TROPICAL ATMOSPHERE-OCEAN (TAO)

PROGRAM FINAL CRUISE REPORT

RB-18-05

Area: Equatorial Pacific: 8°S 165°E to 8°N 165°E and 8°S 180°W to 8°N 180°W

Itinerary:

RB-18-05 DEP *July 25, 2018, Darwin, Australia*

ARR *September 2, 2018, Honolulu, HI*

CRUISE DESCRIPTION

The Tropical Atmosphere Ocean (TAO) array consists of 55 buoys utilizing a taut line mooring configuration used to mount data collection sensors for climate research purposes. Repair and maintenance of the buoys is performed by NDBC contracted personnel on an annual basis utilizing the NOAA Ships and other contract vessels. The buoys' deployment lifecycles are up to 18 months to ensure at least one year of data collection can be completed.

TAO Cruise Objective and Plan:

The objective of this cruise was the maintenance of the TAO Array along the 165°EW and 180°W meridians.

The scientific complement for the cruise embarked at Darwin on July 24, 2018. The ship departed on July 25, 2018 and conducted operations as listed in Section 2.1. The ship arrived in Honolulu, HI on September 2, 2018.

1.0 PERSONNEL

1.1 *CRUISE LEAD AND PARTICIPATING SCIENTISTS*:

Cruise Lead: William Thompson.

Participating Scientists:

Name	Gender	Nationality	Affiliation
William Thompson	M	US	NOAA/NDBC
Keith Rubio	M	US	NOAA/NDBC
Casey Burge	M	US	NOAA/NDBC
Darren Kennedy	M	US	NOAA/NDBC

2.0 OPERATIONS

2.1 TAO Data Recovery Summary

Mooring Operations conducted are shown in the tables below. The following provides details on the data recovery efforts for the buoys serviced. All noted times in this summary report are Coordinated Universal Time (UTC):

TAO Cruise Summary

Buoy Site: 8S 165E Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM196A
Deployed Location: 08 01.51S 164 49.39E	**Deployed Date:** 7/16/2016
Recovered Location: 08 00.69S 165 50.01E	**Recovered Date:** 8/5/2018
Sensors/Equipment Lost at Sea: None	
Sensors Damaged/Fouled: SSC, T25, T50, T75	
Fishing/Vandalism: YES, Small amount of line on bridle, likely from local fisherman. No evidence of commercial fishing.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: Two years at sea. Top section severed. Shipboard SCS not running due to lack of EEZ clearance.	

Buoy Site: 5S 165E Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM249A
Deployed Location: 05 01.00S 165 11.40E	**Deployed Date:** 8/13/2017
Recovered Location: 05 00.65S 165 12.04E	**Recovered Date:** 8/7/2018
Sensors/Equipment Lost at Sea: Wind	
Sensors Damaged/Fouled: SSC, T25, T50, T250	
Fishing/Vandalism: YES, Fishing gear was found throughout full length of the nil spin. Large streamers were pulling at the mooring. Several 55 gal trash bags of line removed from mooring and water. Wind stanchion completely removed, only wind bird connector remained.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: T25 sensor was found to be potentially moved from designated location, cause suspected to be a result of fishing gear and nil spin damage was also found at this location. There was no sensor location id tape located at the sensor so we were unable to verify if the sensor was out of its intended location on the inductive wire. Acoustic release failed to let go of mooring initially, in spite of good comms and replies. Release potentially hung up, but fully let go after line tension increased.	

Buoy Site: 5S 165E Refresh	**Mooring Depth:** 2494M
Mooring Operation: Deployment	**Mooring ID#:** DM286A
Deployed Location: 05 00.78S 165 11.20E	**Deployed Date:** 8/8/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: T10033 original length 580m, cut 10m, new length 570m. Wind speed and direction inaccurate for both ship and buoy. Winds were nonexistent and birds were meandering with the seas. Winds too low for accurate readings. Gen 2 camera system WA003 installed, imbedded hull tracker LC003 P/N 40781 installed. Plastic cap near cable leg is where the hull tracker is. 4 inch threaded PVC cap located under bump.	

Buoy Site: 2S 165E Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM248A
Deployed Location: 02 00.19S 165 00.16E	**Deployed Date:** 8/12/2017
Recovered Location: NA	**Recovered Date:** NA
Sensors/Equipment Lost at Sea: NA	
Sensors Damaged/Fouled: NA	
Fishing/Vandalism: NA	
Sensors/Tubes Downloaded: NA	
General Comments: Station adrift, converted into drifting buoy site.	

