Aerosol, CCN and Cloud Droplets

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Progress Report

CCN and Aerosol Data Sets

Wyoming CCN
- Processed CCN data available by request
- CCN concentration, chamber supersaturation, time stamp

NCAR PCASP
- Sizing and sample volume calibrated in Laramie
- Available in C-130 NetCDF Files
- PCASP Report

NCAR FSSP300
- Sizing calibrated in Laramie
- Available in C-130 NetCDF Files
- FSSP300 Report

Science Analysis

Budget for Cloud Droplet Nuclei (CCN) in the SEP Marine Boundary Layer

CCN Sink Processes
- Attachment scavenging
- Coalescence scavenging

CCN Source Processes
- New particle formation followed by growth
- Sea Spray
- Entrainment into marine boundary layer from free troposphere

Fate of the new particles is uncertain:
- Can some of these grow to CCN size before being attachment scavenged?

In the “ultra-clean” POC environment,
- can the smallest of Aitken mode particles (D_d~20 nm) activate?

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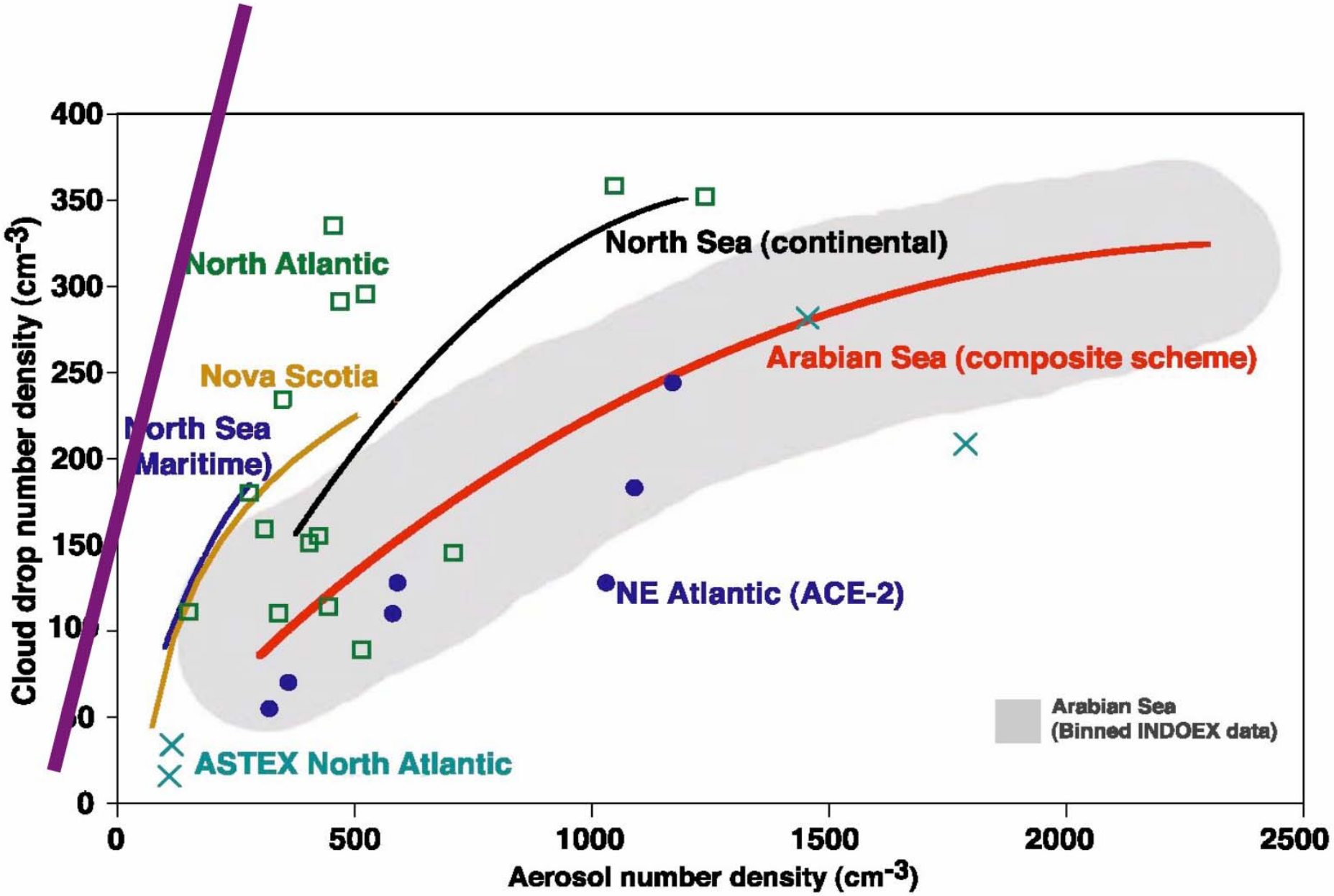
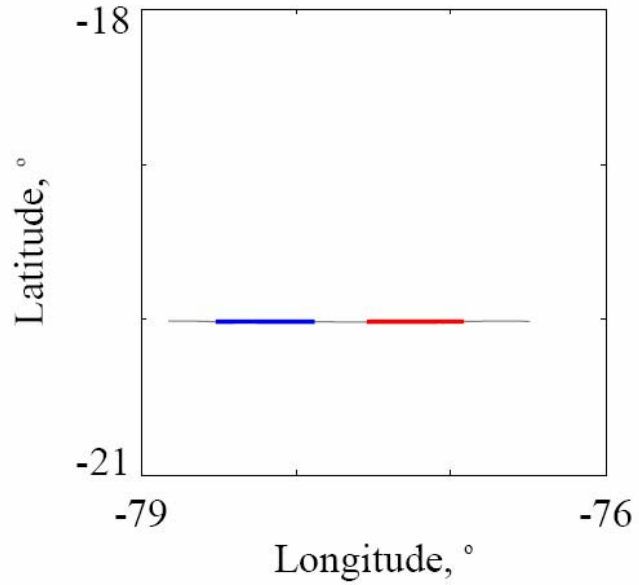


