Team UC Santa Cruz
Patrick Chuang & Jennifer Small

Phase Doppler status:

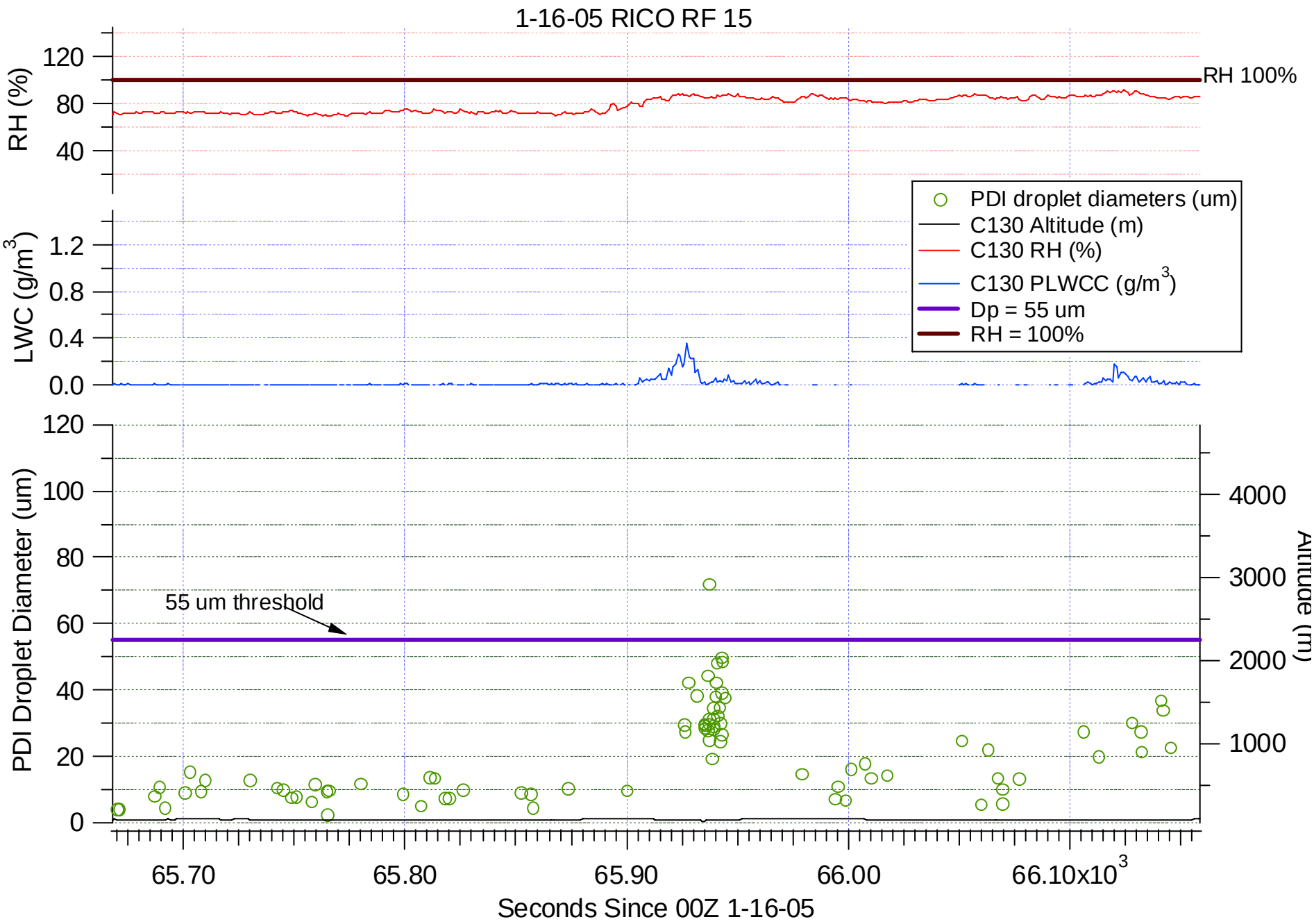
- We have data for RF15 – 19 (but RF17 had only 5 sec of data), so good data available 1/16, 18, 23, and 24.
- We still have a LWC bias (~factor of 2 low) but this will be fixed soon.
- Shape of the distribution is likely to be close to final (so we can look at spectral widths, etc, during this workshop).

