High Speed Cloud Microphysics

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BNL CAPS Probe

Probe Modified in 2008

CAS Particle by Particle @ 40 Hz
Max 544 CDP/cc

For each cloud particle
Forward Scattering
Backward Scattering
Inter-Arrival Time

Inter-Arrival Time Resolution
is 50 nsec, at 100 m/sec = 0.005 mm
Needs at least 20 cloud droplets per 0.025 sec
or about 53 cloud particles per cc

Other DOE G-1 High Speed Measurements

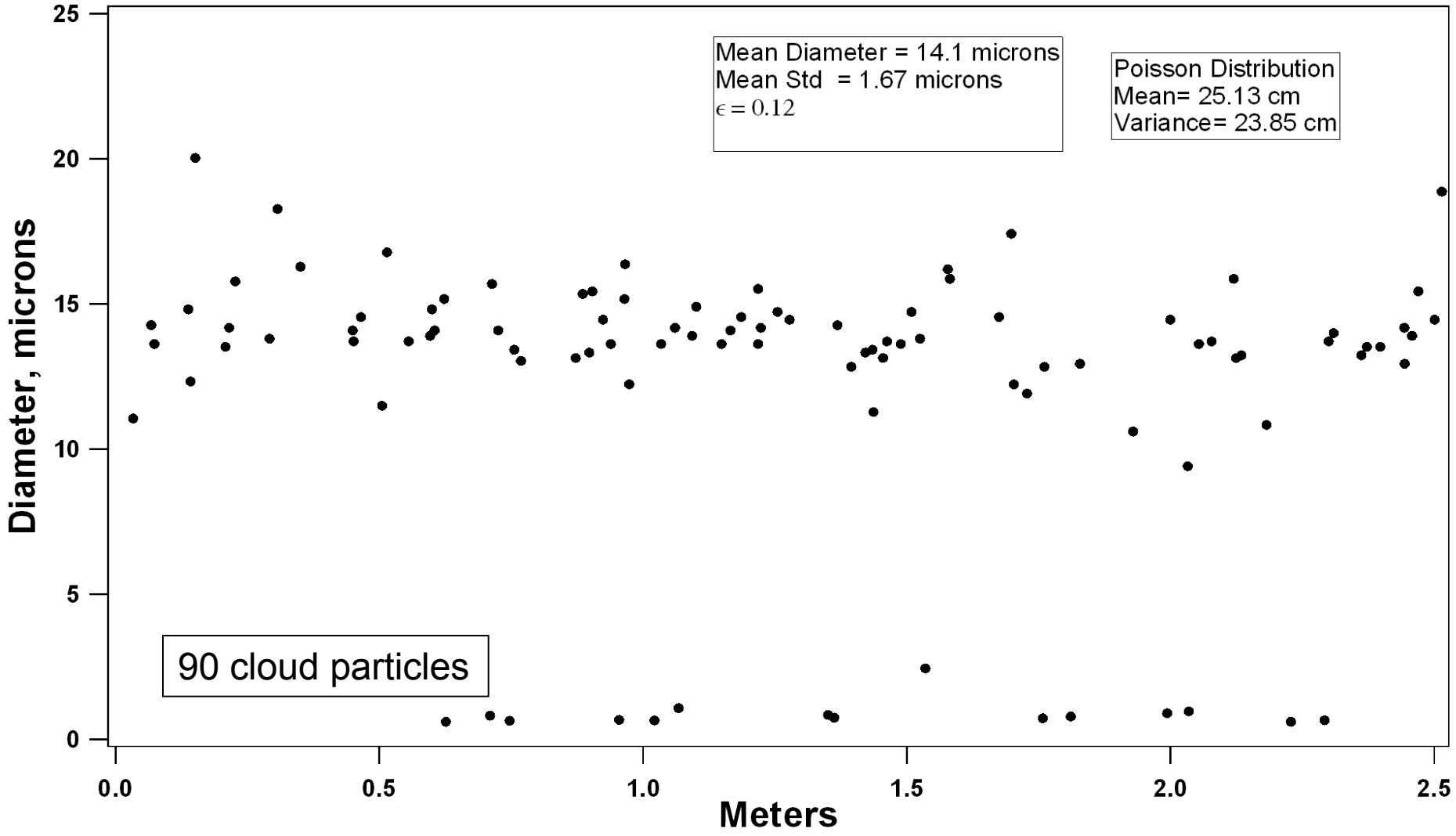
- LWC (Gerber Probe) @ 200 Hz = 0.5 meters
- PCASP (Interstitial Particles) 0.1 to 3 μ, @10 Hz
- CIP (Drizzle) 15 to 1000 μ, @10 Hz
- Gust Probe, @200 Hz

