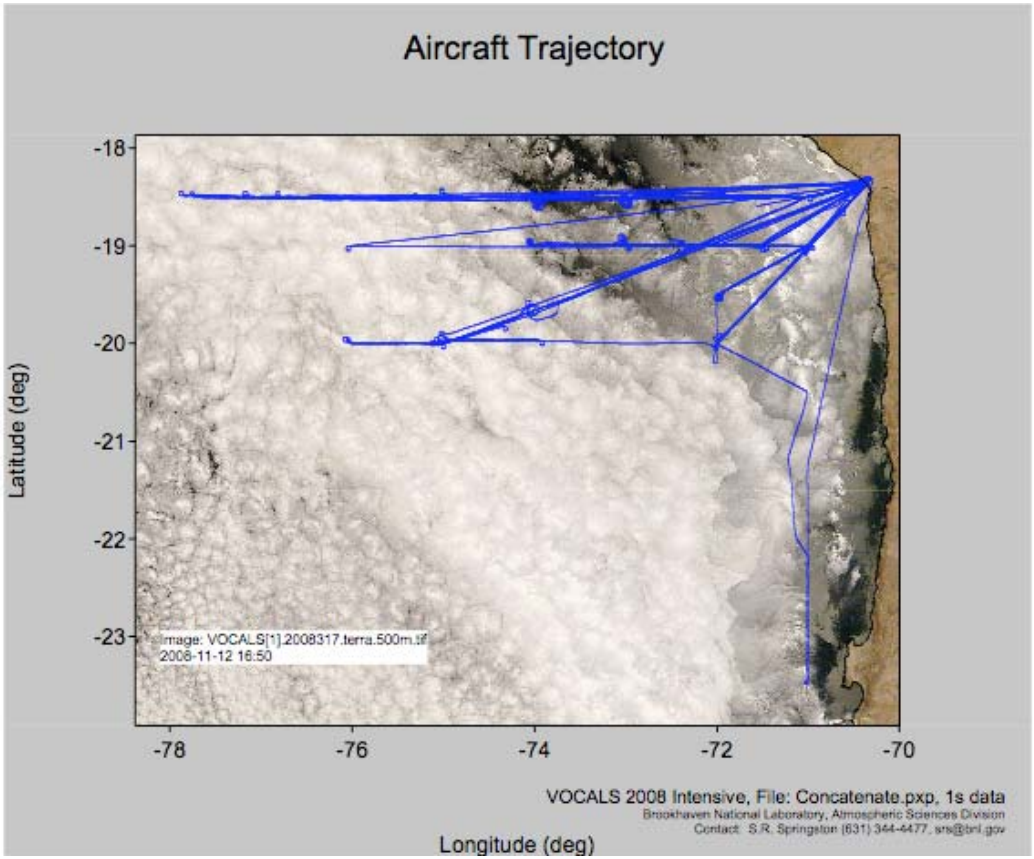
VOCALS G-1 FLIGHTS

PRELIMINARY OBSERVATIONS

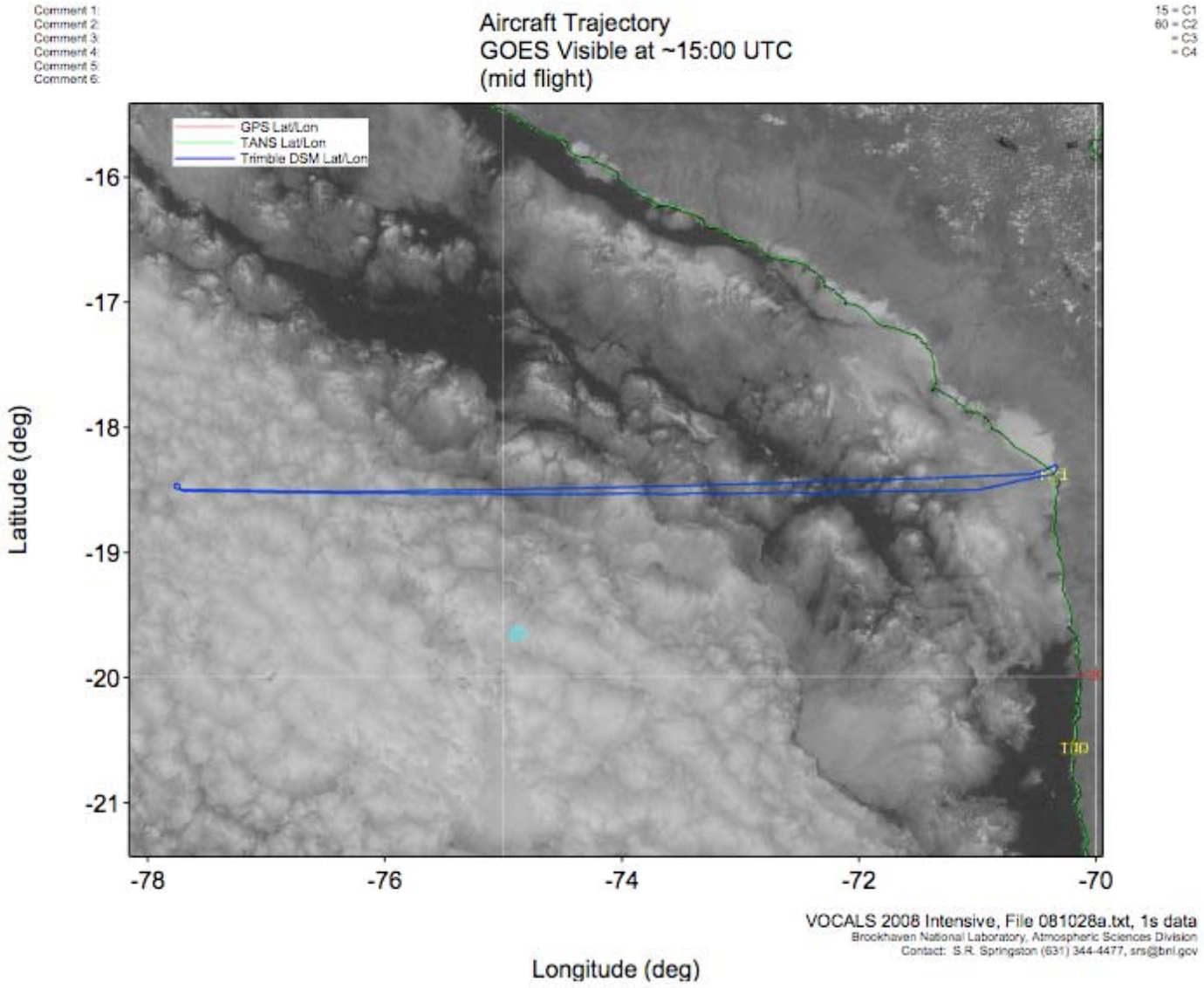
PETER DAUM
BROOKHAVEN NATIONAL LABORATORY

