

TROPICAL ATMOSPHERE-OCEAN (TAO) PROGRAM
FINAL CRUISE REPORT
KA-09-01

Area: Equatorial Pacific between 8°N and 8°S latitude along 155°W Longitude and 8°S to 8°N Latitude along 170°W Longitude.

Itinerary:

KA-09-01	<i>Bellingham, WA</i>	DEP	<i>April 26, 2009</i>
	<i>Kwajalein, RMI</i>	ARR	<i>June 11, 2009</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 contracted personnel on an annual basis utilizing the NOAA Ship *Ka'imimoana* and NOAA Ship *Ronald H. Brown*. The buoys 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 Program 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 155°W and 170°W meridians. In addition to this work, NDBC Weather Buoy 46006 was serviced during the transit to 155°W and two TAO refreshed buoy systems were deployed at 5S 170W and 8N 180. The ATLAS buoy at 8N 180 was also recovered and re-deployed.

The scientific complement for the cruise embarked at *Bellingham, WA* on *April 25, 2009*. The ship departed on *April 26, 2009* and conducted operations as listed in Section 2.1. The ship arrived in *Kwajalein, RMI* on *June 11, 2009*.

1.0 PERSONNEL

1.1 CHIEF SCIENTIST AND PARTICIPATING SCIENTISTS:

Cruise Lead: Jeffrey Wise

Participating Scientists:

Name	Gender	Nationality	Affiliation
Jeffrey Wise	M	US	NOAA/NDBC
Alan Lossett	M	US	NOAA/NDBC
James Rauch	M	US	NOAA/NDBC

2.0 OPERATIONS

2.1 TAO Data Recovery Summary

Mooring Operations conducted are shown in the table below. The following provides details on the data recovery efforts for the buoys serviced. All noted time in the summary reports is Coordinated Universal Time (UTC):

Buoy Site: 8N 155W	Mooring Depth: 5387
Mooring Operation: Recovery	Mooring ID#: PM756A
Deployed Location: 07 58.4N 154 59.2W	Deployed Date: 8/25/08
Recovered Location: 07 58.00N 155 00.575W	Recovered Date: 5/8/09
Previous Repair: None	
Sensors/Equipment Lost at Sea: T14445	
Sensors Damaged/Fouled: None	
Fishing/Vandalism: Nilspin was cut at 50 meters. The cut was about 2" long down to the wire	
Sensors/Tubes Downloaded: All sensors downloaded successfully.	

Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
None			

Buoy Site: 8N 155W	Mooring Depth: 5243
Mooring Operation: Deployment	Mooring ID#: PM810A
Deployed Location: 07 58.720N 154 59.462W	Deployed Date: 5/9/09
Pre-Deployment On Deck Instrument Failures: None	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged: None	
General Comments: Routine Deployment.	

Buoy Site: 5N 155W	Mooring Depth: 4587		
Mooring Operation: Recovery	Mooring ID#: PM721A		
Deployed Location: 05 00.503N 154 55.292W	Deployed Date: 2/5/08		
Recovered Location: 05 03.545N 154 58.563W	Recovered Date: 5/9/09		
Previous Repair: None			
Sensors/Equipment Lost at Sea: Anemometer 28506, T13396, T13452, T13453			
Sensors Damaged/Fouled: SSC 12121, TUBE 667			
Fishing/Vandalism: Lines were fouled inside the bridle and the around the Nilspin. They appeared to be for towing.			
Sensors/Tubes Downloaded: All sensors downloaded successfully.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
Wind	12/11/08	Vane went to zero.	Wind sensor missing
Salinity	1/9/09	Data too high.	Sensor fouled

Buoy Site: 5N 155W	Mooring Depth: 4593
Mooring Operation: Deployment	Mooring ID#: PM811A
Deployed Location: 05 00.3N 154 55.6W	Deployed Date: 5/10/09
Pre-Deployment On Deck Instrument Failures: None	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged: None	
General Comments: Routine Deployment	

Buoy Site: 2N 155W		Mooring Depth: 4659	
Mooring Operation: Recovery		Mooring ID#: PM722A	
Deployed Location: 01 58.47N 154 58.922W		Deployed Date: 2/8/08	
Recovered Location: 01 59.27N 154 57.36W		Recovered Date: 5/11/09	
Previous Repair: None			
Sensors/Equipment Lost at Sea: TP13004			
Sensors Damaged/Fouled: None			
Fishing/Vandalism: A nylon strap from a fishing boat was tied to a tower leg. It was hanging over the side of the buoy and got entangled on the bridal and broke the SSC cable			
Sensors/Tubes Downloaded: All sensors downloaded successfully.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
None			

Buoy Site: 2N 155W		Mooring Depth: 4663	
Mooring Operation: Deployment		Mooring ID#: PM812A	
Deployed Location: 01 59.166N 154 57.785W		Deployed Date: 5/12/09	
Pre-Deployment On Deck Instrument Failures: None			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged: None			
General Comments: The anemometer failed after deployment. It was replaced with anemometer serial number 88404.			

