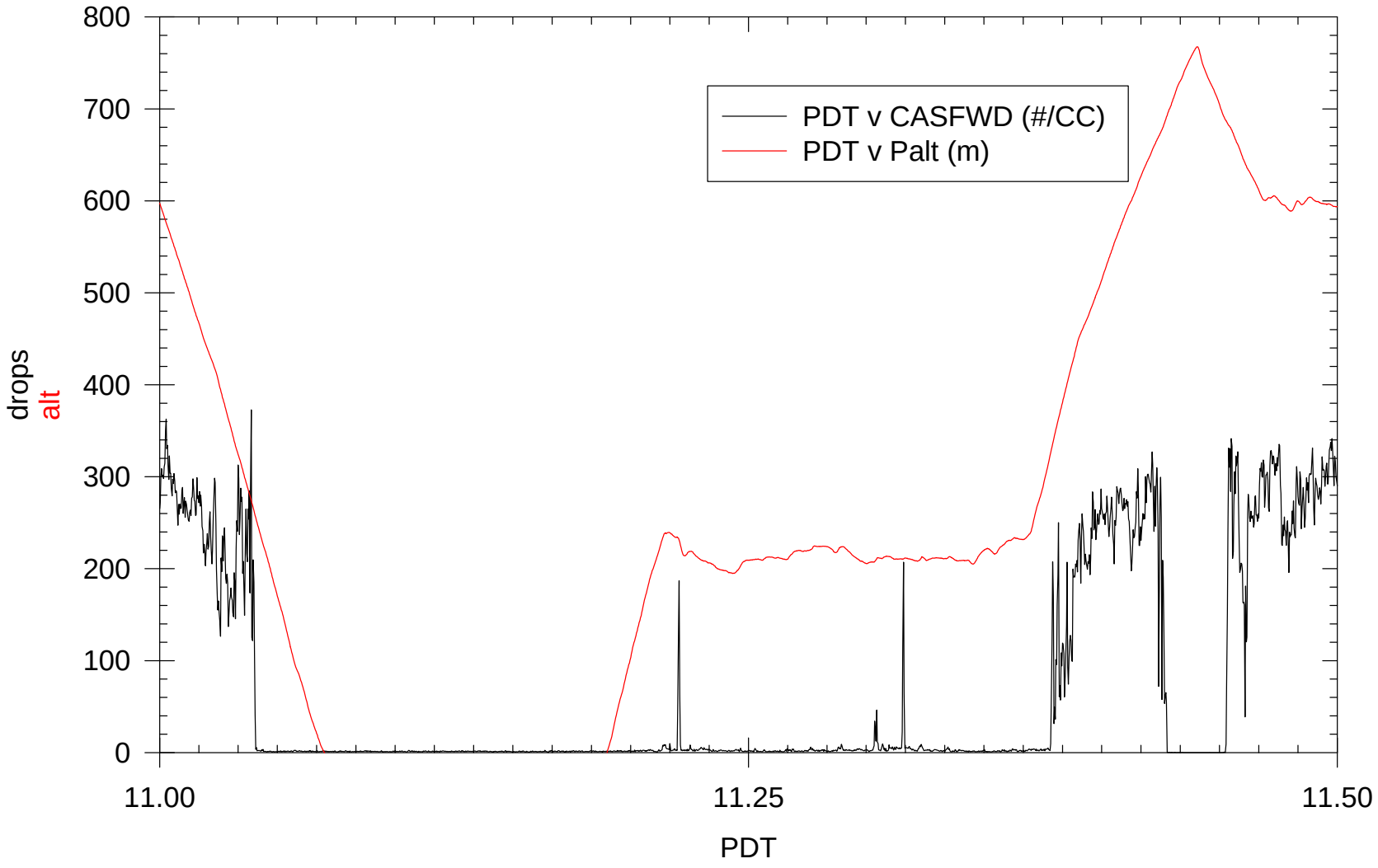
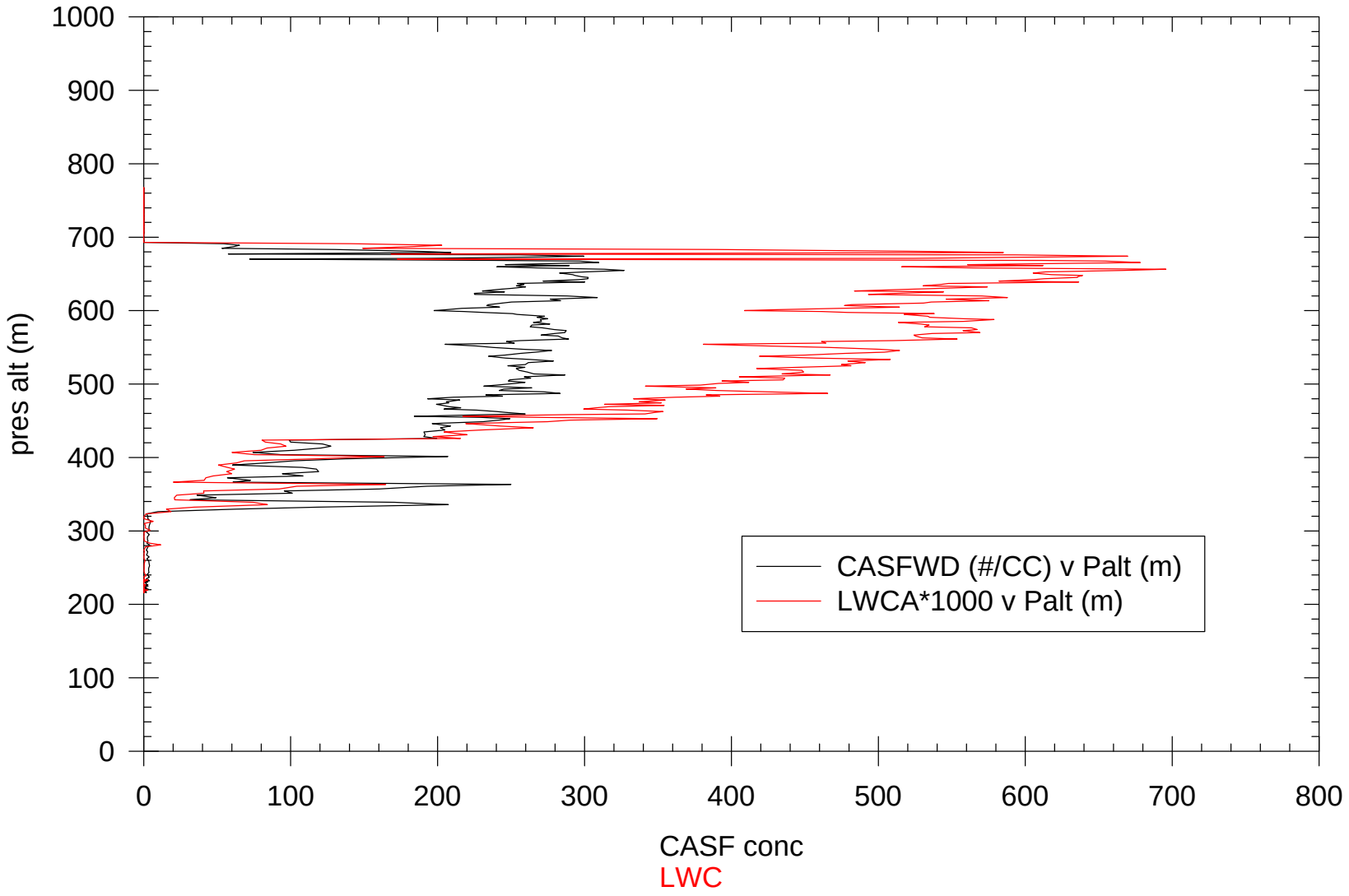
Sounding plots of CCN and CAS conc and LWC, CIRPAS CN.

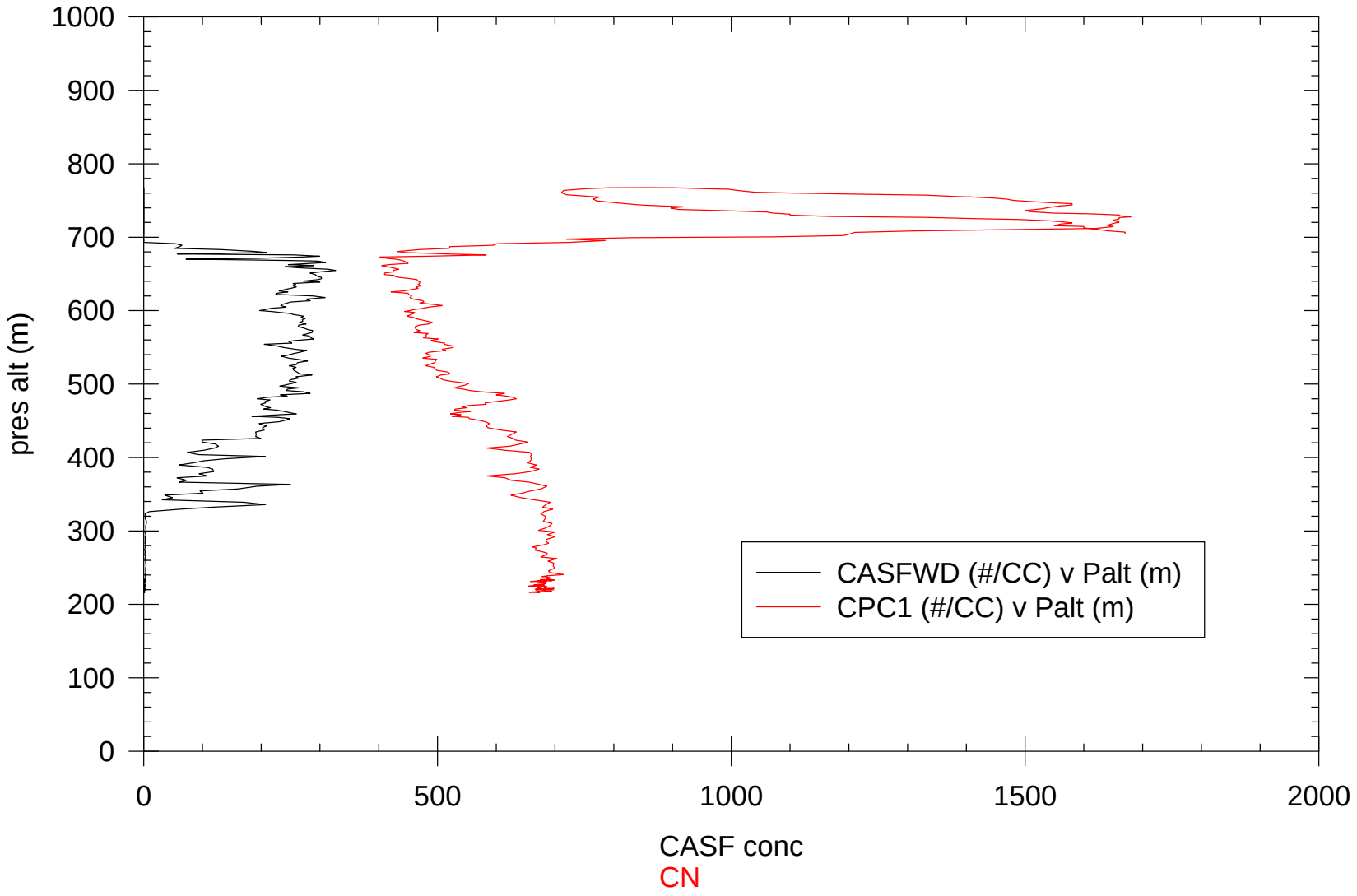
Determine N_c for various cloud thresholds for soundings.
So far 0.1 gcm^{-3}

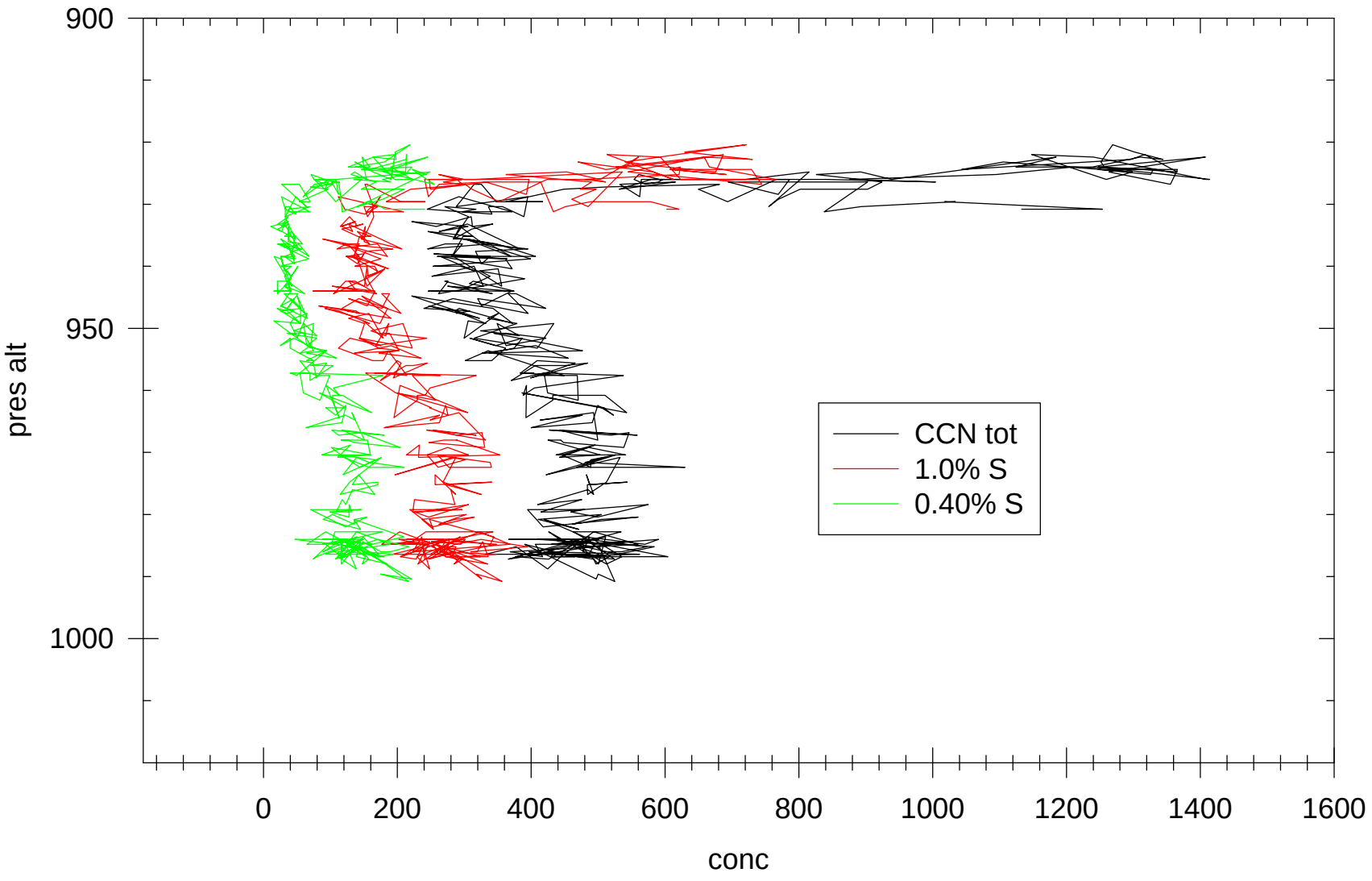
Compare below cloud CCN conc in sounding with N_c.

August 4, 2008 POST Twin Otter 10

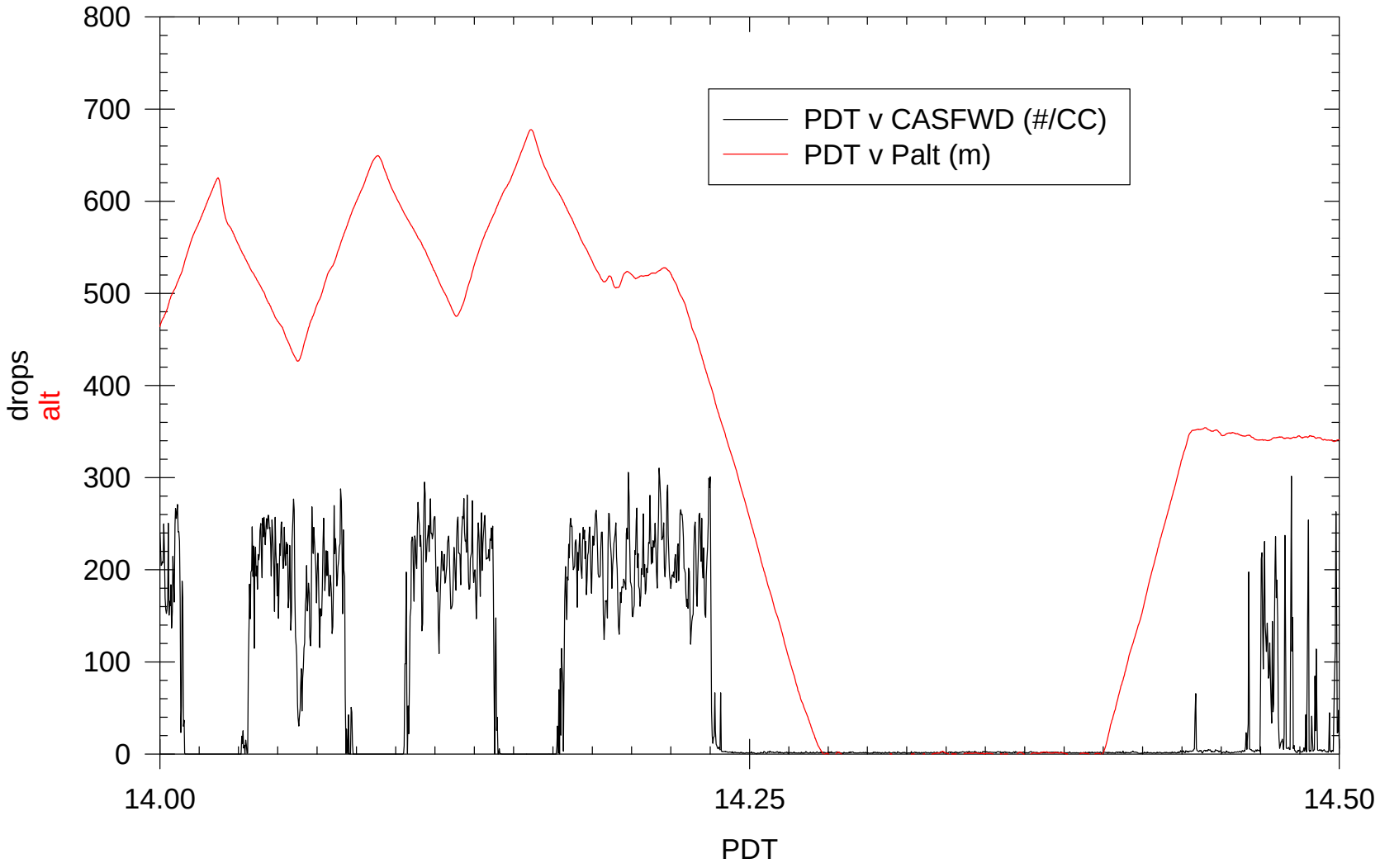


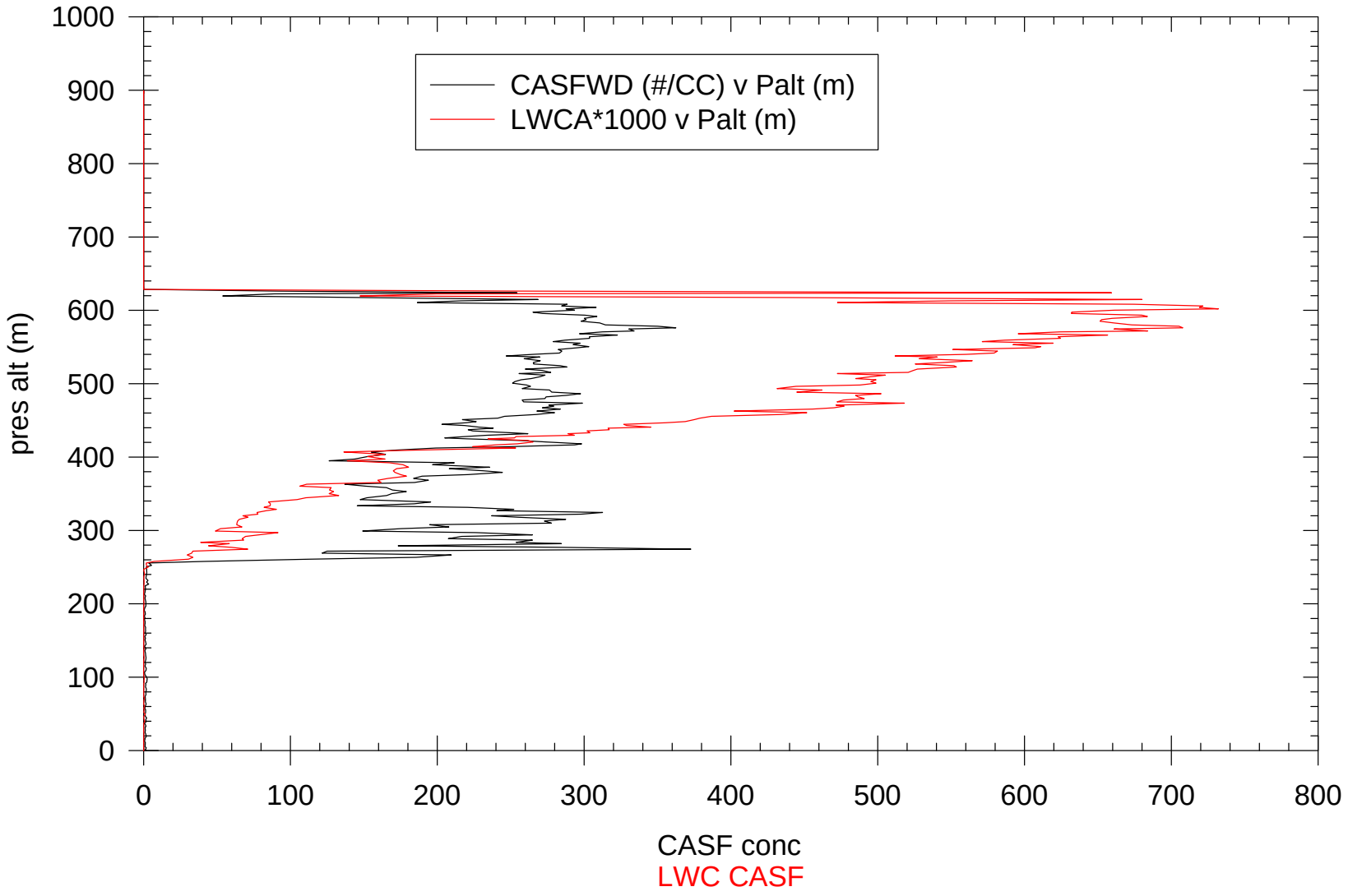

August 4, 2008 POST Twin Otter 10
1121-1127 PDT ascent
pres alt (m)
1000
900
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
CASF conc
LWC
CASFWD (#/CC) v Palt (m)
LWCA*1000 v Palt (m)


August 4, 2008 POST Twin Otter 10
1121-1127 PDT ascent
pres alt (m)
1000
900
800
700
600
500
400
300
200
100
0
0
500
1000
1500
2000
CASF conc
CN
CASFWD (#/CC) v Palt (m)
CPC1 (#/CC) v Palt (m)

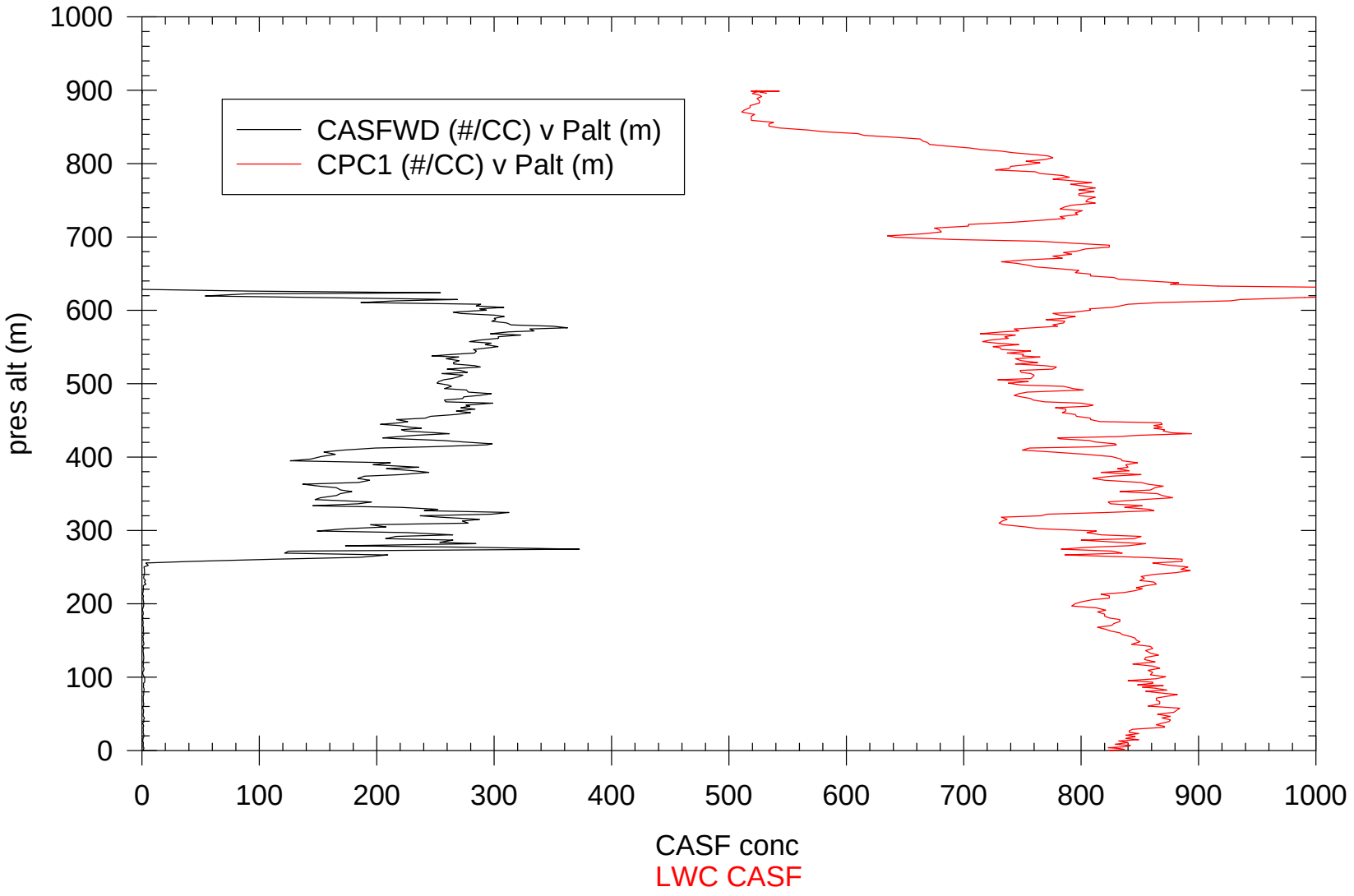

Aug 4, 2008, new spec TO10 Edited
POST
ascent 1121-1127 PDT
900
950
1000
pres alt
0
200
400
600
800
1000
1200
1400
1600
conc
CCN tot
1.0% S
0.40% S

