

TROPICAL ATMOSPHERE-OCEAN (TAO) PROGRAM

FINAL CRUISE REPORT

KA-07-05

September 12, 2007 – November 2, 2007

Area: Equatorial Pacific between 9°N and 5°S latitude along the 140°W Meridian and 8°S to 8°N Latitude along 125°W Meridian.

Itinerary:

KA-07-05	<i>Ford Island, Hawaii</i>	DEP	<i>September 12, 2007</i>
	<i>Nuka Hiva, Marqueses</i>	ARR	<i>October 4, 2007</i>
	<i>Nuka Hiva, Marqueses</i>	DEP	<i>October 8, 2007</i>
	<i>Portland, Oregon</i>	ARR	<i>November 2, 2007</i>

CRUISE DESCRIPTION

The Tropical Atmosphere Ocean (TAO) array consists of 70 buoys utilizing a taut line mooring configuration used to mount data collection sensors for climate research purposes. Fifteen buoys are serviced by JAMSTEC and the remaining 55 buoys from 95°W longitude to 165°E longitude are serviced by National Data Buoy Center (NDBC). Repair and maintenance of the buoys is performed by NDBC personnel on an annual basis utilizing the NOAA Ship KA'IMIMOANA and NOAA Ship RONALD H. BROWN. The buoy deployment lifecycle are up to 18 months to ensure at least one year of data collection can be completed.

TAO Project Points of Contact:

TAO Project Manager

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TAO Operations Manager

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TAO Cruise Objective and Plan:

The objective of this cruise was the maintenance of the TAO Array along the 140°W and 125°W meridians. The scientific complement for the cruise embarked at *Ford Island, HI* on *September 9, 2007*. The ship departed on *September 12, 2007* and conducted operations on the 140°W line. After completion of operations, **NOAA Ship KA'IMIMOANA** proceeded to *Nuka Hiva, Marquises*, arriving on *October 4, 2007*. The ship departed *Nuka Hiva, Marquises* on *October 8, 2007* and worked buoys along the 125°W line and then proceeded to *Portland, Oregon* arriving on *November 2, 2007*.

1.0 PERSONNEL

1.1 CHIEF SCIENTIST AND PARTICIPATING SCIENTISTS:

Chief Scientist: 140°W Leonard Quigley/125°W Richard Gagne

Participating Scientists:

Name	Gender	Nationality	Affiliation
Leonard Quigley 140W Leg	M	US	NOAA/NDBC
Richard Gagne 125W Leg	M	US	NOAA/NDBC
Aaron Boutwell	M	US	NOAA/NDBC
Alan Lossett	M	US	NOAA/NDBC
Rachel Stanley	F	US	Princeton University

2.0 TAO DATA INFORMATION

2.1 TAO Data Recovery Summary

Mooring Operations conducted are shown in the table below. Operations were conducted from (9°N 140°W) to (5°S 140°W) and (8°S 125°W) to (8°N 125°W). The following provides details on the data recovery efforts for the buoys serviced. All noted time in the summary reports is Universal Time Code (UTC):

9N140W

Buoy ID: PM629b	Buoy Configuration: Standard
Buoy Type: ATLAS	Water Depth: 4825 meters
Deployed Location: 8° 59.89N 140° 15.39W	Visit Location: 08° 59.907N 140° 14.936W
Visit Buoy Start Date: 9/18/06	Visit Buoy End Date: Still Active

Field Service Observations: During the pass-by of the buoy, two sensors, temperature at 60 meters and 80 meters, were not reporting on the shipboard receiver.		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
60m Temperature 80m Temperature	12/17/06	No data recovery was performed.

5N140W

Buoy ID: PM628A		Buoy Configuration: Standard
Buoy Type: ATLAS		Water Depth: 4490 meters
Deployed Location: 04° 59.57N 139° 57.21W		Recovered Location: 5° 01.6N 139° 57.4W
Recovered Buoy Start Date: 09/17/06		Recovered Buoy End Date: 09/27/07
Field Service Observations: The temperature sensor at 120 meters was lost at sea. The point source current meter cable was severed and the wires exposed to the saltwater environment. All remaining sensor data was recovered from the buoy.		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
120 meter Temperature	7/25/07	120 meter temperature sensor missing from the mooring

2N140W

Buoy ID: PM626B		Buoy Configuration: Standard
Buoy Type: ATLAS		Water Depth: 4371 meters
Deployed Location: 1° 58.64N 139° 58.55W		Recovered Location: 02° 03.482N 140° 21.490W
Recovered Buoy Start Date: 09/16/2006		Recovered Buoy End Date: 09/29/07
Field Service Observations: During recovery operations, it was noted the buoy had been damaged resulting in the loss of the anemometer. The conductivity sensor at 1 meter depth was noted to be missing a poison puck on one end of the water sampling tube. All available sensor data was recovered from the buoy.		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Anemometer	8/9/07	Anemometer was missing.