Buoy Site: 2S 165E Refresh	**Mooring Depth:** 4454M
Mooring Operation: Deployment	**Mooring ID#:** DM287A
Deployed Location: 01 59.87S 163 50.81E	**Deployed Date:** 8/9/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: T17157 original length 608m, cut 6m, new length 602m. TPOS Payload 41446 IMEI 300234065722540 Iridium 903698 IMM 903789 ANT 903784 SM 903236	

Buoy Site: 0 165E Refresh FLUX	**Mooring Depth:** NA
Mooring Operation: Visit	**Mooring ID#:** DM247B
Repair Location: 00 01.42N 165 04.41E	**Repair Date:** 8/10/2018
General Comments: Visit only. EEZ Clearance not granted by Nauru Government. All ocean sensors on ship off due to lack of clearance, no sst or ssc for comparison.	

Buoy Site: 0 110W ADCP	
Mooring Operation: Recovery	**Mooring ID#:** WA016
Deployed Location: 00 02.16N 165 02.13E	**Deployed Date:** 8/10/2017
Recovered Location: NA	**Recovered Date:** NA
Sensors/Equipment Lost at Sea: NA	
Sensors Damaged/Fouled: NA	
Fishing/Vandalism: NA	
Sensors/Tubes Downloaded: NA	
General Comments: EEZ Clearance not granted by Nauru Government. All ocean sensors on ship off due to lack of clearance, no sst or ssc for comparison. Unable to perform operation.	

Buoy Site: 0 110W ADCP	**Mooring Depth:** NA
Mooring Operation: Deployment	**Mooring ID#:** NA
Deployed Location: NA	**Deployed Date:** NA
Pre-Deployment On Deck Instrument Failures: NA	
Sensors/Equipment Lost at Sea: NA	
Sensors Damaged During Deployment: NA	
General Comments: EEZ Clearance not granted by Nauru Government. All ocean sensors on ship off due to lack of clearance, no sst or ssc for comparison. Unable to perform operation.	

Buoy Site: 2N 165E Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM246A

Deployed Location: 02 00.64N 110 01.75W	**Deployed Date:** 4/30/2017
Recovered Location: 02 00.03N 165 09.52E	**Recovered Date:** 8/10/2018
Sensors/Equipment Lost at Sea: WIND	
Sensors Damaged/Fouled: SSC, T25, T50	
Fishing/Vandalism: NONE	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: NONE	

Buoy Site: 2N 165E Refresh	**Mooring Depth:** 4159M
Mooring Operation: Deployment	**Mooring ID#:** DM289A
Deployed Location: 02 15.14N 164 45.29E	**Deployed Date:** 8/11/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: NONE	

Buoy Site: 5N 165E Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM191A
Deployed Location: 05 02.96N 164 51.99E	**Deployed Date:** 7/9/2016
Recovered Location: 05 03.20N 164 52.78E	**Recovered Date:** 8/11/2018
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged/Fouled: SSC, T25-T75	
Fishing/Vandalism: YES, Trailing net with visual streamers approximately 100ft long, likely for helicopter spotting, Also removed a floating GPS tracker of the same make as previous models.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: NONE	

Buoy Site: 5N 165E Refresh	**Mooring Depth:** 4770M
Mooring Operation: Deployment	**Mooring ID#:** DM290A
Deployed Location: 05 02.83N 164 52.75E	**Deployed Date:** 8/12/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: NONE	

Buoy Site: 8N 165E Refresh	**Mooring Depth:** NA
Mooring Operation: Repair	**Mooring ID#:** DM245B
Repair Location: 08 04.43N 165 07.89E	**Repair Date:** 8/12/2018
General Comments: TPOS station. Removed TPOS sensors as instructed. Attempted repairing known damage. EEZ Clearance not granted by Micronesian Government. All ocean sensors on ship off due to lack of clearance, no sst or ssc for comparison. Recovered 37-15382, 8374, 37-15383, 8690, 37-15384, 37-15369, 39-8214, 39-8215, 7252 Could not correct IM problems on Nilspin, likely made IM comms worse. Wires on nilspin wire pinched and partially cut when installed originally, too many wires in too small a space. May need top section mounting plate modification for future TPOS deployments. No growth on Nortek acoustic heads.	