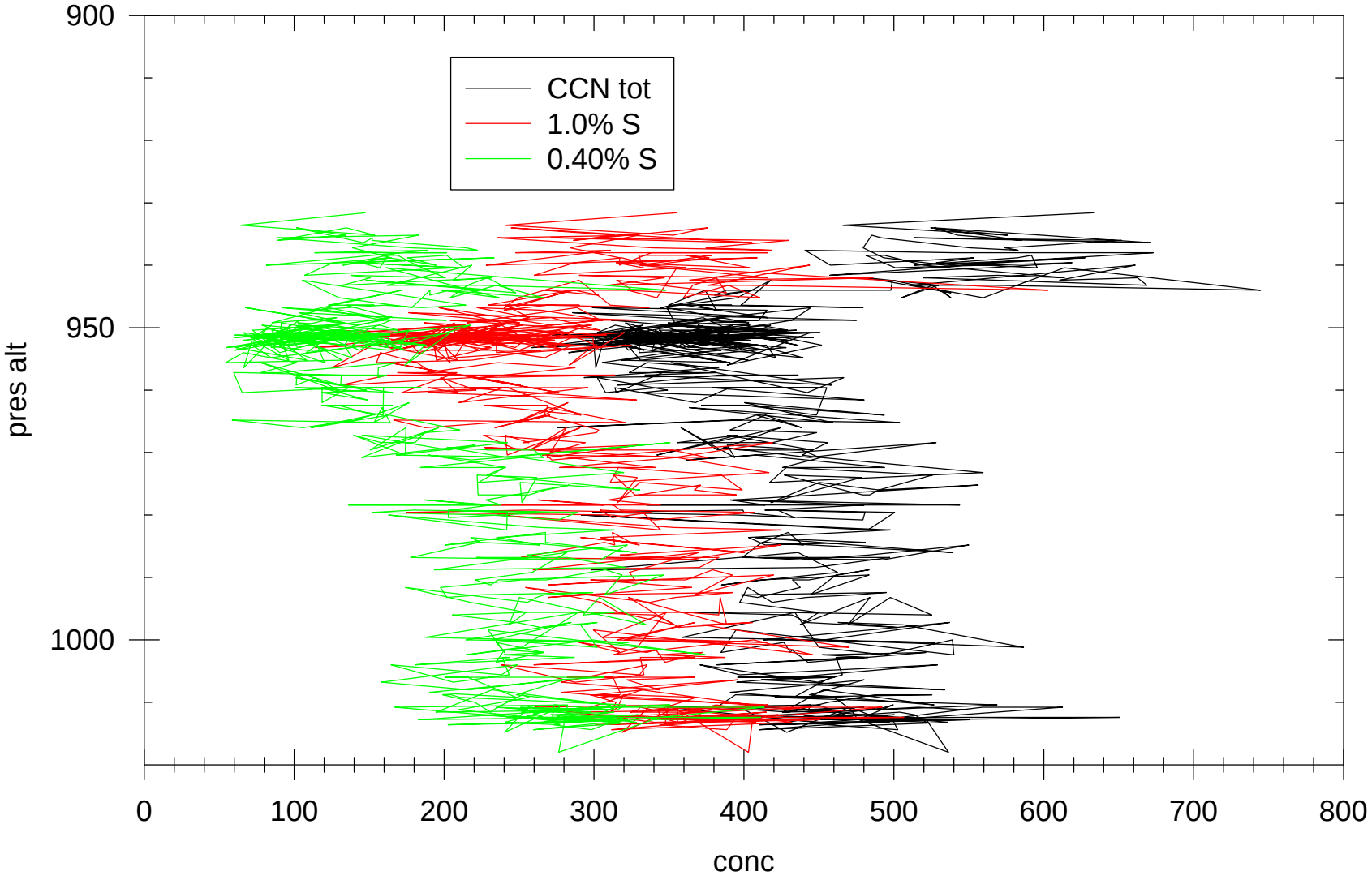
August 4, 2008 POST Twin Otter 10

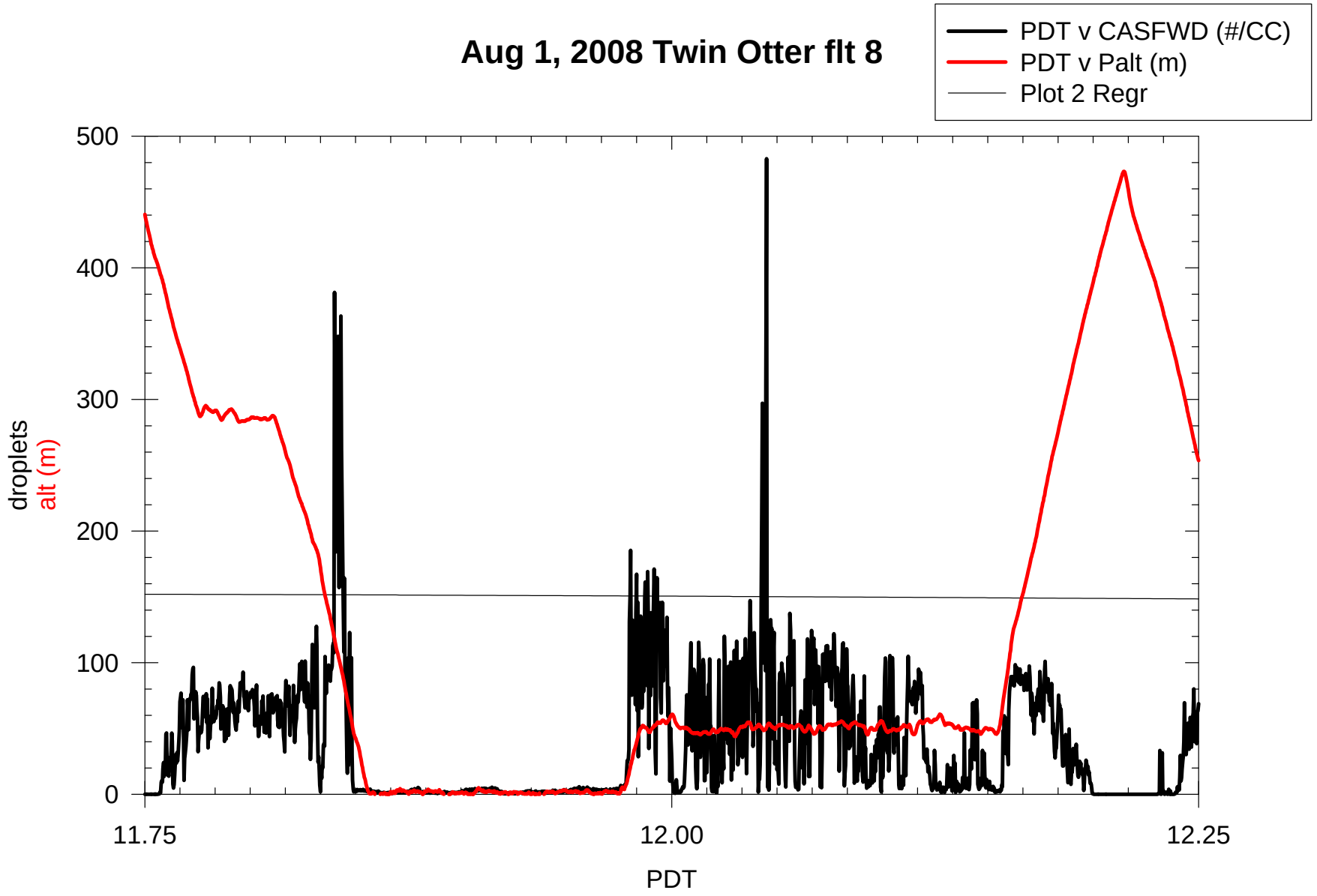


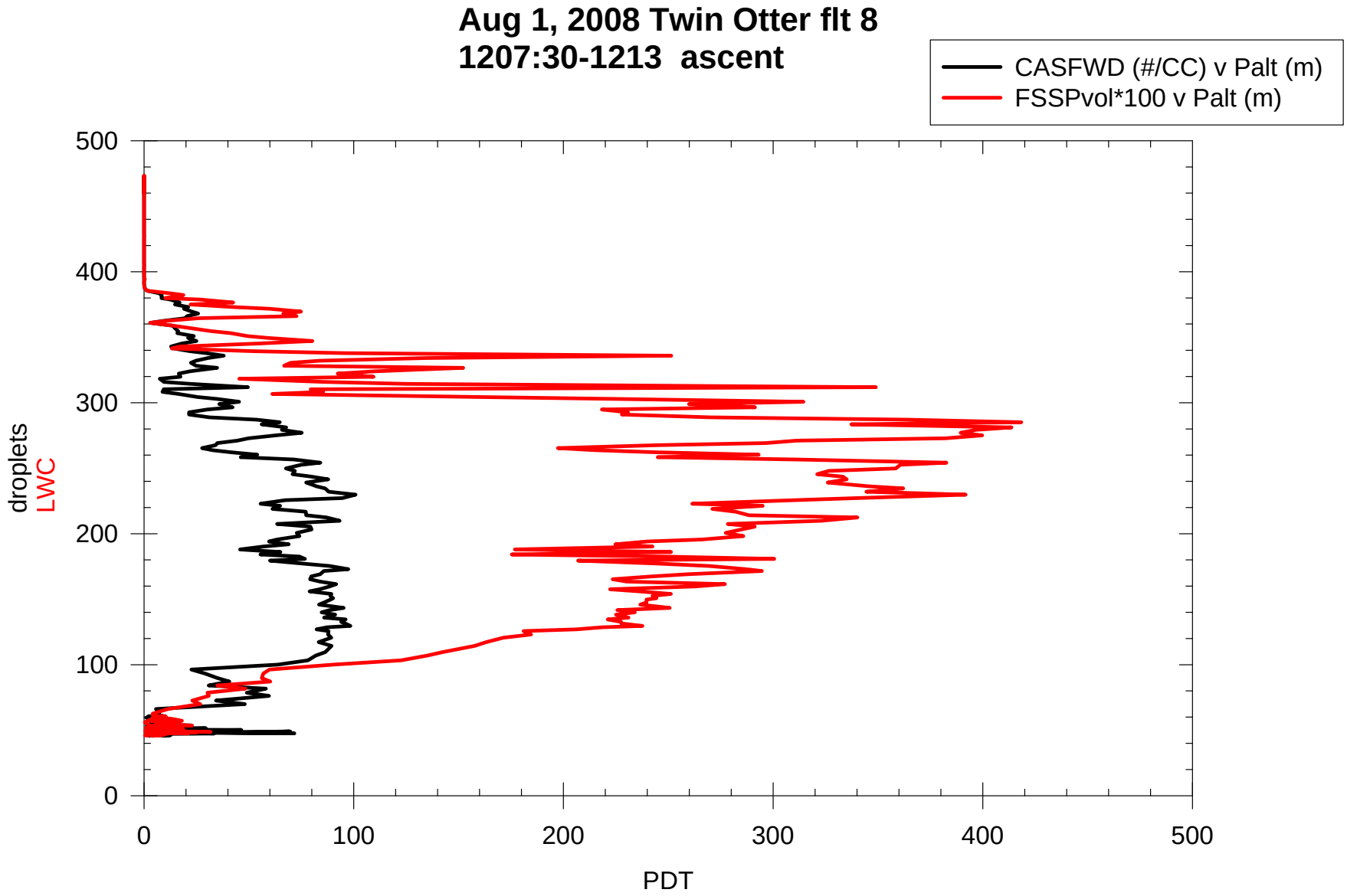

August 4, 2008 POST Twin Otter 10
1409:30-1418 PDT descent
CASFWD (#/CC) v Palt (m)
LWCA*1000 v Palt (m)
pres alt (m)
1000
900
800
700
600
500
400
300
200
100
0
0
100
200
300
400
500
600
700
800
CASF conc
LWC CASF

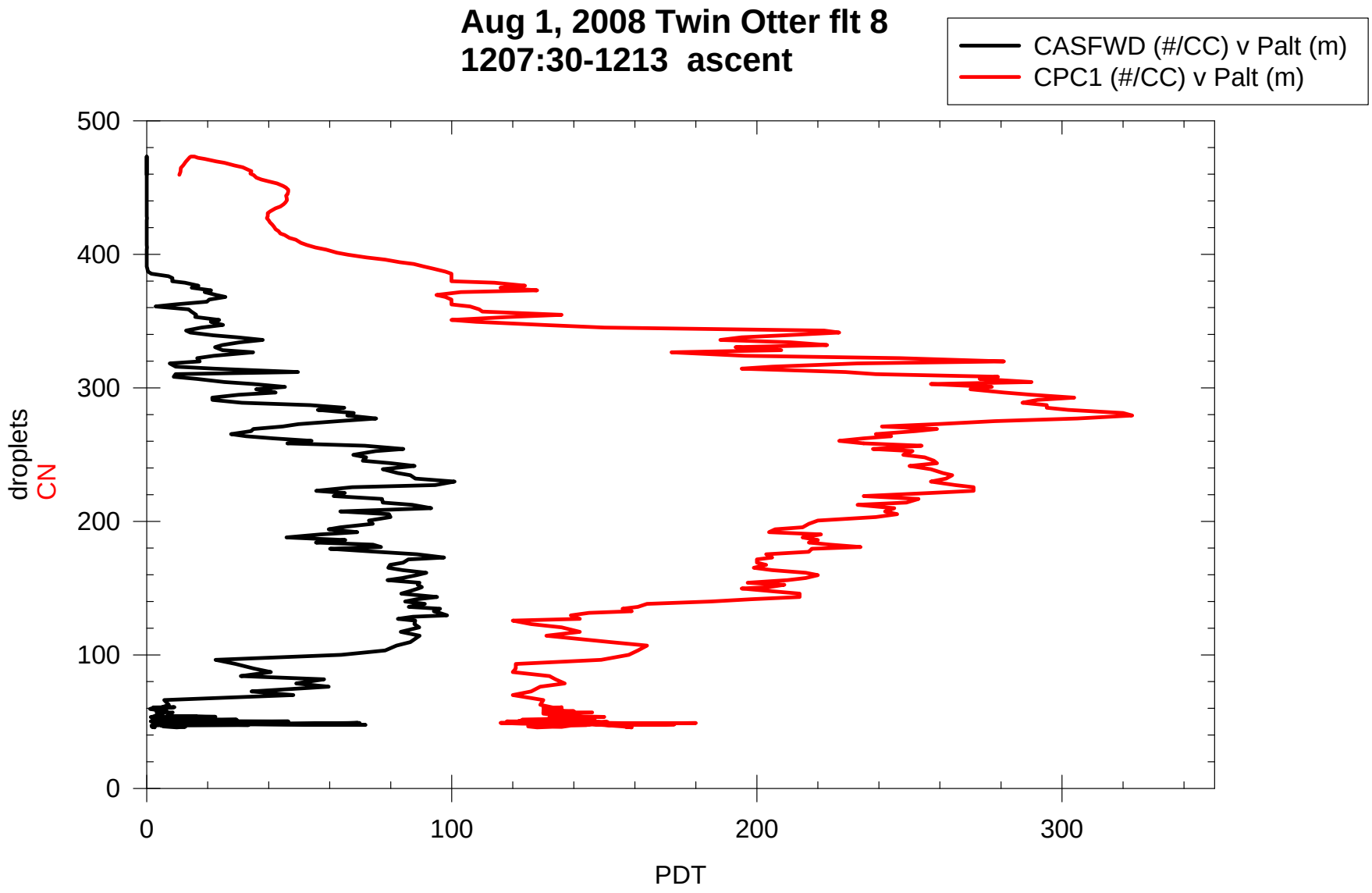
August 4, 2008 POST Twin Otter 10
1409:30-1418 PDT descent

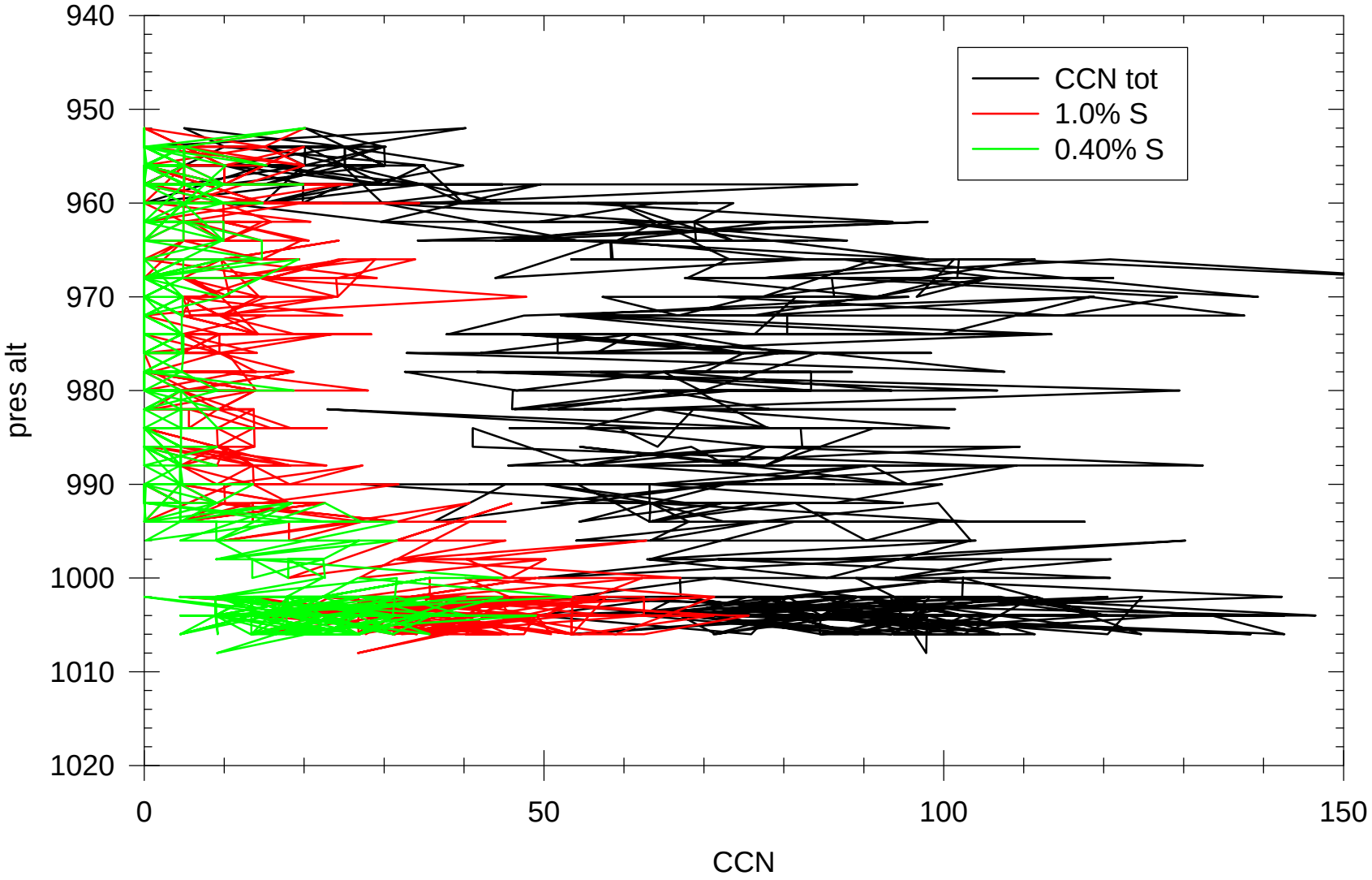


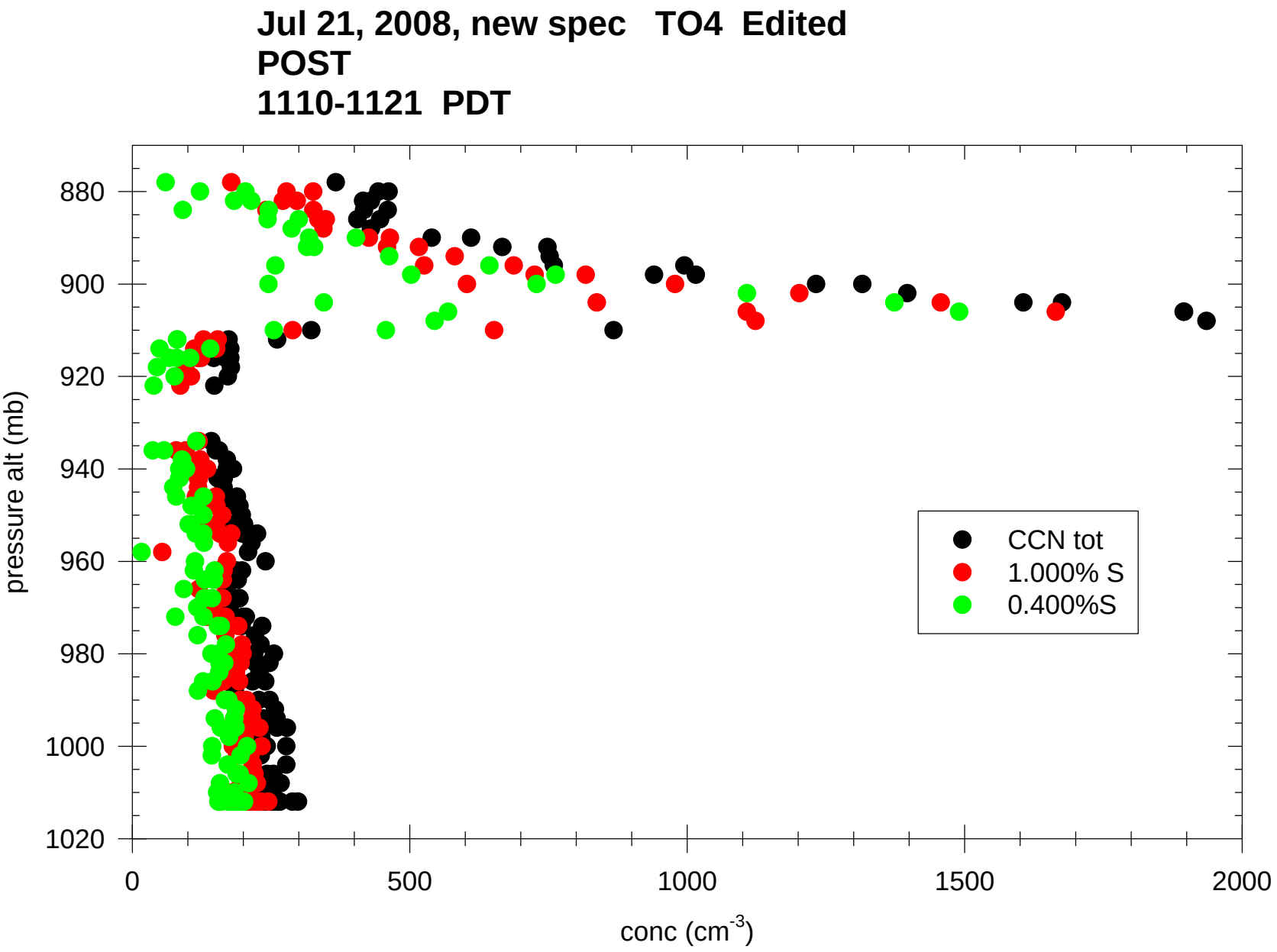

Aug 4, 2008, new spec TO10 Edited
POST
descent 1409:30-1418 PDT
CCN tot
1.0% S
0.40% S
900
950
1000
pres alt
0
100
200
300
400
500
600
700
800
conc

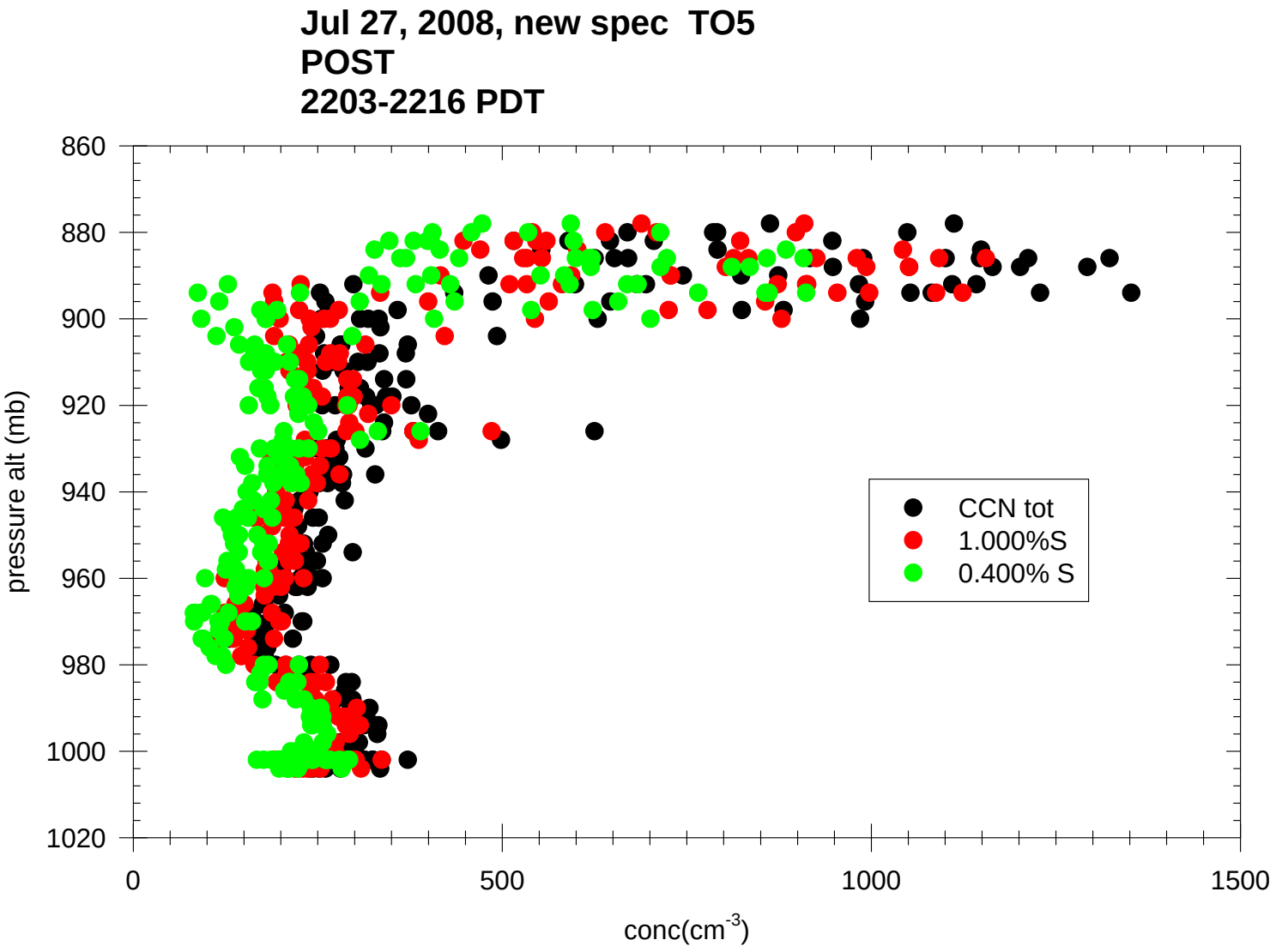

Aug 1, 2008 Twin Otter flt 8
PDT v CASFWD (#/CC)
PDT v Palt (m)
Plot 2 Regr
droplets
alt (m)
500
400
300
200
100
0
11.75
12.00
12.25
PDT

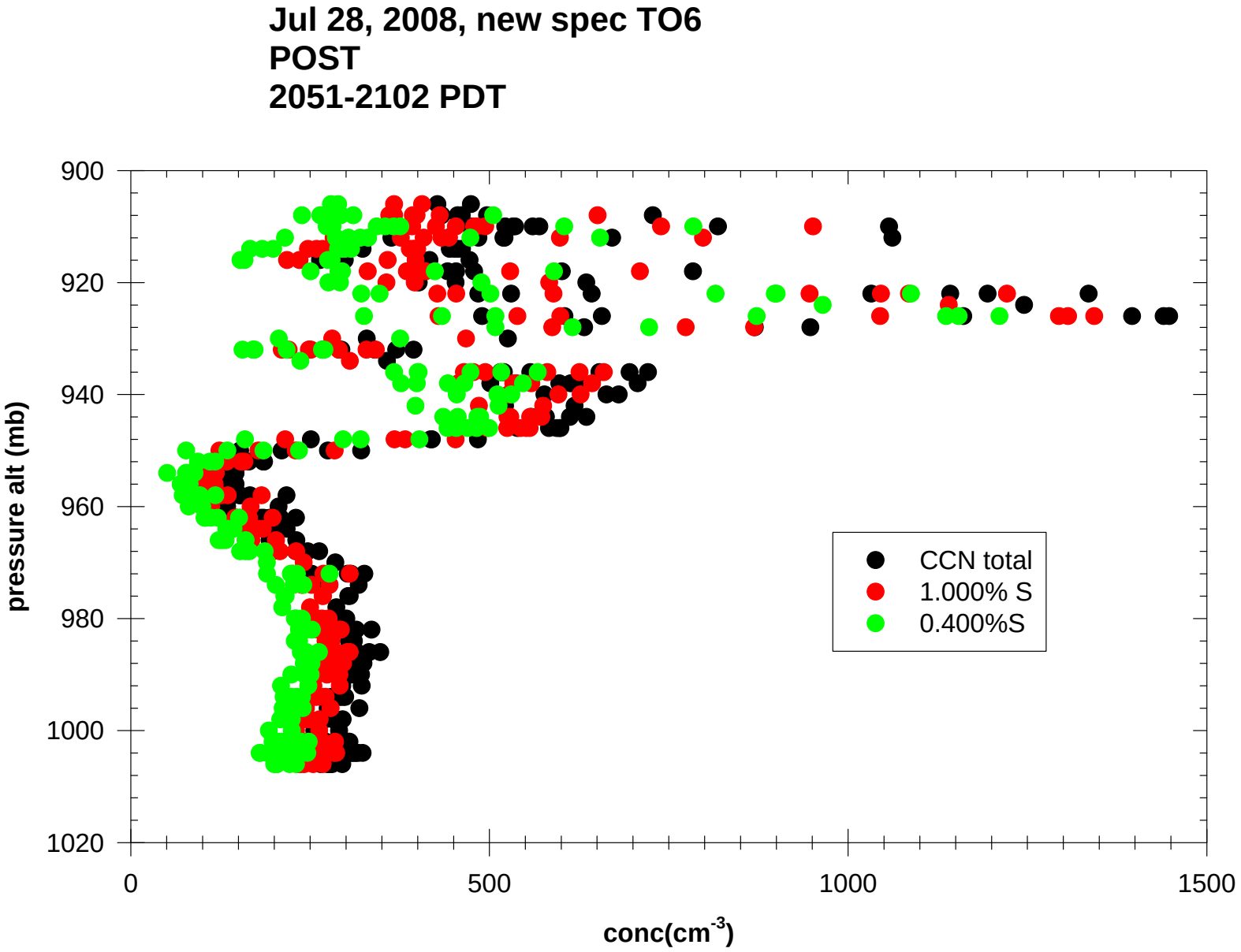

Aug 1, 2008 Twin Otter flt 8
1207:30-1213 ascent
CASFWD (#/CC) v Palt (m)
FSSPvol*100 v Palt (m)
droplets
LWC
0
100
200
300
400
500
PDT

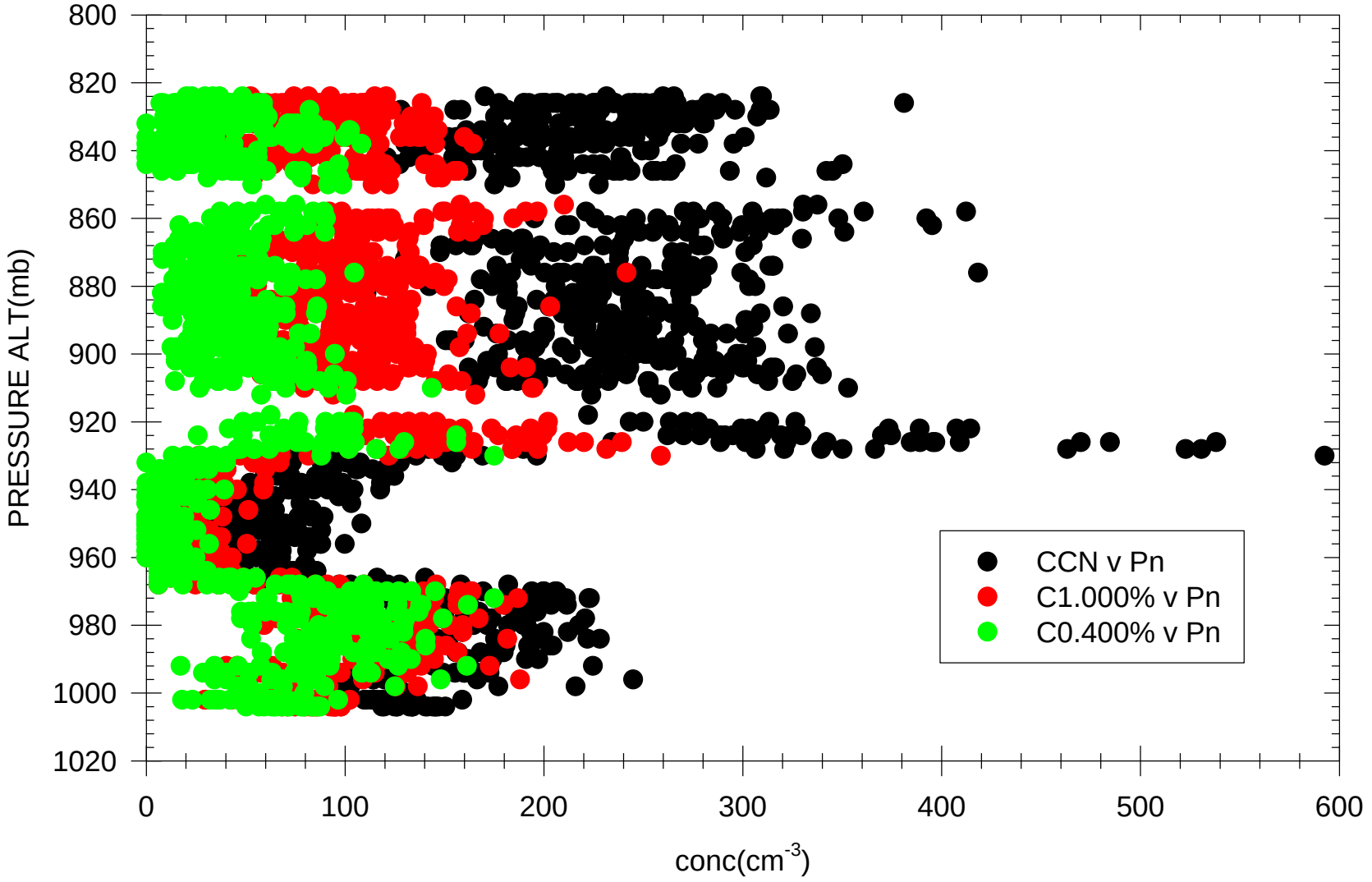

Aug 1, 2008 Twin Otter flt 8
1207:30-1213 ascent
CASFWD (#/CC) v Palt (m)
CPC1 (#/CC) v Palt (m)
droplets
CN
500
400
300
200
100
0
0
100
200
300
PDT

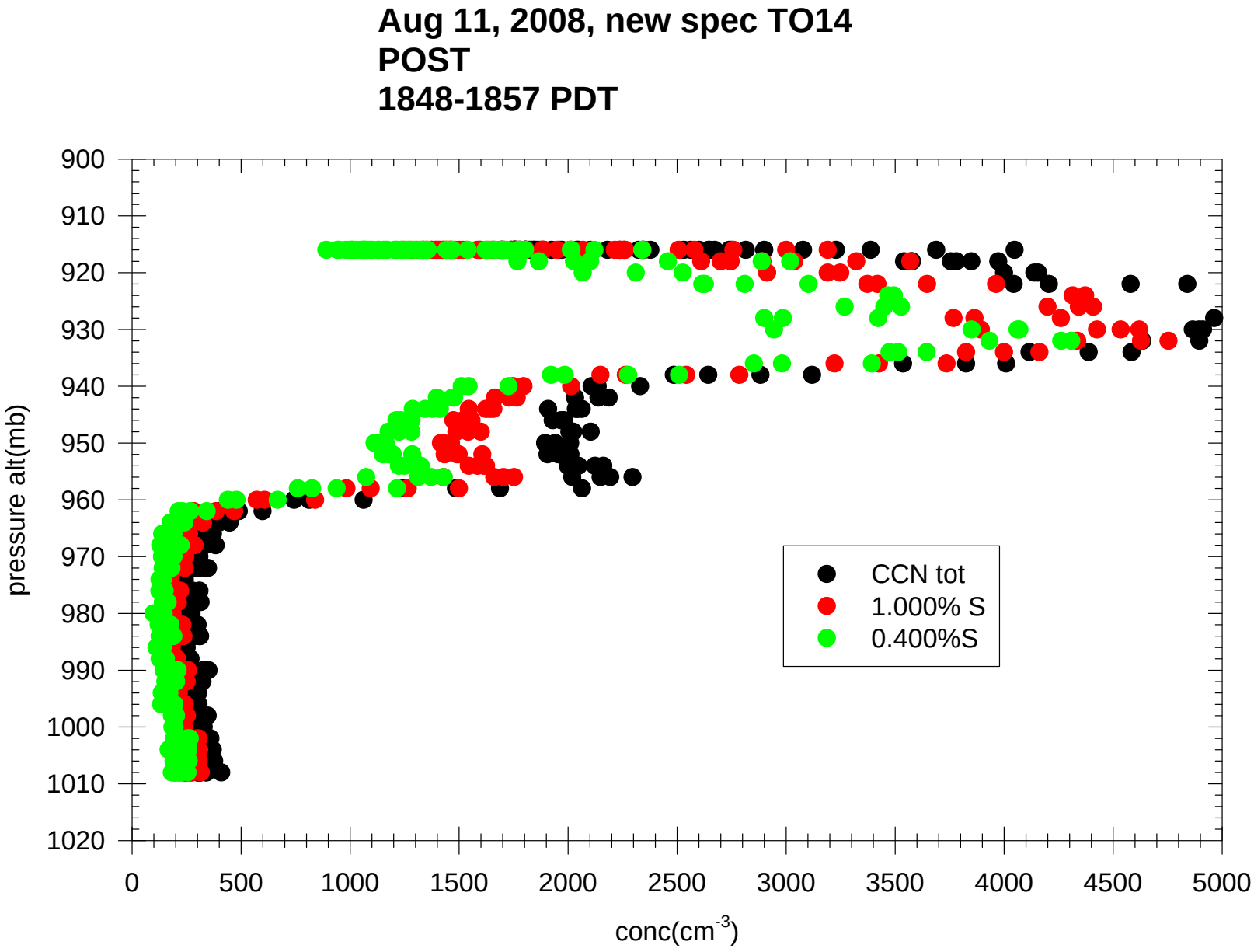

Aug 1, 2008, new spec C-130 TO8 Edited POST
ascent 1207:30-1213
CCN tot
1.0% S
0.40% S
pres alt
940
950
960
970
980
990
1000
1010
1020
0
50
100
150
CCN

