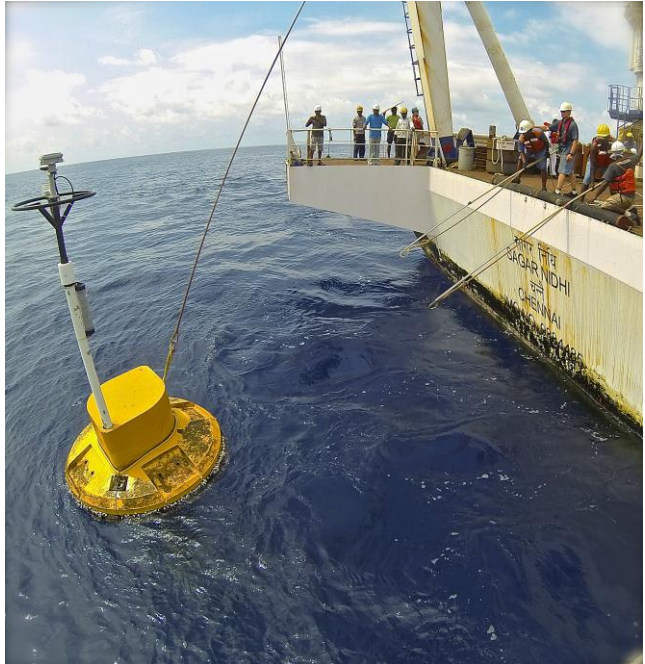


ORV - SAGAR NIDHI

CRUISE REPORT

Cruise No. SN – 14-2014

(24th Nov – 13th Dec, 2014)



Submitted by

Mr. Suresh Kumar

Chief Scientist

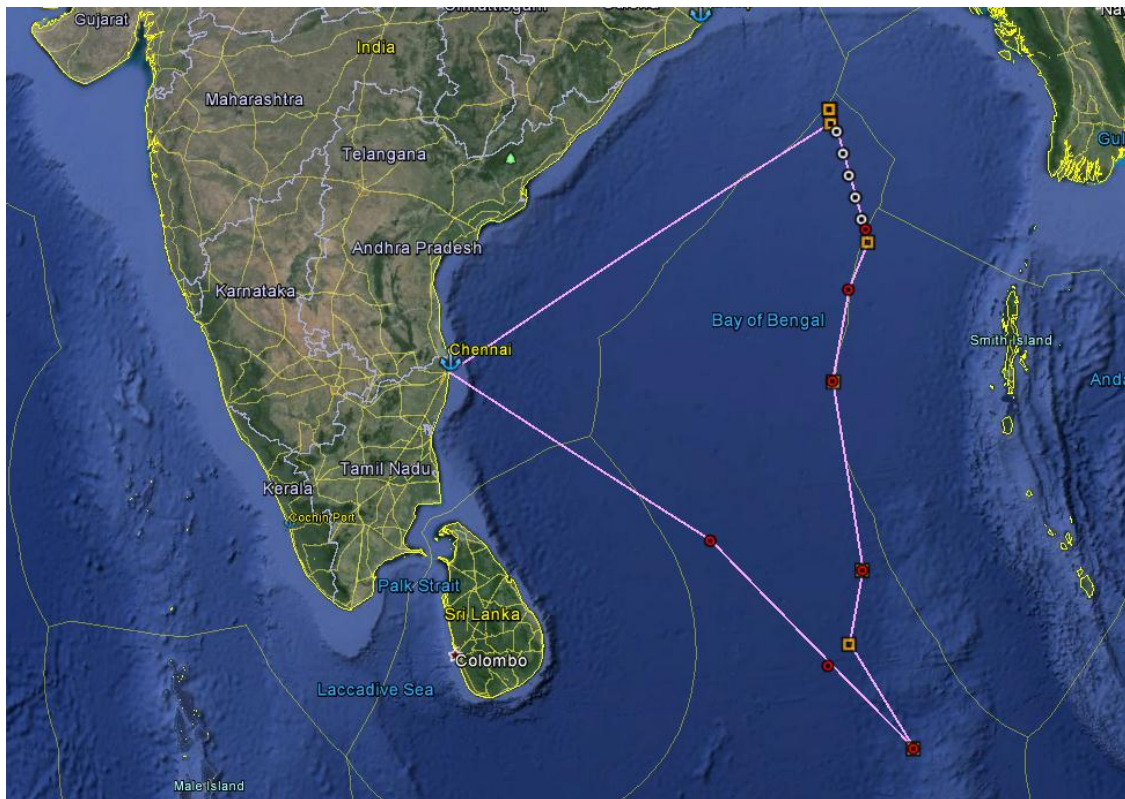
Indian National Centre for Ocean Information Services.

