

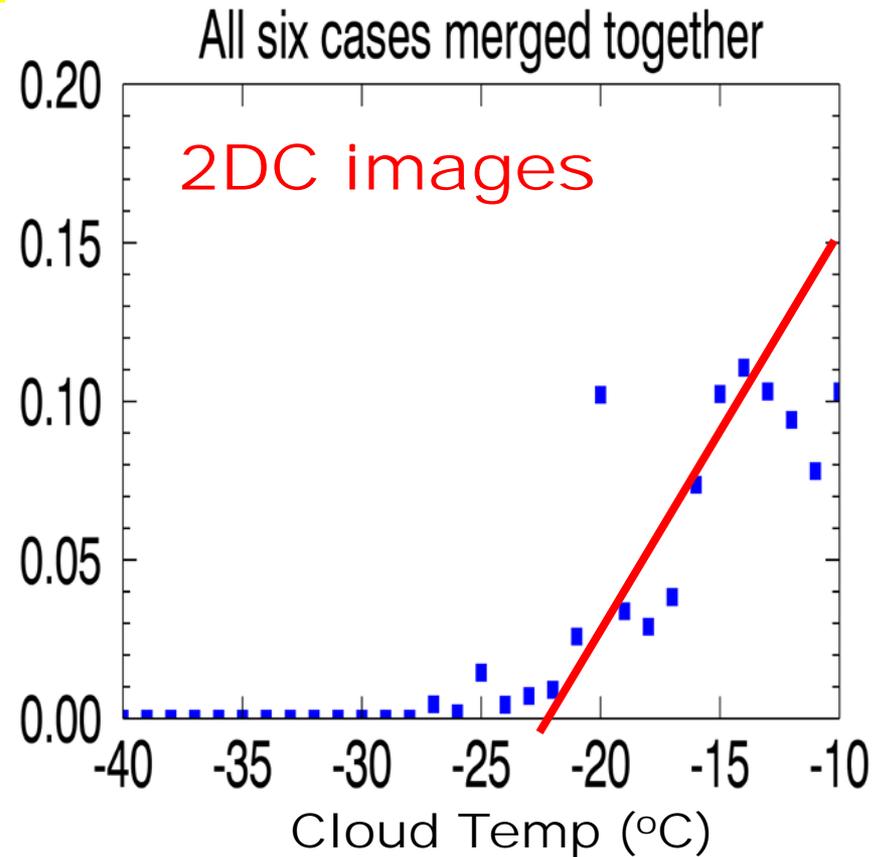
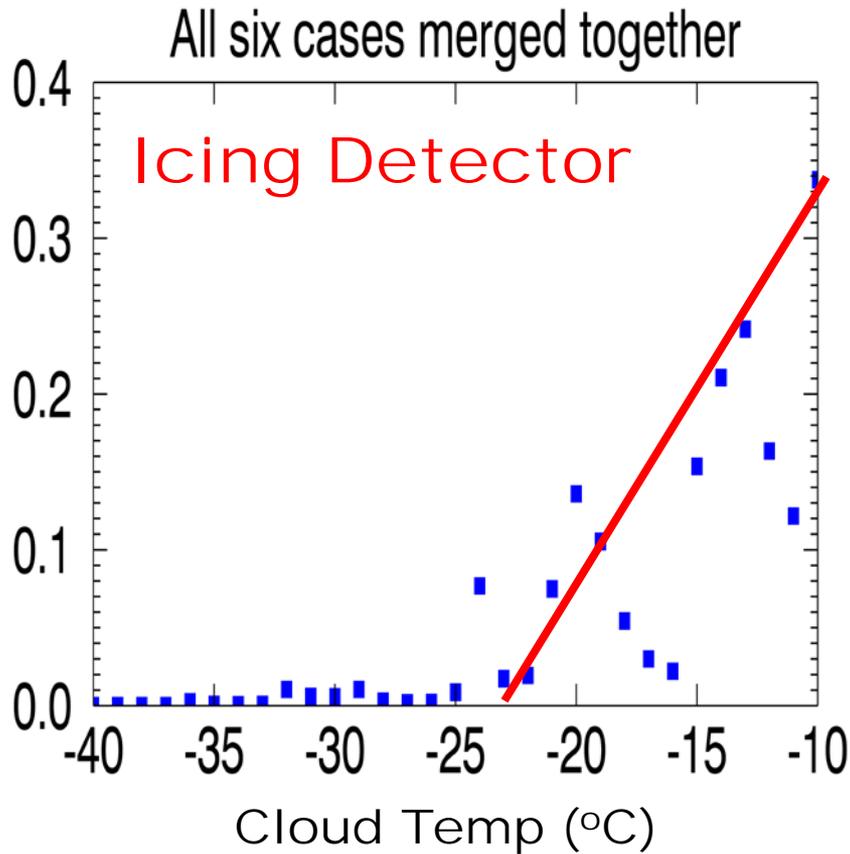
Preliminary aircraft data from MC3E

Jingyu Wang, Xiquan Dong, and Baike Xi
University of North Dakota

Outline

1. Identifying pure-ice-phase layer of DCS
2. Determining the ratio of liquid to ice in the mixed-phase clouds of DCS
3. Investigating the relationship between particle size distribution and temperature

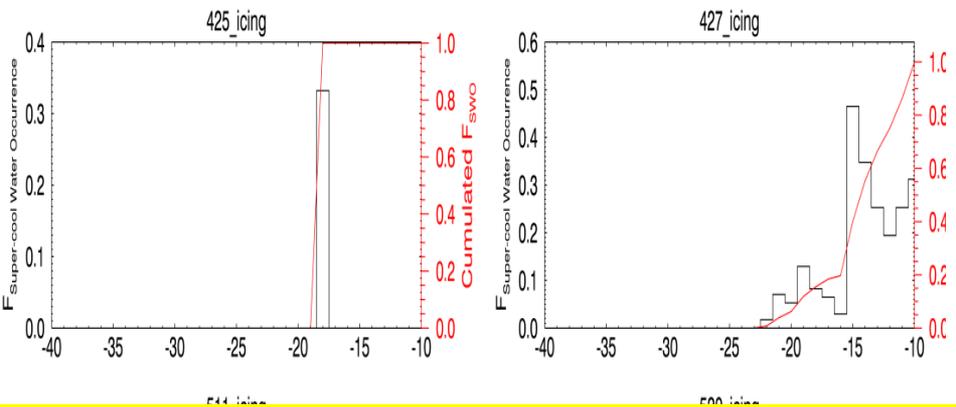
Ice-phase determination based on icing detector and 2DC image reading



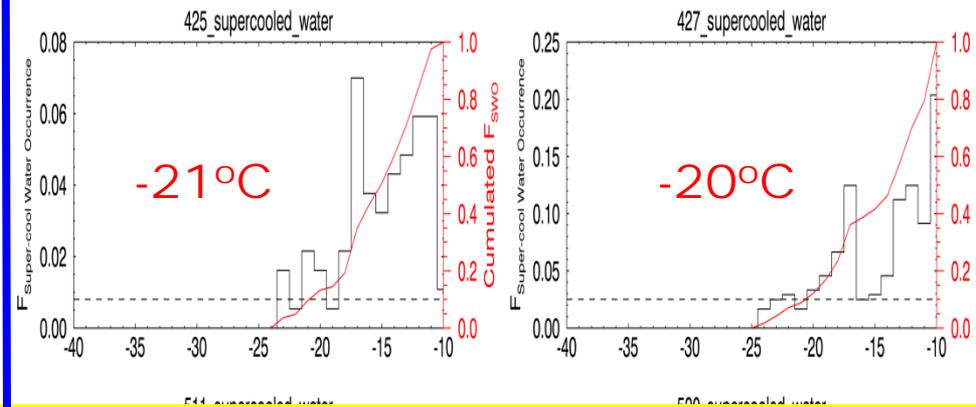
Both icing detector and 2DC image reading provided the same trend of the super-cooled liquid water vs. temp; pure ice occurred at -22°C

