Integrated Database of Cloud Microphysical Properties derived from in-situ Observations obtained during M-PACE, TWP-ICE, ISDAC & RACORO

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1. Overview on role of in-situ Observations

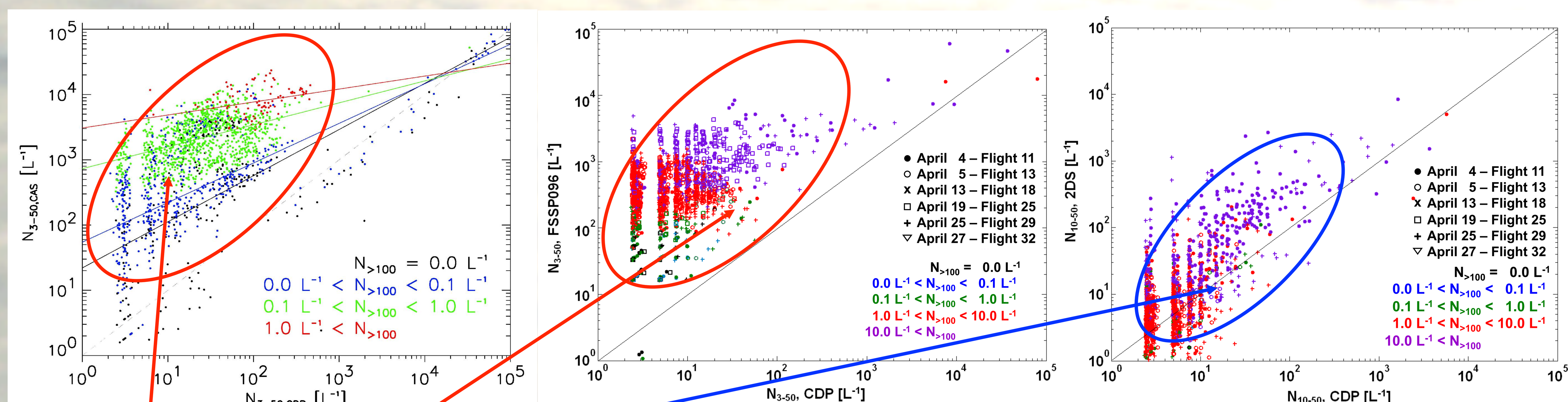
i. Databases of cloud microphysical properties required for evaluation of model simulations, remote sensing retrievals & process-oriented studies of cloud-aerosol and cloud-radiation interactions

ii. Distributions of microphysical quantities (number concentrations of water droplets & ice crystals (N_w, N_i), effective radii of water & ice (r_{ew}, r_{ei}), liquid & ice water contents (LWC, IWC), liquid & ice extinctions (β_l, β_i), size & habit distributions (SDs, HDs), equivalent reflectivity (Z), median mass diameter (D_{mm}), etc.) calculated from size-resolved & bulk probes

iii. Consistency & closure tests determine optimum combination of probes to determine microphysical parameters (can vary day-to-day)

iv. Products will be made available as User Product to assist those unfamiliar with microphysical probes