Buoy Site: 8S 180 Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM256A
Deployed Location: 07 58.74S 179 56.02E	**Deployed Date:** 8/29/2017
Recovered Location: 07 58.13S 179 56.93E	**Recovered Date:** 8/18/2018

Sensors/Equipment Lost at Sea: NONE
Sensors Damaged/Fouled: SSC, TC5 – TP60, T150, TP500
Fishing/Vandalism: YES, Long line gear wrapped in mooring.
Sensors/Tubes Downloaded: Sent to Lab for download
General Comments: NONE

Buoy Site: 8S 180 Refresh	**Mooring Depth:** 5542M
Mooring Operation: Deployment	**Mooring ID#:** DM292A
Deployed Location: 07 58.22S 179 55.34W	**Deployed Date:** 6/13/2017
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: T15065 previous length 615m, cut 13m, new length 602m.	

Buoy Site: 5S 180 Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM255A
Deployed Location: 04 57.9S 179 52.6W	**Deployed Date:** 8/27/2017
Recovered Location: 04 57.76S 179 52.47W	**Recovered Date:** 8/19/2018
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged/Fouled: WIND, SSC, T20 – T75, T150, TP300, TP500	
Fishing/Vandalism: YES, Long line wrapped in sensors. Windbird broken.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: Knot in nilspin at approximately 400m, using up about 10m of wire. Potentially caused by pulling by large amounts of long line, or from slack deployment. SSC sensor appears to have had a malfunction in its RTC. Date and time are impossible, communicates normally otherwise.	

Buoy Site: 5S 180 Refresh	**Mooring Depth:** 5555M
Mooring Operation: Deployment	**Mooring ID#:** DM293A
Deployed Location: 05 01.03S 179 44.01W	**Deployed Date:** 8/20/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: T17161 previous length 594m, cut 174m, new length 420m.	

Buoy Site: 2S 180 Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM254A
Deployed Location: 01 59.50S 179 51.80W	**Deployed Date:** 8/26/2017
Recovered Location: 01 59.78S 179 50.74W	**Recovered Date:** 8/20/2018
Sensors/Equipment Lost at Sea: WIND	
Sensors Damaged/Fouled: SSC, T20 – T75	
Fishing/Vandalism: YES, Wind stanchion and bird missing.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: NONE	

Buoy Site: 2S 180 Refresh	**Mooring Depth:** 5340M
Mooring Operation: Deployment	**Mooring ID#:** DM294A
Deployed Location: 01 59.83S 179 52.31W	**Deployed Date:** 8/21/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	

General Comments: Buoy in rain while ship was not is reasoning for humidity differences.

Buoy Site: 0 180 Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM253A
Deployed Location: 00 01.90N 179 55.20W	**Deployed Date:** 8/25/2017
Recovered Location: 00 01.68N 179 54.94W	**Recovered Date:** 8/21/2018
Sensors/Equipment Lost at Sea: WIND	
Sensors Damaged/Fouled: SSC, SSC, TC5-T25	
Fishing/Vandalism: YES. Wind stanchion was broken. Camera was broken off of its mount and covered with a black plastic bag.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: NONE	

Buoy Site: 0 180 Refresh	**Mooring Depth:** 5393M
Mooring Operation: Deployment	**Mooring ID#:** DM295A
Deployed Location: 00 01.20N 179 54.89W	**Deployed Date:** 8/22/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: NONE	

Buoy Site: 2N 180 Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM252A
Deployed Location: 02 01.06N 179 49.61W	**Deployed Date:** 8/24/2017
Recovered Location: 02 00.21N 179 49.32W	**Recovered Date:** 8/22/2018
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged/Fouled: SSC, T25 – T75	
Fishing/Vandalism: NONE	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: NONE	

Buoy Site: 2N 180 Refresh	**Mooring Depth:** 5477M
Mooring Operation: Deployment	**Mooring ID#:** DM296A
Deployed Location: 02 01.06N 179 49.62W	**Deployed Date:** 8/24/2017
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: NONE	
General Comments: NONE	

Buoy Site: 5N 180 Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM251A
Deployed Location: 05 00.00N 179 53.70W	**Deployed Date:** 8/23/2017
Recovered Location: 04 59.91N 179 52.81W	**Recovered Date:** 8/23/2018
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged/Fouled: WIND, SSC, T25 – T75	
Fishing/Vandalism: YES, Long line wrapped in nilspin at 300m and 500m. Wind stanchion broken.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: NONE	