Cloud phase determination based on icing detector and 2DC image reading

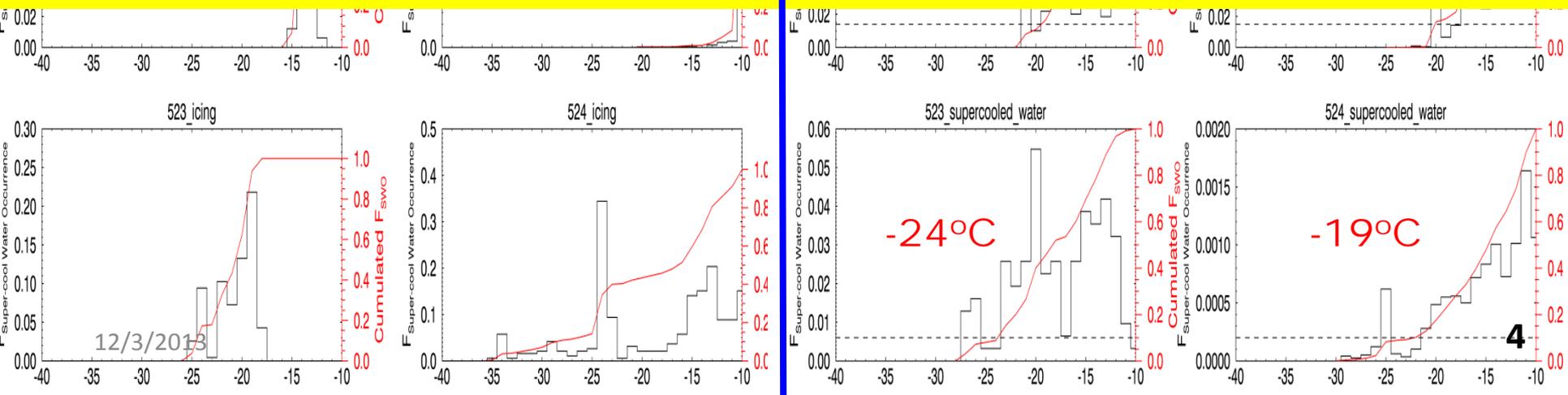
Icing Detector



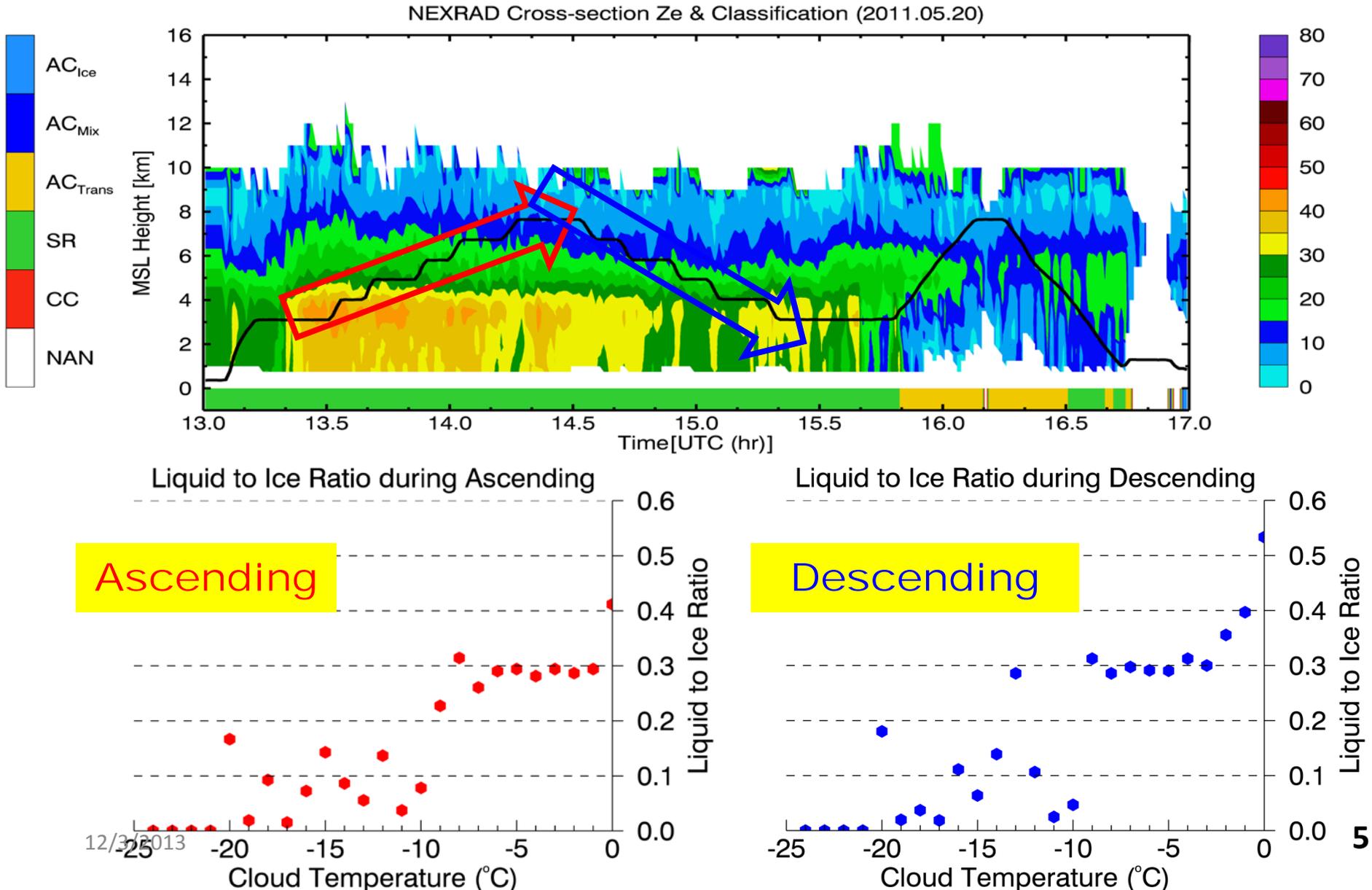
2DC images



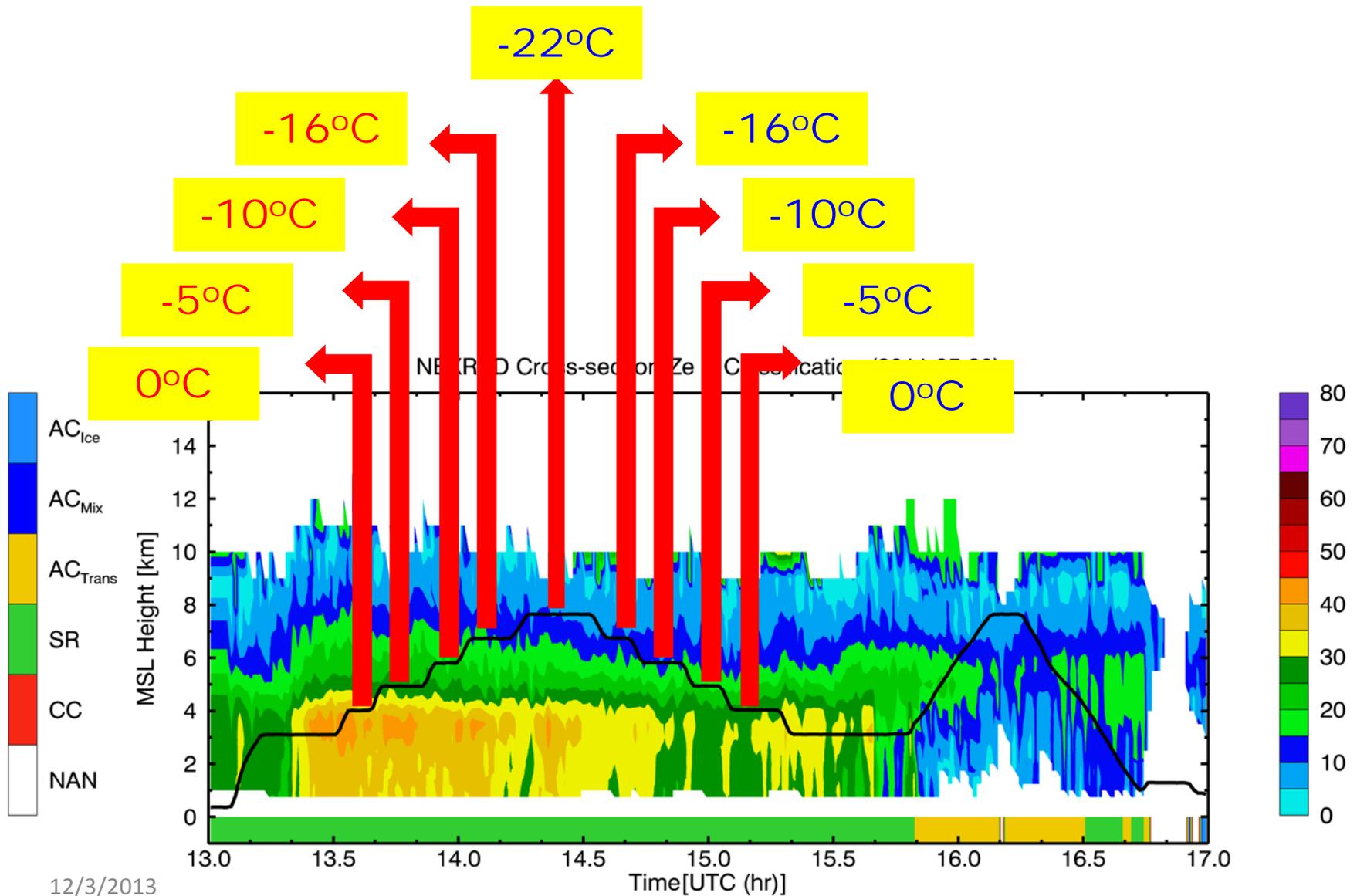
Once the pure-ice-phase temperature threshold was determined for each case, then we can calculate its IWC and LWC for mixed-phase clouds of DCS



The temperature range of mixed-phase for May 20, 2011 is from -20°C to 3°C . The ratio of liquid to ice is generated from 2DC images.

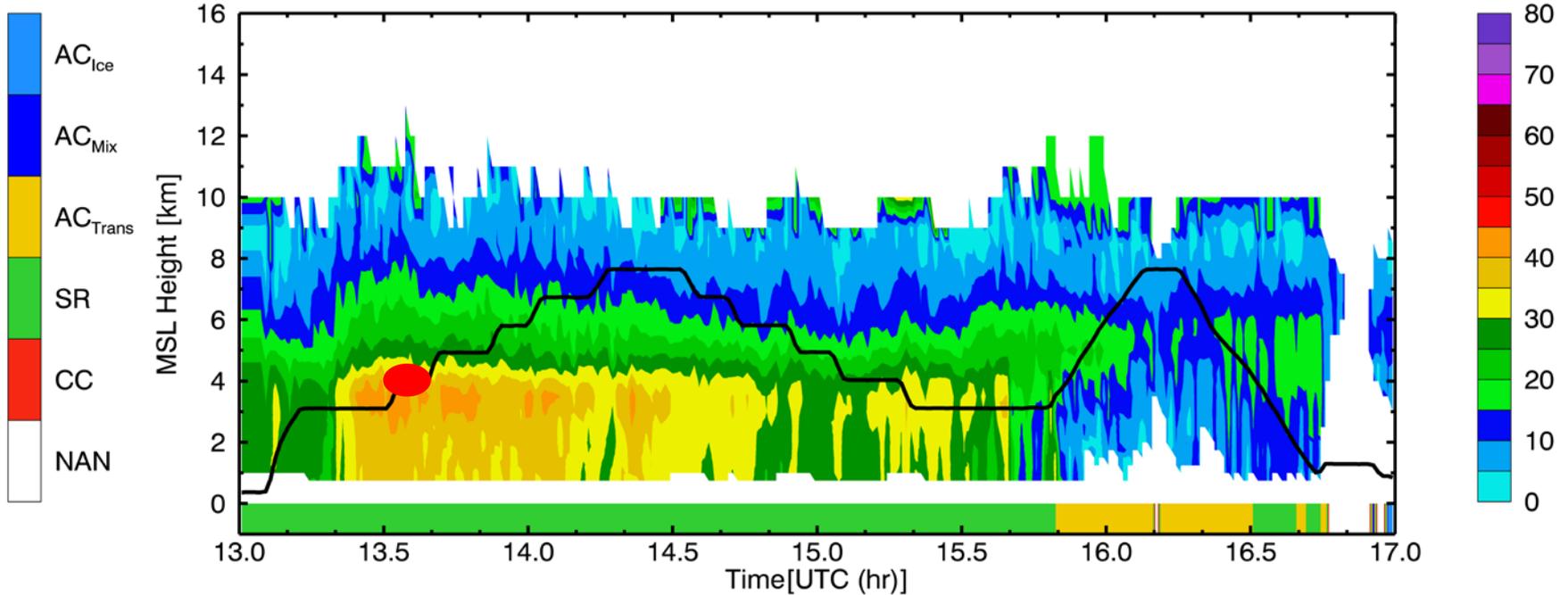


Aircraft flew cloud through five steps during ascending and descending with temperatures of 0, -5, -10, -16, and -22 °C

