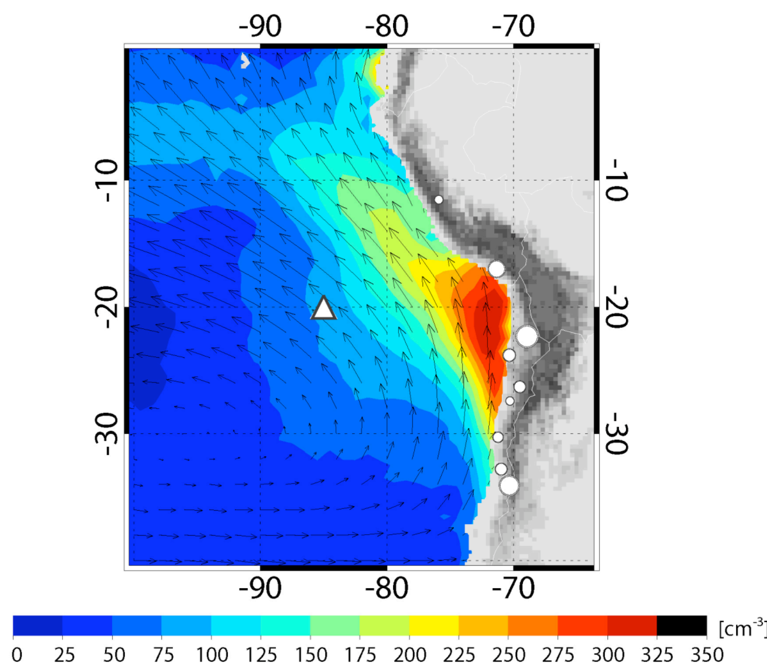
CIRPAS Twin Otter -- Scientific Objectives

- Aerosol-Cloud-Drizzle Interactions
  - Process Studies
  - Gradients in Clouds and Aerosols
- Coastal Processes
  - Diurnal Cycle
  - Stagnation Effects



Twin Otter Instrumentation

Instrument	Observations/Purpose
Standard met	Winds, temp, dewpoint, cloud liquid water, sfc temp, turbulence (Carl Friehe)
Towed-Platform (optional)	Turbulence near surface
94 GHz Doppler FMCW radar	Cloud properties; in -cloud turbulence
Chaff (Dropsonde) Dispenser (with radar)	Track air movements — entrainment, sub -cloud cloud layer coupling, large eddies
CPCs	Ultrafine aerosols
PCASP	Aerosols 0.1 -3 _m
FSSP	Clouds 2 -40 _m
CIP	Drizzle 25 -1500 _m
DMA/TDMA (Don Collins)	Aerosol size/hygrosopicity
N-Mass	5 channel CN, fast response
CCN-200	CCN (fast -2-point; slow -6 points)
Phased Doppler Interferometer (Patrick Chuang)	Cloud -drizzle 2 -600 _m
SP2-Black Carbon	BC mass and ratio to total particles

