ASP VOCALS

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Deployment- One Month in the field between October 15 and November 15, 2008.

Flight hours- Between 60 and 70 research hours depending on budget.

DOE G-1 Aircraft

Objective

Overall objective is to examine how the chemical and microphysical properties of aerosols, and their ability to act as CCN differs between remote marine air-masses and marine air-masses that have been influenced by anthropogenic aerosols, and how these differences in aerosol loading and properties influence the properties of the clouds that form in these different environments.

G-1 Payload- Aerosol and Cloud Microphysics

Parameter	Instrument	Source
Aerosol Size distribution 0.1 – 3 μm	PCASP	PNNL
Aerosol size distribution 30 – 120 nm	FIMS	BNL
Aerosol concentration d> 10 nm	TSI 3010	PNNL
Aerosol concentration d> 3 nm	TSI 3025	PNNL
Cloud droplet and drizzle size distribution	DMT CAPS	BNL
Cloud liquid water content	Gerber Probe/CAPS Probe	PNNL/BNL

VOCALS Payload- Aerosol Properties

Parameter	Instrument	Source
Aerosol composition- soluble inorganic and organic species	PILS	BNL
Aerosol composition	Aerodyne ToF-AMS (high resolution)	BNL/PNNL/ Aerodyne
CCN	3 DMT CCN 1 dual, 2 single	BNL/PNNL
Aerosol extinction and backscatter	TSI 3λ Integrating Nephelometer	PNNL
Aerosol absorption	Photothermal	BNL

VOCALS Payload- Trace gases

Parameter	Instrument	Source
O_3	Thermo Electron 49-100	BNL
CO	UV Fluorescence	BNL
SO_2	Thermo Electron 43S modified	BNL
DMS/Organics	PTRMS	PNNL

Scientific Questions

1. Aerosol/CCN properties

What is the importance of various sources of aerosols and aerosol precursors to aerosols that function as CCN. DMS?, Sea-salt, anthropogenic SO2? How does the importance these various sources change with distance from the coast?

What are the relationship between aerosol size, composition and CCN activity? Are they different from those found in other programs

How does this relationship vary between remote marine aerosols and aerosols that have been influenced by anthropogenic sources?

Scientific Questions

1. Aerosol/CCN properties (cont'd)

   What is the flux of DMS from the ocean surface and how does it vary as a function of ambient conditions? Are variations in DMS fluxes/concentrations correlated with the presence of DMS oxidation products in aerosols.

2. Aerosol properties and cloud microphysics

What are the effects of aerosol loading, size distribution, and composition on the microphysical properties of the clouds. Is the relationship between aerosol loading and droplet number concentration linear?

Is the spectral dispersion of the droplet size distribution a function of aerosol loading and/or aerosol composition? Is the spectral dispersion of remote marine clouds smaller than those that have been influenced by anthropogenic aerosols?

Is a layer of high aerosol concentrations observed just above cloud top as in MASE?

3. **Aerosols, cloud microphysics and drizzle**

   Are gradients in cloud droplet microphysics consistent with gradients in drizzle concentration? Are these gradients in microphysics associated with gradients in aerosol loading?

   Do newly developed parameterizations for the drizzle threshold and rate functions hold over the range of cloud properties observed over the NE Pacific?