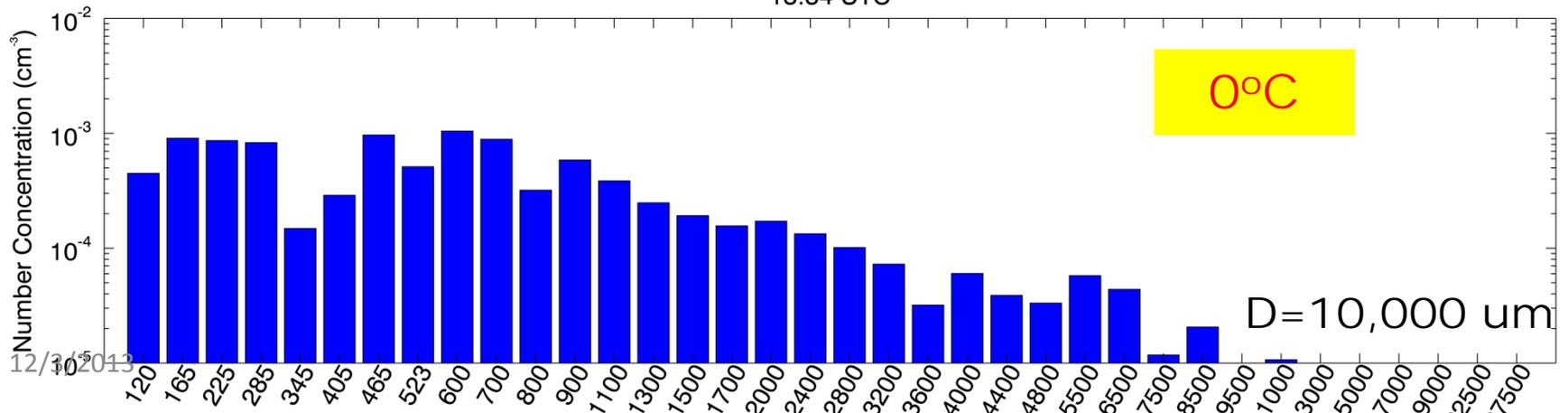


Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)

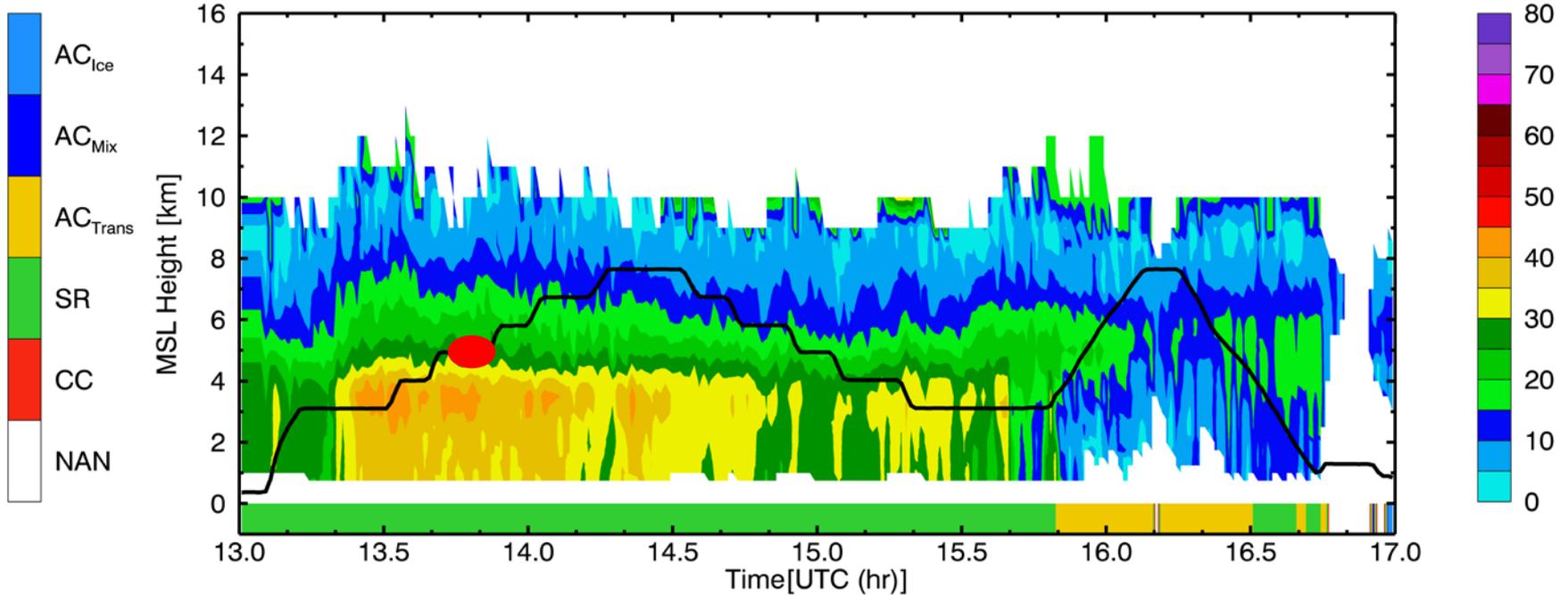


13:34 UTC

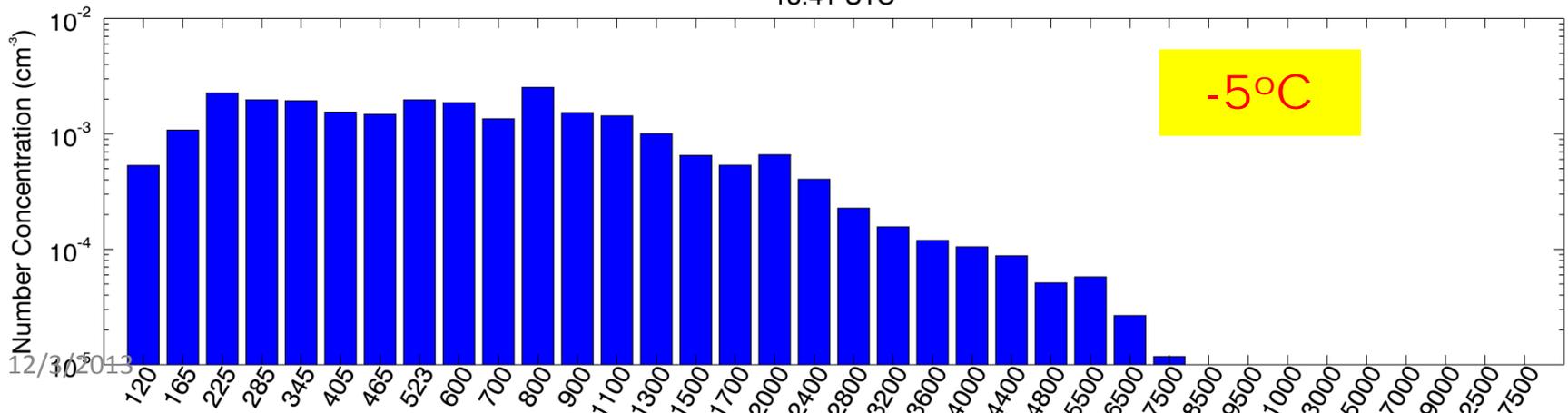


Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)