VOCALS G-1 FLIGHTS

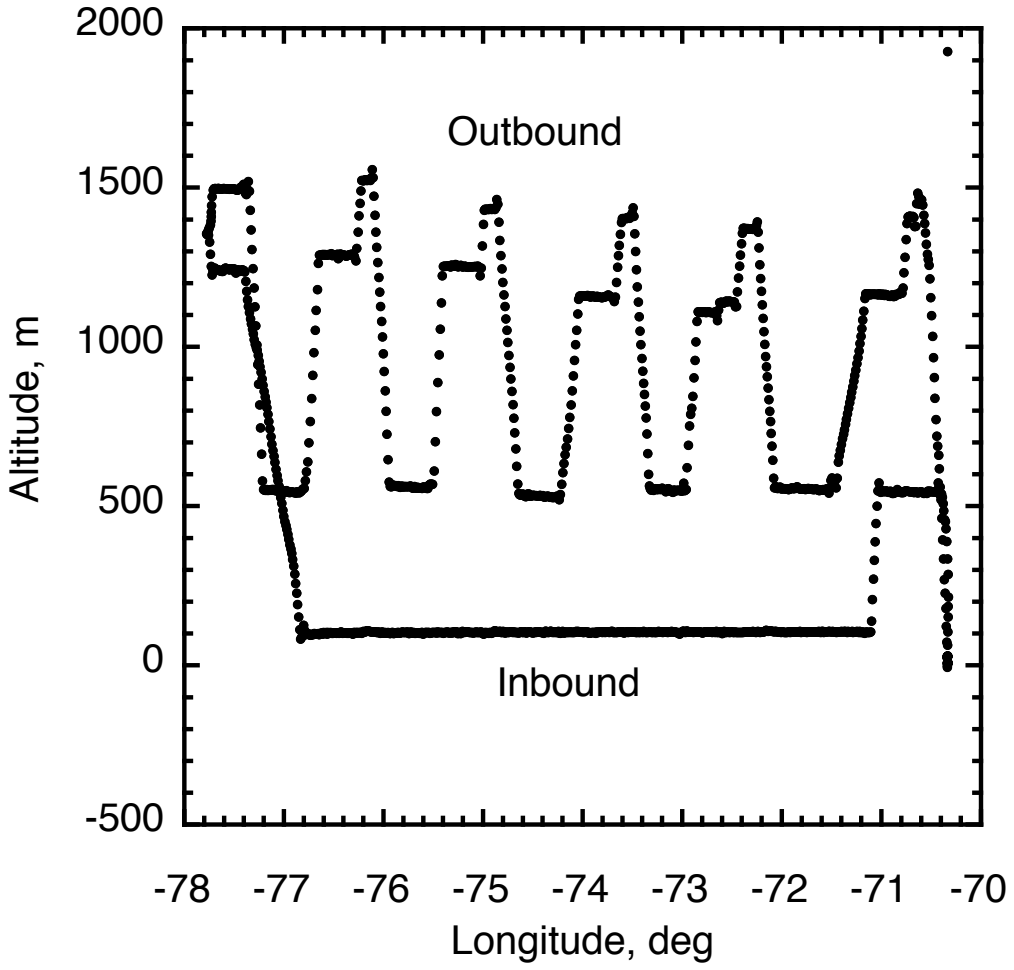


Seventeen flights during the program, mostly E-W to examine gradients in cloud and aerosol properties.