2. Assessing Probe Performance: Shattering during TWP-ICE & ISDAC

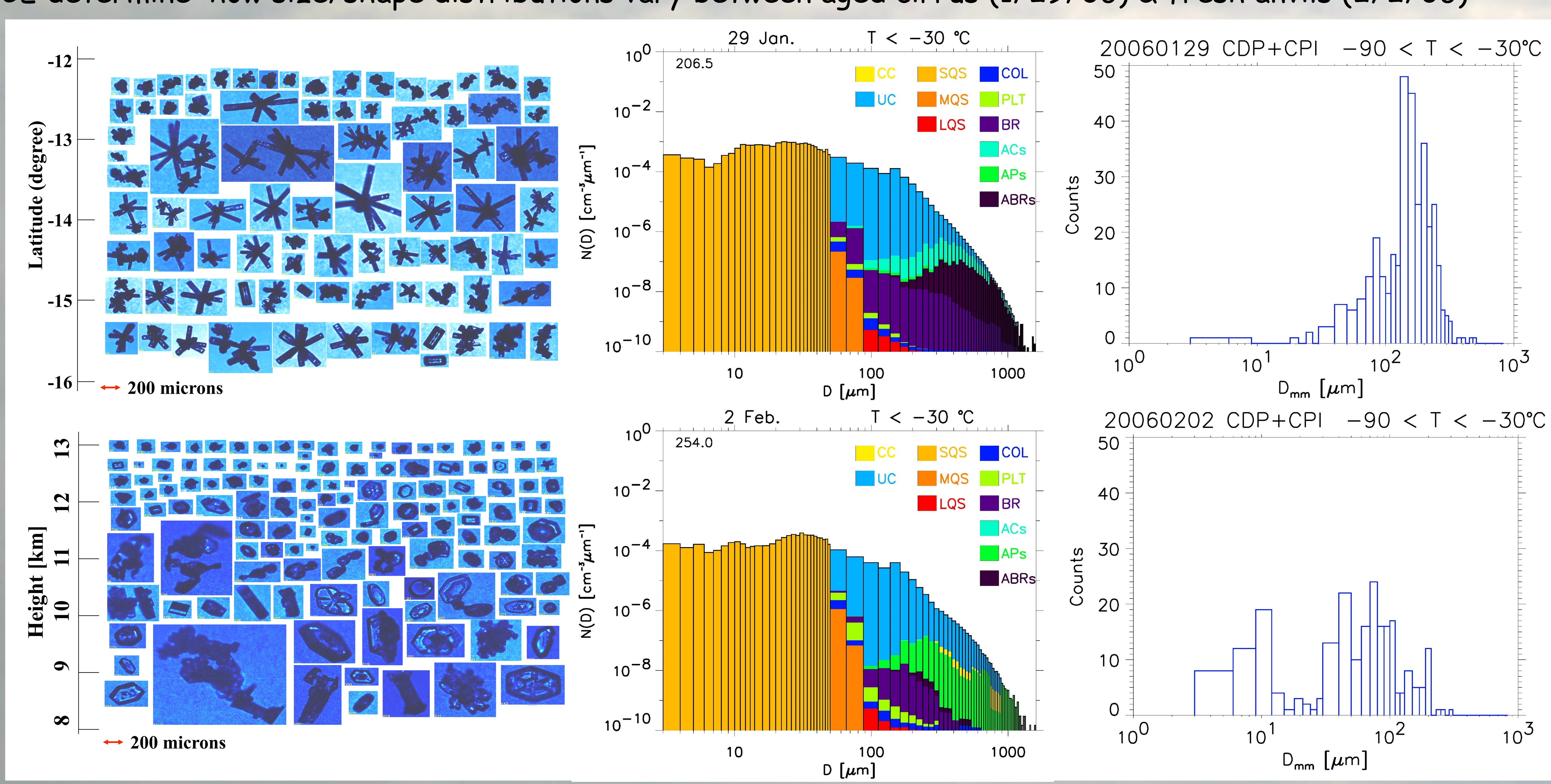


• CAS (TWP-ICE) & FSSP (ISDAC) systematically overestimate CDP concentration (3 < D < 50 μm) in ice, overestimate increasing with concentration of large particles ($N_{>100}$).

• 2DS & CDP (ISDAC) show no systematic difference in concentration: evidence of shattering on FSSP/CAS?

