The VOCALS 20S C130 flights

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with help from

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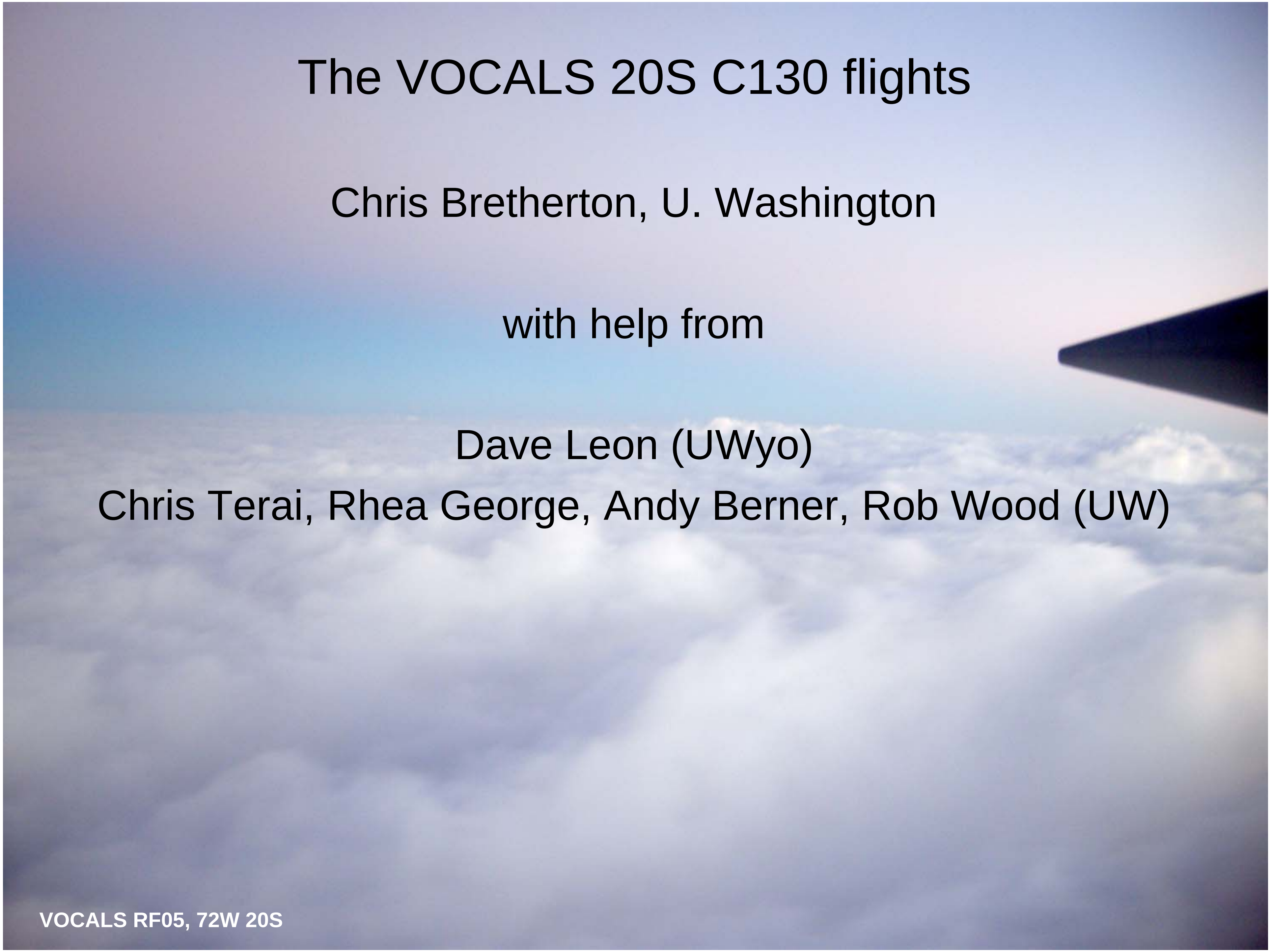
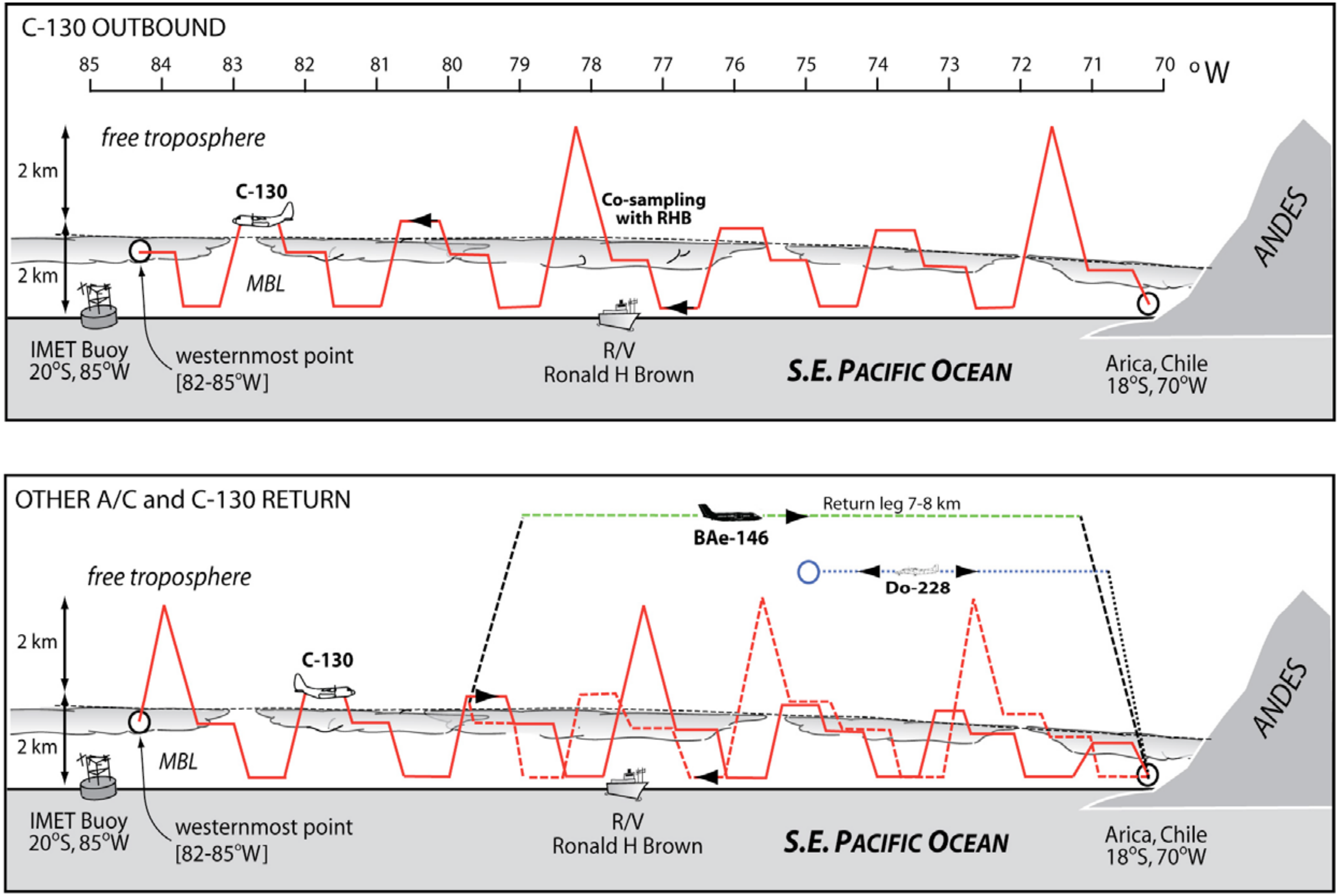
Chris Terai, Rhea George, Andy Berner, Rob Wood (UW)



