Measuring microphysical, chemical and optical properties of aerosols aboard the NCAR/NSF C-130 during VOCALS

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Measuring aerosol microphysics

Condensation Nuclei Counters (CNC's)

-Total particle number > 0.010 μm (X_CNcold)

-Refractory particle number > 0.01 μm (X_CNHot)

-Total particle number > 0.003μm (X_UCN)

Differential Mobility Analyzer (long-DMA & tandem-DMA)

-thermally resolved, Dp = 0.01 – 0.20 μm

-Dp = 0.01 – 0.50 μm

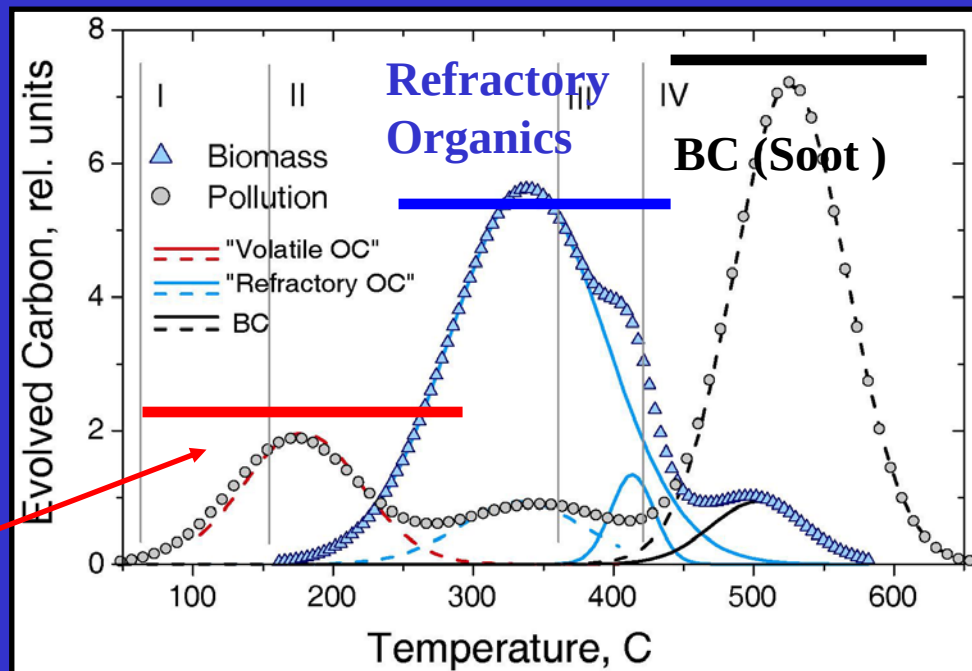
Optical Particle Counter (OPC)

-thermally resolved

-Dp = 0.1 – 10.0 μm

Aerodynamic Particle Sizer (APS)

-Dp = 0.7 – 20.0 μm



Measuring optics and chemistry

Light Scattering & Absorption

-TSI Nephelometer – λ=450, 550, 700 nm (total or submicrometer)

-2 RR PSAP's – λ=470, 530, 670 nm (total and submicrometer)