VOCALS
CIRPAS Twin Otter

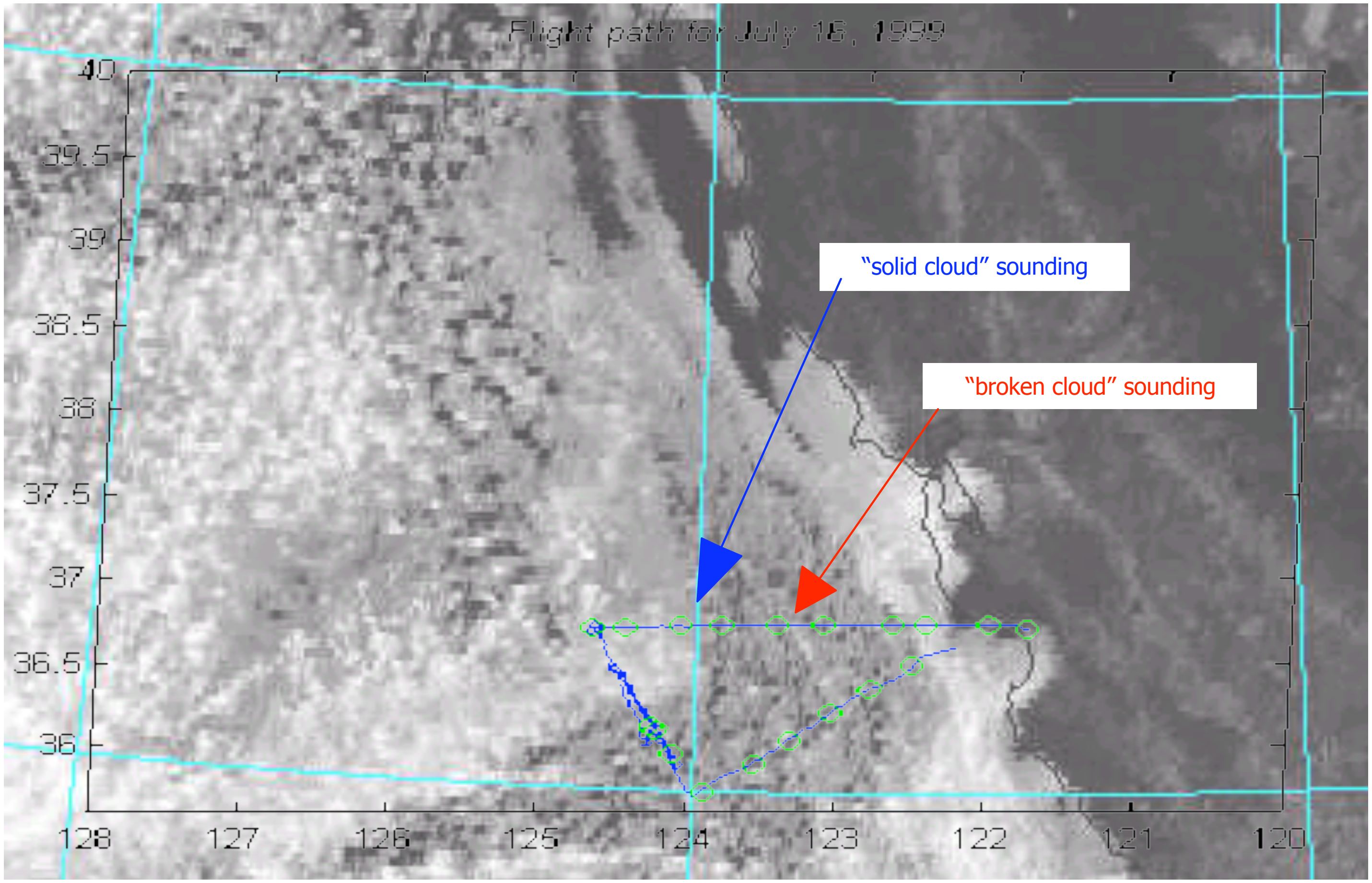
Aircraft Specs:
- Airspeed: ~ 130 knots
- Duration: 4 hours
- Range: 200-400 km

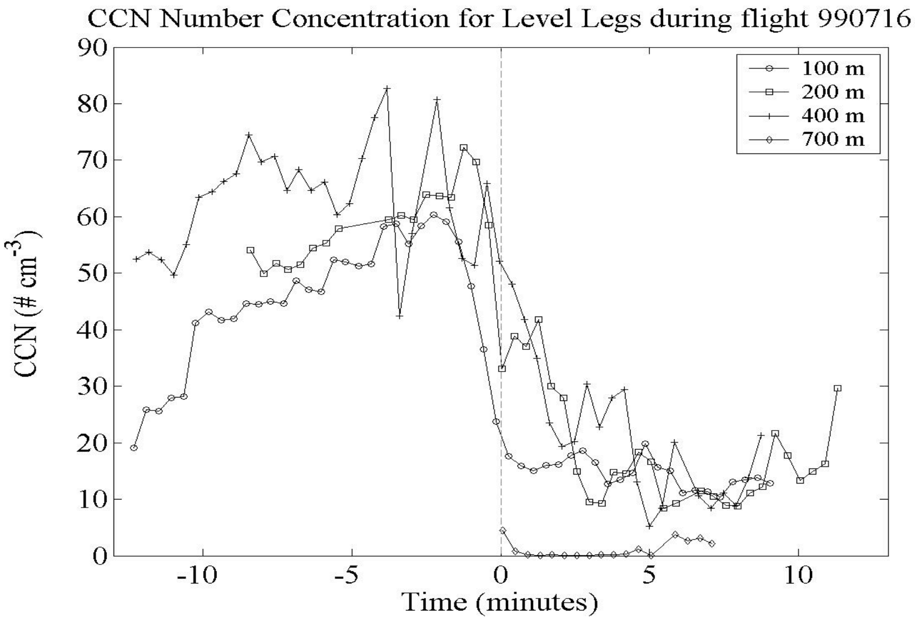
VOCALS Deployment:
80 hours: 20 hours/week