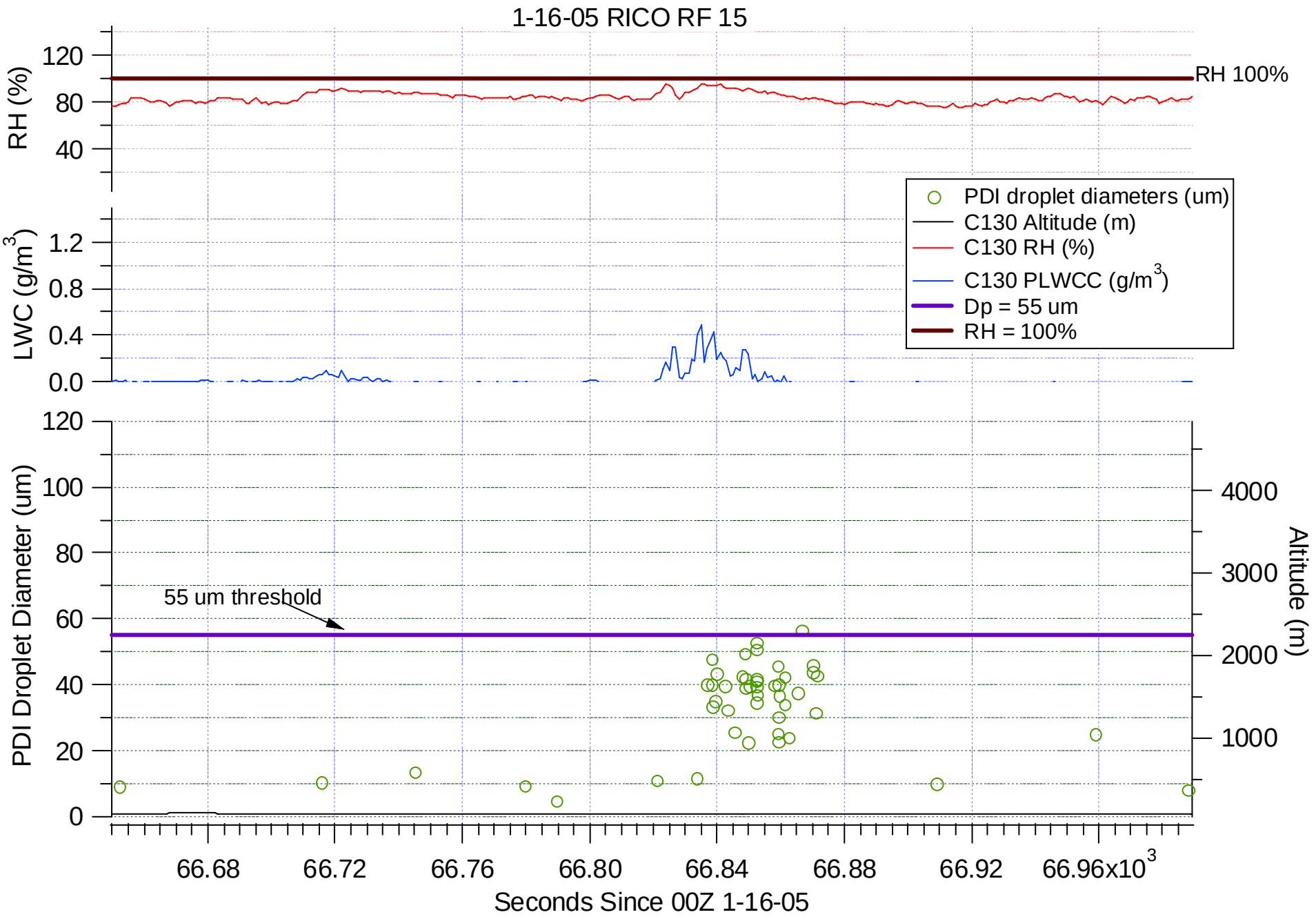
RICO Goals

- Intercomparison with other probes (cloud drop spectrum, LWC, surface area, etc)
- Examine the origin of coalescence nuclei
- Examine “ephemeral clouds”
- Comparison with model shallow cumulus clouds (w/ Sonia Lasher-Trapp)
- Turbulence effects on clouds (w/ Brad Baker, Raymond Shaw)
- Mixing in clouds (w/ Chris Jeffery)

“Ephemeral Clouds”