VOCALS RF05, 72W 20S

VOCALS-REx 20S flight plan



20 South Cross-Section Missions - All Platforms

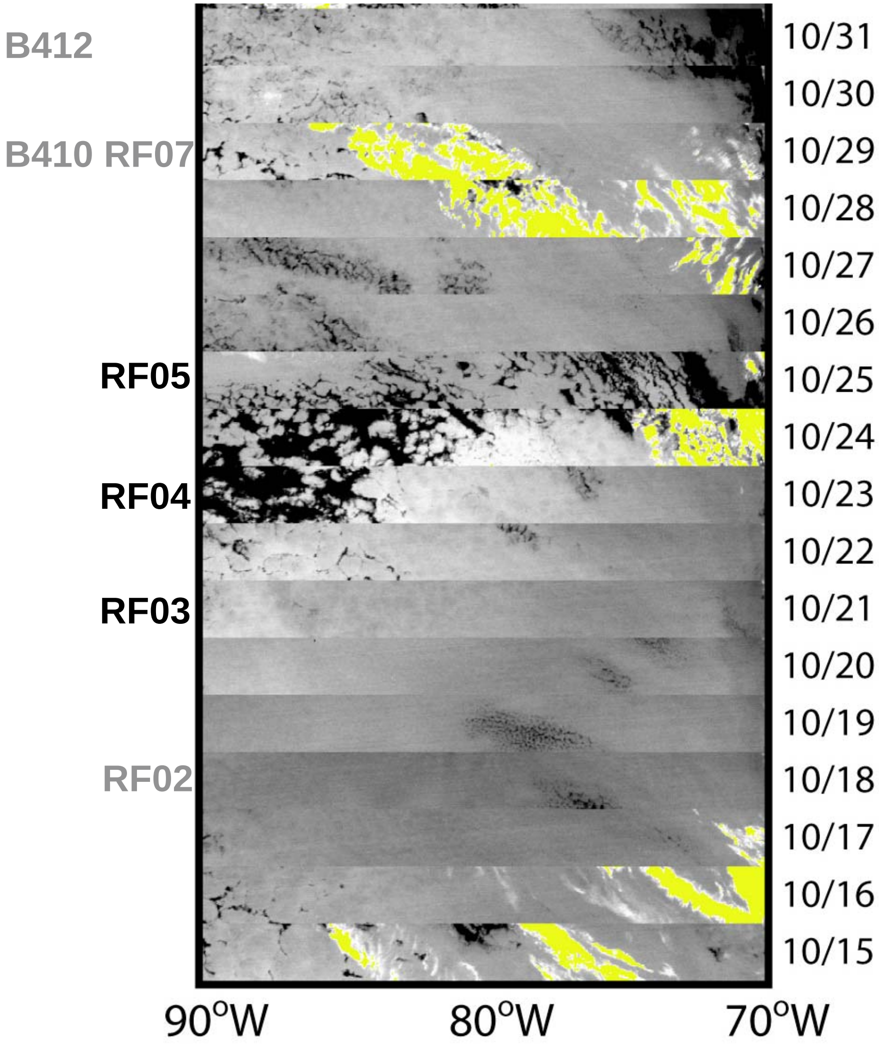
Mission	Date	Aircraft		LONGITUDE West [on 20S] 85 84 83 82 81 80 79 78 77 76 75 74 73 72 71 70	Mission#	Times for 20S data
#1	Oct 18th	C-130	OUT		RF02	13:04:09-16:09:10
		C-130	RET	No return 20S component	RF02	N/A
#2	Oct 21st	C-130	OUT		RF03	06:03:00-10:03:15
		C-130	RET		RF03	10:03:15-14:08:00
#3	Oct 23rd	C-130	OUT		RF04	05:53:00-09:50:00
		C-130	RET		RF04	09:50:00-14:20:00
#4	Oct 25th	C-130	OUT	R	RF05	06:32:24-10:58:00
		C-130	RET		RF05	11:00:20-15:25:00
#5	Oct 29th	BAe-146	OUT		B410	
		BAe-146	RET		B410	
#6	Oct 31st	C-130	OUT	No outbound 20S component	RF07	N/A
		BAe-146	OUT		B412	
		C-130	RET		RF07	12:16:00-14:58:00
		BAe-146	RET		B412	
#7	Nov 4th	C-130	OUT	No outbound 20S component	RF09	N/A
		BAe-146	OUT		B414	
		Do-228	OUT		VA07	
		C-130	RET		RF09	12:24:50-15:19:00
		BAe-146	RET		B414	
		Do-228	RET		VA07	
#8	Nov 6th	C-130	OUT		RF10	06:10:14-10:09:00
		C-130	RET		RF10	10:09:00-14:19:00
#9	Nov 9th	BAe-146	OUT		B417	
		BAe-146	RET		B417	
#10	Nov 13th	C-130	OUT		RF13	13:00:00-15:44:10
		BAe-146	OUT		B420	
		C-130	RET	No return 20S component	RF13	N/A
		BAe-146	RET		B420	
#11	Nov 15th	C-130	OUT		RF14	13:00:00-15:48:00
		C-130	RET	No return 20S component	RF14	N/A

Time Key	Time [local]	Time [UTC]
	3-4	6-7
	5-6	8-9
	7-8	10-11
	9-10	12-13
	11-12	14-15
	13-14	16-17
	15-16	18-19

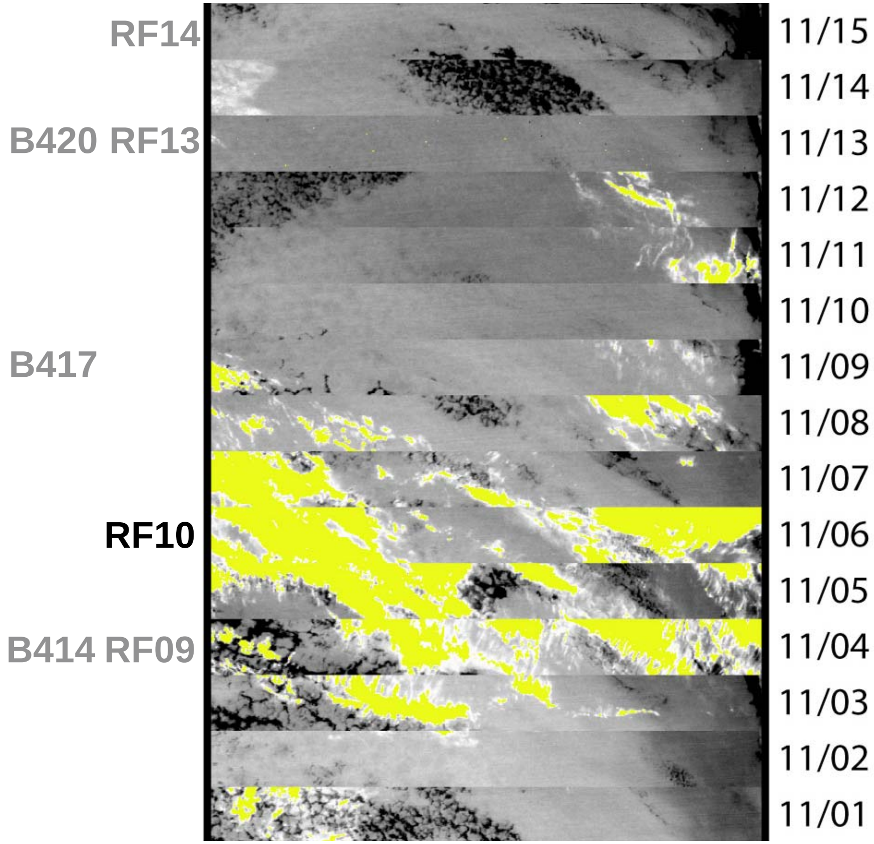
The 20S missions sampled across the diurnal cycle near the coast.

