

ORV - SAGAR KANYA

CRUISE REPORT

Cruise No. SK - 335

(09TH November – 17TH December, 2016)



Submitted by

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OBJECTIVES:

This cruise will be dedicated to the recovery of three and deployment of two deep ocean RAMA moorings, and the recovery of **five** deep ocean subsurface (Acoustic Doppler Current Profiler) ADCP moorings.

The moorings are a part of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA). 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.

(Conductivity, Temperature and Depth) CTD operations were conducted after every RAMA and ADCP Mooring buoy deployment/retrieval locations.

CRUISE TRACK:



SCIENTIFIC PARTICIPANTS SK-335

Sr. No.	Name of Participants	Designation	Institute	Nationality
1.	Mr. Ashok Kumar	Chief Scientist	INCOIS	India
2.	Mr. Narayan Satelkar	Dy. Scientist	NIO	India
3.	Mr. William Lester Higley Jr	Scientist	NOAA/PMEL	USA
4.	Mr. Korey Edward Martin	Scientist	NOAA/PMEL	USA
5.	Ms. Denise Victoria Kester	Scientist	NOAA/PMEL	USA
6.	Mr. Rahul Mavi	Shipboard Asst.	NCAOR	India
7.	Mr. Modini Sreenu	Project Assistant- I	NIO	India
8.	Mr. Kundi Chandrasekhar	Project Assistant- II	NIO	India
9.	Mr. Kotipalli Venkateswara Rao	Project Assistant- III	NIO	India
10.	Mr. V.C. Sarathchandran	Assistant Manager	NORINCO	India
11.	Mr. Avertano Callistus Luis	Assistant Manager	NORINCO	India
12.	Mr. Rajendran Prakash	Service Engineer	NORINCO	India
13.	Mr. Muthusamy Ramesh	Service Engineer	NORINCO	India
14.	Mr. Venkatesan Selvaraj	Deployment Assistant	INCOIS	India
15.	Mr. Udhayakumar Raji	Deployment Assistant	INCOIS	India
16.	Mr. Subramanian Natesan	Deployment Assistant	INCOIS	India
17.	Mr. Nivas Niraimathi	Deployment Assistant	INCOIS	India
18.	Mr. Karthik Udayakumar	Deployment Assistant	INCOIS	India

RECOVERY AND DEPLOYMENT OF RAMA/ADCP 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). RAMA & Acoustic Doppler Current Profiler (ADCP) buoys were recovered and redeployed at assigned locations in Equatorial Indian Ocean and Indian Ocean by MoES/INCOIS/NIO & NOAA/PMEL scientists during this cruise.

The recovery operations start with sighting the buoy on Radar or visually. Then the vessel 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 inflatable boat can be used to carry scientists and seaman's, lowered from the ship main deck midships Starboard 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 and 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 and ADCP buoys during the cruise.

Deployment of RAMA buoy was performed from midships of the ship using ATLAS 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 RAMA buoy was deployed using the midships ATLAS crane deployed by A-frame from main deck and mooring cable passed over the Hanging Pulley Block connected in the deep sea winch 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 ~ 600 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 an Acoustic release was connected to the line, followed by the heavy anchor weight. The anchors were dropped from the ship aft by using A-frame and deep sea winch capstan. Similar procedure followed for all RAMA buoy deployments.

DETAILS OF BUOY RETRIEVALS/DEPLOYMENTS:

Sr. No.	Mooring Descriptions	Date	Mooring Locations	
			Latitude	Longitude
1	RAMA RECOVERY – RT005	16-Nov-2016	03° 54.46' S	080° 27.18' E
2	RAMA DEPLOYMENT – RT010	17-Nov-2016	03° 54.25' S	080° 26.74' E
3	RAMA RECOVERY – RA134	19-Nov-2016	07° 59.87' S	080° 26.08' E
4	RAMA RECOVERY – RT006	26-Nov-2016	11° 59.02' S	080° 12.68' E
5	RAMA DEPLOYMENT – RT012	26-Nov-2016	11° 54.47' S	080° 20.93' E
6	ADCP RECOVERY – EQCM-7.4S	06-Dec-2016	01° 00.12' S	077° 02.03' E
7	ADCP RECOVERY – EQCM-3.9	07-Dec-2016	00° 00.14' N	076° 59.94' E
8	ADCP RECOVERY – EQCM-6.4N	08-Dec-2016	00° 59.59' N	077° 00.11' E

CTD OPERATIONS:

Conductivity, Temperature, and Depth (CTD) casts were made up to 2000 meters depth at all the locations where ARGO Float, RAMA and ADCP buoys were deployed/recovered.

