The VOCALS 20S C130 flights

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with help from

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VOCALS-REx 20S flight plan

C-130 OUTBOUND

- IMET Buoy 20°S, 85°W
- westernmost point [82-85°W]

free troposphere

C-130

MBL

Co-sampling with RHB

R/V Ronald H Brown

S.E. PACIFIC OCEAN

Arica, Chile 18°S, 70°W

OTHER A/C and C-130 RETURN

- IMET Buoy 20°S, 85°W
- westernmost point [82-85°W]

free troposphere

C-130

MBL

BAe-146

Return leg 7-8 km

R/V Ronald H Brown

S.E. PACIFIC OCEAN

Arica, Chile 18°S, 70°W
The 20S missions sampled across the diurnal cycle near the coast.

85W: 4 C130 flights
~80W: 10 C130 flights
5 BAe flights
The 20S missions covered a representative range of cloud conditions
Inversion height

~1000 m near coast

~1600 m at 85W, except RF02 (900 m), RF04 (2100 m)
20S back-trajectories

75W:
Directional variability above inversion;
Coastal contact in PBL

85W:
Consistent SE flow, stronger in PBL.

850 hPa trajectories:
0-75 hPa/d subsidence; generally weaker when flow is more easterly.

[Back 2 days from 12Z of flight day; one point per day]
Above-cld humidity and downwelling LW

Very dry air offshore promotes Sc and turbulent mixing through extreme cloud-top radiative cooling.

black = before 10 UTC,
dark grey 10-14 UTC
light grey after 14 UTC
C130 Radiometric SST

Subcloud 20S Leg Mean

RSTB ≈ SST + 1°C
Droplet conc, LWC variability, drizzle

Cloud 20S Leg Mean

Drop conc. smaller offshore
LWC more variable offshore

PCASP

Drizzle-size LWC in-cloud W of 75

Only isolated near-surface drizzle

Subcloud 20S Leg Mean

2DC LWC [g m$^{-3}$]
20S radar strips (U Wyo - D. Leon) show mesoscale drizzle cells offshore
Vertical structure and decoupling

- As in RHB data, PBL becomes more decoupled offshore.

C. Terai (UW), D. Leon (UWyo)
Next steps

• Synthesize with 146 20S measurements
• 20S summary paper for model assessment on clouds, boundary layer structure, drizzle, droplet concentration.
• Extend/write up decoupling study (C. Terai, D. Leon)
Extra slides
Turbulence: std(w)

Subcloud turbulence varies more between flights (wind speed?) than between lons.
In-cloud turbulence strengthens offshore, but varies substantially between flights.
Longwave radiative flux divergence

At 80W, overall LW flux div = LWnet(above-cld)-LWnet(subcld) = (340-200) - (375-340) ~ 105 W m^{-2}

Above-cld LWdn ~190 (85W) to ~260 (coast) due to moister warmer free trop near coast.

Above-cld LWup ~330 (85W) to 365 (coast)

Subcld LWdn~340-350

Subcld LWup~375, more variable near coast (SST' in eddies?)

At 80W, overall LW flux div = LWnet(above-cld)-LWnet(subcld) = (340-200) - (375-340) ~ 105 W m^{-2}