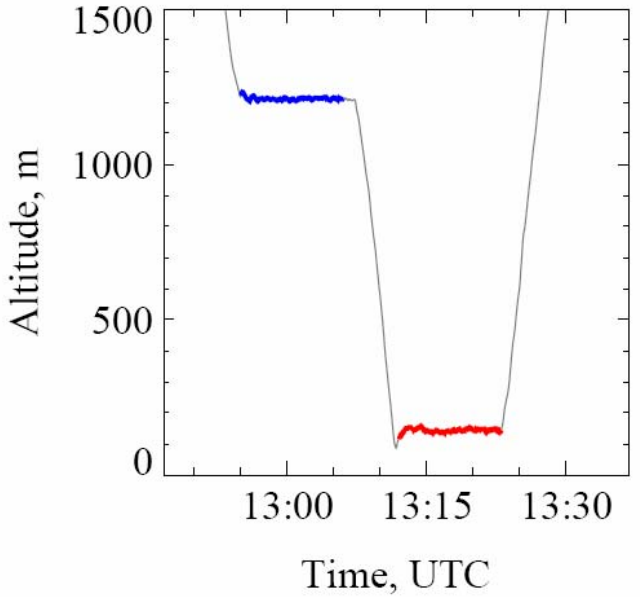
Ramanathan et al., *Science*, 2001

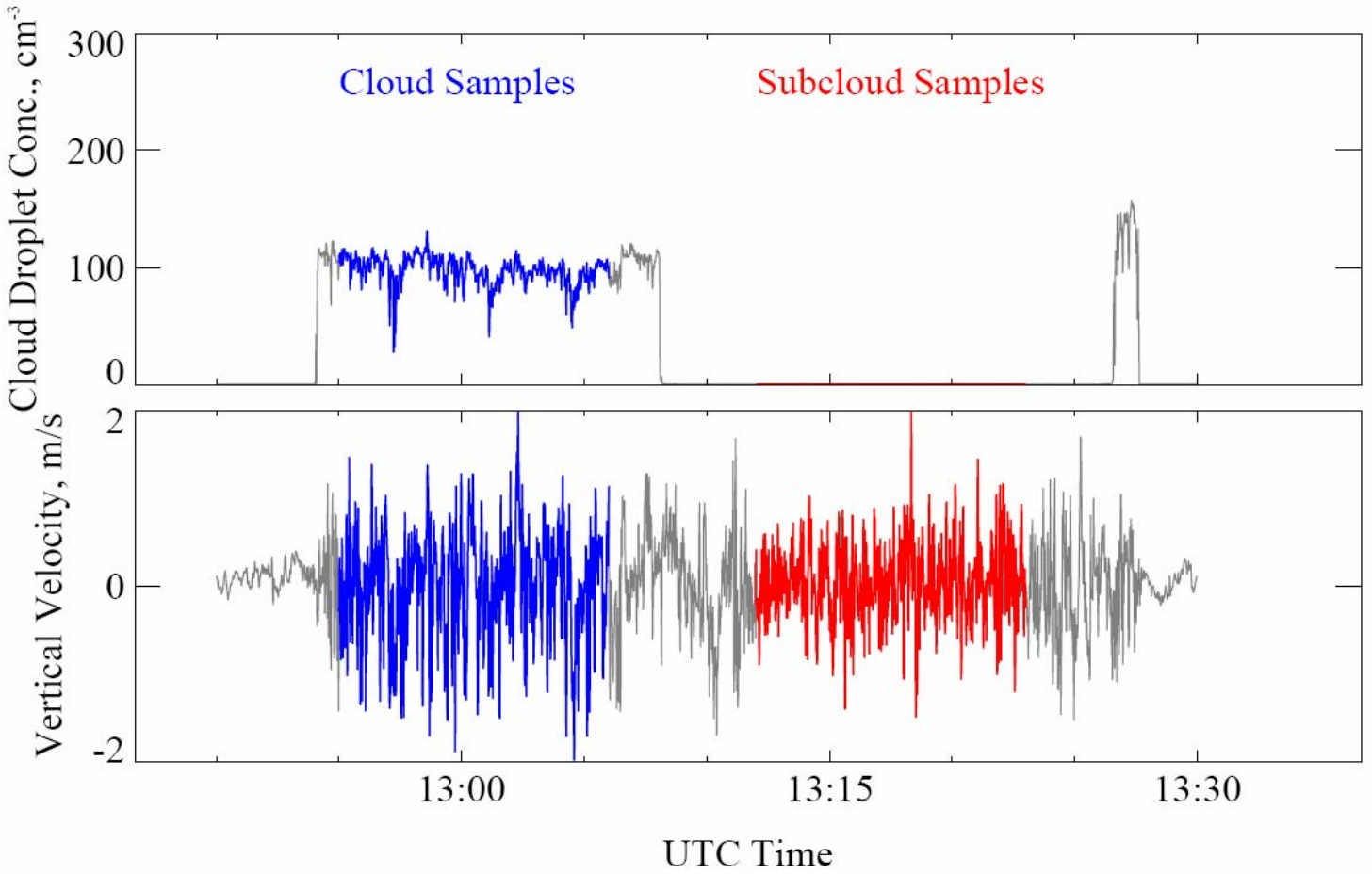
In the Pocket of Open Cells environment, is there evidence for the cloud droplet concentration being CCN-limited, or is the more typical situation of updraft-limited cloud droplet concentration occurring?