85W: 4 C130 flights
~80W:10 C130 flights
5 BAe flights

20S IR strip charts (0845 UTC = early morning)



Rob Wood

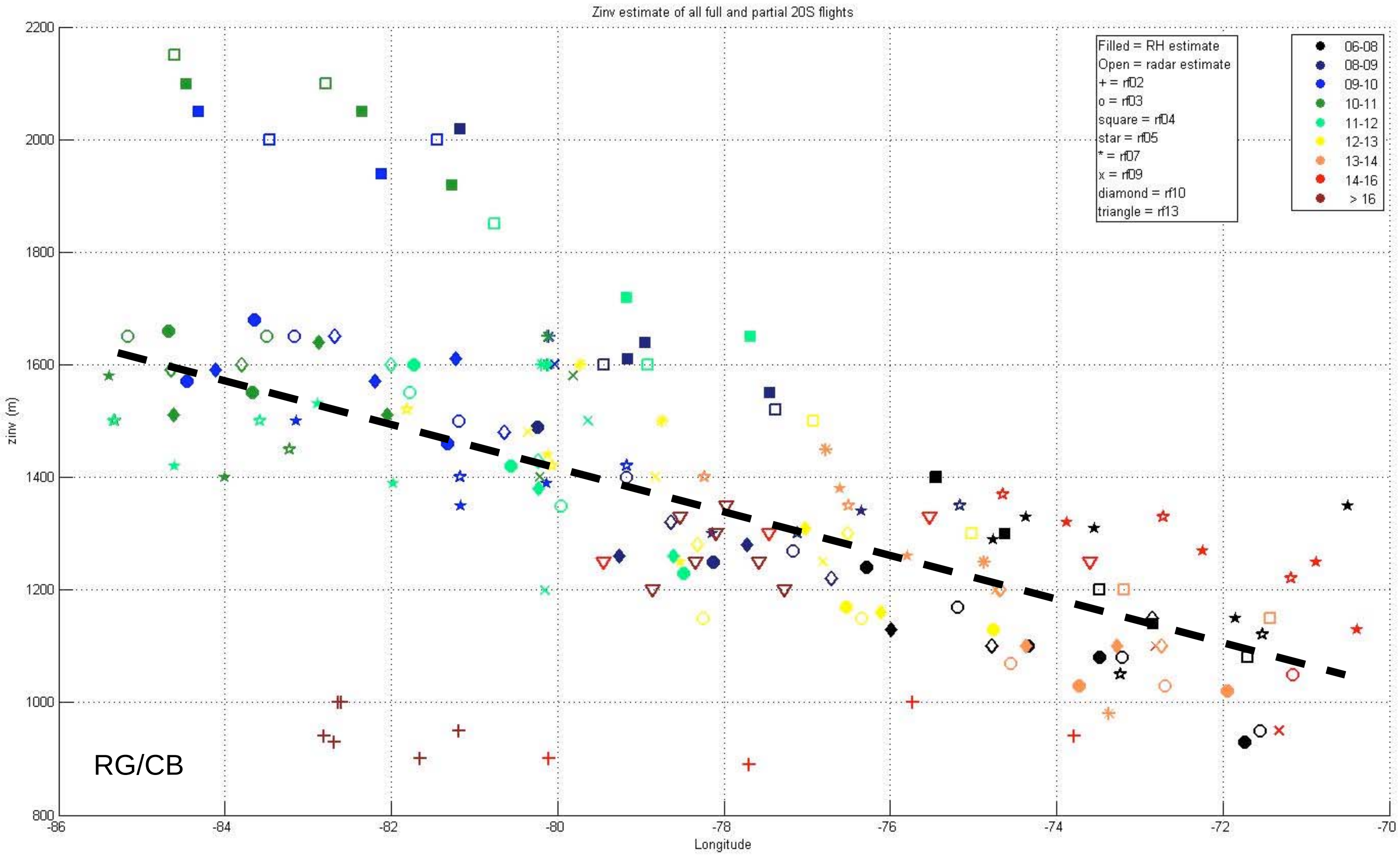


The 20S missions covered a representative range of cloud conditions

Inversion height

~1000 m near coast

~1600 m at 85W, except RF02 (900 m), RF04 (2100 m)