F(RH) at 550 nm

-parallel 1-λ Radiance Research Nephelometers

-RH = 80% (+/-5%) and < 20%

Aerodyne ToF-AMS – *S. Howell & L. Shank*

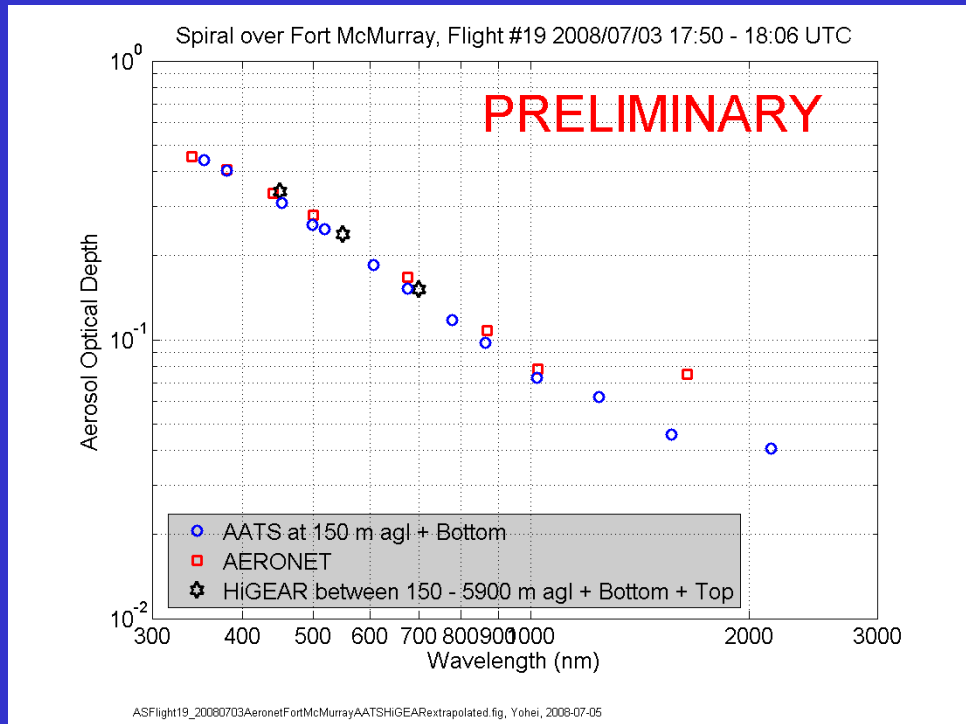
-Volatile aerosol chemistry

-SO4, NO3, NH4, Organics

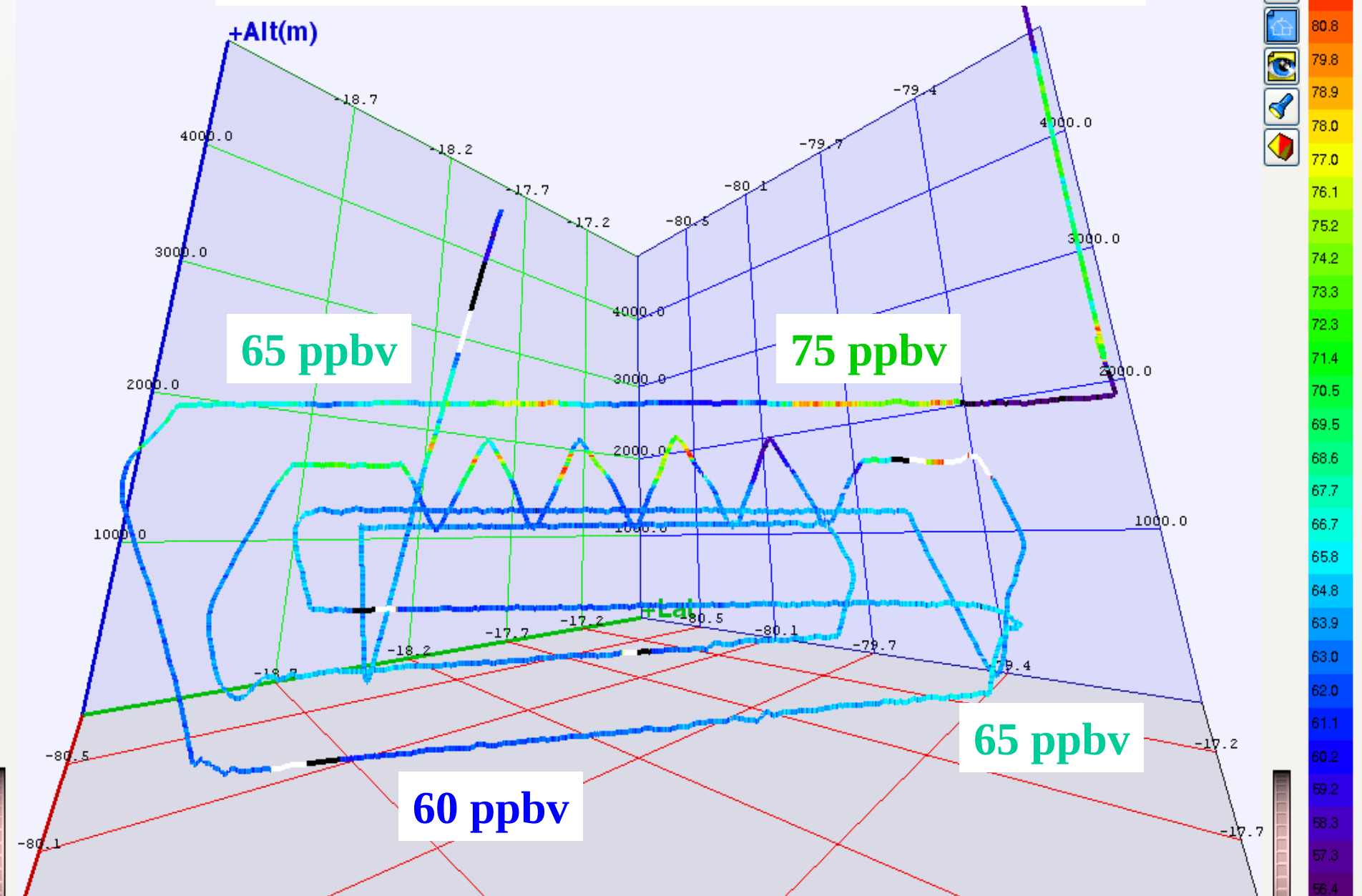
