

ORV SAGAR KANYA CRUISE 141

INDOEX – IFP '99

Area of operation : Western Tropical Indian Ocean

Cruise duration and Track: 20 January – 12 March 1999
Mormagao – Port Louis – Mormagao

Objectives

To collect data on radiation, aerosols, trace gases, meteorological and oceanographic parameters during the northeast monsoon period of 1999 from the Western Tropical Indian Ocean under the Intensive Field Phase Programme of Indian Ocean Experiment (INDOEX – IFP '99)

Participants

1.	Dr.N.Bahulayan	NIO	Chief Scientist
2.	Dr.M.D. George	NIO	
3.	Mr.M.T.Babu	NIO	
4.	Mr.E.P.Rama Rao	NIO	
5.	Mr.Damodar M.Shenoy	NIO	
6.	Ms. Namitha Jadhav	NIO	
7.	Dr.K.S. Zalpuri	NPL	Goa – Port Louis
8.	Mr.Tuhin K.Mandal	NPL	
9.	Dr.Umesh Kulshrestha	NPL	
10.	Mrs.Monica Jain	NPL	
11.	Dr. A.Jayaraman	PRL	
12.	Dr. Manish Naja	PRL	Goa – Port Louis
13.	Mr. K.S.Modh	PRL	
14.	Mr.J.T.Vinchi	PRL	
15.	Mr. Auromeet Saha	SPL	
16.	Mr. D.V.Subramanyam	SPL	
17.	Mr. J.V.S.Raju	IISc	
18.	Mr. C.P.Chandrasekakra	IISc	
19.	Mr.S.D. Pawar	IITM	
20.	Mr.P. Murugavel	IITM	Goa – Port Louis
21.	Dr. Y.Jaya Rao	IITM	
22.	Mr. K.Shaikkoya	IMD	
23.	Mr. Jatin Kumar V	IMD	
24.	Mr. L.D. Mahapatra	IMD	
25.	Mr. Hari Singh Sisodia	IMD	

26. Mr.Nelson V.Sam	IITD	
27. Lt.Cdr.V.Jyothiraman	DNOM	
28. Mr.M.M.Subramaniam	ASC	
29. Mr.K.M.Jayakrishnan	Norinco	
30. Mr.Praveen Rodrigues	Norinco	
31. Mr.M. L. Jean Andre	MMS, Mauritius	Port Louis – Goa

CRUISE ITINERARY :

First Leg (Goa – Port Louis)

ORV Sagar Kanya sailed from Mormagoa Harbour with 30 Scientist onboard on 20 Jan '99 at 1800 Hrs. as originally planned. The vessel proceeded first westwards to the next position (15°N, 72° 20' E) and then traveled in a south-south easterly direction almost parallel to the west coast of India. The vessel maintained a distance of approximately 80 miles from the coast. Surface meteorological observations at one and half hourly intervals by teams from NIO, Goa, IMD, New Delhi and IIT, Delhi started at 0530 Hrs on 21.01.99. Observations on radiation, trace gases, aerosols and oceanographic parameters also started on 21.01.99. NIO, Goa launched two XBT's on 21.01.99. A dummy CTD operation was carried out on 21.01.99 at 1700 Hrs to check the newly installed CTD wire. As the CTD wire was not properly wound on the winch drum during the dummy operation, it was decided to postpone the CTD operation until the entire CTD wire was paid out at a deeper region later. In the mean time NIO, Goa continued with XBT operations at 1° space intervals. On an average 3 GLASS Sondes and one Ozone sonde were launched every day from 21.01.99.

The vessel reached off Trivendrum on 24.01.99 at 0400 Hrs and occupied a station from 0400 Hrs to 1800 Hrs for inter-comparison studies with land based station. Since the atmosphere was cloudy the MWR could not be operated. However, one Ozone sonde and one GLASS sonde were launched from the ship as part of the inter-comparison studies. After the completion of inter-comparison studies at 1800 Hrs the vessel cruised southwards along the scheduled track passing through 77°E longitude. All the routine observations on XBT, surface met, upper air, radiation, trace gases and aerosols continued along the track.

A dummy CTD and actual CTD operations were undertaken on 26.01.99 from 0925 Hrs to 2030 Hrs at 2°N latitude where the depth was approximately 4200m. The entire CTD wire was paid out and rewound. Two drifting buoys were also deployed on 26.01.99. Routine CTD operations started from 2°N latitude. Between 2°N and 2°S latitude CTD was operated at half degree intervals. XBT operations were stopped at 2.5°N latitude.