Flight Plans

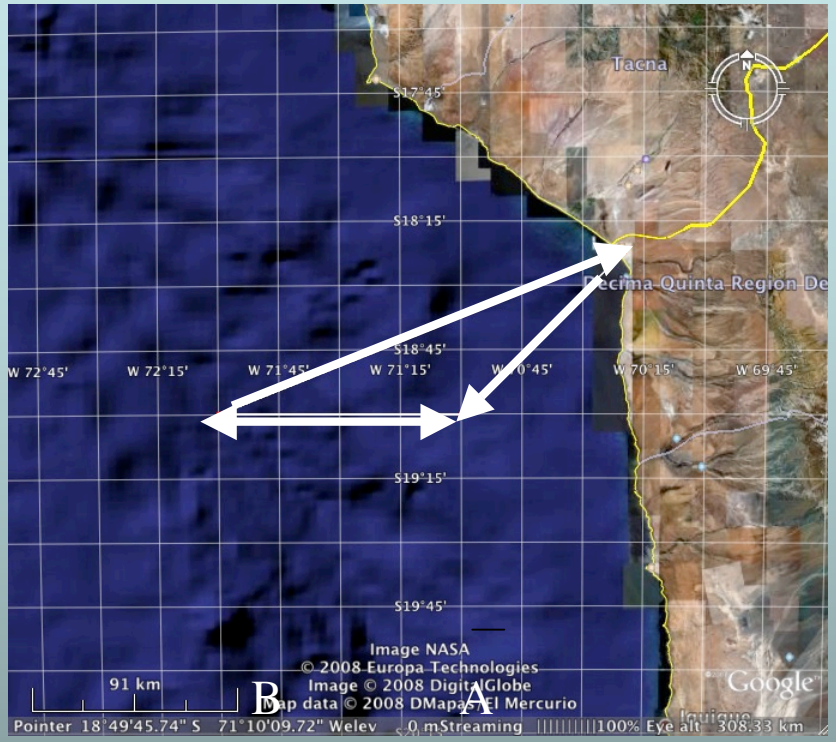
Basic flight strategy

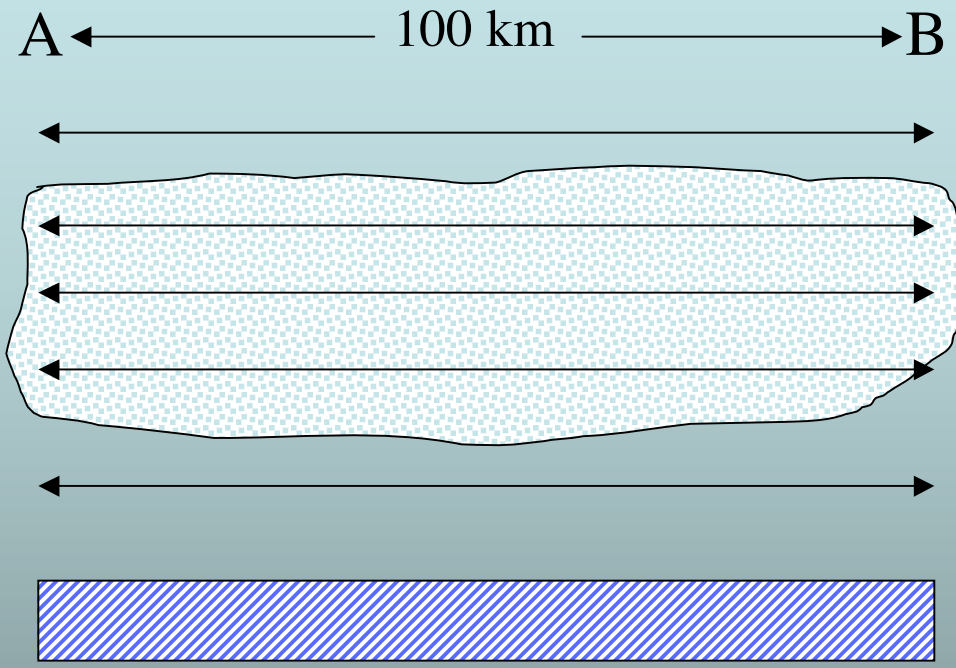
1. Below cloud leg(s) to measure aerosol composition, size distribution, CCN spectra, vertical velocities and their variability.

2. Multiple altitude in-cloud legs to measure measure cloud microphysical properties and their variability both with respect to location and altitude.