Flight Plans for VOCALS

- Feature/Process Sampling
- Diurnal Cycle and Coastal Gradient Mapping

Feature Sampling –Soundings and Horizontal Legs at Different Levels





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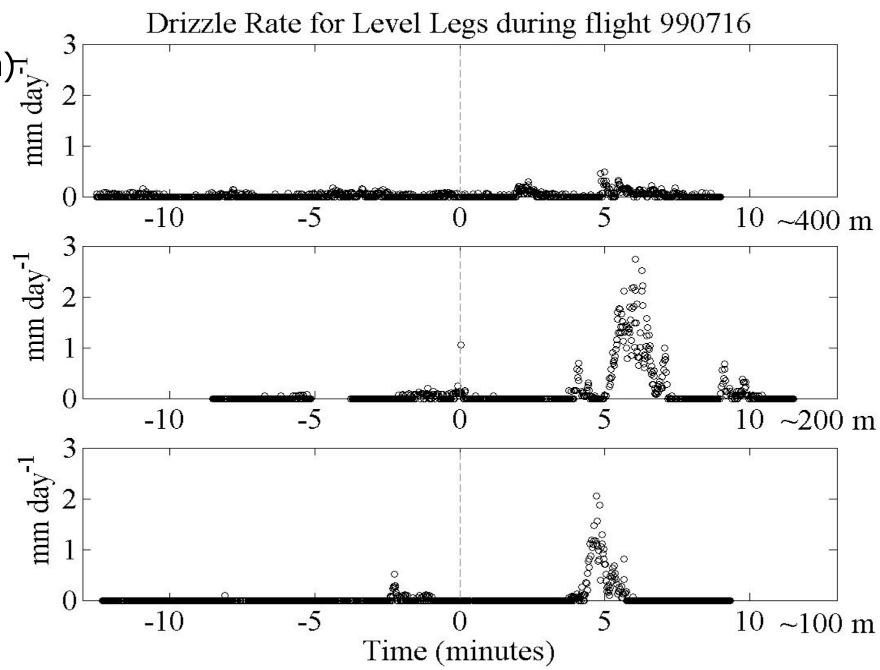
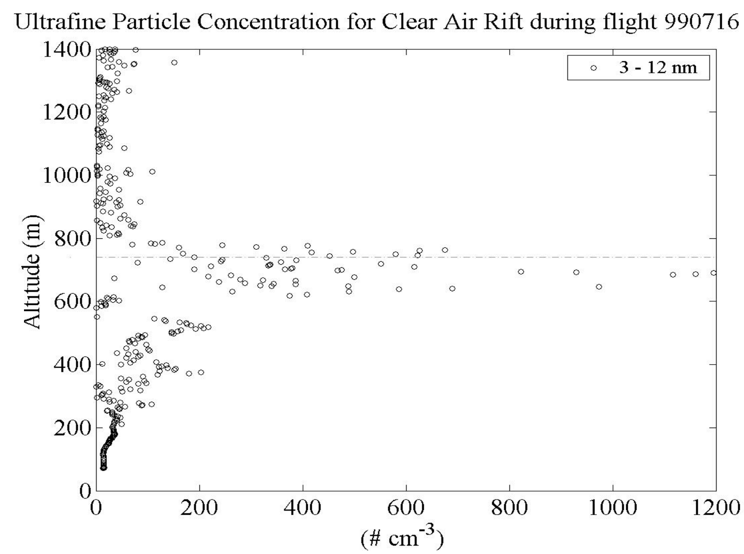
(a)