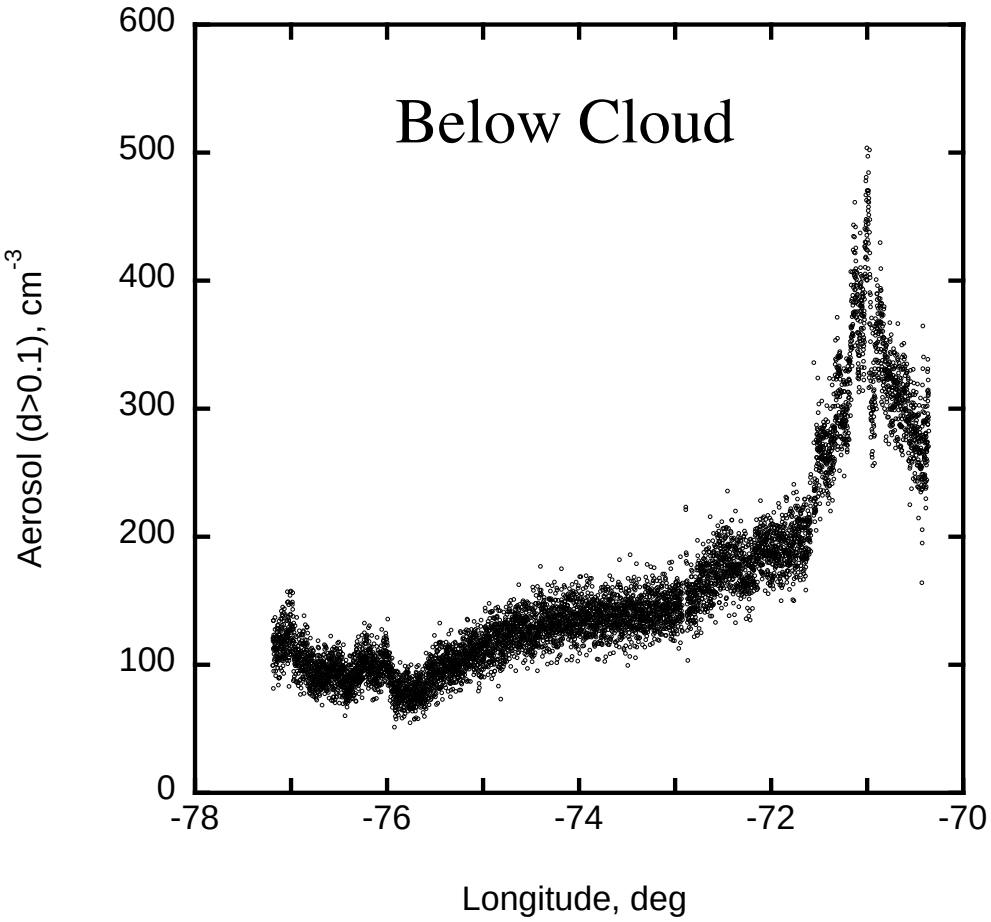
October 28 Gradient Flight



October 28 Flight Profile

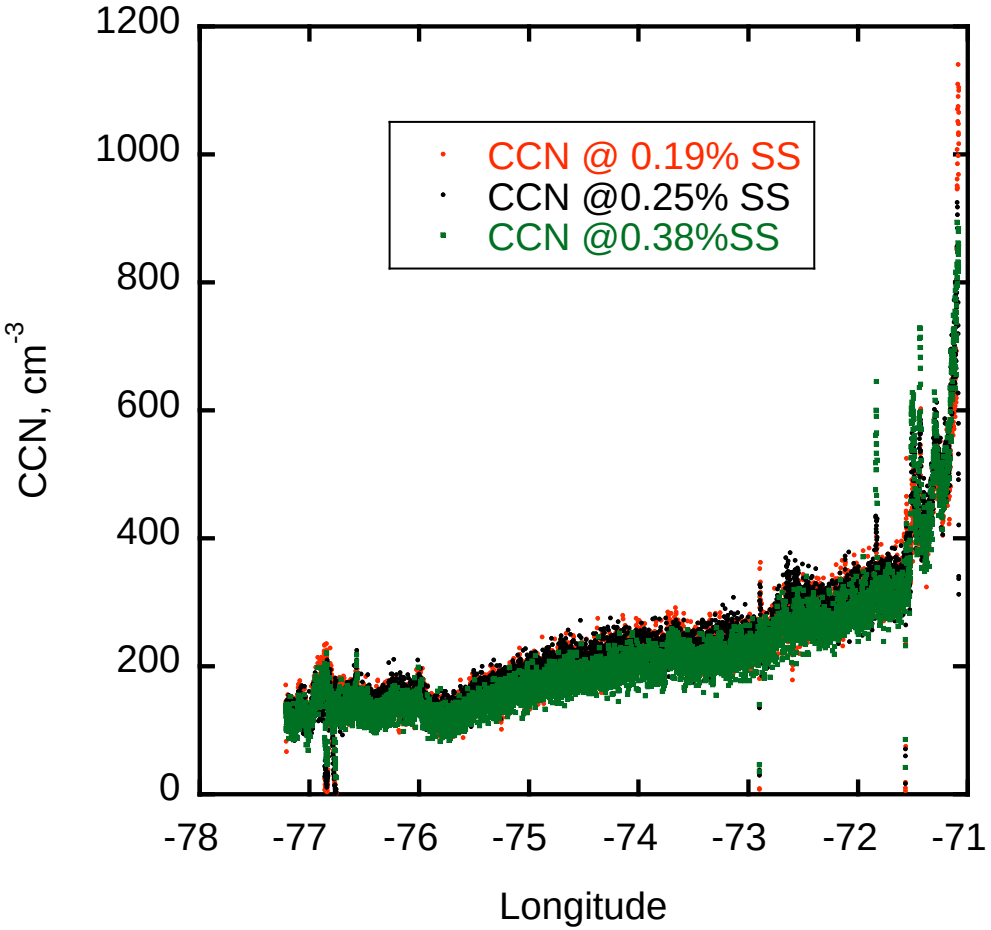


October 28 Aerosol number conc.



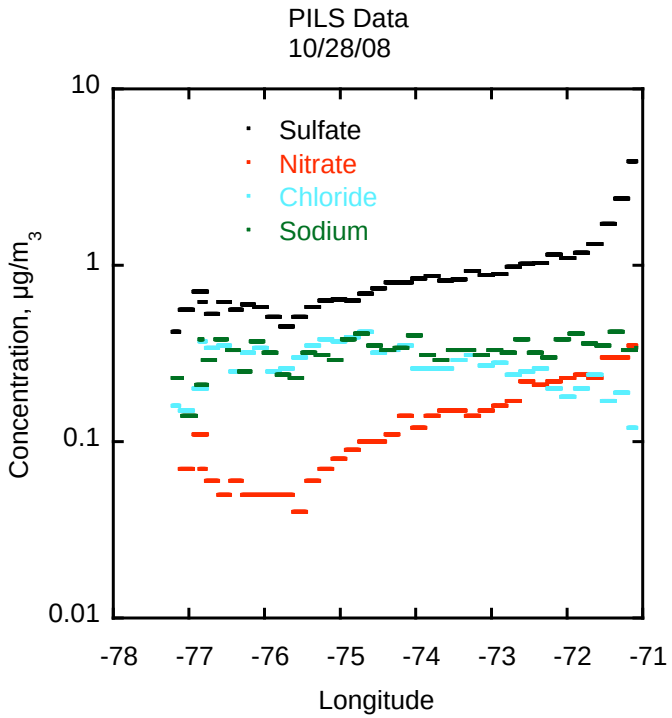
