

SPEC^{inc}

Participation in ICE-T with the SPEC Learjet



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Scientific/Flight Plans Overview

Flight Profiles:

- 1) Penetrate New, Growing Cumulus at 0 °C and Continue to make Rapid Penetrations. Remain at 0 °C to Monitor Drop Evolution, then Climb at 2,000 fpm making Repeated Penetrations to Near Cloud Top (-10 °C to - 20°C).
- 2) Repeated Penetrations at a Constant Altitude.
- 3) Dash and make One-pass Penetrations of as many Cu as Possible.

New Instrumentation:

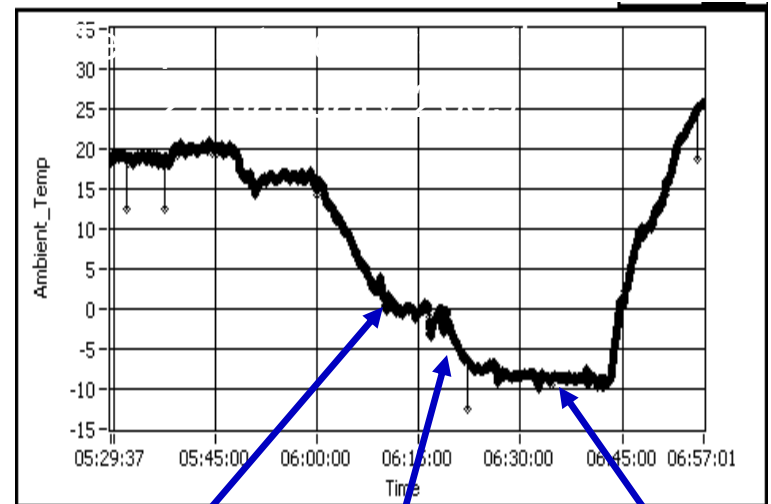
- 3V-CPI, Fast FSSP/CDP, HVPS Record Complete Water Drop and ice Particle Size Distributions from 1 μm to 2 cm.
- 3V-CPI also records up to 400 frames per second of CPI Images Coincident with 2D-S Stereo Images. “Fish” for Ice > 30 μm .
- New Probe Tips and Inter-arrival Time Algorithms used to Remove Splashes and Shatterers from all Probes.

Collaborative Modeling effort with Morrison-Grabowski

Precipitation Process:

Mixed-phase/ice processes initiated by freezing of large drizzle/rain drops and subsequent initiation of natural seeding (ice splintering) process rapidly depleting cloud liquid water content

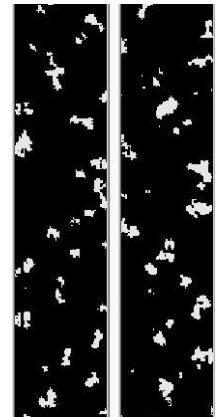
- Large drops @ $\sim 0^{\circ}\text{C}$.
- Freezing at $\sim -5^{\circ}\text{C}$.
 - Initiation of ice splintering process.
- Rapid conversion of LWC to ice.
- Rapid depletion of LWC inhibiting lightning in these cases.