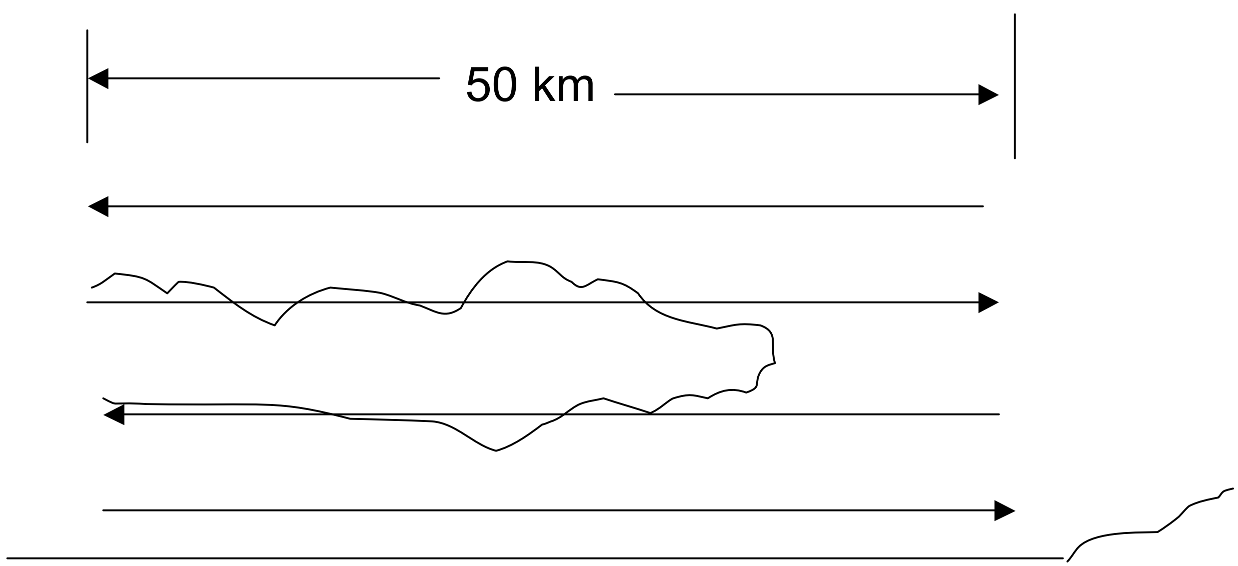




Sharon et al, (2006, JAS)