Telephone/Fax facilities became non-functional since 29 Jan '99

The vessel sailed along 77°E up to 20°S latitude and then proceeded westwards along 20°S latitude. CTD operations at 1° intervals, surface met observations, upper air observations, observations on radiation, aerosols, trace gases continued along the 20°S latitude up to 69°E. All the oceanographic observations were stopped at 69°E, 20°S latitude as the vessel entered the EEZ of Mauritius.

Between Port – Louis and 69°E, 20°S, only atmospheric measurements were carried out.

Halt at Port – Louis:

The vessel arrived at Port – Louis on 11.02.99 at 0900 Hrs. The Indian High Commission in Port – Louis made all arrangements for the scientist's various engagements in Port – Louis.

The Chief Scientist and few senior members of the scientific team called on the Indian High Commission and Deputy High Commissioner on 12.02.99 at 1115 Hrs and apprised them of the various scientific activities onboard ORV Sagar Kanya.

One of the participants of the cruise Dr. Manish Naja, PRL, Ahmedabad disembarked at Port-Louis as he was medically unfit to continue in the cruise.

Dr. K.S. Zalpuri, NPL, Delhi and Mr. Murugavel, IITM, Pune also disembarked at Port-Louis as per the original cruise schedule.

The entire scientists onboard visited the University of Mauritius on 13.02.99 at 0830 Hrs and attended a seminar hosted jointly by the University of Mauritius and Mauritius Meteorological Services.

Dr. N. Bahulayan, Chief Scientist, Dr. A. Jayaraman gave seminar talk at the University of Mauritius at 1100 Hrs on 13.02.99. The National Climate Committee members in Port – Louis and scientists from University of Mauritius, Mauritius Met. Services attended the seminar.

The Deputy High Commissioner and Counselor, Indian High Commission visited Sagar Kanya on 15.02.99 at 1130 Hrs.

The Indian High Commissioner Mr. M.L. Tripathy, hosted a dinner for scientists and officers onboard ORV Sagar Kanya at his official residence on 15.02.99 at 2000 Hrs. The dinner was attended by prominent Indians in Mauritius.

Mr. Mayeppa L. Jean Andre, scientist from the Mauritius Meteorological services boarded the vessel on 16.02.99 as a participant of the cruise.

The vessel was expected to sail from Port – Louis on 16.02.99 but could not sail on that day as bunkers were not delivered to the ship in time.

Second leg (Port – Louis - Goa)

The vessel sailed from Port – Louis with 28 scientists onboard at 1600 Hrs on 17.02.99 and then proceeded to the first CTD station at 16° 20' S, 63°E. One Ozone sonde was released from Port – Louis on 17.02.99.

All atmospheric measurements were started immediately after its departure from Port – Louis. The vessel arrived at the first CTD station at 2200 Hrs on 19.02.99. All oceanographic measurements were started from the position 16° 20' S, 63°E. CTD was operated at 1° interval along the 63°E longitude up to 9°S latitude. CTD operation was stopped at 9°S,63°E as the deck unit and under water unit of CTD started mal-functioning from the said position. In the mean time XBT operations were carried out between 8°S and 1°S latitude. CTD was repaired after two days of continuous effort.

The regular CTD operations again started from 1°S, 63°E. The vessel sailed along the 63°E longitude up to 5°N latitude and then the vessel proceed to 15°N, 60°E. CTD operations were continued only up to 10°N, 61°E. Between 10°N and 15°N along the second leg, only XBT was operated 1° interval.

Observations along the second meridional leg between Port – Louis and 60°E, 15°N were completed at 0800 Hrs on 2 Mar 1999.

Surface met and all routine atmospheric measurements including ADCP operations were continued along the zonal section running along 15°N latitude. The vessel reached the position situated approximately 100 miles from the Goa coast at 1800 Hrs on 5 Mar and then turned towards south. The vessel sailed along the 1000m contour up to 10°N. It reached at 10°N position at 1000 Hrs on 7 Mar and then proceeded northwards. The coordinated observations between Sagar Kanya and US vessel "Ron Brown" started on 7 Mar at 1000 Hrs.

Sagar Kanya sailed within the EEZ of India while Ron Brown sailed out side of EEZ. During the coordinated observations, aerosol samples collected five times a day. XBT was operated at 1° interval. All routine upper air observations and measurements on radiation, aerosols and trace gases continued while both the ships were moving northwards side by side. Sagar Kanya sailed along the original cruise track up to 14°N latitude and then its course was changed to 15° 43' N, 69° 49' E. Both the vessels reached the above position at 1645 Hrs on 9

Mar to start the one day inter-comparison to study on radiation, aerosol and trace gases. Both the ships were placed at a distance of 1 Km with the US vessel Ron Brown at the front. Both the ships were moving at an average speed of 6 Knots during the inter-comparison period.