  Updrafts/Downdrafts, min Wa ~ 2 cm/sec

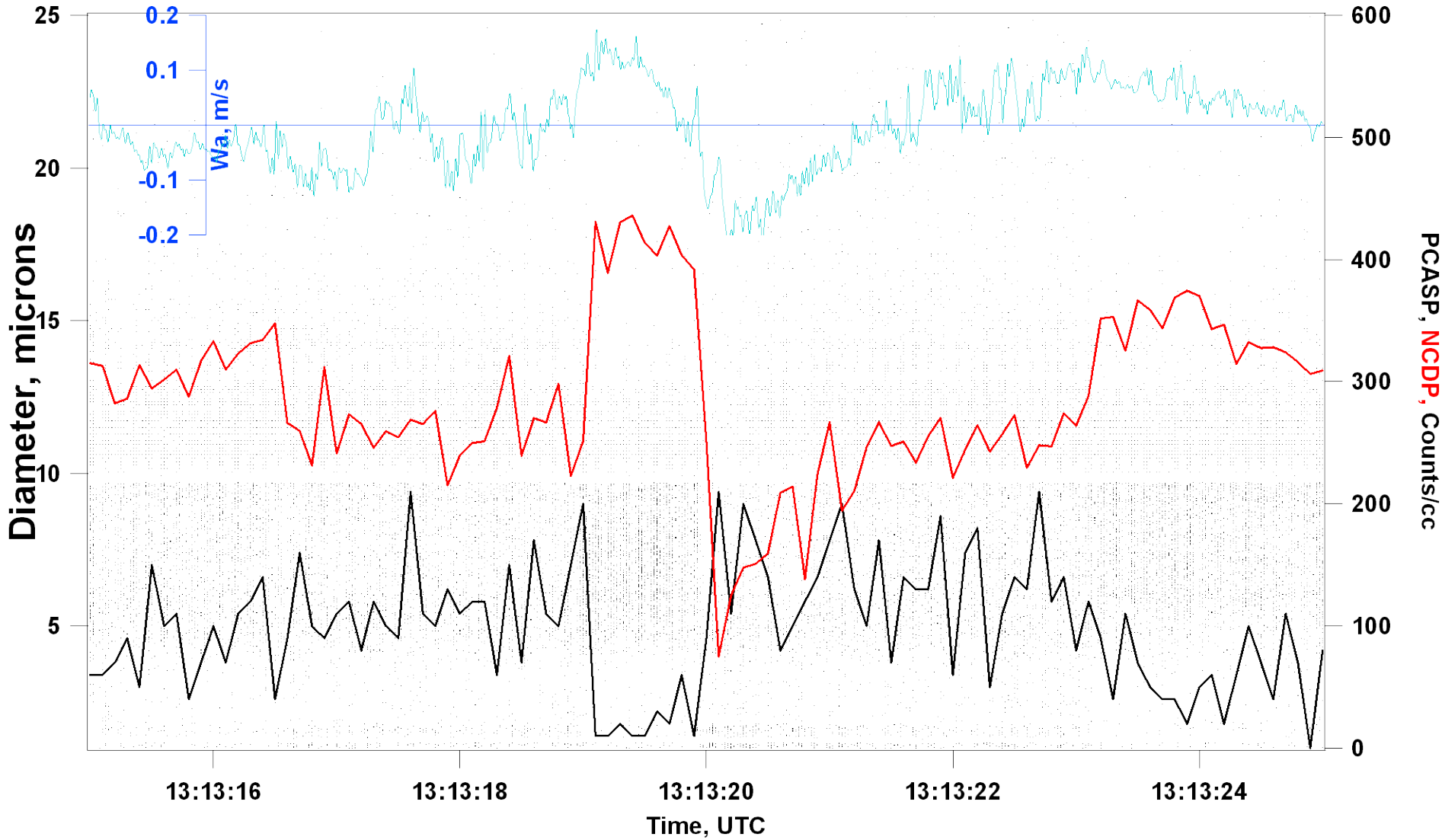
  Turbulence(Turbulent Energy Dissipation Rate)
- Meteorological, @200 Hz