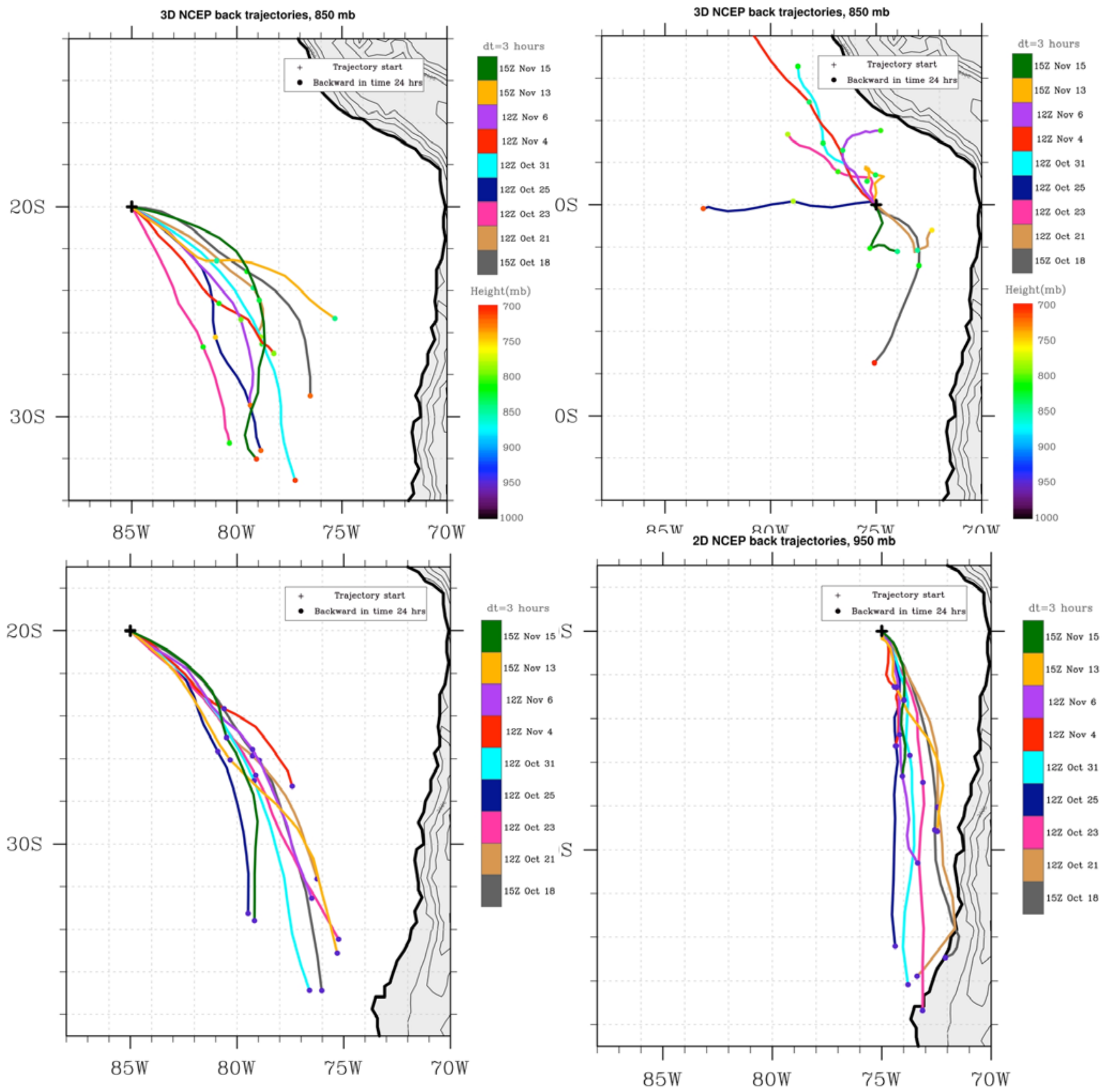


20S back-trajectories

<u>75W</u>:
Directional variability above inversion;
Coastal contact in PBL

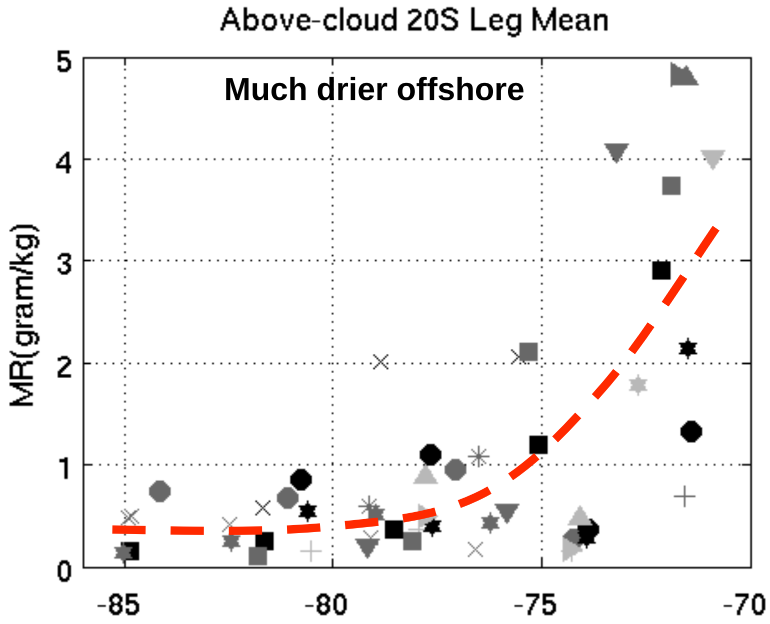
<u>85W</u>:
Consistent SE flow, stronger in PBL.

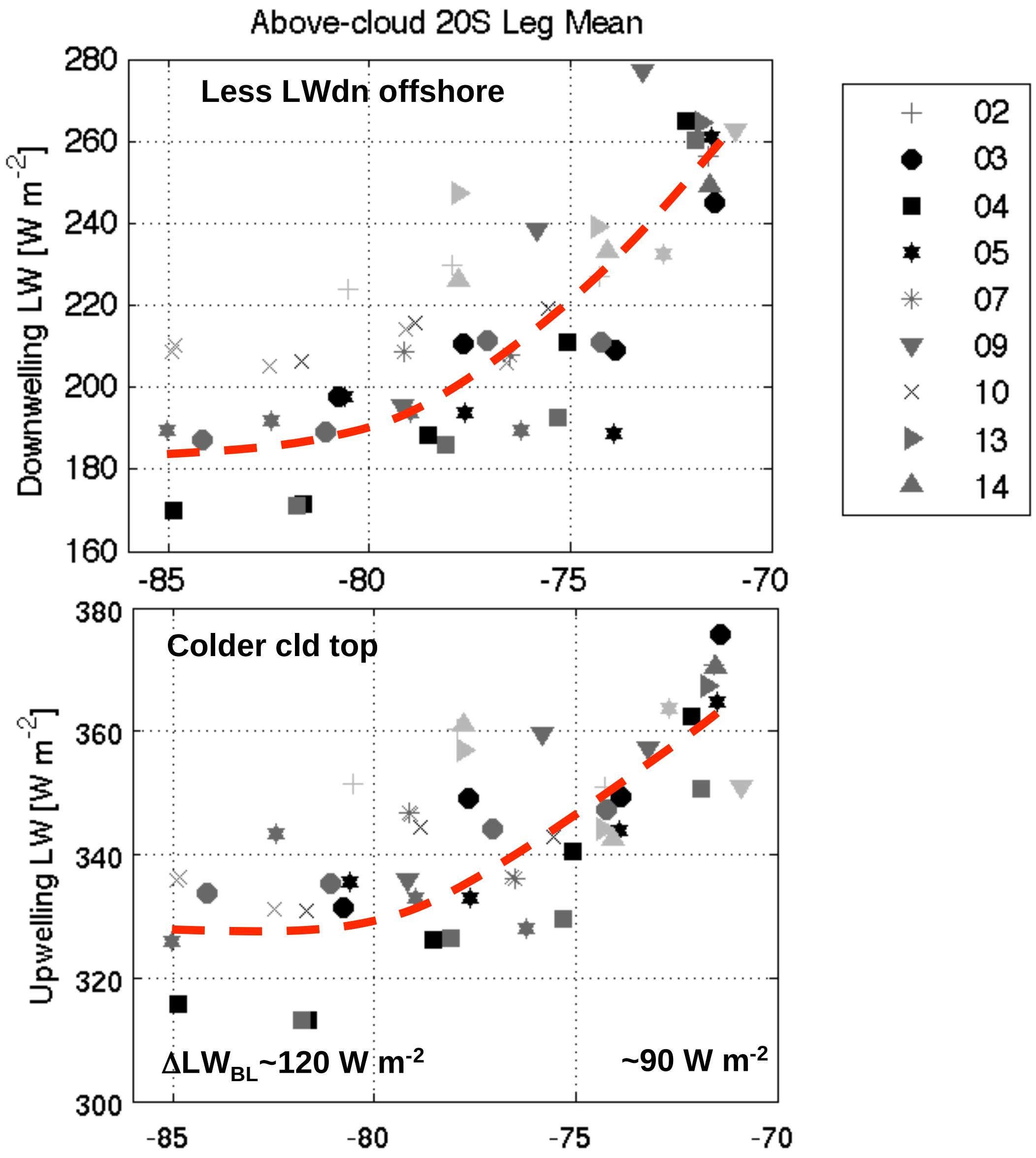
<u>850 hPa trajectories</u>:
0-75 hPa/d subsidence; generally weaker when flow is more easterly.