0140W Buoy

Buoy ID: PM683A		Buoy Configuration: Flux/CO2
Buoy Type: ATLAS/CO2		Water Depth: 4358
Deployed Location: 00° 00.3N 139° 51.9W		Repair Location: 0° 00.7N 139° 53.1W
Repair Buoy Start Date: 05/31/07		Repair Buoy End Date: Still Active
Field Service Observations: The CO2 and 5 meter conductivity/temperature sensor could not be swapped out due to rough sea conditions inhibiting the service. All atmospheric sensor data was recovered from the buoy. Ocean sensor data will be recovered on its annual cycle.		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
5 meter Conductivity/Temperature	7/30/07	No data scheduled for recovery was lost.

0140W ADCP

Mooring ID: CAO12A		Buoy Configuration: Narrowband ADCP
Mooring Type: Sub-Surface		Transducer Depth: 272.5 meters
Deployed Location: 0° 02.46N 140° 02.37W		Recovered Location: 0° 02.46N 140° 02.37W
Recovered Mooring Start Date: 09/14/06		Recovered Mooring End Date: 09/30/07
Data Recovery Notes: All data was recovered from the ADCP instrument but the temperature/pressure sensor data was not downloaded. The sensor will be replaced by a Conductivity/Temperature/Depth sensor in October 2008		

2S140W

Buoy ID: PM624B		Buoy Configuration: Standard
Buoy Type: ATLAS		Water Depth: 4326 meters
Deployed Location: 2° 01.48S 140° 00.46W		Recovered Location: 2° 00.76S 140° 01.06W
Recovered Buoy Start Date: 09/13/06		Recovered Buoy End Date: 10/01/07
Field Service Observations: The point source current meter stabilization fin was broken off and the serial cable for the sea surface conductivity/temperature sensor was severed and wires exposed to saltwater environment. All buoy sensor data was recovered from the buoy.		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Sea Surface Conductivity/Temperature	9/13/07	No data scheduled for recovery was lost.

5S140W

Buoy ID: PM681A	Buoy Configuration: Standard
Buoy Type: ATLAS	Water Depth: 4367 meters
Deployed Location: 4° 58.6S 139° 55.5W	Visit Location: 4° 58.9S 139° 54.9W
Visit Buoy Start Date: 05/28/07	Visit Buoy End Date: Still Active
Field Service Observations: During the pass-by of the buoy, it was noted the buoy was riding well in the water and there was no apparent damage to the buoy.	

8S125W

Buoy ID: PM678A	Buoy Configuration: Standard
Buoy Type: ATLAS	Water Depth: 4404 meters
Deployed Location: 7° 59.13S 124° 58.42W	Visit Location: 7° 59.12S 124° 59.23W
Visit Buoy Start Date: 05/21/07	Visit Buoy End Date: Still Active
Field Service Observations: During the pass-by of the buoy, it was noted the buoy was riding well in the water and there was no apparent damage to the buoy.	

5S125W

Buoy ID: PM677A	Buoy Configuration: Standard	
Buoy Type: ATLAS	Water Depth: 4526 meters	
Deployed Location: 05° 00.47S 124° 56.73W	Repair Location: 5° 00.7S 124° 57.4W	
Repair Buoy Start Date: 05/20/07	Repair Buoy End Date: Still Active	
Field Service Observations: After swap out of the sea surface conductivity/temperature sensor, it was noted the sensor had bio-fouling within the conductivity flow through tube. All atmospheric buoy sensor data was recovered and the sea surface conductivity/temperature data was recovered. The remaining ocean sensor data will be recovered on its annual cycle.		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Sea Surface Conductivity/Temperature	6/30/07	No data scheduled for recovery was lost.