  Temperature and Pressure

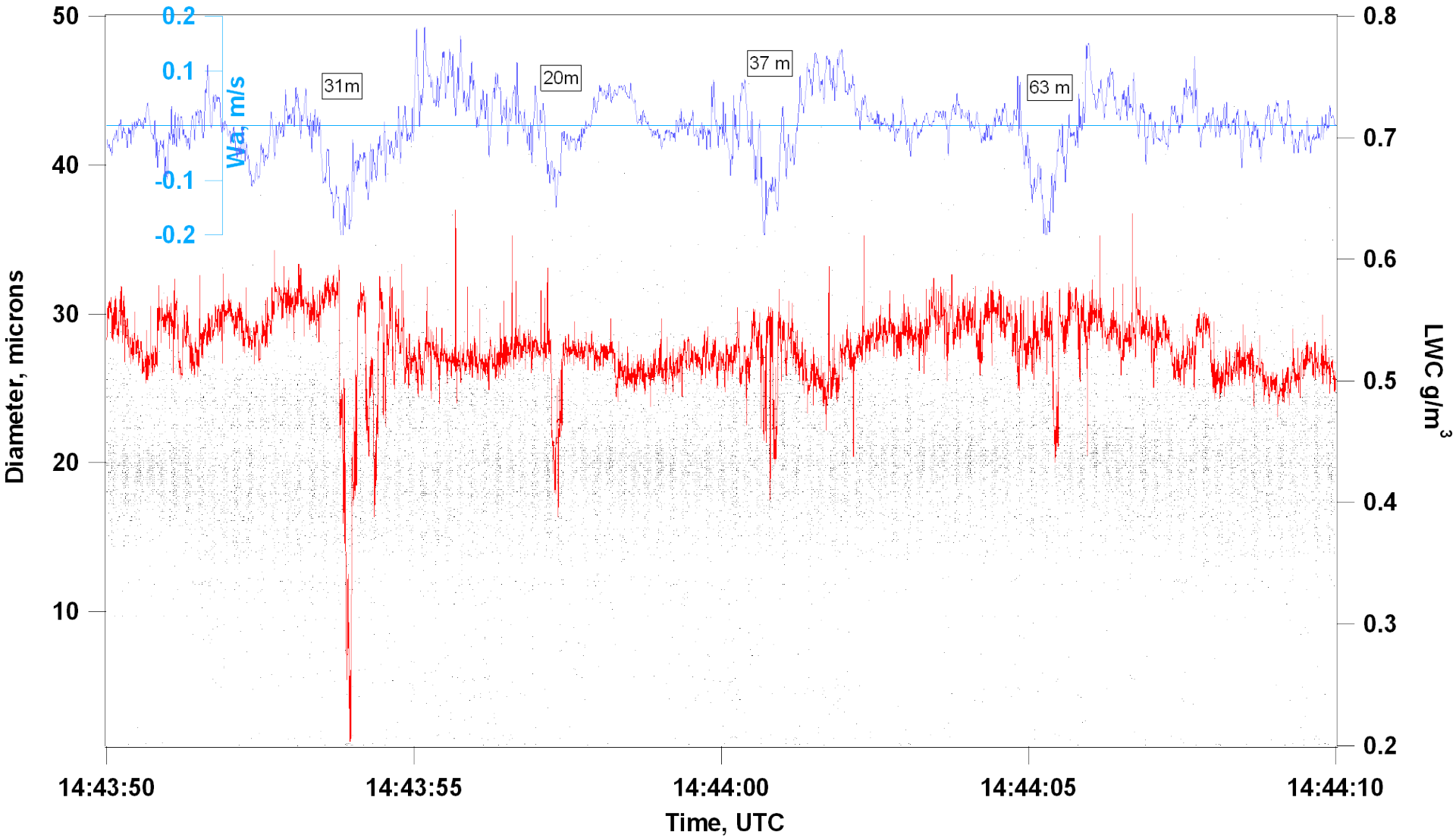
Particle by Particle Cloud Droplet Sampling
5 micron Spatial Resolution