Smooth decrease in accumulation mode #concentration with distance offshore.

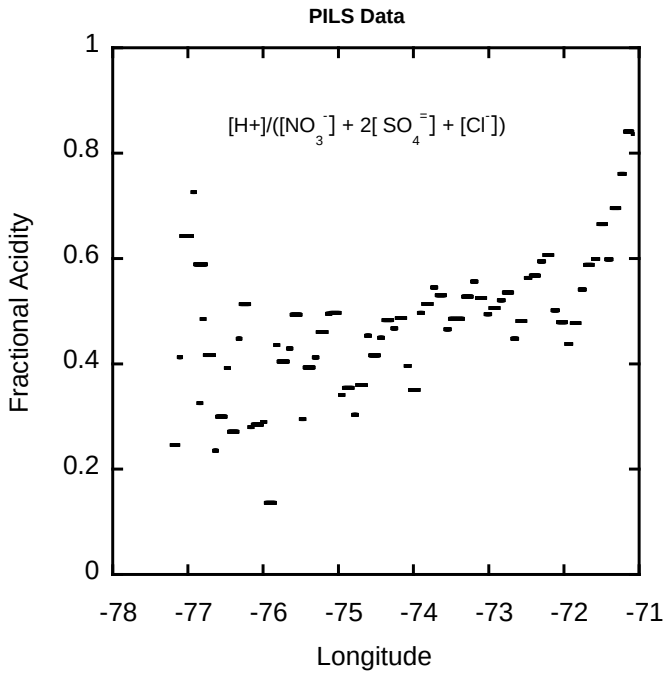
October 28 CCN Gradient



CCN at 3 different %SS identical. All particles activated at 0.2%. Trend identical to PCASP particle concentrations