Sl.No	Latitude	Longitude	Date	start time (LT)	Depth
1	03° 54.91 S	080° 29.64 E	16-Nov-2016	19:20	2000 Meters
2	07° 57.68 S	080° 26.09 E	18-Nov-2016	05:37	2000 Meters
3	11° 55.31 S	080° 20.50 E	27-Nov-2016	04:09	2000 Meters
4	00° 56.73 N	077° 00.37 E	08-Dec-2016	02:37	2000 Meters

DRIFTER:

The drifters are designed to track the water currents (15 meters deep) beneath the ocean surface. Developed for unattended operation in the oceans, the SVP consists of at least two sensors: sea surface temperature and hull submergence sensors to acquire meteorological and oceanographic data, a battery power source, and a satellite transmitter that relays the data through the ARGOS satellite system.

Sl.No	Drifter ID	Latitude	Longitude	Date	Time (GMT)
1	451640	02° 01.60 S	080° 48.66 E	15-Nov-2016	12:07
2	471590	03° 54.48 S	080° 27.04 E	17-Nov-2016	07:42
3	471560	11° 54.43 S	080° 20.80 E	26-Nov-2016	13:05

ARGO FLOATS:

The Autonomous Salinity and Temperature Profiling Floats (ARGO) were deployed during the cruise SK-335. 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 then transmitted to the ARGOS/Iridium satellite by the Antennas fixed on the float. This cycle is repeated at every 10 days.

Sl.No	Serial No.	Latitude	Longitude	Date	Time (IST)
1	7539	04° 00.51 S	080° 27.44 E	17-Nov-2016	14:12
2	7538	07° 59.85 S	080° 24.68 E	19-Nov-2016	21:16
3	7537	11° 55.45 S	080° 20.69 E	27-Nov-2016	03:48
4	7553	00° 00.04 N	077° 10.90 E	07-Dec-2016	14:56
5	7554	00° 00.45 N	083° 00.16 E	10-Dec-2016	18:00

DAIRY OF EVENTS

09- Nov -2016, Day 1

- Scientific team signed on at 11:00 Hrs and accommodation allotted to all of them.
- All scientific equipments from NIOT were loaded prior onboard on 08-Nov- 2016 from 13 trucks.
- PMEL Electrical winch is successfully fitted in main deck with local workshop people.
- All scientific gears were inventoried and verified by PMEL team. All five seamen secure all the cruise material.
- Because of crane and some other issue sailing is not done.
- @ 16:00 Hrs, we had meeting regarding sailing with ship captain.

10- Nov -2016, Day 2

- Crane & other issues were carried out aboard.
- @ 10:30 Pilot onboard and 11:00 Hrs, Vessel sail out from JD3 Chennai port.
- NOAA scientist with help of seamen's set up the lab facility & instruments on deck and staged the mooring hardware and gears according to the order of operations.
- @ 16:15 Hrs, Safety drills were conducted onboard with scientific team and ship crew members.

11- Nov -2016, Day 3

- @ 10:00 Hrs, we had meeting regarding for operation and plan with ship captain, officers and few crew members and scientific team and Norinco Engineers.
- Assembled two RAMA buoy for our first deployment operation and fixed all met sensor near to first accommodation deck for testing.
- Kept 2 no's RAMA tube to second accommodation deck for testing the met sensors.
- Vessel proceeds to first RAMA buoy deployment location, ETA 15/Nov/2016 AM.

12- Nov -2016, Day 4

- PMEL team and all seamen's are preparing for first RAMA buoy deployment like rope, pulley - A frame, winch power supply, etc.
- Approx. ETA is 15th Nov-2016, PM, for first location.

13- Nov -2016, Day 5

- Seamen's are doing paint work on RAMA mooring, which we are going to deploy in this cruise.
- Assembled one more RAMA buoy for our deployment operation and fixed all met sensor near to first accommodation deck for testing.

14- Nov -2016, Day 6

- Current meter we tested/configure and kept to second deck for testing, it is working fine or not.
- Once again we cross check, all the buoy secure or not which we kept to transmission test.
- A small meeting happened with NORINCO, NIO, PMEL team regarding CTD operation and Water sampling, which we will do each our first RAMA buoy deployment.
- Approx. ETA is 16th Nov-2016, 10:30 Hrs, for first location, for first location because of ship speed delay for reach location.