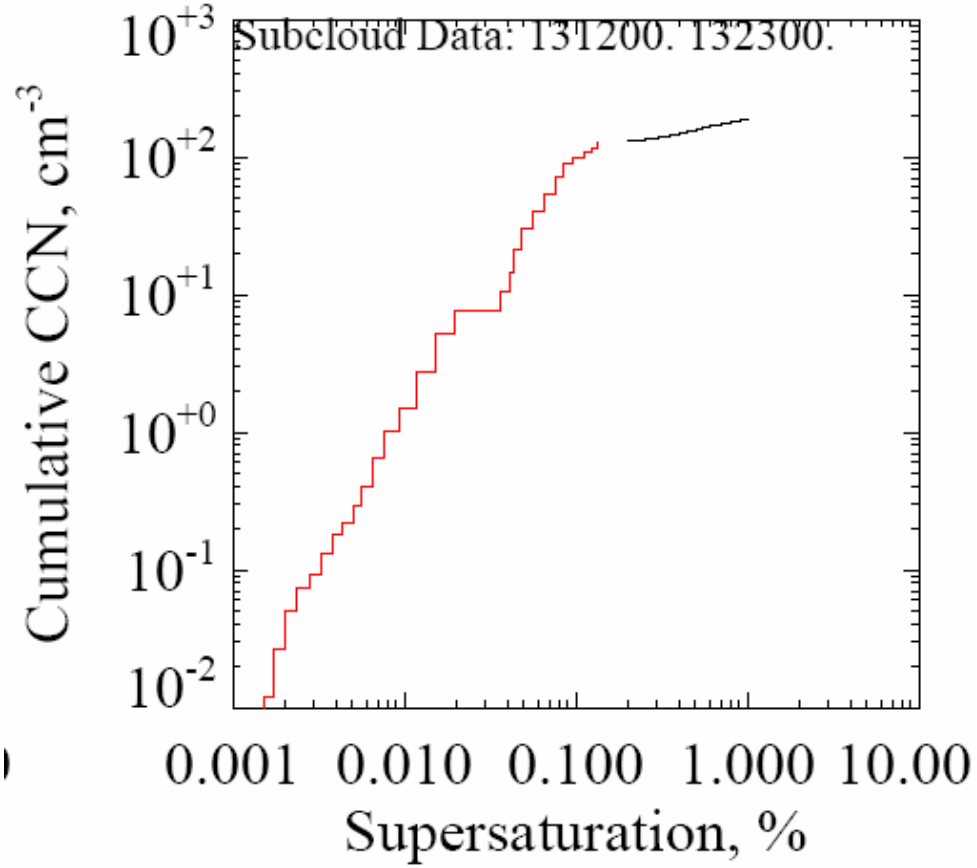
RF05

Updraft-Limited N_d

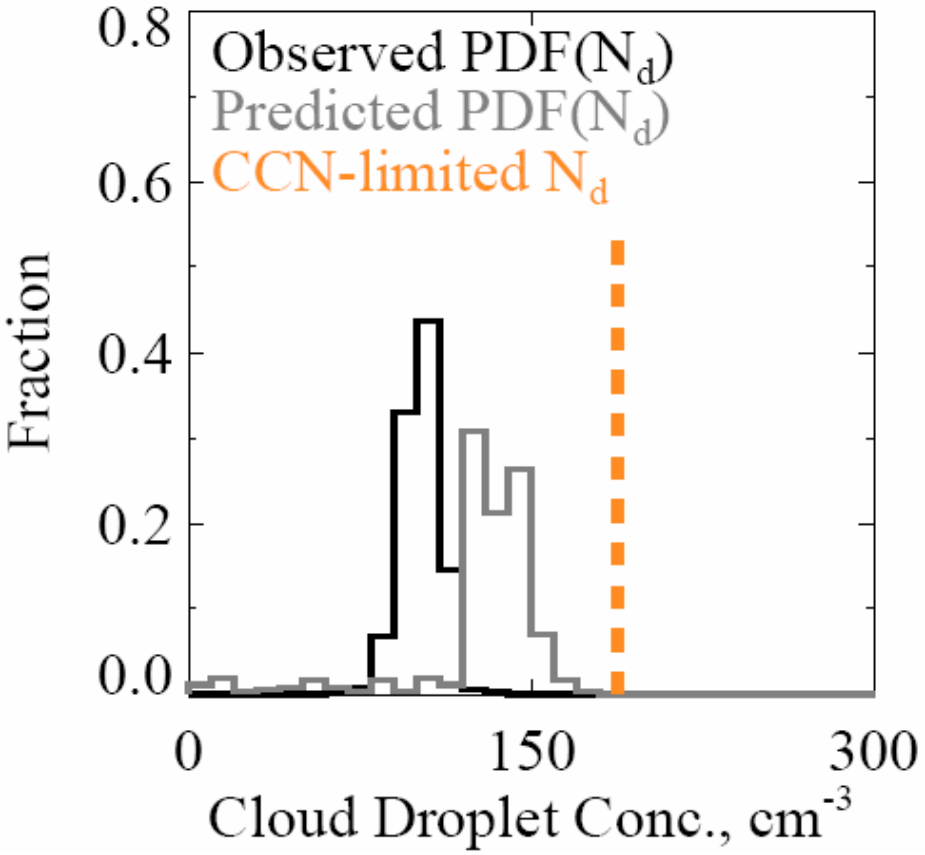






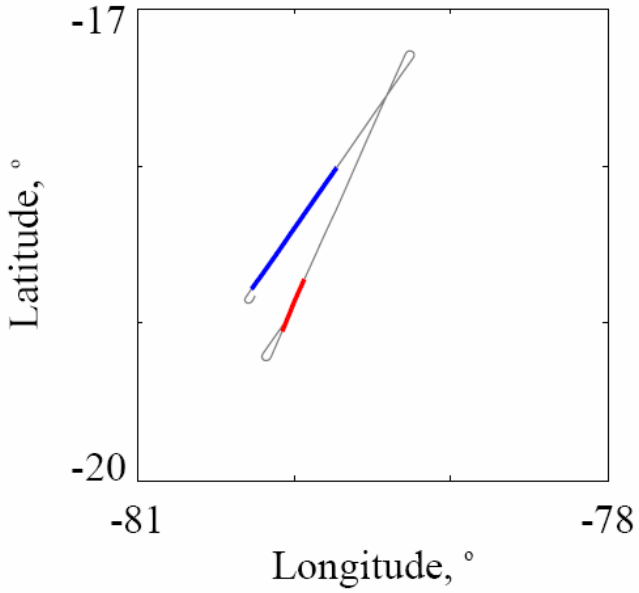


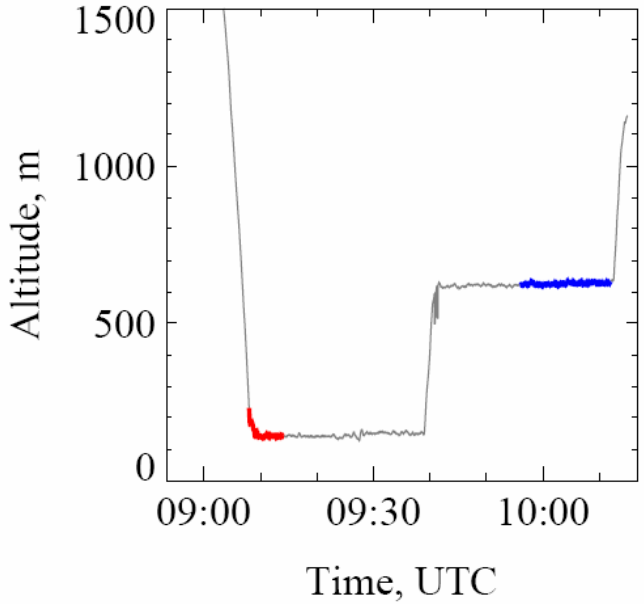
RF05
Updraft-Limited N_d