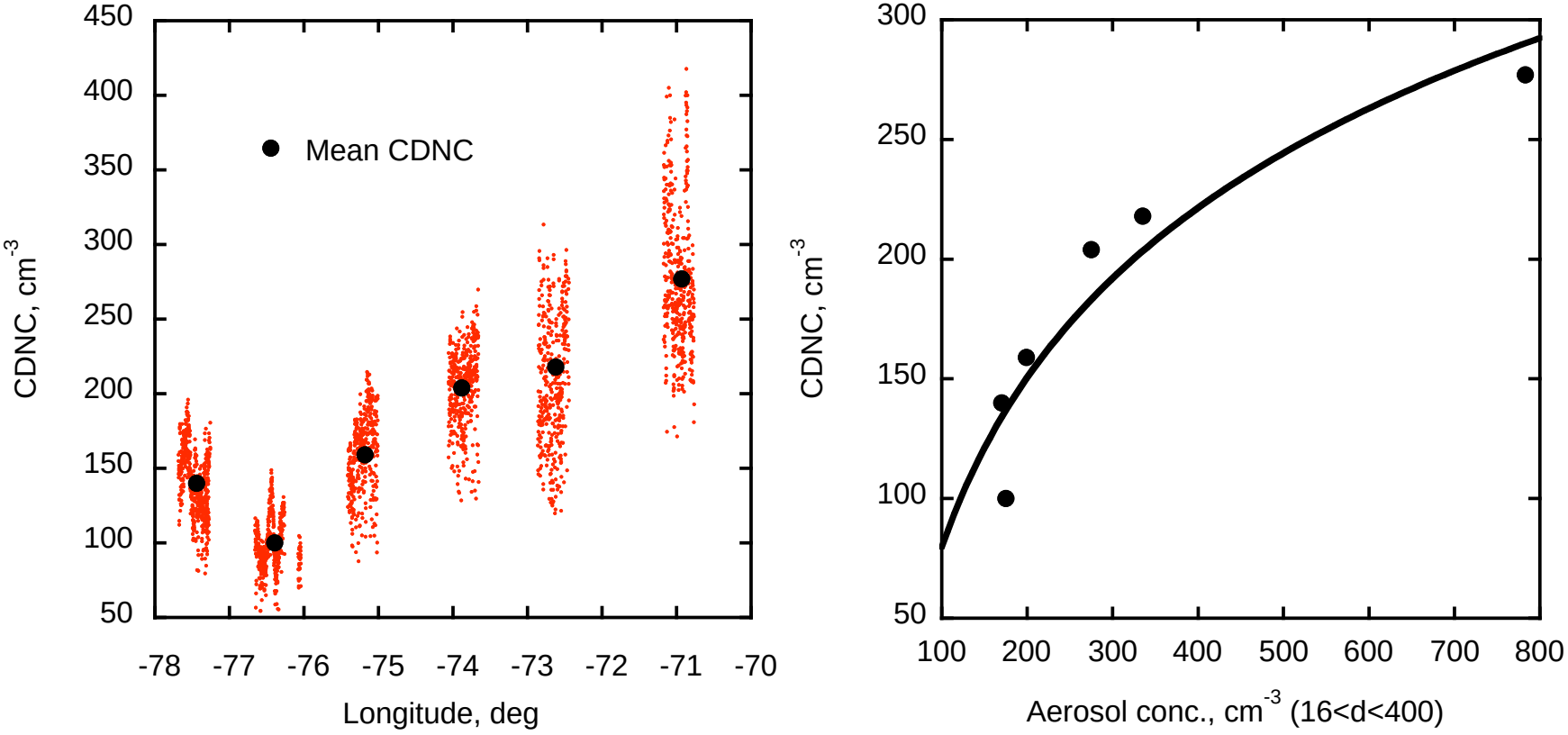
AEROSOL COMPOSITION





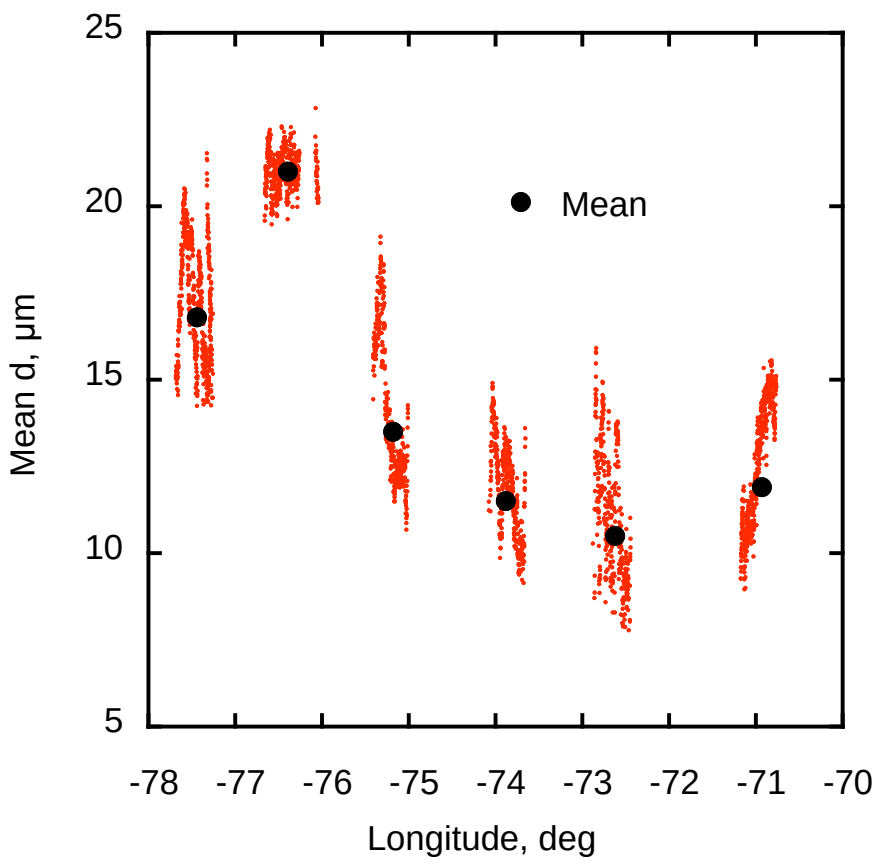
Composition dominated by sulfate near-shore indicating anthropogenic source. Aerosol