15- Nov -2016, Day 7

- A small meeting happened with captain, PMEL team and chief officer regarding small boat trial.
- @ 11:30 Hrs, small boat lowered in the sea with tree persons (2-PMEL, 1-Seamen) for testing the small boat 09:50 Hrs, boat onboard.
- @ 16:00 Hrs, we had meeting regarding for operation and plan with ship captain, officers and few crew members and scientific team and Norinco Engineers.

- Tested 3 No's ARGO floats (7537, 7538 & 7539) and sent capture file to Suresh Sir (INCOIS) for verification. Suresh sir replied all the three Argo floats are good, we can deploy only we should to floats to Pressure Activation mode before deployed.
- Drifter buoy (451640) deployed, Approx. ETA is 16th Nov-2016, 11:00 Hrs.

16- Nov -2016, Day 8

- @ 12:45 Hrs, RAMA buoy (RT005) signed.
- @ 13:10 Hrs, Transducer lower in the water from starboard side for release the buoy but unfortunately the bottom release and ship board Acoustic transducers couldn't make communication successfully.
- @ 14:05 Hrs, we lowered a small boat in water and this time three persons, for release the Acoustic because it not release while we tried from onboard. They couldn't able to do release the buoy because of some communication issued.
- @ 14:35 Hrs, Buoy has released, we tried to pull the working line and picked up the RAMA buoy on deck while heaving the buoy, the tag line which we connected between Buoy and A-Frame Railings got high tensed.
- @ 15:10 Hrs, small boat onboard with all the metrological sensors.
- @ 15:25 Hrs, RAMA buoy (RT005) on deck.
- @ 15:50 Hrs, RAMA Recovery operation started.
- @ 20:15 Hrs, RAMA Recovery operation completed.
- Deployment of New mooring we will start tomorrow morning at 0600 Hrs.

17- Nov -2016, Day 9

- @ 06:45 Hrs, we are ready for deploy the RAMA buoy, waiting for deployment position ETA 10 to 15 minutes.
- @ 07:30 Hrs, we started the RAMA buoy (RT010) deployment.
- @ 09:20 Hrs, we deployed 700m wire rope and fixed all the sensors on it according plan.
- @ 11:00 Hrs deployed all the nylon rope according the depth now we are waiting for Anchor deployment position.
- @ 12:15 Hrs, anchors dropped in targeted site.
- We came to near deployed RAMA buoy location for confirm the all sensors data.

- Recovery buoy we kept one side and remove the tower, bridle and all the sensors from the buoy.
- First CTD Argo float (7539) deployed, before deployment of Argo float I did float in pressure activation mode.
- Drifter buoy (471590) deployed, Approx. ETA is 18th Nov-2016, 23:00 Hrs.

18- Nov -2016, Day 10

- Testing of RAMA mooring sensors and doing data testing, checking coming right or not.
- Testing, checking of Acoustic release and deck unit before deployment of Acoustic release.
- Next RAMA buoy is ready for deployment with all met and ocean sensors.
- Tested all the sensors which we are going to deployed/fixed to our next RAMA buoy deployment.
- PMEL team with help of seamen's set up the RAMA buoy for next operations.

19- Nov -2016, Day 11

- @ 10:00 Hrs, buoy (RA132) signed, now we are going to near approx. 100m the buoy for release.
- @ 10:40 Hrs, Transducer lower in the water from starboard side for release the buoy and we got release confirmation.
- @ 12:10 Hrs, small boat lowered in water and tied the buoy and around 11:55 Hrs, small boat onboard with all the meteorological sensors which we removed from the RAMA buoy.
- @ 14:50 Hrs, RAMA buoy (RA132) on deck
- @ 12:25 Hrs, RAMA Recovery operation started. 14:00 Hrs we recovered 700m wire rope with all oceanographic sensors.
- @ 19:10 Hrs, RAMA Recovery operation completed.
- @ 09:30 Hrs, we started the RAMA buoy (RT011) deployment.
- @ 12:20 Hrs, we deployed 700m wire rope and fixed all the sensors on it according plan.
- @ 13:00 Hrs deployed all the nylon rope according the depth now we are waiting for Anchor deployment position.
- @ 14:30 Hrs, anchors dropped in targeted site.
- We came to near deployed RAMA buoy location for confirm the all sensors data.
- Recovery buoy we kept one side and remove the tower, bridle and all the sensors from the buoy.

- Second CTD Argo float (7538) deployed, before deployment of Argo float I did float in pressure activation mode. Approx. ETA is 21th Nov-2016, 14:00 Hrs for next location.

