

# CRUISE REPORT

**ORV SAGAR KANYA**

**Cruise No. 110**

(29 February to 10 March 1996)



राष्ट्रीय समुद्र विज्ञान

संस्थान

**NATIONAL INSTITUTE  
OF  
OCEANOGRAPHY**

**ORV SAGAR KANYA**

**Cruise No. 110**

(29 February to 10 March 1996)

**NATIONAL INSTITUTE OF OCEANOGRAPHY**

(Council of Scientific and Industrial Research)

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# **REPORT ON THE 110TH OCEANOGRAPHIC CRUISE OF ORV SAGAR KANYA**

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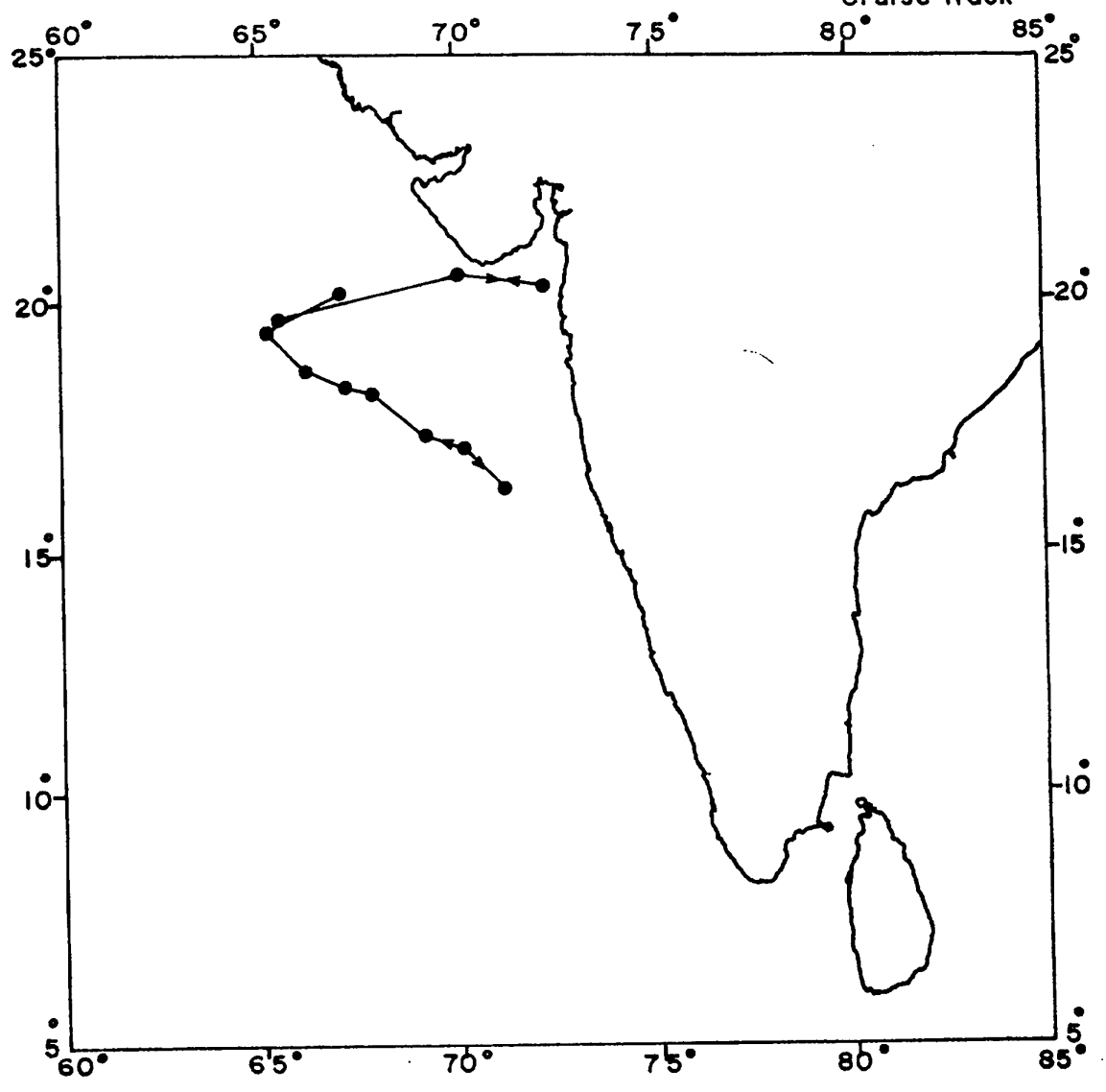
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SK-110  
Cruise track



## **2. CRUISE SUMMARY**

The cruise was organized to collect sea truth for validation of satellite data from NOAA for estimation of SST. Another satellite IRS P3 carrying ocean colour sensor was due for launch in February 96 and it was decided to use the opportunity to collect synchronous ocean colour data simultaneously and begin the exercise of algorithm development for ocean colour thus expand the scope of sea truth collection programme. However, the launch of IRS P3 was delayed and hence the cruise was considered as a dry run for ocean colour data collection.

