



SPartICus: Small Particles In Cirrus

ARM Aerial Facility Field Campaign

***Jay Mace, Jennifer Comstock, Eric Jensen, Tim
Garrett, Tom Ackerman, David Mitchell, Xiaohong Liu***



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Objectives

- What is the nature and variability of the particle size distribution in cirrus?
- How do cloud-scale dynamical processes control the evolution of cirrus properties through nucleation, particle growth, and sublimation?
- What degree of complexity is required in cloud property retrieval algorithms, and what minimal set of algorithms can be used to rigorously describe cirrus microphysical properties using ground-based ACRF data?

SPartICus Summary

- Routine aircraft in situ measurements in cirrus over SGP
- Total Hours: 190 research / 10 test flight
- Hours Flown: ~85
- 20 Flight Days (1-3 flights per day)
 - 9 SGP Flights
 - 9 CALIPSO/CloudSat Flights
 - 2 Orographic or other cirrus not associated with remote sensors

Platform: SPEC, Inc. Learjet 25

Instruments

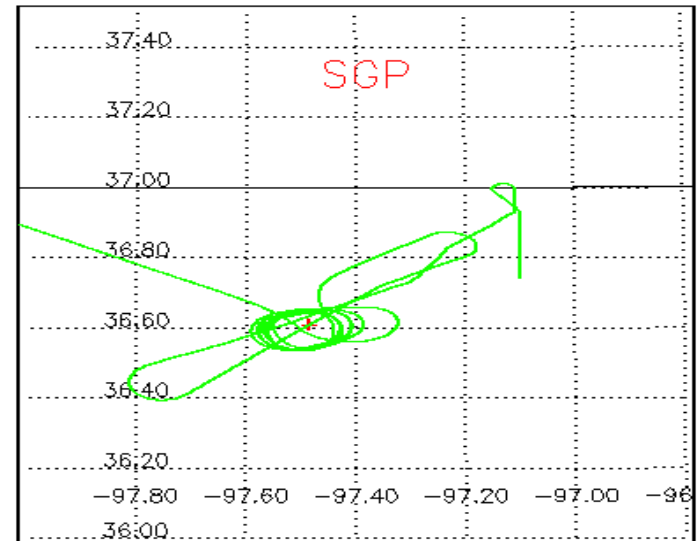
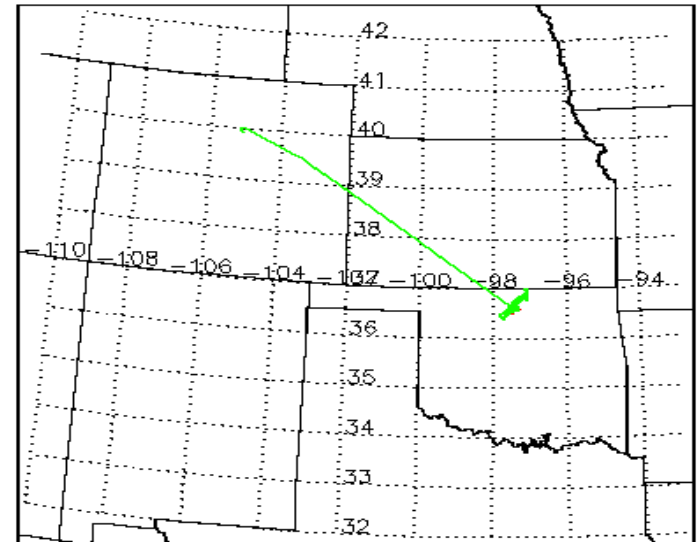
- FSSP, CDP, 2D-S, 2D-P, CPI
- PCASP, Deep Cone Nevzorov
- Rosemount, AIMMS-20
- DLH (NASA – LaRC)'; PI Glenn Diskin