[Back 2 days from 12Z of flight day; one point per day]

Above-cld humidity and downwelling LW

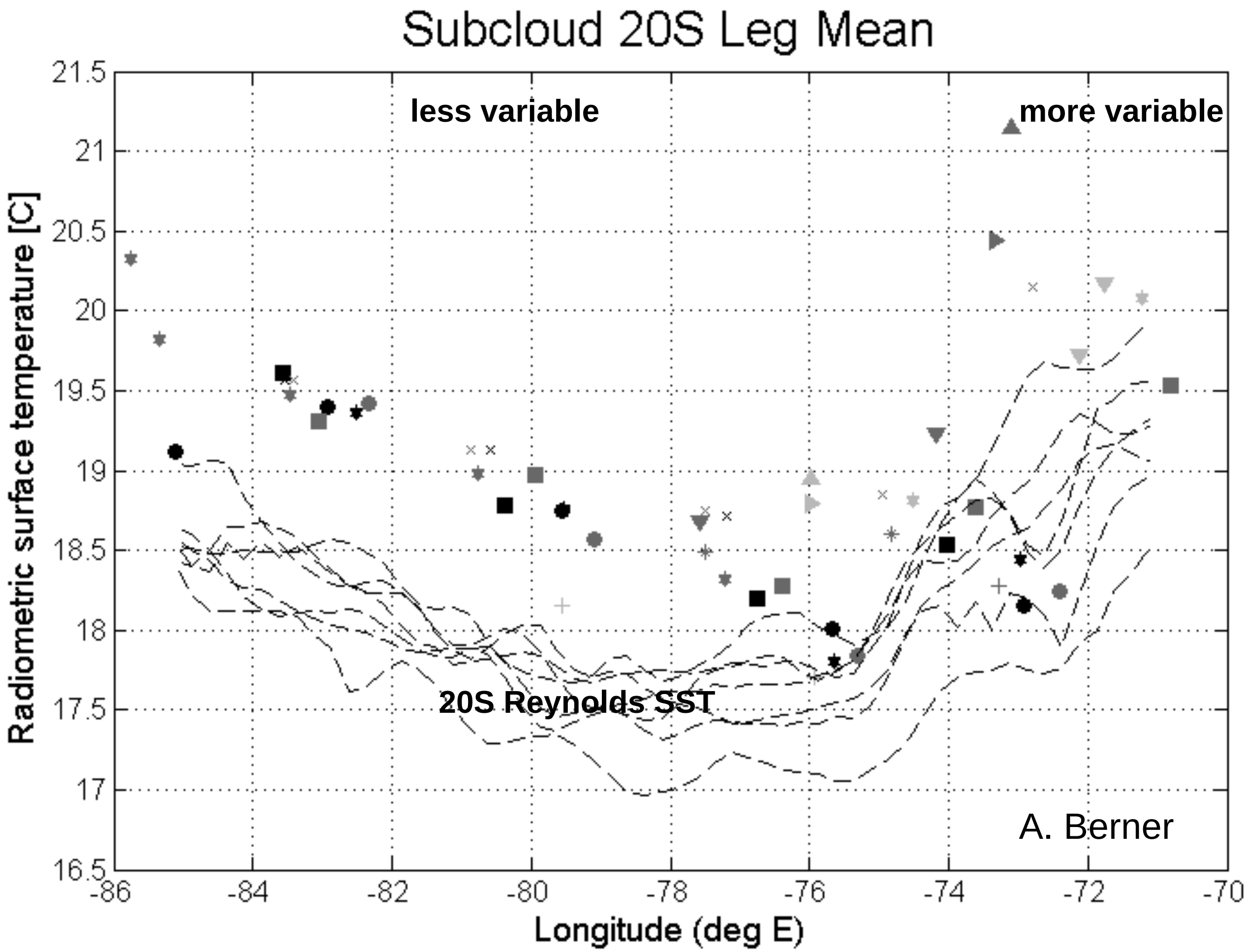




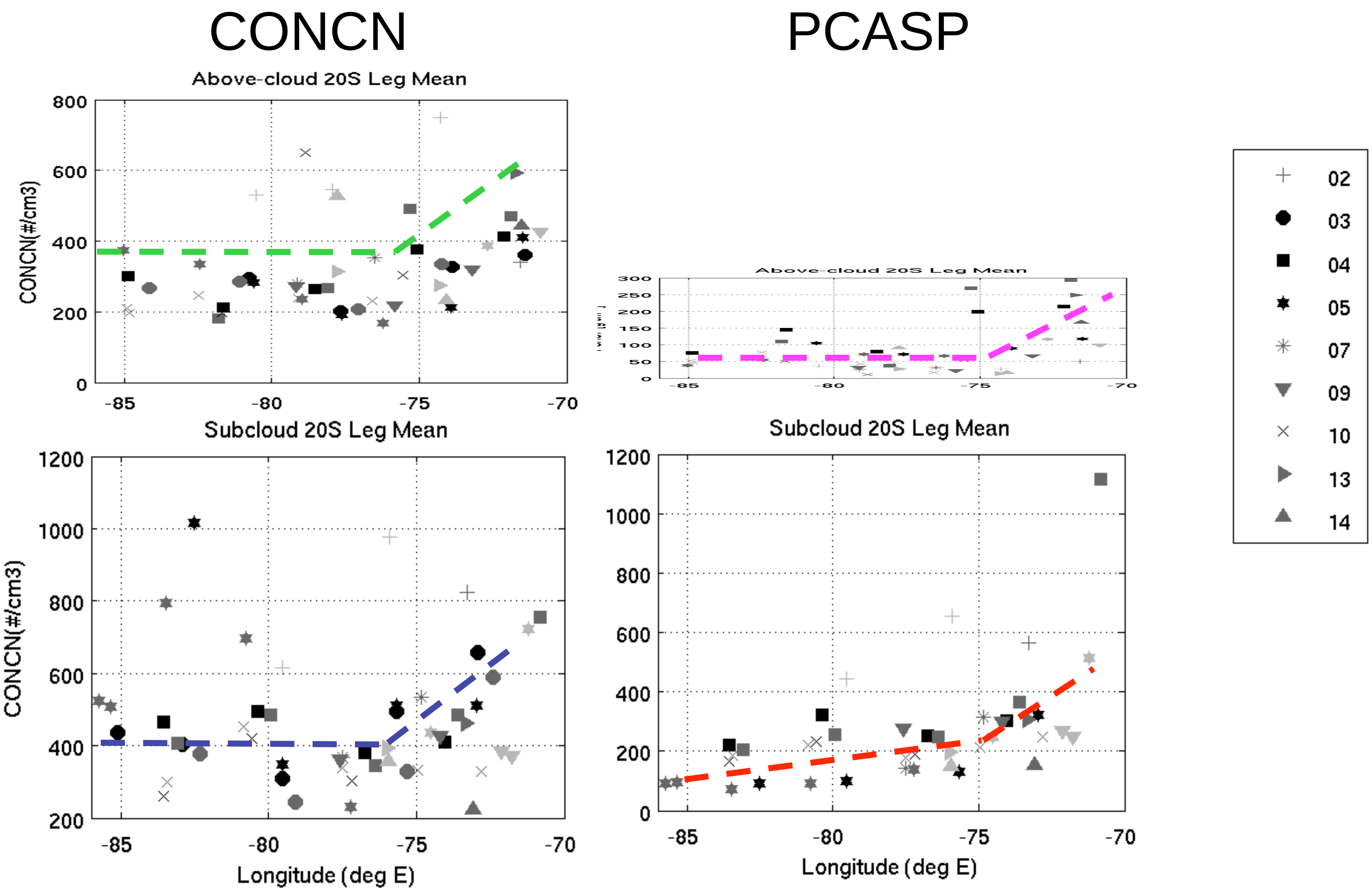
Very dry air offshore promotes Sc and turbulent mixing through extreme cloud-top radiative cooling.