Objectives:

The primary objectives of this cruise are to recover and deploy RAMA (Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction) deep sea moorings, servicing NIOT Tsunami Buoy and deploying WHOI (Woods Hole Oceanography Institute) in Bay of Bengal. In addition, and ARGO floats (Autonomous Temperature and Salinity Profiling Floats) & Surface Drifters were deployed along ship en route at different locations for observing the ocean parameters and conventional CTD operations that are conducted after every mooring buoy deployment.

The moorings are a part of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA) and Bay of Bengal observatory program. This array is under development as part of a multi-national effort to provide data essential for monitoring, understanding, and predicting basin scale ocean-atmosphere variability such as the Asian monsoon, the Indian Ocean Dipole, and the Madden-Julian Oscillation.

Cruise Track:



Scientific Participants SN-14/2014.

Sr. No.	Name of Participants	Designation	Institute	Nationality
1.	SURESH KUMAR NEELAKANDAN	Chief Scientist	INCOIS	INDIA
2.	PRAVEEN KUMAR BALAN	Scientist	INCOIS	INDIA
3.	MURUGESH POTHIKASALAM	Scientist	NIOT	INDIA
4.	JEFFREY BOWE LORD	Dy. Scientist	WHOI	USA
5.	SEAN PATRICK WHELAN	Scientist	WHOI	USA
6.	DAVID KEITH ZIMMERMAN	Scientist	NOAA-PMEL	USA
7.	DAVID MICHAEL RIVERA	Scientist	NOAA-PMEL	USA
8.	KOTHANDARAMAN DINESH	Scientific Asst.	INCOIS	INDIA
9.	SRIDHARAN RAMALINGAM	Scientific Asst.	NIOT	INDIA
10.	VENGATESAN GOPALAKRISHNASAMI	Scientific Asst.	NIOT	INDIA
11.	SARAVANAN JAYAVELU	Service Engg.	NIOT	INDIA
12.	SUSAI RAJ ANTONY RAJ	Service Engg.	NIOT	INDIA
13.	SAKTHIVEL DEVARAJ	Deployment Asst.	INCOIS	INDIA
14.	UDHAYAKUMAR RAJI	Deployment Asst.	INCOIS	INDIA
15.	KIRUBAKARAN NARAYANASAMY	Deployment Asst.	INCOIS	INDIA
16.	RAJAPART RAMALINGAM	Deployment Asst.	INCOIS	INDIA
17.	SUBRAMANIAN NATESAN	Deployment Asst.	INCOIS	INDIA

Recovery and Deployment of RAMA-PMEL mooring Buoy:

The Research Moored Array for African Asian Australian Monsoon Analysis and Prediction (RAMA) moored buoy is an international program of „Global Ocean Observation System. (GOOS). ATLAS RAMA buoys were recovered and redeployed at assigned locations 4N,8N,12N & 15N | 89 E,.in Bay of Bengal by PMEL/INCOIS scientists during this cruise.

