

# **The Production of Warm Rain in Tropical Cumulus Clouds**

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# OBJECTIVE:

- To **quantify** the production of **warm rain** in shallow **cumulus clouds**.
  - Examine relative importance of (1) aerosols and (2) entrainment and mixing on spectral broadening.

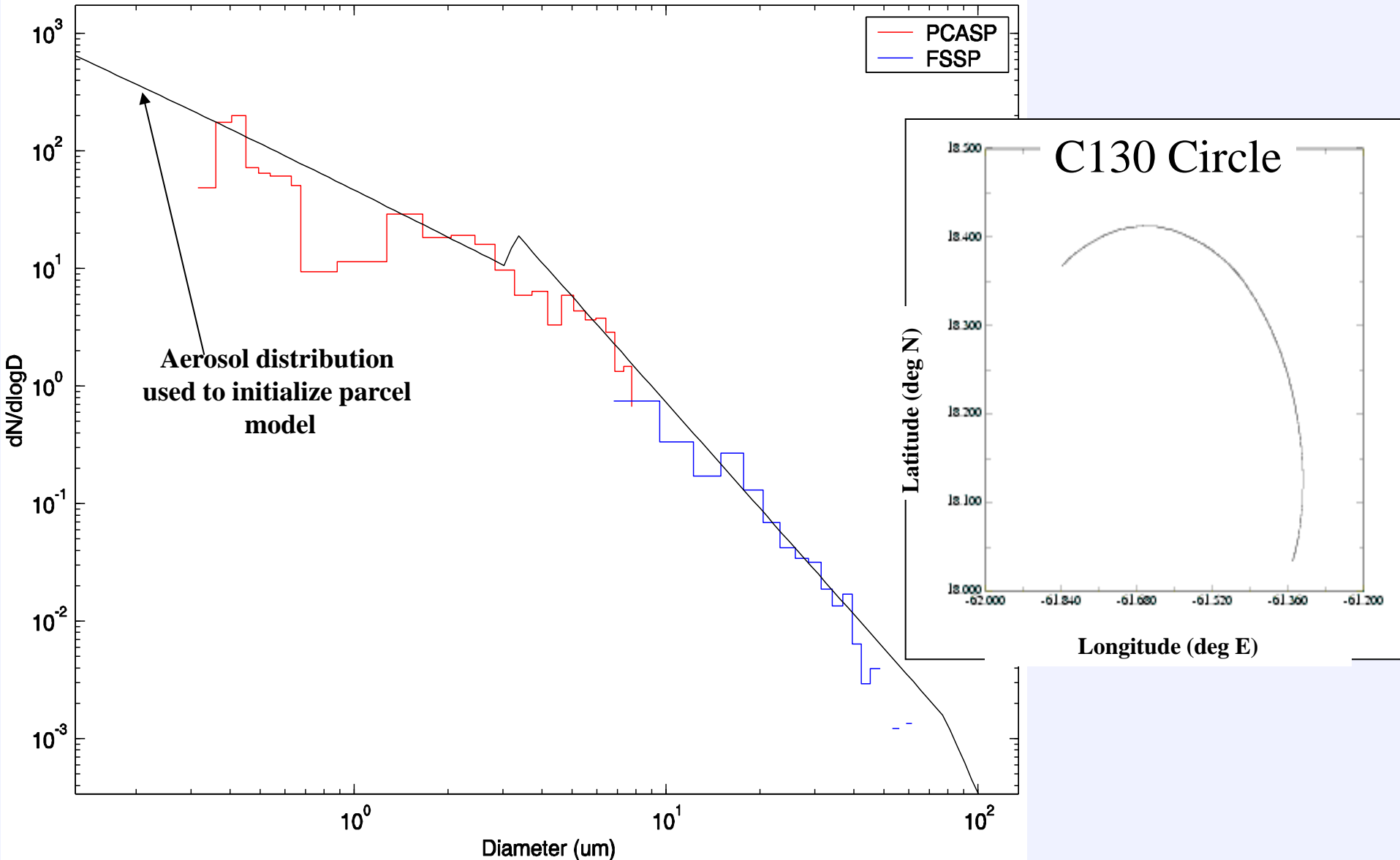
# Platforms:

- Microphysics probes onboard NCAR C130, BAE146 and Wyoming King Air
  - SPolKa Radar
- 