highly acidic, tending to be higher near the coast.

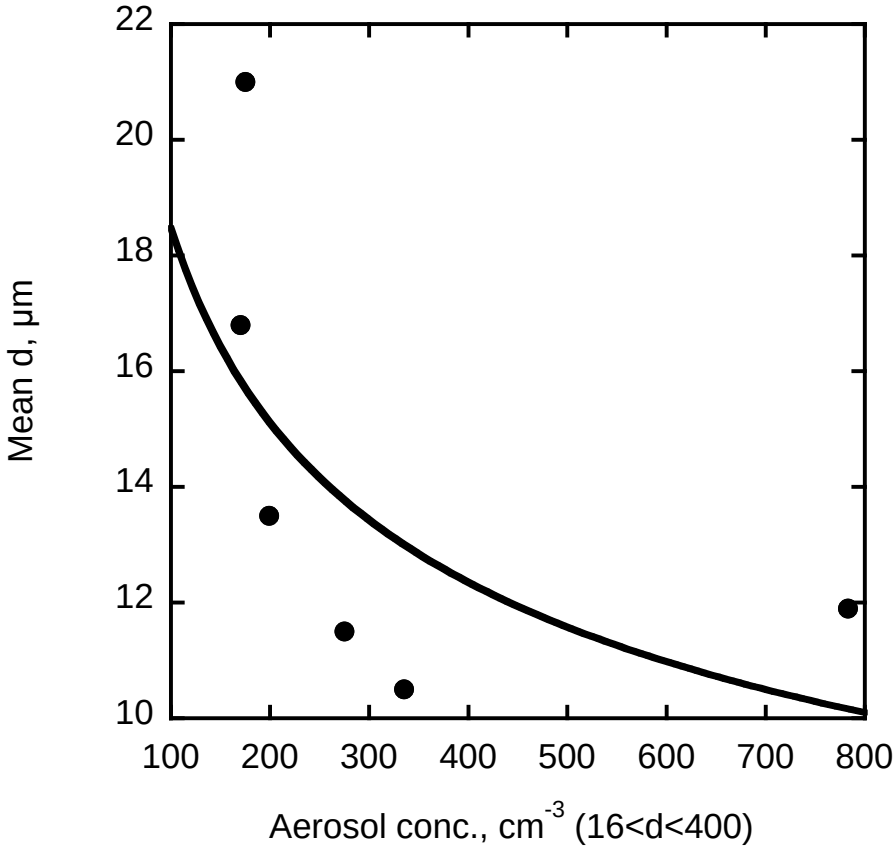
October 28 CDNC



CDNC respond in the expected way to the gradient in aerosol concentration.