3. Above cloud leg to characterize chemical and microphysical properties of above cloud air.

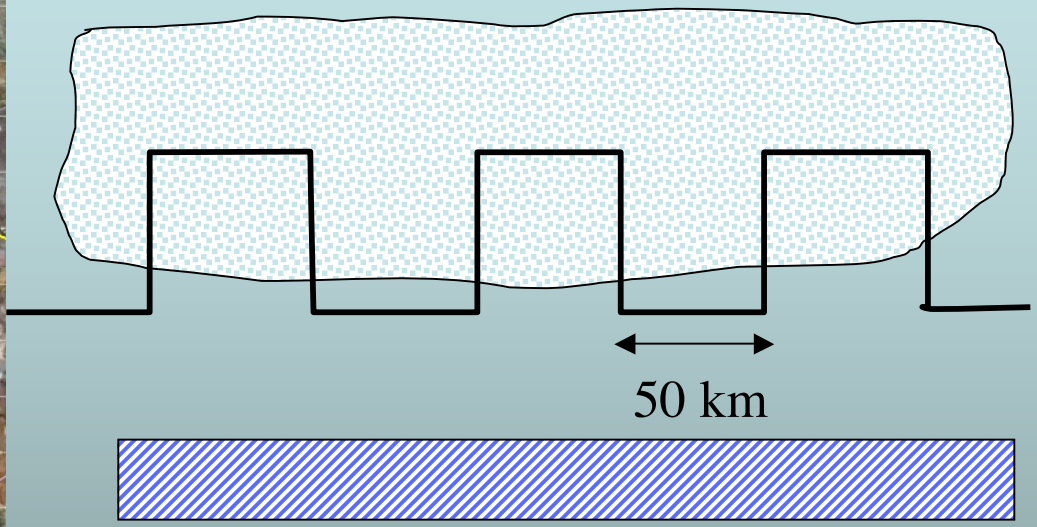
Basic Flight Plan

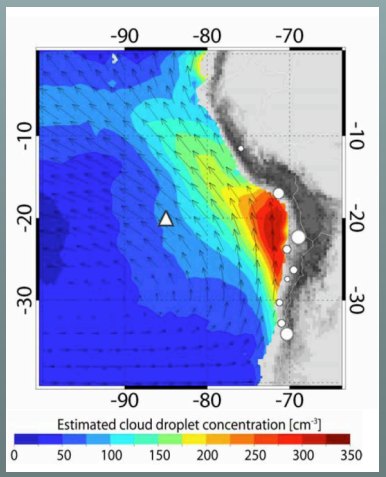




Strategy of basic flight plan is to get statistically meaningful data on properties of clouds and the conditions under which they were formed by by flying ~100 km legs below-, in- and above-cloud.