During the inter-comparison period, four GLASS sondes, one Radiometer Sonde and one Ozone sonde were also released. The inter-comparison experiment was concluded at 1630 Hrs on 10 Mar 1999. Sagar Kanya's position was 17° 27' N, 68° 24.8' E at 1630 Hrs on 10 Mar 1999. Sagar Kanya changed the course at the above position and then proceed to Mormagoa.

SUMMARY OF OBSERVATIONS:

The entire observations under IFP'99 programme of INDOEX were classified into five broad areas, namely, trace gases, aerosols, radiation, meteorology and oceanography. A number of R&D organisations in the country have participated in the above mentioned observational programme.

Trace gases:

NPL, New Delhi and PRL, Ahmedabad participated in the studies on trace gases in the Tropical Indian Ocean. The parameters measured include NO, NO_x, SO₂, CH₄, N₂O, CO, CO₂ and columnar ozone concentration.

NPL, Delhi :

Samples of SO₂, NO_x were collected in impingers by absorbing into tetrachloromercurate (TCM) and sodium hydroxide-arsenite reagents respectively. Air samples were collected in stainless and glass samplers for the analysis of the gases like CH₄, N₂O, CO and CO₂. The collected samples will be analysed at NPL, Delhi and IICT, Hyderabad.

Total number of samples collected for

SO₂ and NO_x : 14

Rain water : 7

GHGS (daily) : 38

PRL, Ahmedabad:

Concentration ozone (O₃), nitric oxide and carbon monoxide (CO) in the marine boundary layer were measured continuously. The data were averaged for every two minutes and stored in the computer. A total of about 100 air samples were collected during the entire cruise.

Aerosols:

NPL, New Delhi, PRL, Ahmedabad, VSSC, TVM and IITM, Pune participated in the studies on aerosols.

NPL, New Delhi :

Samples of total suspended particulate matter (TSP), fine aerosols and soot were collected on different types of filter papers.

No. of samples collected for TSP :	24
No. of samples collected for soot :	32
Fine aerosol collected :	
IMI, Sweden :	48
NPL, New Delhi :	48
No. of samples collected for inorganic aerosols :	18 + 20

PRL, Ahmedabad:

The parameters measured related to aerosols are the aerosol optical depth, aerosol size distribution, aerosol scattering coefficient and particle absorption coefficient. The aerosol optical depth was measured at six wavelengths, viz., 400, 500, 660, 850 and 1050nm. Approximately 15 measurements were made in a day. The scattering coefficient and absorption coefficient measurements are continuous and the data are averaged for every 5 minutes in the case of scattering coefficient and every 1 minute in the case of absorption coefficient. The size distribution measurements were made in 10 size ranges viz., 25, 12, 6, 3, 1.6, 0.8, 0.4, 0.2, 0.1 and 0.05 μm diameter, 8 times in a day.

VSSC, Trivandrum:

The parameters measured are solar extinction and aerosol mass loading. A total of 29 samples were collected for aerosol mass loading. A total of 37 measurements were made for solar extinction.

IITM, Pune:

IITM, Pune was involved in the study of atmospheric electric field and aerosol number concentration. Aerosol number concentration in 0.003-1 μm radius was measured at 2 hourly intervals.

Radiation:

PRL, Ahmedabad and IITM, Pune were involved in the studies on radiation.

PRL, Ahmedabad:

The parameters measured are the surface reaching global flux (direct solar + diffused sky) and direct solar radiation intensity. The measurements were continuous and data are averaged for every 10 seconds in the case of Pyranometers.

IITM, Pune:

A multi channel radiometer was used for the measurements of solar radiation at 14 wavelengths. Measurements of solar radiation at 14 wavelengths were made 24 times during the entire cruise.

Meteorology:

In meteorology measurements were made for surface met conditions, boundary layer structure and upper air structure. NIO, Goa, IMD, New Delhi, IIT, Delhi, IISC, Bangalore, VSSC, TVM and NPL, Delhi were involved in the meteorological studies. The following is the summary of measurements made in the area of meteorology.


1. Ozone sondes launched	:	37
2. Radiometer sondes launched	:	16
3. Total no. of surface met observations:		460
4. Glass sonde operation	:	148

Oceanography:

The following observations were carried out in the area of oceanography.

1. CTD observations	:	55
2. XBT	:	56
3. ADCP	:	continuous
4. Drifting buoy deployed	:	18
5. Nutrients	:	19 water samples
6. DMS	:	
7. Chlorophyll	:	20 samples

Total distance covered during the cruise : 7794 n. miles


12/3/99
Dr. N. Balakrishnan
CHIEF SCIENTIST
ORV "SAGAR KANYA"

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CRUISE TRACK