20- Nov -2016, Day 12

- Testing of RAMA mooring sensors and doing data testing, checking coming right or not.
- Testing, checking of Acoustic release and deck unit before deployment of Acoustic release.
- Next RAMA buoy is ready for deployment with all met and ocean sensors.
- Tested all the sensors which we are going to deployed/fixed to our next RAMA buoy deployment.
- PMEL team with help of seamen's set up the RAMA buoy for next operations.
- Today afternoon we got an email from Subramaniam sir (NCAOR), regarding our cruise track, in our cruise track little changed in actual track we have to go 12S & 67E from 12S & 80E but now we have to go 8S & 67E from the 12S & 80E.
- Approx. ETA is 21th Nov-2016, 13:00 Hrs.

21- Nov -2016, Day 13

- @ 12:50 Hrs, RAMA buoy (RT006) signed and vessel is going to near the buoy because we have to release the buoy/lower the small boat.
- We have tried to release the buoy but cannot release the buoy because of high wind and swell.
- We have tried three times to release the buoy, One time star board side and two time port side but not success to release.
- Here (12S/80.5E) weather was not good, so we have taken one meeting with captain, chief officer and PMEL team and decided, we will wait for tomorrow then will start the work because of high wind and swell.
- We have informed to INCOIS, NCAOR, regarding holding the ship here up to tomorrow morning because of weather issue.

22- Nov -2016, Day 14

- @ 07:50 Hrs, we got a big alarm sound then suddenly all persons onboard came out from their cabin/work place and asked each other what happened, also ship has listing 7 degree to port side.
- We all (PMEL team, NORINCO scientist and NIO scientist) went to bridge and asked what happened, why alarm rung, then Captain has told one emergency is here (on board).

- He (Captain) told on board one leakage (hole) is there and also from hole water is coming inside (Hydraulic room) & yet now Approx. 2000 litter has come inside.
- So immediately we had a meeting with Captain, chief officer, chief Engineer, NORINCO, PMEL and NIO scientist then Captain has decided we have to go nearest port because of emergency.
- Then we turn the ship to nearest port (Diego Garcia) and our ETA is 26/11/2016 PM, Same we have inform to NORINCO, NIO, INCOIS and SCI office.
- Now we got on more message from Captain that ship staff mess room also water is coming inside but slowly-2, not a problem he told continue they are checking where is the leakage.

23- Nov -2016, Day 15

- Captain has decided, now we will go to Galle port because Diego Garcia port is Navel based (it is not Indian port) and we will not get there proper repair, so now ship turned to Galle port & now our ETA to Galle port is 29/11/2016 PM.
- Ship staff is removed all the water from Hydraulic room and now ship also is stable condition, we are not getting rolling.
- In parallel we have received an email from PMEL office, they don't want to do any operation until 100% secure ship.
- Ship is coming toward to Galle port then luckily we got a message from Captain he told they have found hole, which water was coming inside also ship is not listing now, approx. 2-3 degree listing.
- Captain told now ship is fully under controlled so we can start our operation work, PMEL team also agrees so we have decided, we will start our reaming wok now we are not going Galle.
- We have received one email from PMEL in that email they have written our deployed RAMA buoy (TR011) has drifted, so we have to recover the buoy and Re-deploy.
- We had meeting regarding for operation (drift buoy) with ship captain, chief officers, PMEL team, decided first we will do recovery of drifted buoy and re-deploy the buoy then we will go to our cruise track.
- Because we have lost 5 days here, so we have asked to captain we can do our all the operation or not, Captain also agree to same and also he (Captain) told ship has enough fuel, provisional and fresh water to do all the work according the cruise track.
- ETA to reach drifted RAMA buoy location (8S/80.5E) : 24/11/2016; 1100 Hrs

24- Nov -2016, Day 16

- @ 10:45 Hrs, RAMA buoy (RT011) signed.

- @ 11:15 Hrs, we lowered a small boat in water and this time three persons, they (PMEL team and seamen's) removed all the met sensors safely and , they tried buoy from working line, 12:10 Hrs, small boat onboard with all the metrological sensors.
- RAMA buoy (RT011) on deck while heaving the buoy, the tag line which we connected between Buoy and A-Frame Railings got high tensed.
- @ 12:50 Hrs, RAMA Recovery operation started.
- @ 15:15 Hrs, RAMA Recovery operation completed.
- Recovery buoy we kept one side and fixed the entire remove met sensors to buoy.
- @ 15:45 Hrs, we are ready for deploy the same RAMA buoy (RT011), waiting for deployment position ETA 30 to 40 minutes.
- @ 16:30 Hrs, we started the RAMA buoy (RT011) deployment.
- @ 17:40 Hrs, we deployed 700m wire rope and fixed all the sensors on it according plan.
- @ 19:35 Hrs deployed all the nylon rope according the depth now we are waiting for Anchor deployment position.
- @ 20:50 Hrs, anchors dropped in targeted site.
- We came to near deployed RAMA buoy location for confirm the all sensors data.
- Small meeting with NORINCO with PMEL team regarding parameters value like SST, AT, RH and wind direction etc....
- PMEL team plan to skip two operations (4S/67E & 8S/67E) because of time shortage this decision was taken PMEL office, from ship side everything is ok. Then afterwards they agree to do all the operation because they have received email from their office regarding this.
- Approx. ETA (Station No-03) is 26th Nov-2016, 12:00 Hrs because ship speed is 6.8 knots.