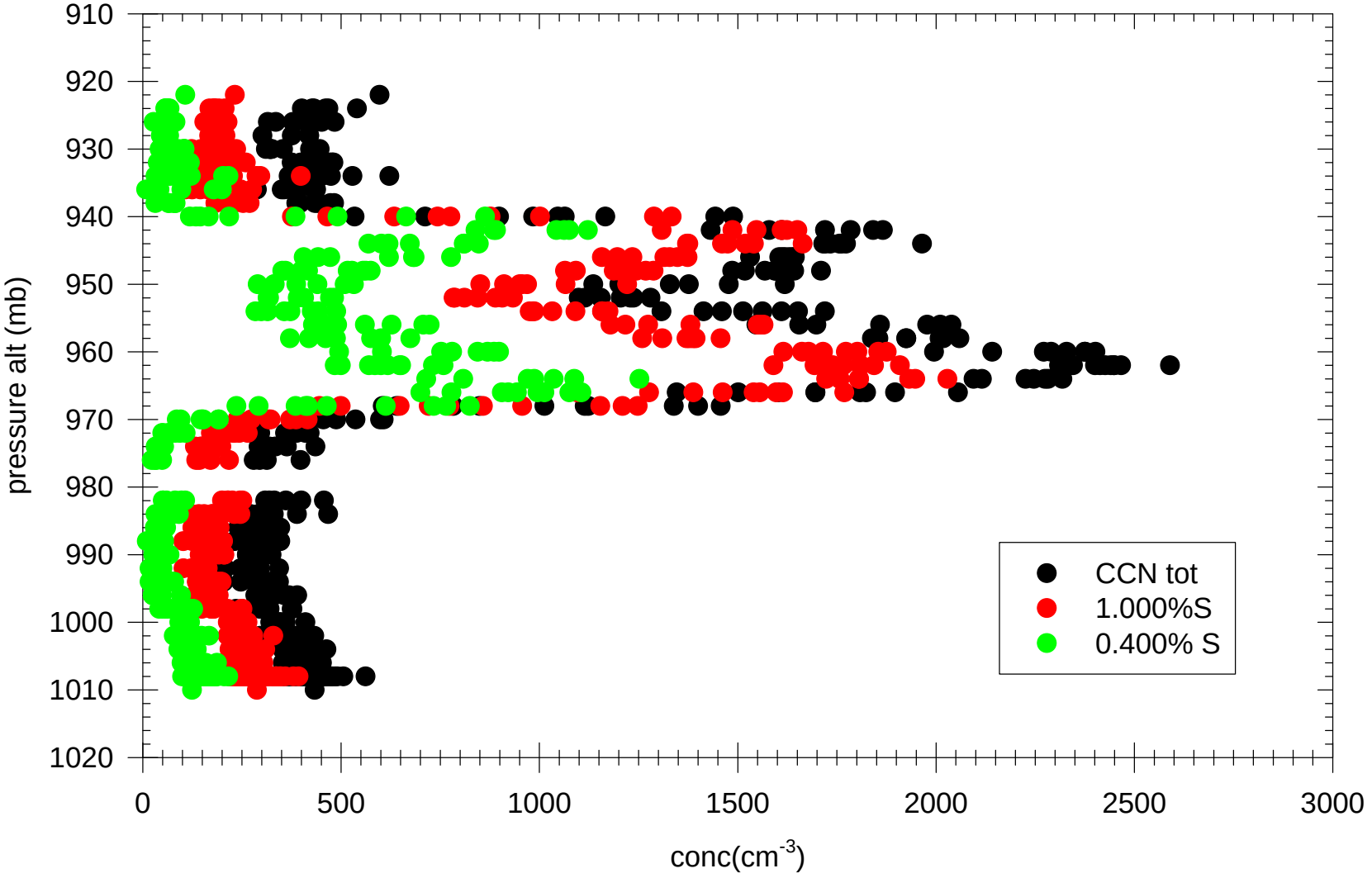

Jul 21, 2008, new spec TO4 Edited
POST
1110-1121 PDT
pressure alt (mb)
880
900
920
940
960
980
1000
1020
0
500
1000
1500
2000
conc (cm-3)
CCN tot
1.000% S
0.400%S


Jul 27, 2008, new spec TO5
POST
2203-2216 PDT
pressure alt (mb)
860
880
900
920
940
960
980
1000
1020
0
500
1000
1500
conc(cm-3)
CCN tot
1.000%S
0.400% S

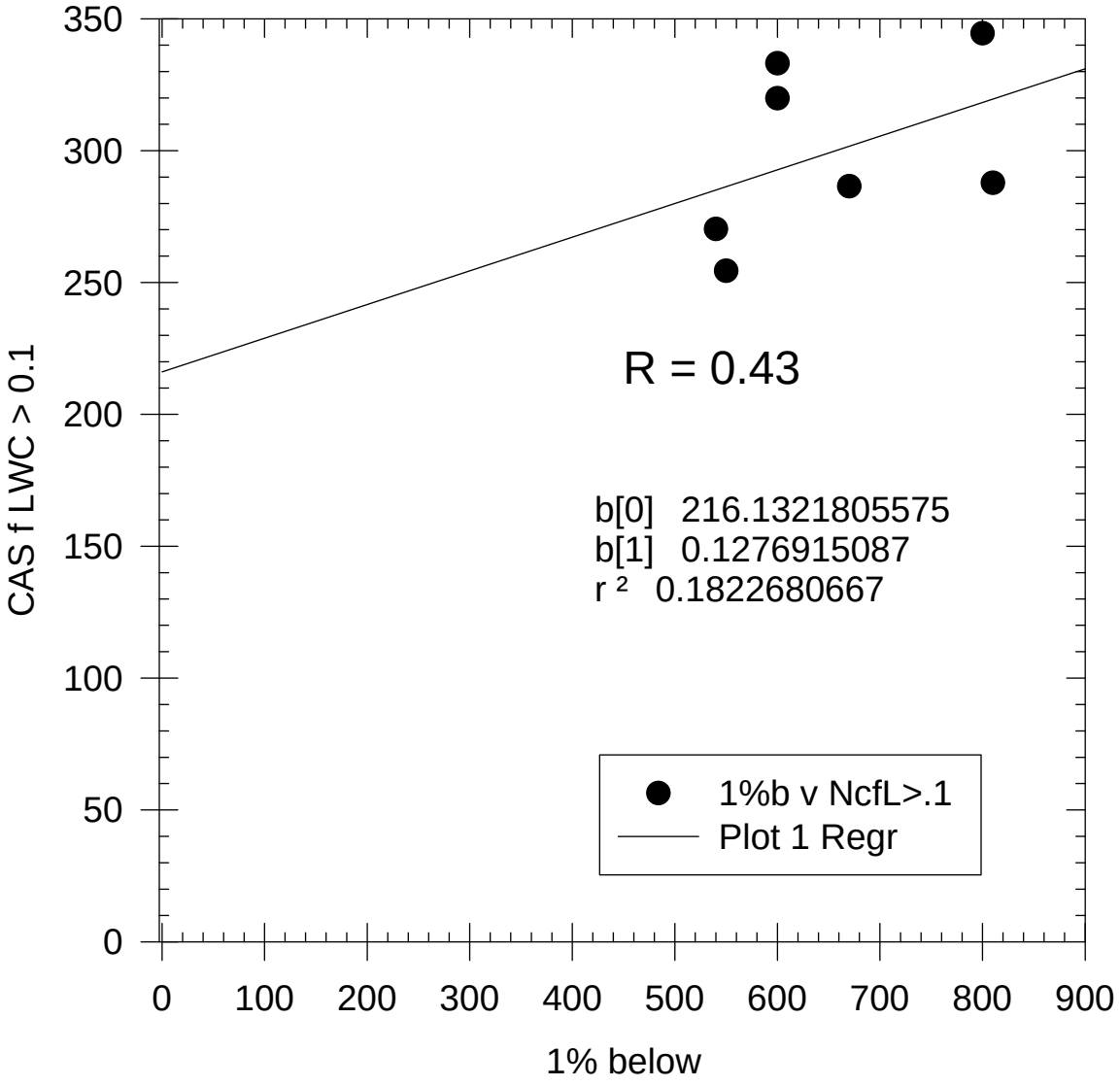

Jul 28, 2008, new spec TO6
POST
2051-2102 PDT
pressure alt (mb)
900
920
940
960
980
1000
1020
0
500
1000
1500
conc(cm-3)
CCN total
1.000% S
0.400%S


Aug 8, 2008, new spec TO13
POST
2226-2240 PDT
PRESSURE ALT(mb)
800
820
840
860
880
900
920
940
960
980
1000
1020
0
100
200
300
400
500
600
conc(cm-3)
CCN v Pn
C1.000% v Pn
C0.400% v Pn

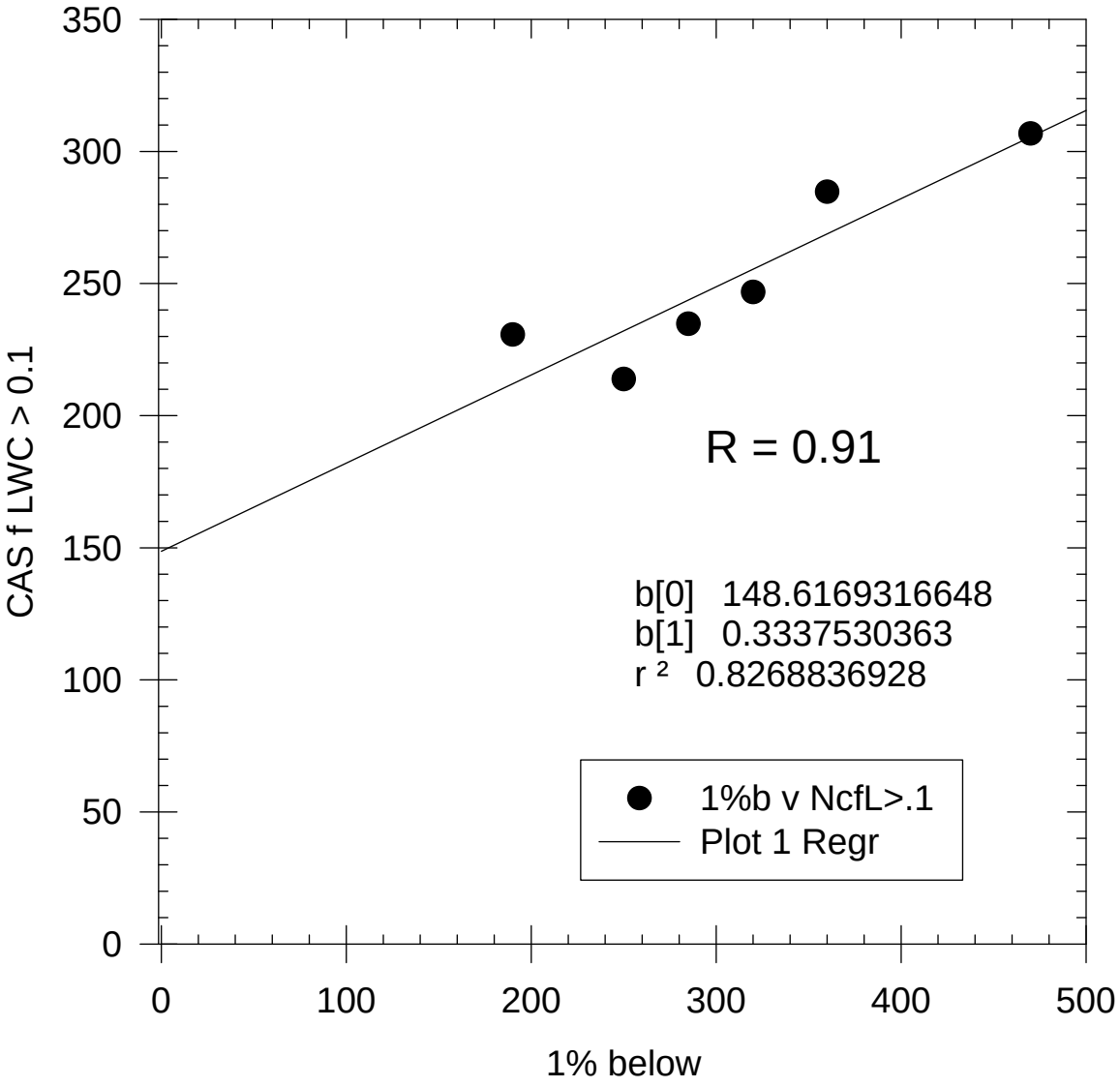

Aug 11, 2008, new spec TO14
POST
1848-1857 PDT
pressure alt(mb)
900
910
920
930
940
950
960
970
980
990
1000
1010
1020
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
conc(cm-3)
CCN tot
1.000% S
0.400%S


Aug 15, 2008, new spec TO17 EDITED
POST
1002.3-1012 PDT
pressure alt (mb)
910
920
930
940
950
960
970
980
990
1000
1010
1020
0
500
1000
1500
2000
2500
3000
conc(cm-3)
CCN tot
1.000%S
0.400% S

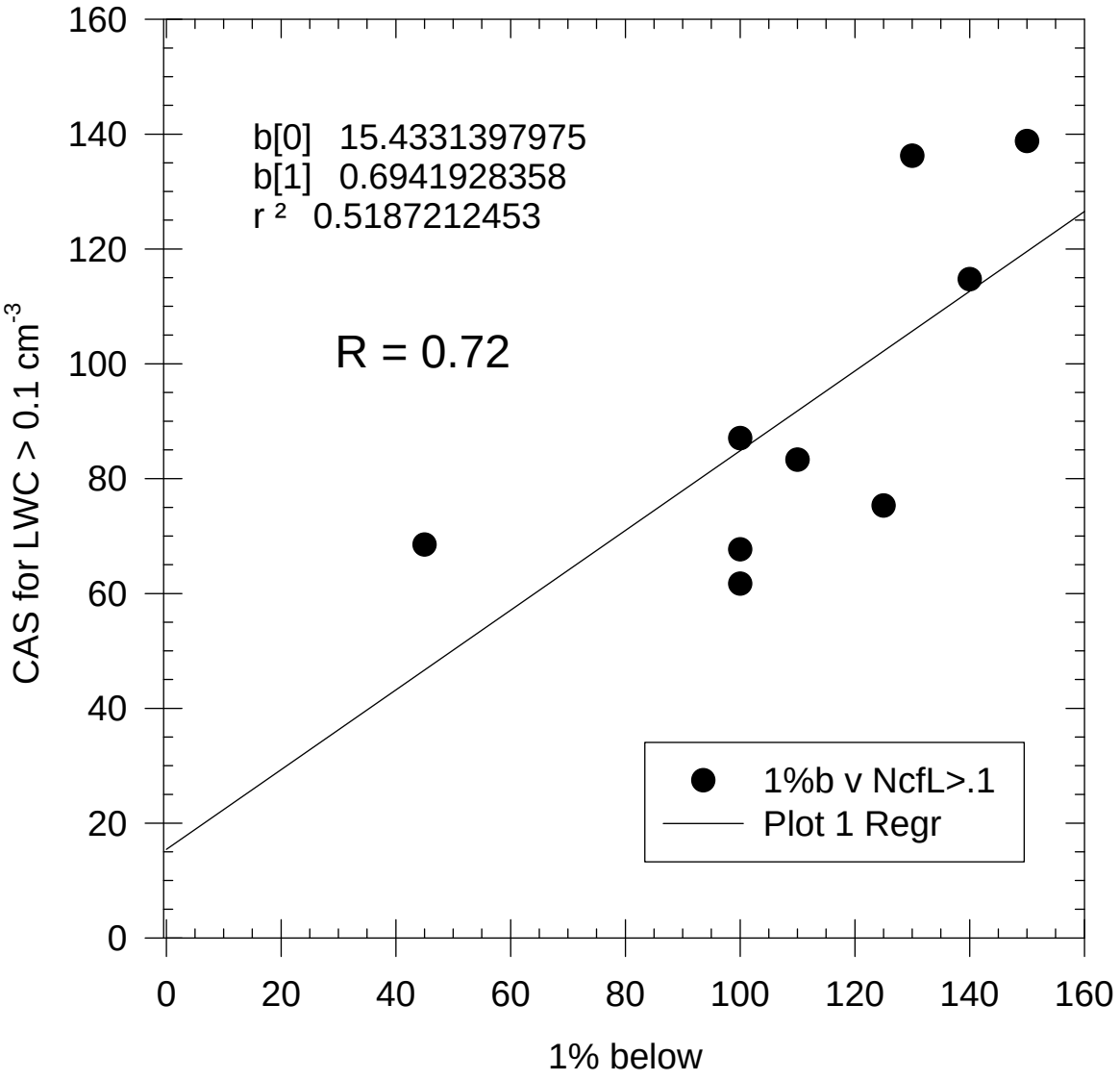
July 18 TO3


CAS f LWC > 0.1
1% below
R = 0.43
b[0] 216.1321805575
b[1] 0.1276915087
r ² 0.1822680667
1%b v NcfL>.1
Plot 1 Regr
0
50
100
150
200
250
300
350
0
100
200
300
400
500
600
700
800
900

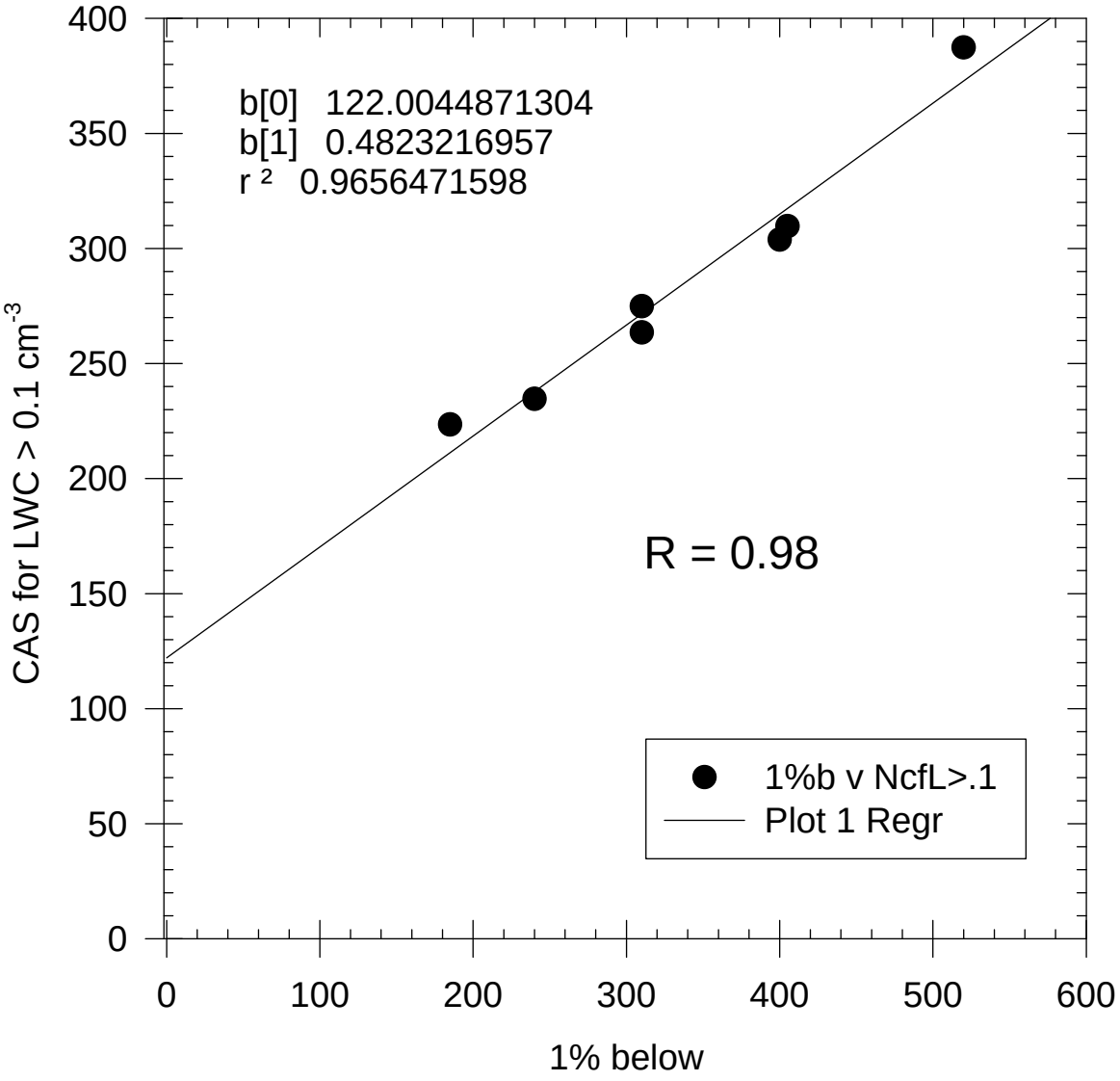
July 28 TO6 2008 POST



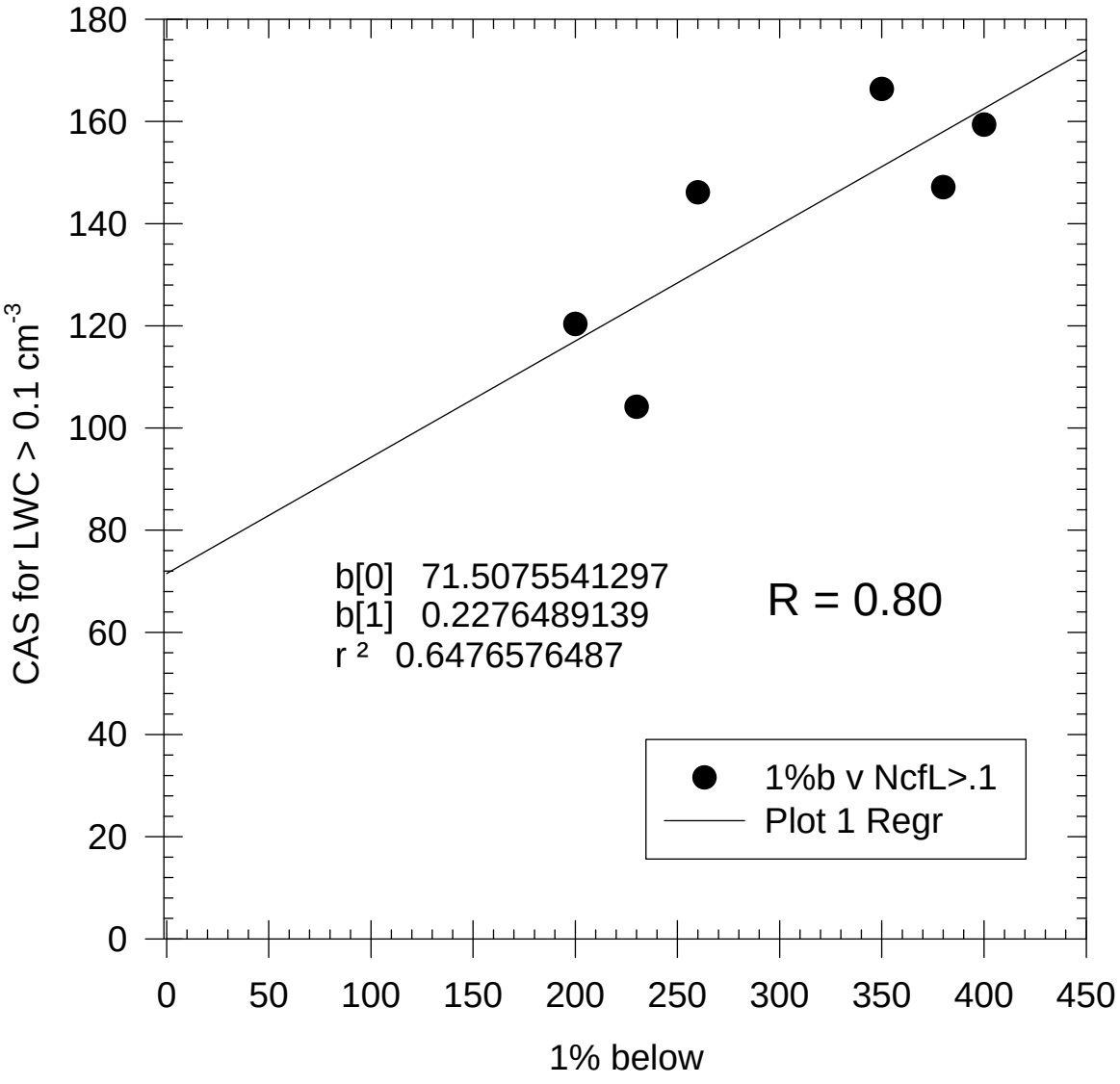
August 1 TO8 2008 POST



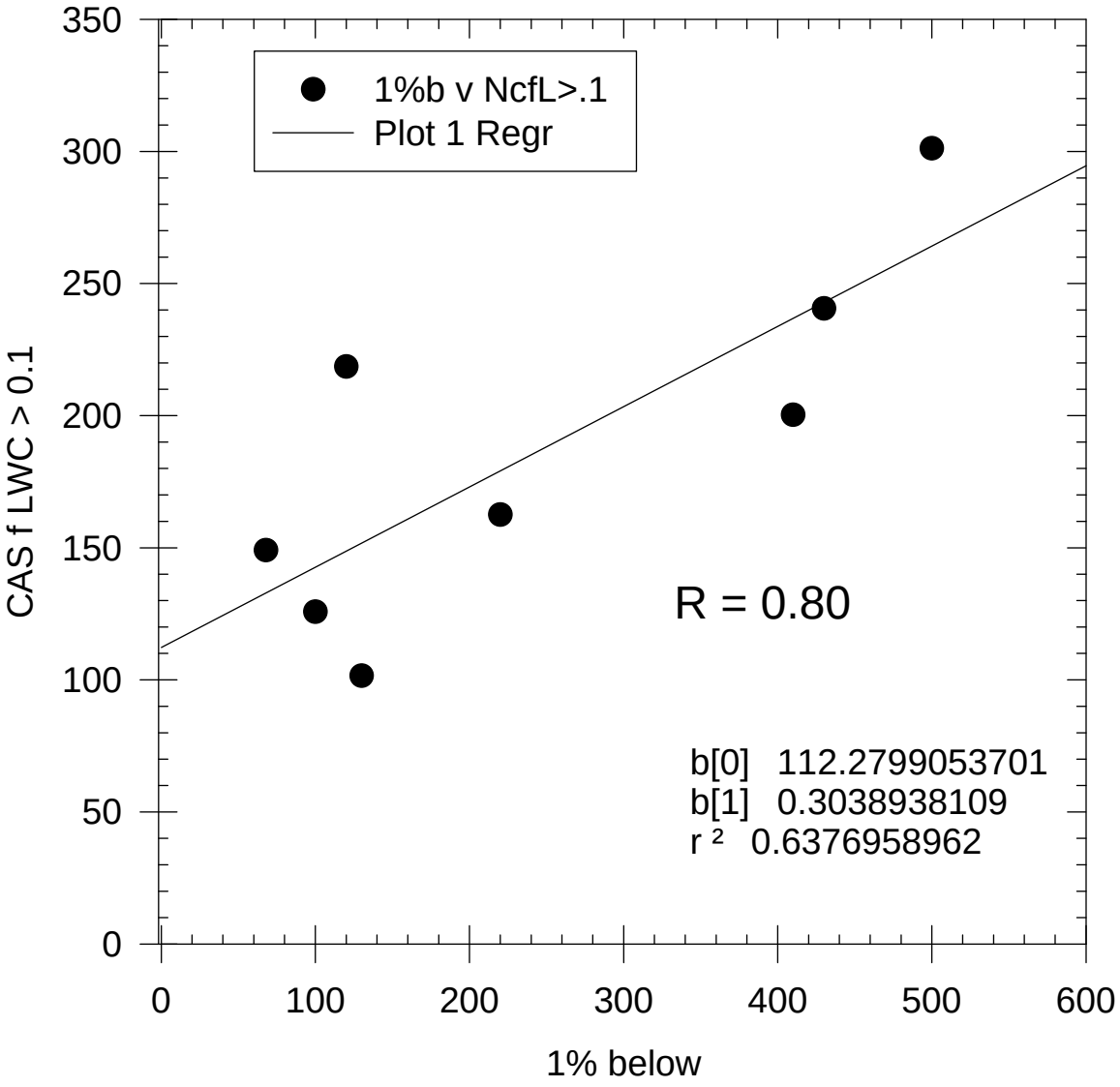
August 7 TO 12 2008 POST



August 11, TO14 2008 POST

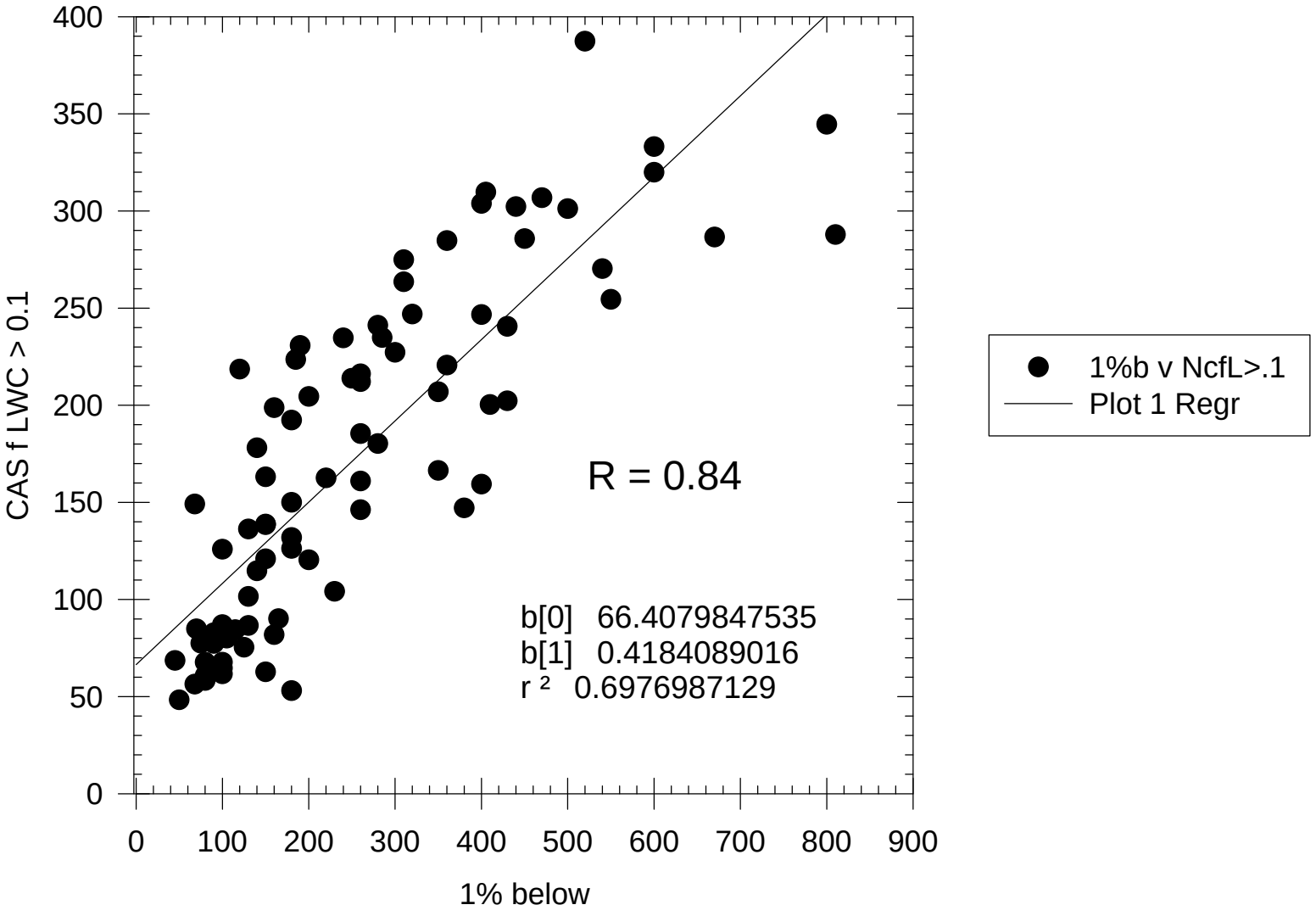


August 12 TO15 2008 POST

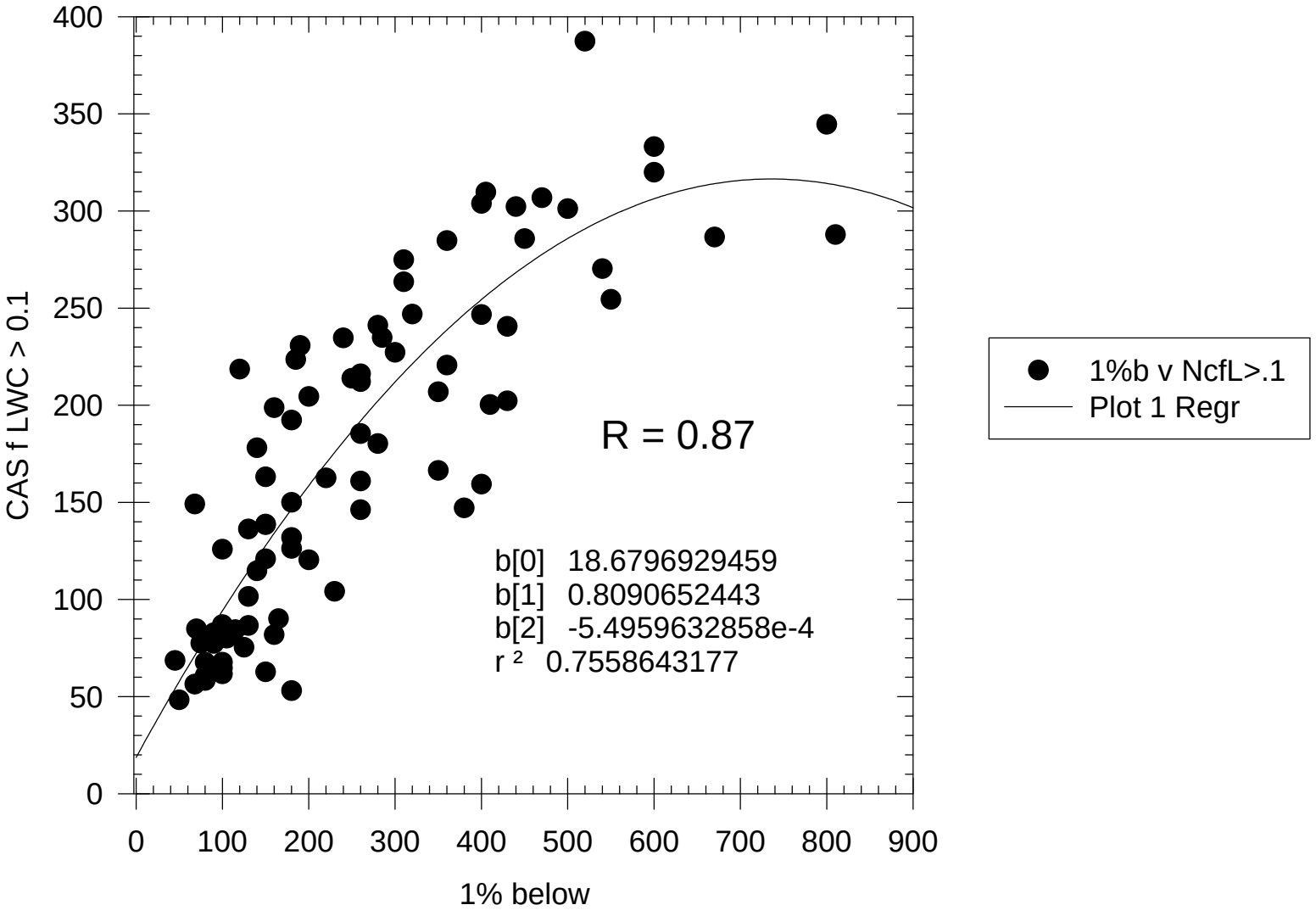


Date	flight	time	operator	cal	processing	N	R^2	R	CCN range
July 18	TO3	night	Hudson	rack	volatility	7	0.18	0.42	500-800
July 21	TO4	day	Hudson	rack	volatility	4	0.02	0.15	100-200
July 27	TO5	night	Jha	bags		6	0.59	0.77	150-450
July 28	TO6	night	Jha	bags		6	0.83	0.91	200-500
July 30	TO7	day	Hudson	bags		9	0.64	0.80	50-170
Aug. 1	TO8	day	Hudson	bags		9	0.52	0.72	40-160
Aug. 2	TO9	day	Hudson,	bags		little			
Aug. 4	TO10	day	Hudson	bags		6	0.06	0.25	250-400
Aug. 5	TO11	night	Hudson	bags		High			
Aug. 7	TO12	night	Hudson	bags		7	0.97	0.98	180-520
Aug. 8	TO13	night	Hudson	bags		8	0.68	0.82	65-265
Aug. 11	TO14	night	Noble	bags		6	0.65	0.80	200-400
Aug. 12	TO15	night	Hudson	bags		8	0.64	0.80	60-500
Aug. 14	TO16	day	Hudson	rack	Vol., size-S_c	3	0.64	0.80	150-180
Aug. 15	TO17	day	Hudson	rack	Vol., size-S_c	5	0.004	0.06	180-270