The recovery operations start with citing the buoy on Radar and visually. The vessel then moved close (up to 50-100 m) to the buoy float. Buoy is then released from the anchor weights by sending acoustic pulses to the Acoustic Release unit which connected between the Mooring line and Anchors. After that a small zodiac boat, carrying scientists, lowered from the ship main deck either Starboard or Port side from main deck. This boat approached to the buoy and all meteorological sensors (wind speed and direction, solar radiation, humidity and air temperature) taken off from the buoy tower. The buoy is then hooked with a rope (working Line ~300m) which is passed to the boat from ship. Finally the buoy was recovered on the main deck using A-frame and Win-tech Electric winch capstan, after recovery of the buoy float, the cable was pulled by winch and all sub-surface sensors were taken off from the mooring cable. Similar procedure followed for recovery of all RAMA buoys during the cruise.

Deployment of RAMA-ATLAS buoy float was performed from the centre of the stern of the ship using A-frame & Crane, before the deployment, the top tower, with all meteorological sensors clamped on it, was fixed on the Buoy. Then a cable Nilspin (Conductive Cable) was connected to the bottom tower of float and subsurface sensors were clamped at defined Depths on the mooring cable. The cable was laid along the Main Deck of the ship towards the ship aft. The buoy was deployed using the folding crane from port side aft and mooring cable passed over the Hanging Pulley Block connected in centre of A-Frame and then by finally pass it Wintech Electrical Winch tech by entangle with 4-5 straps in winch of NOAA heaving capacity ~6 Ton . For Surface Buoy after completing Pay out ~700 m of Nilspin cable, the nylon rope was connected to the buoy mooring line for remaining length till up to sea-bed. At the end before connecting Anchors a Acoustic release was connected to the line, followed by the heavy anchor weight. The anchor was dropped using Folding crane and A-frame from the ship aft. Similar procedure followed for all RAMA buoy deployments.

Deployment of WHOI mooring Buoy:

Mooring Operation:

Arrival at site and Confirm bathymetry near to 2100m and move downwind 4.5 nm from anchor drop position bow into wind hold station with DP also Disengage port drive. Use crane on port side to deploy first 50 meters of mooring and instruments into water by buoy. The lower portion will be connected to a working line that goes down the rail, through the a-frame, and back to the winch.

First deployed is 21 meters mooring wire with instruments attached. This will be lifted as high as possible with crane. The remaining portion of wire/instruments will be lowered into the water by hand, using a slip line as needed.

The crane wire will come down to deck level and this wire will be stopped off and removed from crane. A segment of instruments, chain, and hardware will be attached to the crane and raised. The lower portion will be shackled into the stopped off wire deployed earlier. The crane will take tension, stopper is removed, and the crane will lower this whole section into the water, stopping at the deck. The working line will follow the instrument array down. A person will tend this line so there is never slack going under the ship. A stopper will be attached, taking the mooring load, and another segment of instruments will be raised and deployed by the crane. The deployed mooring array will be stopped off with a slip line at the deck above the 3.5 meter instrument. The remaining mooring sections will be attached to this and connected to the buoy.

The crane will move over the buoy in preparation of deployment, tag lines will be attached in the three places on the buoy, and the quick release will be attached to the crane hook, when everybody is ready, the crane will lift the buoy off the deck and swing outboard. As the centre of the buoy goes over the side, the slip line holding the instrument array will transfer the load to the mooring. This will stabilize the buoy during the deployment. At this point, the ship can begin to move ahead slowly, making a turn to port to kick the stern out slightly away from the buoy.

The crane will continue to swing outboard (and jib out). The slip lines on the tower and base will be removed. The slip line on the buoy deck will remain in place to prevent the buoy from spinning. When the buoy is approximately 15-20 feet from the ship, the crane will quickly lower it into the water. Once the buoy is settled into the water, the quick release will be tripped. The ship will move ahead SLOWLY as the buoy moves behind it. Personnel tending the working line will release it as it goes down the rail. The ship will slowly maneuver so it is once again pointing into the wind with the buoy behind the vessel.