25- Nov -2016, Day 17

- We have filtered data from sampled water which we have taken from CTD cast time as PMEL team requested each RAMA buoy location they want water sample at diffrenrt-2 depth.
- We prepared the new RAMA buoy for our next deployment (12S/80.5E) waiting for deployment location all the met sensors also fixed.
- We have received an email from PMEL office, regarding 12S/80.5E RAMA buoy (RT006) has released, which we have tried three time on 21/Nov/2016, but that time we did not received confirmation from release because bed whether, high swell and high wind.

- Also we have received latest portion of release RAMA buoy (RT006), buoy is moving according water current.
- Approx. ETA is 26th Nov-2016, 14:00 Hrs because ship speed is 6.3 knots for Station No-03.

26- Nov -2016, Day 18

- @ 13:45 Hrs, RAMA buoy (RT006) signed.
- @ 14:15 Hrs, we lowered a small boat in water and this time three persons, they (2- PMEL person and 1- seamen) we did not remove all the met sensors because of weather (High wind & High swell), directly they tried buoy from working line, 14:40 Hrs, small boat onboard.
- RAMA buoy (RT006) on deck while heaving the buoy, the tag line which we connected between Buoy and A-Frame Railings got high tensed, because of high wind speed & high swell two metrological sensors (Rain gauge and Wind speed) broken.
- @ 15:20 Hrs, RAMA Recovery operation started.
- NIO Electrical winch is stopped suddenly then we called to Electrical Engineer, he came and checked and finally he repaired the winch near 30 to 40 minutes he has taken for repair.
- @ 18:40 Hrs, RAMA Recovery operation completed.
- Drifter buoy (471560) deployed,
- Recovery buoy we kept one side and preparing to new deployment buoy.
- @ 19:35 Hrs, we are ready for deploy the new RAMA buoy (RT012), waiting for deployment position ETA 20 to 30 minutes.
- @ 20:40 Hrs, we started the RAMA buoy (RT012) deployment.
- @ 22:35 Hrs, we deployed 700m wire rope and fixed all the sensors on it according plan.

27- Nov -2016, Day 19

- @ 00:35 Hrs deployed all the nylon rope according the depth now we are waiting for Anchor deployment position.
- PMEL person (Mr. William Lester Higley Jr) has given wrong coordinate for Anchor deployment then later he has given correct coordinate for Anchor deployment but we have to go 120 degree angle difference from first coordinate and ship will take Approx. One hour to reach location.
- @ 01:15 Hrs, anchors dropped in targeted site.
- We came to near deployed RAMA buoy location for confirm the all sensors data.

- NORINCO team has given all the parameters value like SST, AT, RH and wind direction etc....
- PMEL team got an email from their office regarding drifting buoy which we have deployed at 8S/80.5E second time, Already this buoy one time drifted one time but again it drifted.
- Now ship is going to 8S/67E but after confirmation from PMEL, INCOIS office Captain Change ship heading to 8S/80.5E for recovery of drifted buoy. Also PMEL office decided now they will skip 8S/67E because of time shortage.
- We had meeting regarding for operation and plan with ship captain, chief officers and PMEL team, finally we have decided first we will do 8S/80.5E recovery and deployment then we will go 4S/67E after this we will go for NIO mooring operation, ETA to Chennai 22/Dec/2016.
- Third CTD Argo float (7537) deployed, before deployment of Argo float I did float in pressure activation mode.
- Approx. ETA (8S/80.5E) for recovery of drifted buoy is 29th Nov-2016, PM Hrs because ship speed is 6.7 knots.

28- Nov -2016, Day 20

- Testing of RAMA mooring sensors which we have recovered yet now and doing data testing, checking coming right or not from sensors.
- Removed all the metrological form recovered buoy and kept one place for testing, also removed bridle, tower from the buoy, Downloading of data is started from retrieval RAMA mooring.
- Approx. ETA (8S/80.5E) for recovery of drifted buoy is 29th Nov-2016, 22:00 Hrs because ship speed is 6.5 knots.

