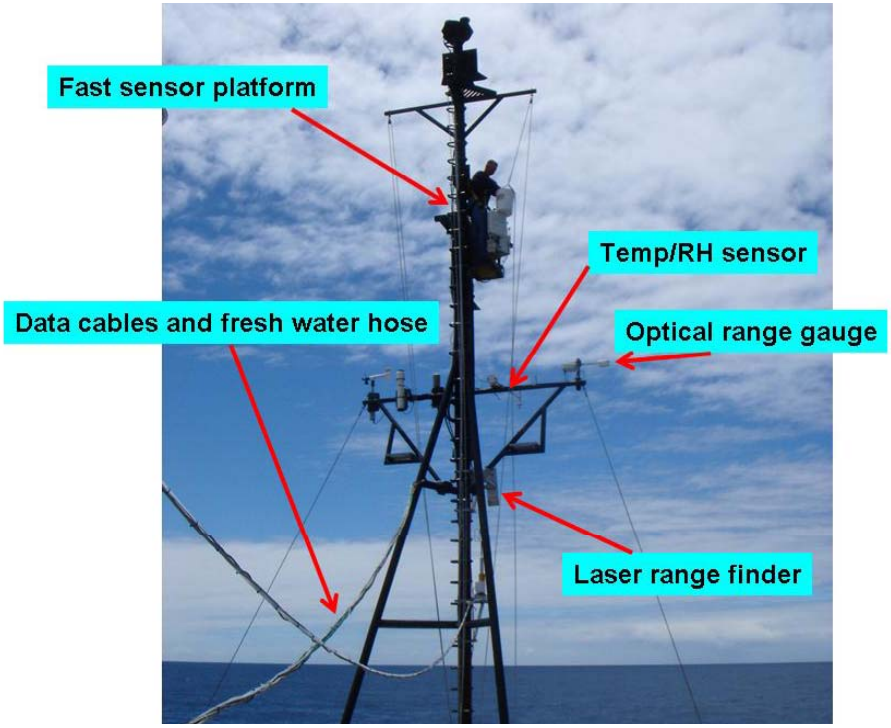
Air-Sea Science Objectives

- Interface, near-surface
  - Diurnal warm layers
  - Eddy covariance intercomparisons (include CO2)
  - Bulk flux relationships
  - Wave aspects – breaking & CO2, aerosol production, wind-stress
- Boundary layer and Convective dynamics
  - Warm-layers as triggers for convection
  - BL coupling to surface properties – updrafts/downdraft, precipitation, divergence-entrainment (isotopic analysis)
  - Links to mesosale (diurnal and isotopic)
- Ocean mixing processes