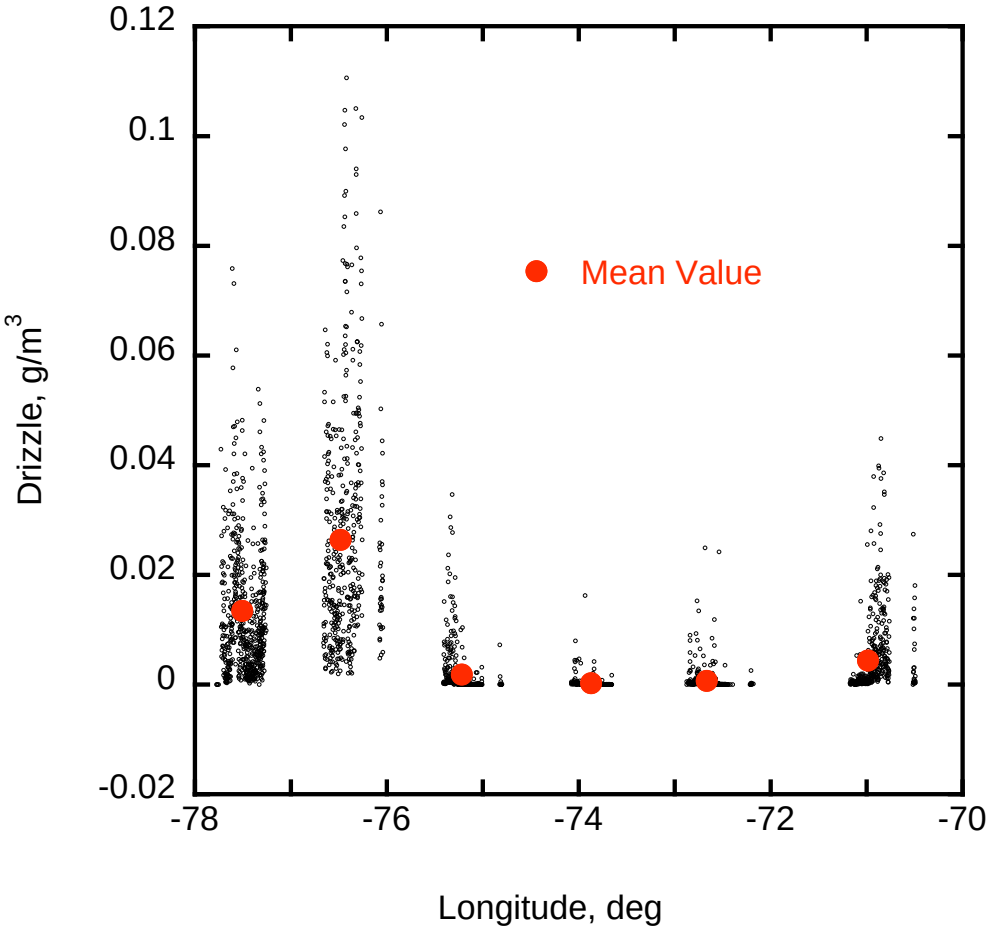
October 28 Droplet Size

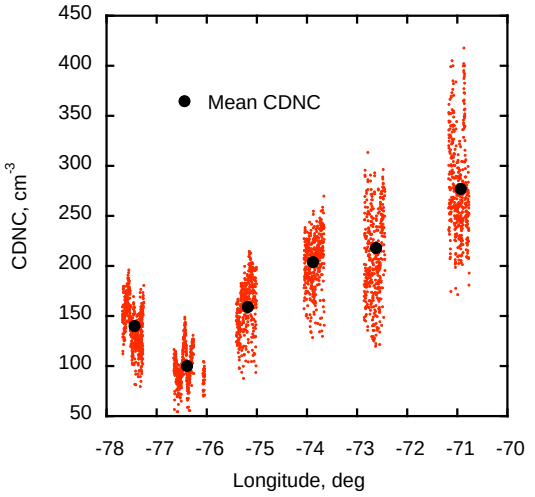


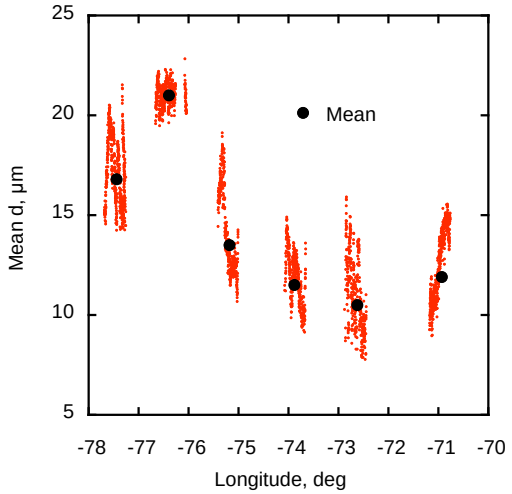


Decrease in CDNC and aerosol concentration with distance offshore is associated with an increase in droplet size.

October 28 drizzle







Highest drizzle concentrations associated with lowest droplet concentrations and the largest mean diameters.