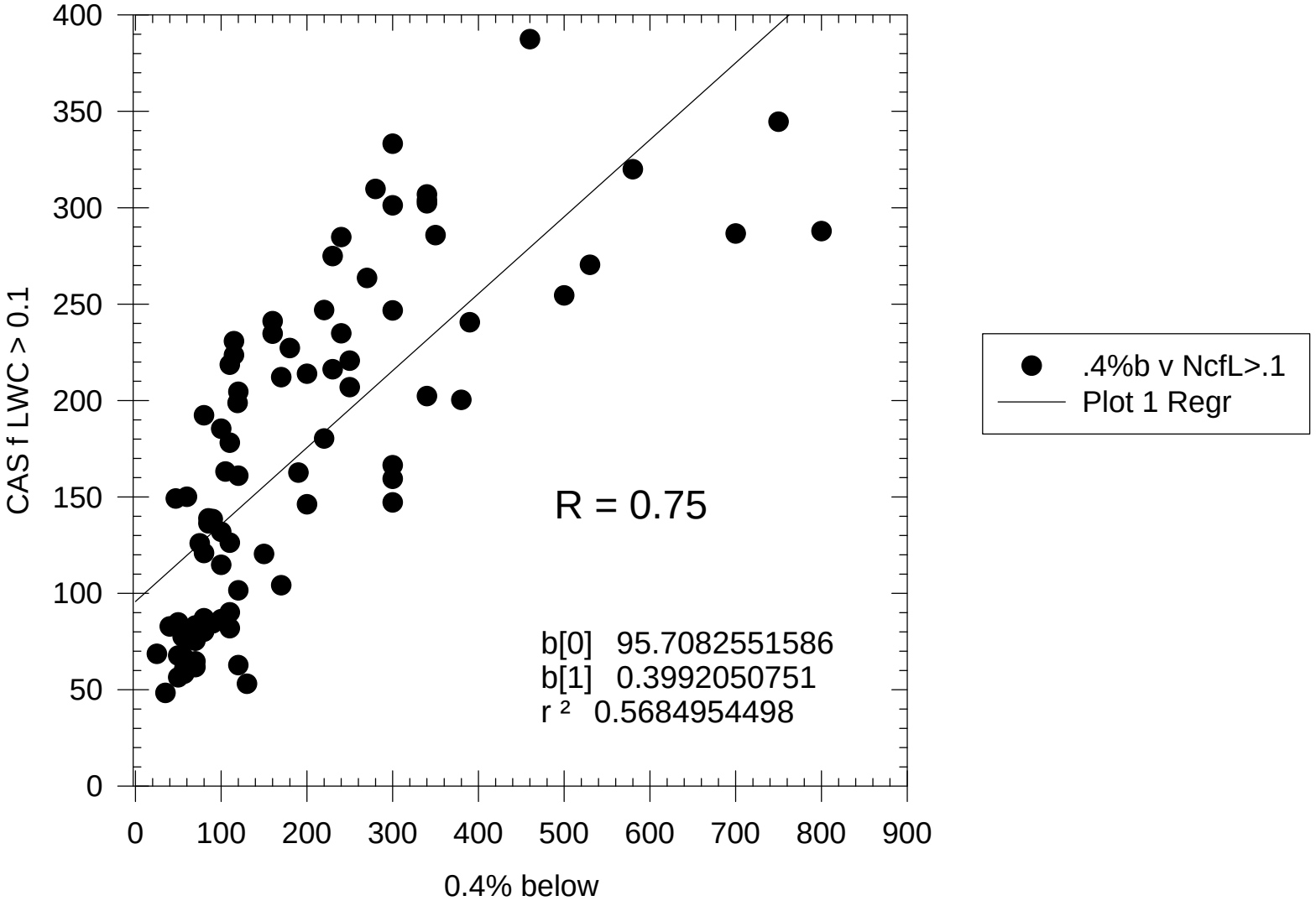
July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11
84 soundings



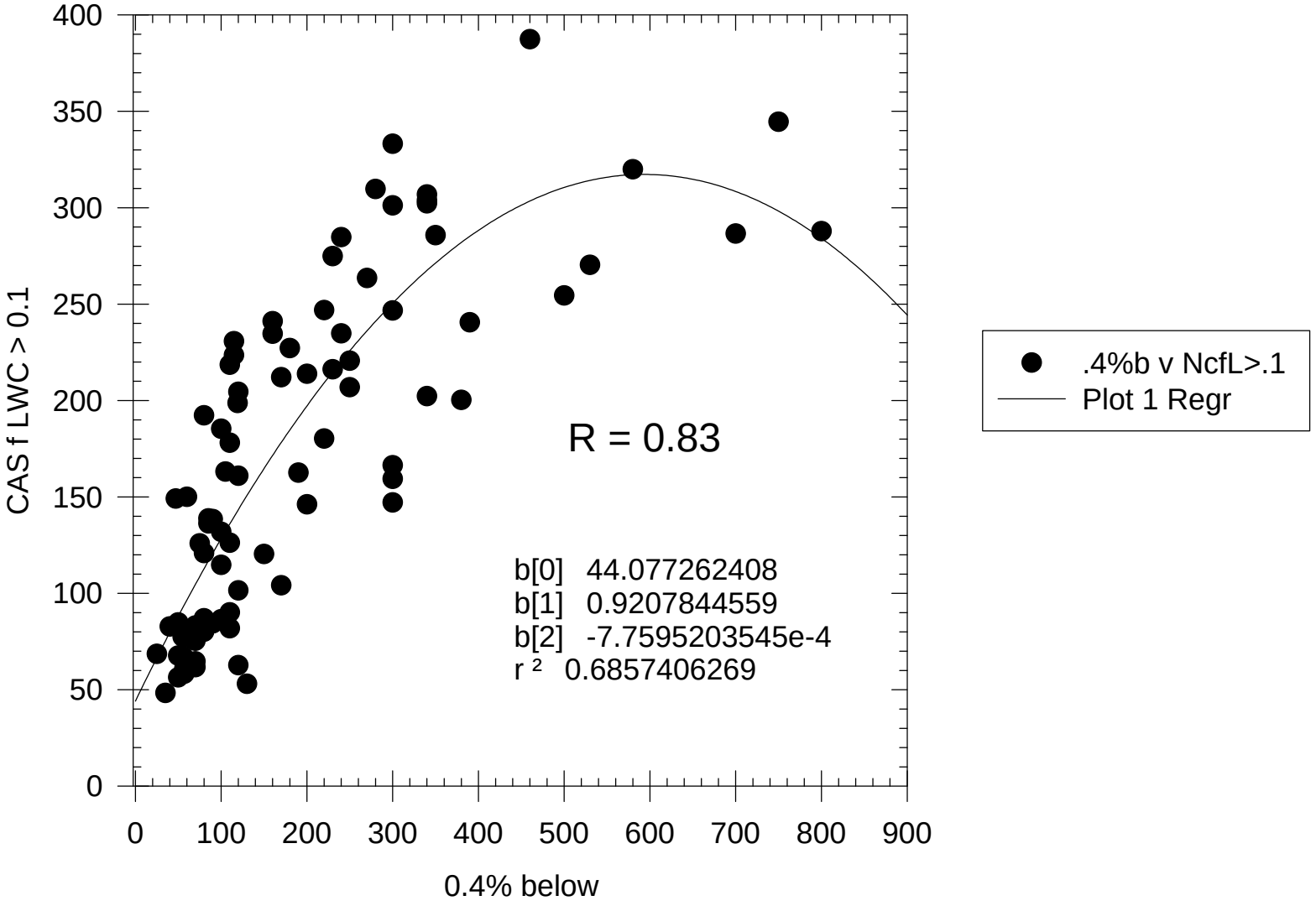
July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11



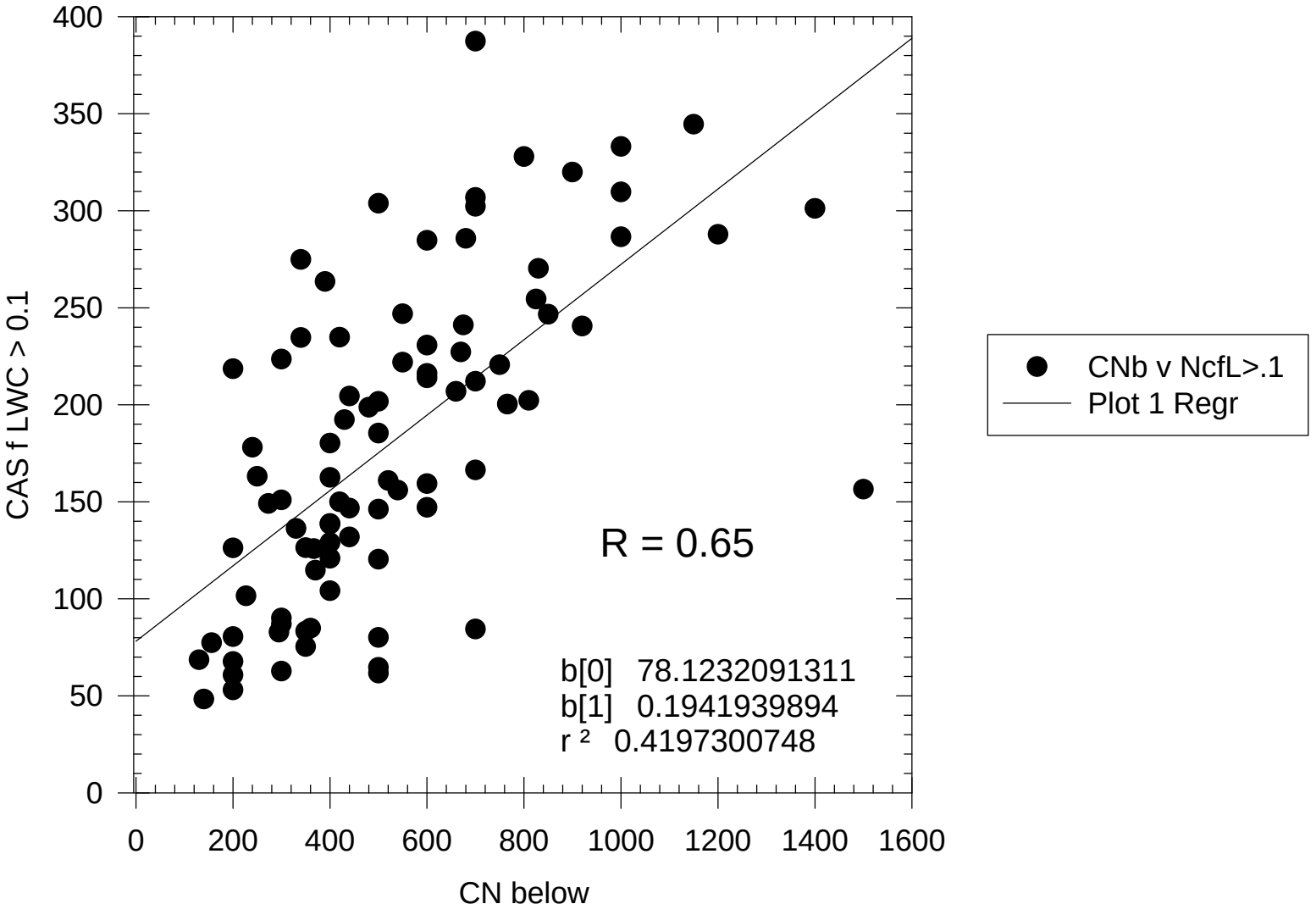
July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11



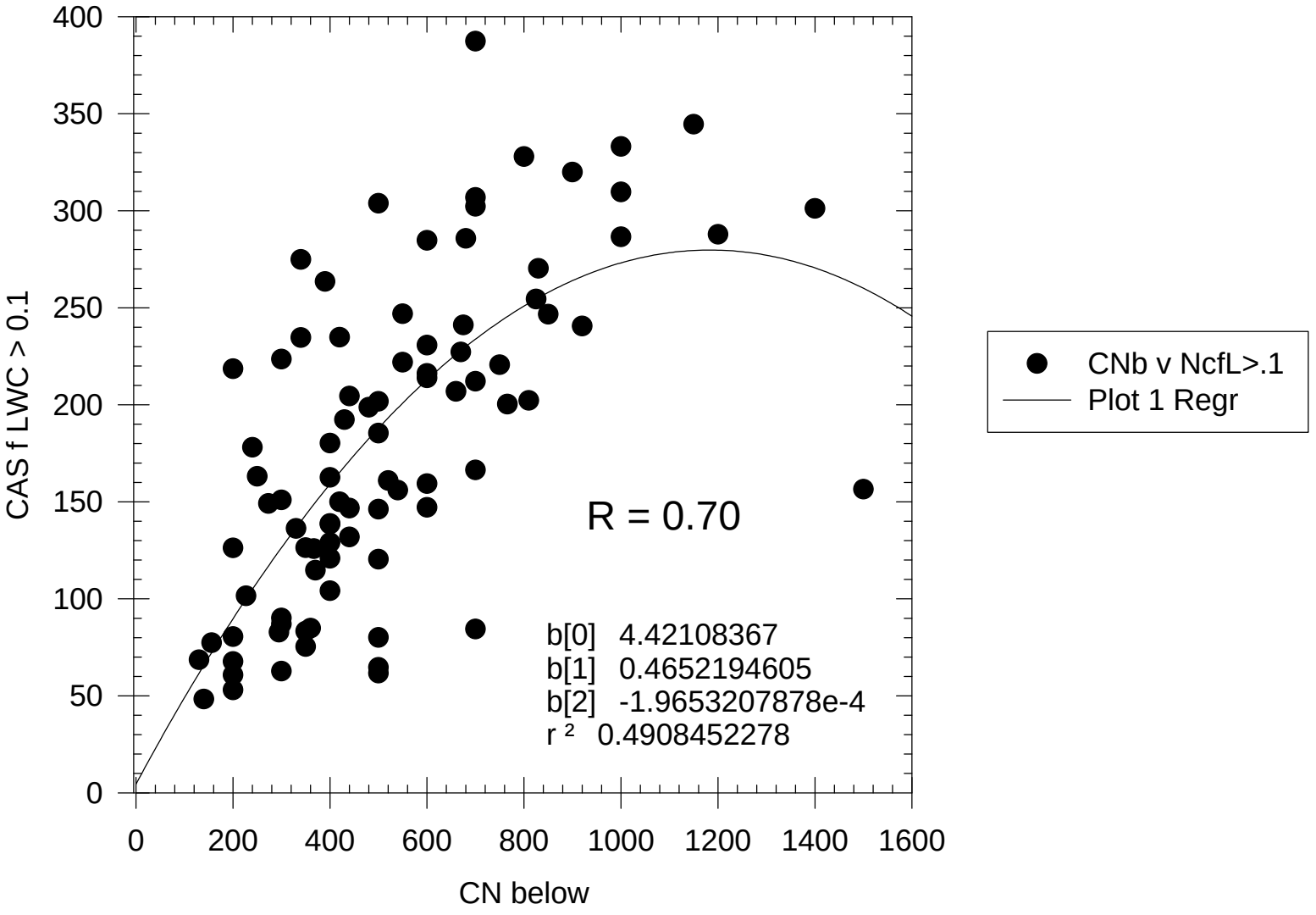
July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11



July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11



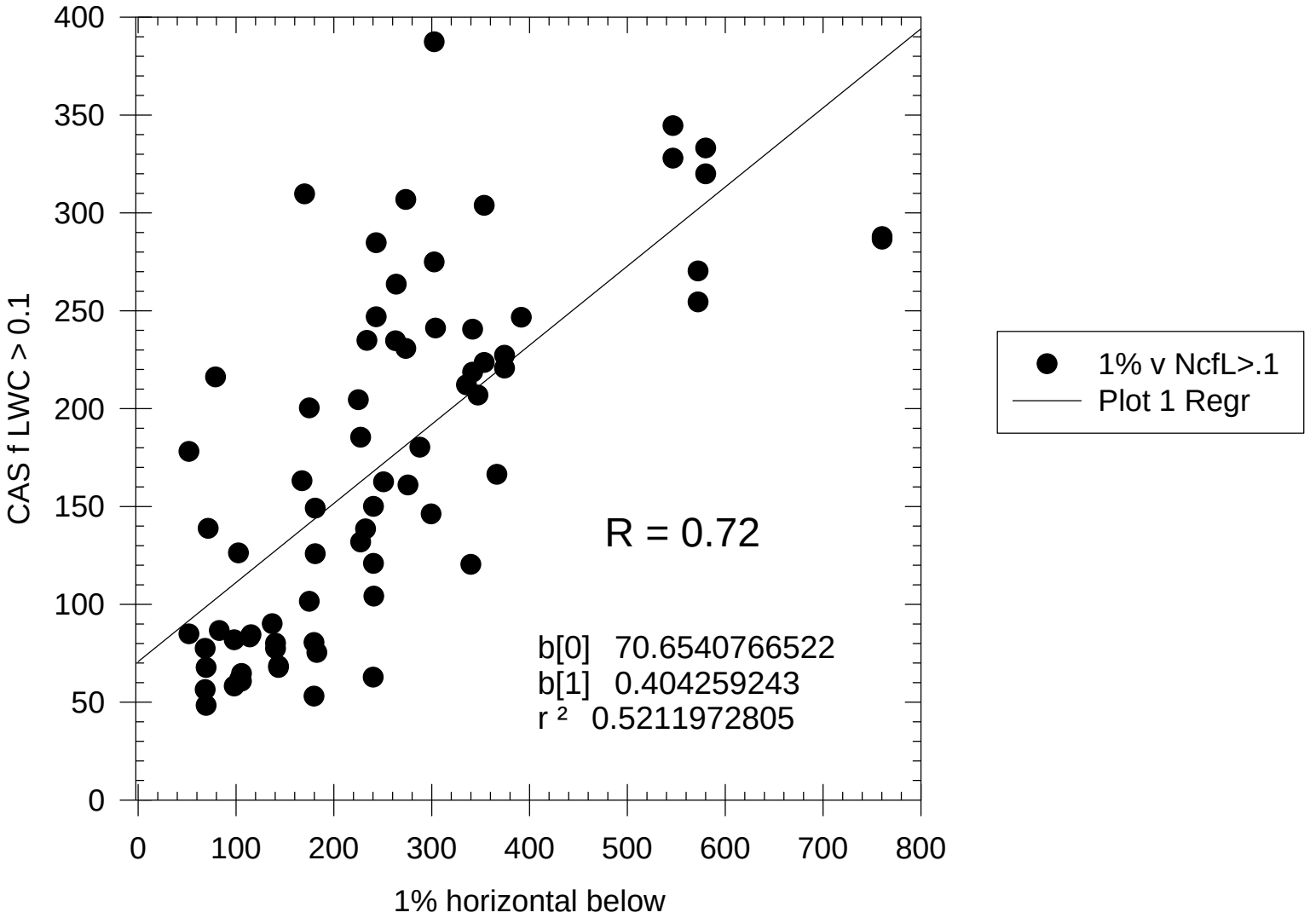
July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11



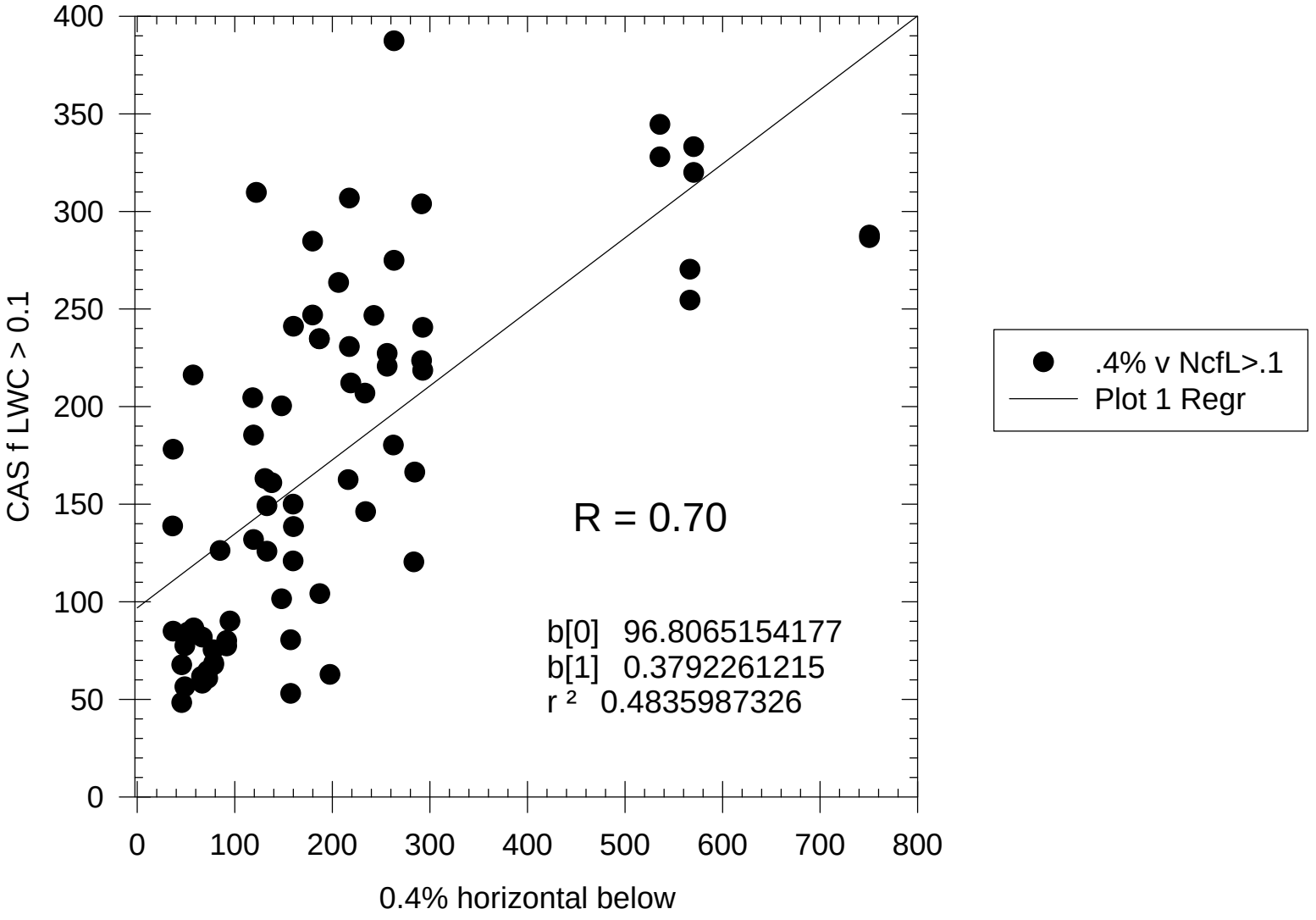
Determine CCN conc. for horizontal passes at 100’ and 300’ near soundings

Compare with N_c.

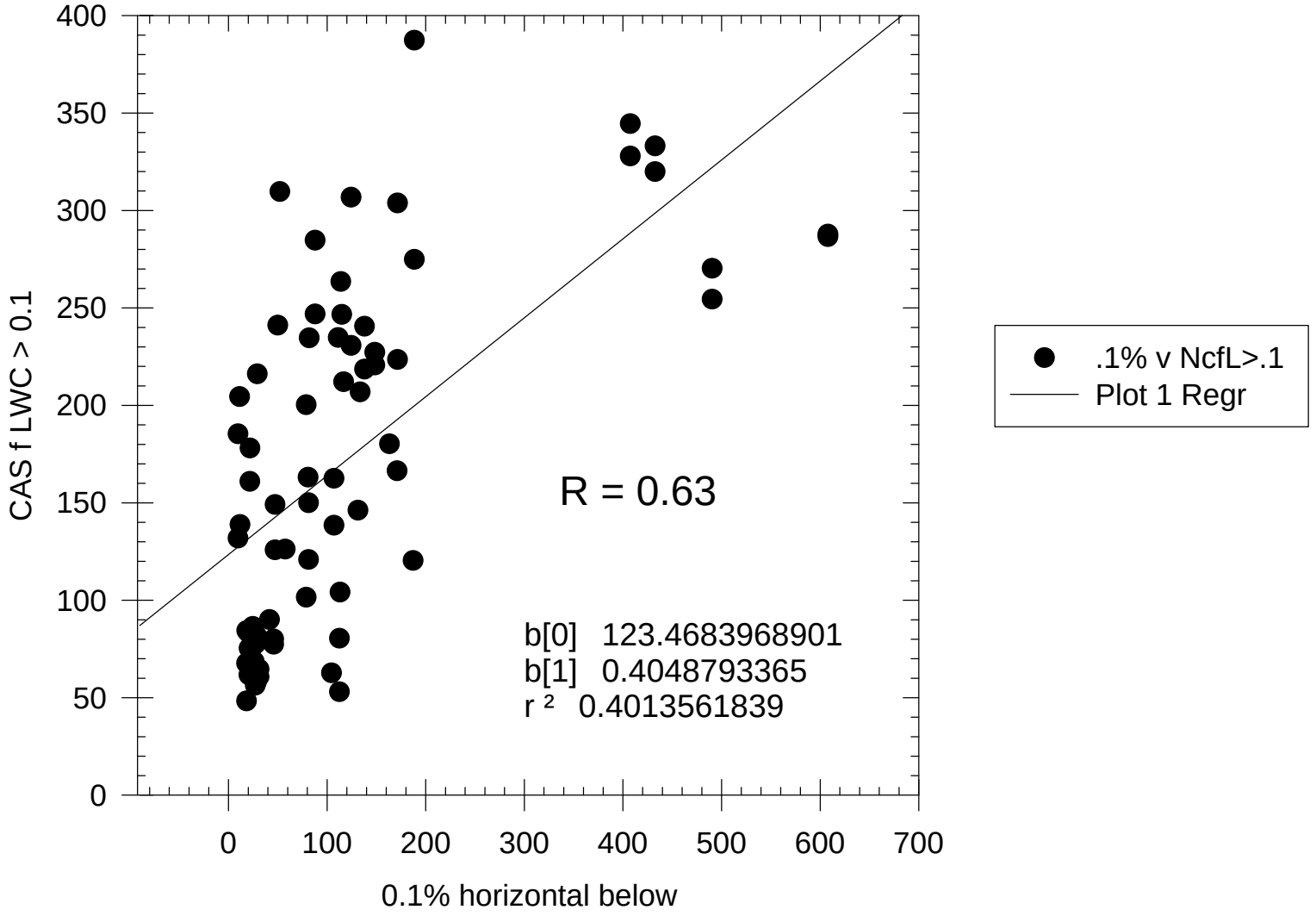
July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11
68 soundings