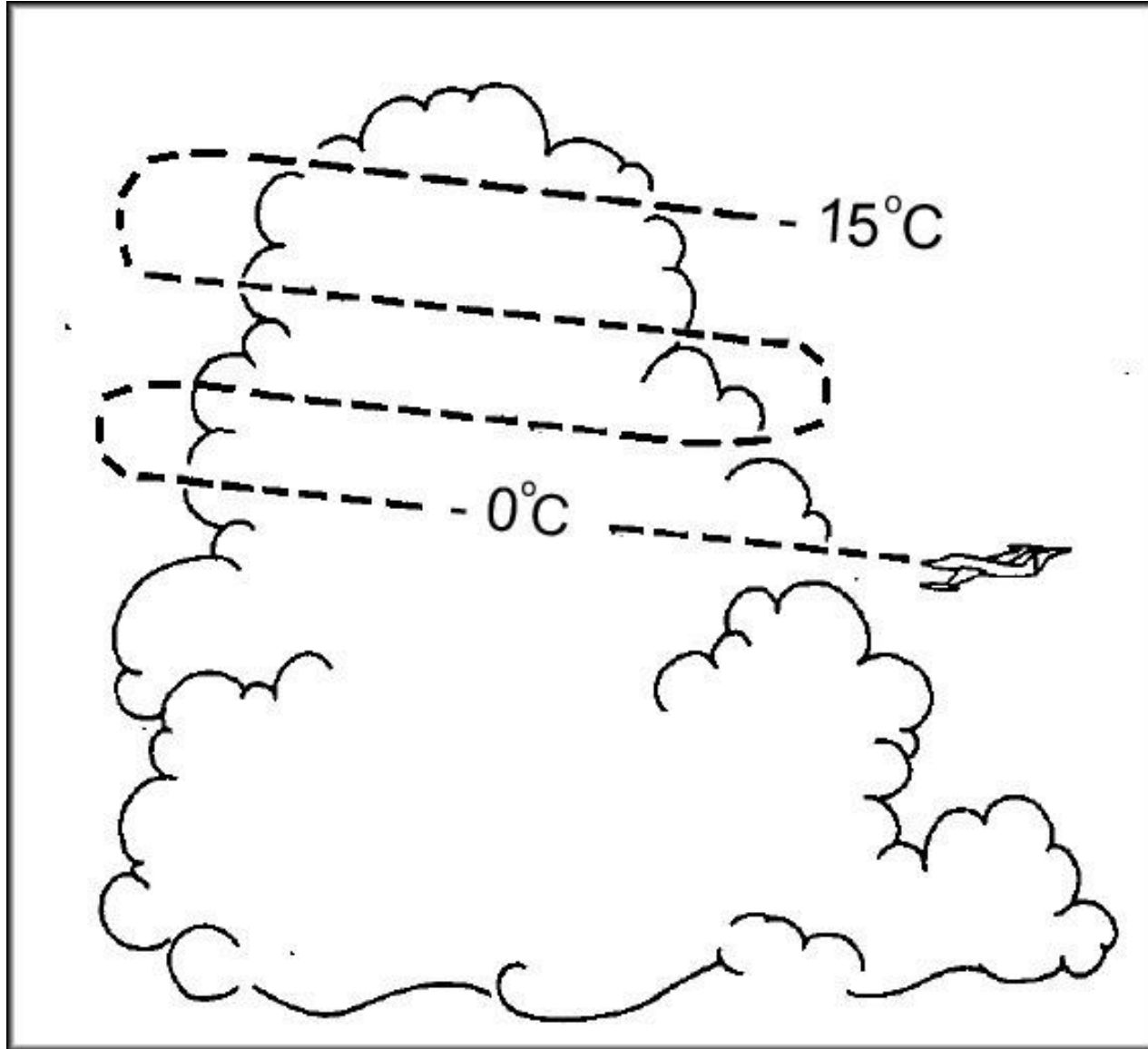
0°C

-5°C

-8°C

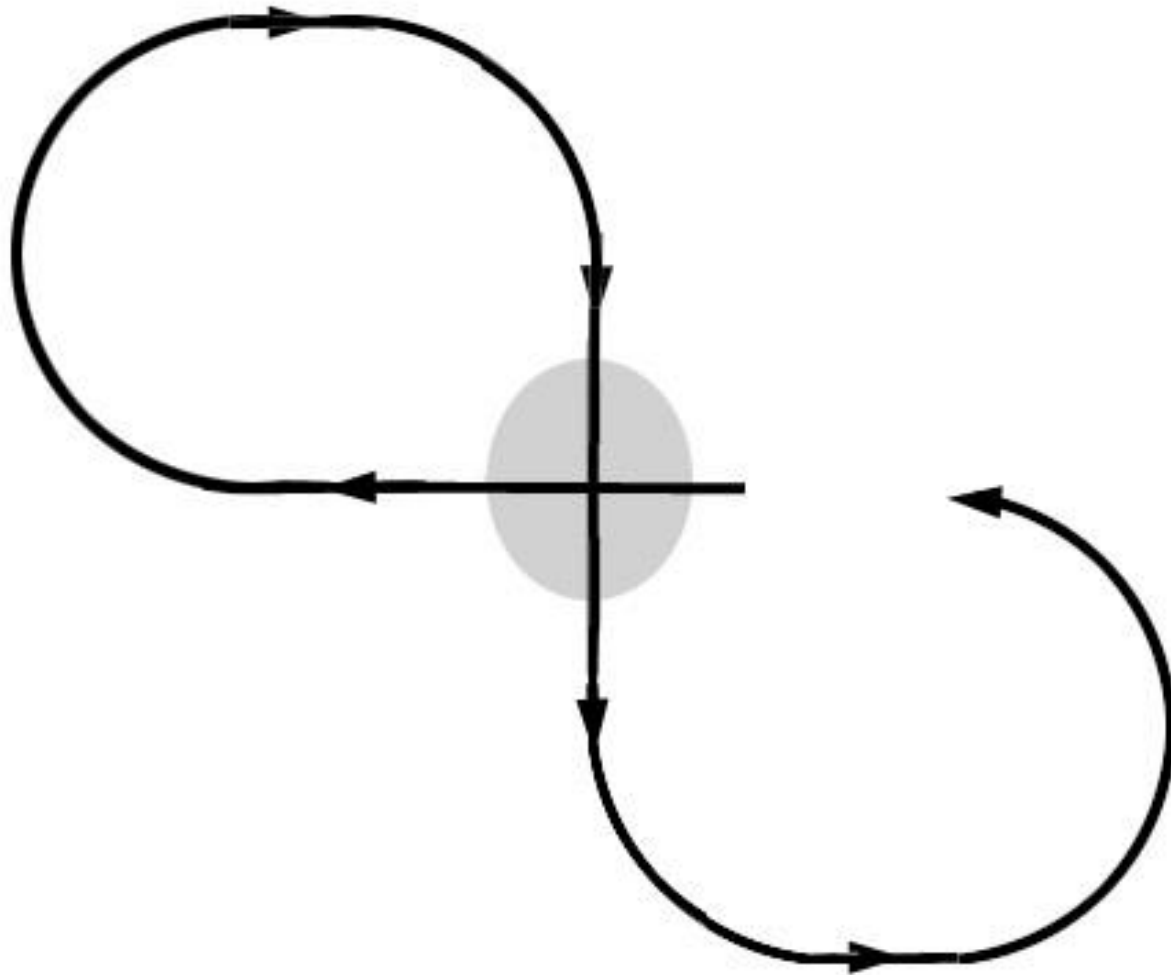


Frequent, Repeated (~ 1 to 2 min) Learjet Penetrations Results in Quasi-Lagrangian Measurements of Particles in the Updraft



Lear Climbing Figure 8 Pattern

(Plan View Looking Down on Cloud)

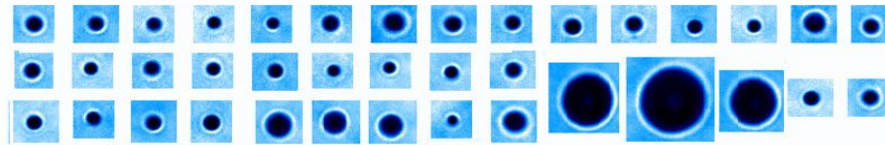


Features of the 3V-CPI

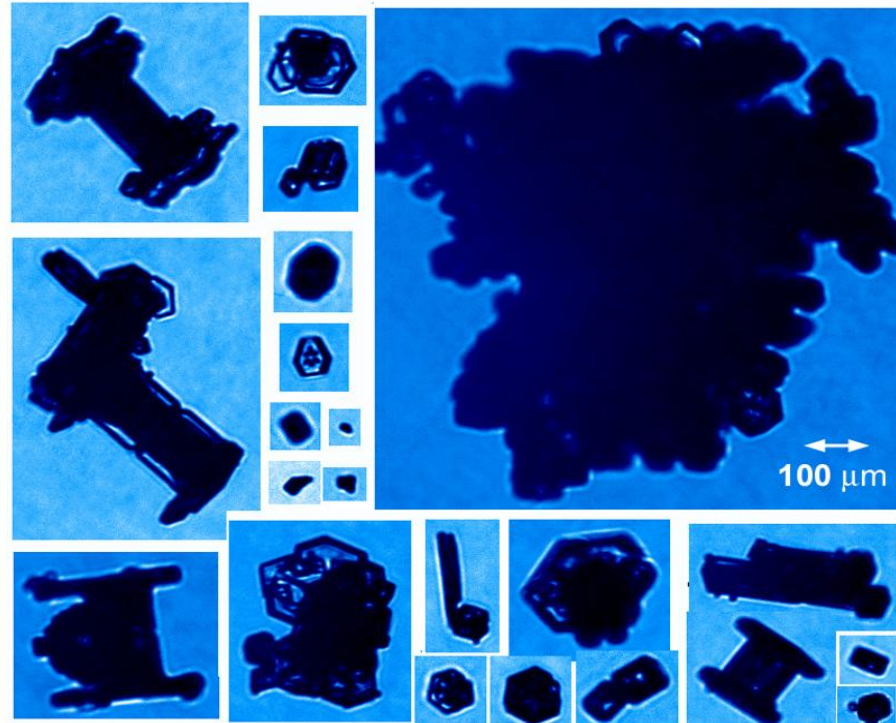
- **Retain all of the Present Features of the 2D-S:**
 - 1) Quantitative PSD from 10 μm to a few mm (e.g. Image both Cloud Drops and Ice Particles)**
 - 2) New Probe Tips and Inter-arrival time Algorithm Shatterer/Splasher Rejection**
- **CPI will be “Triggered” by the 2D-S.**
- **CPI Camera Frame Rate of 400 s^{-1}**
- **Three views of CPI/2D-S Images with Shatter/Splasher Rejection on Both Probes.**
- **Ability to “Fish” for Particles Larger than User-Selected Size (e.g., $> 30 \mu\text{m}$).**