Diurnal Cycle and Near Coast Sampling

- Levels at 50,500,1000,1500m; soundings at end of legs
- 05-06 AM and 04-05 PM

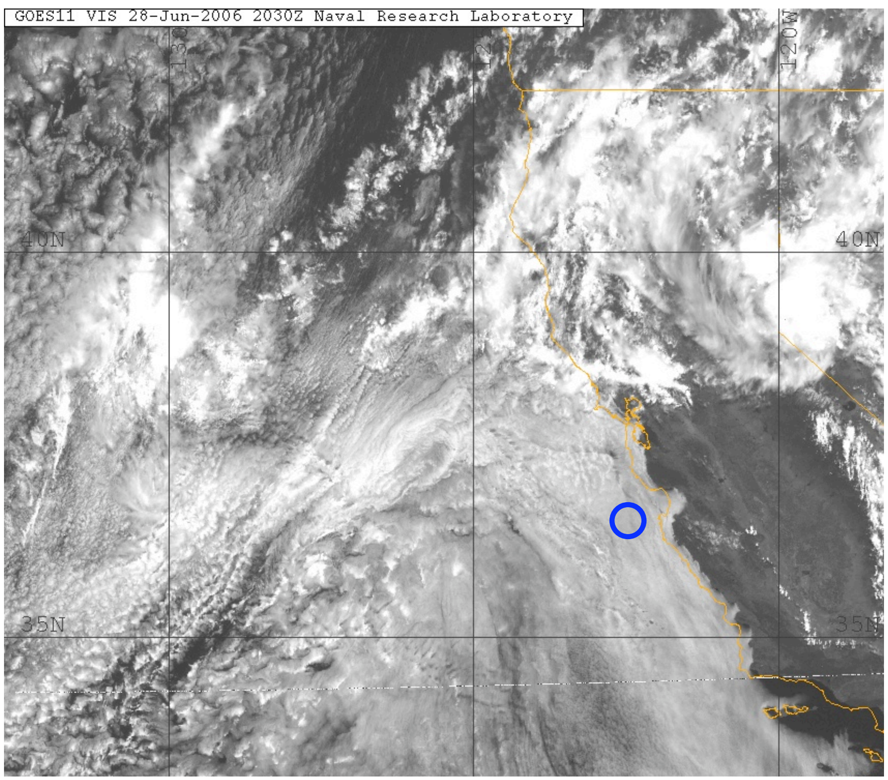


Missions (20 total)

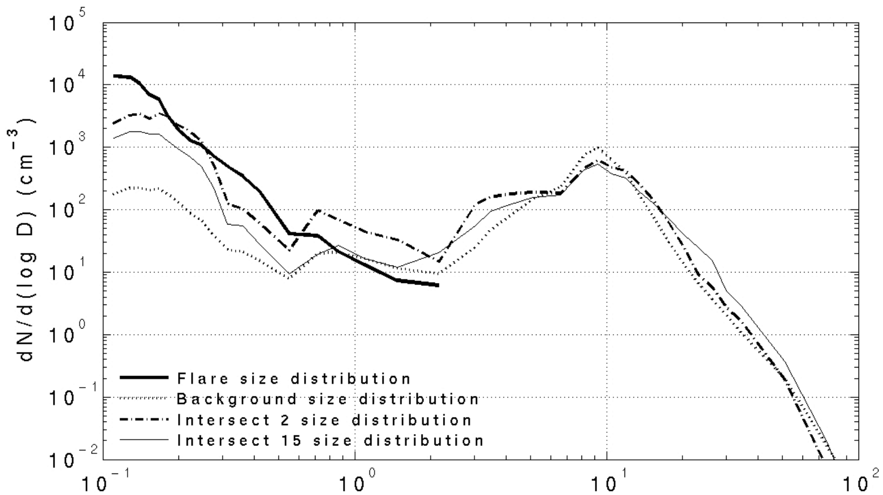
- Features and Process Studies (#?)
- Diurnal (#?)
- Coastal Mapping (#?)
- Coordination with other aircraft (?)