Black Carbon Mass – *S. Freitag*

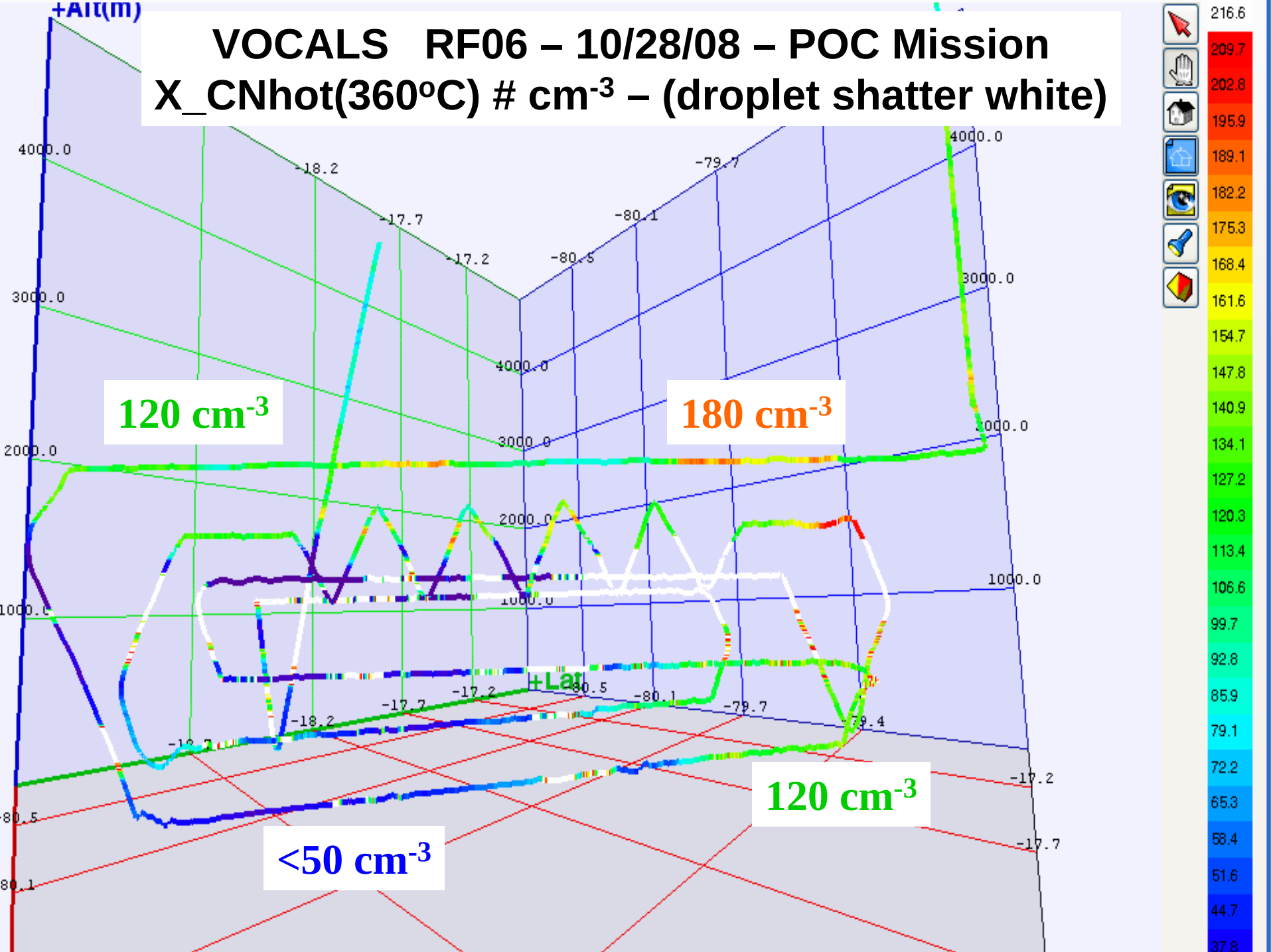
-DMT SP2

-Dp ~0.1 – 0.50 μm



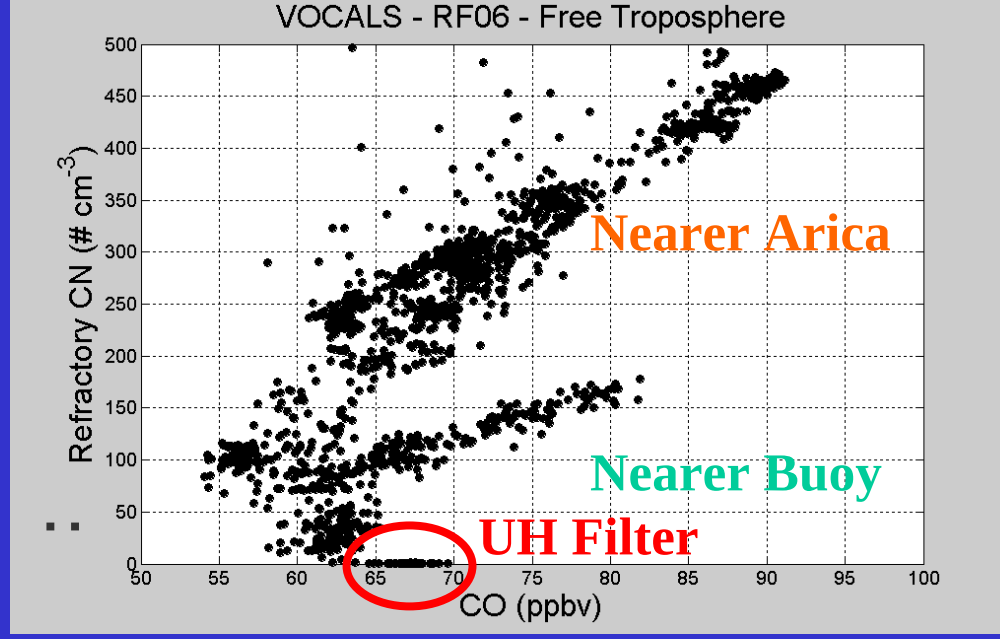
VOCALS RF06 – 10/28/08 – POC Mission
CO mixing ratio (ppbv)

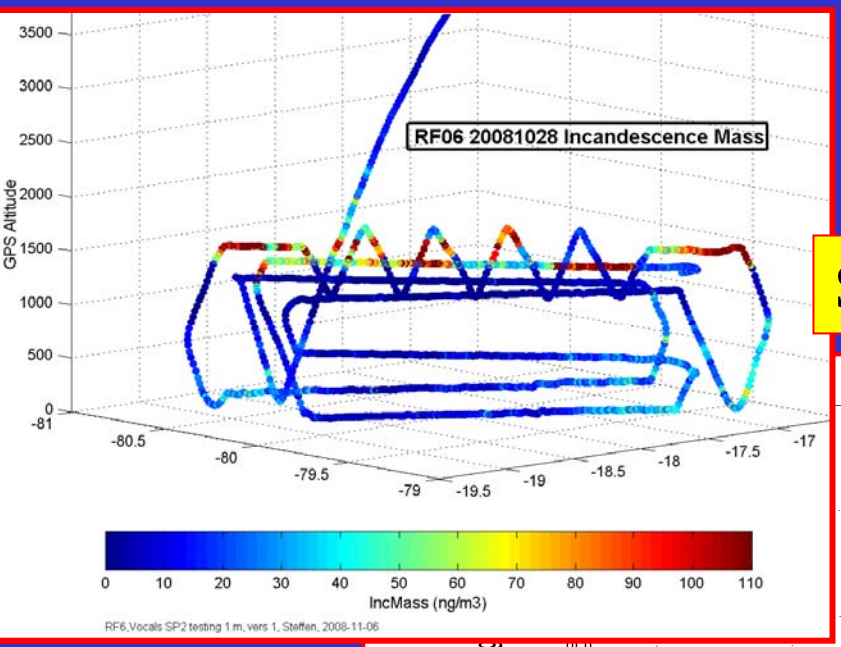



VOCALS RF06 – 10/28/08 – POC Mission
X_CNhot(360ºC) # cm-3 – (droplet shatter white)
120 cm-3
180 cm-3
120 cm-3
<50 cm-3
+Alt(m)
+Lat
216.6
209.7
202.8
195.9
189.1
182.2
175.3
168.4
161.6
154.7
147.8
140.9
134.1
127.2
120.3
113.4
106.6
99.7
92.8
85.9
79.1
72.2
65.3
58.4
51.6
44.7