AUTOCONVERSION- THE CONVERSION OF CLOUD DROPLETS TO DRIZZLE

Autoconversion rate ($g/m^3/s$), $P = P_0 T$

Where-

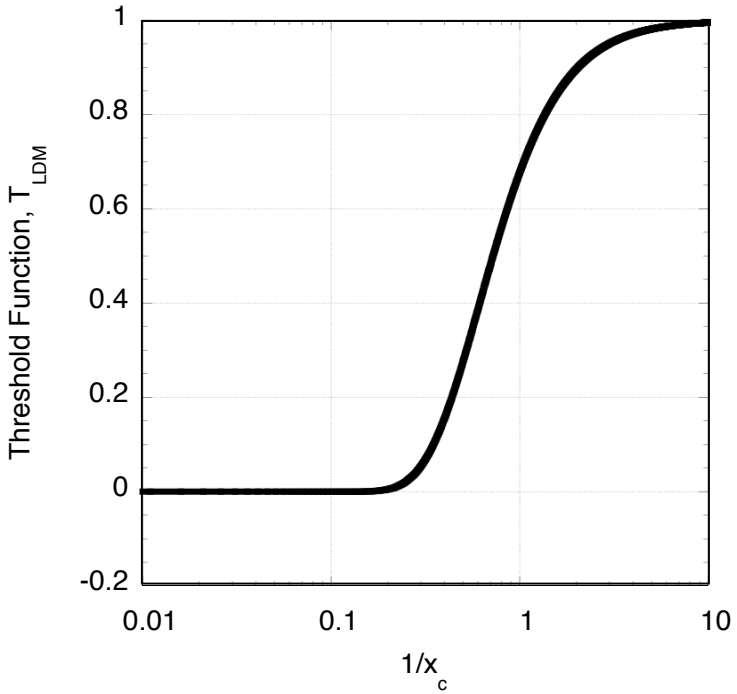
- T *is the threshold function that describes the onset of drizzle.*
- P_0 *is the conversion rate after the onset of the autoconversion process*

THRESHOLD FUNCTION

(Liu, Daum, McGraw, GRL, 2005)

$T_{LDM} = 1/2(x_c^2 + 2x_c + 2)(1+x_c)exp(-2x_c)$

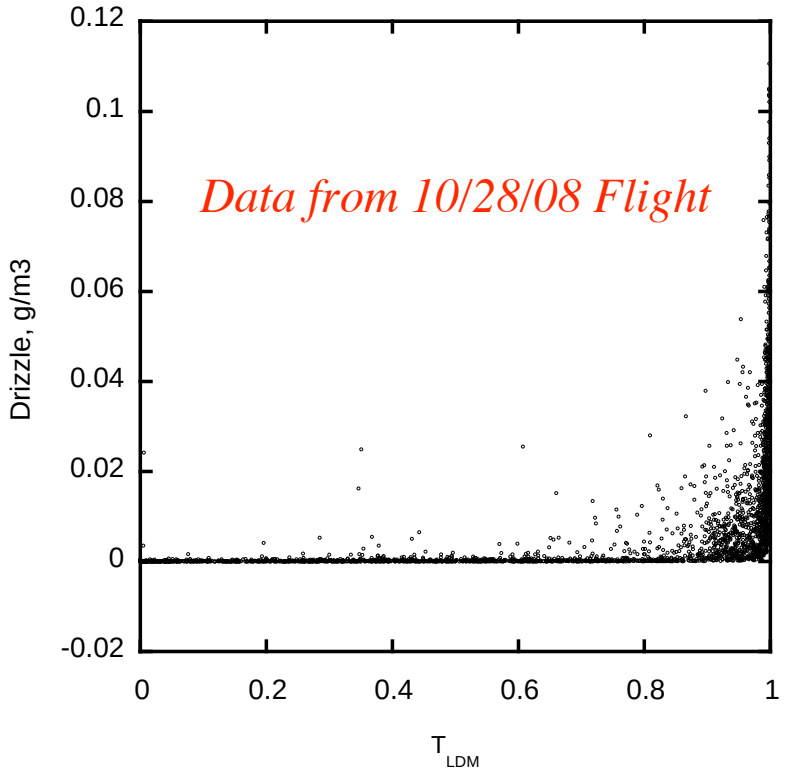
Where, $x_c = 9.7 \times 10^{-17} N^{3/2} L^{-2}$



If cloud microphysics are such that $1/x_c >> 1$, $P = P_0$ and the cloud drizzles. If $1/xc << 1$, $P = 0$ and the cloud does not drizzle. Transition region $0.3 < 1/x_c < 1.2$.

THRESHOLD FUNCTION

How well does the LDM threshold function work?



Drizzle water concentration is low until TLDM> ~0.8 then increases exponentially, consistent with LDM theory.

ACKNOWLEDGEMENTS

Scientists- Steve Springston, Gunnar Senum, Larry Kleinman, Yin-Nan Lee, John Jayne, John Hubbe, Liz Alexander, Alex Laskin, Art Sedlacek, Ryan Moffet

Aircraft- Bob Hannigan, Dick Hone, Bill Svancara, Mikhail Pekour

Doe- For funding the science and the aircraft