SPEC LEARJET MODEL 25

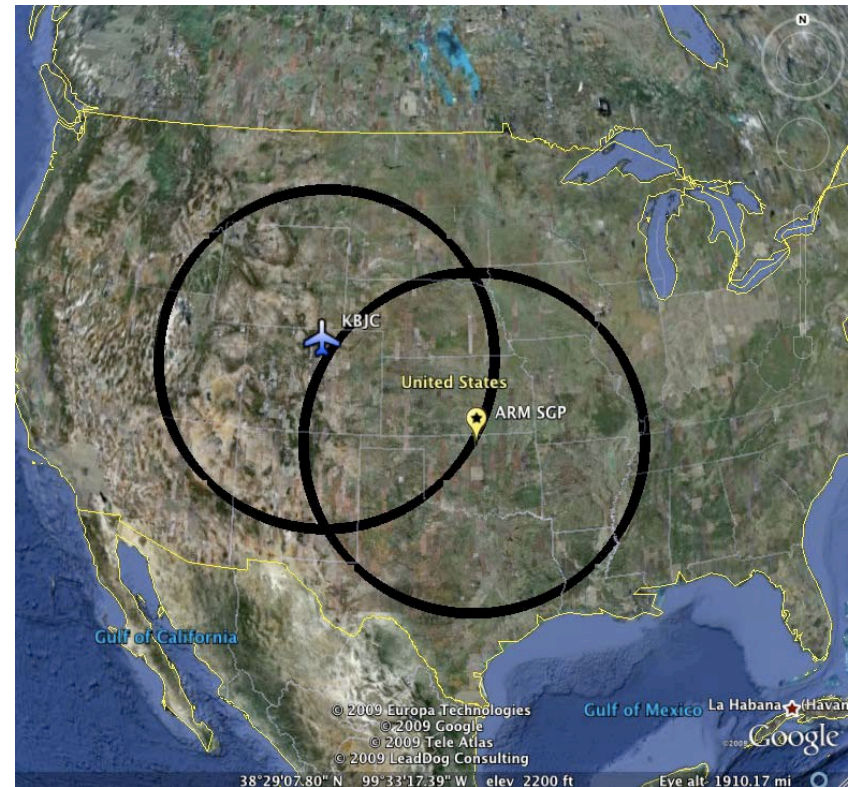
Flight Plans

- Standard SGP Flight
 - Spirals and step down horizontal legs
 - Remote sensing retrieval algorithm development
 - Small particle contribution



Flight Plans

- CloudSat/CALIPSO overpass
 - Horizontal legs and spiral along satellite track
- Cirrus within the flight domain