# Modeling:

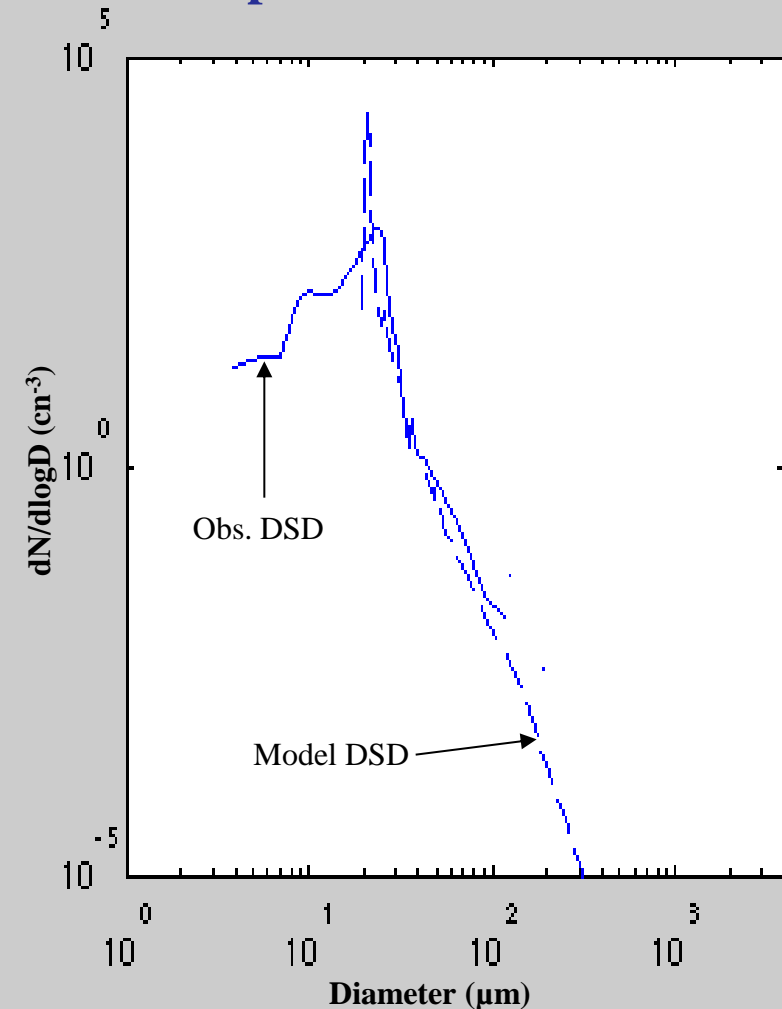
- Stochastic Coalescence Model (Cooper et al. 1997) initialized with **observed**:
  - Sub-cloud aerosol distribution.
  - Cloud-base temperature and pressure.
  - Cloud updraft speeds.
- Modified Parcel Model (Lasher-Trapp et al. 2005) with entrainment and mixing.

# Aerosol Size Distribution from PCASP and FSSP, Averaged over 750 s @ ~100 m above MSL (14 Jan '05)



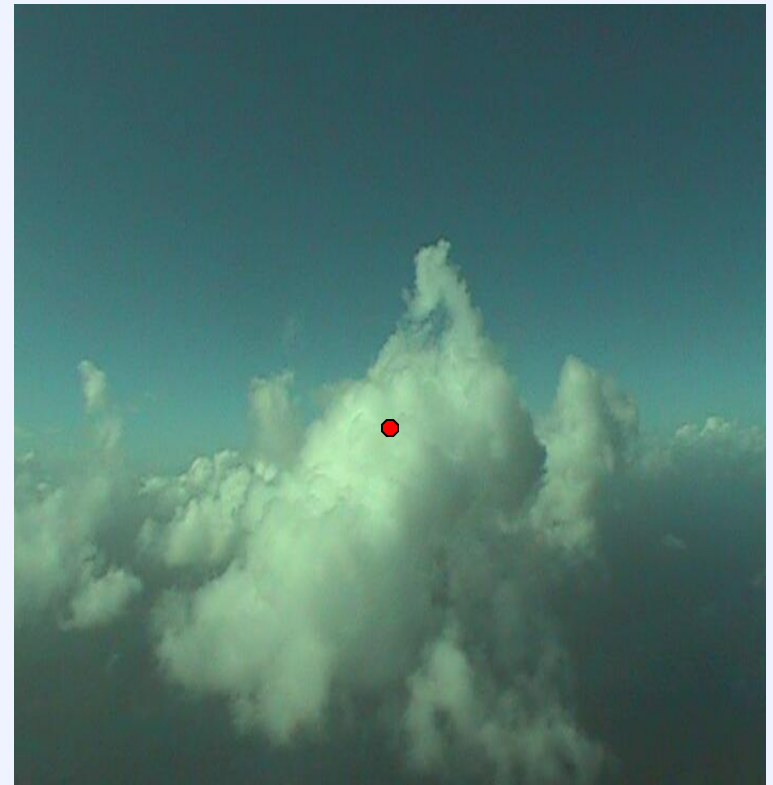
# Comparison of Observed and Model-Produced DSDs ~ 880 m Above Cloud-Base (14 Jan '05)