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

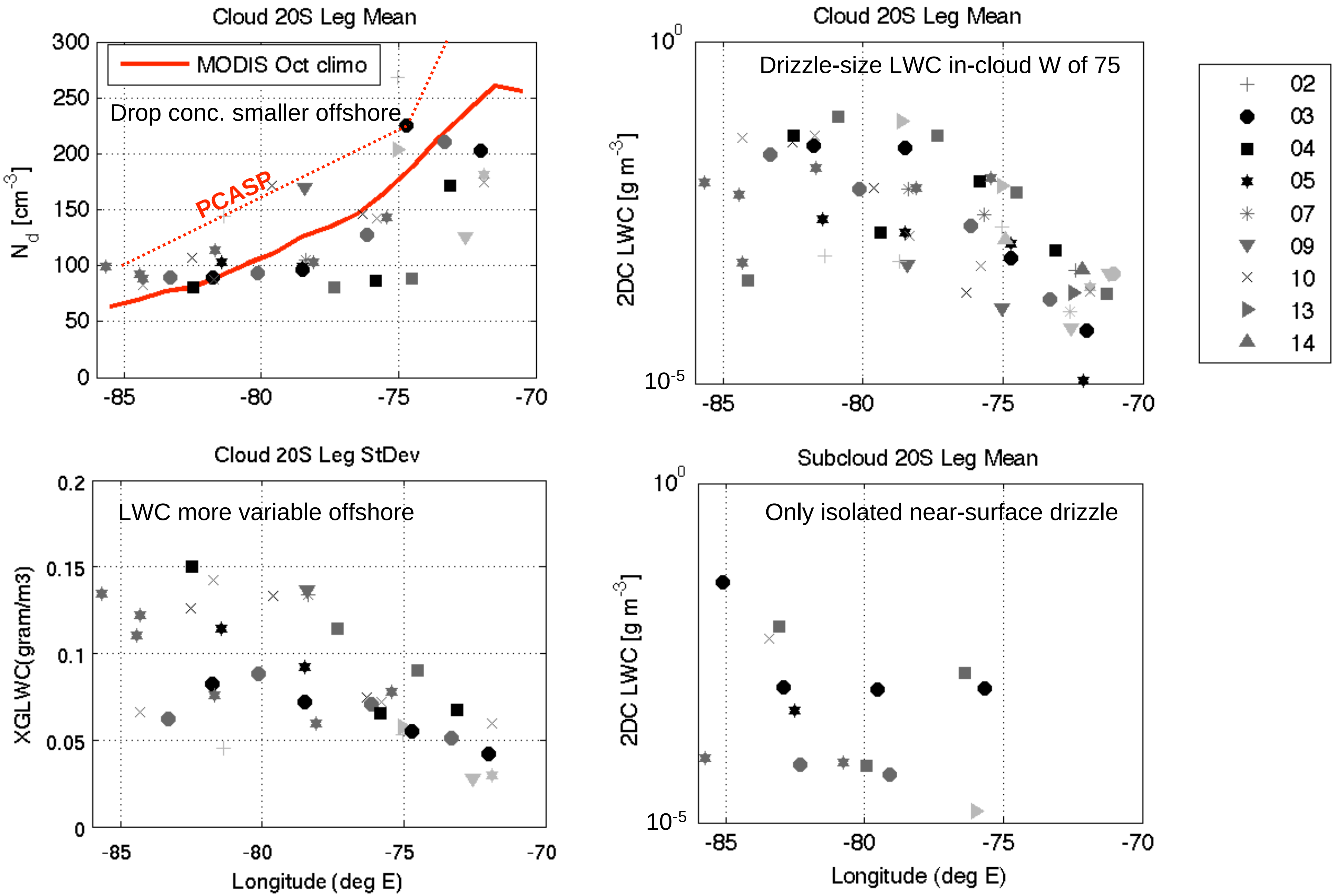
C130 Radiometric SST



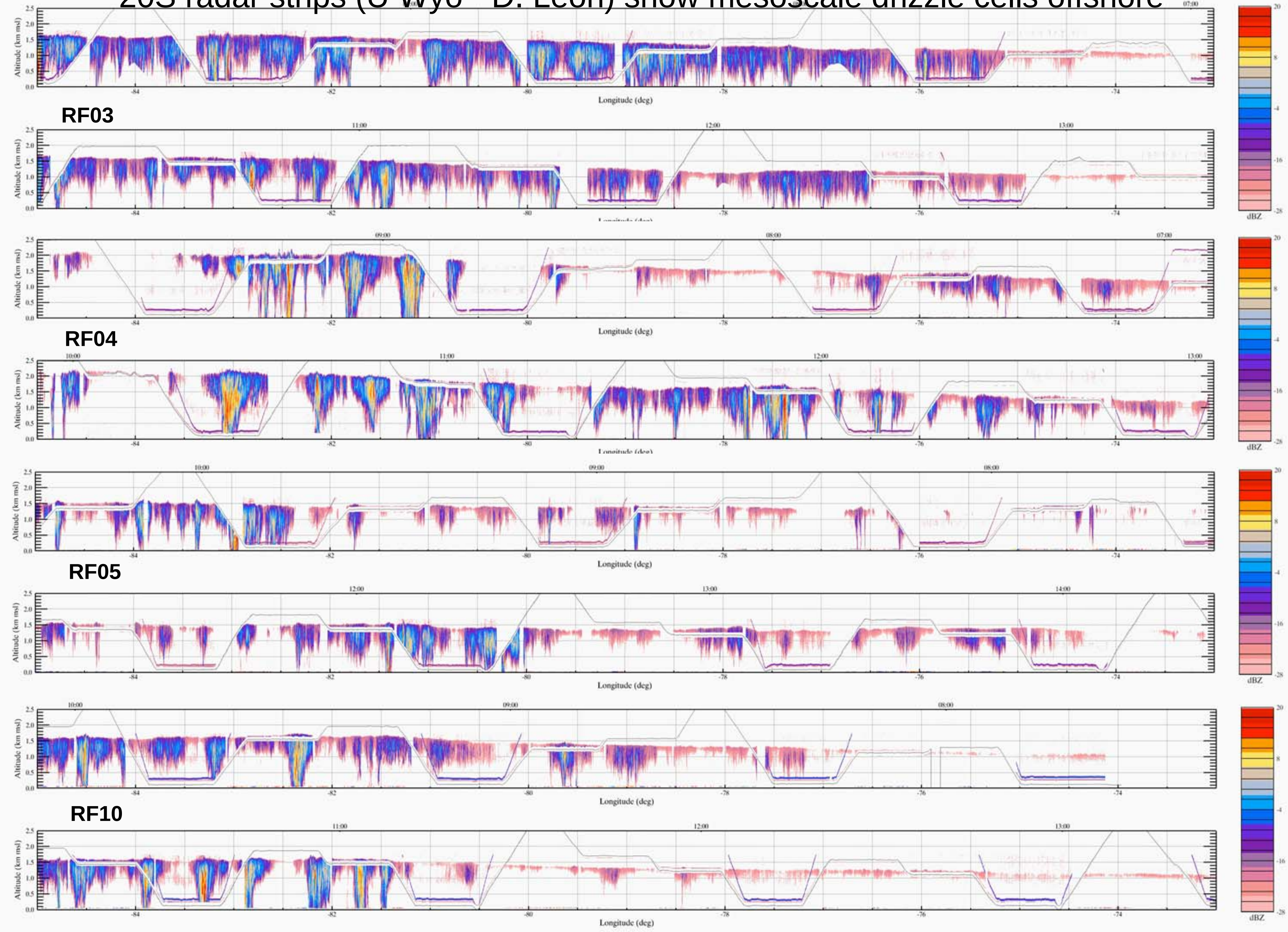
RSTB ≈ SST + 1 C


CONCN
PCASP
Above-cloud 20S Leg Mean
CONCN(#/cm3)
800
600
400
200
0
-85
-80
-75
-70
Subcloud 20S Leg Mean
1200
1000
800
600
400
200
CONCN(#/cm3)
Longitude (deg E)
Above-cloud 20S Leg Mean
300
250
200
150
100
50
0
Subcloud 20S Leg Mean