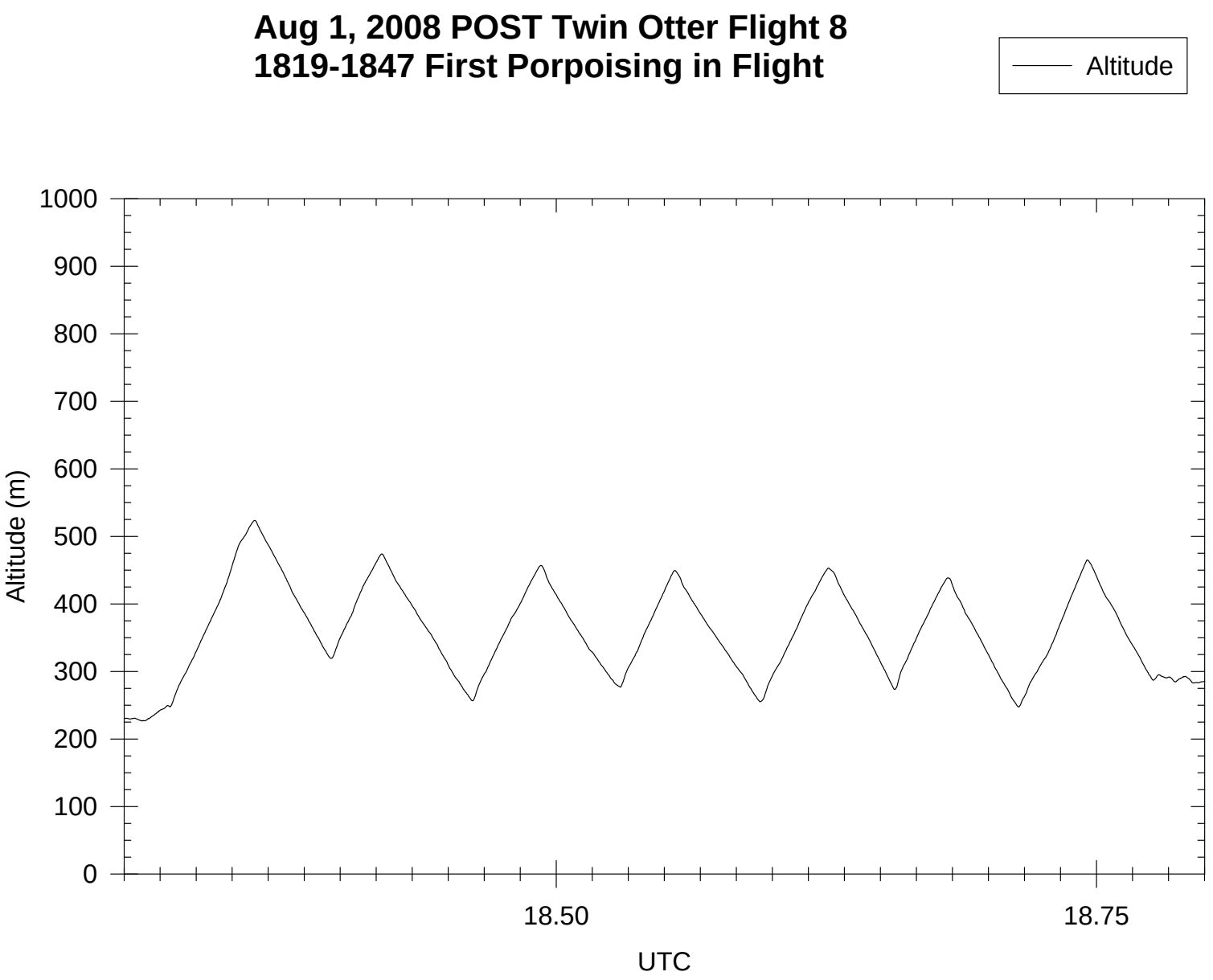


July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11

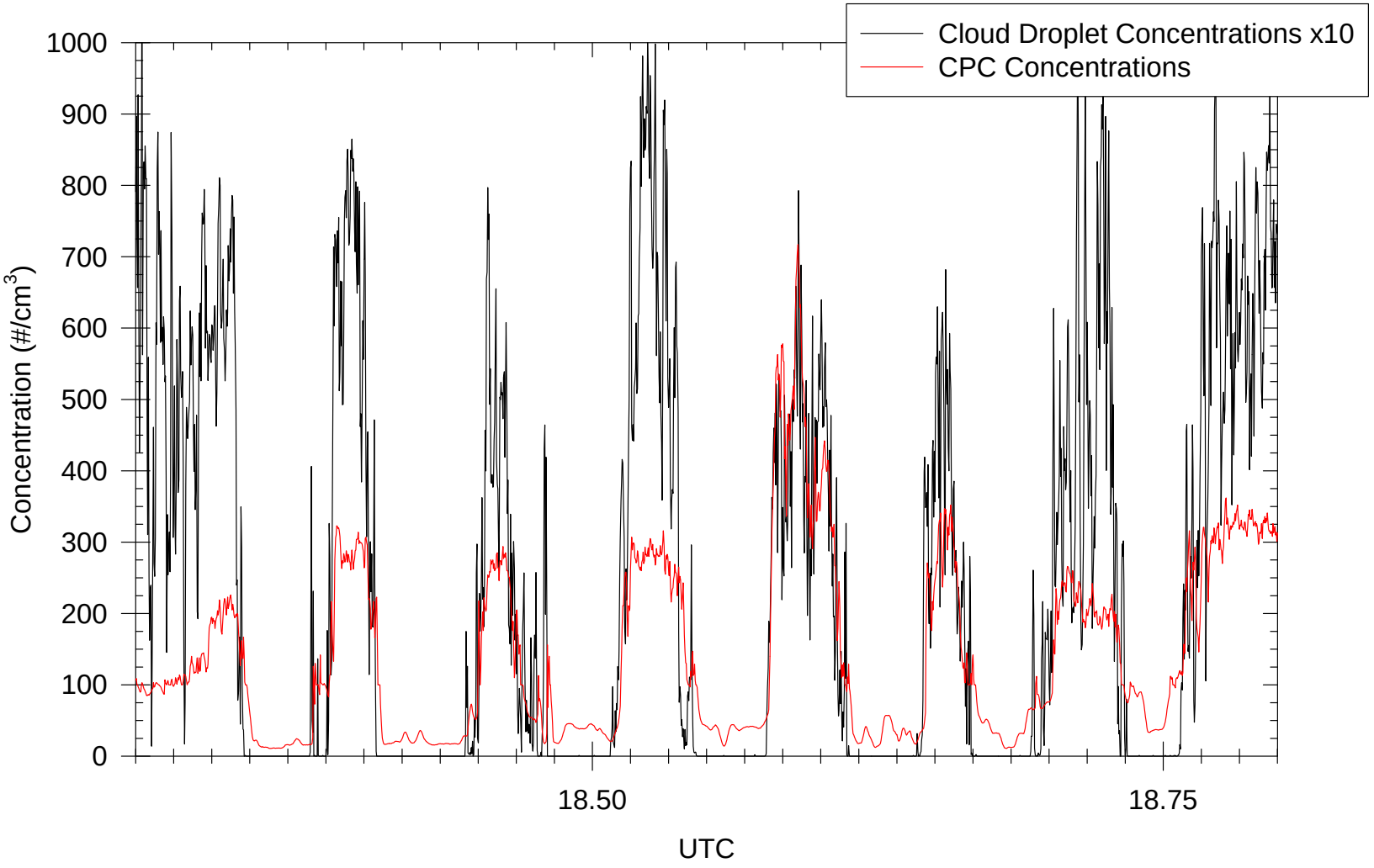


July 18,21,27,28,30, Aug 1,4,7,8,11,12,14,15
13 flights not TO1,2,9,11

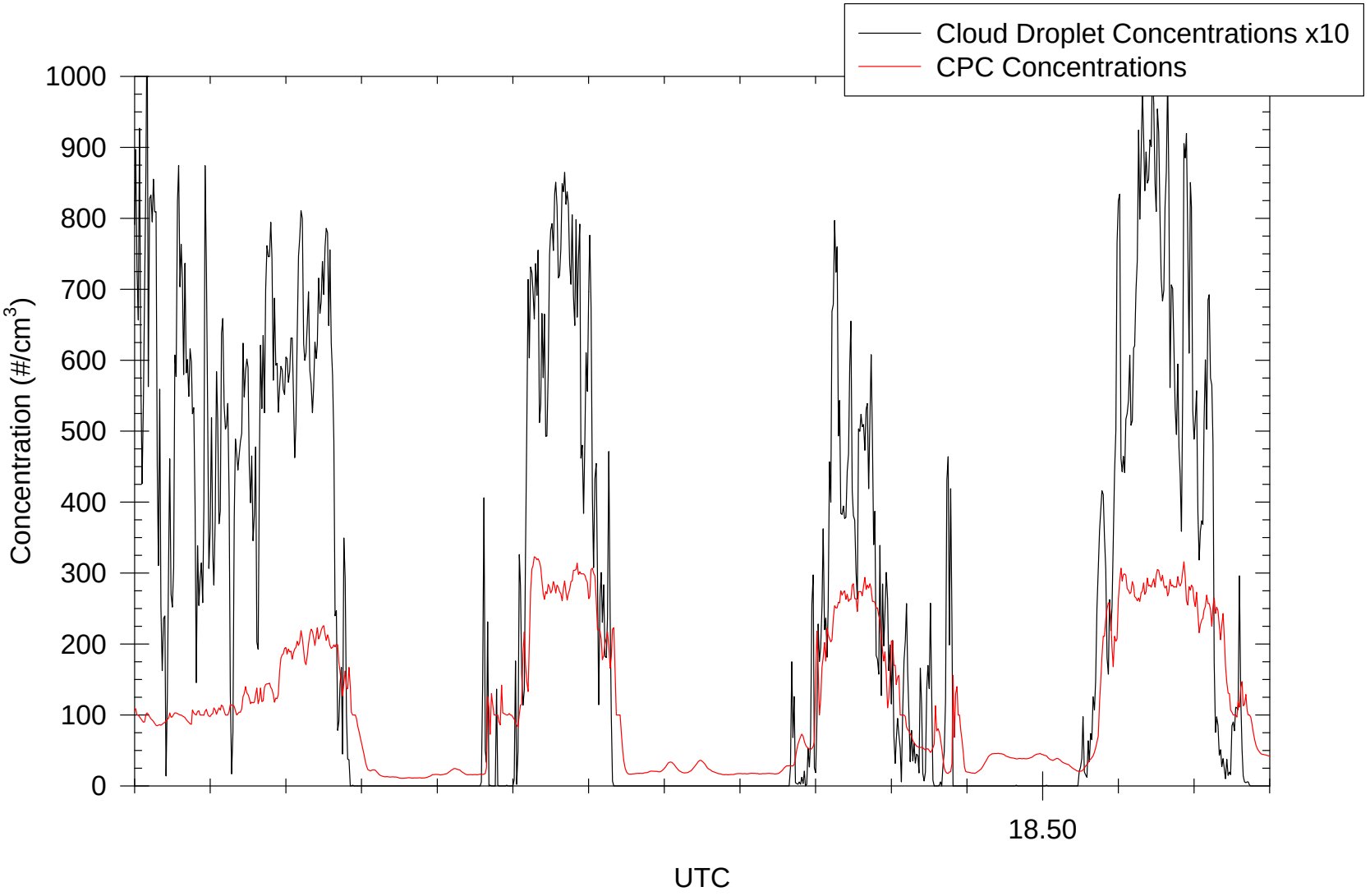



Aug 1, 2008 POST Twin Otter Flight 8
1819-1847 First Porpoising in Flight
Altitude
1000
900
800
700
600
500
400
300
200
100
0
Altitude (m)
18.50
18.75
UTC

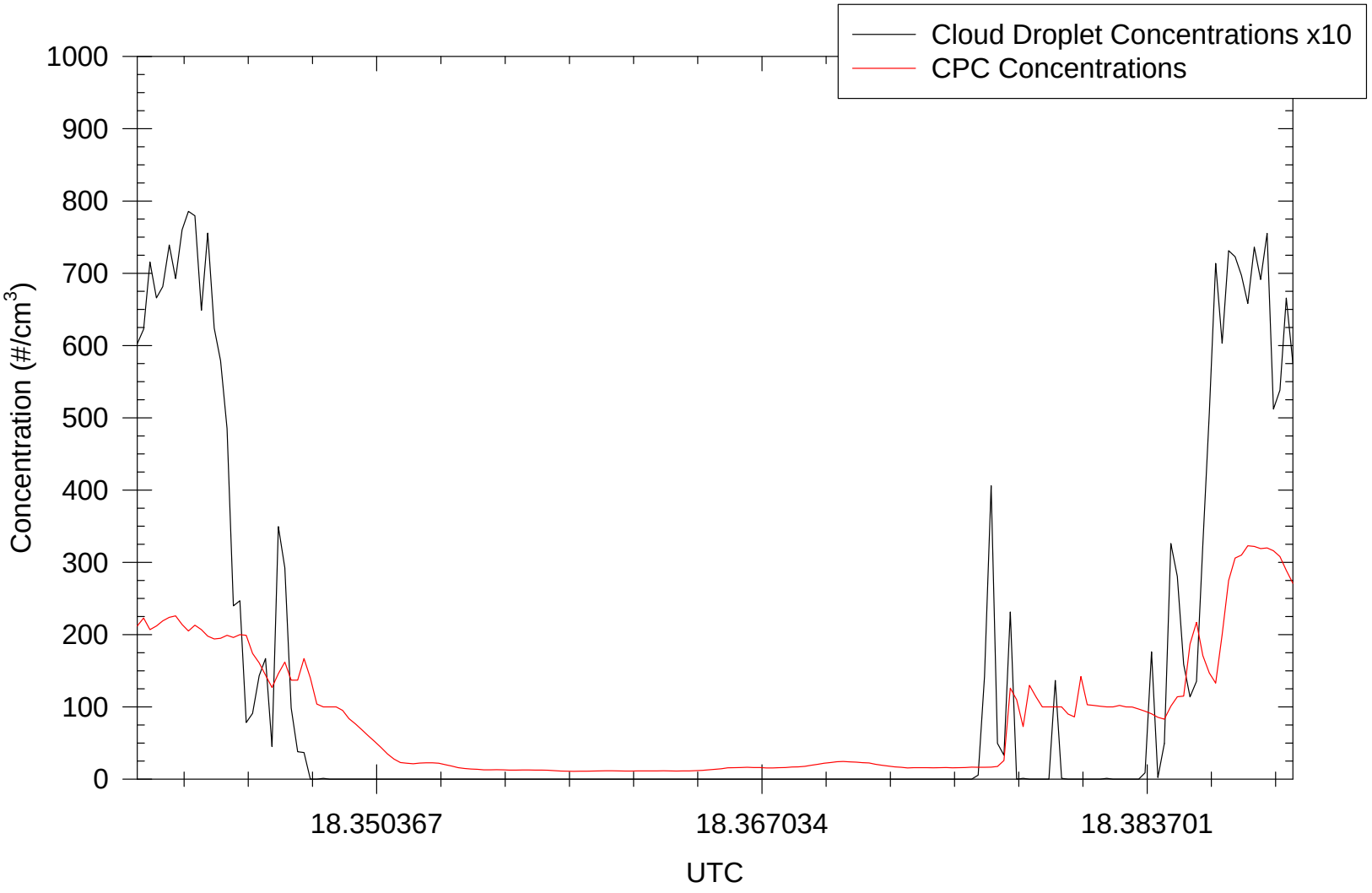
Aug 1, 2008 POST Twin Otter Flight 8
1819-1847 First Porpoising in Flight

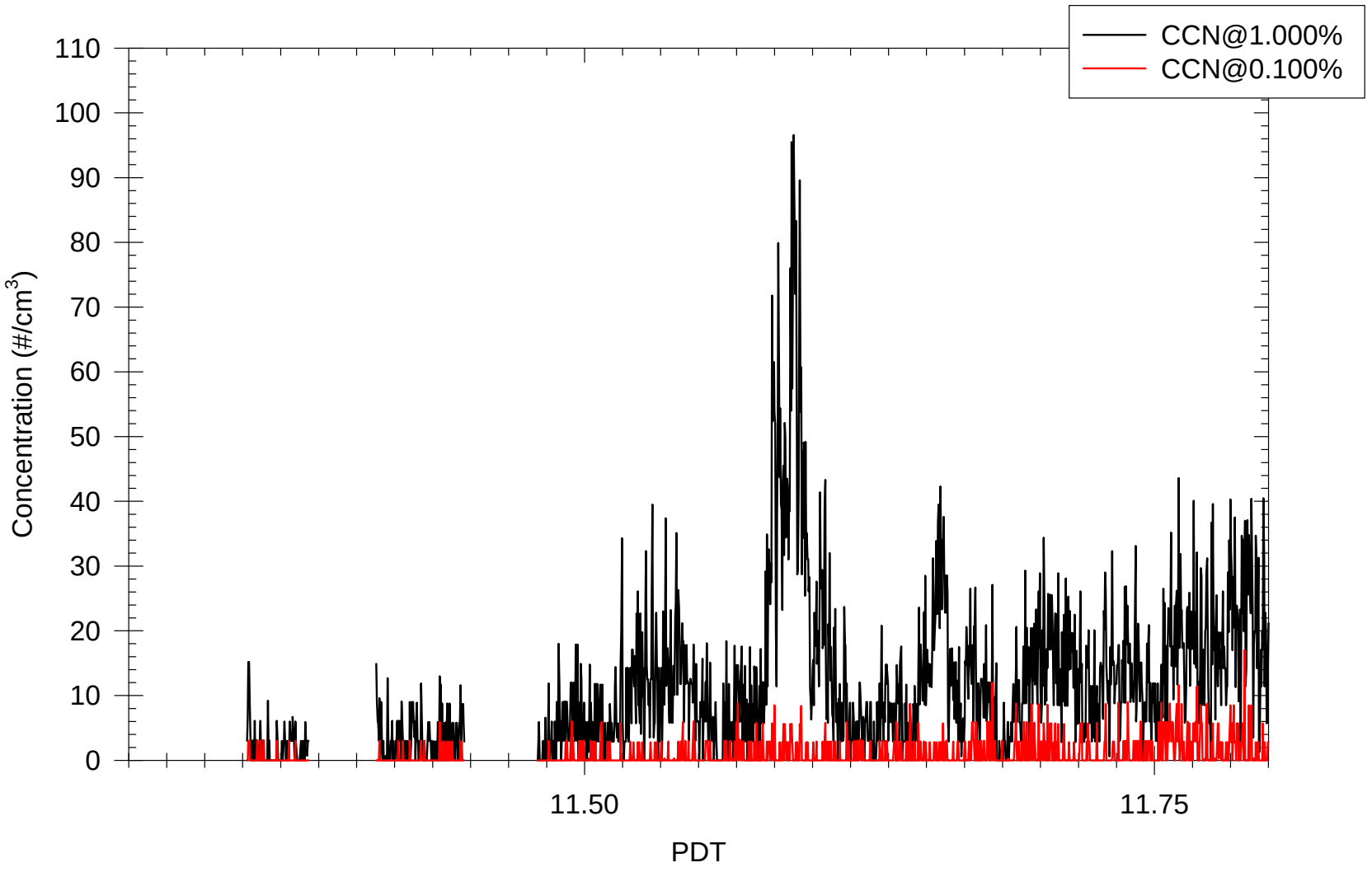


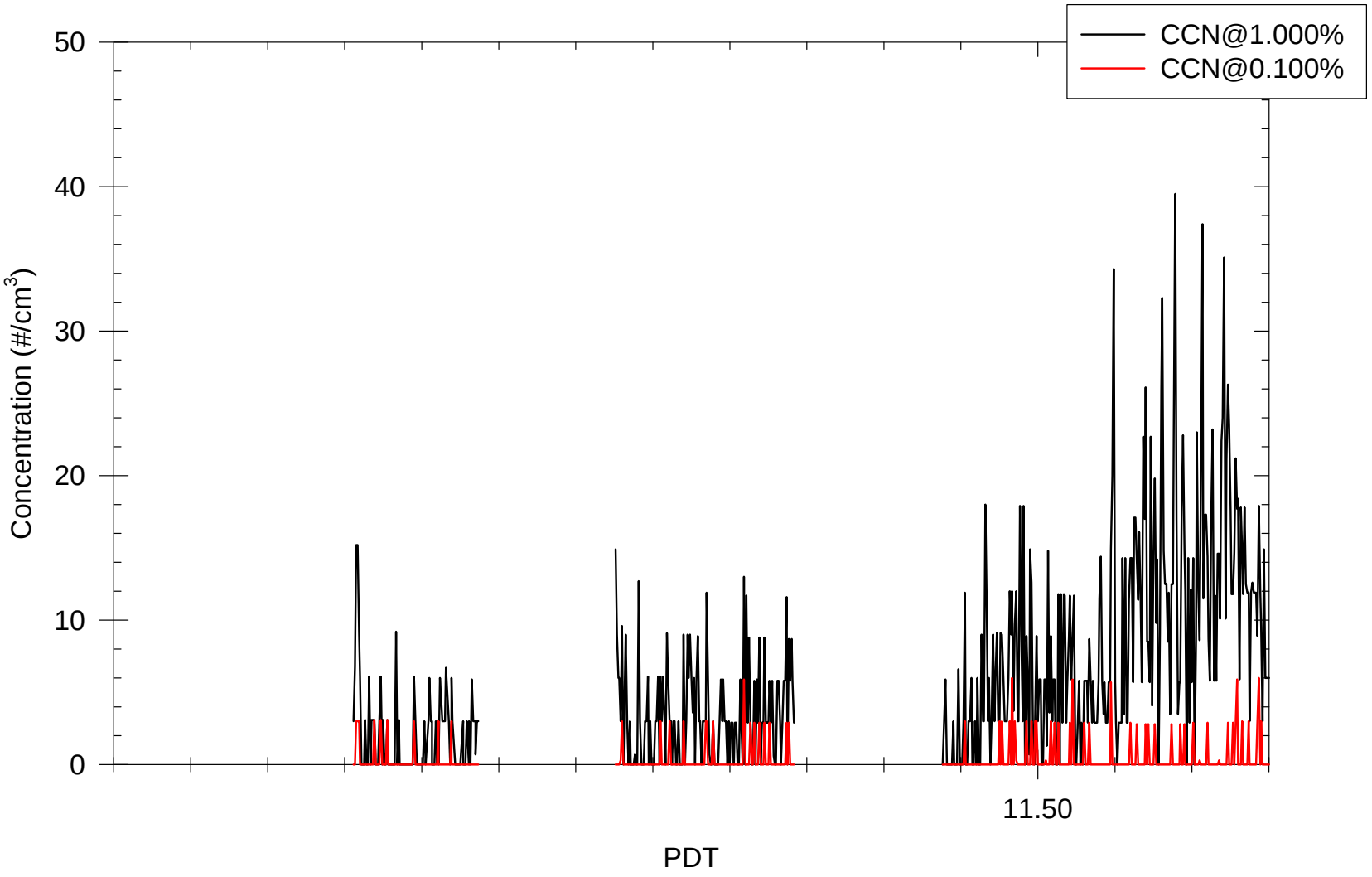
Aug 1, 2008 POST Twin Otter Flight 8
1819-1847 First Porpoising in Flight

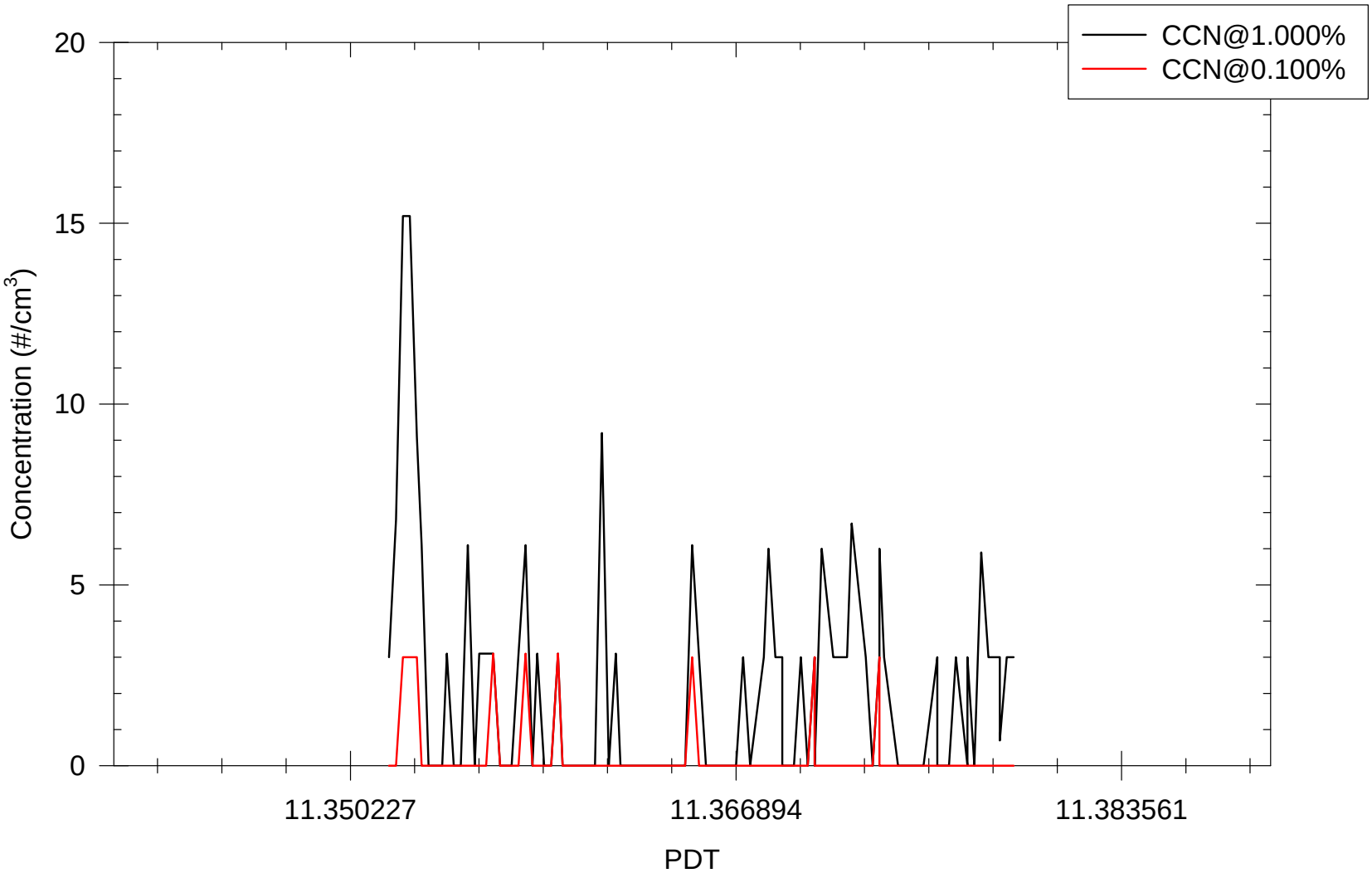


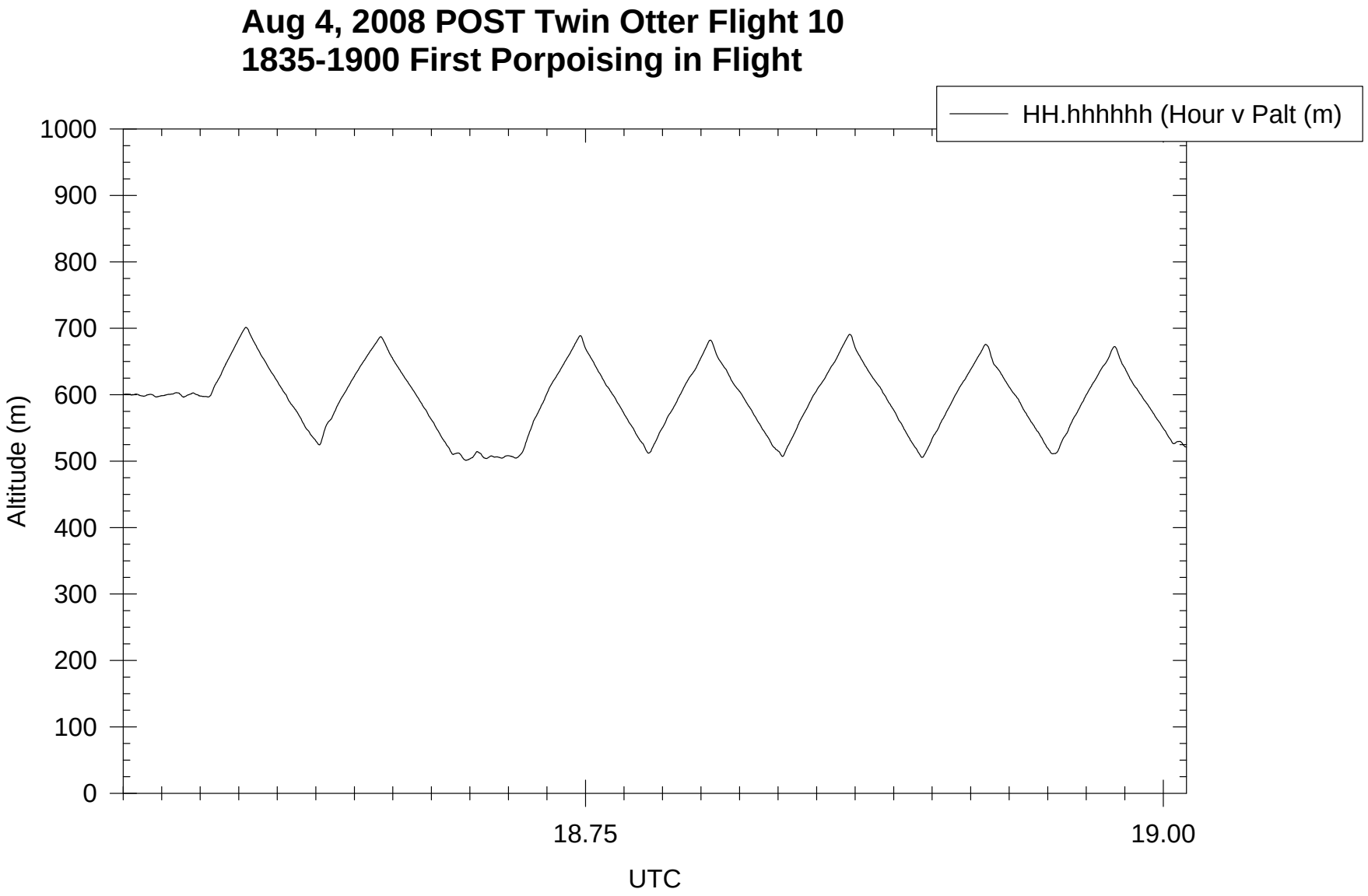
Aug 1, 2008 POST Twin Otter Flight 8
1819-1847 First Porpoising in Flight

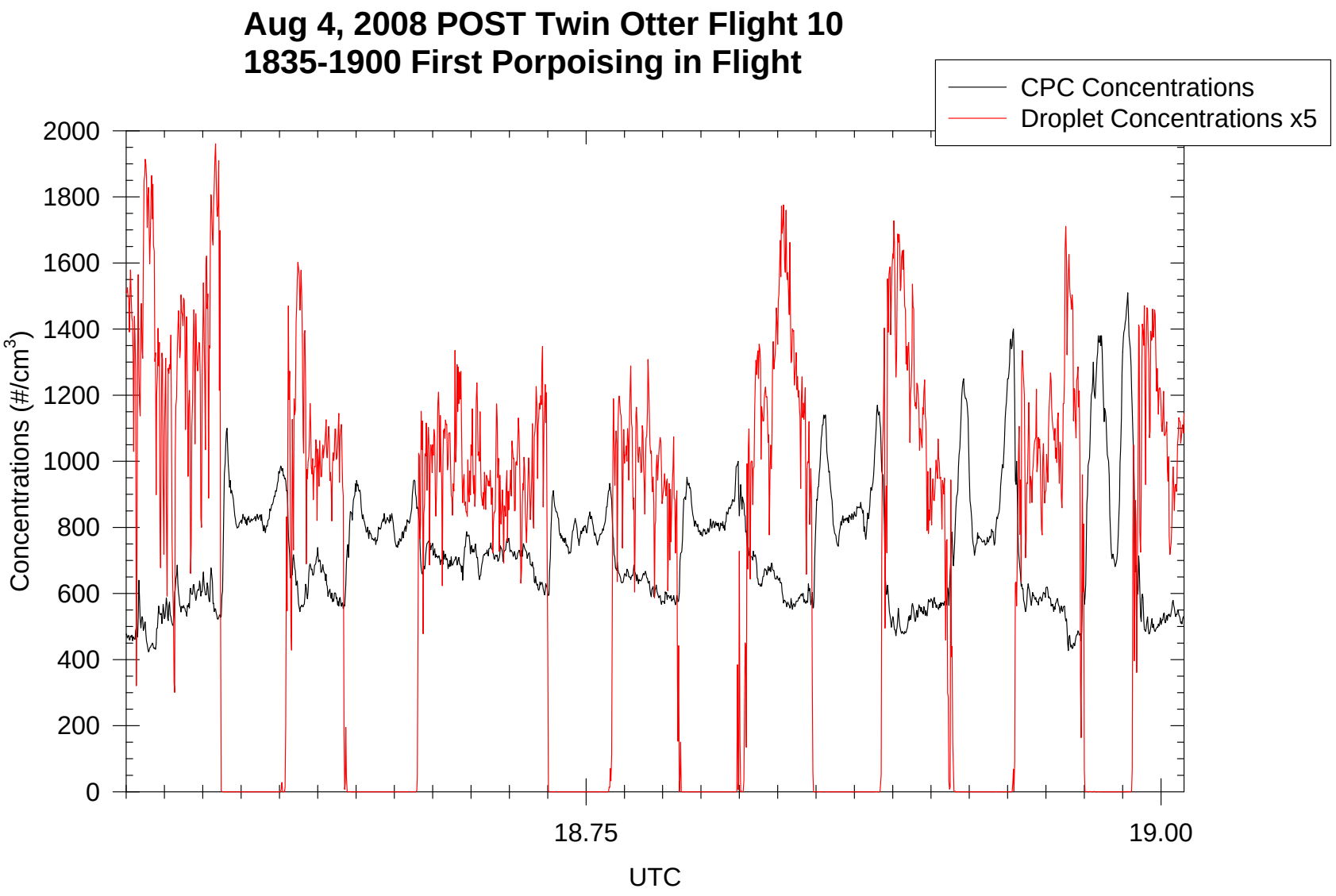


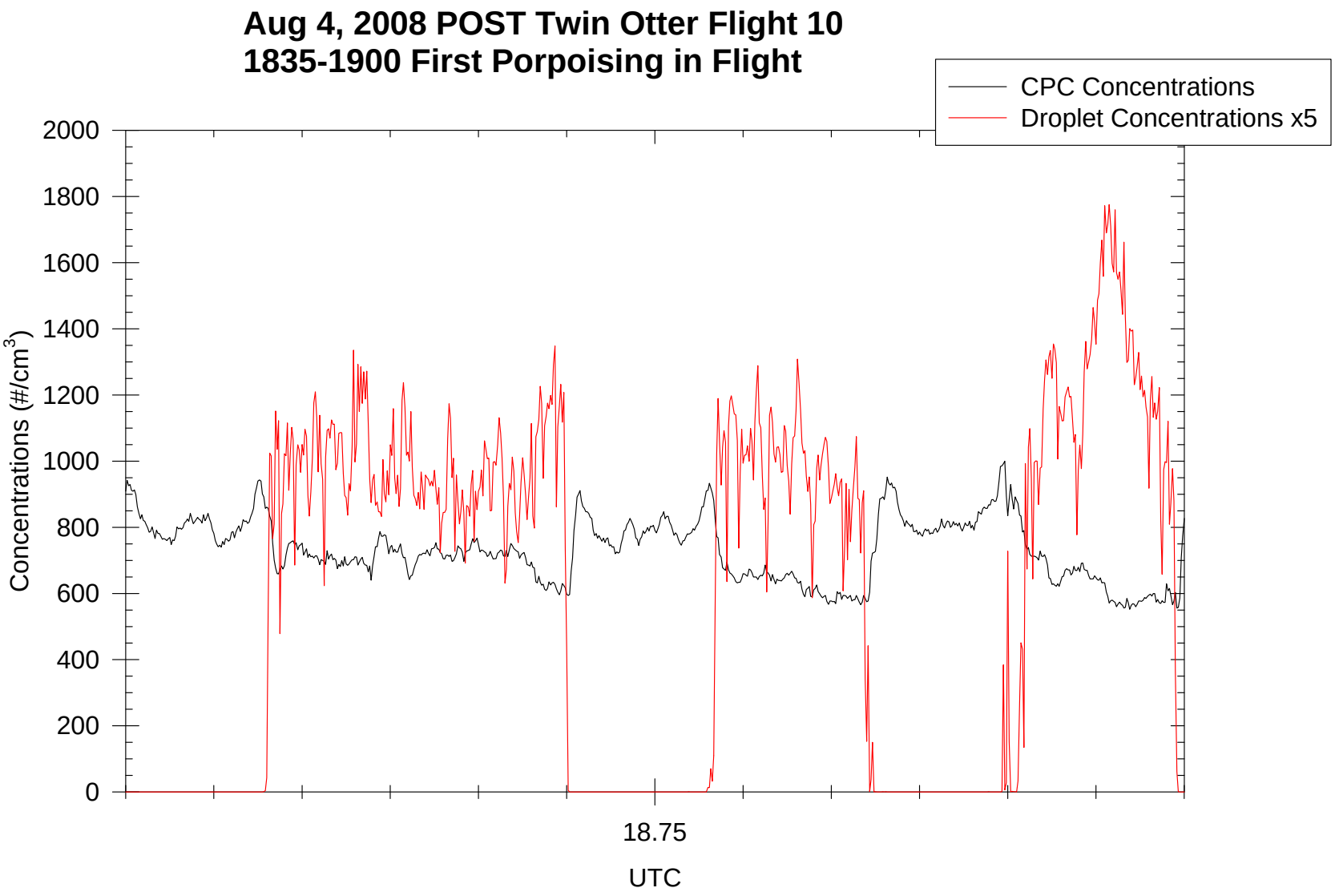

Aug 1, 2008, POST Twin Otter Flight 8
1819-1847 CCN Concentrations
CCN@1.000%
CCN@0.100%
Concentration (#/cm3)
110
100
90
80
70
60
50
40
30
20
10
0
11.50
11.75
PDT