29- Nov -2016, Day 21

- @ 05:15 Hrs, RAMA buoy (RT011) signed.
- @ 06:25 Hrs, we lowered a small boat in water and this time three persons, they (PMEL team and seamen's) removed all the met sensors safely and , they tried buoy from working line, 07:10 Hrs, small boat onboard with all the metrological sensors.
- @ 07:35 Hrs, RAMA buoy (RT011) on deck while heaving the buoy, the tag line which we connected between Buoy and A-Frame Railings got high tensed.
- @ 08:10 Hrs, RAMA Recovery operation started.
- @ 09:50 Hrs, RAMA Recovery operation completed, because while recovery he have receive only half Nylon rope out of seven coil, reaming we have lost in the water with Acoustic release.

- Recovery buoy we kept one side and fixed all the sensors for deployment of same buoy.
- @ 11:20 Hrs, we are ready for deploy the new RAMA buoy (RT011), waiting for deployment position ETA 25 to 35 minutes.
- In this location we have did Multibeam with help of NORINCO team available onboard for measuring depth of buoy deployment & buoy settle position.
- @ 13:45 Hrs, we started the RAMA buoy (RT011) deployment.
- @ 15:25 Hrs, we deployed 700m wire rope and fixed all the sensors on it according plan.
- @ 17:40 Hrs deployed all the nylon rope according the depth now we are waiting for Anchor deployment position.
- @ 18:05 Hrs, anchors dropped in targeted site.
- We came to near deployed RAMA buoy (RT011) location for confirm the all sensors data and we wait Approx. 1 hour in this location for buoy settle.
- NORINCO team has given all the parameters value like SST, AT, RH and wind direction etc....
- Later we leave this location for our next mooring operation (12S/80.5E), ETA is 01/Dec/2016 16:00 Hrs.

30- Nov -2016, Day 22

- PMEL team got message from their office regarding deployed buoy (RT011) yesterday (29/Nov/2016) was communication failed. So again we have to go 8S/80.5E for repair the buoy.
- A small meeting with chief officer, Captain and PMEL team regarding our cruise plan, now ship is going to 12S/80.5E for retrieve and deployment the drifted buoy (RT012) after this (12S/80.5E) buoy operation vessel will go to 8S/80.5E for repair the buoy(RT011).
- Approx. ETA is 01st Dec-2016, 07:30 Hrs because ship speed is 6.8 knots.

01- Dec -2016, Day 23

- @ 05:15 Hrs, RAMA buoy (RT012) signed.
- @ 07:45 Hrs, we lowered a small boat in water and this time three persons, they (2- PMEL and 1-seamen's) removed all the met sensors safely and , they tried buoy from working line, 08:10 Hrs, small boat onboard with all the metrological sensors.
- @ 09:05 Hrs, RAMA buoy (RT012) on deck while heaving the buoy, the tag line which we connected between Buoy and A-Frame Railings got high tensed.

- @ 09:40 Hrs, RAMA Recovery operation started.
- @ 12:50 Hrs, RAMA Recovery operation completed, in this recovery we have recovered all the Nylon rope with Acoustic release, last 50 meter piece was broken.
- Recovery buoy we kept one side and fixed all the sensors for deployment of same buoy.
- @ 15:10 Hrs, we are ready for deploy the new RAMA buoy (RT012), waiting for deployment position ETA 15 to 25 minutes.
- In this location we have did Multibeam survey with help of NORINCO team available onboard for measuring depth of buoy deployment & buoy settle position.
- @ 15:50 Hrs, we started the RAMA buoy (RT012) deployment.
- @ 17:30 Hrs, we deployed 700m wire rope and fixed all the sensors on it according plan.
- @ 18:40 Hrs deployed all the nylon rope according the depth now we are waiting for Anchor deployment position. 19:25 Hrs, anchors dropped in targeted site.
- We came to near deployed RAMA buoy (RT012) location for confirm the all sensors data and we wait Approx. 1 hour in this location for buoy settle.
- NORINCO team has given all the parameters value like SST, AT, RH and wind direction etc....
- Later we leave this location for our next drifted mooring (RT011) operation (8S/80.5E), ETA is 03/Dec/2016 08:00 Hrs.

02- Dec -2016, Day 24

- We are going to repair the deployed buoy (RT011), but we got message from onboard team that buoy (RT011) was drifted again (third time), so now we will recover the buoy. Because we don't have more Anchor onboard so we cannot do now more deployments.
- A small meeting with chief officer, Captain and PMEL team regarding our cruise plan, now ship is going to 01S/77E for retrieve of NIO ADCP mooring.
- ETA for Drifted buoy (8S/80.5E) is 03-Dec-2016, 06:00Hrs.