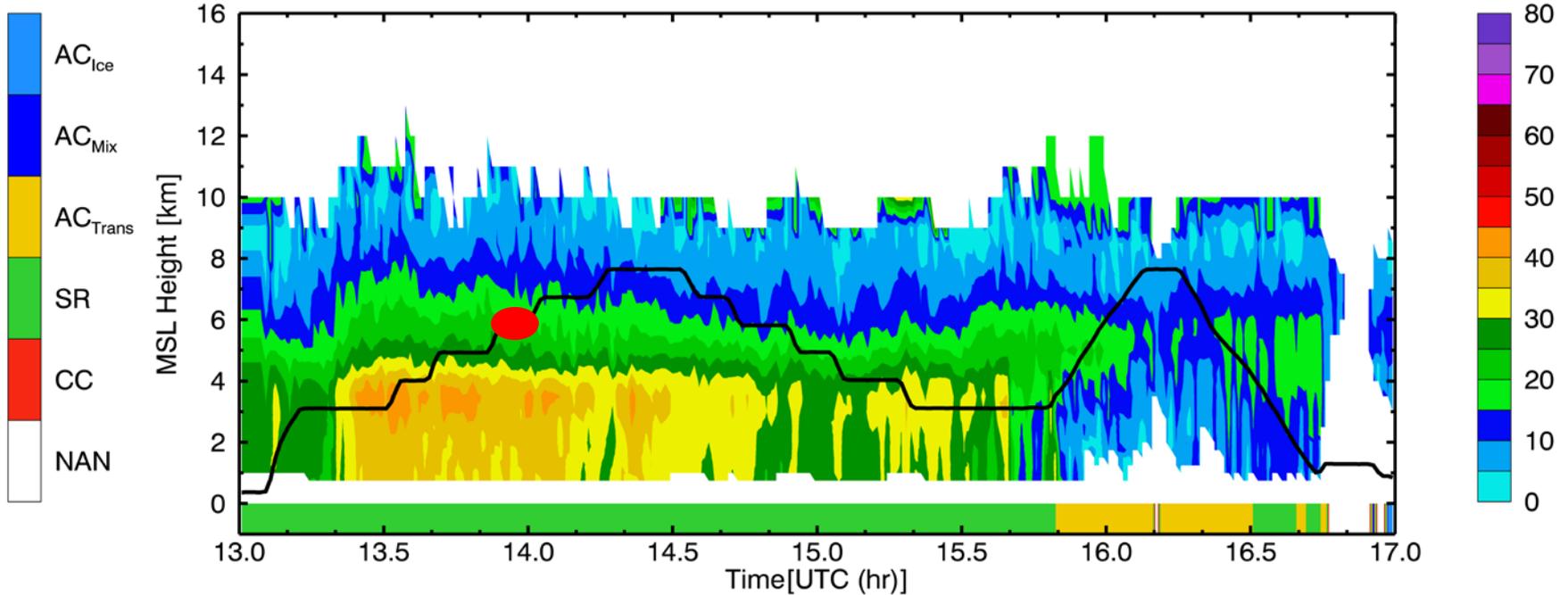
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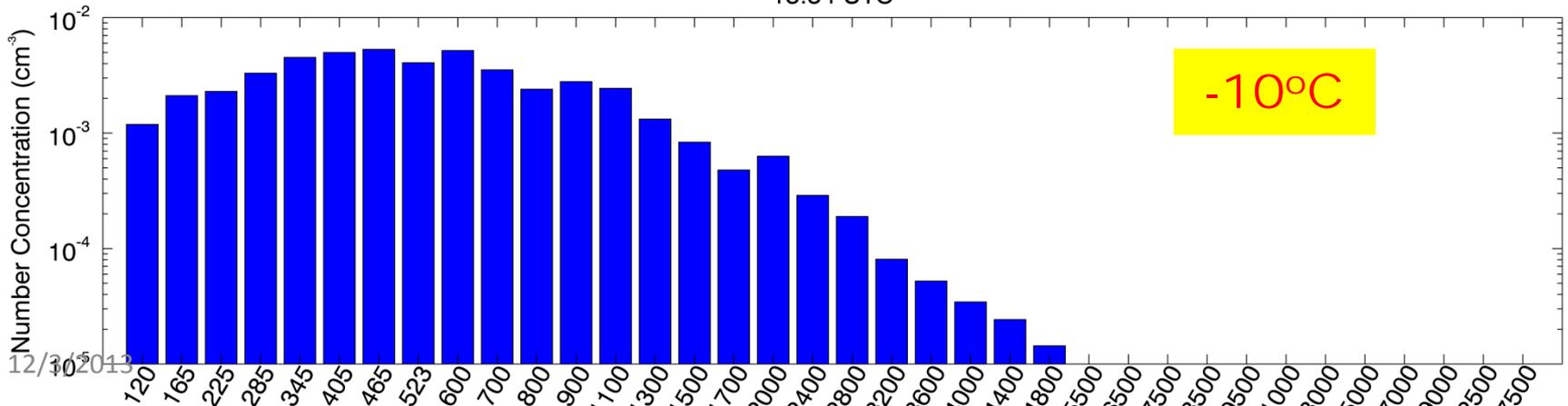
12/31/2013

Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)

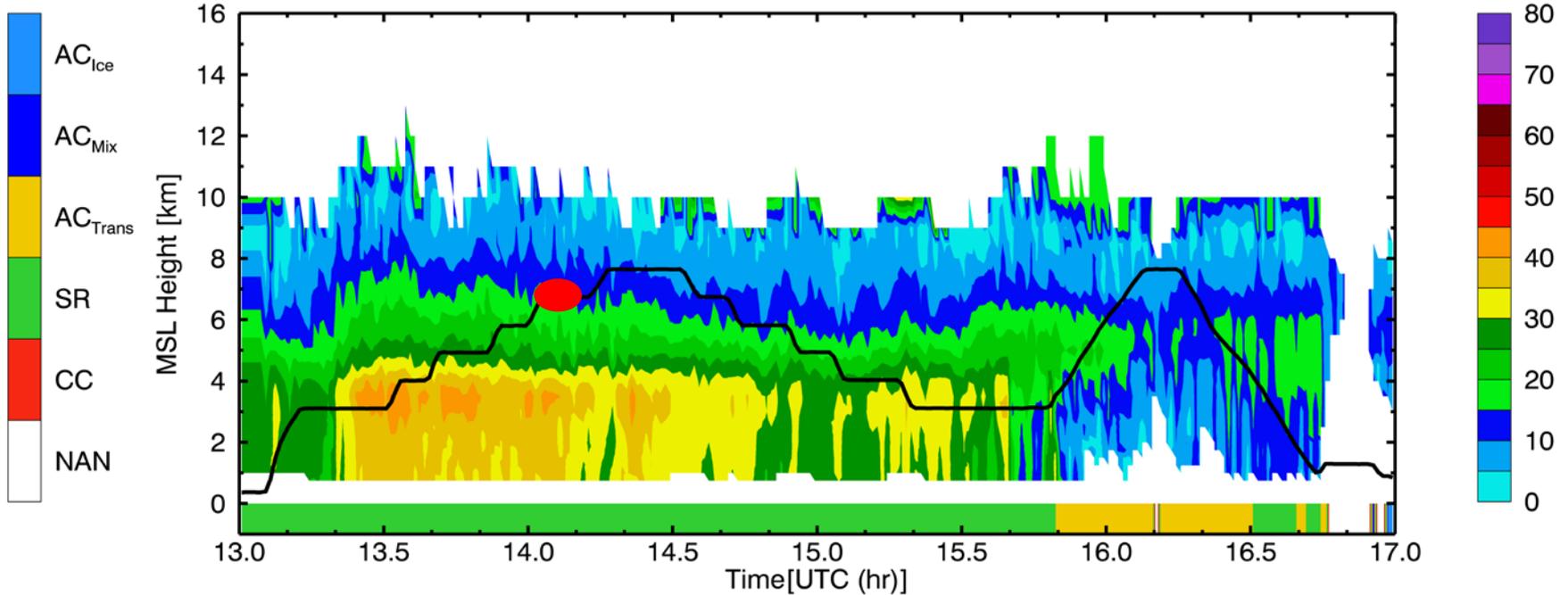


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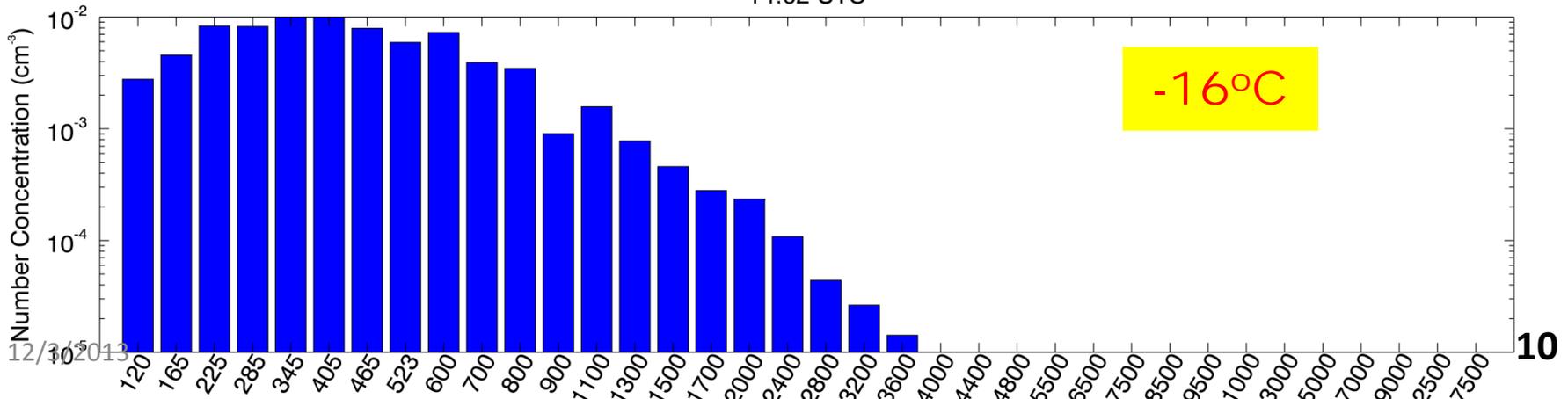


Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)