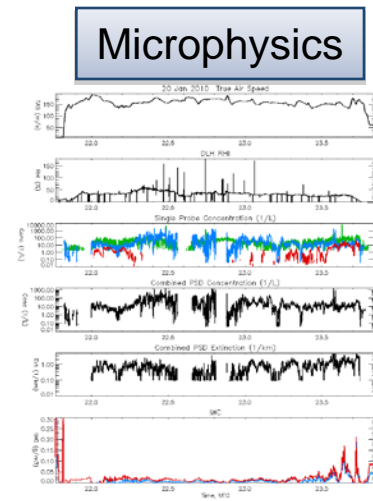
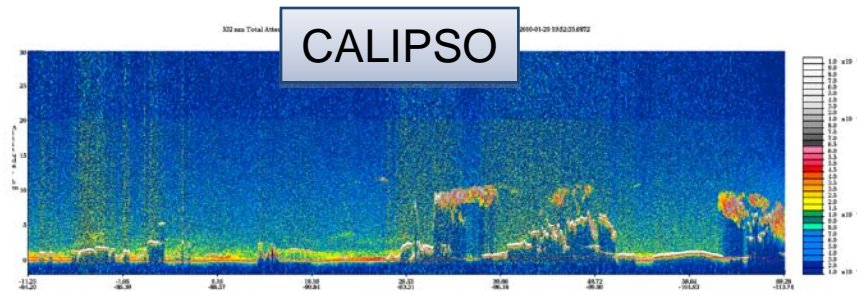
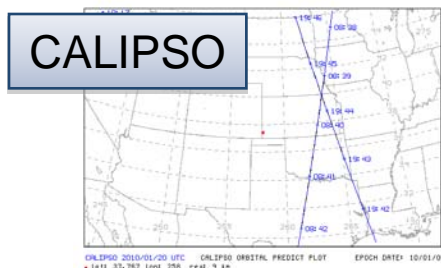
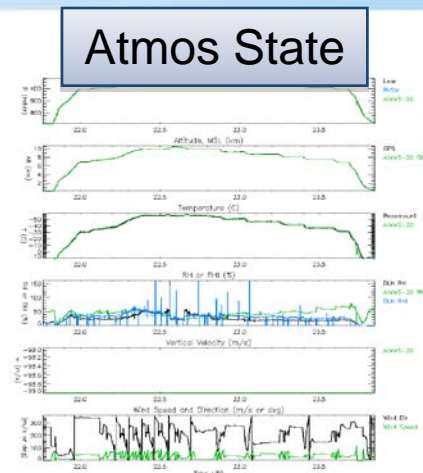
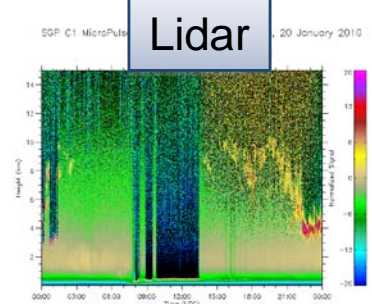
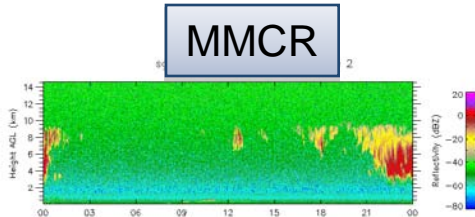
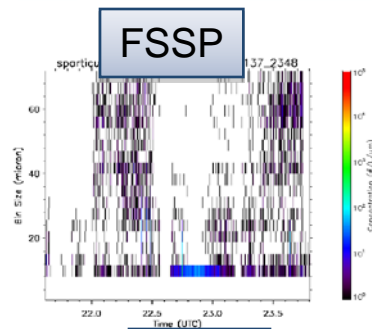
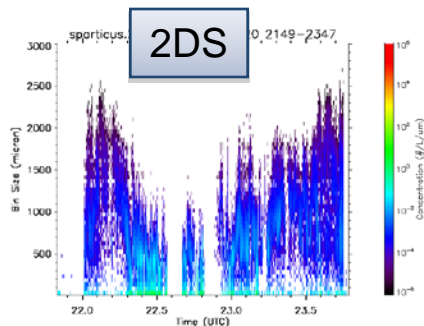
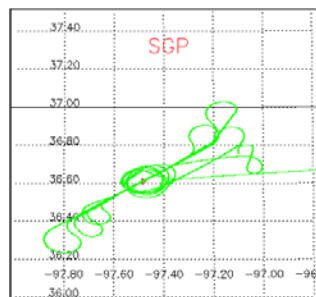
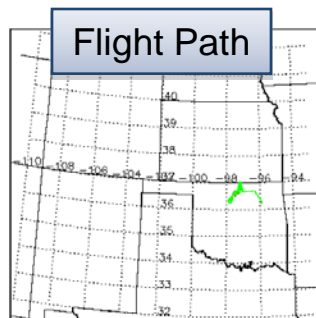
Weather Summary

- January
 - Series of high pressure ridges and deep troughs bringing cirrus to either Rocky Mountain region or prefrontal cirrus to SGP
- February
 - Low clouds became persistent over SGP
 - Around 10 Feb, subtropical jet dominated, bringing cirrus and a series of winter storms to the southern U.S.
 - Subtropical jet gave way to zonal flow, basically shutting down cirrus
- March – split flow, but picking up