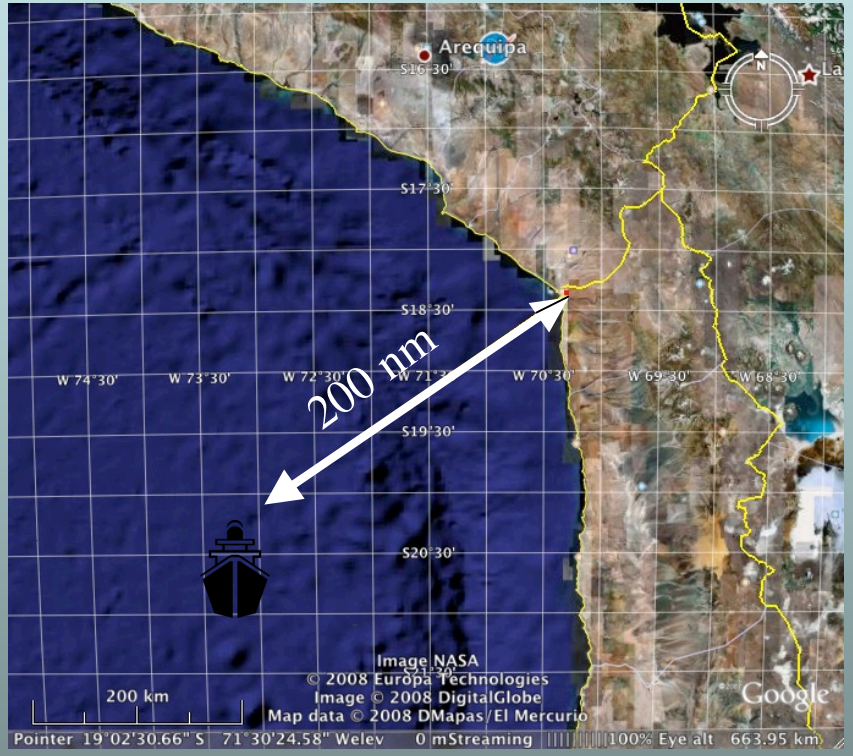
Gradient Flight Plan

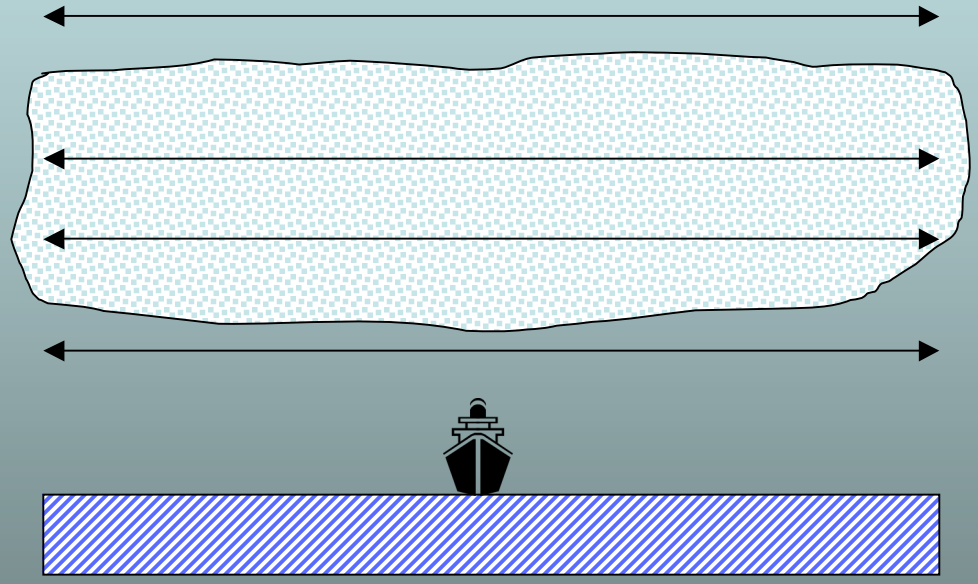




Objective is to characterize gradient in CCN and cloud microphysical properties that has been inferred from satellite measurements.