03- Dec -2016, Day 25

- @ 06:20 Hrs, RAMA buoy (RT011) signed.
- @ 06:40 Hrs, we lowered a small boat in water and this time three persons, they (PMEL team and seamen's) removed all the met sensors safely and , they tried buoy from working line, 07:10 Hrs, small boat onboard with all the metrological sensors.

- @ 08:25 Hrs, RAMA buoy (RT011) on deck while heaving the buoy, the tag line which we connected between Buoy and A-Frame Railings got high tensed.
- @ 09:10 Hrs, RAMA Recovery operation started.
- @ 11:50 Hrs, RAMA Recovery operation completed, while recovery he have receive only two and half Nylon rope out of seven coil, reaming we have lost in the water with Acoustic release.
- Recovery buoy we kept one side and ship proceed to first recovery (01S/77E) site for NIO, first ADCP mooring. ETA to next (first ADCP recovery site) location 06-Dec-2016 AM.

04- Dec -2016, Day 26

- PMEL team want to storage 3 No's RAMA buoy onboard for next BoB cruise, Because all three buoy are ready for deployment, in this cruise we did not deployed these buoys because of shortage of Anchors and repeated operation. Also they want to know possibility to increase number of days for next BOB cruise to do 4S, 8S, and 12S/67E operation. For same I have sent email to our office waiting for reply.
- A small meeting with Chief Officer and Captain regarding ETA to Chennai. Tentative ETA to Chennai is 20-Dec-2016 AM, if all goes well.

05- Dec -2016, Day 27

- Tested 2 No's BIO ARGO floats (7553 & 7554) and sent capture file to Suresh Sir (INCOIS).
- A small meeting with NIO Scientist, Chief Officer and Captain regarding ADCP mooring operation, Vessel proceeds to our first ADCP buoy recovery site, approx. ETA is 05th Dec-2016, 23:30 Hrs.

06- Dec -2016, Day 28

- @ 03:15 Hrs, we reached ADCP recovery site. AND @ 04:00 Hrs, we have started CTD operation but due to strong current we did not take CTD cast. We have lowered CTD in water, but not success. Finally we have skipped the CTD in this location (01S/77E). After some time we have stated our ADCP recovery work.
- @ 05:45 Hrs, Transducer lower in the water from starboard side for release the ADCP buoy, but we did not get the release confirmation because of strong current and high wind ship was drifted Approx. 800 m from original position.
- Once again (After 35 minutes) we have lower transducer in the water from starboard side for release the ADCP buoy and we got release confirmation.
- @ 08:35 Hrs, ADCP buoy (EQCM-7.4S) signed.

- @ 09:05 Hrs, we lowered a small boat in water and tied the ADCP buoy, this time three persons went in small boat (2-PMEL, 1-seamen). 09:40 hrs, small boat onboard.
- @ 10:15 Hrs, ADCP buoy onboard and we started the recovery of ADCP mooring.
- @ 14:00 Hrs, we finished recovery of ADCP.
- Vessel heading towards next location (2nd ADCP recovery), Approx. ETA is 07th Dec-2016, AM.

07- Dec -2016, Day 29

- @ 04:15 Hrs, we reached ADCP recovery site.
- @ 04:45 Hrs, we have started CTD operation but due to strong current we did not take CTD cast. We have lowered CTD in water, but not success. Finally we have skipped the CTD in this location (00N/77E). After some time we have stated our ADCP recovery work.
- @ 06:35 Hrs, Transducer lower in the water from starboard side for release the ADCP buoy, but we did not get the release confirmation because of strong current and high wind ship was drifted Approx. 600 m from original position.
- Once again (After 20 minutes) we have lower transducer in the water from starboard side for release the ADCP buoy and we got release confirmation.
- @ 10:05 Hrs, ADCP buoy (EQCM-3.9) signed.
- @ 10:50 Hrs, we lowered a small boat in water and tied the ADCP buoy, this time three persons went in small boat (2-PMEL, 1-seamen). 11:20 hrs, small boat onboard.
- @ 12:25 Hrs, ADCP buoy onboard and we started the recovery of ADCP mooring.
- @ 16:10 Hrs, we finished recovery of ADCP.
- Vessel heading towards next location (ADCP recovery), Approx. ETA is 08th Dec-2016, AM.