3V-CPI Images from NCAR GV (8-15-2010) in PREDICT

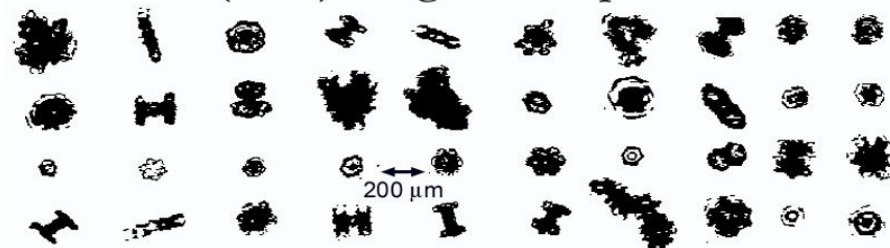
3V-CPI (CPI) Images of Water Drops in Cumulus



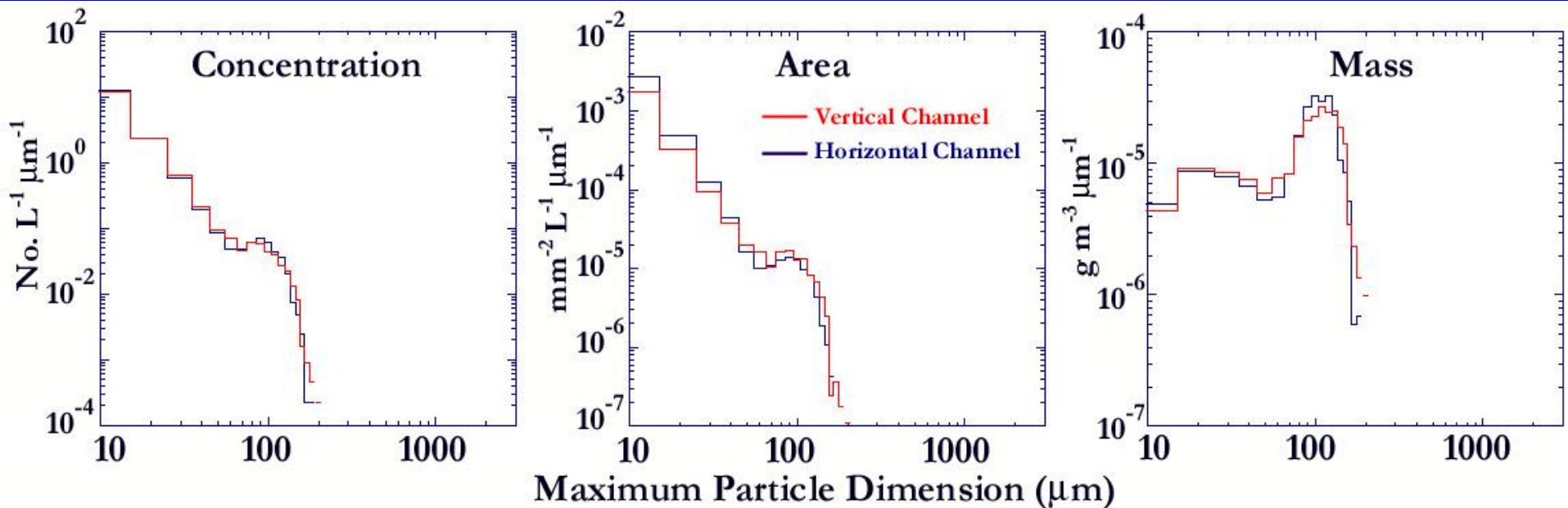
3V-CPI (CPI) Images in Tropical Anvil



3V-CPI (2D-S) Images in Tropical Anvil



Size Distributions from 2D-S Horizontal and Vertical Channels of 3V-CPI Probe Installed on NCAR GV in PREDICT (8-15-2010)



Data Processing and Analysis

- **Data processed and placed in ICE-T Archives with no Access Restrictions**
- **Processing includes Water and Ice Size Distributions as a function of Number, Area and Mass, Particle Habits and Air Motions**
- **SPEC Scientists Collaborating with Morrison and Grabowski to Compare Measurements with Two-Moment CRM.**