The ship sailed from Bombay on 29-2-1996 with a total of 28 participants. The cruise covered 9 ocean colour stations, 31 CTD stations, 64 surface met stations, 16 radio sonde balloon stations and 33 stations for sky radiance and aerosol measurements. Annexures 1 to 5 give a summary of station locations and schedule.

The area of operation was Gujarat Coast near the Gulf of Cambay and Saurashtra which is known for high fishery catch in the Central Arabian sea. The plan to calibrate sun photometer with MWR based at Minicoy was curtailed since the ship was required at Goa by 10th March 1996. The sea was calm and weather was pleasant throughout the cruise.

### 3. PARTICIPANTS

#### 3.1 Scientific component

P.V. Sathe	)	Chief Scientist
P.M. Muraleedharan	)	
A. Almeida	)	
R. Vailhianathan	)	
Elgar Desa	)	
T. Suresh	)	NIO, Goa
Antonio Mascarenhas	)	
P.M.A. Bhattathiri	)	
Jolley Curien	)	
Arvind Ghosh	)	
T. Pankajakshan	)	
P.V. Bhaskar	)	
Sindhu Ramachandran	)	
G. Chandiwale	)	
A.R. Jaswal	)	
N.G. Yadav	)	
S.V. Varude	) —	India Meteorological
C.B. Jagtap	)	Department, Pune
J. Kumar	) —	Indian Navy
M.K. Sagar	)	
Shallesh Nayak	) --	Space Application Centre,
M. Mohan	)	Ahmedabad
H.U. Solanki	)	
A. Jayaraman	) —	Physical Research Laboratory,
	)	Ahmedabad
S.K. Satheesh	—	Space Physics Laboratory,
		Trivandrum
Gautam Mangalorekar	—	Computer Maintenance
		Corporation, Bombay
K. Balakrishnan	) —	NORINCO, Goa
Sudeesh Curien	)	

#### 3.2 Ship's complement

Captain K.K. Reddy	Master
M.S. Pangley	Chief Officer
S. Swaminathan	Addl. Chief Officer
A. Jeya Kumar	3rd Officer
S. Janaka	Chief Engineer
G.J. Rao	2nd Engineer
R.P. Ghosh	3rd Engineer
D.P. Sharma	Electrical Officer
V.C. Chandran	Radio Officer
L.M.F. Rodrigues	Catering Officer

#### 4. INTRODUCTION

The cruise was originally planned as a special campaign for sea truth collection for validation of satellite data under the National Remote Sensing Programme under the DOD Grant-in-aid project on sea truth collection in which SST and surface meteorological data were to be collected for validation of AVHRR derived SSTs from NOAA satellite. The Standing Committee on Ocean Resources in its meeting held at Bangalore on 17th October 1995, decided to expand the scope of sea truth collection to include ocean colour and other ocean parameters keeping in view the proposed launch of Indian satellites IRS P3 and Oceansat which were dedicated to ocean studies. The IRS P3 validation committee in their subsequent meetings held at NIO during 6 and 7 November 1995 and 24th January 1996, worked out the detailed sea truth plan for ocean colour parameters and decided to implement it during this cruise. The IRS P3 was scheduled for launch during February 1996 and this cruise would have been well-suited for synchronous data collection.

The satellite launch of IRS P3 was delayed beyond the cruise period and the cruise was considered as a dry-run for the validation exercise whenever the satellite was launched. This was a multidisciplinary cruise enlisting participation from optical oceanographers, biologists, space physicists, meteorologists, besides personnel from ocean remote sensing.

#### 5. CRUISE DETAILS

The ship left Bombay at 1915 hrs on 29th February 1996 and proceeded towards the coast of Gujarat, near the gulf of Cambay to cover coastal stations for ocean colour. The surface met observations and radiosonde balloon flights began immediately on sailing. Due to depth constraints, ship could not enter the gulf and the first station was taken at 20 m depth off Narmada. After covering another station off Veraval, which is known to be an area with high fish catch, the ship proceeded to open ocean along the first leg of the planned track for sea truth collection for AVHRR in the northern Arabian sea. While covering the first leg, a message was received from NIO that DOD wanted the ship back to Goa on 10th March and this required the programme to be revised.

At position 64.59 N and 19.45 E, half-way along the first leg of CTD track, cruise programme was modified in accordance with radio message received from NIO. The remaining time was planned to be utilized optimally by sailing straight towards Goa and stopping every degree for time series observations of CTD, ocean colour and other studies.

The scientific work done during the cruise consisted of four major activities. The CTD operation (time series) with sampling for biological parameters wherever required was carried out at locations given in annexure 1. A total of 31 CTD locations were covered during the cruise.