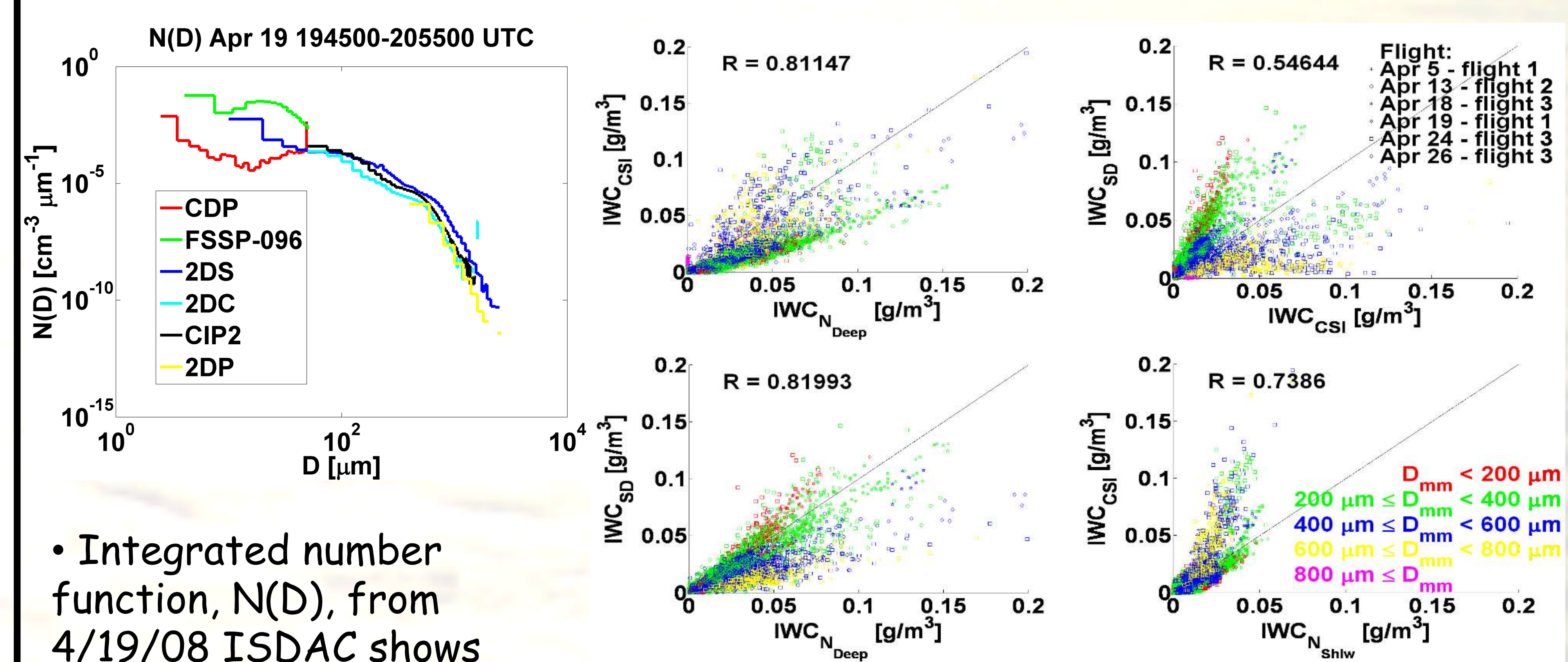
3. Size and Shape Distributions in Tropical Anvils

• Observations from Cloud Droplet Probe, Cloud Particle Imager & Cloud Imaging Probe on Proteus during TWP-ICE determine how size/shape distributions vary between aged cirrus (1/29/06) & fresh anvils (2/2/06)



• Left: Visual difference in habits in aged cirrus (top) & fresh anvil (bottom); Middle: Habit recognition scheme shows habit difference (more bullet rosettes in aged cirrus than fresh anvils); Right: Microphysical properties D_{mm} larger on average for aged cirrus (top) than fresh anvils (bottom)