2S125W

Buoy ID: PM675A	Buoy Configuration: Standard
Buoy Type: ATLAS	Water Depth: 4681 meters
Deployed Location: 02° 01.94S 124° 53.32W	Repair Location: 01° 59.46S 125° 02.13W
Repair Buoy Start Date: 05/16/07	Repair Buoy End Date: Still Active
Field Service Observations: The wind and air temperature/relative humidity sensor data being received by the vessel was determined to be invalid. Both sensors were replaced with spares. The sensor data was not downloaded.	

0125W

Buoy ID: PM619B		Buoy Configuration: Flux/CO2
Buoy Type: Flux/CO2		Water Depth: 4777 meters deployment depth
Deployed Location: 00° 9.9S 124° 24.15w		Recovered Location: 00° 23.53W 123° 16.25W
Recovered Buoy Start Date: 08/31/06		Recovered Buoy End Date: 10/15/07
Field Service Observations: The buoy was set adrift 2 days prior to recovery and the mooring line had parted at 4,600 meters depth. During recovery operations, it was noted the anemometer stanchion was broken off the tube, the shortwave radiation sensor mount was broken off the mounting plate and the sensor was damaged, the 40 meter temperature sensor batteries were depleted, and the sea surface conductivity/temperature sensor anti-fouling pucks were missing and flow through tube had bio-fouling inside of it. All buoy sensor data was recovered.		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Anemometer	7/18/07	No data scheduled for recovery was lost.
40 meter depth temperature	6/10/07	
AT/RH	8/3/7 & 6/29/7	
Surface Salinity	7/30/07	

2N125W

Buoy ID: PM673A	Buoy Configuration: Standard
Buoy Type: ATLAS	Water Depth: 4715 meters deployment depth
Deployed Location: 1° 55.9N 125° 36.1W	Recovered Location: Adrift
Recovered Buoy Start Date: 05/14/07	Recovered Buoy End Date: Not Recovered
Field Service Observations: Buoy recovery was cancelled due to being over 200 NM off station at time of recovery. A new buoy was deployed.	

Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Buoy Adrift	09/29/2007	No data recovery was performed.

5N125W

Buoy ID: PM617A		Buoy Configuration: Standard
Buoy Type: ATLAS		Water Depth: 4373
Deployed Location: 05° 05.80N 124° 52.49W		Recovered Location: 05° 07.28N 124° 55.85W
Recovered Buoy Start Date: 08/27/06		Recovered Buoy End Date: 10/18/07
<p>Field Service Observations: During recovery operations. It was noted the anemometer was separated from the stanchion and caught in the protective cage and the serial cable for the point source current meter was severed and wires exposed to the saltwater environment. The payload transmitter had failed due to an expended transmitter battery pack. All buoy sensor data was recovered, the anemometer data may have anomalies.</p>		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Anemometer	6/17/07	No data scheduled for recovery was lost.
13 Meter Temperature/Velocity	7/7/07	
Buoy	9/10/07	

8N125W

Buoy ID: PM616A		Buoy Configuration: Standard
Buoy Type: ATLAS		Water Depth: 4588
Deployed Location: 8° 02.79N 124° 59.09W		Repair Location: 08° 13.35N 124° 57.99W
Repair Buoy Start Date: 08/26/06		Repair Buoy End Date: Still Active
<p>Field Service Observations: Second sea surface conductivity/temperature sensor installed on the mooring. The anemometer was missing the propeller and a hawser line attached to the buoy indicating vandalism. All buoy atmospheric sensor data was recovered from the buoy and the ocean sensor data will be recovered on its annual cycle.</p>		
Sensor	Date of Real-time Sensor Data Loss	Reason for Data Loss
Sea Surface Conductivity/Temperature	6/6/07	Wind speed data lost due to missing propeller from the anemometer.
20 meter Temperature	6/5/07	
Anemometer	7/19/07	
40 meter Temperature	8/9/07	

2.2 CTD Casts Completed

A Sea-Bird 911plus CTD with dual temperature and conductivity sensors was provided by the program. Temperature and conductivity sensors are calibrated yearly at Sea-Bird and sent in for diagnostics as necessary. A Sea-Bird 24-position carousel and twenty four 5-liter Niskin bottles were used to collect water samples for the analysis of salinity.