Longitude (deg E)
02
03
04
05
07
09
10
13
14

Droplet conc, LWC variability, drizzle

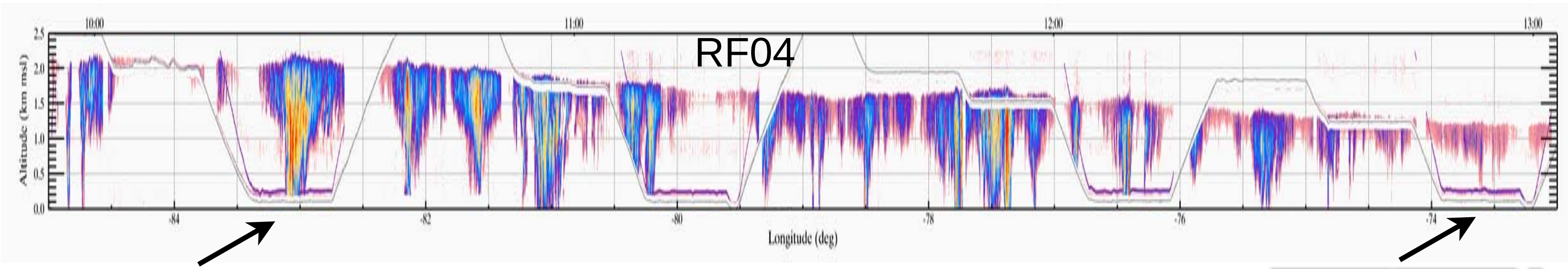


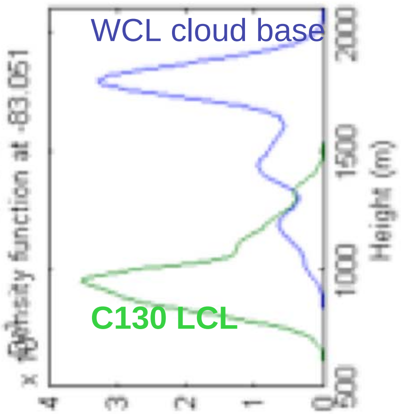
20S radar strips (U Wyo - D. Leon) show mesoscale drizzle cells offshore



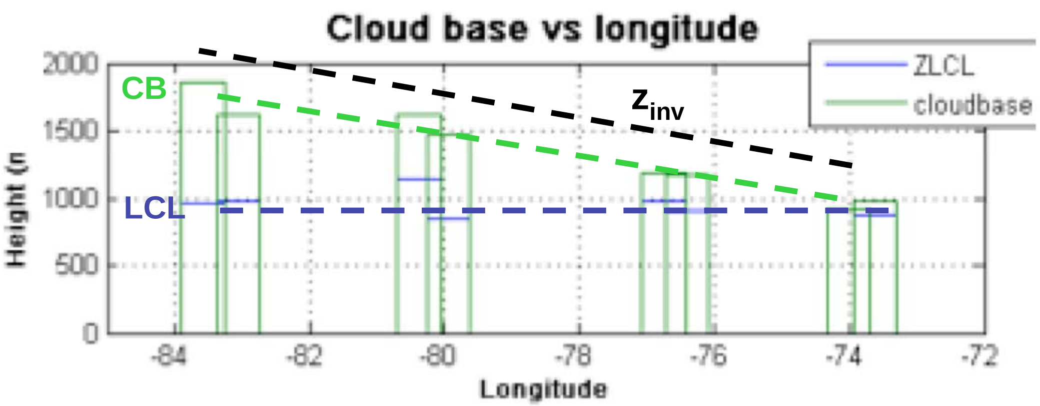
Vertical structure and decoupling

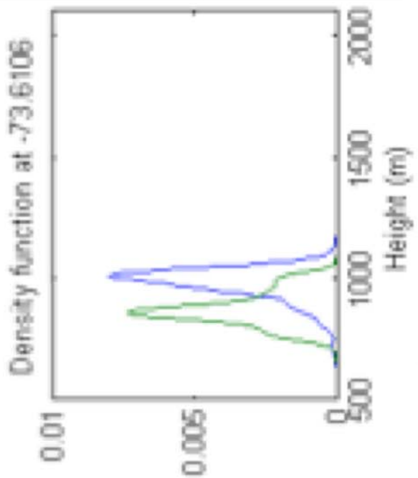
- As in RHB data, PBL becomes more decoupled offshore.