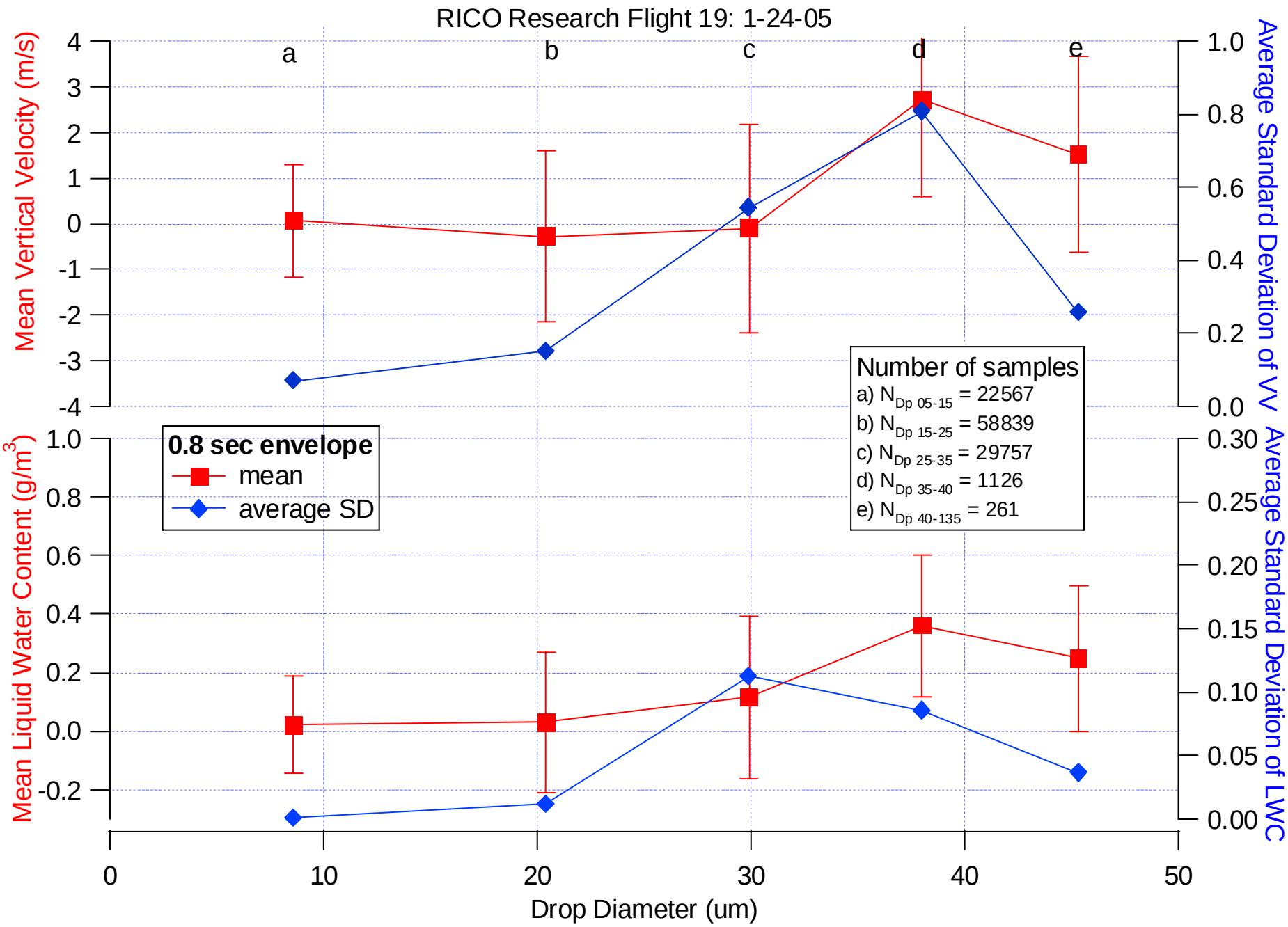
- Characterized by:
  - events are located in the sub-cloud layer
  - a size distribution where small drops are notably absent; strongly skewed toward much larger sizes (mean diameter ~30 to 40 um)
  - LWC probes also peak (~0.2 to 0.4 g/m3)
  - Most found during RF15 (Jan 16).
- Calculated average conc is ~ 1 L^{-1}
- Origin? Implications for rain initiation?