Buoy Site: 5N 180 Refresh	**Mooring Depth:** 5670M
Mooring Operation: Deployment	**Mooring ID#:** DM297A
Deployed Location: 04 59.94N 179 53.62W	**Deployed Date:** 8/24/2018
Pre-Deployment On Deck Instrument Failures: NONE	

Sensors/Equipment Lost at Sea: NONE
Sensors Damaged During Deployment: NONE
General Comments: NONE

Buoy Site: 8N 180 Refresh	
Mooring Operation: Recovery	**Mooring ID#:** DM250A
Deployed Location: 08 01.363N 179 52398W	**Deployed Date:** 8/21/2017
Recovered Location: 08 01.34N 179 51.32W	**Recovered Date:** 8/24/2018
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged/Fouled: SSC, T25, T75 – TP500	
Fishing/Vandalism: YES, Long line gear found down most of the length of nilspin and two spools of nylon.	
Sensors/Tubes Downloaded: Sent to Lab for download	
General Comments: NONE	

Buoy Site: 8N 180 Refresh	**Mooring Depth:** 5948M
Mooring Operation: Deployment	**Mooring ID#:** DM298A
Deployed Location: 08 01.24N 179 52.95W	**Deployed Date:** 8/25/2018
Pre-Deployment On Deck Instrument Failures: NONE	
Sensors/Equipment Lost at Sea: NONE	
Sensors Damaged During Deployment: 500m TP sensor failed during anchor drop.	
General Comments: 500m TP sensor failed during anchor drop.	

2.2 CTD Casts Completed

2.3

CTD Operations				
Coordinates LAT/LONG		**Date**	**Cast #**	**Comments**
05 01.6365S	165 11.4456E	8/8/2018	5S 165E	NONE
02 00.6767S	163 51.6763E	8/9/2018	2S 165E	NONE
02 15.5477N	164 44.0811E	8/11/2018	2N 165E	NONE
05 02.7686N	164 51.0175E	8/12/2018	5N 165E	NONE
07 59.0754S	179 54.5416W	8/19/2018	8S 180	NONE
05 01.5669S	179 42.2872W	8/20/2018	5S 180	NONE
01 58.3406S	179 52.1600W	8/21/2018	2S 180	NONE
00 01.6327N	179 53.3182W	8/22/2018	0 180	NONE
02 01.9290N	179 46.6539W	8/23/2018	2N 180	NONE
04 58.4000N	179 54.6738W	8/24/2018	5N 180	NONE
08 02.0809N	179 54.1047W	8/25/2018	8N 180	NONE

2.4 Ancillary Science Projects Supported by the Cruise

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

Atlantic Oceanographic and Meteorological Laboratory (AMOL) Surface Drifting Floats

Twenty (20) 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 LAT/LONG		**Date**	**SN#**	**Comments**
3.001667S	164.246667W	08/09/2018	7530	3S 165E
3.001667S	164.246667W	08/09/2018	7520	3S 165E
0.034783N	165.071550E	08/10/2018	0862	0 165E
3.00744N	164.78721E	08/11/2018	7540	3N 165E
3.00783N	164.78729E	08/11/2018	8540	3N 165E
3.00785N	164.78732E	08/11/2018	8530	3N 165E
5.989900N	164.951017E	08/12/2018	7910	6N 165E
5.989900N	164.951017E	08/12/2018	7890	6N 165E
5.989900N	164.951017E	08/12/2018	6540	6N 165E
13.80522N	170.29994W	08/27/2018	7920	13.8N 170W
13.80530N	170.29980W	08/27/2018	8520	13.8N 170W

Pacific Marine Environmental Laboratory (PMEL) Argo Profiling CTD Floats

Fill in with number (XX) Argo floats were scheduled for deployment on this 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 PROFILERS					
Coordinates LAT/LONG		**Date**	**Time**	**SN#**	**Comments**
0002.6978N	16504.3783E	08/10/2018	05:20:26	0862	NONE
0215.4502N	16446.1160E	08/11/2018	08:40:27	0863	NONE
2.000908S	179.872367W	08/21/2018	06:46:00	0864	NONE
0.012917N	179.932917W	08/22/2018	05:26:00	0865	NONE
0201.6538N	17948.0611W	08/23/2018	04:06:10	0866	NONE