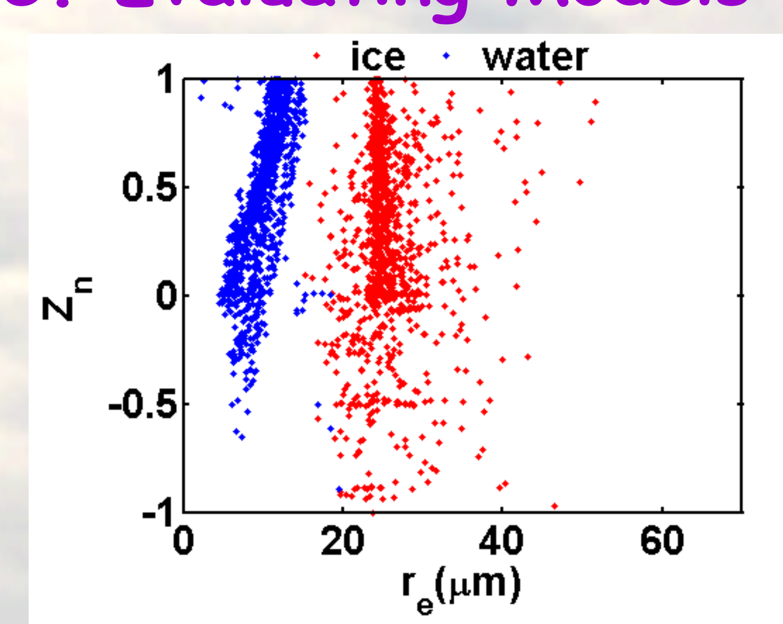
4. Probe Consistency & Closure Tests

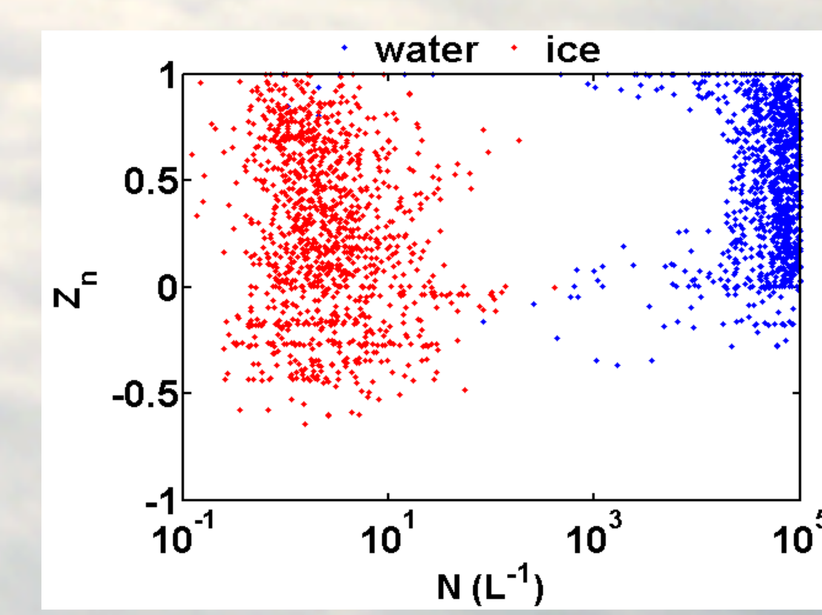


• Integrated number function, N(D), from 4/19/08 ISDAC shows discrepancy between probes: consistency & closure tests determine probes best characterizing SDs for each flight

• Mass closure tests for ISDAC cirrus cases: determine bulk probe (CSI, shallow (N_{Shlw}) or deep (N_{Deep}) Nevzorov probe) and SD that give best mass match under which conditions necessary for integrated cloud product

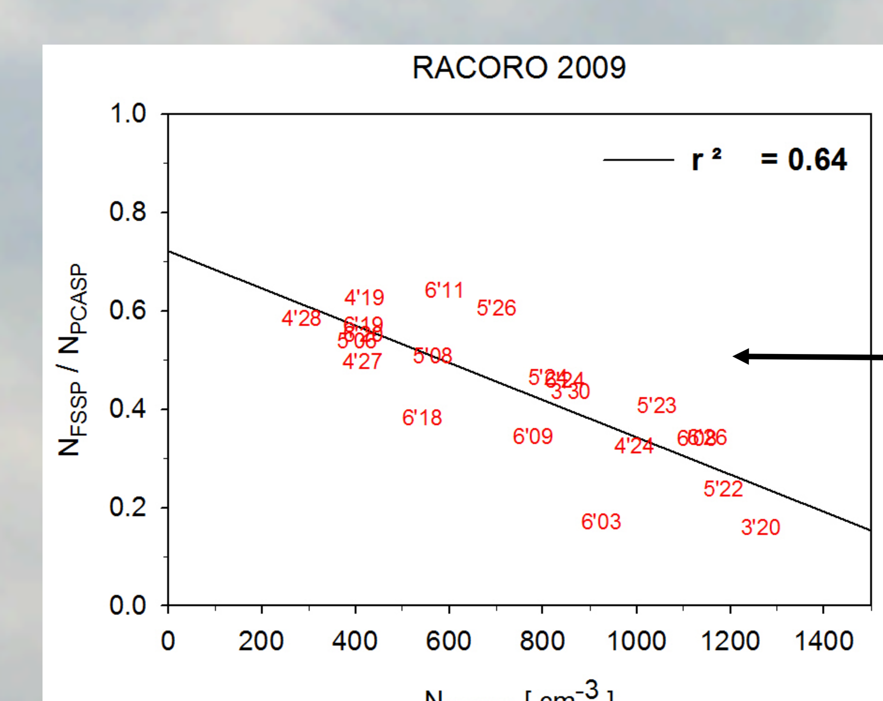
5. Evaluating Models & Cloud-Aerosol Interactions





• From M-PACE, similar steps identified optimum probes characterizing cloud properties (r_{ei}, r_{ew}, N_i, N_w, SDs, LWC, IWC, etc.)

• Properties (e.g., r_{ei}, r_{ew}, N_i, N_w) as function of normalized altitude Z_n used to evaluate remote sensing retrievals & model simulations, models ultimately identifying processes responsible for observed microphysics



Preliminary relation of RACORO cloud droplet (FSSP) and aerosol (PCASP) concentrations for different days (plotted in red); continuing work further stratifying relation according to meteorology

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