The following outlines the CTD casts completed during the cruise:

Date	Lat/Lon	Approximate Depth	Completion Time	Notes
09/25/07	9° 2.64N 140° 14.23W	3000.6 Meters	0741 PST	Whole Degree Deep Cast
09/26/07	7° 59.85N 140° 10.54W	1000.4 Meters	1009 PST	Whole Degree Cast
09/26/07	6° 59.74N 140° 6.38W	1000.6 Meters	1720 PST	Whole Degree Cast
09/27/07	5° 59.95N 140° 1.46W	1001 Meters	0140 PST	Whole Degree Cast
09/28/07	4° 58.28 N 139° 57.06 W	1000.6 Meters	0347 PST	Whole Degree Cast
09/29/07	1° 59.54N 139° 58.91W	1000.1 Meters	1108 PST	Whole Degree Cast
09/30/07	1° 29.45N 139° 58.36W	1000 Meters	0101 PST	Half Degree Cast
09/30/07	1° 00.21N 139° 56.05W	1000.9 Meters	0520 PST	Whole Degree Cast
09/30/07	0° 30.20N 139° 54.54W	1000 Meters	0950 PST	Half Degree Cast
09/30/07	0° 1.11N 139° 54.54W	3000.3 Meters	1443 PST	Whole Degree Deep Cast
10/01/07	0° 59.80S 139° 57.00W	1000.8 Meters	1430 PST	Whole Degree Cast
10/02/07	1° 59.13S 140° 1.05W	1000.9 Meters	0337 PST	Whole Degree Cast
10/03/07	2° 59.89S	1000.6 Meters	0944 PST	Whole Degree Cast

	139° 59.00W			
10/03/07	4° 59.08S 139° 56.42W	1001.3 Meters	2155 PST	Whole Degree Cast
10/12/07	7° 57.90S 124° 58.52W	1000.8 Meters	1650 PST	Whole Degree Cast
10/13/07	7° 00.12S 124° 58.58W	999 Meters	0032 PST	Whole Degree Cast
10/13/07	5° 59.87S 124° 57.26W	1000.1 Meters	0910 PST	Whole Degree Cast
10/13/07	4° 59.47S 124° 56.63W	1000.9 Meters	1834 PST	Whole Degree Cast
10/14/07	4° 00.08S 124° 56.11W	1000.4 Meters	0250 PST	Whole Degree Cast
10/14/07	2° 59.92S 124° 55.07W	1000.1 Meters	1033 PST	Whole Degree Cast
10/14/07	2° 30.08S 124° 54.46W	1000 Meters	1446 PST	Half Degree Cast
10/14/07	1° 58.77S 125° 2.06W	1000.3 Meters	1932 PST	Whole Degree Cast
10/15/07	0° 59.99S 124° 14.23W	1000.5 Meters	0551 PST	Whole Degree Cast
10/15/07	0° 29.41S 123° 50.18W	1000 Meters	1027 PST	Half Degree Cast
10/16/07	0° 7.95S 124° 24.12W	3000.6 Meters	0929 PST	Whole Degree Deep Cast
10/17/07	1° 00.28N 124° 46.99W	1002.1 Meters	0442 PST	Whole Degree Cast
10/17/07	1° 30.20N 124° 56.74W	1000 Meters	0831 PST	Half Degree Cast
10/17/07	1° 57.31N 125° 5.81W	1000.7 Meters	1226 PST	Whole Degree Cast
10/17/07	2° 59.87N 125° 2.62W	1000.8 Meters	2102 PST	Whole Degree Cast
10/18/07	4° 0.28N 124° 59.57W	1000.9 Meters	0543 PST	Whole Degree Cast
10/18/07	5° 5.99N 124° 55.59W	1000.6 Meters	1400 PST	Whole Degree Cast

10/19/07	8° 5.37N 124° 58.00W	3000.1 Meters	1940 PST	Whole Degree Cast
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The following outlines the scheduled CTD casts not completed and why:

CTD Cast	Reason for not Completing
4° 00.00N 140° 00.00W 3° 00.00N 140° 00.00W 2° 30.00N 140° 00.00W 0° 30.00S 140° 00.00W 1° 30.00S 140° 00.00W 2° 30.00S 140° 00.00W	Rough sea states caused the vessel to have to reduce speeds so CTD casts were eliminated to maintain buoy service schedule.
1° 30.00S 125° 00.00W 0° 30.00N 125° 00.00W	Ancillary scientist unavailable for cast due to their research being performed at time of cast and survey technician was off-duty.
2° 30.00N 125° 00.00W 6° 00.00N 125° 00.00W 7° 00.00N 125° 00.00W	Vessel debarkation port entry date changed to 24 hours sooner and chase down of 0 125°W adrift buoy delayed buoy service. Dropped half degree cast and whole degree casts to make up time.