Once the ship is settled, holding station or moving ahead at 0.5 knots, the working line will be hauled in, and removed. The mooring wire will pay out and instruments will be clamped to the wire as in previous deployments on this voyage. Occasionally, the mooring will be stopped off so instruments in cages can be inserted between segments of wire rope. At 1100 meters, the mooring will be stopped off and the remaining synthetic line, contained in a large crate, will be slipped over a bit into the water. Once all the synthetic line has been stopped off, 52 glass balls will be deployed in an array using the winch and stopper lines to deploy these in 8 meter segments. The acoustic releases will be attached to the mooring line once all of the glass balls have been inserted. This will be attached to segments of chain and line that will eventually connect to the anchor. This remaining section of the mooring will be deployed using the winch and the last section of chain will be stopped off on the deck and attached to the anchor. A slip line will be used to transfer the load to the anchor. Once at the target deployment site, the crane will lift the anchor tip plate and the anchor will slide off the stern into the sea.

Details of Buoy Retrievals-Deployments:

Sr. No.	Mooring Descriptions	Date	Mooring Locations	
			Latitude	Longitude
1	ATLAS BUOY DEPLOYED	30-Nov-14	03°56.65 N	89°39.58 E
2	NIOT-TSUNAMI BUOY RECOVERED	01-Dec-14	06°25.73 N	88°32.33 E
3	NIOT-TSUNAMI BUOY DEPLOYED	01-Dec-14	06°19.85 N	88°35.02 E
4	ATLAS BUOY DEPLOYED	02-Dec-14	07°58.54 N	88°59.42 E
5	ATLAS BUOY RECOVERED	04-Dec-14	12°03.82 N	88°49.67 E
6	ATLAS BUOY DEPLOYED	04-Dec-14	12°03.59 N	88°48.83 E
7	ATLAS BUOY RECOVERED	06-Dec-14	14°59.78 N	89°56.35 E
8	ATLAS BUOY DEPLOYED	06-Dec-14	14°59.74 N	89°56.27 E
9	CONE BUOY RECOVERED	07-Dec-14	18°00.25 N	89°28.16 E
10	WHOI BUOY DEPLOYMENT	08-Dec-14	17°59 14 N	89°27.35 E
11	CONE BUOY DEPLOYMENT	09-Dec-14	17°41.24 N	89°24.32 E

Argo Floats deployments:

The Autonomous Salinity and Temperature Profiling Floats (ARGO) were deployed at 10 locations during the cruise SN-14/2014 by INCOIS scientists. These floats first sink in to 2000 m depth and then adjust their buoyancy to rise up to sea surface accordingly the no. of Cycle days programmed in it. While ascending in the water column, it records (PTS) the temperature and salinity profile with respect to Pressure and depth table, this recorded information is transmitted to the ARGOS-Iridium satellite by the Antennas fixed on the float. This cycle is repeated at every 10 days. Details of Argo floats deployed during SN-14/2014 are listed below.

ARGO FLOATS deployed during cruise onboard (ORV-SAGAR NIDHI, SN-14/2014)