1-16-05 RICO RF 15
RH (%)
120
80
40
RH 100%
LWC (g/m3)
1.2
0.8
0.4
0.0
PDI droplet diameters (um)
C130 Altitude (m)
C130 RH (%)
C130 PLWCC (g/m3)
Dp = 55 um
RH = 100%
PDI Droplet Diameter (um)
120
100
80
60
40
20
0
55 um threshold
Altitude (m)
4000
3000
2000
1000
65.70
65.80
65.90
66.00
66.10x10^3
Seconds Since 00Z 1-16-05


1-16-05 RICO RF 15
RH (%)
120
80
40
RH 100%
LWC (g/m3)
1.2
0.8
0.4
0.0
PDI droplet diameters (um)
C130 Altitude (m)
C130 RH (%)
C130 PLWCC (g/m3)
Dp = 55 um
RH = 100%
PDI Droplet Diameter (um)
120
100
80
60
40
20
0
55 um threshold
4000
3000
2000
1000
Altitude (m)
66.68
66.72
66.76
66.80
66.84
66.88
66.92
66.96x10^3
Seconds Since 00Z 1-16-05

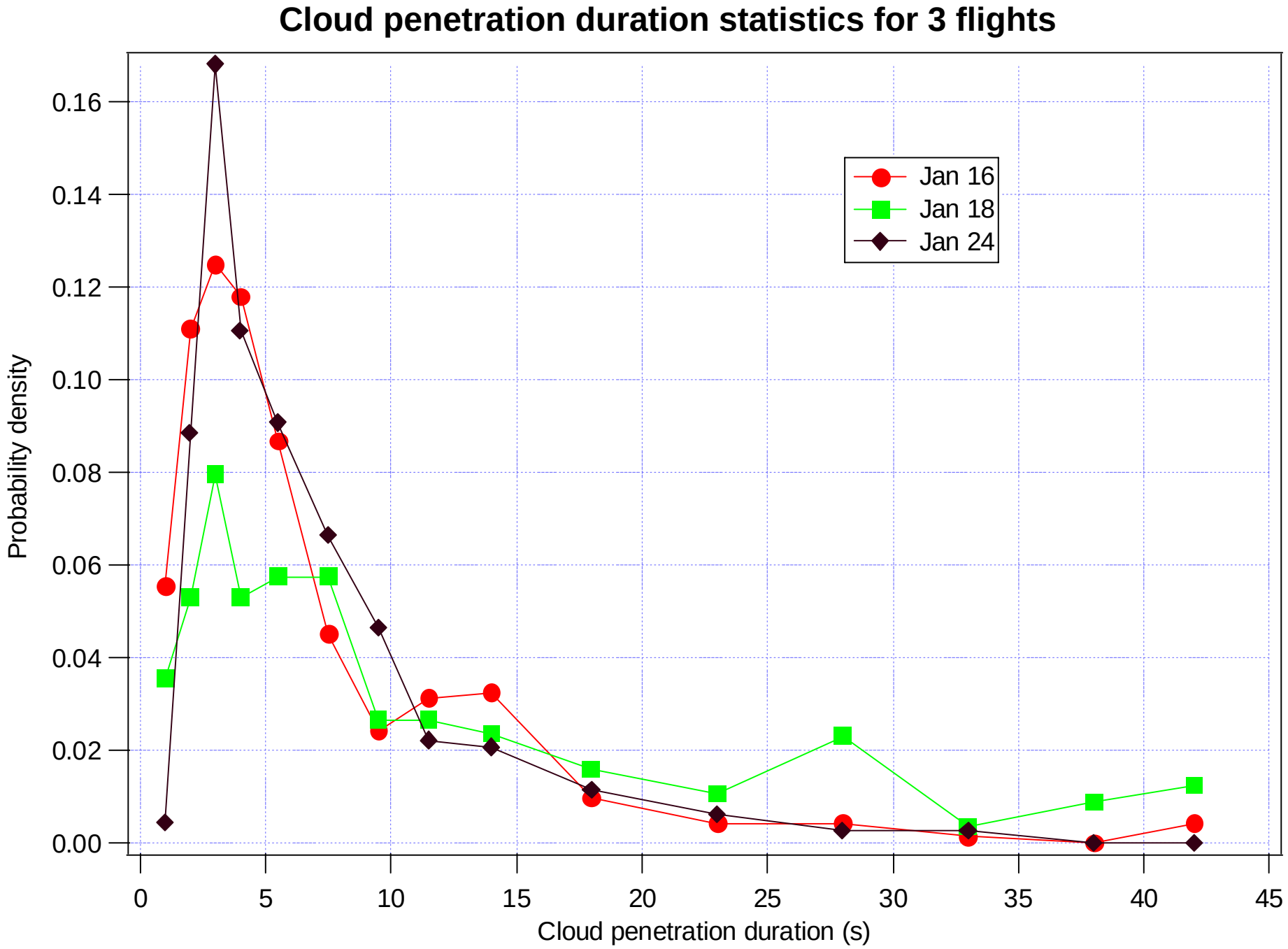
Origin of Coalescence Nuclei

- For each cloud drop observed, we study a “small” envelope (envelopes of 0.4, 0.8 and 1.2 s) around it.
- Seek to address the question: is the environment around rarer, larger drops different from the environment around the smaller, more numerous drops?
- Thus far, looked at vertical velocity and LWC.


RICO Research Flight 19: 1-24-05
a
b
c
d
e
Mean Vertical Velocity (m/s)
Average Standard Deviation of VV
Mean Liquid Water Content (g/m3)
Average Standard Deviation of LWC
0.8 sec envelope
mean
average SD
Number of samples
a) N Dp 05-15 = 22567
b) N Dp 15-25 = 58839
c) N Dp 25-35 = 29757
d) N Dp 35-40 = 1126
e) N Dp 40-135 = 261
Drop Diameter (um)

Common (?) Questions

- For each cloud penetration:
  - where are we relative to cloud base?
  - where are we relative to cloud base?
  - do we pass through an adiabatic core?
  - at what point in the cloud's life cycle does the penetration occur?
  - what is the duration of each penetration?
  - how many drops are observed for each penetration?


Cloud penetration duration statistics for 3 flights
Probability density
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0
5
10
15
20
25
30
35
40
45
Cloud penetration duration (s)
Jan 16
Jan 18
Jan 24