Wiki Site

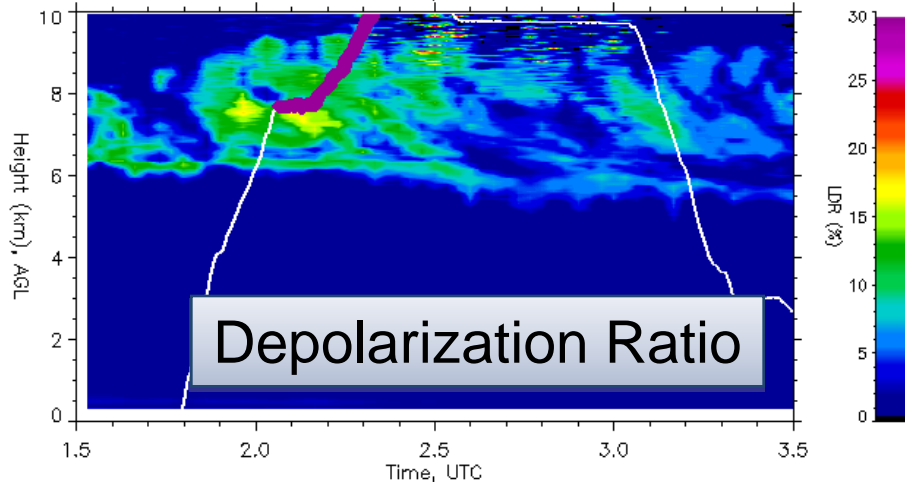
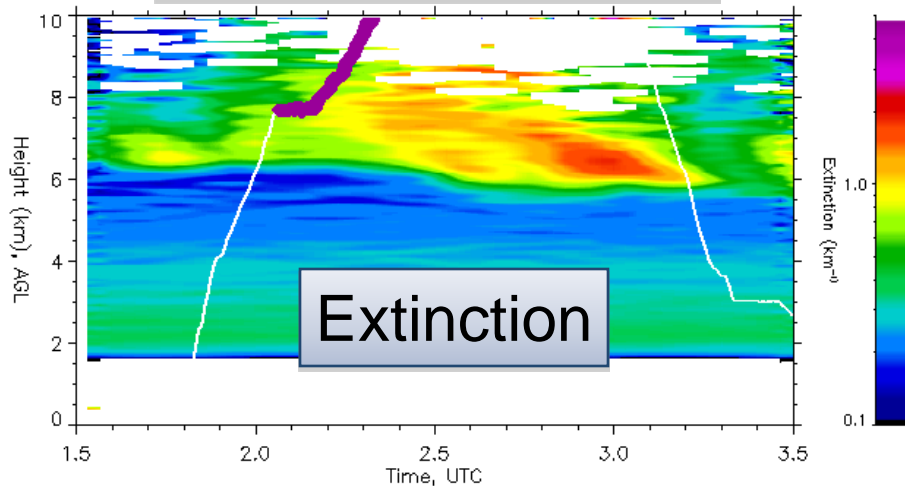
- Satellite overpasses
- Real-time data links (satellite and SGP data)
- Weather forecasting links
- Record of all research flights