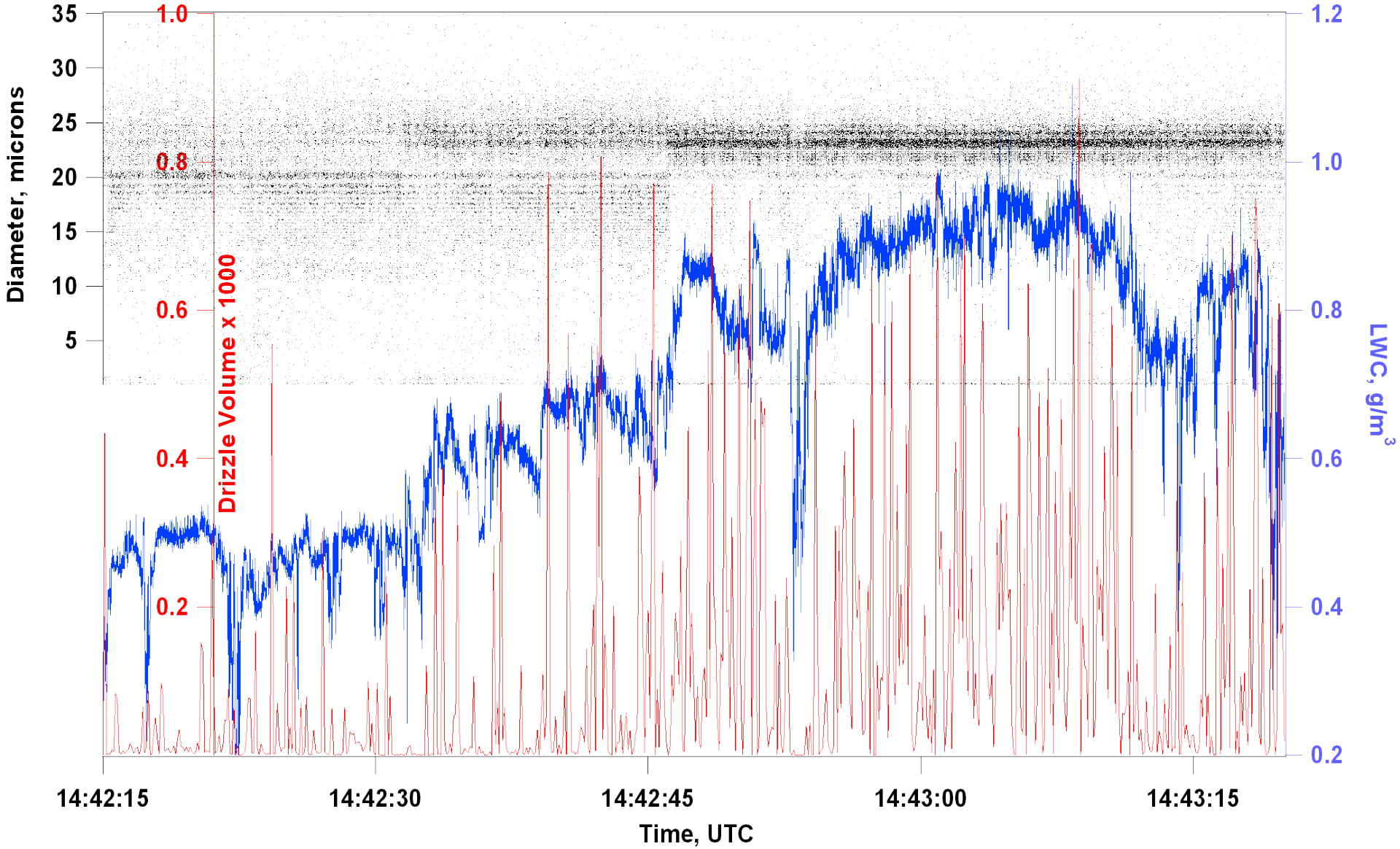
Effect of up/down drafts on NCDP and CCN oncentrations
Eddy about 200 meters wide
Near Shore, polluted, 081028a



