10^2
10^0
10^{-2}
10^{-4}
N_0 (1/cm^4)
−50
−40
−30
−20
−10
0
Temperature (C)
Aug 30
Sep 01
Sep 02
Aug 20 (NAMMA)
Sep 12 (NAMMA)


09_02_2010, Pass 3
Diameter (microns)
10
19.80
19.85
19.90
19.95
20.00
20.05
Time (UTC)
10^{14}
10^{13}
10^{12}
10^{11}
10^{10}
10^{9}
10^{8}
10^{7}
Concentration (m^{-4})

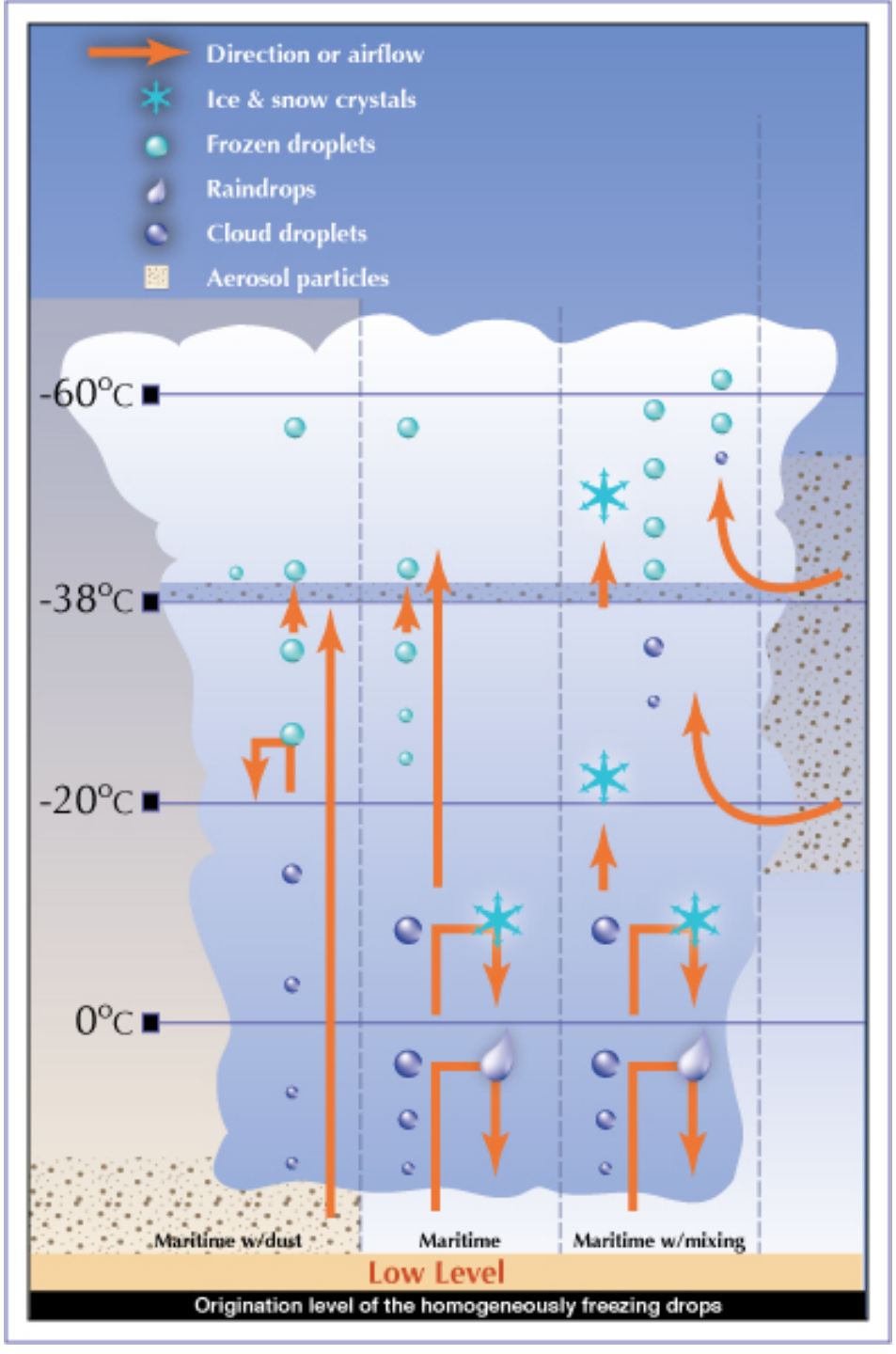

09_02_2010, Pass 1
CDP LWC (g/m3)
RICE LWC (g/m3)
LWC (g/m3)
0.0
0.1
0.2
0.3
0.4
0.5
17.20
17.25
17.30
17.35
17.40
17.45
Time (hours UTC)


1000
100
10
1
Lambda (1/cm)
−50
−40
−30
−20
−10
0
Temperature (C)
Aug 30
Sep 01
Sep 02
Aug 20 (NAMMA)
Sep 12 (NAMMA)


Temperature (C)
−50
−40
−30
−20
−10
0
10^{-4}
10^{-2}
10^{0}
10^{2}
10^{4}
N_0 (1/cm^4)
Aug 30
Sep 01
Sep 02



Heymsfield et al. 2010



Heymsfield et al. (2010)

Plans For the Coming Year

- Report one study on specific microphysical observations from EARL and then a synthesis of all microphysical observations from GRIP
  - Seek collaboration on aerosol properties in the boundary layer and mid-levels, vertical motion fields, lightning studies, especially modeling intercomparisons.
- Synthesize CAMEX-4, NAMMA, GRIP Microphysical Observations
  - Seek collaborators on a study of hurricane ice microphysics f(vertical motions, aerosols in the boundary layer, lightning production, hurricane model results)
- Complete Organization of ICE-D (Ice in Clouds Experiment-Dust) for 2015 from Cape Verde