Sr. No.	Float Serial #	Float Deployed					
		LAT	LONG	Area of Deployment	Time & Date (IST) (LT -Hrs)	Vessel	Cruise #
1	7119	08°57.631'N	85°47.153'E	Bay of Bengal	28-Nov-2014, 01:59	ORV-Sagar Nidhi	SN-14-2014
2	7121	06°00.01'N	88°01.18'E	Bay of Bengal	29-Nov-2014, 03:37	ORV-Sagar Nidhi	SN-14-2014
3	7131	03°57.98'N	89°39.67'E	Bay of Bengal	30-Nov-2014, 08:33	ORV-Sagar Nidhi	SN-14-2014
4	7120	07°59.24'N	89°00.71'E	Bay of Bengal	02-Dec-2014, 19:50	ORV-Sagar Nidhi	SN-14-2014
5	7130	12°03.87'N	88°48.66'E	Bay of Bengal	04-Dec-2014, 14:42	ORV-Sagar Nidhi	SN-14-2014
6	7118	14°00.94'N	89°23.25'E	Bay of Bengal	05-Dec-2014, 06:08	ORV-Sagar Nidhi	SN-14-2014
7	7129	15°16.81'N	89°53.59'E	Bay of Bengal	06-Dec-2014, 15:47	ORV-Sagar Nidhi	SN-14-2014
8	7128	17°41.92'N	89°26.67'E	Bay of Bengal	10-Dec-2014, 03:38	ORV-Sagar Nidhi	SN-14-2014
9	OIN 13 AR-21	15°30.49'N	89°51.92'E	Bay of Bengal	06- Dec -2014, 17:26	ORV-Sagar Nidhi	SN-14-2014
10	OIN 13 AR-22	16°00.26'N	89°47.18'E	Bay of Bengal	06- Dec -2014, 20:50	ORV-Sagar Nidhi	SN-14-2014
11	OIN 13 AR-23	16°30.05'N	89°42.13'E	Bay of Bengal	07- Dec -2014, 00:17	ORV-Sagar Nidhi	SN-14-2014
12	OIN 13 AR-24	17°00.03'N	89°37.97'E	Bay of Bengal	07- Dec -2014, 03:50	ORV-Sagar Nidhi	SN-14-2014
13	OIN 13 AR-25	17°30.22'N	89°32.96'E	Bay of Bengal	07- Dec -2014, 07:38	ORV-Sagar Nidhi	SN-14-2014
14	OIN 13 AR-26	17°41.92'N	89°26.67'E	Bay of Bengal	10- Dec -2014, 03:40	ORV-Sagar Nidhi	SN-14-2014

Drifter deployments:

To determine Sea Surface Temperature & Currents at various locations and collection of met-ocean data in Bay of Bengal, INCOIS scientist's deployed 08 x Surface drifter buoys during the cruise at tabled locations.

Drifter Name	Drifter Id	Deploy			
		Lat	Long	Date	Time
NIO Drifter – 1	138416	03°57.986'N	89°39.667'N	30-Nov-2014	08:33 Hrs (UTC)
NIO Drifter – 2	138408	05°14.33'N	89°03.69'N	30-Nov-2014	18:16 Hrs (UTC)
NIO Drifter – 3	138414	06°55.12'N	88°44.04'E	02-Dec-2014	05:35 Hrs (UTC)
NIO Drifter – 4	116349	07°59.32'N	89°00.77'E	02-Dec-2014	19:54 Hrs (UTC)
NIO Drifter – 5	135777	12°03.87'N	88°48.66'E	04-Dec-2014	14:42 Hrs (UTC)
NIO Drifter – 6	138412	14 00.94'N	89 23.25'E	05-Dec-2014	06:08 Hrs (UTC)
NIO Drifter – 7	126936	15 16.81'N	89 53.59'E	06-Dec-2014	15:47 Hrs (UTC)
NIO Drifter – 8	126934	17°41.92'N	89°26.67'E	10-Dec-2014	03:38Hrs (UTC)

CTD operations:

Conductivity, Temperature, and Depth (CTD) casts with water samples taken up to ~2000m depth at Mooring buoy locations.

File Name / Cast No.	Station Position		Time (UTC)		Maximum Depth Measured	Maximum Cable Pay-out	No. of Bottle closed	ES Depth
	Latitude (N)	Longitude (E)	Start	End				
30-11-2014 / 01	03°56'77"	89°40'06"	00:57	02:03	2000	1996	12	3255
02-12-2014 / 02	07°58'89"	88°58'39"	17:05	18:27	1000	1007	12	3595
04-12-2014 / 03	12°03'90"	88°49'26"	07:42	09:32	2000	2015	12	3148
05-12-2014 / 04	14°58'62"	89°55'10"	17:33	19:47	2000	2016	12	2706
07-12-2014 / 05	18°00'66"	89°27'94"	15:16	16:38	1500	1511	12	2154
10-12-2014 / 06	17°41'64"	89°26'12"	01:13	02:48	1800	1813	12	2205

Dairy of Events

24-November-2014, Day 1

- Cruise materials offloaded from the trucks and loaded into the ship at 12.00 hrs and got over by 23:00 hrs.
- Scientific party signed on at 16:00 Hrs and accommodation allotted to all of them.