Research Flights – Preliminary Data

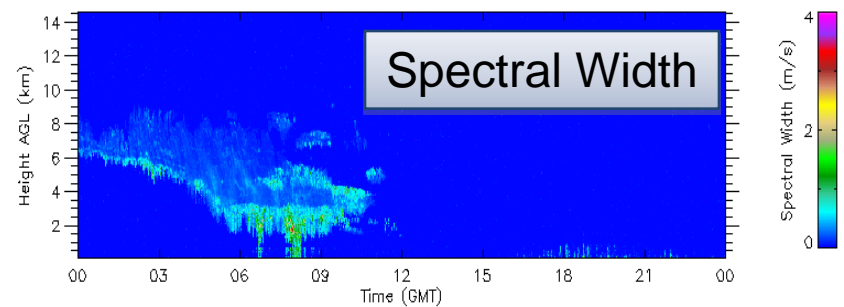
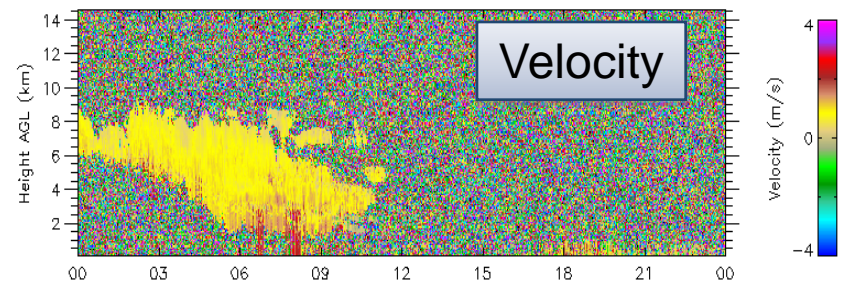
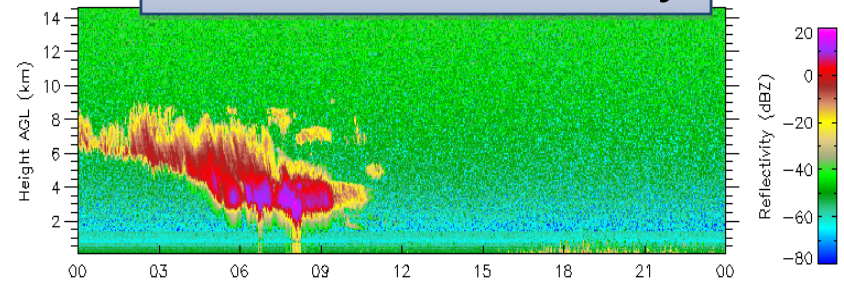