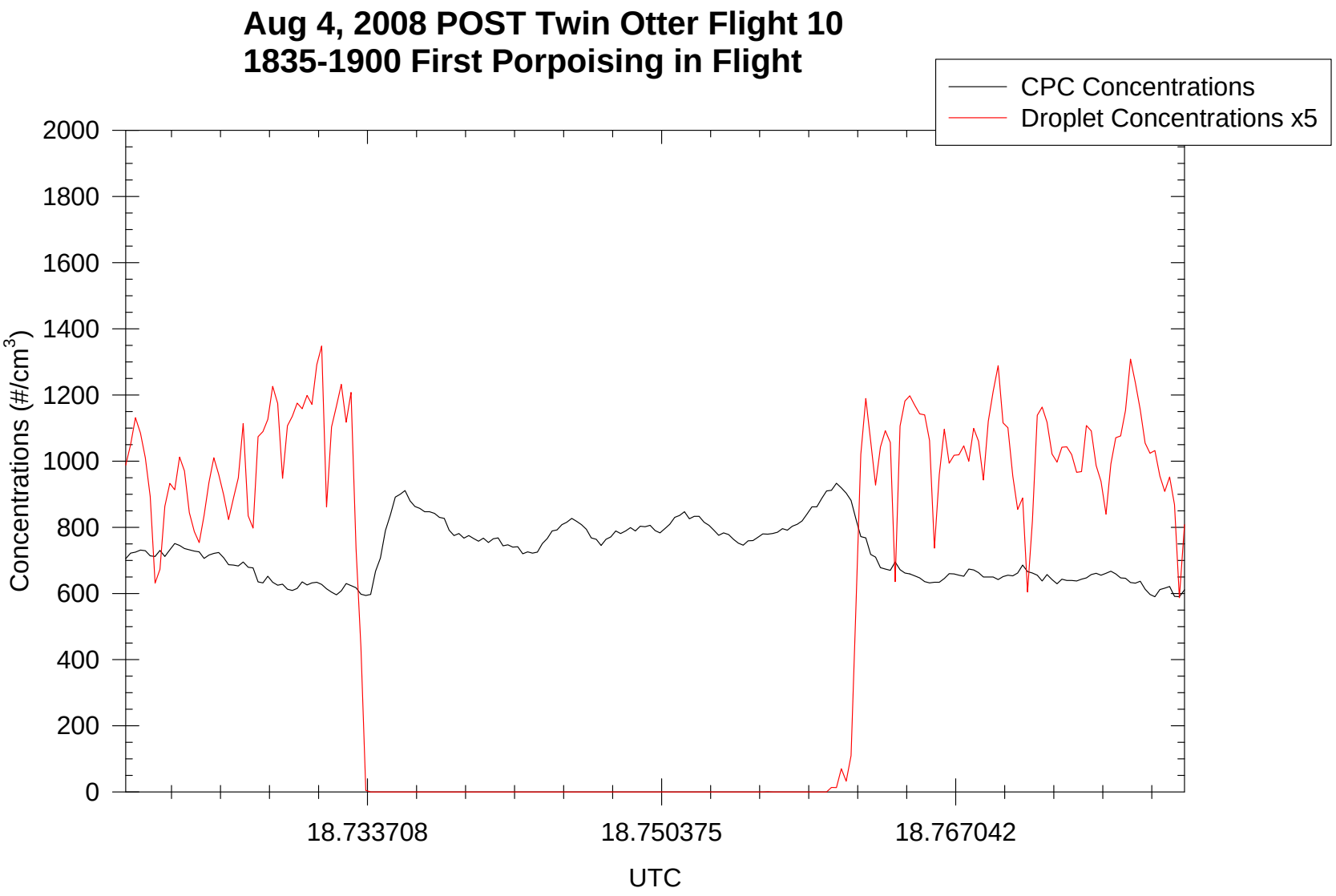

Aug 1, 2008, POST Twin Otter Flight 8
1819-1847 CCN Concentrations
CCN@1.000%
CCN@0.100%
50
40
30
20
10
0
Concentration (#/cm3)
11.50
PDT

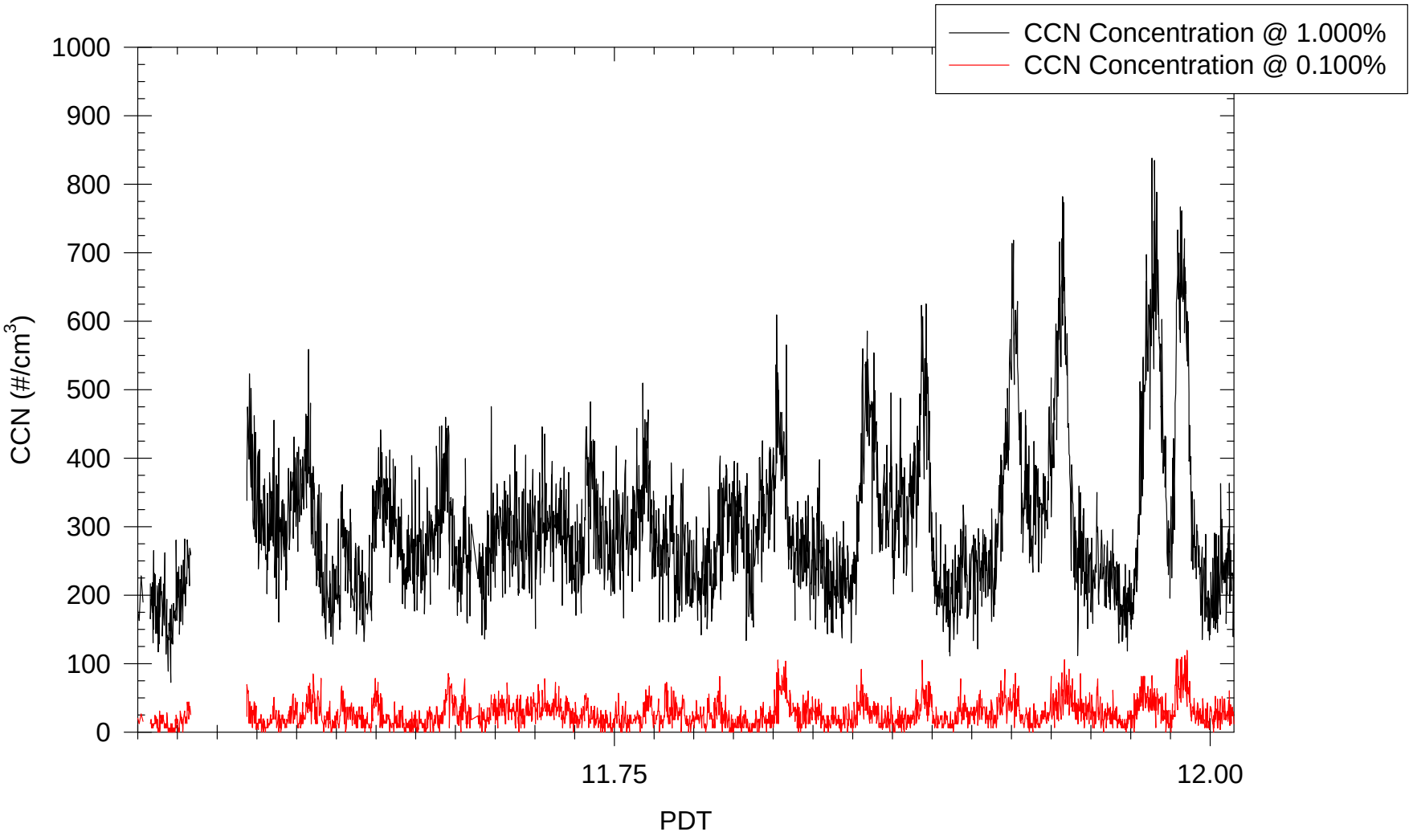

Aug 1, 2008, POST Twin Otter Flight 8
1819-1847 CCN Concentrations
CCN@1.000%
CCN@0.100%
20
15
10
5
0
Concentration (#/cm3)
11.350227
11.366894
11.383561
PDT

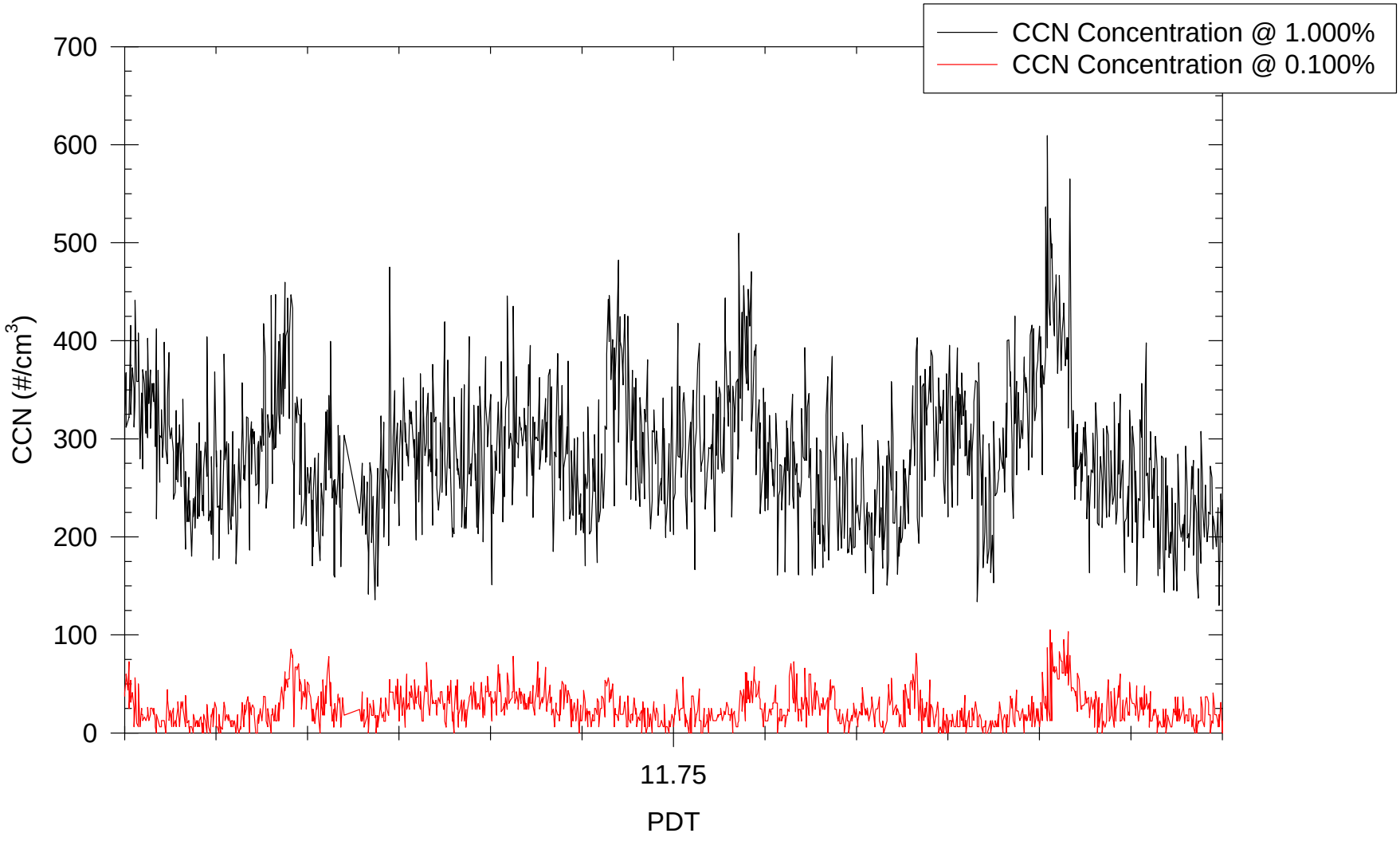

Aug 4, 2008 POST Twin Otter Flight 10
1835-1900 First Porpoising in Flight
HH.hhhhhh (Hour v Palt (m)
1000
900
800
700
600
500
400
300
200
100
0
Altitude (m)
18.75
19.00
UTC

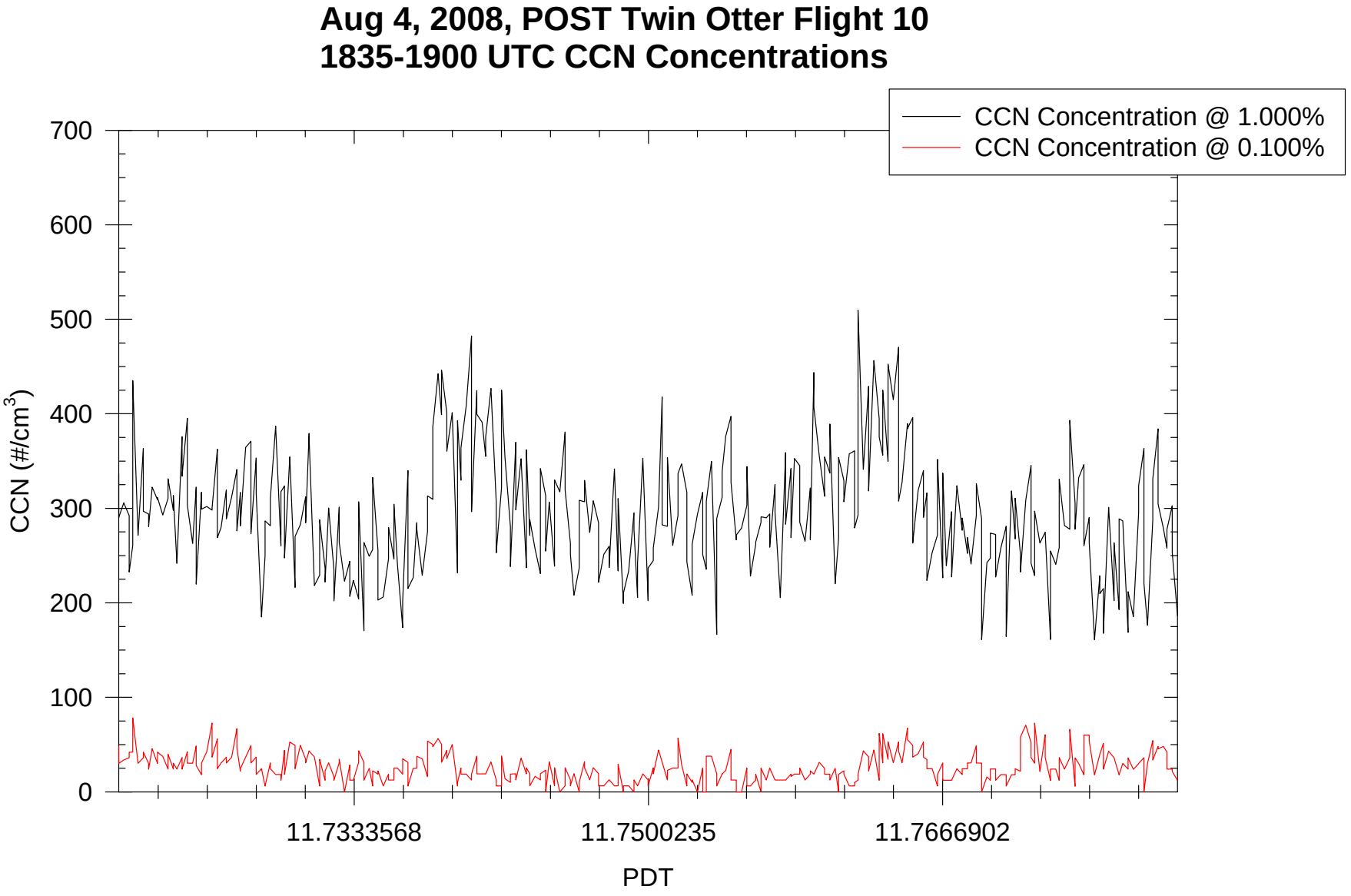

Aug 4, 2008 POST Twin Otter Flight 10
1835-1900 First Porpoising in Flight
CPC Concentrations
Droplet Concentrations x5
Concentrations (#/cm3)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
18.75
19.00
UTC

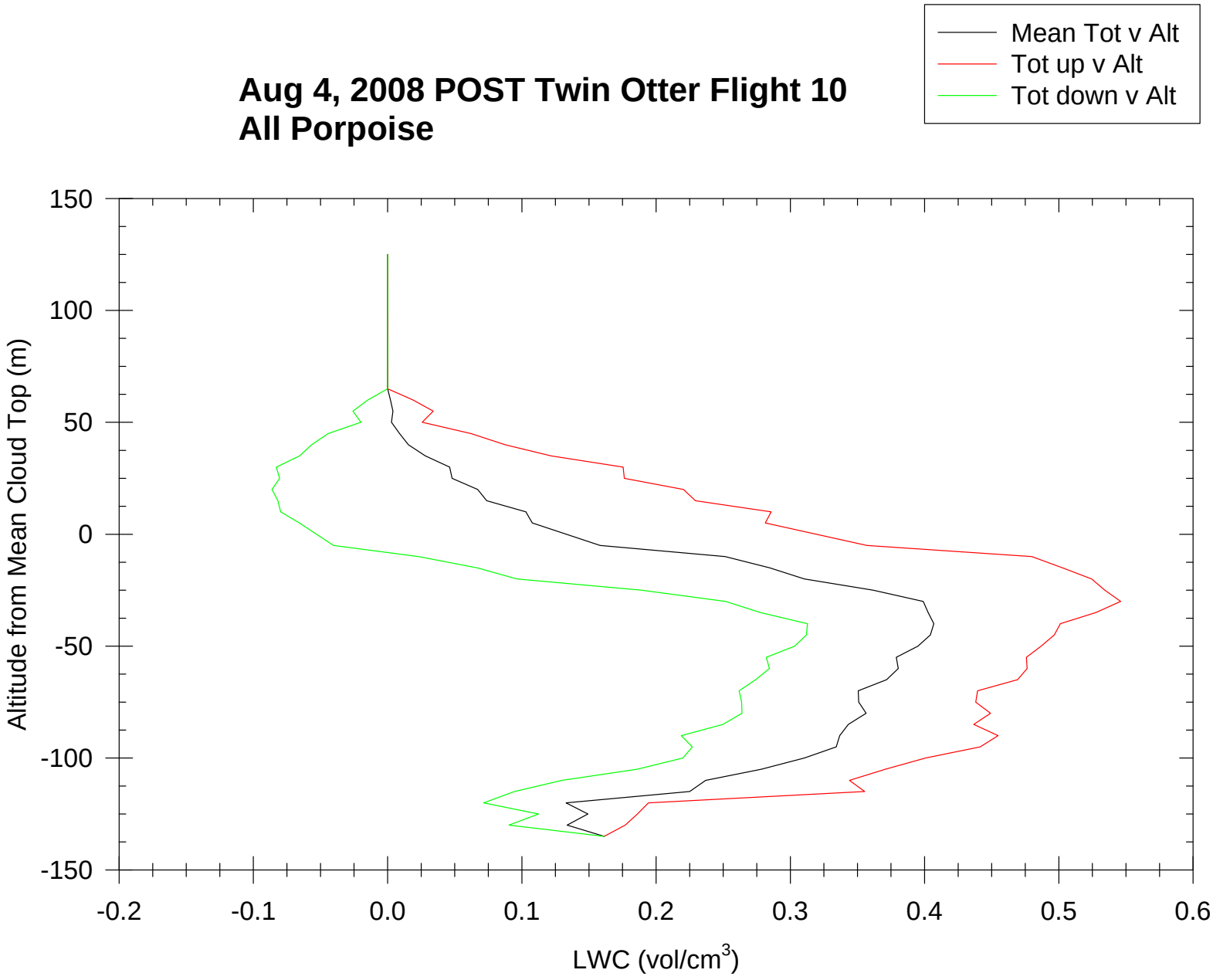

Aug 4, 2008 POST Twin Otter Flight 10
1835-1900 First Porpoising in Flight
CPC Concentrations
Droplet Concentrations x5
Concentrations (#/cm3)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
18.75
UTC

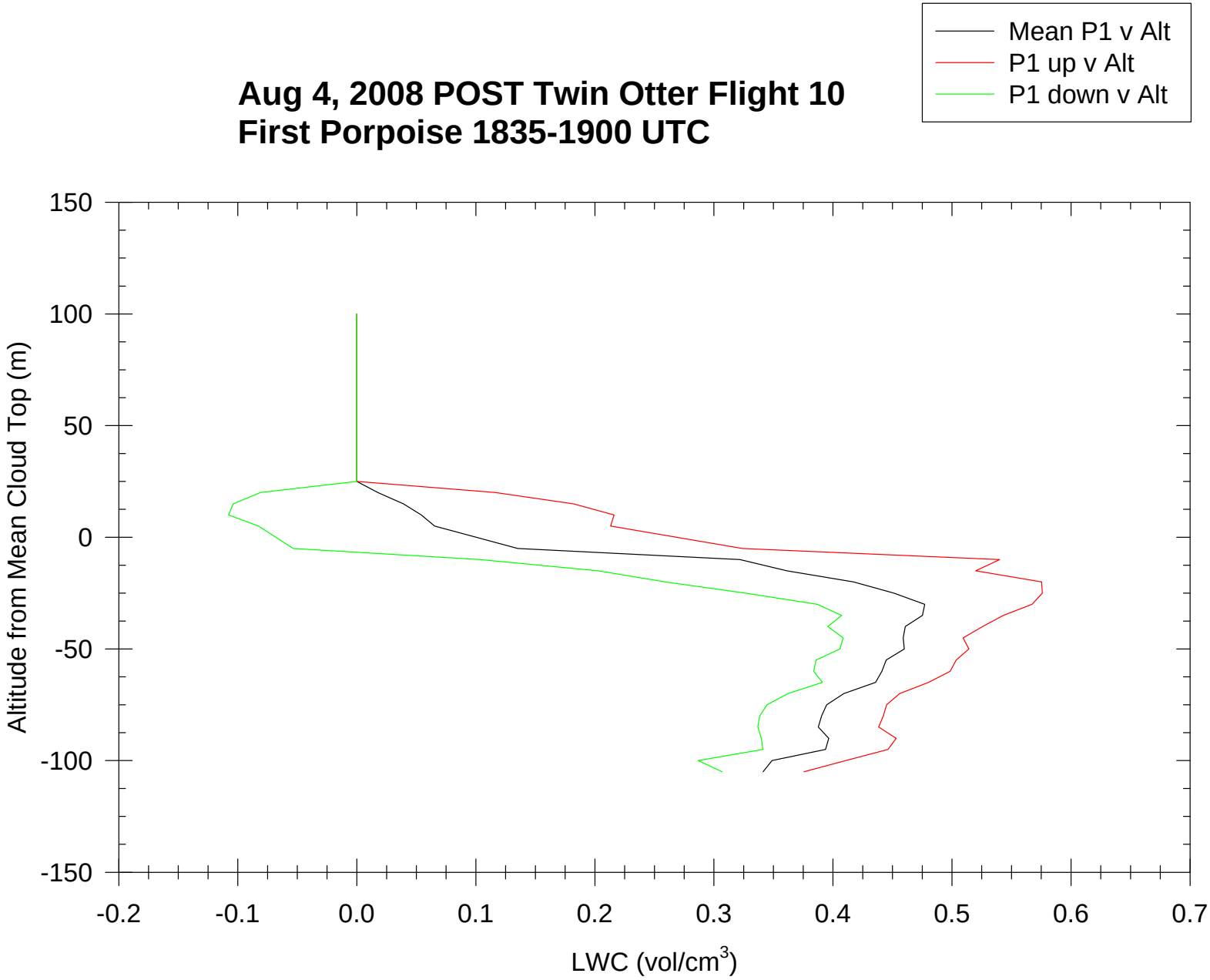

Aug 4, 2008 POST Twin Otter Flight 10
1835-1900 First Porpoising in Flight
CPC Concentrations
Droplet Concentrations x5
Concentrations (#/cm3)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
18.733708
18.750375
18.767042
UTC

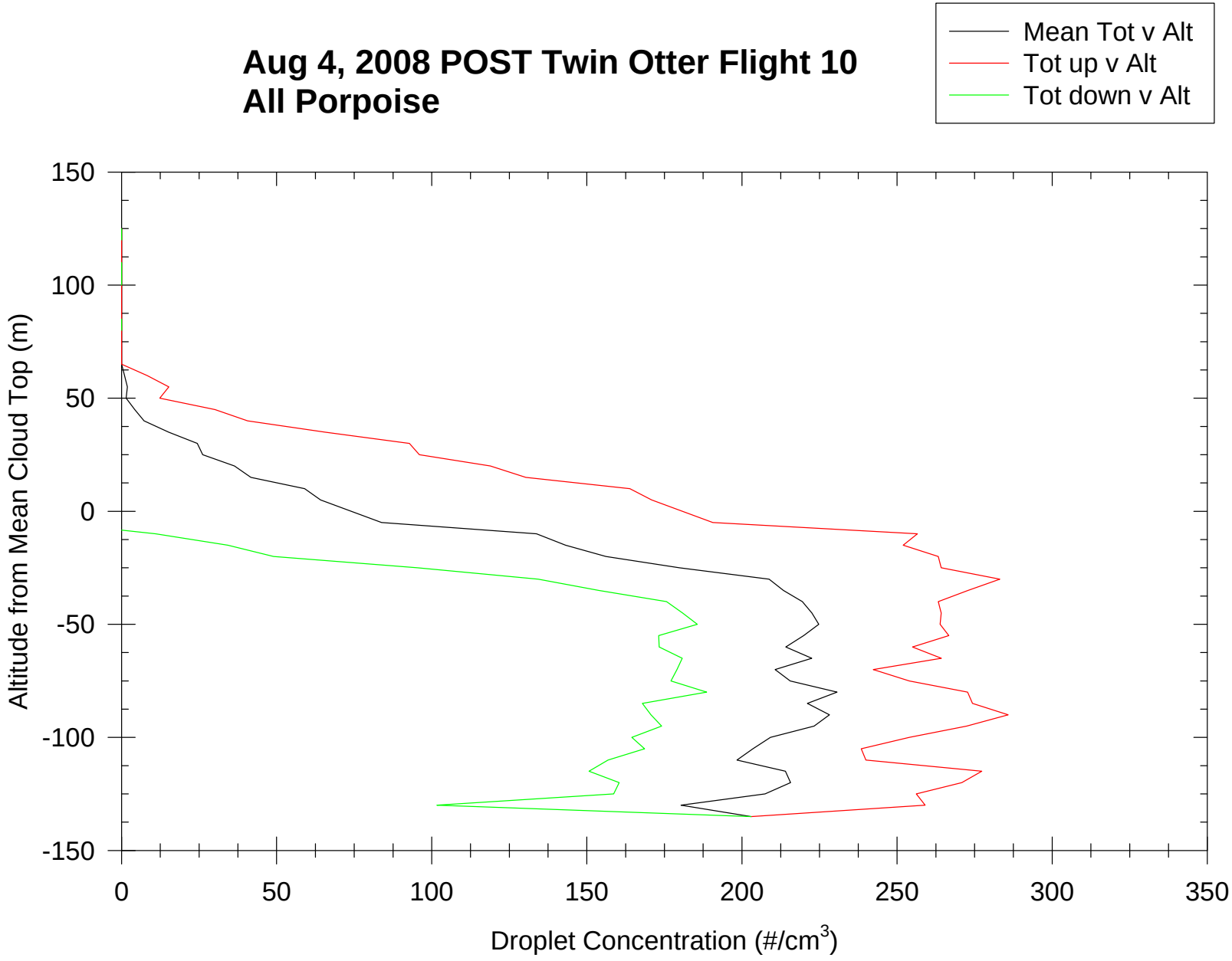

Aug 4, 2008, POST Twin Otter Flight 10
1835-1900 UTC CCN Concentrations
CCN Concentration @ 1.000%
CCN Concentration @ 0.100%
1000
900
800
700
600
500
400
300
200
100
0
CCN (#/cm3)
11.75
12.00
PDT

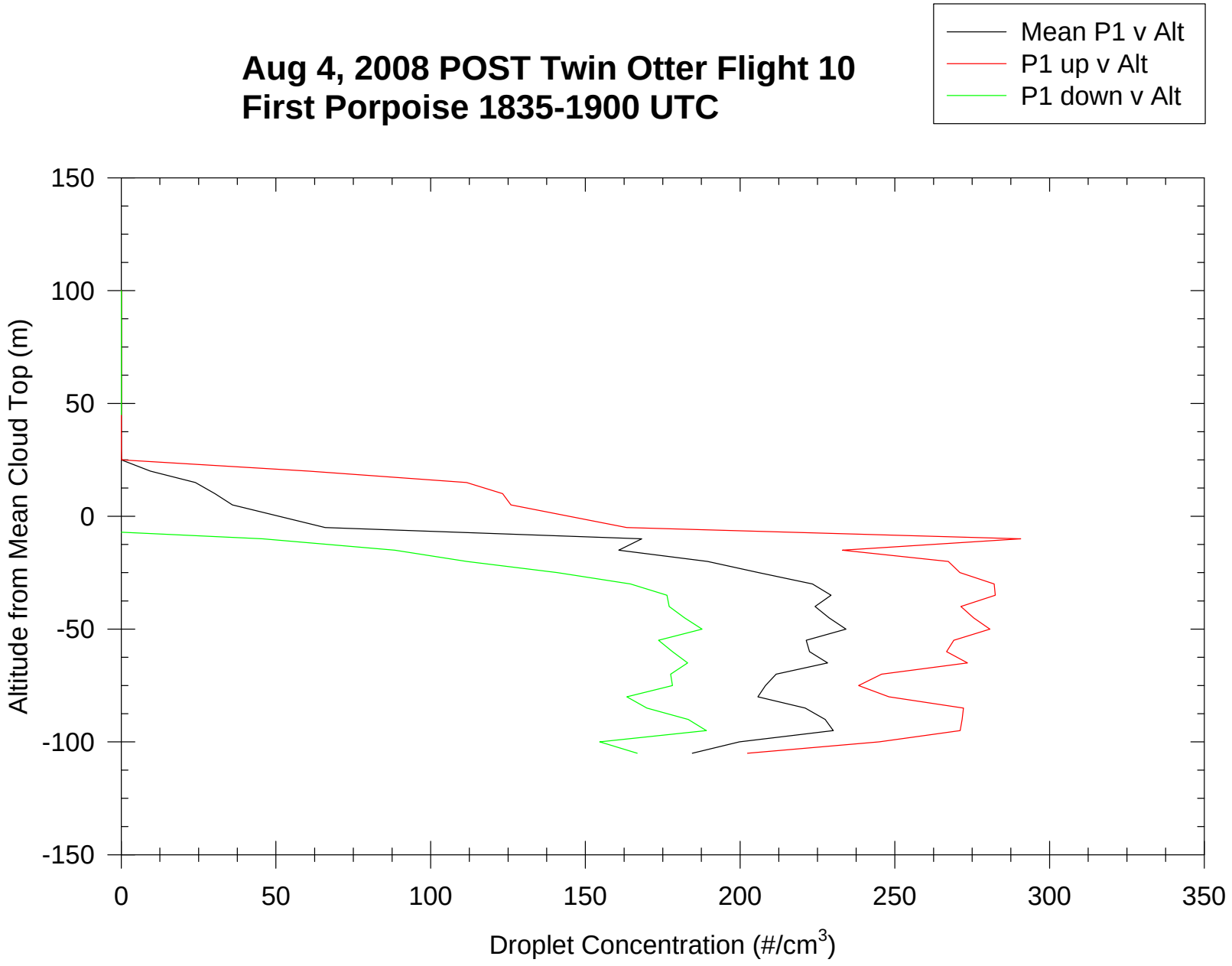

Aug 4, 2008, POST Twin Otter Flight 10
1835-1900 UTC CCN Concentrations
CCN Concentration @ 1.000%
CCN Concentration @ 0.100%
700
600
500
400
300
200
100
0
CCN (#/cm3)
11.75
PDT