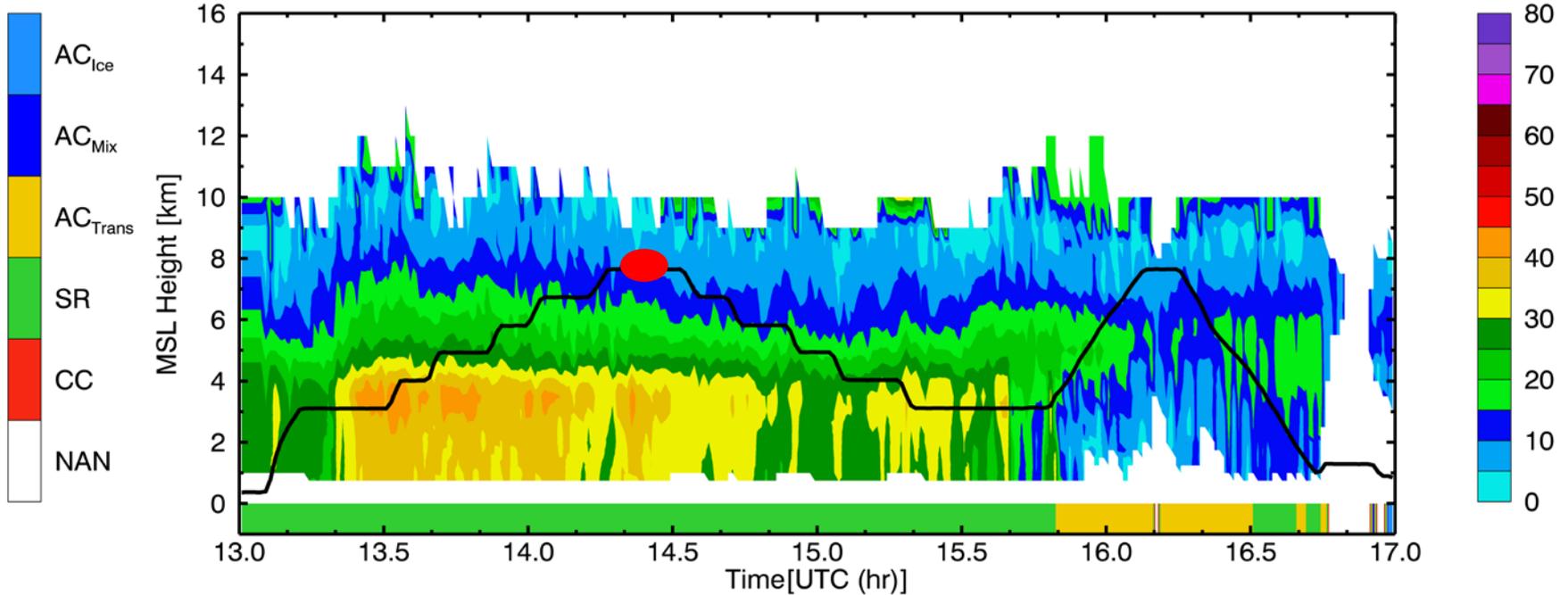
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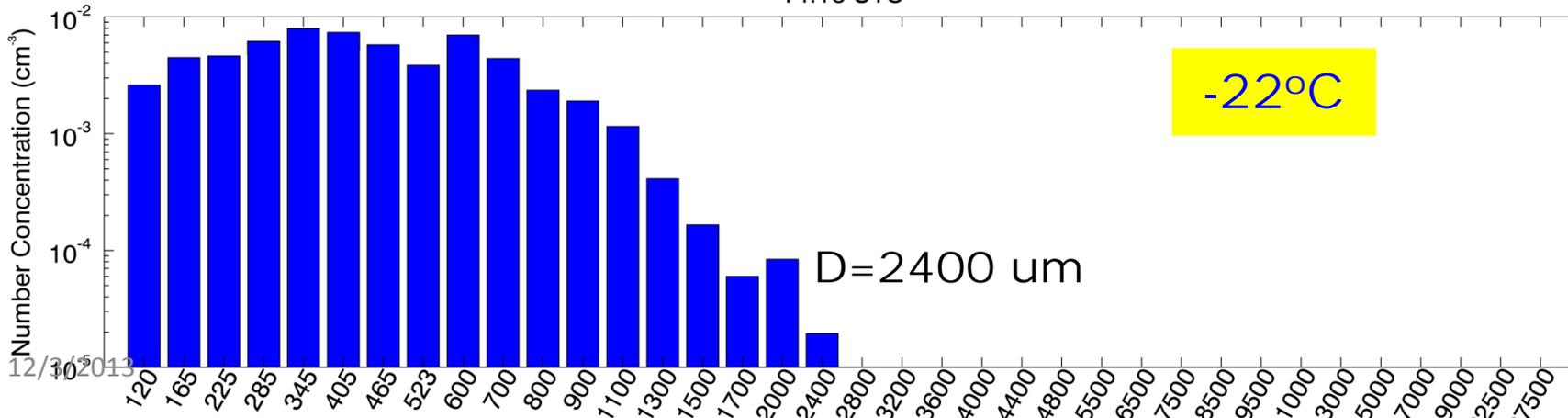
12/31/2013

Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)

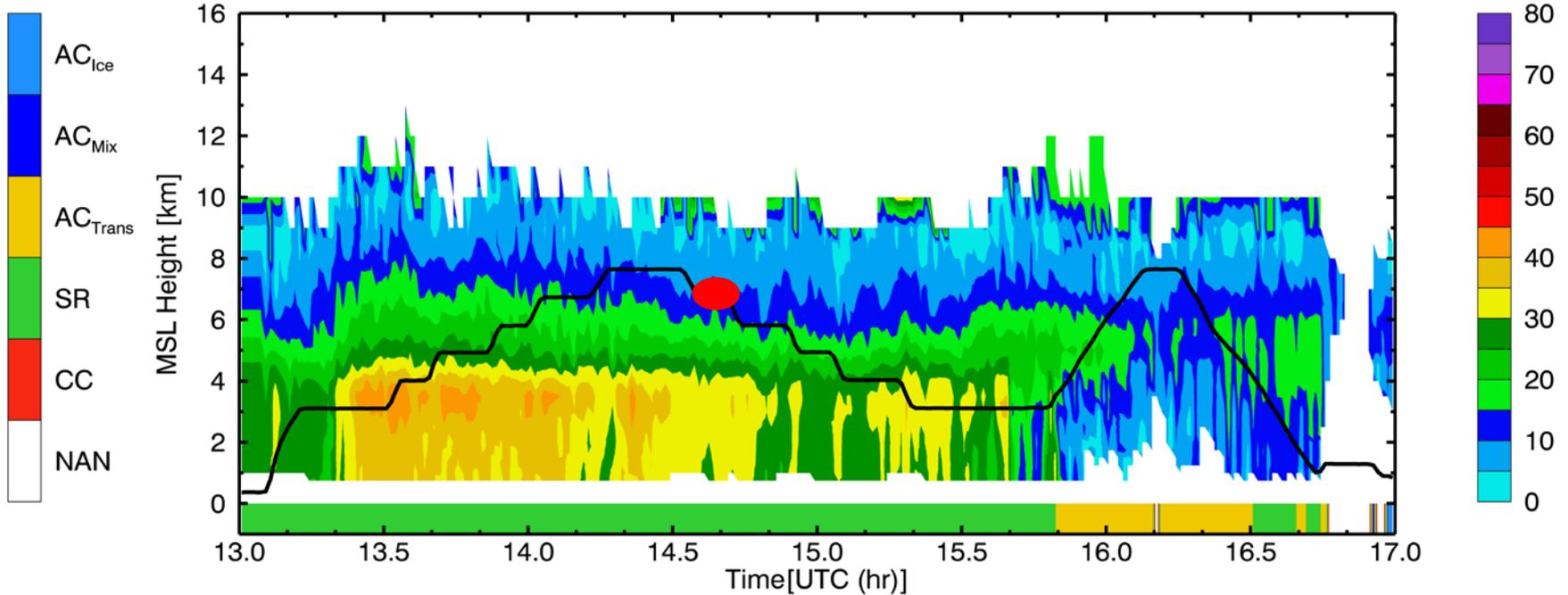


14:16 UTC

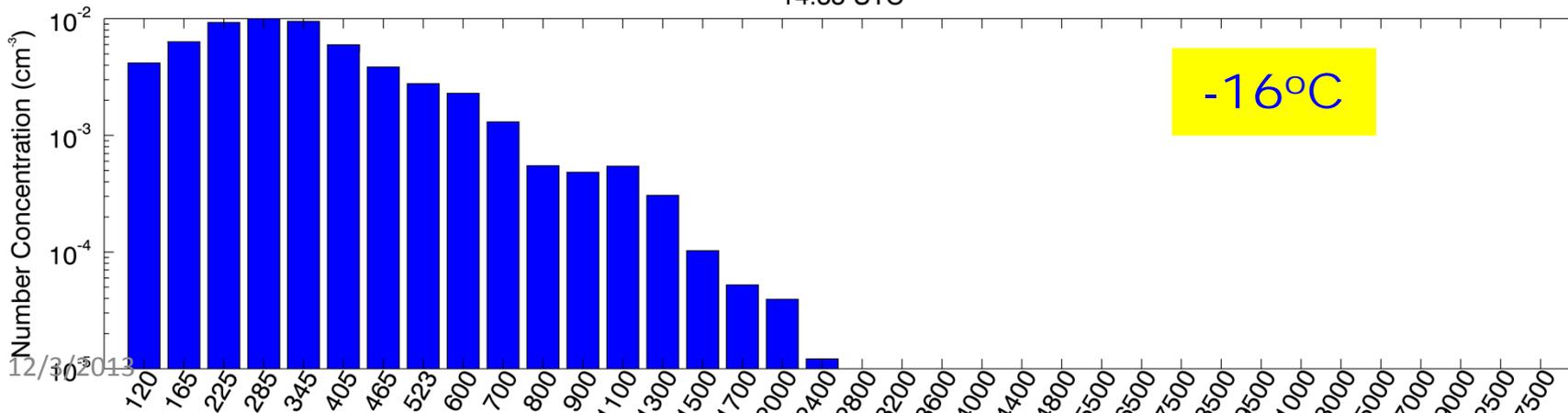


Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)