25- November-2014, Day 2

- Morning 08:00 hrs vessel shifted to SQ1 to JD4 wharf/Jetty.
- @ 10:00 hrs Ship crew signed off and new crew joined the ship.
- @ 12:00 hrs NIOT team offloaded their winch, boat and motor from ship and sent back to NIOT.
- @17:15 hrs vessel departed from port.

26-November-2014, Day 3

- @ 08:30 hrs advised the bridge to proceed to 4N|90E for our first mooring operation as per the revised cruise planned.
- @ 10:00 hrs pre-cruise meeting was conducted with Master, Officers, crew and scientific parties. briefed mooring operations plan and requirements during meeting.
- @ 16:45 hrs safety drills were conducted onboard with scientific team and ship crew members.

27-November-2014, Day 4

- @ 10:00 hrs PMEL and WHOI team started setting-up their instruments in main deck.
- @ 16:00 hrs INCOIS ARGO floats and NIO surface drifters were tested as per the deployment order.
- @ 17:30 hrs onboard we celebrated Thanks Giving party along with the US participants.

28-November-2014, Day 5

- First ARGO float deployed at 08°57.631N | 85°47.153 @ 07:29 hrs
- PMEL set-up the first ATLAS buoy for 4N,90E deployment

29-November-2014, Day 6

- @ 09:17 hrs deployed second ARGO float at 06°00.01N | 88°01.18E

30-November-2014, Day 7

- @ 05:30 hrs vessel arrived 4N,89E and started preparations for the first RAMA buoy deployment.
- @ 06:30 CTD commenced for 2000m cast, and got over by 08:30 hrs
- @ 09:42 RAMA buoy deployed from 2.75 nm from the Anchor drop position downwind.
- @ 11.50 hrs Anchor deployed at 03°56.65N | 89°39.58E.
- @ 13.30 hrs fly-by (data transmission check) by PMEL and confirmed the data reception from the buoy.
- @ 14.03 hrs third ARGO float and first NIO drifter deployed at 03°57.98N | 89°39.66E.
- @ 14:30 hrs vessel headed towards the second location for the NIOT tsunami buoy recovery and deployment
- @ 23:46 hrs second NIO surface drifter deployed at 05°14.33N | 89°03.69E

01-December-2014, Day 8

- @ 08.30 hrs vessel arrived second station
- @ 09:06 hrs BPR (Bottom Pressure Recorder) released at 06°25.04N | 88°31.54E
- @ 10.18 hrs BPR retrieved and brought onboard, and vessel moved toward the buoy for retrieval
- @ 11:36 hrs tsunami buoy retrieved successfully at 06°25.73N | 88°32.33E
- @ 13.29 hrs new tsunami buoy deployed at 06°19.91N | 88°35.24E
- @ 17:30 hrs anchor dropped at 06°19.84N | 88°35.02E
- @ 20:00 hrs BPR deployed at 06°19.77N | 88°35.47E
- @ 22:06 hrs during BPR deployment, hydrographic winch stopped working when BPR along with winch wire reached 2500m depth. Onboard engineers and electrical officers came and rectified the issue. Around 22:54 hrs the winch operation restarted.
- @ 23:50 hrs BPR successfully released from winch wire at 06°19.77N | 88°35.42E

02-December-2014, Day 9

- @ 02:50 hrs hydrographic winch wire onboard.
- @ 03:05 vessel drifted away from tsunami buoy location and started monitoring the buoy and BPR status.
- @ 07:10 hrs confirmation received from NIOT shore station and advised bridge to proceed to the next station for the 2nd RAMA operation.
- @ 18:30 arrived vessel arrived the location and started 2nd RAMA buoy deployment
- @ 19:54 hrs buoy deployed and 21:58 hrs anchor dropped at 07°58.54N | 88°59.42E
- @ 22:32 hrs CTD commenced for 1000m and got over by 24:00 hrs