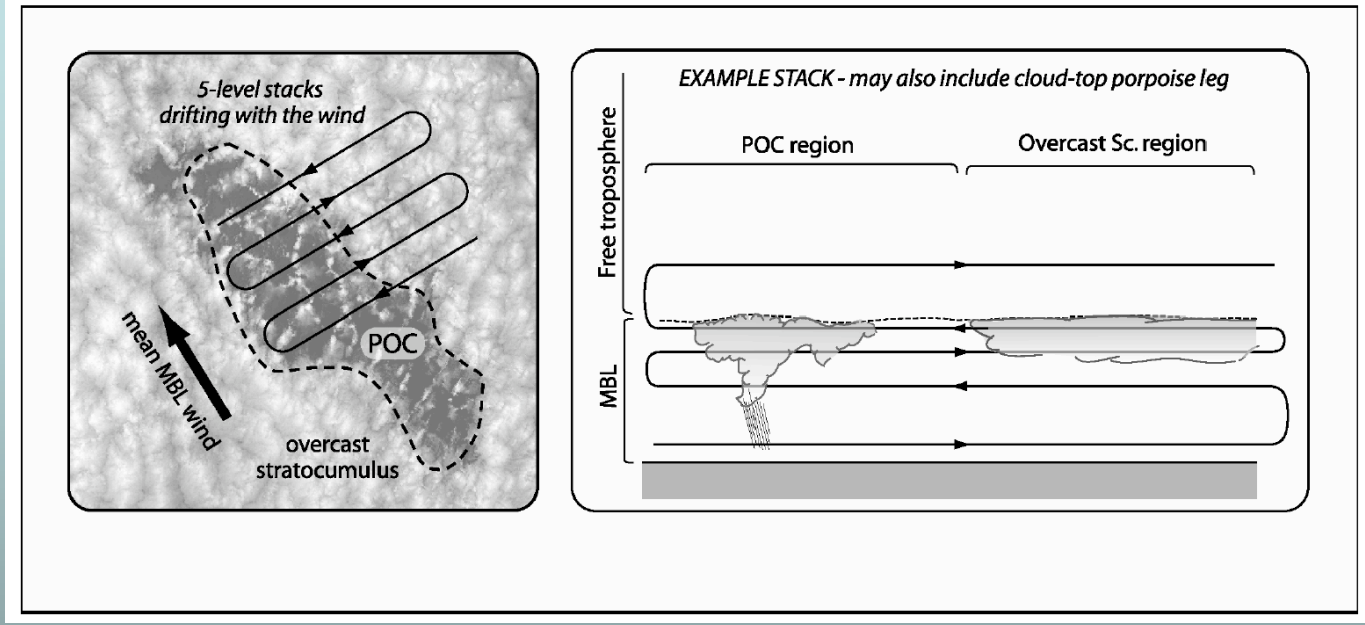
Overpass of the Ron Brown





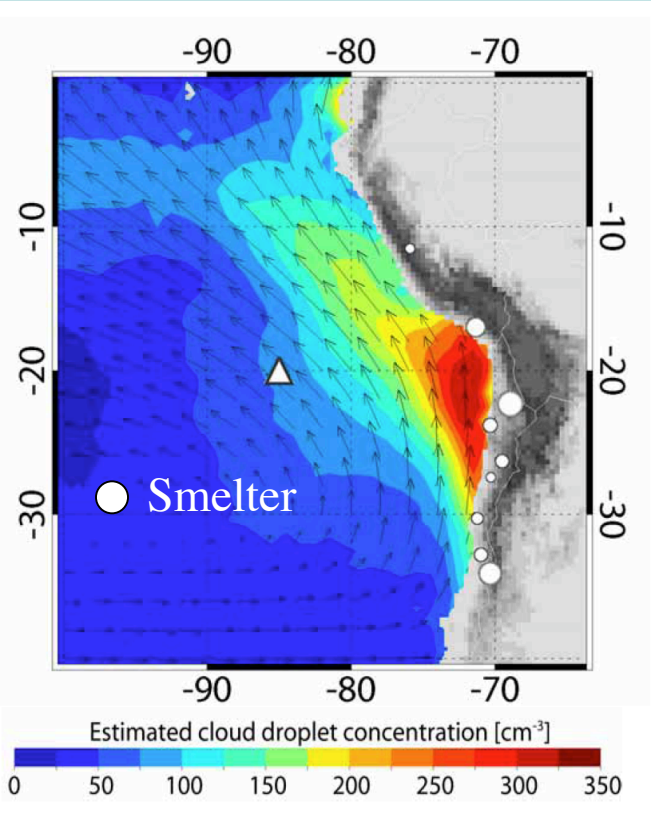
For G-1 Flight to be useful, Ron Brown must be within 200 nm of Arica. This allows 1 hr transit, 2 hrs sampling above the Ron Brown, and 1 hr transit back to Arica.

Pockets of Open Cells (POC) Flight Plan



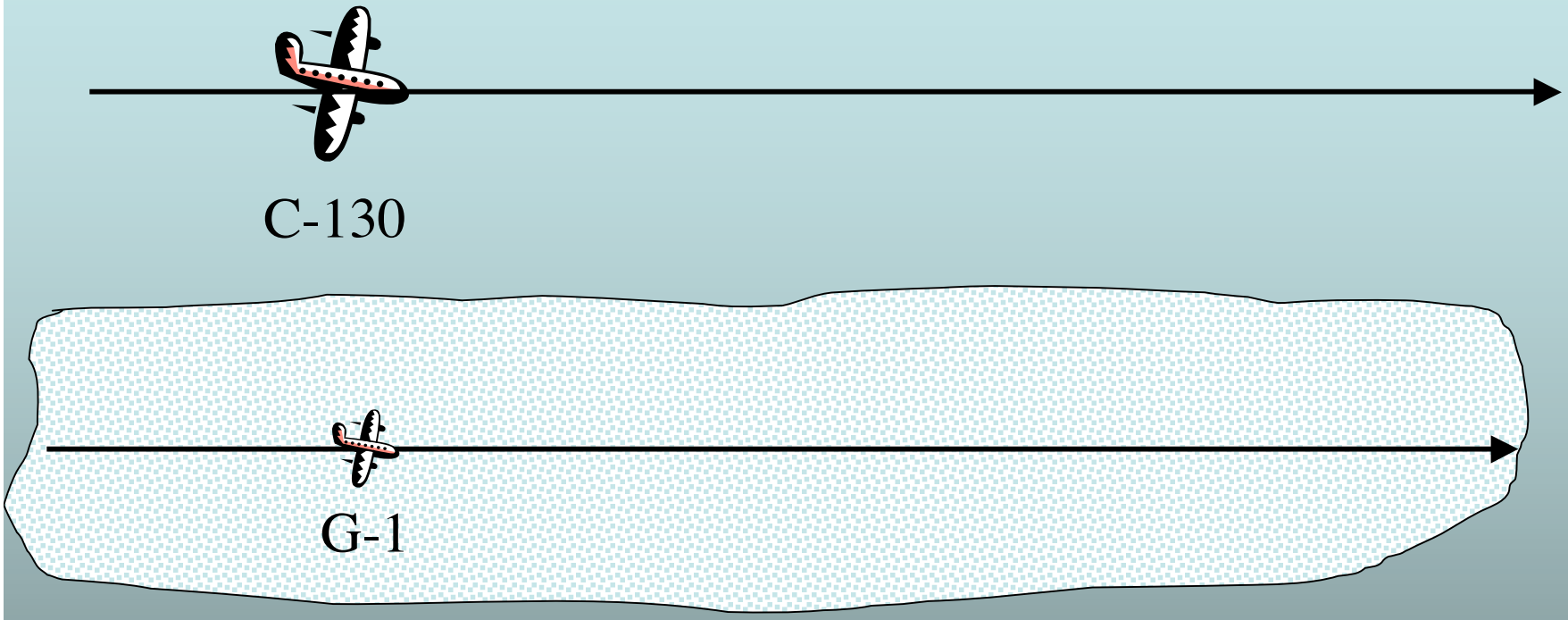
POC flights will occur primarily in collaboration with the C-130 who will locate cells and conduct initial sampling. POC's must be within ~200 nm of Arica for useful sampling to be conducted.