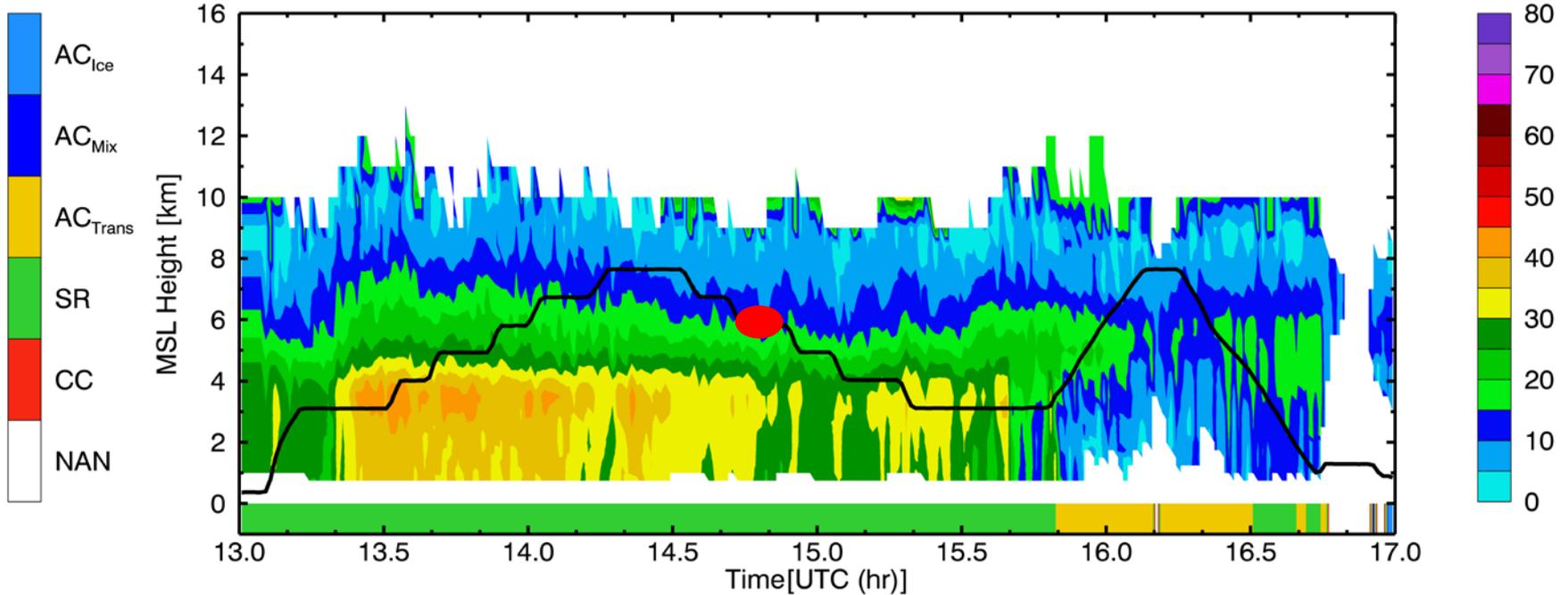


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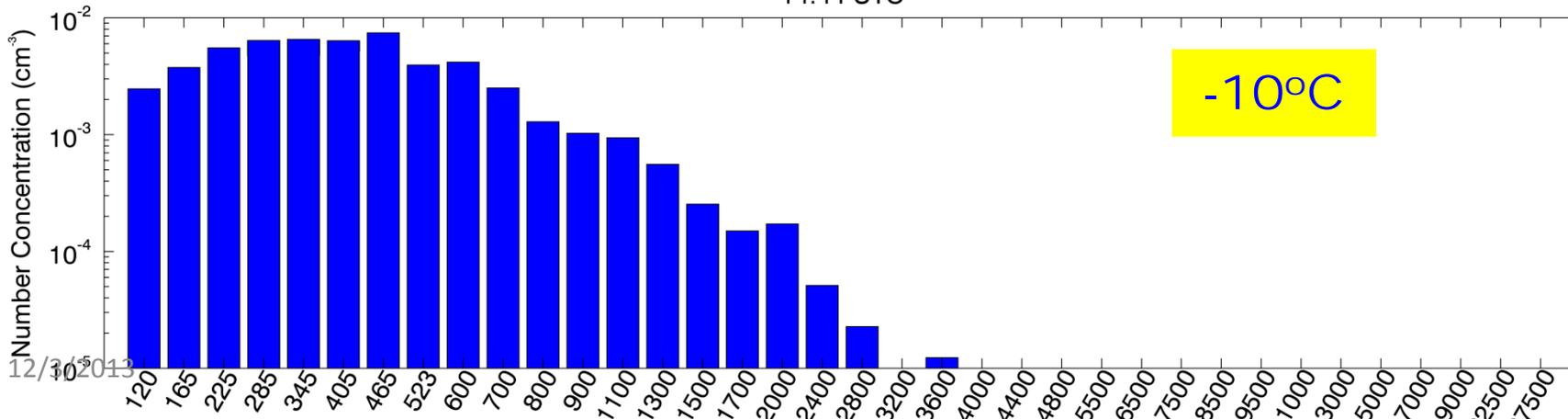


Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)

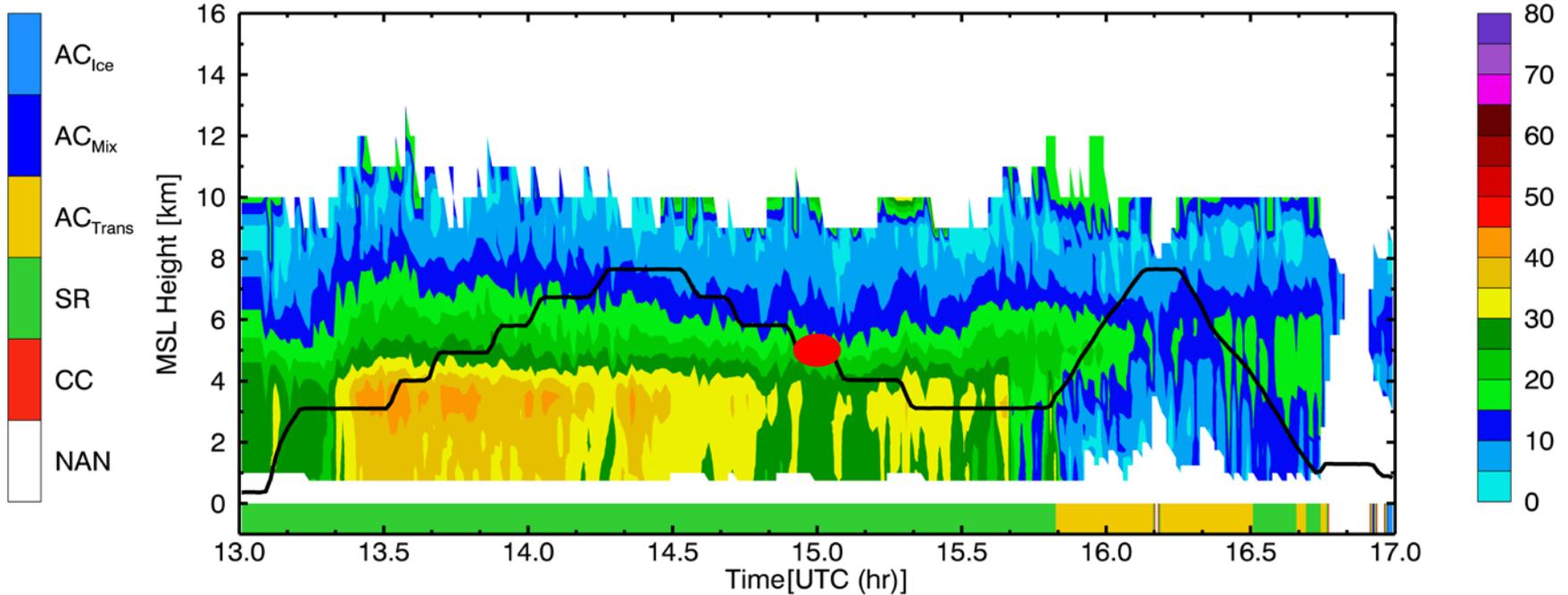


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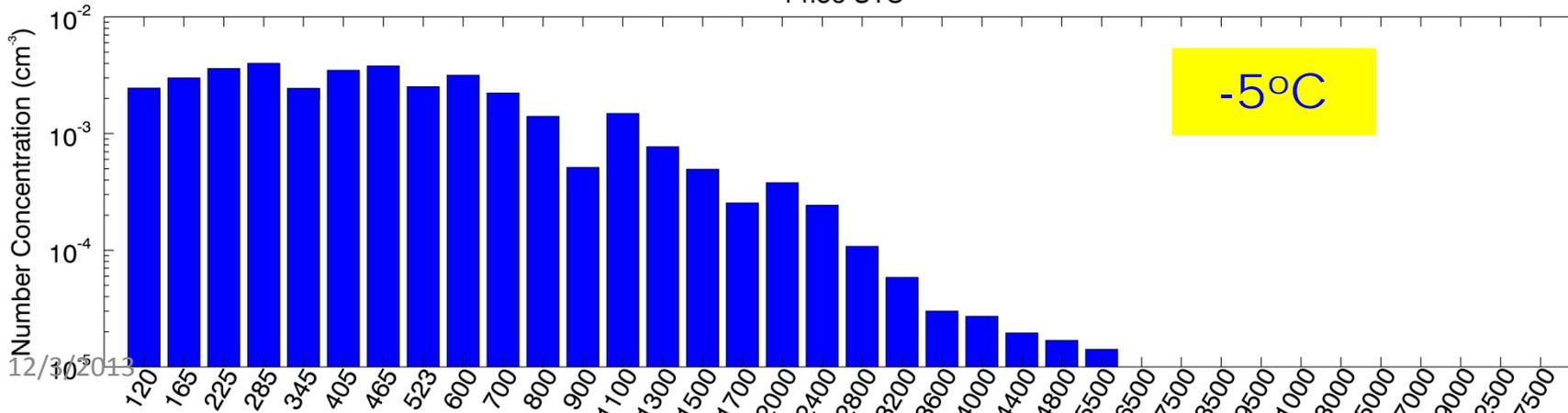