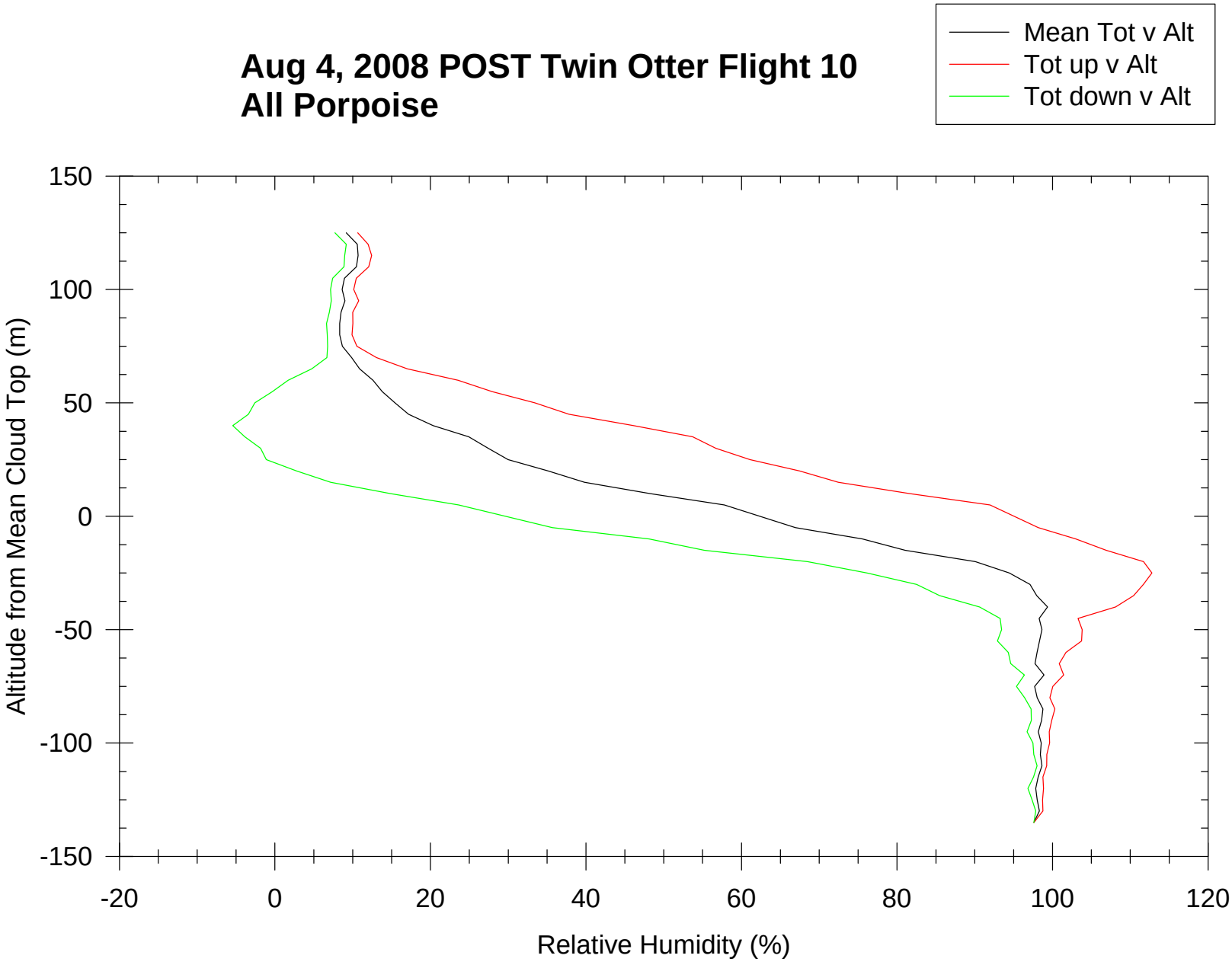

Aug 4, 2008, POST Twin Otter Flight 10
1835-1900 UTC CCN Concentrations
CCN Concentration @ 1.000%
CCN Concentration @ 0.100%
700
600
500
400
300
200
100
0
CCN (#/cm3)
11.7333568
11.7500235
11.7666902
PDT

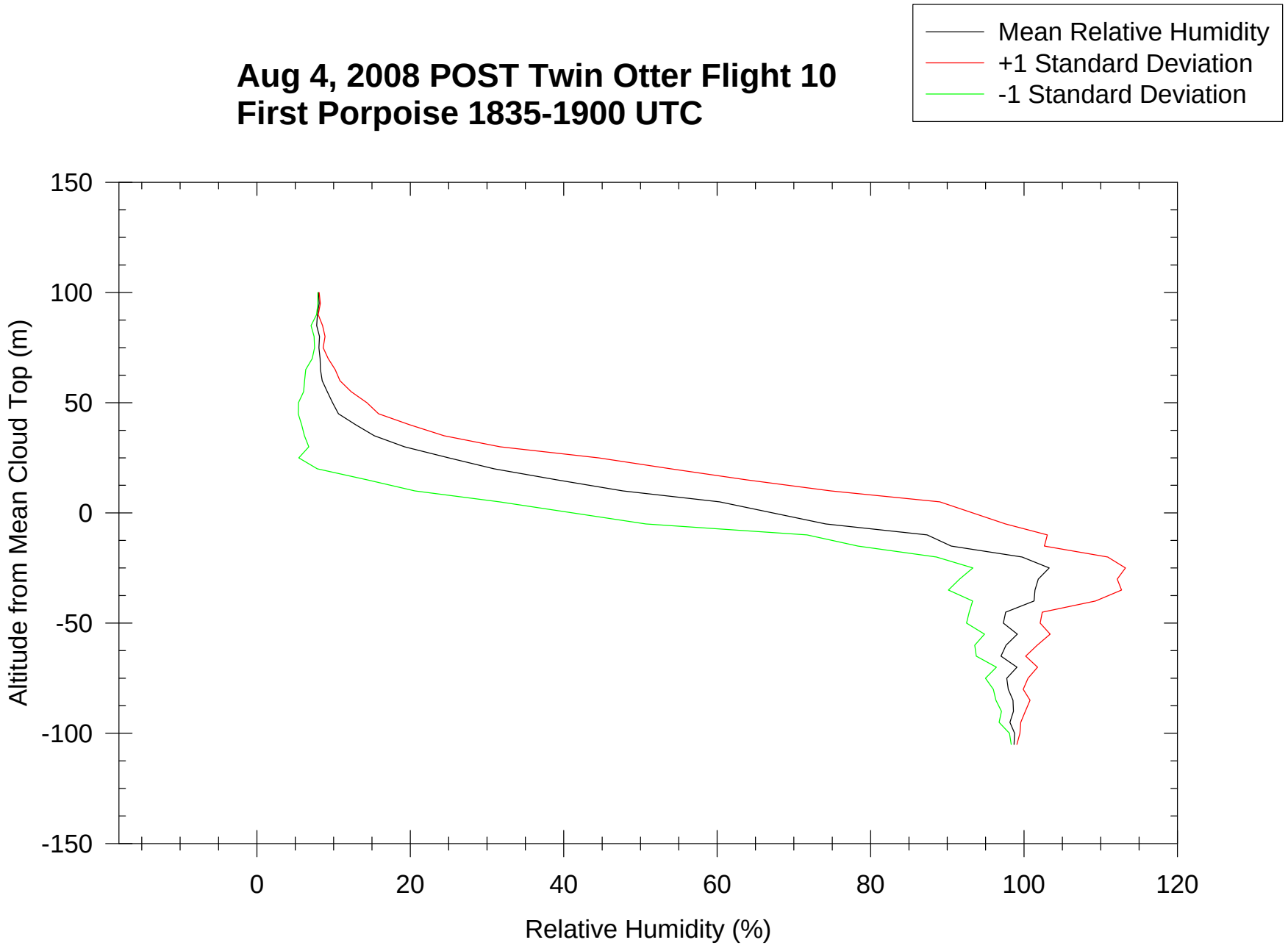

Aug 4, 2008 POST Twin Otter Flight 10
All Porpoise
Mean Tot v Alt
Tot up v Alt
Tot down v Alt
Altitude from Mean Cloud Top (m)
150
100
50
0
-50
-100
-150
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
LWC (vol/cm3)

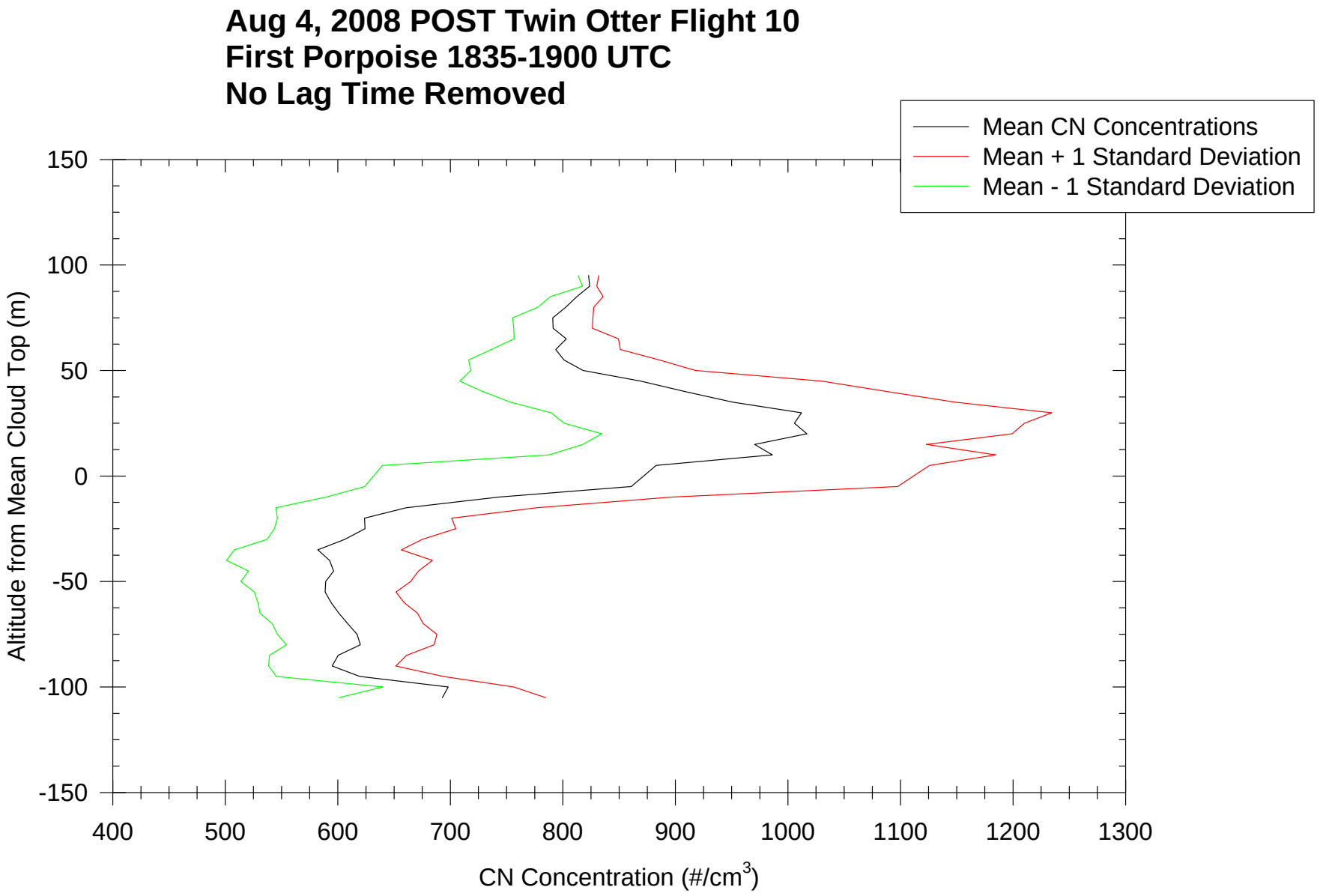

Aug 4, 2008 POST Twin Otter Flight 10
First Porpoise 1835-1900 UTC
Mean P1 v Alt
P1 up v Alt
P1 down v Alt
Altitude from Mean Cloud Top (m)
150
100
50
0
-50
-100
-150
-0.2
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
LWC (vol/cm3)


Aug 4, 2008 POST Twin Otter Flight 10
All Porpoise
Mean Tot v Alt
Tot up v Alt
Tot down v Alt
Altitude from Mean Cloud Top (m)
150
100
50
0
-50
-100
-150
0
50
100
150
200
250
300
350
Droplet Concentration (#/cm3)

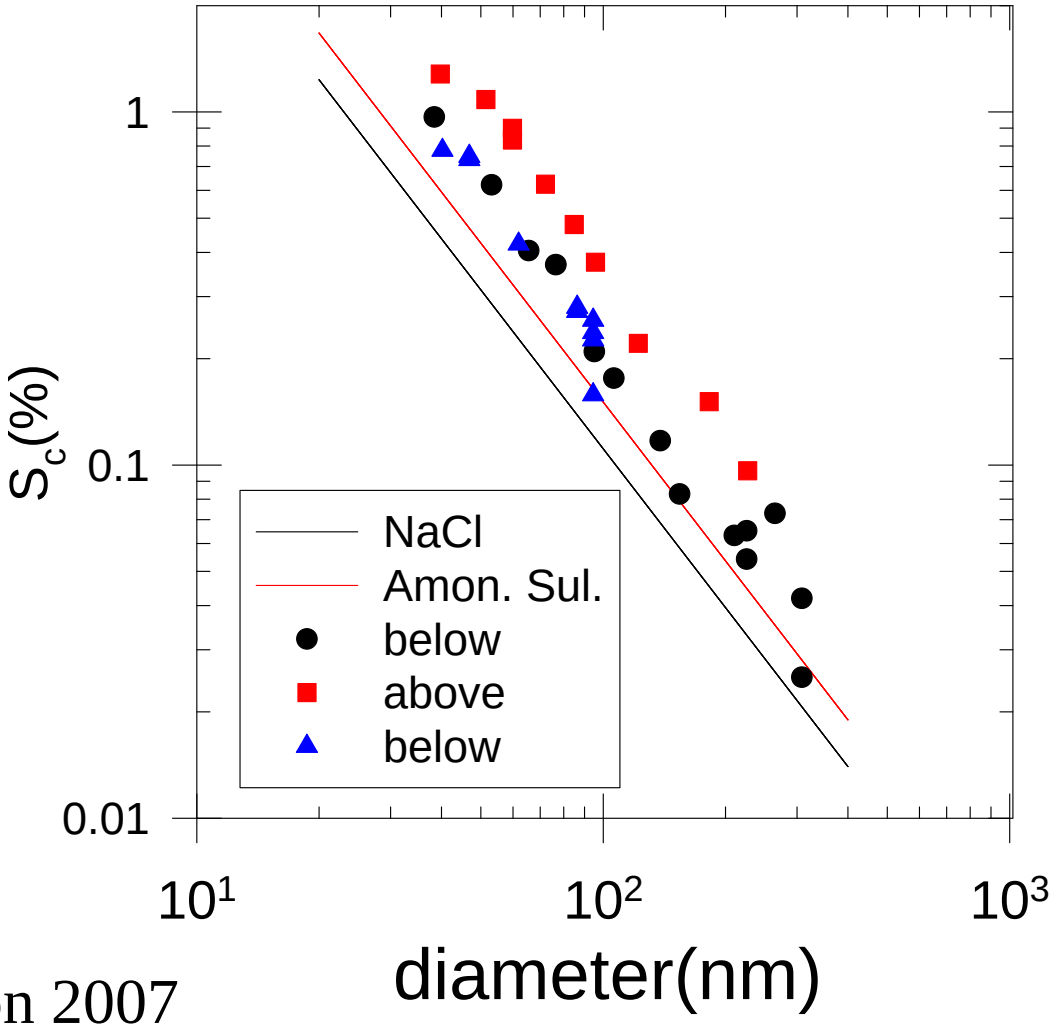

Aug 4, 2008 POST Twin Otter Flight 10
First Porpoise 1835-1900 UTC
Mean P1 v Alt
P1 up v Alt
P1 down v Alt
Altitude from Mean Cloud Top (m)
150
100
50
0
-50
-100
-150
0
50
100
150
200
250
300
350
Droplet Concentration (#/cm3)


Aug 4, 2008 POST Twin Otter Flight 10
All Porpoise
Mean Tot v Alt
Tot up v Alt
Tot down v Alt
Altitude from Mean Cloud Top (m)
150
100
50
0
-50
-100
-150
-20
0
20
40
60
80
100
120
Relative Humidity (%)


Aug 4, 2008 POST Twin Otter Flight 10
First Porpoise 1835-1900 UTC
Mean Relative Humidity
+1 Standard Deviation
-1 Standard Deviation
Altitude from Mean Cloud Top (m)
150
100
50
0
-50
-100
-150
0
20
40
60
80
100
120
Relative Humidity (%)

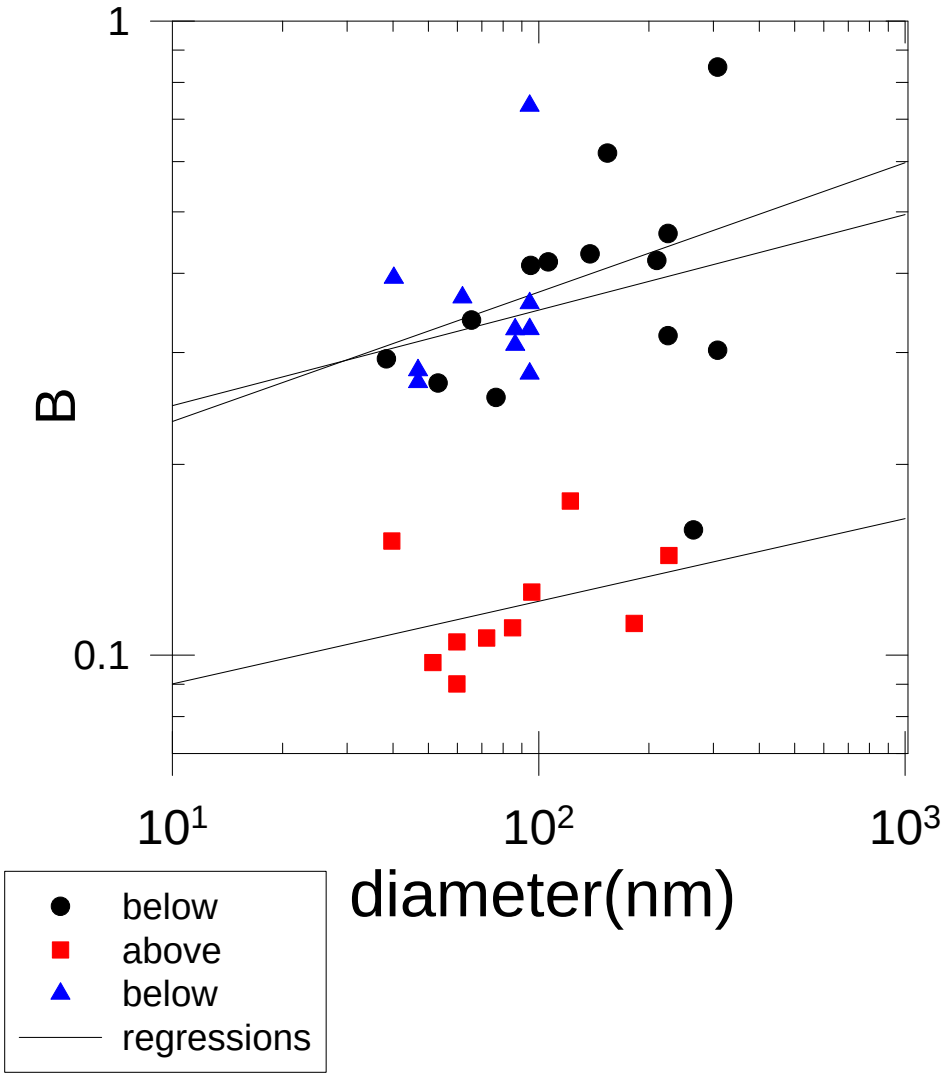

Aug 4, 2008 POST Twin Otter Flight 10
First Porpoise 1835-1900 UTC
No Lag Time Removed
Mean CN Concentrations
Mean + 1 Standard Deviation
Mean - 1 Standard Deviation
Altitude from Mean Cloud Top (m)
150
100
50
0
-50
-100
-150
400
500
600
700
800
900
1000
1100
1200
1300
CN Concentration (#/cm3)

Particle critical supersaturation (Sc)
versus dry diameter
July 25, 2005
MASE off the Central California Coast
below and above stratus cloud layer



From Hudson 2007

Hygroscopicity parameter (B)
versus dry diameter
July 25, 2005
MASE off the Central California Coast
below and above stratus cloud layer

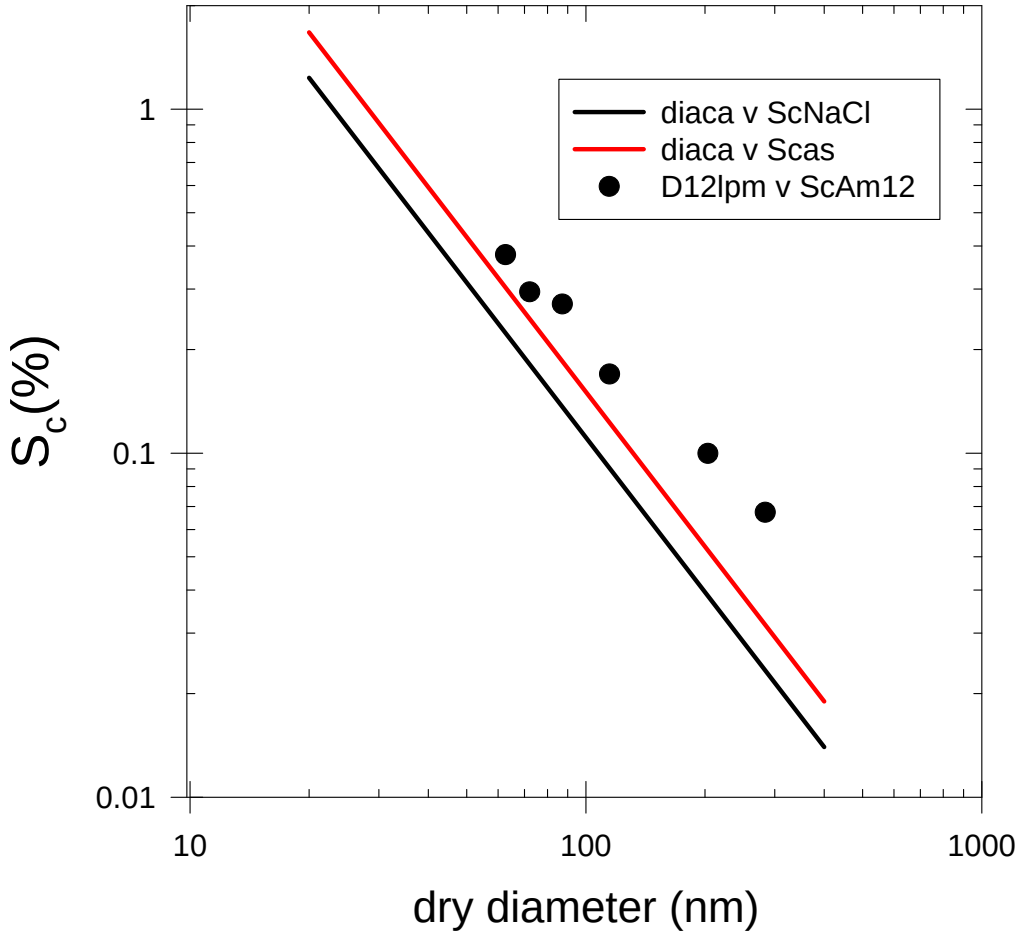


Below
y = -0.76 + 0.15x
R2 = 0.065

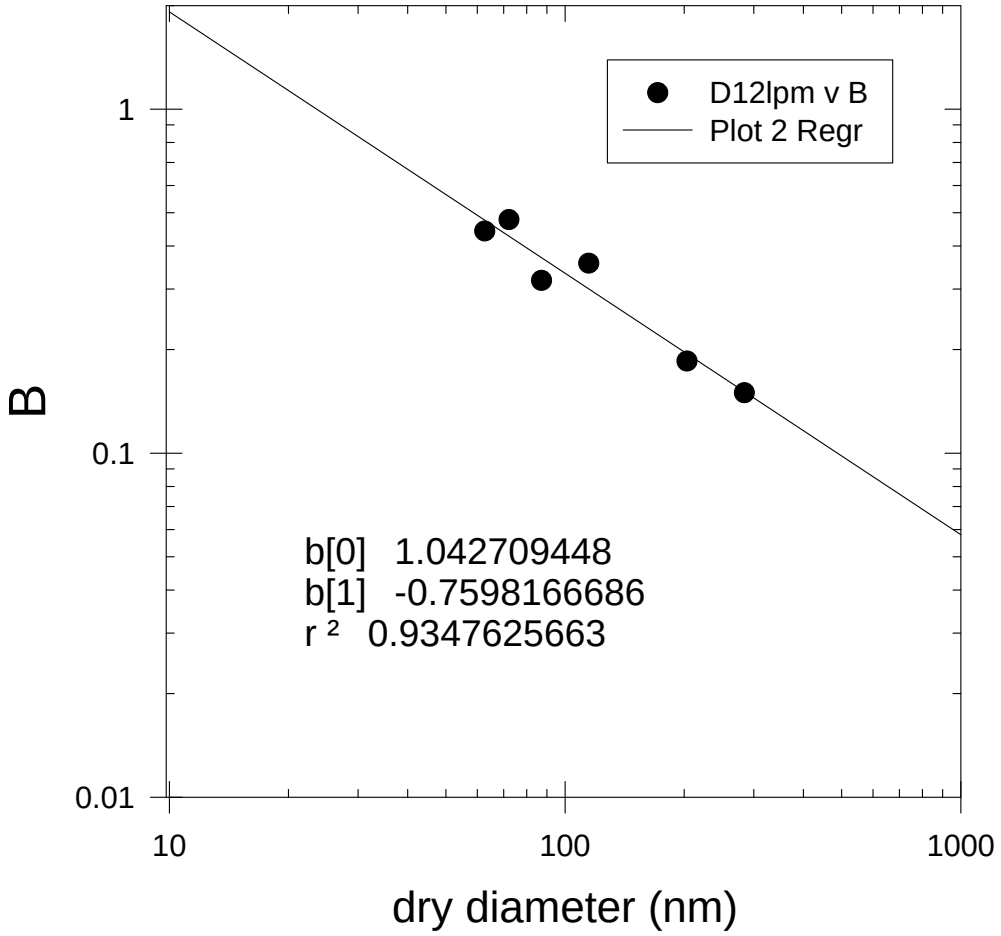
Above
y = -1.18+0.13x
R^2 = 0.12

Below
Y = -0.84 + 0.20
R^2 = 0.06

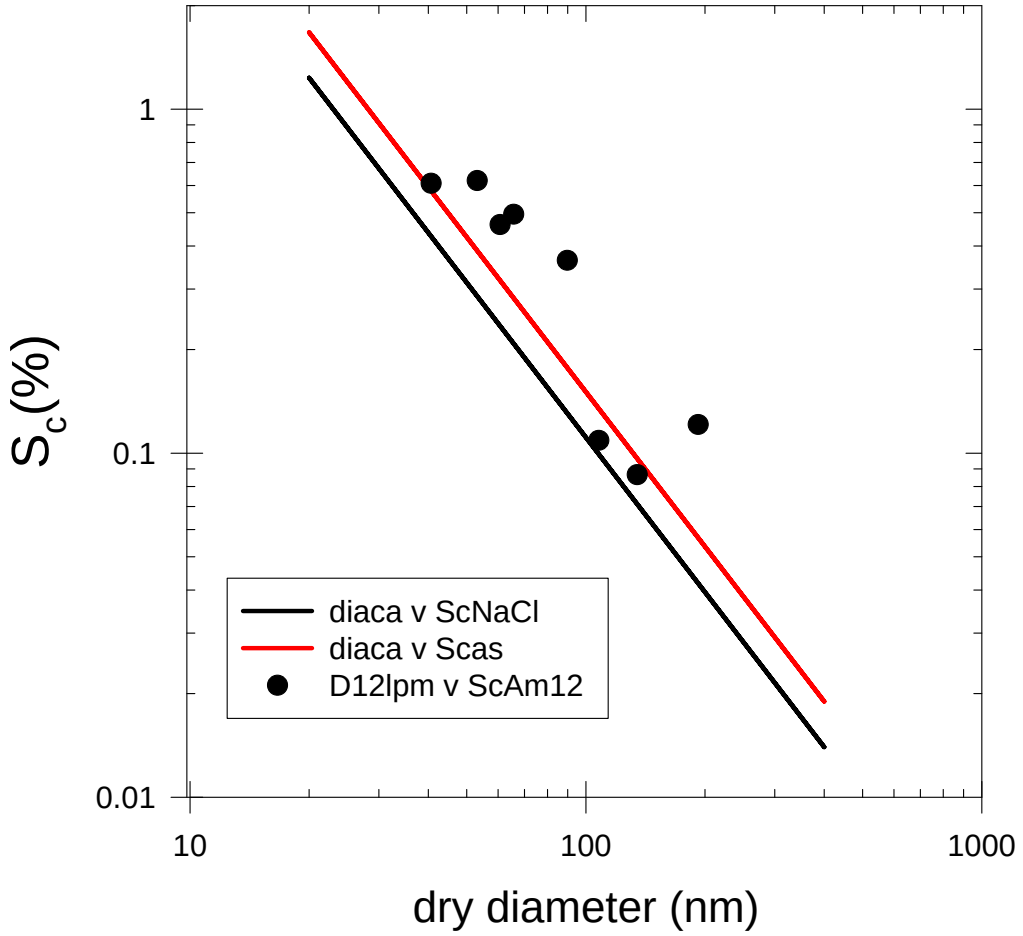
Aug 14, 2008 1051-1100
DT = 0,1.5,3,5.5,7,8 Twin Otter, POST
new spec.; OPC sn 50106, 6 sample holes open
sf =1.05-1.10v LV = 6.65v; HV = 530v TM = 20-19°C
offs 0.75, gain 4.5 old sf met
amb 12 lpm DMA 965-966mb
above cld CN 1297-1942



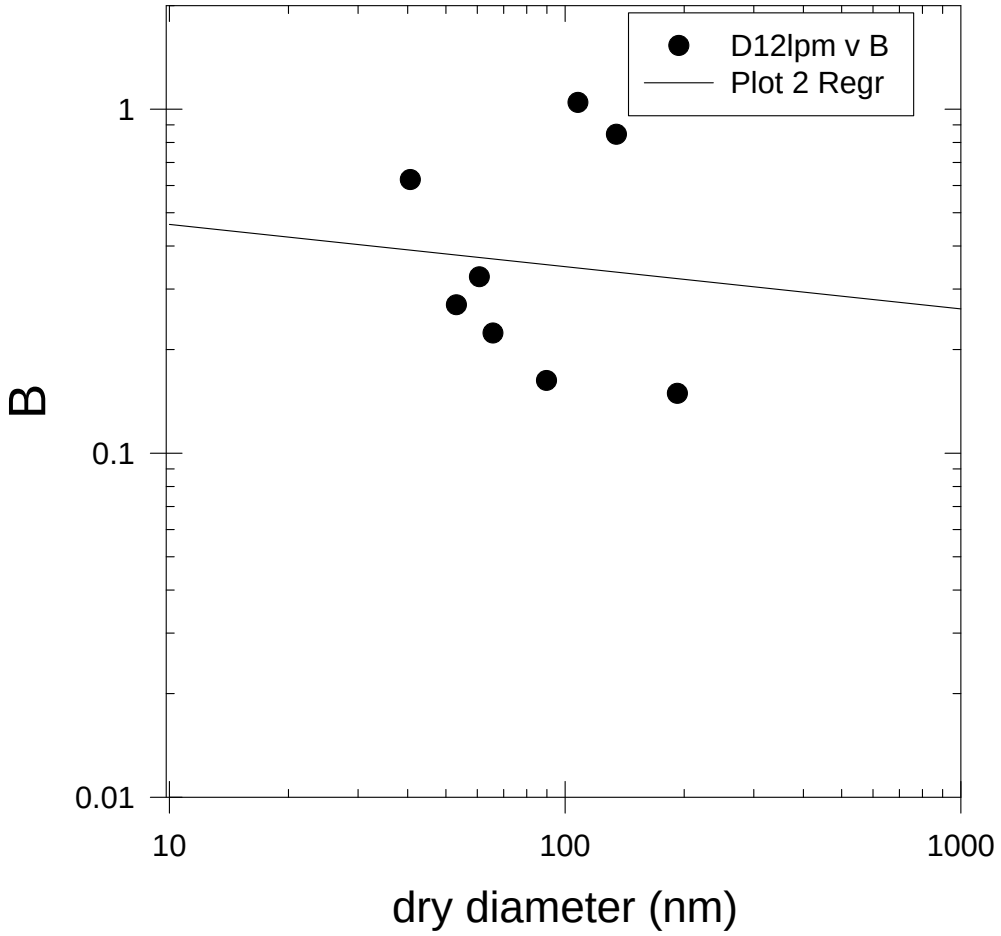
Aug 14, 2008 1051-1100
DT = 0,1.5,3,5.5,7,8 Twin Otter, POST
new spec.; OPC sn 50106, 6 sample holes open
sf =1.05-1.10v LV = 6.65v; HV = 530v TM = 20-19°C
offs 0.75, gain 4.5 old sf met
amb 12 lpm DMA 965-966mb
above cld CN 1297-1942