Decoupled
CB >> LCL





Nearly well-mixed
CB ≈ LCL

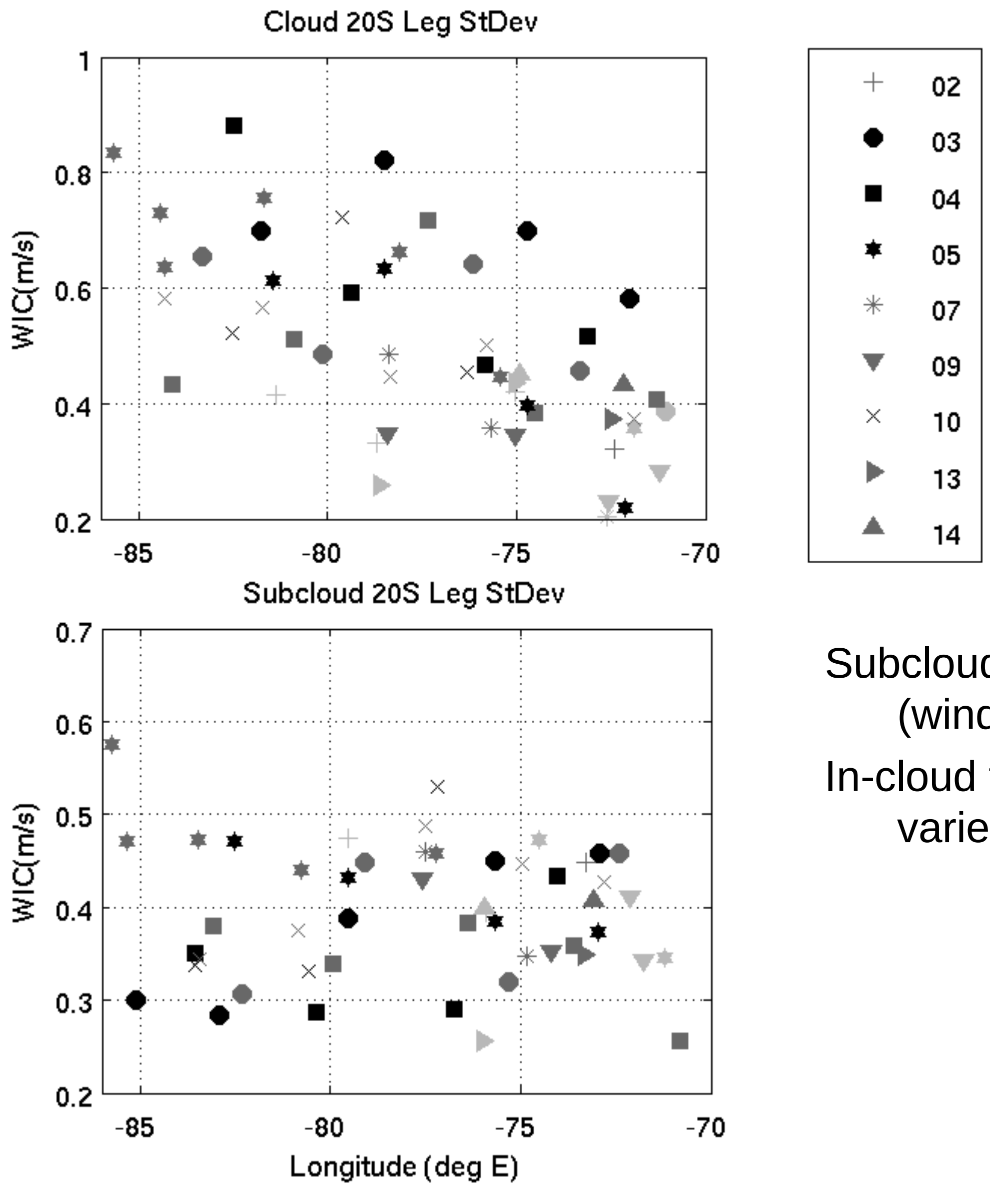
C. Terai (UW), D. Leon (UWyo)

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

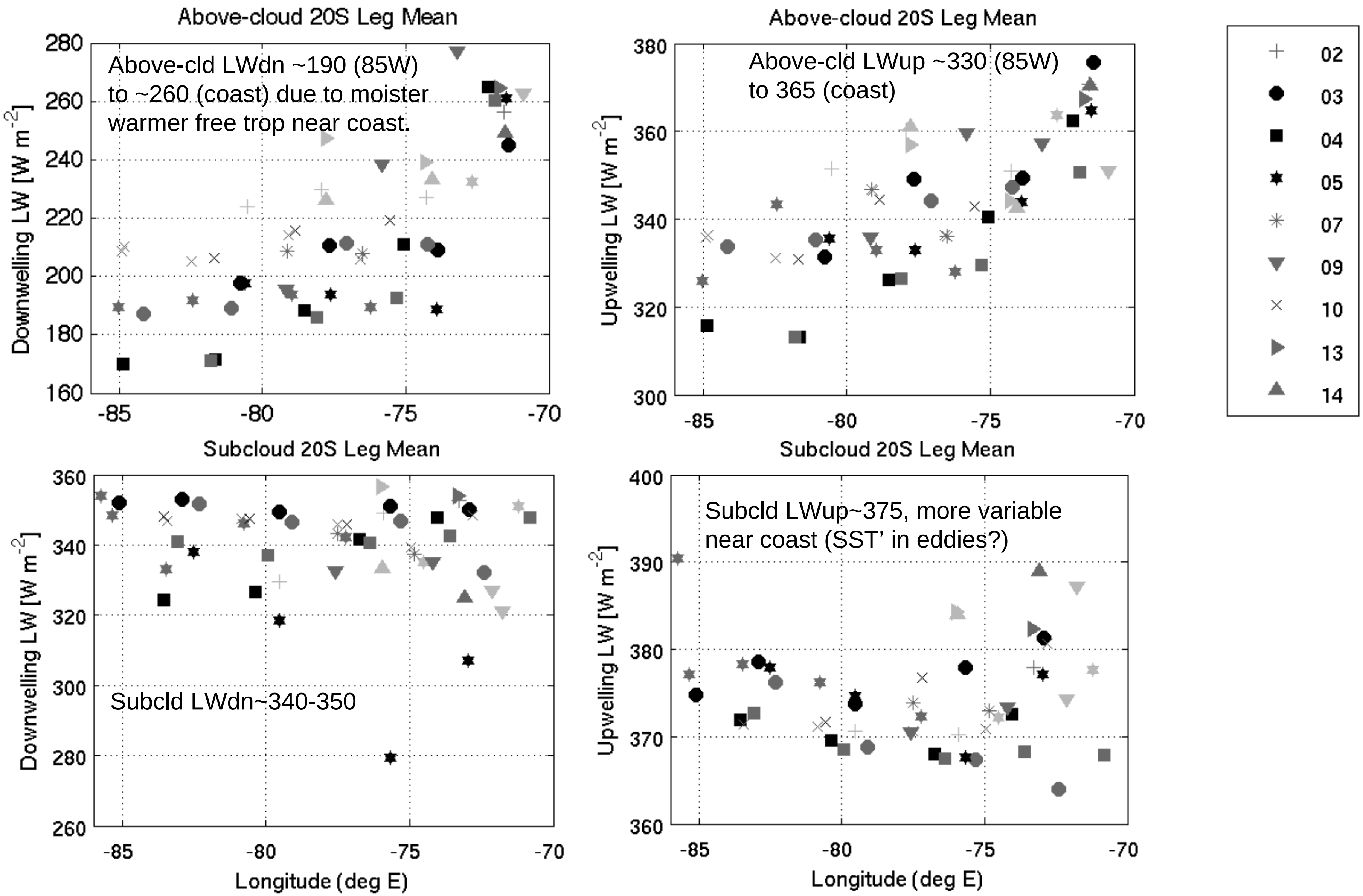
Turbulence: std(w)



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}