Particle size distribution vs. cloud temperature

NEXRAD Cross-section Ze & Classification (2011.05.20)

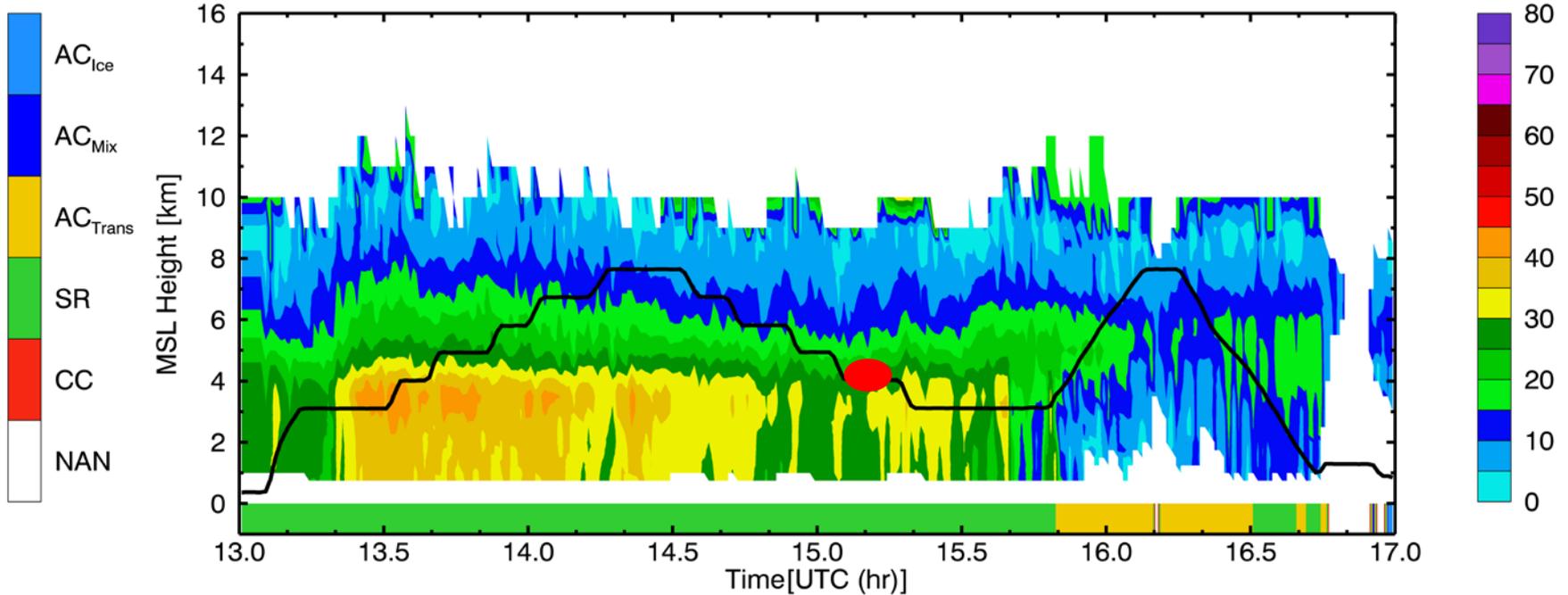


14:56 UTC

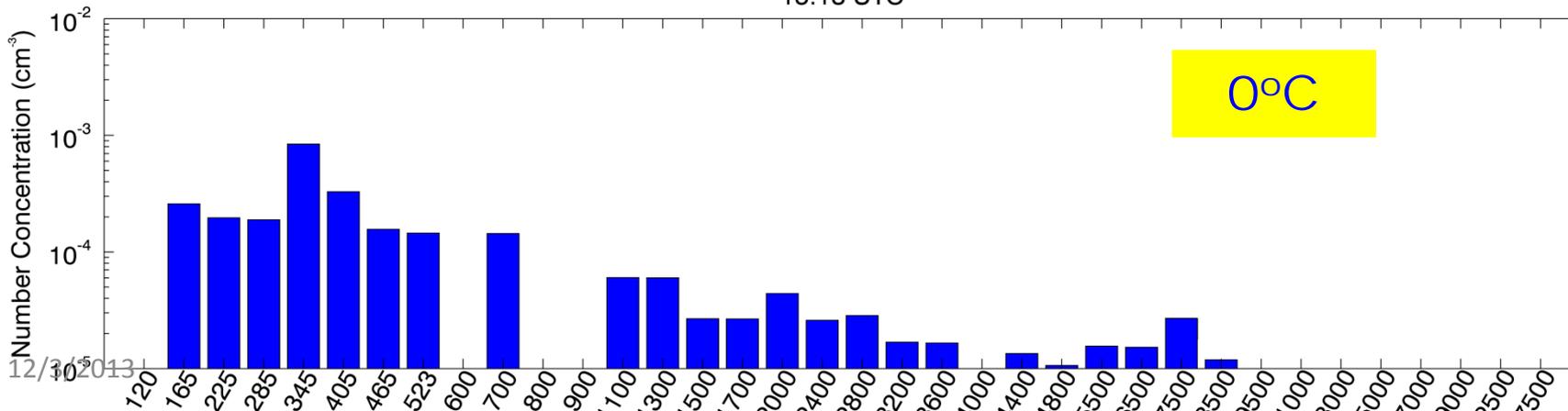


Particle size distribution vs. cloud temperature

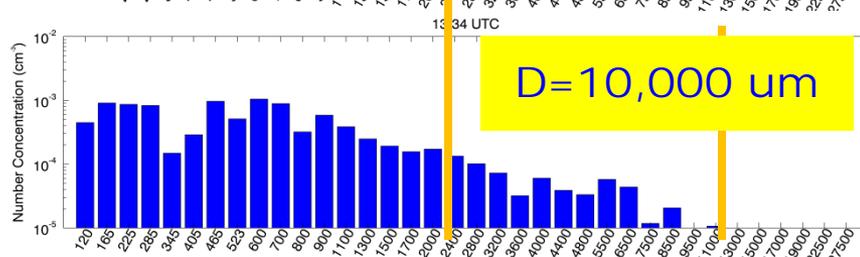
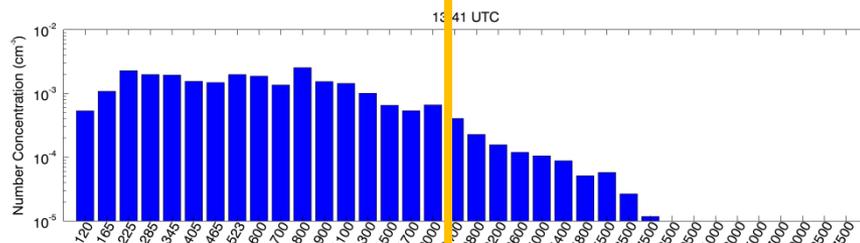
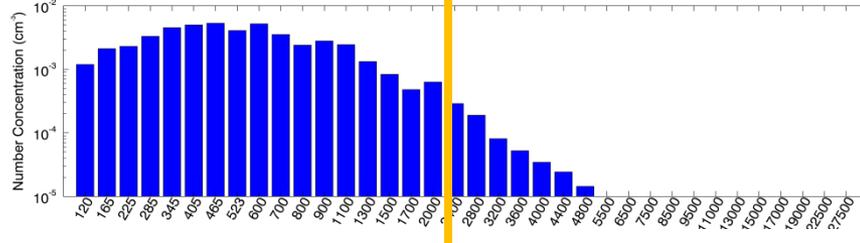
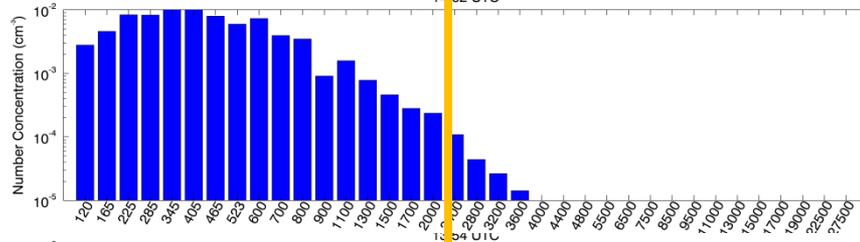
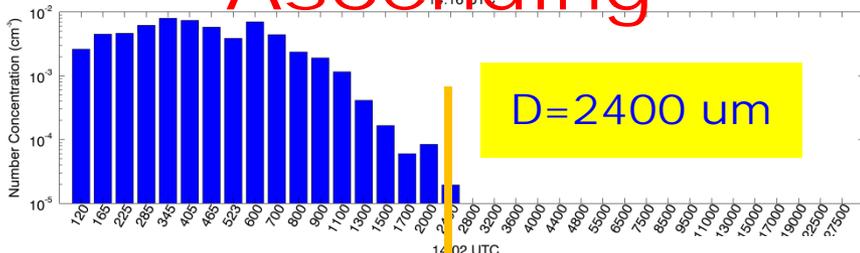
NEXRAD Cross-section Ze & Classification (2011.05.20)