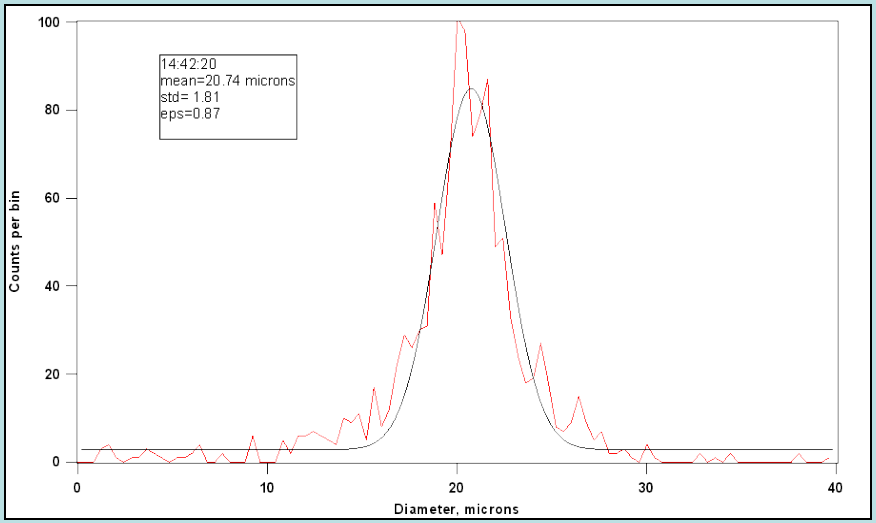
Narrow downdrafts from above the cloud with drying of cloud droplets