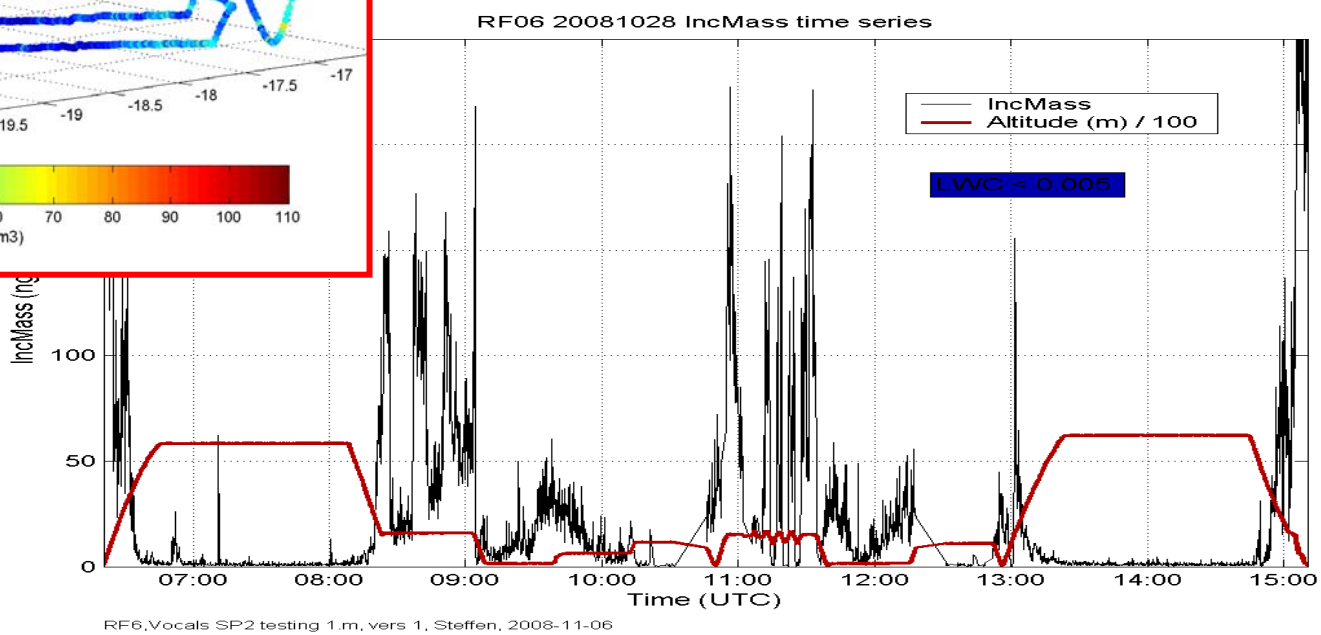
Prior to wet removal, refractory "soot" aerosol show robust correlations with CO.