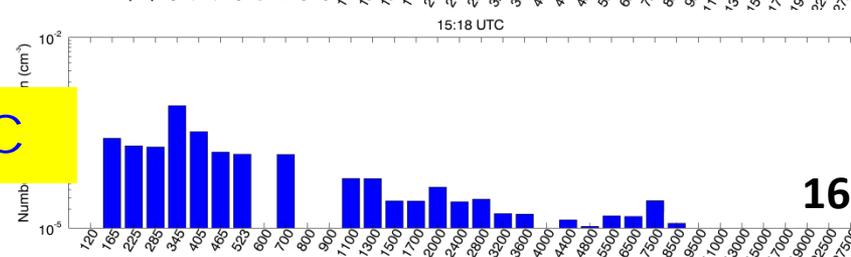
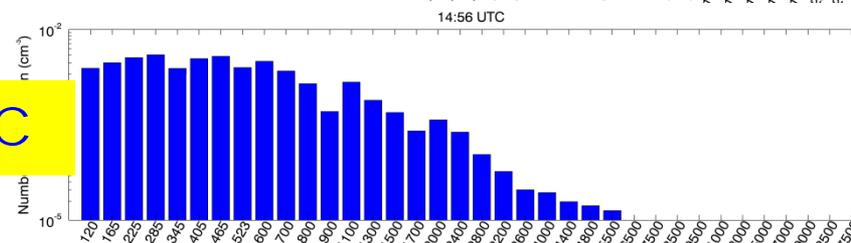
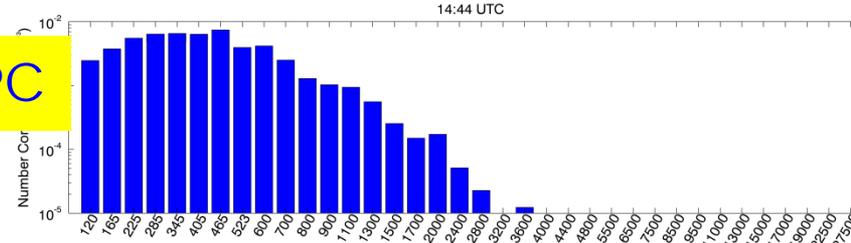
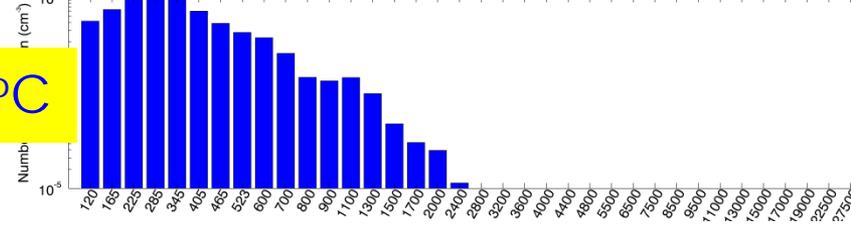
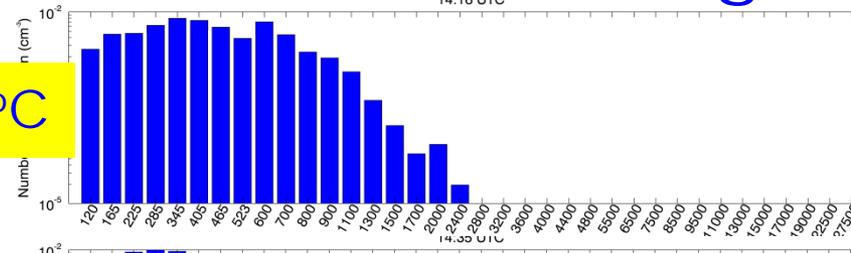
15:18 UTC



Ascending



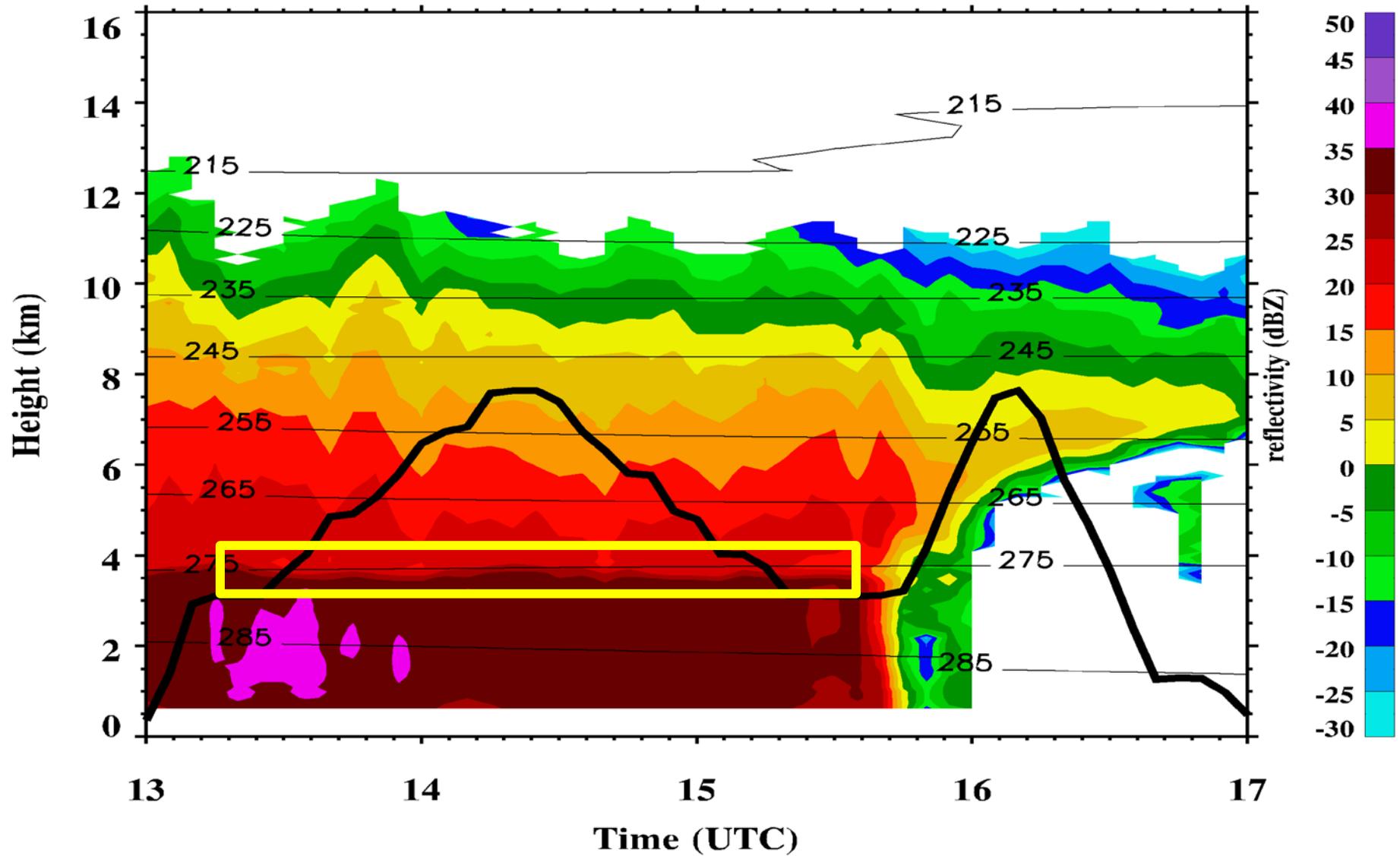
Descending



Max Diameters range from 2400 to 10,000 um when T increases from -22 to 0°C.

12/3/2013

KAZR Reflectivity 20110520



Some large ice particles found below melting band ($0\text{ }^{\circ}\text{C}$) until cloud temp = $4\text{ }^{\circ}\text{C}$.

Flight Date: 05/11/11 Start Time = 64024.9609(17:47:4.9609) End Time = 64024.9648(17:47:4.9648) Delta Time = 0.00390625 [s] TAS = 110.91 [m/s] TEMP = 1.00 [C]

Flight Date: 05/11/11 Start Time = 64025.0625(17:47:5.0625) End Time = 64025.0625(17:47:5.0625) Delta Time = 0.00000 [s] TAS = 111.51 [m/s] TEMP = 0.93 [C]

1 °C

Flight Date: 05/11/11 Start Time = 64025.1602(17:47:5.1602) End Time = 64025.1641(17:47:5.1641) Delta Time = 0.00390625 [s] TAS = 116.80 [m/s] TEMP = 0.21 [C]



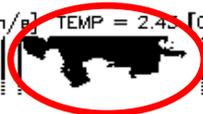
Flight Date: 05/11/11 Start Time = 64025.2617(17:47:5.2617) End Time = 64025.2617(17:47:5.2617) Delta Time = 0.00000 [s] TAS = 113.85 [m/s] TEMP = 0.79 [C]

Flight Date: 05/11/11 Start Time = 64084.9609(17:48:4.9609) End Time = 64084.9727(17:48:4.9727) Delta Time = 0.0117188 [s] TAS = 108.63 [m/s] TEMP = 2.40 [C]

Flight Date: 05/11/11 Start Time = 64085.0625(17:48:5.0625) End Time = 64085.0625(17:48:5.0625) Delta Time = 0.00000 [s] TAS = 110.20 [m/s] TEMP = 2.23 [C]

2 °C

Flight Date: 05/11/11 Start Time = 64085.1602(17:48:5.1602) End Time = 64085.1719(17:48:5.1719) Delta Time = 0.0117188 [s] TAS = 107.73 [m/s] TEMP = 2.45 [C]



Flight Date: 05/11/11 Start Time = 64085.2617(17:48:5.2617) End Time = 64085.2656(17:48:5.2656) Delta Time = 0.00390625 [s] TAS = 108.06 [m/s] TEMP = 2.39 [C]

Flight Date: 05/11/11 Start Time = 58391.3398(16:13:11.3398) End Time = 58392.2930(16:13:12.2930) Delta Time = 0.953125 [s] TAS = 0.41 [m/s] TEMP = 3.23 [C]

Flight Date: 05/11/11 Start Time = 58615.1602(16:16:55.1602) End Time = 58620.0586(16:17:0.0586) Delta Time = 4.89844 [s] TAS = 407.88 [m/s] TEMP = -94.11 [C]

3 °C

Flight Date: 05/11/11 Start Time = 59052.6406(16:24:15.6406) End Time = 59055.9922(16:24:15.9922) Delta Time = 3.35156 [s] TAS = 120.69 [m/s] TEMP = -22.98 [C]



Flight Date: 05/11/11 Start Time = 59167.4492(16:26:7.4492) End Time = 59168.3516(16:26:8.3516) Delta Time = 0.902344 [s] TAS = 117.15 [m/s] TEMP = -22.54 [C]



**Thanks for Your attention!
Questions?**