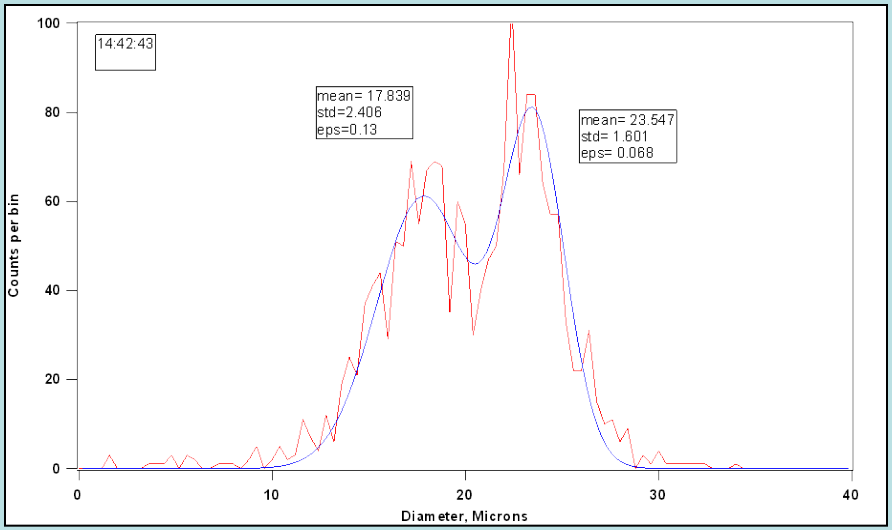


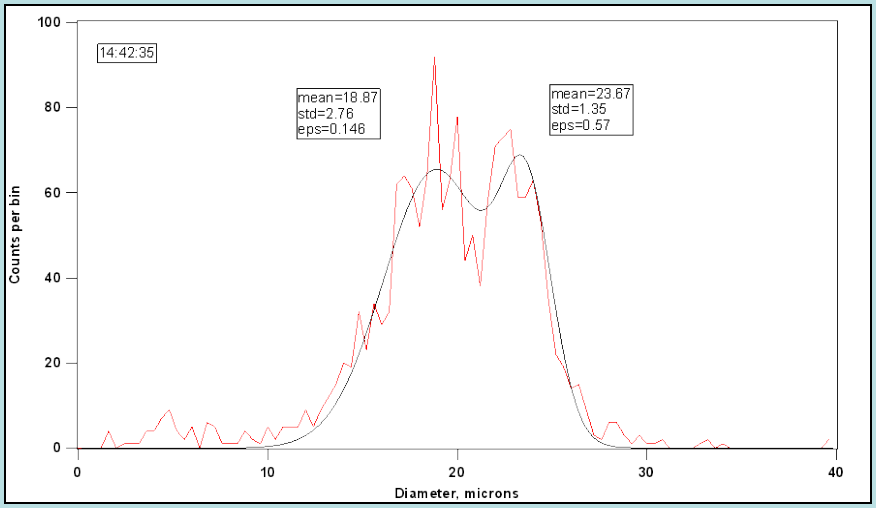
Changes in cloud droplets distribution with increasing drizzle and LWC; unimodal to bimodal to unimodal

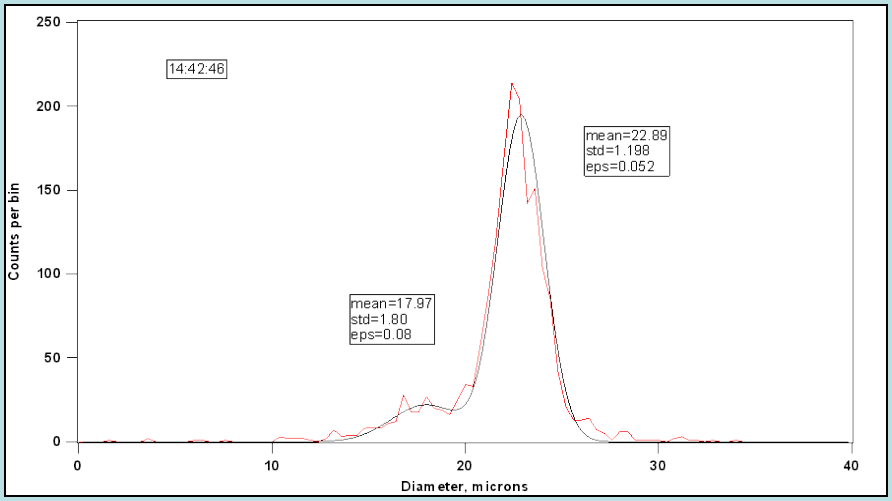


100 meter binned cloud droplet distributions
0.4 micron bin size
cloud droplet coalescence