## Droplet Size Distributions



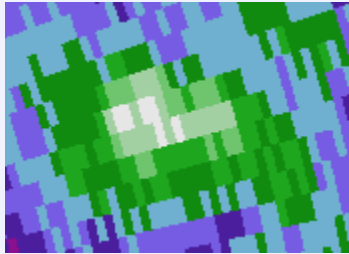
## DSD Observed:

- Slightly Below Cloud-Top
- In Max. Updraft ( $4.7 \text{ ms}^{-1}$ )

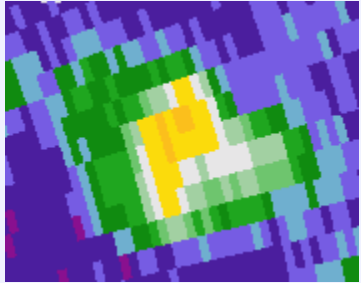


# SPolKa Radar- Time Height Diagrams

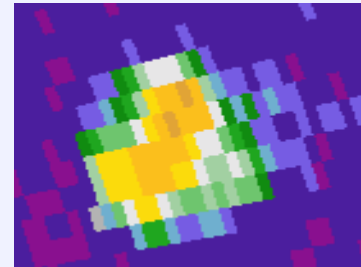
1.5° PPI scan (~0.8 km)



2.5° PPI scan (~1.4 km)



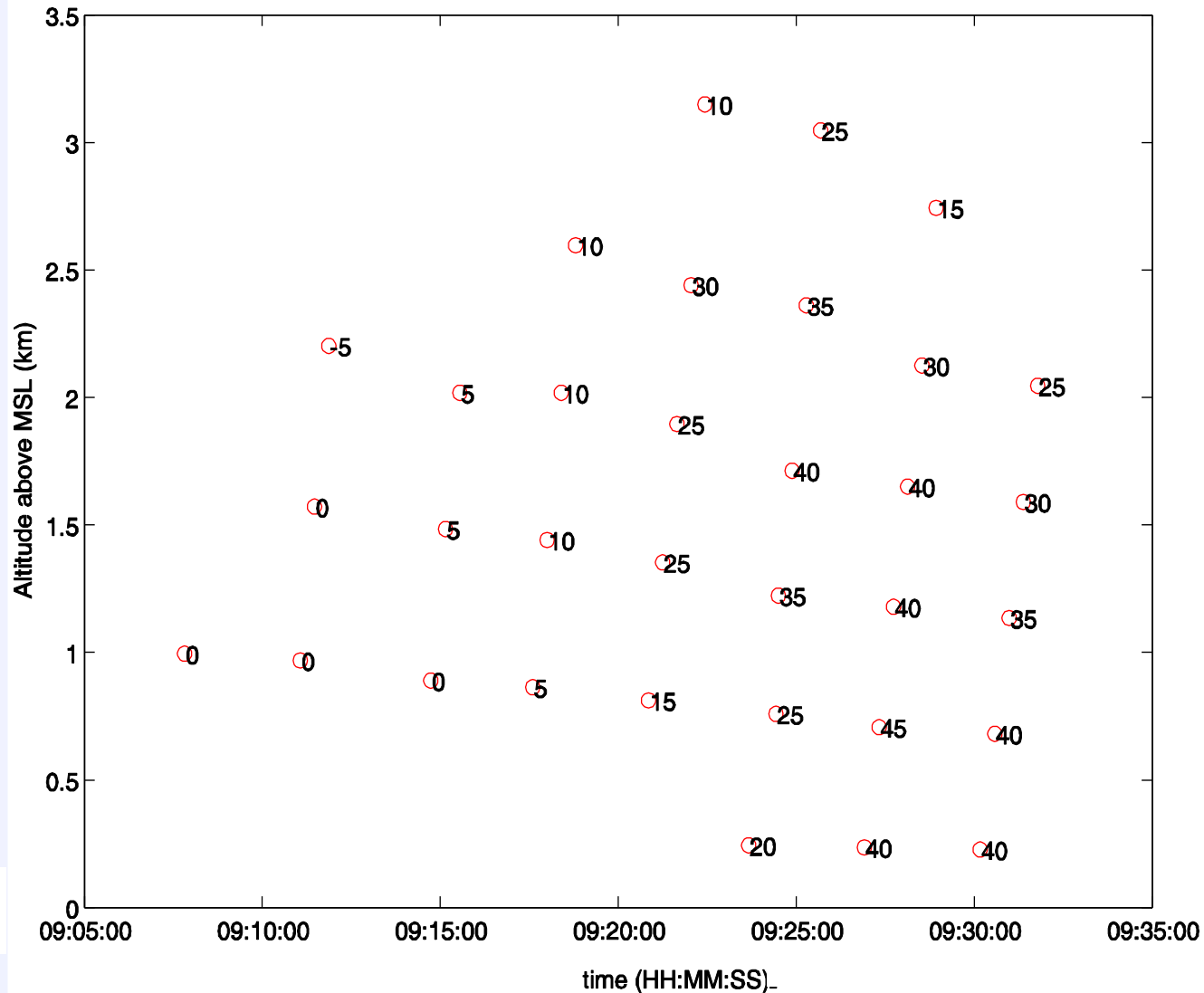
4.5° PPI scan (~2.4 km)