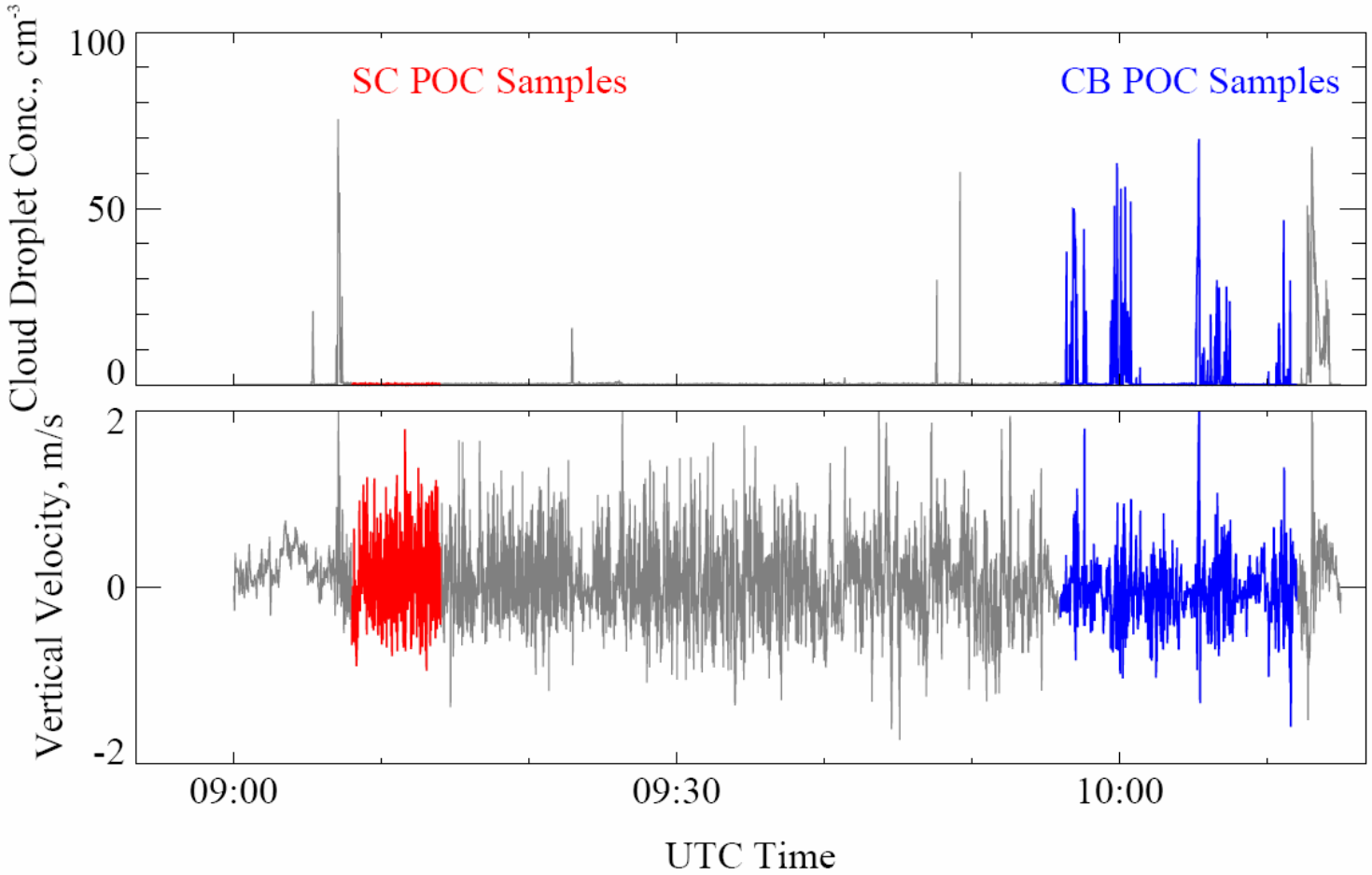


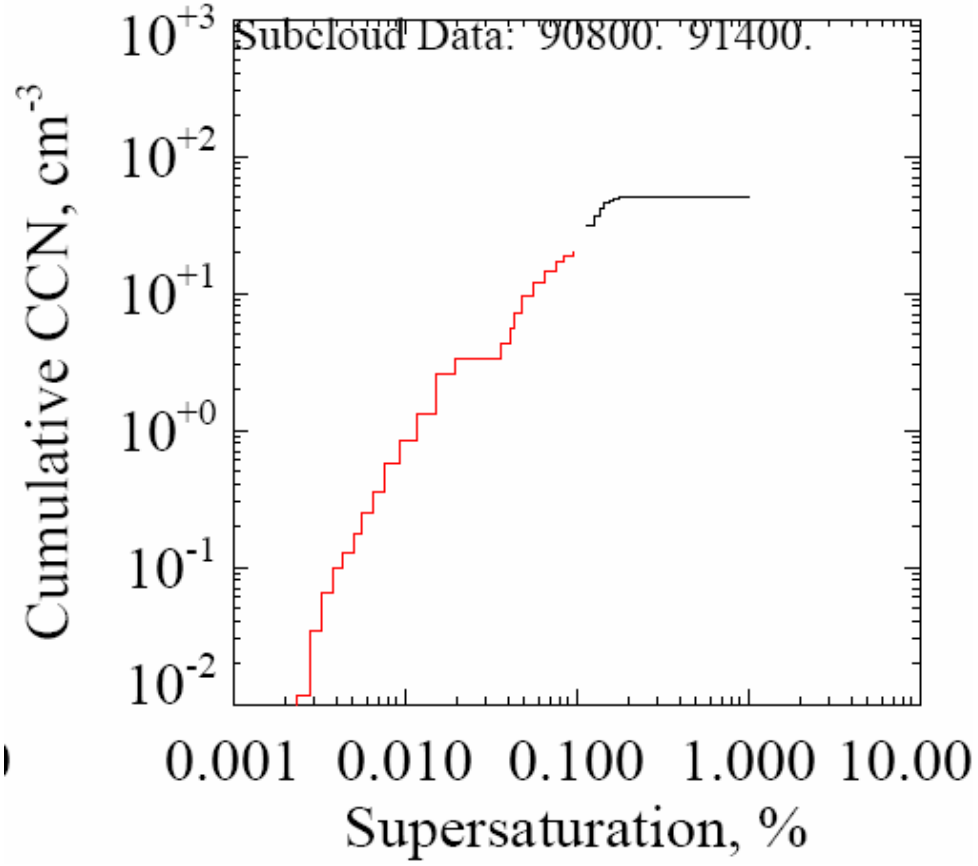
RF06

CCN-Limited N_d

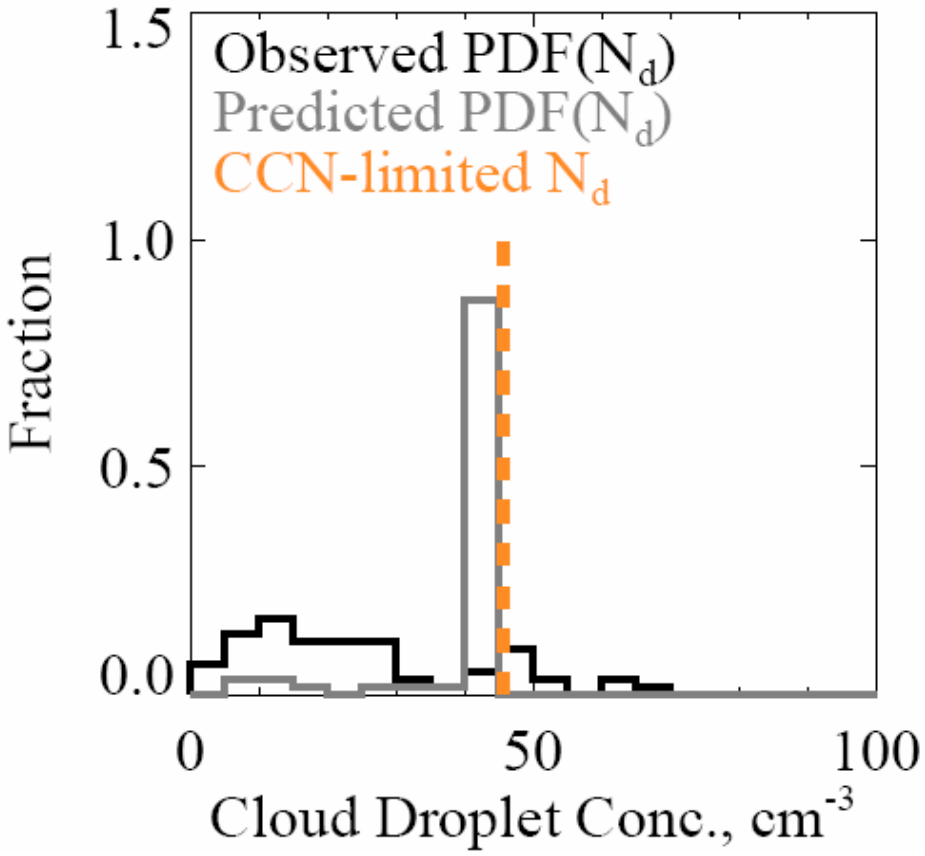








RF06
CCN-Limted N_d



For a near-shore case from RF05, with larger total particle concentration (~180 cm^{-3}), approximately 60% of the aerosol population activates to become cloud droplets. Incomplete activation of the aerosol is the situation in most clouds.

Cloud droplet concentration is updraft-limited

For the RF06 Pocket of Open Cells region, with total particle concentration (~50 cm^{-3}), the parcel model predicts that nearly all of the aerosol particles are activated to cloud droplets

Cloud droplet concentration is CCN-Limited