Extinction Profiles – 27 Jan 2010

Raman Lidar Data



MMCR Reflectivity

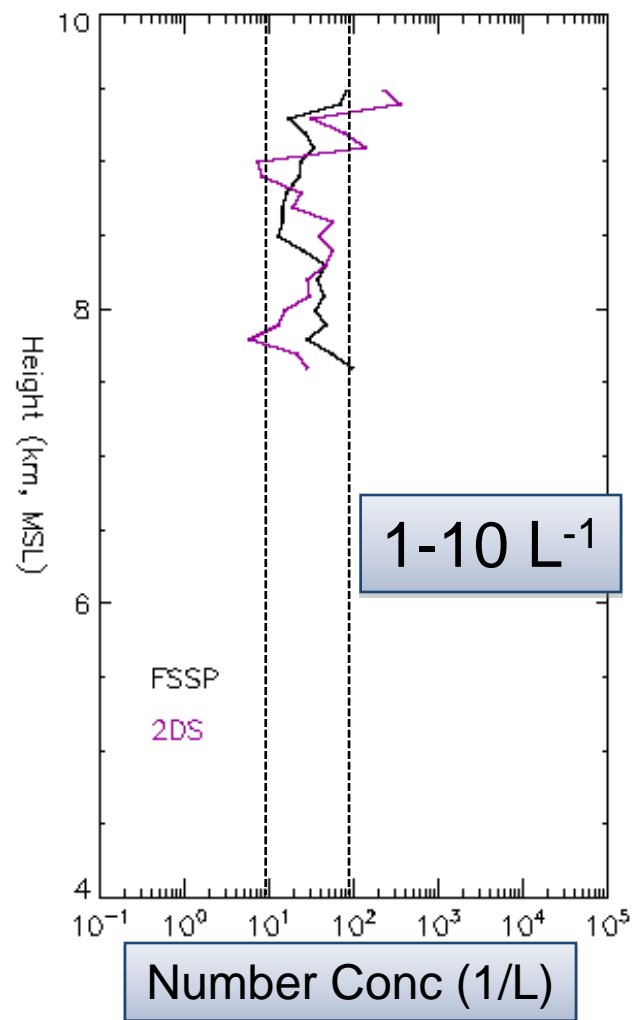
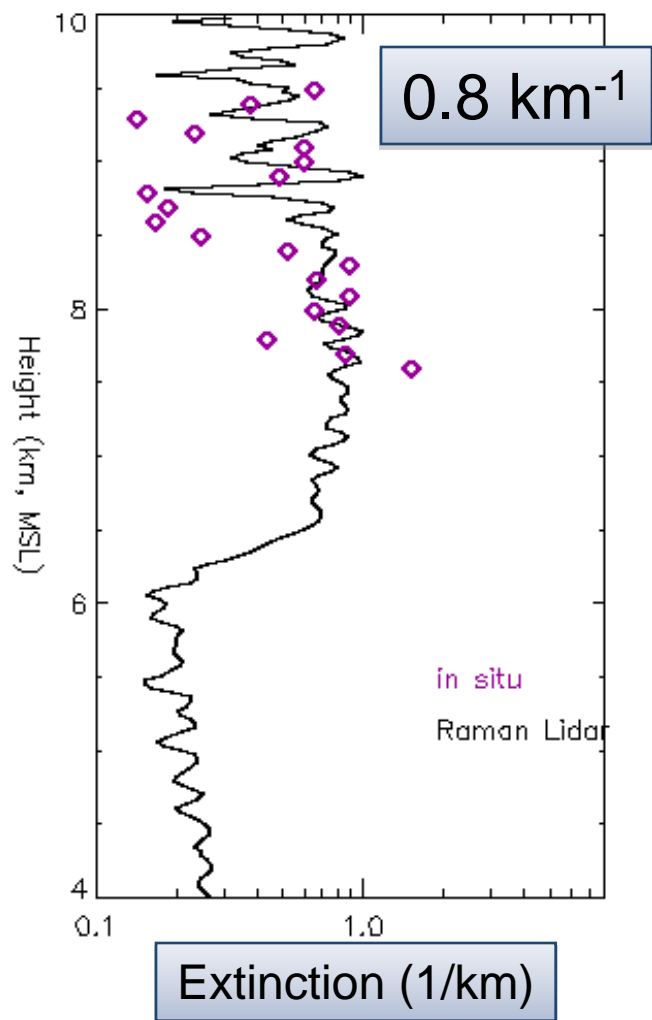