08- Dec -2016, Day 30

- @ 03:25 Hrs, we reached ADCP buoy (EQCM-6.4N) recovery site.
- @ 06:15 Hrs, Transducer lower in the water from starboard side for release the ADCP buoy and we got release confirmation.
- @ 07:20 Hrs, we lowered a small boat in water and tied the ADCP buoy, this time three persons went in small boat (2-PMEL, 1-seamen). 07:50 hrs, small boat onboard.
- @ 08:15 Hrs, ADCP buoy onboard and we started the recovery of ADCP mooring.

- @ 11:40 Hrs, we finished recovery of ADCP.
- Vessel heading towards next location (ADCP recovery), Approx. ETA is 10th Dec-2016, AM.

09- Dec -2016, Day 31

- Packing of instruments started, making material list according material which we have onboard.
- Re-Assembled all assembled buoy onboard which we have planned to store onboard for our next BoB RAMA cruise.
- We have reached station No- 9 (0N/83E), at 09/12/2016 (23:30 Hrs).

10- Dec -2016, Day 32

- We are waiting since last night for good weather but weather is not good here (wind speed 35 knot and high swell approx. 3 - 4 m).
- Evening around 18:00 Hrs, we (NIO scientist, captain and INCOIS) have decided that we will skip this station and move to next station because of bad weather.
- Around 21:00 hrs, we have received an email from NIO office that no need to go to (last station) station no- 10 because weather is bad there. So we have decided onboard that ship will head to Chennai, Now no more operation.
- Vessel heading towards Chennai port, ETA is 16th Dec-2016, PM. ship speed is 4.2 knots.

11- Dec -2016, Day 33

- Finally we made list of material which have to offload from ORV Sagar Kanya ship, when ship will reach Chennai. PMEL team are preparing for their sign-off.
- Labeled the entire material according list. Vessel heading towards Chennai port.

12- Dec -2016, Day 34

- Vessel heading towards Chennai port, ETA is 15th Dec-2016, 20:00 Hrs. ship speed is 5.2 knots.

13- Dec -2016, Day 35

- Vessel heading towards Chennai port, ETA is 15th Dec-2016, 22:00 Hrs. ship speed is 6.2 knots.

14- Dec -2016, Day 36

- Vessel heading towards Chennai port, ETA is 15th Dec-2016, 23:00 Hrs. ship speed is 3.7 knots.

15- Dec -2016, Day 37

- @ 11:00 Hrs, we had meeting regarding for sign off for cruise participants with ship captain, chief officers, chief engineer. Captain has told once ship will reach Chennai we will anchored waiting for berthing conformation that will decided tomorrow (16-Dec-2016) after 10:30 Hrs.

16- Dec -2016, Day 38

- Vessel reached near to Chennai port at 18:00 Hrs. and anchored, awaiting for berth. We did not get berth, Mostly tomorrow will get berth this message we got from NCAOR/SCI.

17- Dec -2016, Day 39

- Today around 12:00 Hrs we got berth confirmation and sign off all the cruise participants.

SUMMARY OF THE SCIENTIFIC WORKS DONE DURING CRUISE SK-335:

- 2-RAMA buoys were deployed and 3-RAMA & 3-ADCP buoys were recovered in Latitudes 4S, 8S, 12S along with 80.5 E longitude lines of RAMA Moorings and Latitudes 1S, 0N along with 77E longitude of ADCP Moorings.
- Conductivity-Temperature-Depth (CTD) profiles taken every RAMA and ADCP buoy locations.
- 5- ARGO floats (3- Argo Telemetry and 2- Bio Argo) were deployed at different locations along with Ship cruise track (SK-335).
- 3 - Surface Drifters were deployed during this cruise.


ACKNOWLEDGEMENTS

I on behalf of the scientific team of RAMA cruise SK-335, would like to thank Director, NCAOR for providing the research vessel "ORV Sagar Kanya" and all the facilities onboard for our operations i sincerely thank to Captain S.R. LOKHANDE, Chief Officer Mr. VISHANT V CHAVAN, Chief Engineer Mr. MATHEW EIPE and all Officers, Doctor, Electrical Engineers and Crew members onboard ORV-Sagar Kanya, for their excellent cooperation and good team work throughout the cruise in making this voyage a very successful, I am also thankful to Dr. M. Ravichandran, INCOIS for the kind support and valuable suggestions.

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Thanks to M/s NORINCO Engineers onboard for their untiring works during RAMA, ADCP buoy and CTD operations. Finally I would like to thank all the members of scientific team of SK-335 to make this a completely successful and enjoyable cruise.

Date: 17 -Dec-2016



(Ashok Kumar)
Chief Scientist, SK-335