2.3 Ancillary Science Projects Completed on the Cruise

The following outlines the ancillary science work performed in conjunction with the TAO operations on the cruise:

Pacific Marine Environmental Laboratory (PMEL) Argo Profiling CTD Floats

8 Argo floats were scheduled for deployment on this cruise. The chief scientist verified and briefed the Operations Officer on the deployment positions prior to the start of the cruise. All Argo Float deployments were completed as scheduled.

Questions concerning ARGO Floats should be directed to:

Gregory Johnson, NOAA/PMEL
Tel: (206) 526-6806
E-mail: pmel_floats@noaa.gov

or

Elizabeth Steffen, NOAA/PMEL
Tel: (206) 526-6747
E-mail: pmel_floats@noaa.gov

The following outlines the Argo floats deployed during the cruise:

Serial Number	Location	Date	Time GMT
3107	0° 01.94N 140° 01.64W	10/01/07	0629

3108	0° 59.80S 139° 57.00W	10/01/07	1612
3352	8° 7.23S 127° 00.28W	10/12/07	0343
3353	7° 57.90S 124° 58.52W	10/12/07	1650
3354	6° 24.93S 124° 57.39W	10/13/07	0929
3355	4° 00.08S 124° 56.11W	10/14/07	0250
3091	0° 59.99S 124° 14.23W	10/15/07	0551
3365	0° 8.45S 124° 23.46W	10/16/07	2229

Atlantic Oceanographic and Meteorological Laboratory (AOML) Surface Drifters

10 AOML Surface Drifters were scheduled for deployment on this cruise. The chief scientist verified and briefed the Operations Officer on the deployment positions prior to the start of the cruise. All AOML Surface Drifter deployments were completed as scheduled.

Questions concerning AOML Surface Drifters should be directed to:

Shaun Dolk, NOAA/AOML

Global Drifter Center,

Tel: (305) 361-4546

Fax: (305) 361-4436

E-mail: shaun.dolk@noaa.gov

The following outlines the AOML Surface Drifters deployed during the cruise track:

HULL#	Date	Time	LAT	LONG
71284	9/28/2007	5:26:43	4° 57.68N	139° 58.47W
71289	9/29/2007	21:45:55	1° 57.54N	140° 0.99W
59895	9/29/2007	21:48:05	1° 57.19N	140° 1.02W
71285	10/1/2007	6:32:12	0° 1.79N	140° 1.70W
71291	10/3/2007	3:55:52	2° 2.63S	139° 56.94W
59820	10/3/2007	3:57:28	2° 2.92S	139° 56.98W
71287	10/3/2007	22:59:42	4°59.51S	139° 55.97W
71288	10/14/2007	22:02:39	1°59.12S	125° 1.92W
71286	10/16/2007	22:32:03	0° 8.22S	124° 23.57W
71290	10/17/2007	13:46:56	1° 57.89N	125° 7.85W

PCO2 and Nitrate Mapping System and Nutrient Samples

Twenty-seven 30ml water samples were collected on this cruise. The chief scientist verified and briefed the Operations Officer on the specifications of the water samples to be collected during CTD casts prior to the start of the cruise. All water samples were collected as scheduled.