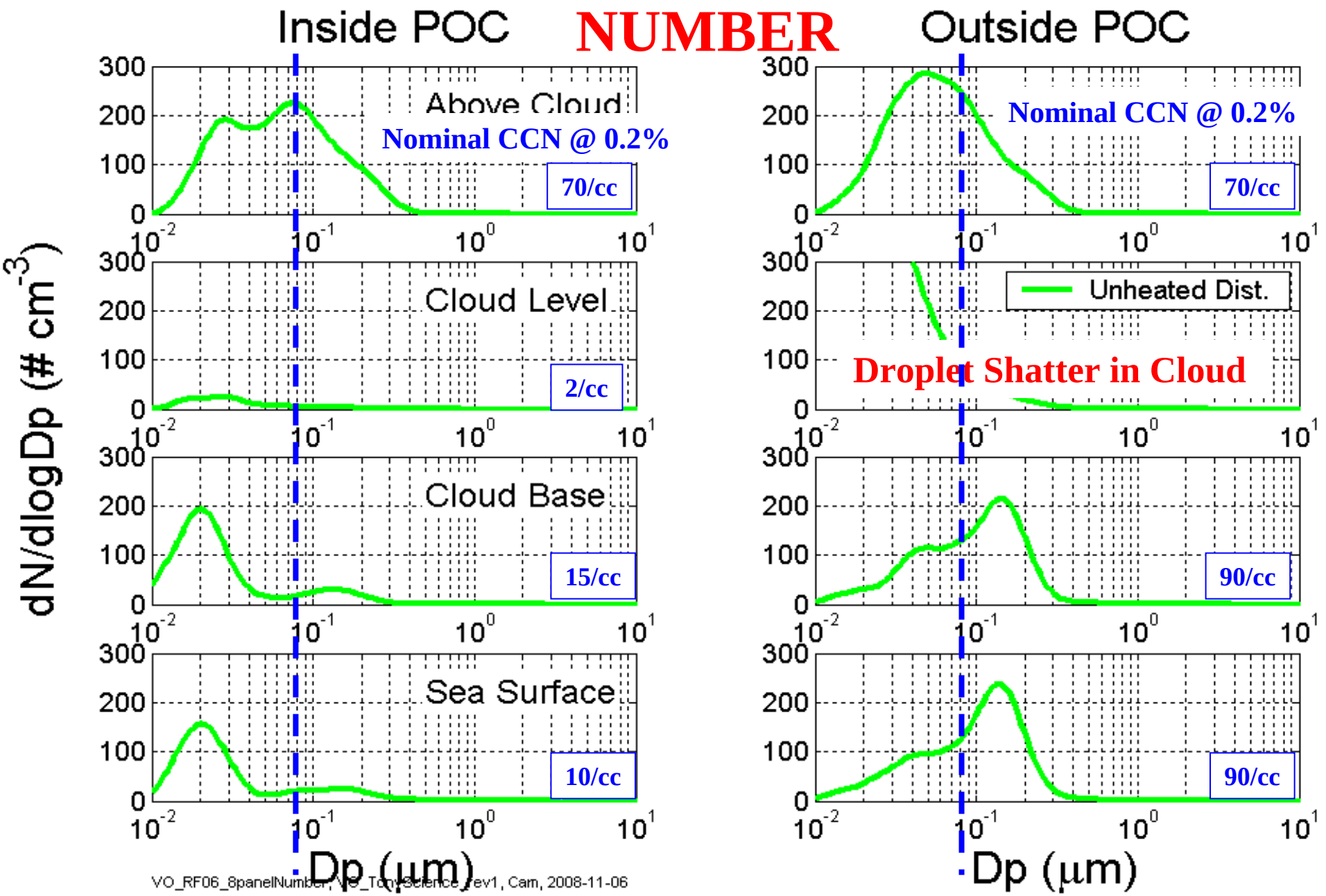
Differing slopes are often indicative of airmasses of different origins and/or type.