Buoy Site: 0 155W		Mooring Depth: 4656 m	
Mooring Operation: Visit		Mooring ID#: PM758A	
Deployed Location: 00 00.63N 154 58.20W		Deployed Date: 8/15/08	
Visit Location: 00 00.93N 154 58.50W		Visit Date: 5/12/09	
Previous Repair: None			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged/Fouled: None			
Fishing/Vandalism: None			
Sensors/Tubes Downloaded: None			
General Comments: Visit only. Buoy riding well, no signs of damage or vandalism.			

Buoy Site: 2S 155W		Mooring Depth: 4988	
Mooring Operation: Recovery		Mooring ID#: PM723A	
Deployed Location: 01 58.58S 155 00.01W		Deployed Date: 2/10/2008	

Recovered Location: 01 58.8S 155 1.6W		Recovered Date: 5/13/09	
Previous Repair: None			
Sensors/Equipment Lost at Sea: T12566, T12570, T13314			
Sensors Damaged/Fouled: T12695			
Fishing/Vandalism: Marker float near buoy. Large amount of long liner gear on mooring. Buoy moved 1.6 nm from deployed location.			
Sensors/Tubes Downloaded: T12568 not downloaded. All other sensors downloaded successfully.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
None			

Buoy Site: 2S 155W	Mooring Depth: 4987
Mooring Operation: Deployment	Mooring ID#: PM813A
Deployed Location: 01 58.34 S 154 59.57W	Deployed Date: 5/14/09
Pre-Deployment On Deck Instrument Failures: None	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged: None	
General Comments: Routine Deployment	

Buoy Site: 5S 155W	Mooring Depth: 5028 m
Mooring Operation: Visit	Mooring ID#: PM760A
Deployed Location: 04 59.40S 154 58.29W	Deployed Date: 8/17/08
Visit Location: 05 00.2S 154 58.9W	Visit Date: 5/14/09
Previous Repair: None	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged/Fouled: None	
Fishing/Vandalism: None	
Sensors/Tubes Downloaded: Tube downloaded successfully.	
General Comments: Visit only. Buoy riding low, no signs of damage or vandalism.	

Buoy Site: 8S 155W	Mooring Depth: 5331
Mooring Operation: Recovery	Mooring ID#: PM724B
Deployed Location: 08 15.73S 155 01.03W	Deployed Date: 2/12/08
Recovered Location: 08 16.3S 155 02.4W	Recovered Date: 5/15/09
Previous Repair: 8/18/08 – ATRH sensor replaced.	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged/Fouled: Thick red growth on Nilspin for first 100 meters.	

Fishing/Vandalism: None			
Sensors/Tubes Downloaded: All sensors downloaded successfully.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
None			

Buoy Site: 8S 155W	Mooring Depth: 5335
Mooring Operation: Deployment	Mooring ID#: PM814A
Deployed Location: 08 15.730S 154 59.550W	Deployed Date: 5/16/09
Pre-Deployment On Deck Instrument Failures: None	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged: None	
General Comments: Routine deployment.	

Buoy Site: 8S 170W	Mooring Depth: 5371		
Mooring Operation: Recovery	Mooring ID#: PM725A		
Deployed Location: 07 58.52S 170 01.70W	Deployed Date: 2/23/08		
Recovered Location: 07 58.66S 170 02.340W	Recovered Date: 5/27/09		
Previous Repair: None			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged/Fouled: None			
Fishing/Vandalism: None			
Sensors/Tubes Downloaded: All sensors downloaded successfully.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
None			

Buoy Site: 8S 170W	Mooring Depth: 5373
Mooring Operation: Deployment	Mooring ID#: PM815A
Deployed Location: 08 00.2S 170 00.4W	Deployed Date: 5/28/09
Pre-Deployment On Deck Instrument Failures: T13671	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged: None	
General Comments: Routine deployment.	

Buoy Site: 5S 170W		Mooring Depth: 5430	
Mooring Operation: Recovery		Mooring ID#: PM726A	
Deployed Location: 04 59.95S 170 01.04W		Deployed Date: 2/24/08	
Recovered Location: 05 02.1S 170 07.5W		Recovered Date: 5/29/09	
Previous Repair: None			
Sensors/Equipment Lost at Sea: SST12747			
Sensors Damaged/Fouled: None			
Fishing/Vandalism: None			
Sensors/Tubes Downloaded: All sensors downloaded successfully.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
Salinity	1/24/09	Downward drift.	Lost at sea
Buoy	3/1/09	Moved off station.	Drifted off station

Buoy Site: 5S 170W (Refresh)		Mooring Depth: 5417	
Mooring Operation: Deployment		Mooring ID#: DM001A	
Deployed Location: 04 58.3S 169 57.1W		Deployed Date: 5/29/09	
Pre-Deployment On Deck Instrument Failures: None			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged: None			
General Comments: The T sensor at 25m failed after deployment.			