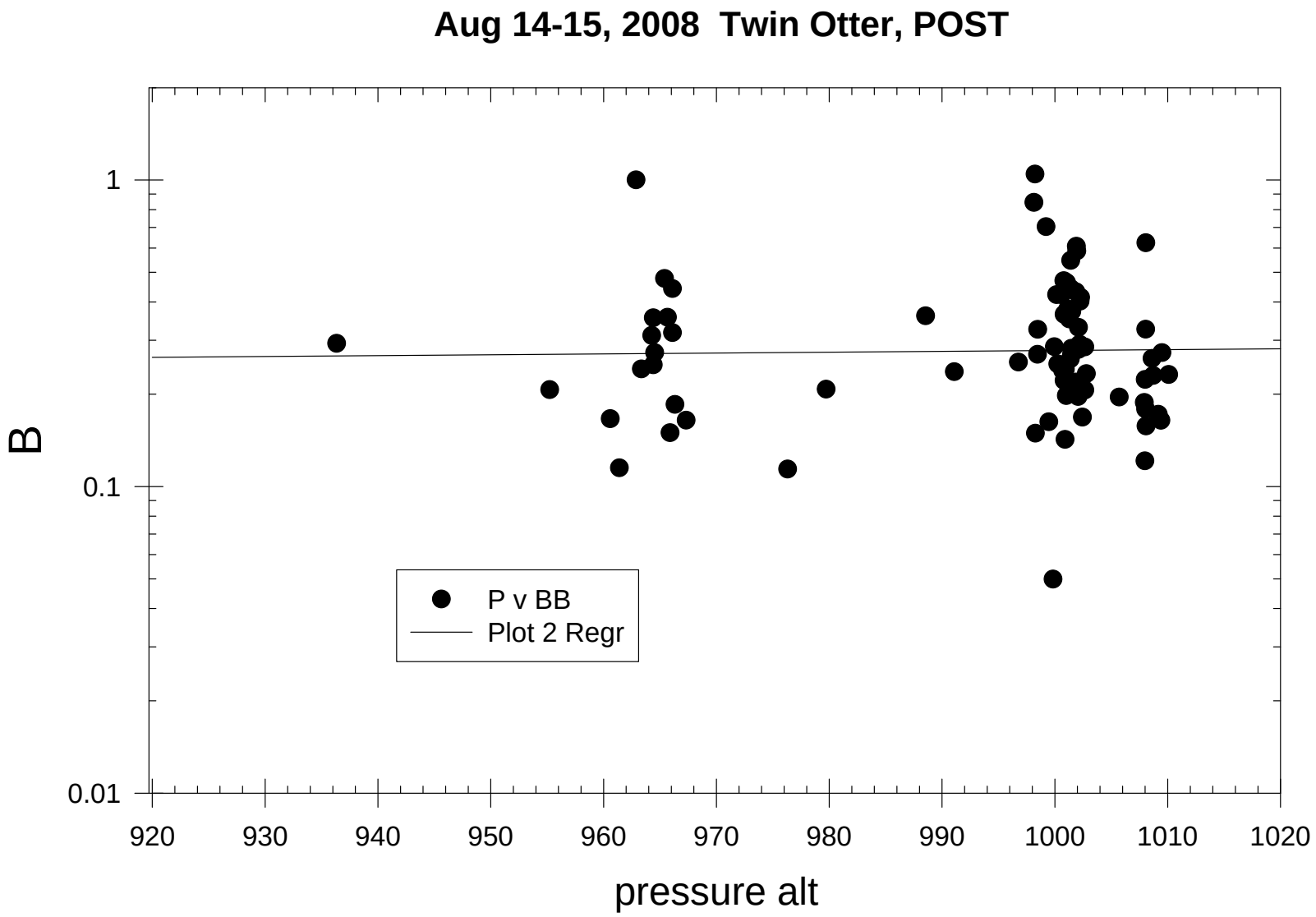


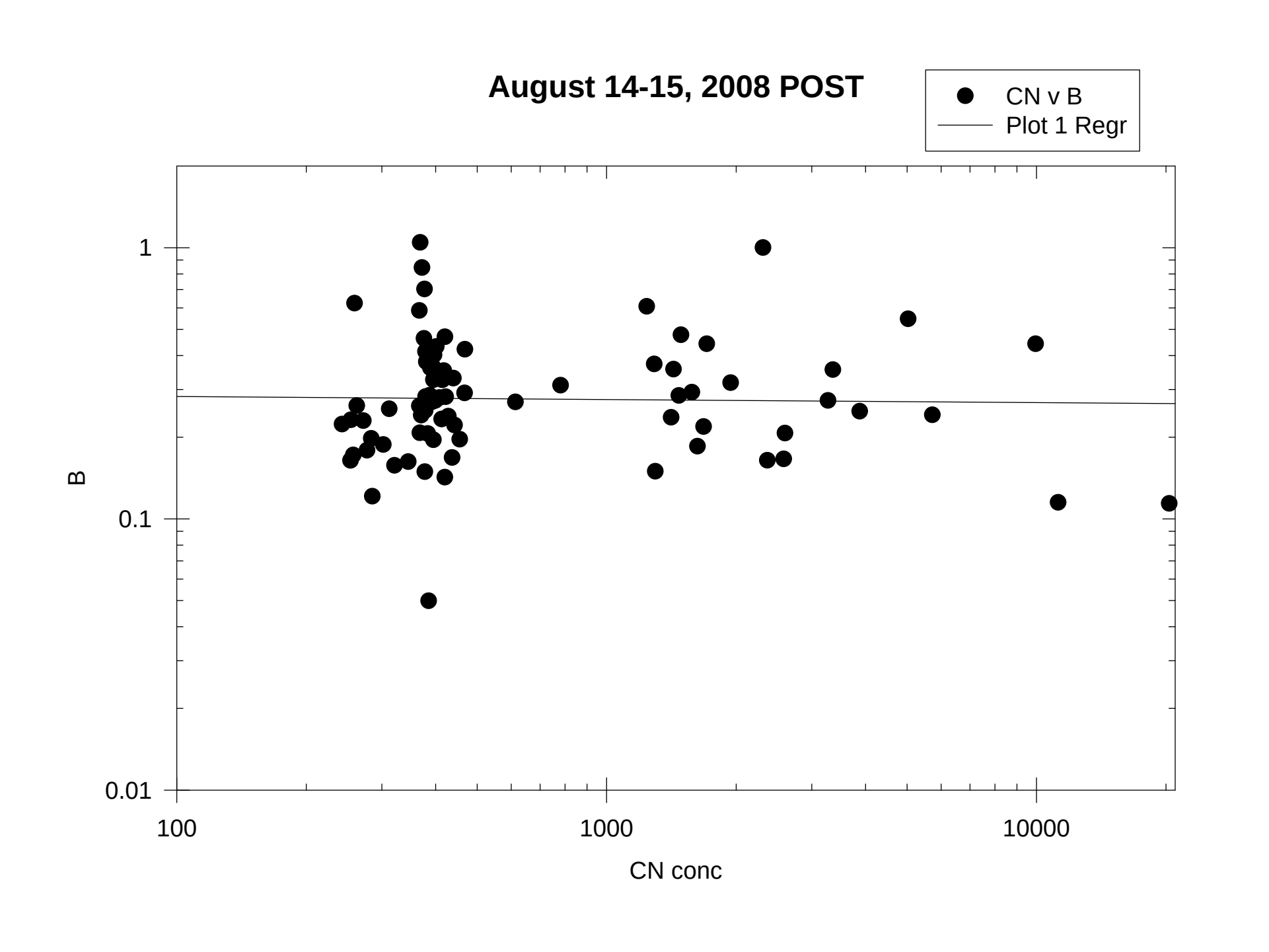
Aug 14, 2008 1319-1336
DT = 0,1.5,3,5.5,7,8 Twin Otter, POST
new spec.; OPC sn 50106, 6 sample holes open
sf =1.01-1.07v LV = 6.65v; HV = 530v TM = 20-19°C
offs 0.75, gain 4.5 old sf met
amb 12 lpm DMA 998-1008mb
100 & 400' blo cld CN 242-613

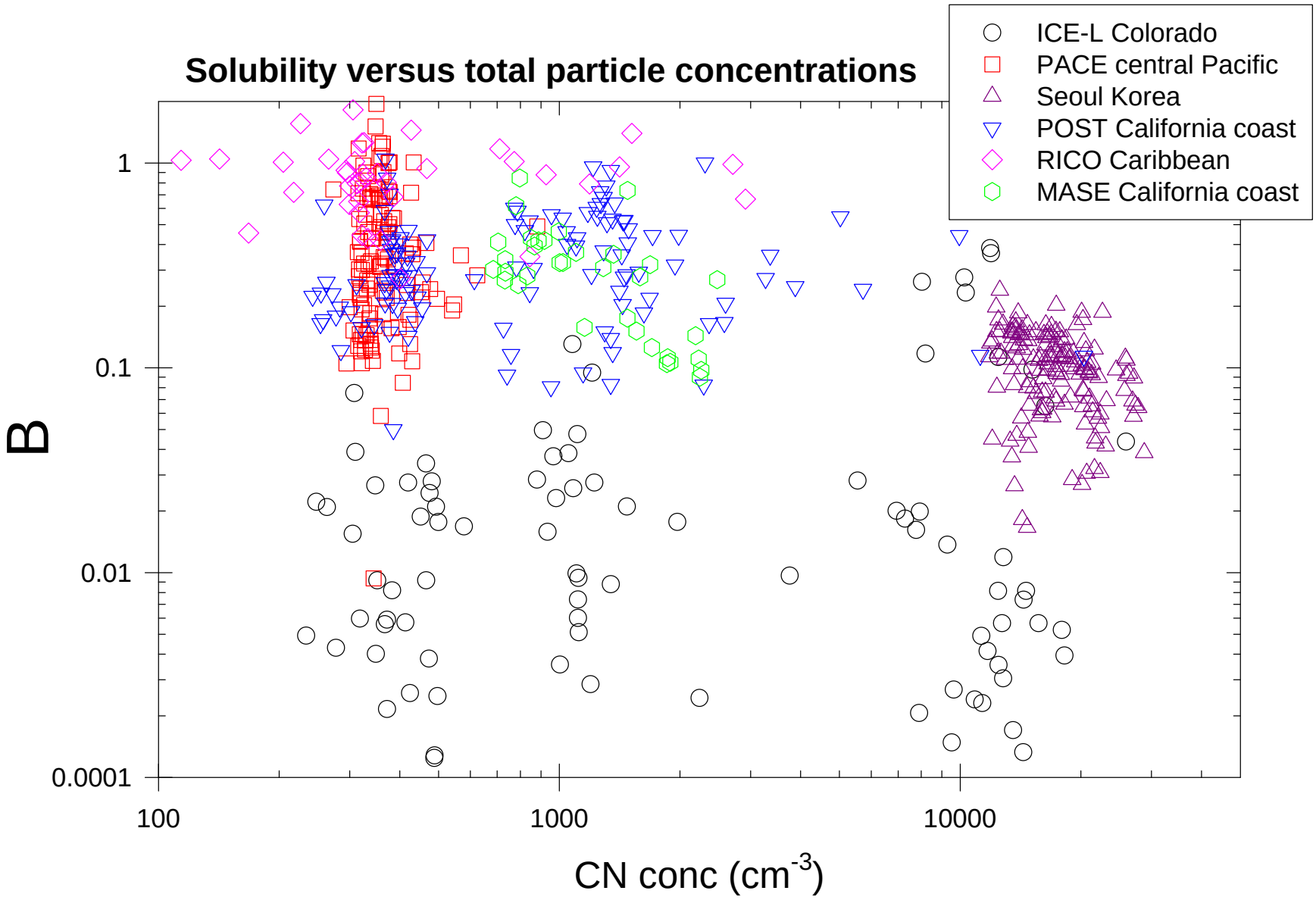


Aug 14, 2008 1319-1336
DT = 0,1.5,3,5.5,7,8 Twin Otter, POST
new spec.; OPC sn 50106, 6 sample holes open
sf =1.01-1.07v LV = 6.65v; HV = 530v TM = 20-19°C
offs 0.75, gain 4.5 old sf met
amb 12 lpm DMA 998-1008mb
100 & 400' alt belo cld CN 242-613




Aug 14-15, 2008 Twin Otter, POST
B
1
0.1
0.01
920
930
940
950
960
970
980
990
1000
1010
1020
pressure alt
P v BB
Plot 2 Regr


August 14-15, 2008 POST
CN v B
Plot 1 Regr
1
0.1
0.01
B
100
1000
10000
CN conc


Solubility versus total particle concentrations
ICE-L Colorado
PACE central Pacific
Seoul Korea
POST California coast
RICO Caribbean
MASE California coast
B
1
0.1
0.01
0.0001
100
1000
10000
CN conc (cm-3)

Correlations with larger droplet concentrations and drizzle drop concentrations and LWC a la RICO (Hudson et al. 2009 JGR)

Volatility for TO3, 4, 16, and 17

Examine updraft velocity, W.

R for concentrations at various S

Determine adiabatic N_c from cloud base temperature and altitude compared to altitude of cloud measurements (Hudson and Yum 2000 and 2002).

Predict N_c from W and complete CCN spectra and compare with adiabatic N_c.

Remove data obtained in cloud and produce another file for archive.

Determine whether above cloud CCN affect microphysics or visa versa.

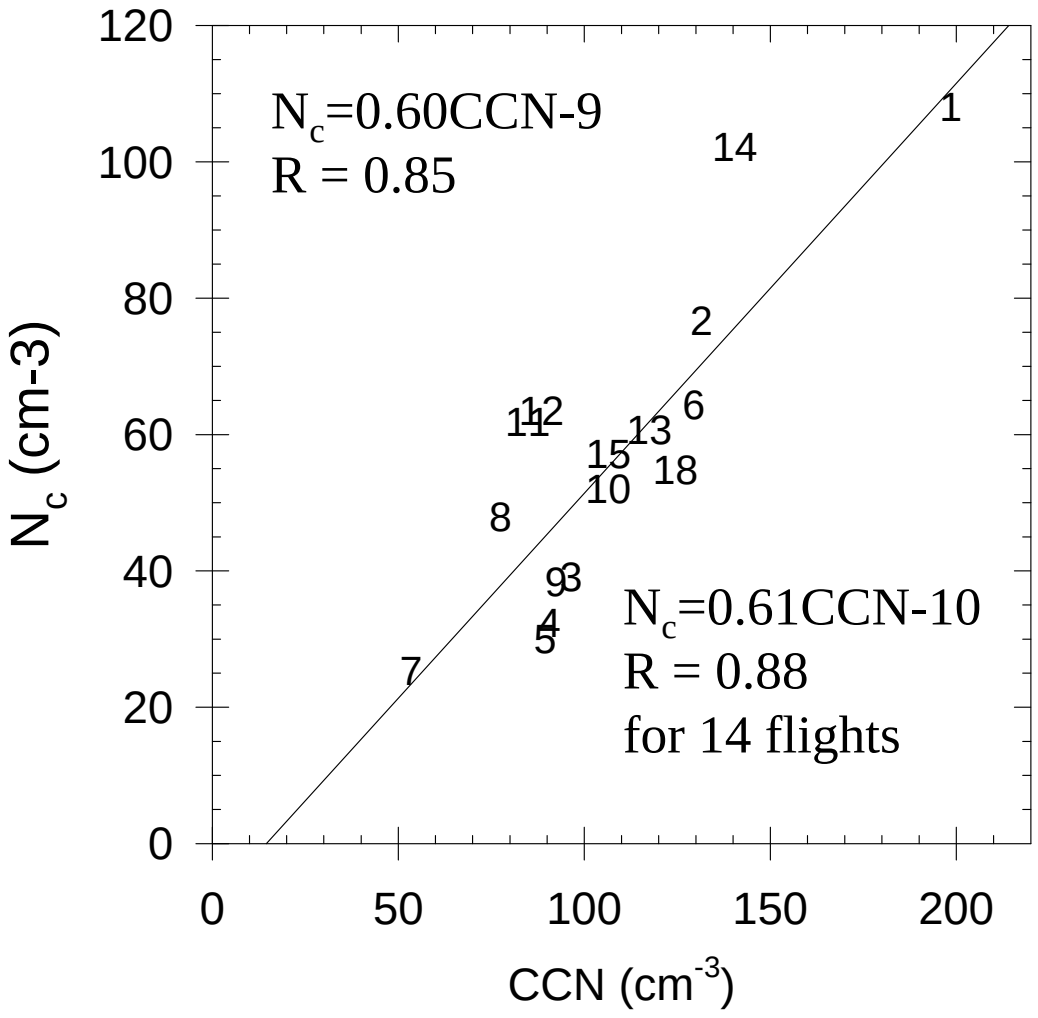


Figure 1. Average total (>2.4 µm) FSSP droplet concentrations (Nc) measured during each flight within the 600-900m altitude range and FSSP LWC > 0.1 gm-3 against the average 100m altitude CCN concentrations at 1% S for each flight. Data points are plotted as the flight number (Table 1). All of the 17 flights considered here except RF17 (J19) had clouds within this altitude range. The linear regression line, equation and correlation coefficient (R) is shown as well as the linear regression and R for only the same 14 flights considered by HM7 (excluding RF4 and 11 [D10 and J7]).

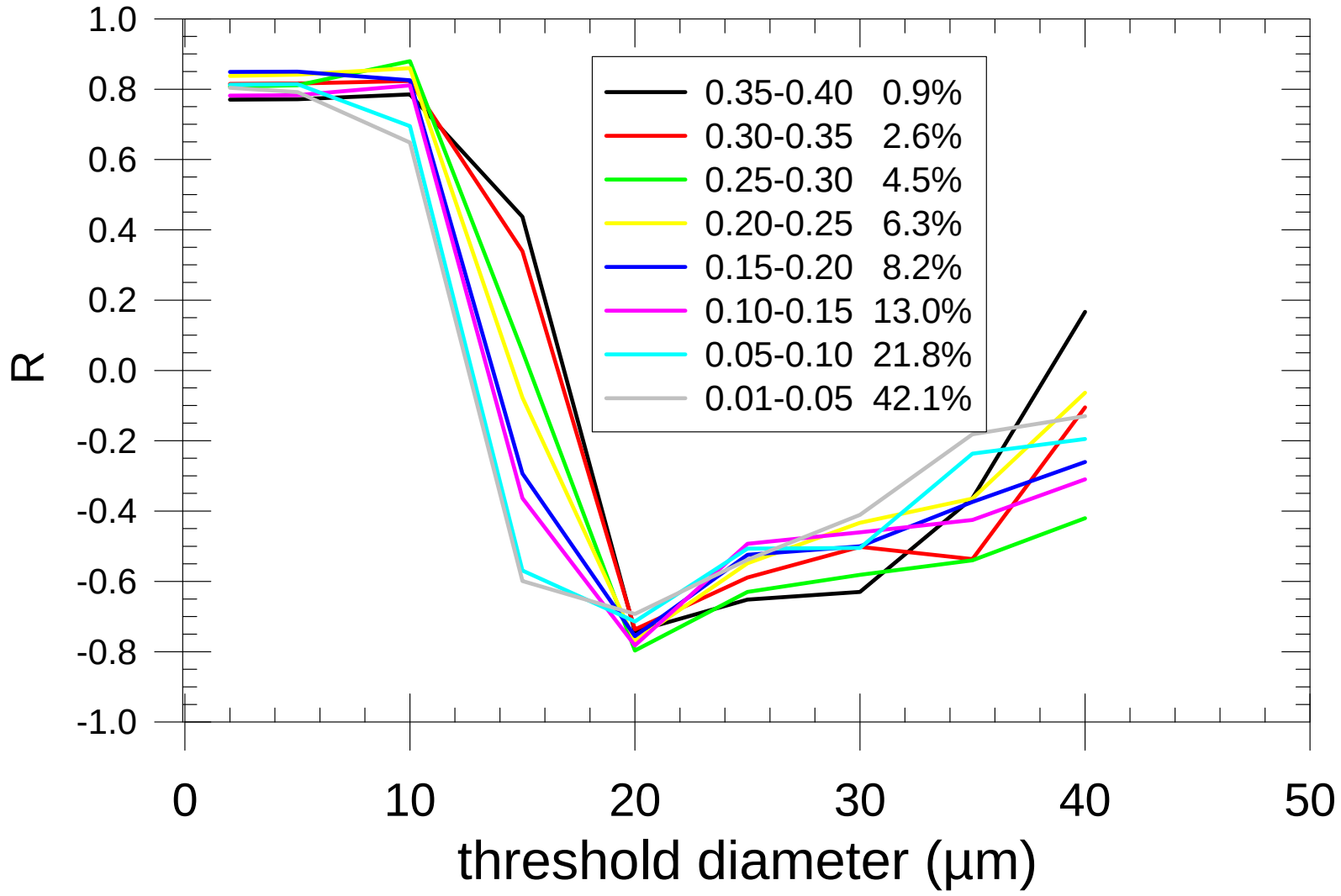


Figure 14. As Figs. 12 or 13 except that the different lines here represent various LWC ranges denoted in the legend in gm^{-3} . All data are for the same 600-900m altitude band from the same eleven flights that had data in all of these LWC intervals. This then excludes RF2, 4, 7, 11, 17 and 18 (D8, D10, D17, J7, J19, J23). The legend also shows the percentage of data (time) for each interval; 0.7% exceeded 0.40 gm-3.

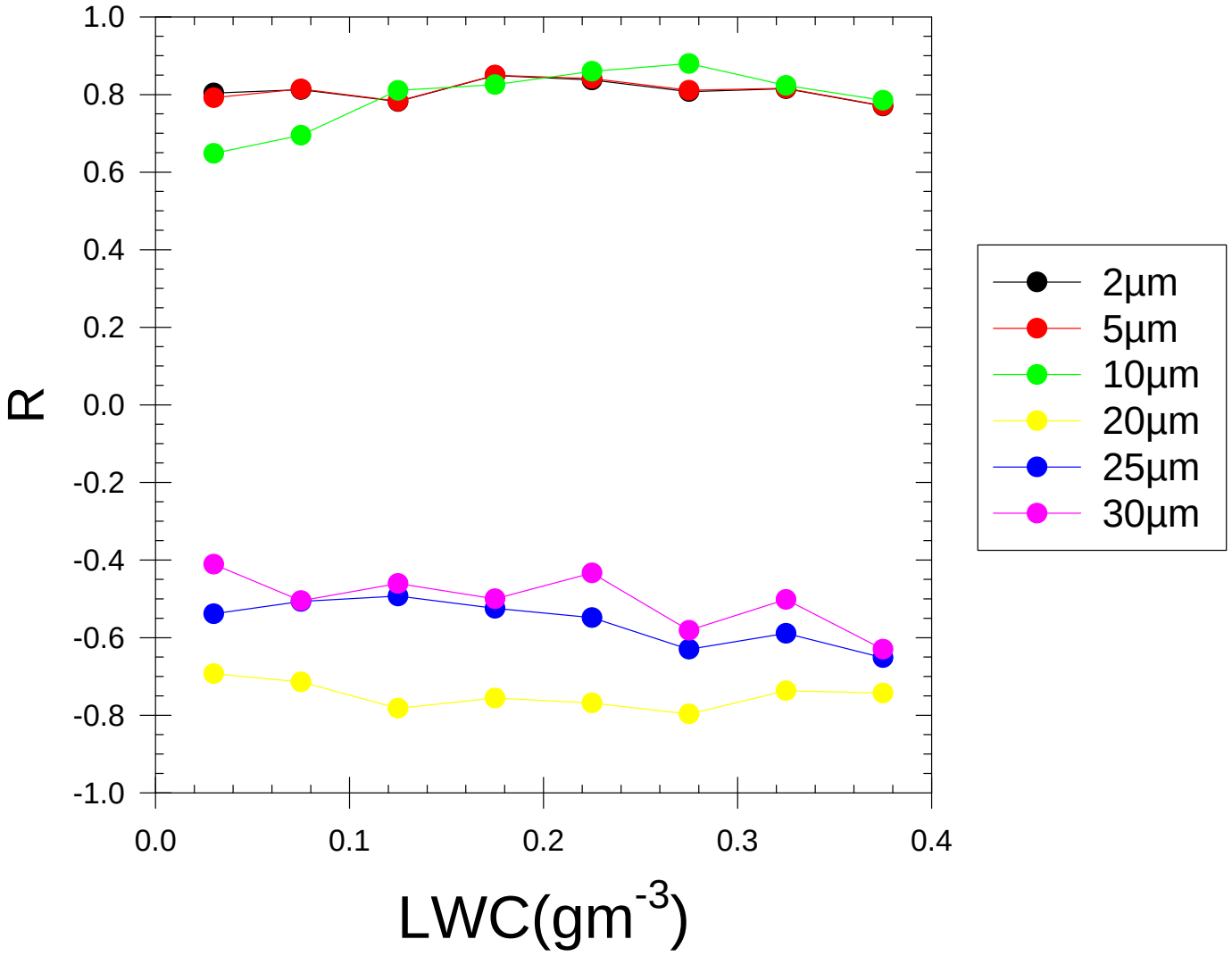


Figure 15. Same data displayed in Fig. 14, but with R plotted against the LWC intervals for each threshold diameter denoted in the legend.

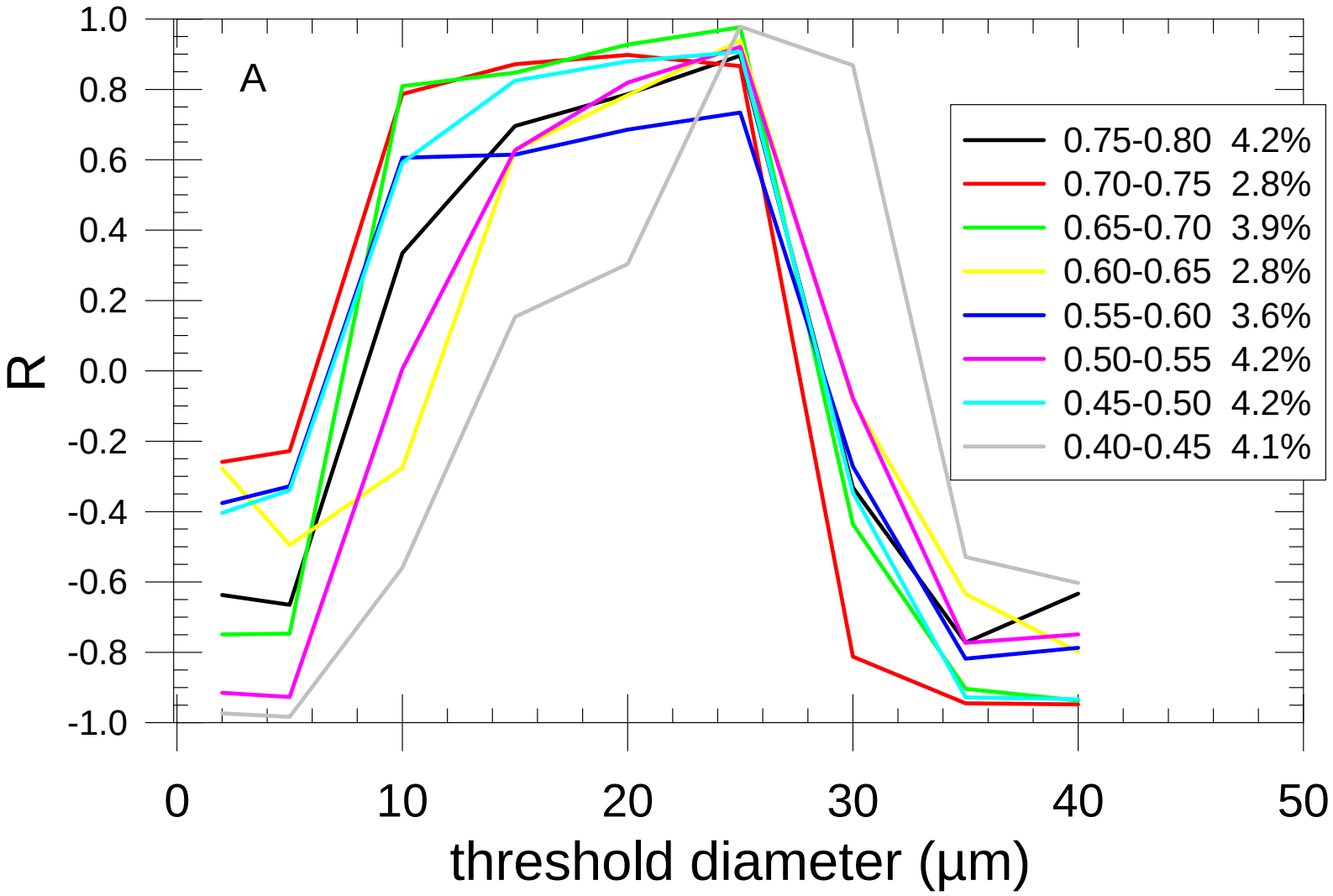


Figure 20. As Fig. 18 but for 2400-3000m altitude. Only four flights; RF1, 11, 13 and 15; 16% exceeded 0.80gm^{-3}. The 0.25-0.30 gm-3 interval with 5.8% of the data is not shown because it did not have data from all four flights.

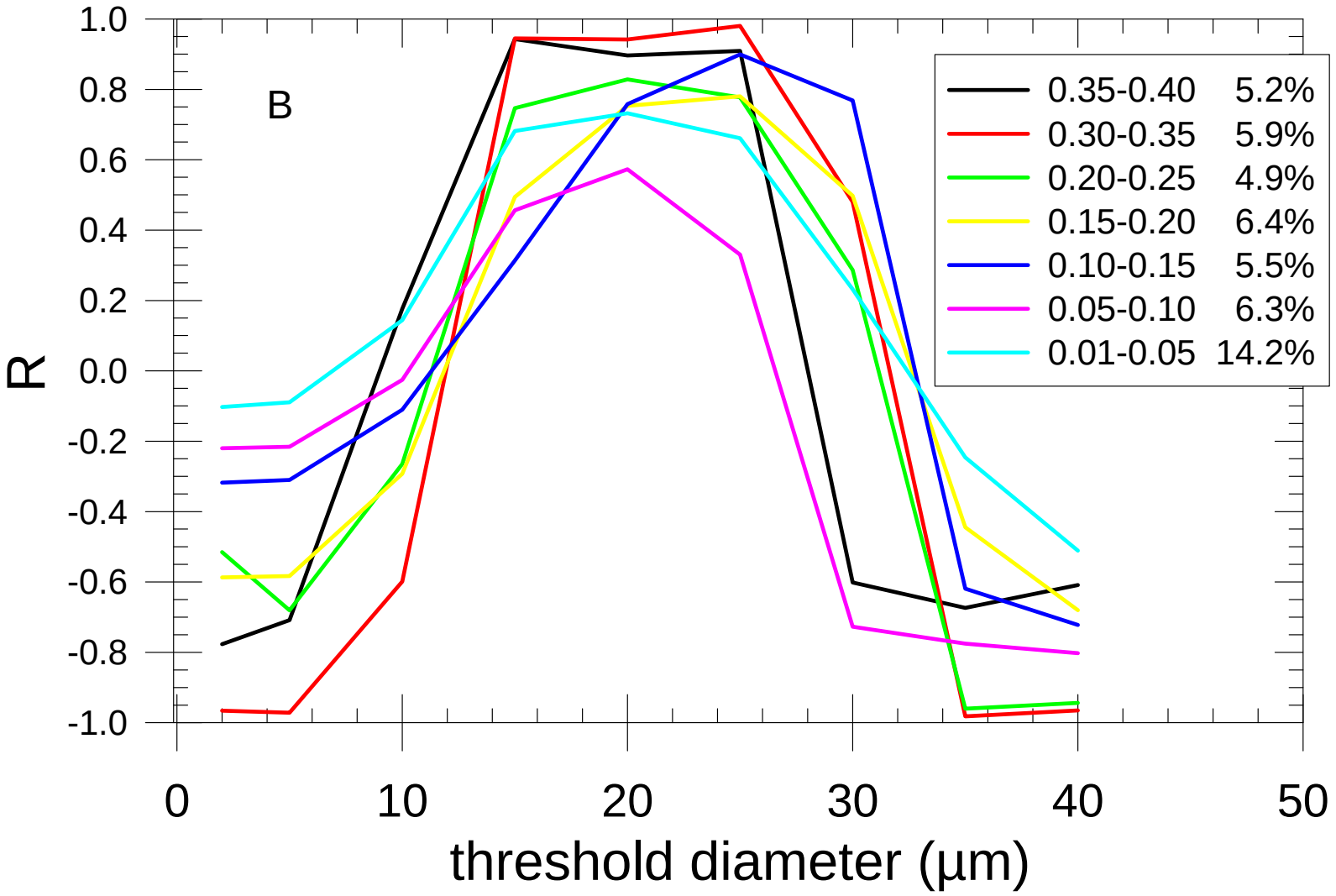

B
R
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
0
10
20
30
40
50
threshold diameter (µm)
0.35-0.40 5.2%
0.30-0.35 5.9%
0.20-0.25 4.9%
0.15-0.20 6.4%
0.10-0.15 5.5%
0.05-0.10 6.3%
0.01-0.05 14.2%

Figure 20B.