03-December-2014, Day 9

- @ 00:45 hrs fly-by carried out and confirmed the data reception.
- @ 01:19 hrs ARGO float and NIO surface drifter deployed at 07°59.24N | 89°00.71E.
- @ 01:25 started sailing to 3rd RAMA site at 12N | 89E

04-December-2014, Day 10

- @ 07:30 hrs vessel arrived at the station for recovery and deployment of RAMA ATLAS buoy.
- @ 07:40 hrs buoy sighted through radar and later by visually.
- @ 07:55 hrs acoustic transducer lowered and released the buoy from the anchor.
- @ 08:48 hrs small boat lowered and connected the heaving line from the ship to buoy.
- @ 09:30 hrs small boat on deck and 12:30 ATLAS buoy retrieved successfully.
- @ 13:05 hrs CTD commenced for 2000m and got over by 15:10hrs
- @ 16:34 new ATLAS buoy deployed and anchor dropped at 18:33 hrs in position 12°03.59N | 88°48.82E
- @ 19:55 fly-by taken and confirmed the data.
- @ 20:00 hrs Bio-ARGO float and surface drifter deployed at 12°03.87N | 88°48.66E
- @ 20:15 vessel headed towards next station.

05-December-2014, Day 11

- @ 11:38 hrs ARGO float and surface deployed at 14°00.94N | 89°23.25E
- @ 20:30 hrs vessel arrived station for the 3rd RAMA buoy operation.
- @ 20:36 hrs CTD and MBN commenced for 2000m and 1000m respectively.

06-December-2014, Day 12

- @ 01:26 hrs CTD and MBN operation completed.
- @ 08:42 hrs buoy recovery operations started.
- @ 09:55 hrs – 12:06 hrs RAMA ATLAS P_{CO2} buoy recovered.
- @ 12:12 hrs vessel proceeded to the buoy deployment location.
- @ 15:15 hrs buoy deployed, and anchor dropped at 14°59.74N | 89°56.26E
- @ 18:15 hrs fly-by carried out and confirmed the data reception.
- @ 21:17 hrs Bio-ARGO float and surface drifter deployed at 15°16.81N | 89°53.59E
- @ 23:00 hrs NKE ARGO float deployed at 15°30.49N | 89°51.92E

07-December-2014, Day 13

- @ 02:20 hrs NKE ARGO float deployed at 16°00.26N | 89°47.18E.
- @ 05:47 hrs NKE ARGO float deployed at 16°30.05N | 89°42.12E.
- @ 09:10 hrs NKE ARGO float deployed at 17°00.03N | 89°37.97E.
- @ 13:08 hrs NKE ARGO float deployed at 17°30.22N | 89°32.96E.
- @ 16:30 hrs Vsl arrived CONE buoy mooring locations at 18°00.25N | 89°28.25E.
- @ 17:10 hrs Small Boat lowered in water for connecting the heaving line to buoy.
- @ 17:20 hrs Buoy is connected by rope .
- @ 17:25 hrs Small Boat on boarded.
- @ 17:38 hrs Buoy released from Anchors at 18°00.68N | 89°28.16E.
- @ 17:45 hrs buoy on deck and completed recovery by 19:55 hrs.
- @ 20:45 hrs CTD & MBN commenced and finished by 23:20 hrs.

08-December-2014, Day 14

- @ 06:20 hrs, preparation for WHOI-ASIMET mooring in Cone buoy recovered location and cone buoy is plan to deploy down south of 35 kms from WHOI mooring site.
- @ 07:00 hrs bottom depths is confirmed and ready for deployment and bridge advised to move ahead towards 4 nm in downwind of Buoy Anchor site.
- @ 08:48 hrs, WHOI buoy deployed in water@ 17°59.14N | 89°24.11E.
- @ 14:00 hrs, WHOI buoy Anchor dropped in position 18°00.61N | 89°27.35E.
- @ 14:36 hrs, Triangulation carried out at 18°00.91N | 89°28.00E.
- @ 16:30 hrs, Triangulation completed and advise bridge to keep away from buoy 500 meters and executed wind correction experiments – over by 19:48 hrs.
- Vsl. moved 19nm down south from WHOI buoy site and started.
- @ 22:00 hrs, Vsl in location for Bathymetric survey commenced.