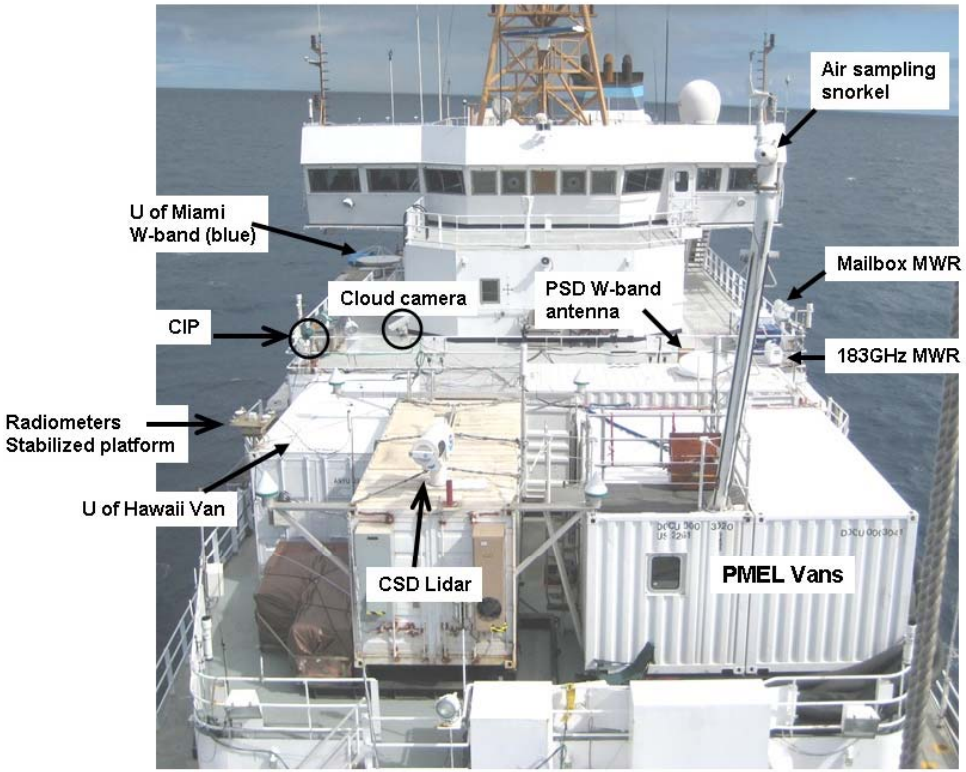
R/V Revelle Atmospheric Sensors

- Fluxes and Near-Surface Meteorology – Uconn (Edson), ESRL/PSD (Fairall), OSU (deSzoeke)
- C-band Radar – CSU (Rutledge)
- W-band Radar – ESRL/PSD (Fairall)
- Microwave Radiometer – U Miami (Zuidema)
- Doppler Lidar – ESRL/CSD (Brewer)
- Water isotopic composition – CSU (Noone/Kurita)
- Wind Profiling Radar – NCAR (Brown)
- Balloon Sounding System - NCAR (Brown)
- Surface waves – Columbia U (Zappa)
- UAV – Scripps (Melville)

Example from VOCALS 2008 Field Program



Flux and near-surface meteorology sensors on the jactstaff



Seatainer laboratories on Ron Brown during VOCALS 2008. The PMEL, CSD Lidar, and PSD W-band vans will go on DYNAMO

Air-Sea Measurements R/V Revelle

Item	System	Measurement	Freq	Institution
1	Sonic anemometer/thermometer	Small-scale winds	10 / sec	ESRL/UConn/UH
2	Motion measurement	Motion correction	10 / sec	ESRL/UConn/UH
3	IR fast H_2O/CO_2 (open-path)	Water vapor / CO_2	10 / sec	ESRL/UConn/LDEO
4	Mean sea surface temperature	SST	1 / min	ESRL
5	Mean air temperature / humidity	T & RH	1 / min	ESRL
6	Pyranometer / Pyrgeometer	Solar & IR Radiance	1 / min	ESRL
7	IR laser wave sensor	Wave height	10 / sec	ESRL
8	Rain gauge	Rain rate	1 / min	ESRL
9	GPS	Course, speed	1 / sec	ESRL
10	IR laser ceilometer	Cloud base height	1 / minute	ESRL
11	IR fast CO_2 sensor (closed-path)	Carbon dioxide	10 / sec	LDEO
12	SCS	Sea and met data	1 / sec	NOAA/*Revelle*
13	Thermosalinigraph	T, salinity	1 / sec	NOAA/*Revelle*
14	Air and sea CO_2 fugacity	fCO_2	1 / 15 min	NOAA/AOML
15	Surface Waves	Sigh, 2-D spec	10-min	LDEO
16	Water Isotopes	Vapor, sea, rain	3/s;…	Univ Co;
17	Aerosol concentration/flux	C, wc	1-min	PMEL

	R. Revelle	Mirai	S. Kanya
Instrument/measurement			
BOUNDARY LAYER			
radiosondes	3 hr (SOP) and 6 hr (IOP)	3 hr	6 hr
Doppler C-band radar	Continuous	Continuous	
Doppler W-band radar	Continuous	Continuous	
scanning Doppler lidar (HRDL)	20 min turbulence, winds	Continuous	
Mie-scattering Lidar	Continuous	Continuous	
wind profiler (915 MHz)	10 min	-	
ceilometer	20 sec	1 min	
Aerosol optical depth, Microtops	1 hr	10 min	
MAX-DOAS		Continuous	
video sondes		15 times	
water vapor / (ozone) sondes		15 times	
SURFACE			
UAV SST imaging	20 km radius of ship, 2/day		
Infrared Surface Radiometer (skin SST)		10 min	
surface met/bulk flux	10 min	10 min	1 min
turbulent flux	10 min	10 min	
Solar/IR radiometer	10 min	10 min	
Microwave radiometer	20 sec		
Ozone UV absorbance	1 min		
OS2, Pulsed fluorescence	1 min		
radon	13 min		
Aerosol chemistry, Q-AMS	5 min		
Aerosol chemistry, Impactors	4-12 hrs		
Aerosol light scatt &absorption	1 min		
Total particle number CNC	1 sec		
Aerosol number size distribution	5 min		
Stable water isotope		10 min	
GPS water vapor	10 min	10 min	
Surface wave properties WAMOS radar	10 min directional spectra		
Scanning surface lidar	continuous		
Video imaging of sea surface	continuous		

	R. Revelle	Mirai	S. Kanya
Instrument/measurement			
SUBSURFACE			
CT chain upper 5 m	1 sec		
120 kHz echosounder (150m)	1 sec		
Chameleon turbulence profiler (200m)	8-10 per hour		
Radiant heating, I(z)	1 / day, noon		
CTD	1 / day, noon	3 / 6 hr (500m)	6 hr
ADCP	5 sec (500m)	5 min (16 m bin / 40 layers)	5 min (300m)
TSG	1 min	1 min	1 min
SST	1 min	1 min	1 min
Sea-Soar			
water sampling (biogeochemical analysis)	1 / day, noon	3 / 6 hr	6 hr
MPN (Multiple Plankton Net)			Mid-day & mid-night

Action Points

*Need for intercomparison periods for ships
*Possible coordination S Kanya bulk met obs