Ground-Based – Aircraft Comparison

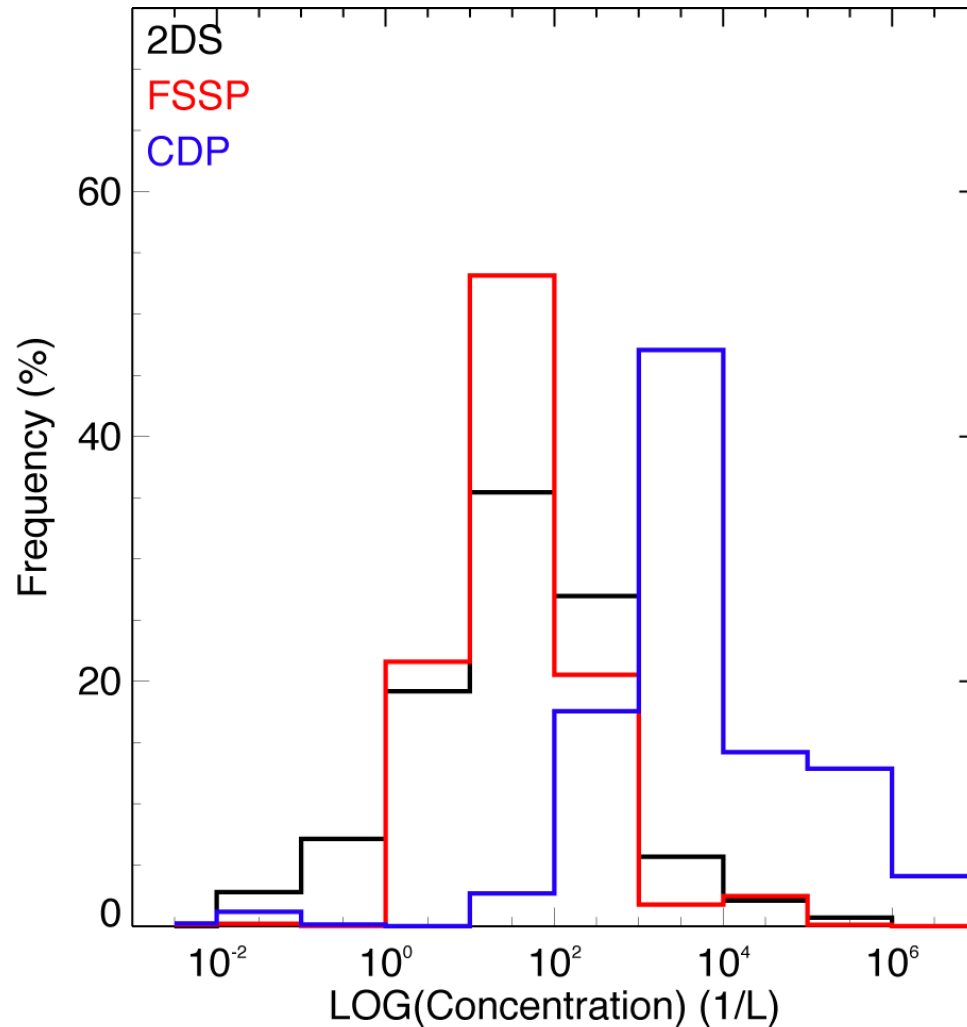
Average profiles during the spiral

Aircraft: 100 m

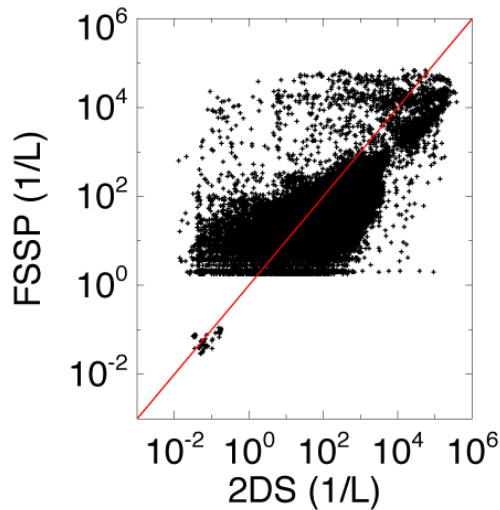
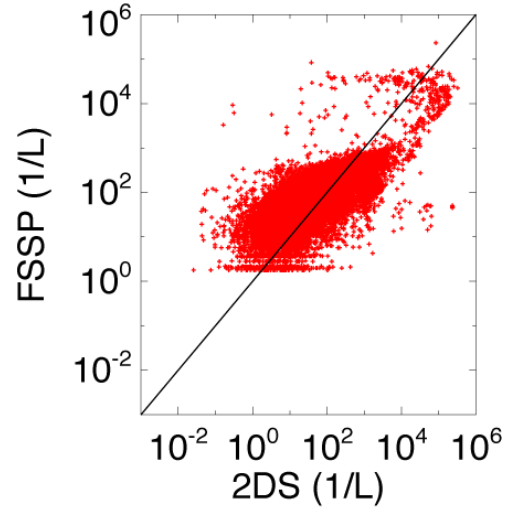
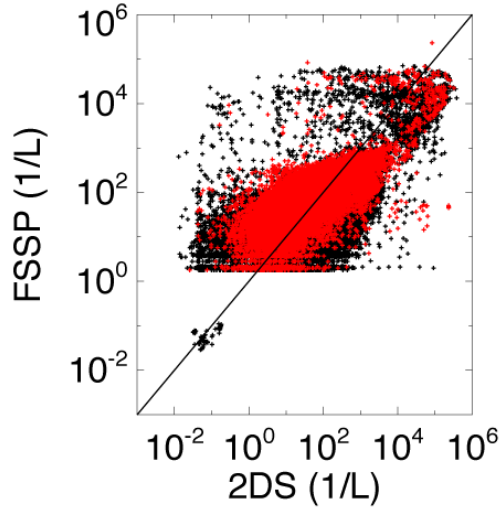
Optical Depth: 1.2-4.7 during spiral



Particle Concentrations



FSSP and 2DS comparison



RED=When 2DP detects large particles