09-December-2014, Day 15

- @ 01:00 hrs, Bathymetric Survey completed.
- @ 01:06 hrs, Vsl moved towards WHOI-buoy location for Sun Up & Sun down observation.
- @ 05:00 hrs, Vsl at location at 18°00.85N | 89°26.80E.
- @ 13:00 hrs, Small boat lowered in water for Photo session.
- @ 14:06 hrs, Small on deck.
- @ 15:26 hrs, Vsl moving towards Cone buoy deployment site.
- @ 18:37 hrs, Cone Buoy deployed in location 17°41.04N | 89°24.32E.
- @ 20:34 hrs Anchor dropped in position 17°41.24N | 89°26.57E.
- @ 20:36 hrs, Vsl moved 5 miles ahead from buoy Anchored drop location and hold the position.

10-December-2014, Day 16

- @ 05:05 hrs, Vsl started moving to cone buoy location.
- @ 05:45 hrs, Cone buoy sighted by visual from bridge in location at 17°41.625N | 89°26.155E.
- @ 06:44 hrs, CTD lowered in water and completed by at 08:25 hrs.

- @ 08:54 hrs, Small boat lowered in water for cone buoy lifting strap
- @ 09:08 hrs, Bio Argo float, NIOT surface drifter and NKE Argo float deployed at 17°41.92N | 89°26.67E.
- @ 09:24 Vsl propelled to Chennai port
- Successfully completed all planned mooring operations.

11-December-2014, Day 17

- Vessel head towards Chennai port.
- Two NIO surface drifters not deployed due bad satellite transmission.

12-December-2014, Day 18

- Vessel propelled to Chennai , ETA to Chennai is 13th Dec 2014, morning hours.

13-December-2014, Day 19

- @ 06:30 Hrs, Sagar Nidhi arrived Chennai port and awaiting for PILOT to be onboard
- @ 08:30 Vessel got birthed in Jawaharlal docks, Chennai harbour.
- @ 15:00-18:30 Hrs, Singed Off (INCOIS,NIOT,PMEL & WHOI) procedure completed.
- @ 15:00-19:00 Hrs, Cruise Materials offload job completed successfully.
- Cruise ended.

Summary of the scientific works done during cruise SN-14/2014:

1. 4-ATLAS buoys, 1-NIOT Tsunami buoy, 1-WHOI-ASIMET buoy and 1-INCOIS Cone buoy were deployed and 2-ATLAS buoys, 1-Cone Buoy recovered at 7 sites in 89E & 90E longitude lines of RAMA array in Bay of Bengal.
2. 14-ARGO floats (autonomous temperature and salinity profiling floats) deployed at different locations along with Ship cruise track. (SN-14/2014)
3. Conductivity-Temperature-Depth (CTD) profiles taken every RAMA buoy locations.
4. 08-NIO Surface Drifter buoys were deployed during the cruise ship en route.

Acknowledgements

I on behalf of the scientific team of RAMA/WHOI cruise SN-14/2014, would like to thank **Captain Karun Sunder M**, Chief Officer Vivekanand P, Chief Engineer Toms George and all Officers, Electrical Engineers and Crew members onboard ORV-Sagar Nidhi, for their excellent cooperation and good team work throughout the cruise in making this voyage a successful.

I wish to thank Mr. **D Rajasekhar** & Mr. N Ravi NIOT, & Mr. Hariharan for all the administrative and logistic supports during the cruise.

Thanks to M/s. NORINCO Engineers onboard for their untiring works during buoy and CTD operations. Finally I would like to thank all the members of scientific team of SN-14/2014 to make this a enjoyable cruise.



Date: 13-Dec-14

(N Suresh Kumar)
Chief Scientist, SN-14/2014