-5    5    15    25    35



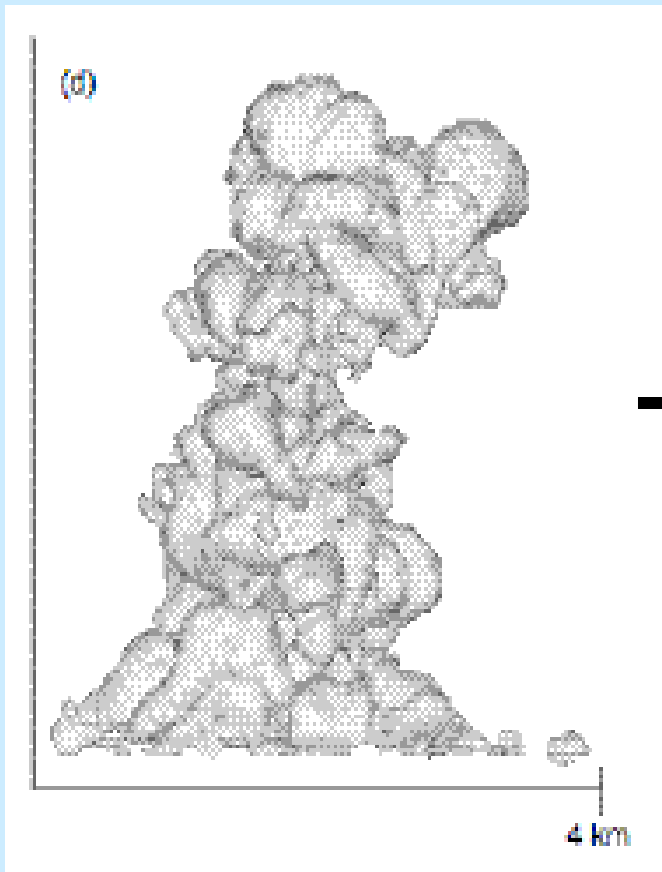
January 11, 2005 (RF12) : Time-Height Diagram; Reflectivity (dBZ)



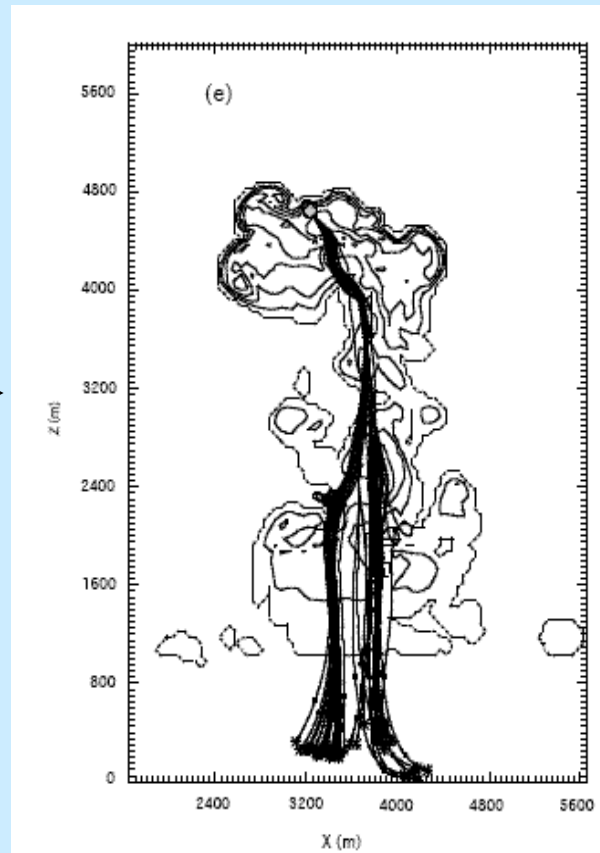
**Objective:** Compare increases in radar reflectivity with parcel model and aircraft obs.

# Future Work: Collaboration with Sonia Lasher-Trapp

**Straka 3-D Cloud Model**



**Modified Parcel Model  
w/ Entrainment and Mixing**



Compare  
DSDs from  
Modified  
Parcel Model  
with  
Observations