Questions concerning Nutrient Samples should be directed to:

Cathy Cosca
 NOAA/PMEL
 7600 Sand Point Way NE
 Seattle, Washington 98115
 Tel: (206) 526-6183
 E-mail: cathy.cosca@noaa.gov

The following outlines the nutrient samples taken during the cruise:

Sample Number	GMT Date	GMT Time	Cast Number	Lat	Long
U551	25-Sep-07	7:41:54	KA50011	9° 02.6427 N	140° 14.2293 W
U552	26-Sep-07	10:09:40	KA50021	7° 59.8493 N	140° 10.5389 W
U553	26-Sep-07	17:20:17	KA50031	6° 59.7399 N	140° 06.3768 W
U554	27-Sep-07	1:40:33	KA50041	5° 59.9545 N	140° 01.4619 W
U555	28-Sep-07	3:47:27	KA50051	4° 58.2779 N	139° 57.0643 W
U556	29-Sep-07	11:08:22	KA50061	1° 59.5449 N	139° 58.9056 W
U557	30-Sep-07	5:20:59	KA50081	1° 00.2110 N	139° 56.0544 W
U558	30-Sep-07	14:43:39	KA50101	0° 01.1086 N	139° 54.2535 W
U559	1-Oct-07	14:30:08	KA50111	0° 59.8003 S	139° 56.9986 W
U560	2-Oct-07	4:27:18	KA50121	1° 58.3169 S	140° 01.3856 W
U561	3-Oct-07	10:31:35	KA50131	2° 59.3840 S	139° 59.4032 W
U562	3-Oct-07	22:45:32	KA50141	4° 59.0930 S	139° 56.1187 W
U563	12-Oct-07	17:39:10	KA50151	7° 57.6451 S	124° 58.6496 W
U564	13-Oct-07	1:18:54	KA50161	7° 00.0492 S	124° 58.8058 W
U565	13-Oct-07	9:10:11	KA50171	5° 59.8694 S	124° 57.2623 W
U566	13-Oct-07	19:22:39	KA50181	4° 59.6278 S	124° 57.0033 W
U567	14-Oct-07	3:39:11	KA50191	4° 00.1367 S	124° 56.8723 W
U568	14-Oct-07	11:21:03	KA50201	2° 59.3896 S	124° 55.3030 W
U569	14-Oct-07	20:23:38	KA50221	1° 58.4341 S	125° 02.3370 W
U570	15-Oct-07	6:38:12	KA50231	0° 59.2963 S	124° 14.1318 W
U571	16-Oct-07	9:29:14	KA50251	0° 07.9505 S	124° 24.1241 W
U572	17-Oct-07	4:42:59	KA50261	1° 00.2784 N	124° 46.9851 W
U573	17-Oct-07	13:30:48	KA50281	1° 57.5609 N	125° 07.5614 W
U574	17-Oct-07	21:02:43	KA50291	2° 59.8659 N	125° 02.6172 W
U575	18-Oct-07	6:10:06	KA50301	4° 00.2549 N	125° 00.0679 W
U576	18-Oct-07	14:58:16	KA50311	5° 04.8163 N	124° 55.4095 W

U577	19-Oct-07	21:53:44	KA50321	8° 04.4911 N	124° 56.4504 W
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CO2 Instrumentation on TAO moorings

The buoys at 0140W and 0125W have mounted CO2 sensors to provide high-resolution time-series measurements of atmospheric boundary layer and surface ocean CO₂ partial pressure (pCO₂). The chief scientist verified and briefed the Operations Officer on the additional build efforts for the CO2 buoys prior to the start of the cruise.

Questions concerning CO2 measurement data should be directed to:

Chris Sabine, NOAA/PMEL
7600 Sand Point Way NE
Seattle, Washington 98115
Tel: (206) 526-4809
E-mail: Chris.Sabine@noaa.gov

Richard Feely, NOAA/PMEL
7600 Sand Point Way NE
Seattle, Washington 98115
Tel: (206) 526-6214
E-mail: Richard.A.Feely@noaa.gov

Carbon Cycling in the Equatorial Pacific Ocean

The first leg of the cruise along the 140°W meridian involved using the concentration and isotopic composition of oxygen to delineate rates of new, net and gross production at high resolution. Continuous measurements of O₂/Ar from a membrane inlet mass spectrometer (MIMS), continuous O₂ measurements from an OPTODE, O₂/Ar measurements from discrete bottles samples, measurements of $\Delta^{17}\text{O}$, and estimates of gas exchange were combined in order to constrain NCP and gross production.

The second leg of the cruise along the 125W° meridian involved collection of helium samples for part of a separate project studying ENSO-induced changes in the ventilation of the shallow tropical Pacific using transient tracers.

Questions concerning the Carbon Cycling Project should be directed to:

Rachel Stanley, Princeton University
Tel: 508-289-2927
Fax: 508-457-2193
Email: rstanley@whoi.edu