Smelter Plumes Flight Plan



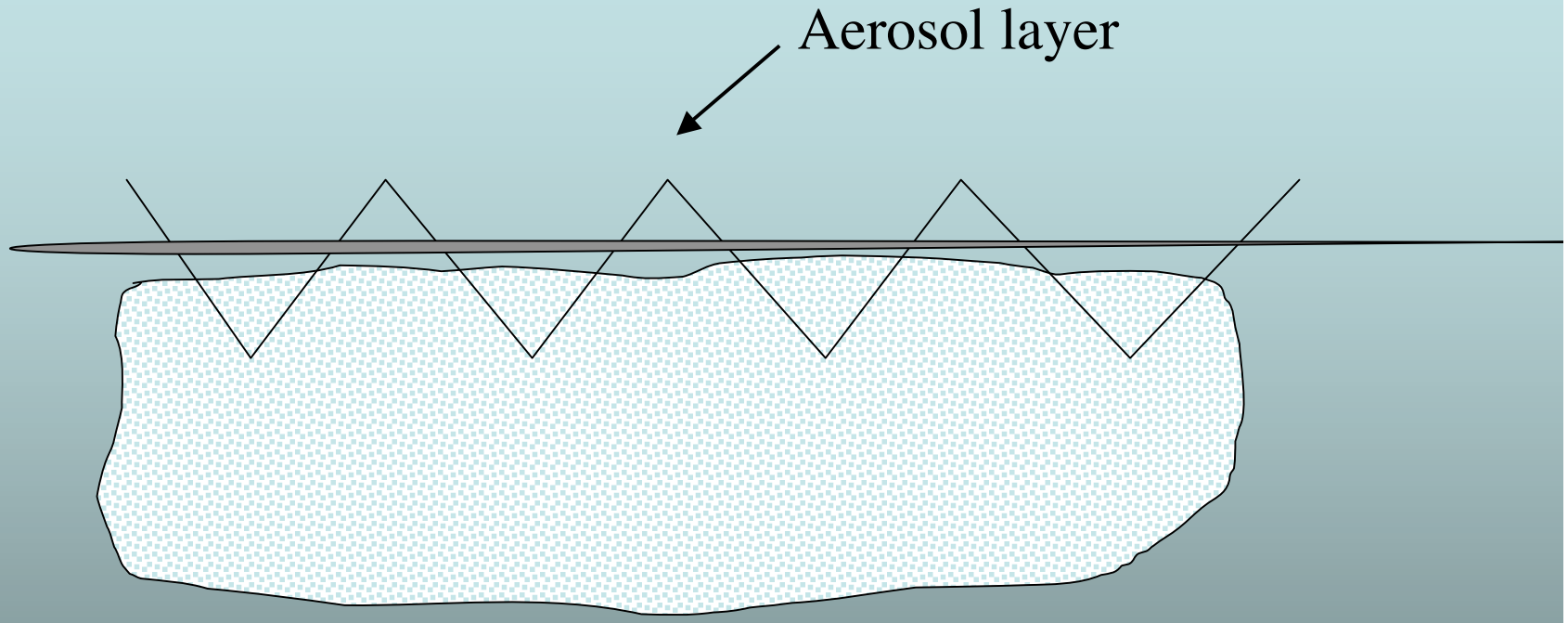
Under appropriate flow conditions, characterize in- and out-of plume cloud properties. Vertical profiles obtain information on entrainment.

Joint Flights With The C-130



Objective of these flights is to link remote sensing measurements of cloud properties by the C-130 to in-situ cloud properties measured by the G-1. Of interest are C-130 cloud radar, and radiation fields measurements. Such flights are planned to be conducted towards the end of the C-130 flights within about 200 nm of the coast.

Sampling the Interface between cloud-top and the free troposphere



Determine whether aerosol layer observed just above cloud-top during MASE is also seen in VOCALS.