Buoy Site: 5S 170W		Mooring Depth: 5417	
Mooring Operation: Deployment		Mooring ID#: PM816A	
Deployed Location: 05 00.0S 169 59.5W		Deployed Date: 5/30/09	
Pre-Deployment On Deck Instrument Failures: None			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged: None			
General Comments: Routine deployment.			

Buoy Site: 2S 170W		Mooring Depth: 4960	
Mooring Operation: Recovery		Mooring ID#: PM727B	
Deployed Location: 02 09.71S 170 00.74W		Deployed Date: 2/25/08	
Recovered Location: 02 09.3S 170 00.8W		Recovered Date: 5/30/09	
Previous Repair: 8/22/2008 – T25 sensor replaced.			
Sensors/Equipment Lost at Sea: T12839, T12366			
Sensors Damaged/Fouled: SST12688 fouled with barnacles			

Fishing/Vandalism: There was a small line on the buoy tower and the shackle on the lifting line was removed from the buoy pad eye. Large amount of fishing line on mooring and Nilspin			
Sensors/Tubes Downloaded: T14466			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
Salinity	7/13/08	Slow downward drift.	Fouled with barnacles

Buoy Site: 2S 170W	Mooring Depth: 4962
Mooring Operation: Deployment	Mooring ID#: PM817A
Deployed Location: 02 09.9S 170 00.5W	Deployed Date: 5/31/09
Pre-Deployment On Deck Instrument Failures:	
Sensors/Equipment Lost at Sea: None	
Sensors Damaged: None	
General Comments: None	

Buoy Site: 00 170W	Repair Date: 6/1/09	Mooring Depth: 5602	
Mooring Operation: Repair		Mooring ID#: PM764B	
Deployed Location: 00 02.445S 170 03.064W		Deployed Date: 8/23/08	
Sensors/Equipment Lost at Sea: RAIN 1224			
Sensors Damaged:			
Sensors/Tubes Downloaded: TUBE 617 did not download correctly, although we did get a file the might contain data.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
Rain	11/8/09	Erratic data.	
50m Salinity	5/20/09	Persistent density inversion.	

Buoy Site: 2N 170W	Repair Date: 6/2/09	Mooring Depth: 5387	
Mooring Operation: Repair		Mooring ID#: PM765B	
Deployed Location: 02 00.8N 170 01.1W		Deployed Date: 8/25/08	
Sensors/Equipment Lost at Sea: None			
Sensors Damaged: None			
Sensors/Tubes Downloaded:			
General Comments: Recovered SSC 13237 and replaced it with SSC 12296 with diver assistance. Data dump. Put tube in dep mode. Recovered buoy light.			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations

Salinity	10/6/08	Data too low.	
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Buoy Site: 5N 170W		Mooring Depth: 5789	
Mooring Operation: Recovery		Mooring ID#: PM728A	
Deployed Location: 05 00.1N 169 58.7W		Deployed Date: 2/28/08	
Recovered Location: 04 59.8N 169 59.1W		Recovered Date: 6/3/09	
Previous Repair: None			
Sensors/Equipment Lost at Sea: T13555			
Sensors Damaged/Fouled: TUBE 448- antennae hit ship on recovery, WIND 6877-damaged			
Fishing/Vandalism: Marker buoy was floating inside the torroid. Some fishing gear wrapped around the mooring.			
Sensors/Tubes Downloaded:			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
Wind	8/22/08	Data went to zero.	

Buoy Site: 5N 170W		Mooring Depth: 5790 m	
Mooring Operation: Deployment		Mooring ID#: PM818A	
Deployed Location: 04 59.5N 169 58.4W		Deployed Date: 6/4/09	
Pre-Deployment On Deck Instrument Failures:			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged: None			
General Comments: None			

Buoy Site: 8N 170W		Mooring Depth: 5542 m	
Mooring Operation: Visit		Mooring ID#: PM766A	
Deployed Location: 08 00.2N 170 00.4W		Deployed Date: 8/27/08	
Visit Location: 07 59.9N 170 03.9W		Visit Date: 6/5/09	
Previous Repair:			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged/Fouled: None			
Fishing/Vandalism: None			
Sensors/Tubes Downloaded: None			
General Comments: Visit only. Repair to station (SSC and T1 were out) cancelled due to heavy weather. Buoy riding well. No sign of damage or vandalism.			