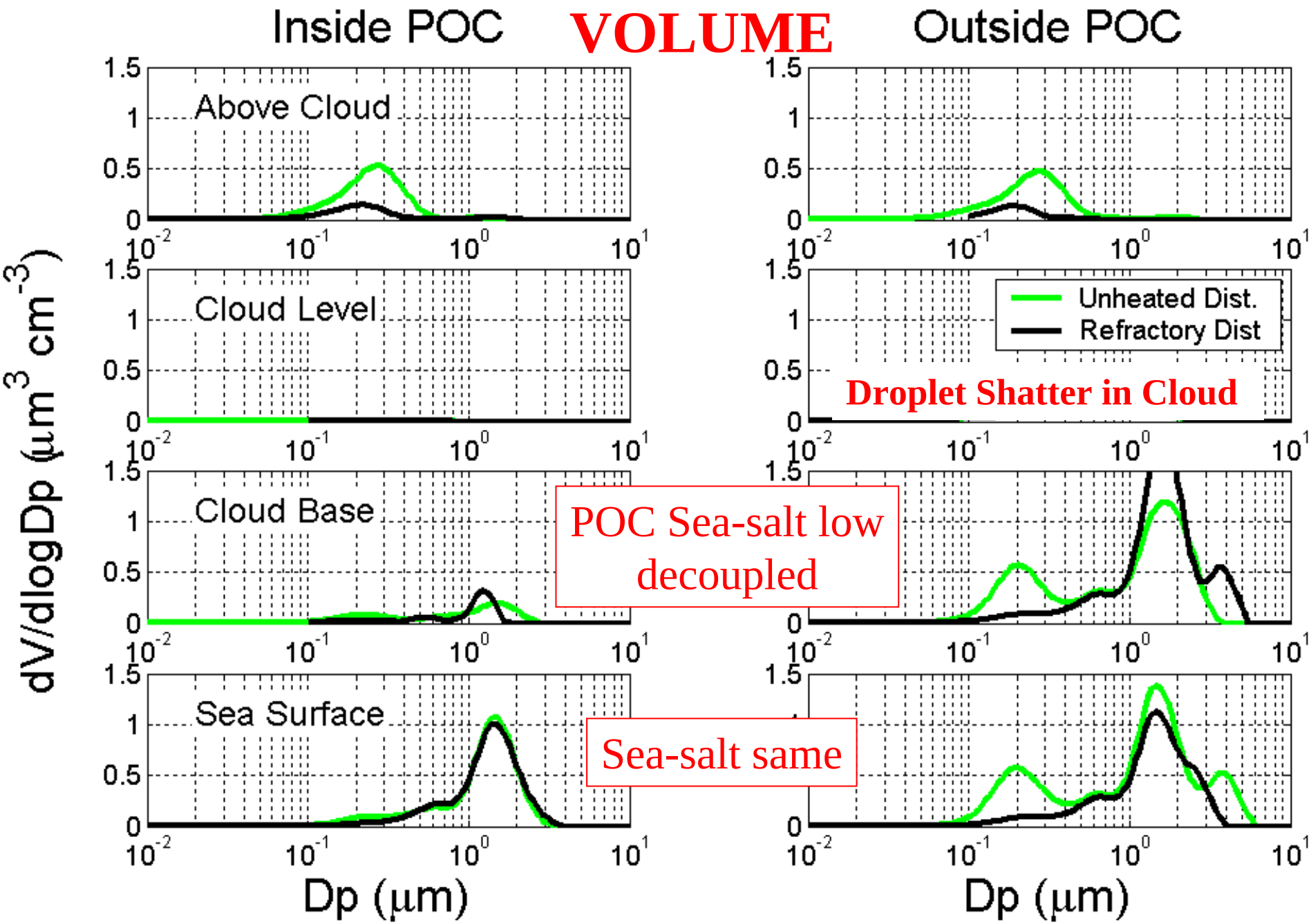
SP2 Black Carbon on Flight RF06



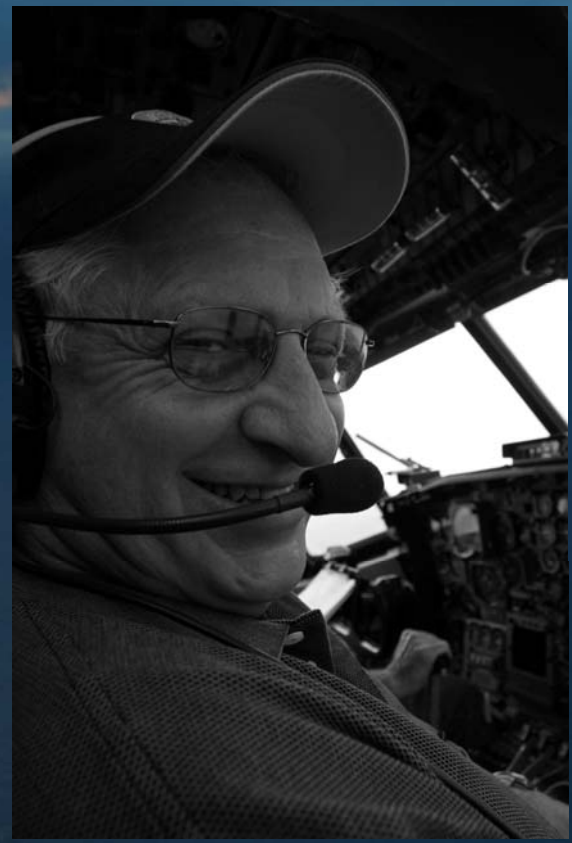


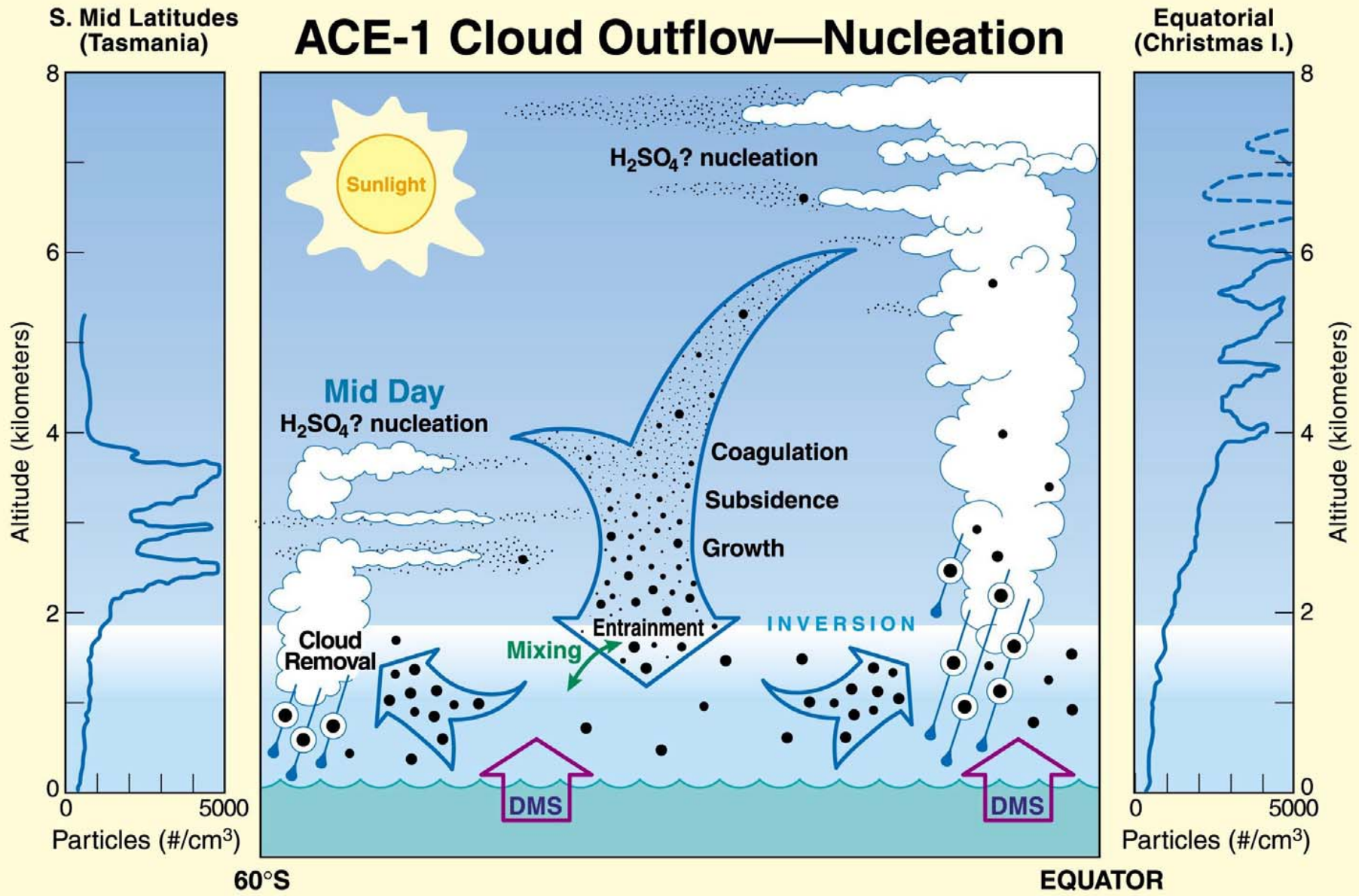
More scavenging of aerosol in POC
Lower entrainment of aerosol aloft??

More processing/growth out of POC
Higher entrainment of aerosol from aloft??


Inside POC
VOLUME
Outside POC
Above Cloud
Cloud Level
Cloud Base
Sea Surface
Unheated Dist.
Refractory Dist
Droplet Shatter in Cloud
POC Sea-salt low decoupled
Sea-salt same
dV/dlogDp (μm3 cm-3)
Dp (μm)
Dp (μm)

Thanks to C-130 pilots, crew and UCAR support staff…





Clarke et al., Particle production in the remote marine atmosphere: Cloud outflow and subsidence during ACE-1, Jour. Geophys, Res., 103, 16,397-16,409, 1998

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