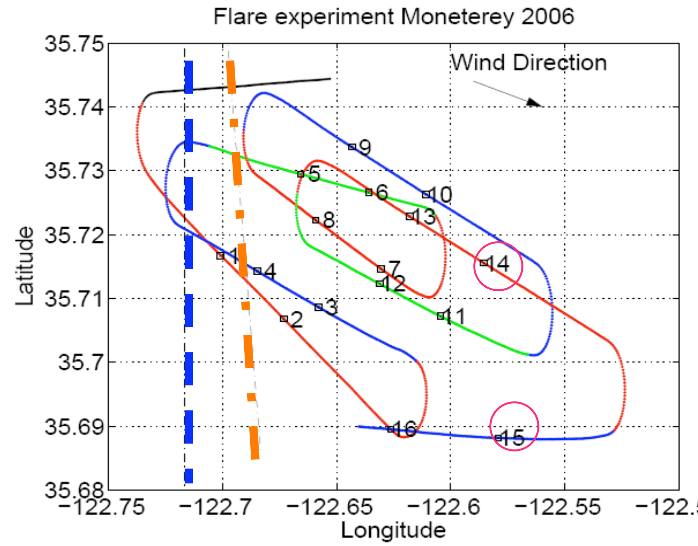
Proactive Probing—Cloud Seeding

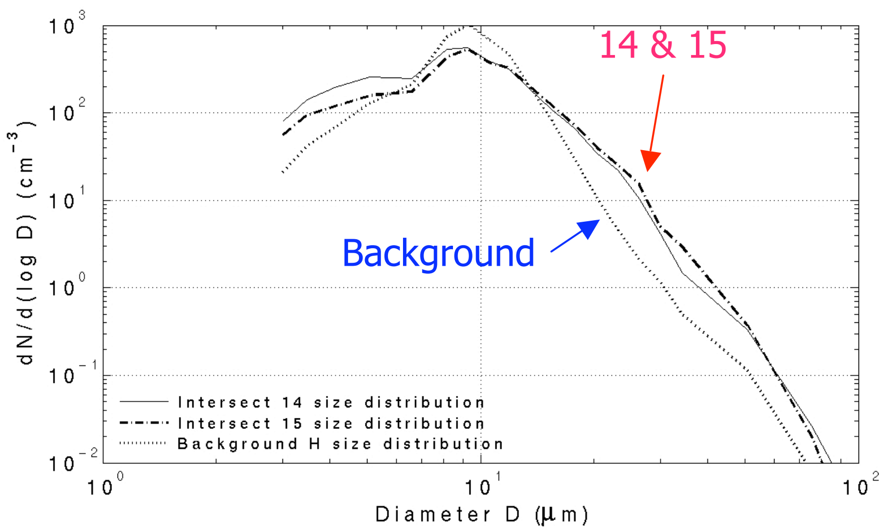
Purpose: Study response of cloud microphysics to artificial introduction of giant CCN – cause and effect (Hypothesis 1 A and 1B)

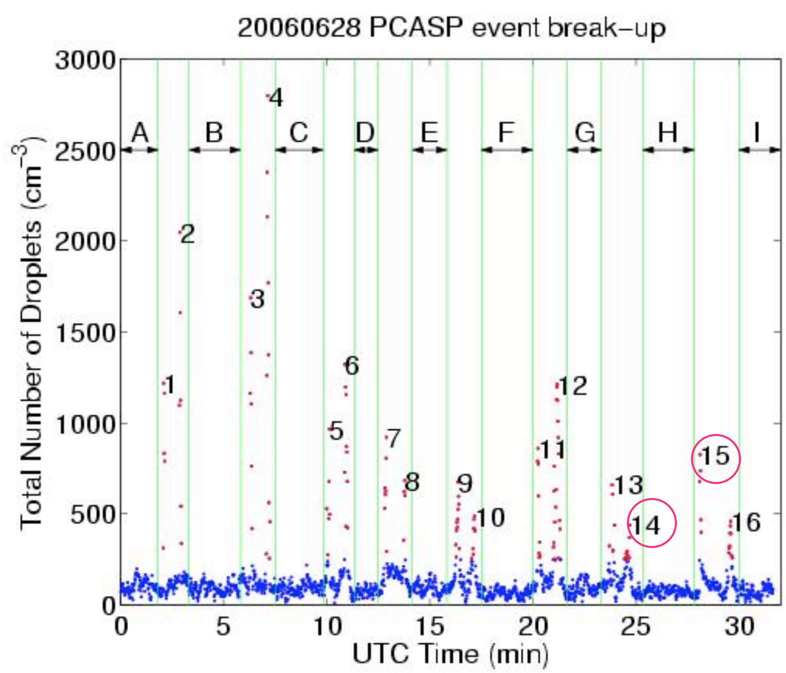


Cloud Response









VOCALS Seeding ? – Artificial Introduction of GN and UGN in Stratocumulus

Role of GM and UGN in Precipitation Enhancement

(Hypothesis 1 A and 1B)

- Seeding Techniques
  - Flares
  - Salt ($CaCl_2$)—Grind and dispense
  - Water—Spray
- Targets
  - Near-shore polluted marine
  - Clean marine (POCS environment)

VOCALS Seeding ? – Artificial Introduction of GN and UGN in Stratocumulus

Hypothesis 1 A and 1B

- Flares
- Salt ($CaCl_2$)—Grind and dispense
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Cloud Seeding as a Technique for Studying Aerosol-Cloud Interactions in Marine Stratocumulus

- Feasibility demonstrated
  - Marine stratocumulus provide stable background
  - Small (cloud-inactive) aerosols produced by flares make useful tracers
  - Clear evidence of broadening of the cloud droplet distribution by condensational growth and collision and coalescence processes
- Potential for future studies
  - Model evaluations of microphysical responses to aerosol forcing
  - Seeding possibilities
    - Aerosol size and composition variations
    - Background effects on response
    - Transports