Buoy Site: 8N 180		Mooring Depth: 5950	
Mooring Operation: Recovery		Mooring ID#: PM693B	
Deployed Location: 07 59.7N 179 52.66W		Deployed Date: 8/6/07	
Recovered Location: 7 59.3N 179 54.0W		Recovered Date: 6/7/09	
Previous Repair: 3/2/08			
Sensors/Equipment Lost at Sea: T13427, TP12673			
Sensors Damaged/Fouled:			
Fishing/Vandalism: Long liner gear wrapped around mooring from 50m to 150m.			
Sensors/Tubes Downloaded: SST12196, T13399			
Site Sensor Failures	Date Sensors Failed	Why sensors were Failed	Field Service Observations
Buoy	1/1/09	Transmission failure, low transmit battery voltage.	

Buoy Site: 8N 180W		Mooring Depth: 5950	
Mooring Operation: Deployment		Mooring ID#: PM819A	
Deployed Location: 07 59.6N 179 52.0W		Deployed Date: 6/8/09	
Pre-Deployment On Deck Instrument Failures: None			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged: None			
General Comments: Fathometer was not working well. We used chart depth for final depth.			

Buoy Site: 8N 180W (Refresh)		Mooring Depth: 5929	
Mooring Operation: Deployment		Mooring ID#: DM002A	
Deployed Location: 07 58.3N 179 53.1W		Deployed Date: 6/9/09	
Pre-Deployment On Deck Instrument Failures: GPS Antenna 31664			
Sensors/Equipment Lost at Sea: None			
Sensors Damaged: None			
General Comments: The T sensors at 50m and 125m failed after deployment.			

2.2 *CTD Casts Completed*

A Sea-Bird 911plus CTD with dual temperature and conductivity sensors was provided by the NMAO. Temperature and conductivity sensors are calibrated yearly at Sea-Bird and sent in for diagnostics as necessary. A Sea-Bird 12-position carousel and twelve 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:

CTD Operations		
Site	Date	Comments
8N 155W	5/8/09	3000 m
7N 155W	5/9/09	1000 m
6N 155W	5/9/09	1000 m
5N 155W	5/10/09	1000 m
4N 155W	5/11/09	1000 m
3N 155W	5/11/09	1000 m
2N 155W	5/11/09	1000 m
1N 155W	5/12/09	1000 m
0S 155W	5/12/09	3000 m
1S 155W	5/13/09	1000 m
2S 155W	5/13/09	1000 m
3S 155W	5/14/09	1000 m
4S 155W	5/14/09	1000 m
5S 155W	5/14/09	1000 m
6S 155W	5/15/09	1000 m
7S 155W	5/15/09	1000 m
8S 155W	5/16/09	3000 m
8S 170W	5/27/09	3000 m
7S 170W	5/28/09	1000 m
6S 170W	5/28/09	1000 m
5S 170W	5/29/09	1000 m
4S 170W	5/30/09	1000 m
3S 170W	5/30/09	1000 m
2S 170W	5/31/09	1000 m
1S 170W	6/1/09	1000 m
0N 170W	6/1/09	3000 m
1N 170W	6/2/09	1000 m
2N 170W	6/2/09	1000 m
3N 170W	6/3/09	1000 m
4N 170W	6/3/09	1000 m
5N 170W	6/3/09	1000 m
6N 170W	6/4/09	1000 m
7N 170W	6/4/09	1000 m
8N 170W	6/5/09	3000 m

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

Three 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:

ARGO Floats			
Coordinates	Date	SN#	Comments
0100.535N 15457.197W	5/12/2009	4016	
0059.844S 15459.262W	5/13/2009	4180	
0000.511S 15455.498W	5/12/2009	4181	

Atlantic Oceanographic and Meteorological Laboratory (AMOL) Surface Drifting Floats

Twelve 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 Drifting floats deployed during this cruise:

AOML Floats			
Coordinates	Date	SN#	Comments
0456.754N 15457.658W	5/10/2009	81971	
0300.089N 15457.321W	5/11/2009	81978	
0000.871S 15455.512W	5/12/2009	81973	
0000.962S 15455.514W	5/12/2009	81977	
0259.865S 15501.100W	5/14/2009	81972	
0501.069S 15458.238W	5/15/2009	81980	
0458.832S 17000.701W	5/29/2009	81968	
0259.325S 17002.614W	5/30/2009	81966	
0001.987S 16959.868W	6/1/2009	81967 / 81964	
0258.943N 16958.506W	6/3/2009		SN Missing From EMOA

0459.482N 16958.105W	6/4/2009	81953	
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PCO2 and Nitrate Mapping System and Nutrient Samples

Thirty-four 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:

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7600 Sand Point Way NE
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