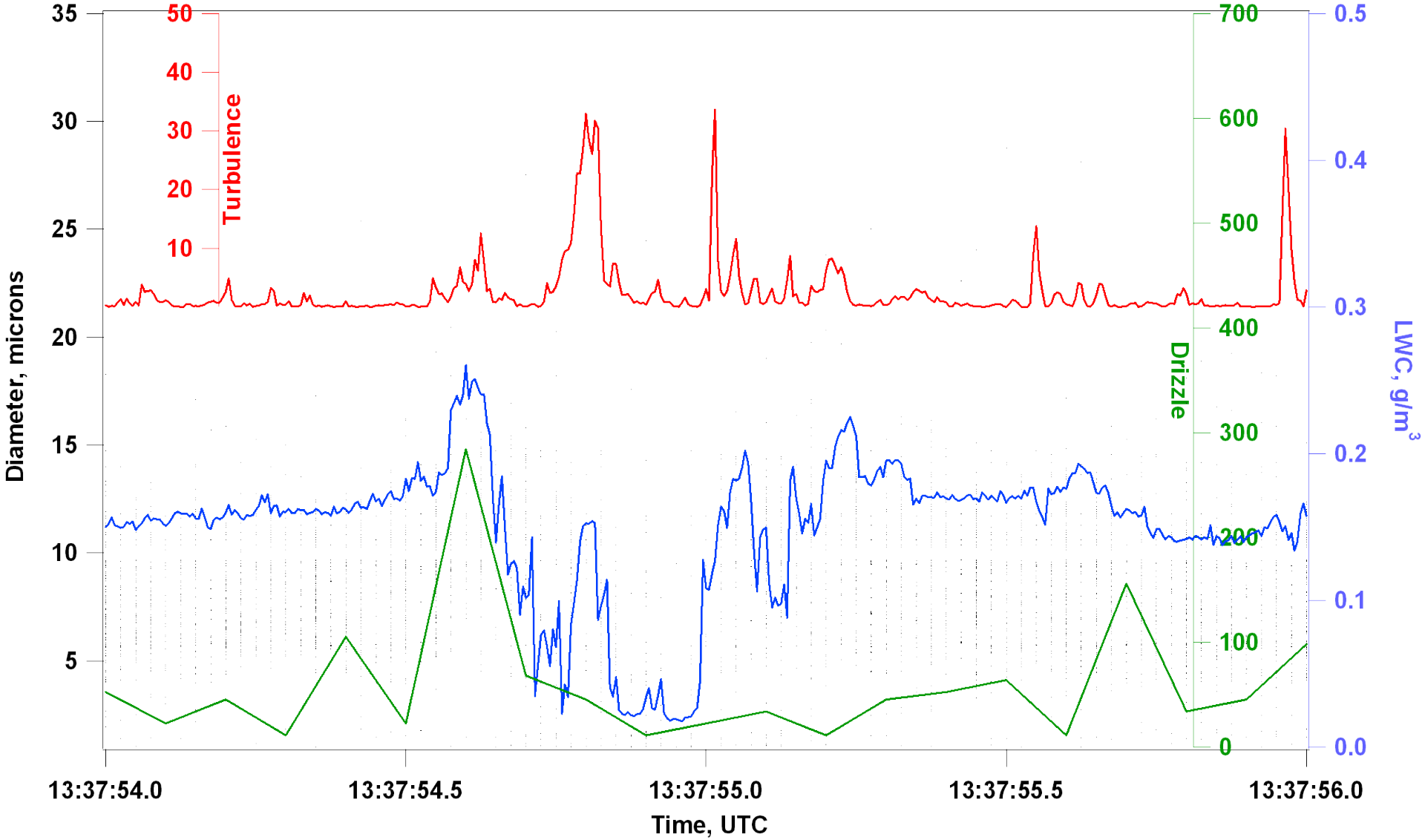








Effect of turbulence on cloud droplet distribution, drizzle, LWC in 33m wide rift 081028a



Conclusions

- The VOCALS dataset is very rich.

With this high speed dataset we can identify, study and parameterize

- Aerosol Indirect Effect
- Downdrafts
- Effects of Turbulence in Clouds
- Coalescent Cloud Structure in Drizzle