The ocean colour measurements were carried out at 9 locations which covered nearshore stations along the coast of Gujarat and open ocean stations in the Arabian sea and along the way back to Goa. The locations are given in annexure 2. The nearshore stations included area off Veraval which is known for high fisheries yield. The measurements consisted of the following parameters:

1. Transparency of water: Secchi disk and an array of coloured disks were used to establish attenuation for each colour.



2. Reflectance: Upwelling and downwelling light at various depths for the spectral range from 400 to 800 nm.
3. Inherent optical properties (IOP): The back-scatters sensors from SRI, USA were used at two wavelengths namely, 440 and 675 nm at various depths. AC-9 meter (WETLABS) was used to measure absorption and beam attenuation at 9 wavelengths viz, 412, 440, 488, 510, 555, 630, 650, 676 and 715 nm. Figure 2 shows a back scatter plot for two wavelengths namely, 440 and 675 nm.
4. PAR and total ambient radiation incident on the sea surface using pyranometer and PAR quantum sensor (LICOR).

At all locations where ocean colour measurements were made, simultaneous biological observations were taken with a view to relate outgoing radiation to concentration of biological matter in the sea. These included chlorophyll pigment concentration and primary production at different depths. Nutrients, poly saccharides and dissolved oxygen available were also measured. Sub-surface chlorophyll maxima was found around 30 meters depth.

Sky radiation incident on the sea surface in different wavelengths (both specular and diffuse) and aerosol concentration in the atmosphere form important inputs in algorithm development in ocean colour estimation from satellite data. Participants from PRL, Ahmedabad and SPL, Trivandrum were specially invited for these measurements.

Sun photometer designed and fabricated by PRL was used to measure intensity of ambient radiation in five wavelengths viz, 400, 500, 650, 880 and 1050 nm with a bandwidth of 10 nm. Multi-wavelength Radiometer designed and fabricated by SPL was used to make similar measurement at 9 wavelengths with a similar bandwidth. These wavelengths were 380, 400, 450, 500, 600, 650, 750, 850, 935 and 1075 nm. Aerosol concentration in the atmosphere was measured by QCM Impactor (Quartz Crystal Microbalance) for particles in 10 size ranges, namely, 0.05, 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.5 and in excess of 25 microns as micrograms per meter<sup>3</sup>. Measurements were done four times a day at locations and times given in annexure 3. A total of 33 locations were covered during the cruise for these observations.

Radio sonde balloons were launched every day at 0530 and 1730 hrs. A total of 16 balloons were launched during the cruise. Their positions are given in annexure 4. Surface met observations and seatruth required for validation of AVHRR derived SST were conducted every 3 hours. A total of 64 surface met stations were covered during the cruise. Their locations are given in annexure 5.

## **6. PERFORMANCE OF ONBOARD EQUIPMENTS**

The motor of CTD winch failed once while CTD was being hoisted up during the very first station and this had caused delay by about 6 hours to set the motor right. The computer interface of CTD winch had also failed twice during the cruise. In IMD lab, following things were found to be non-functional

1. FAX recorder
2. APT system
3. Wind weather radar

As a result, IMD team was unable to receive weather information in the form of analysed facsimile charts and could not obtain wind data from radio sonde balloons.

### **7. LOSS REPORT**

One 5l niskin bottle was lost during the cruise as its handle broke down during the cast.

### **8. ACKNOWLEDGEMENTS**

The participants are thankful to the Department of Ocean Development, New Delhi, for sponsoring the seatruth collection programme and the Master, O.R.V. SAGAR KANYA and his officers for cooperation extended during the cruise.

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Annexure-1

Station locations and schedule for CTD deployment

Sr No	Date (1996)	Time (IST)	Lat (N) (degrees)	Lon (E)
1	03/03	1755	19:59.8	65:59.9
2	04/03	1020	20:14.4	67:18.3
3	04/03	1330	19:45.1	64:58.7
4	04/03	1915	19:33.8	65:30.0
5	04/03	2215	19:32.0	65:27.8
6	05/03	0900	18:58.3	66:28.9
7	05/03	1300	18:56.3	66:24.5
8	05/03	1515	18:55.2	66:22.8
9	05/03	1815	18:53.7	66:20.5
10	05/03	2110	18:52.3	66:18.3
11	06/03	0015	18:50.3	66:16.9
12	06/03	0915	18:28.3	67:30.5
13	06/03	1230	18:26.7	67:32.3
14	06/03	1515	18:25.2	67:33.0
15	06/03	1600	18:24.8	67:33.2
16	06/03	1740	18:24.0	67:36.1
17	06/03	2100	18:14.8	68:00.9
18	06/03	2330	18:13.2	68:02.2
19	07/03	1005	17:31.6	69:30.8
20	07/03	1315	17:28.9	69:30.1
21	07/03	1600	17:26.7	69:28.9
22	07/03	1905	17:23.1	69:26.5
23	07/03	2200	17:19.8	69:23.9
24	07/03	2355	17:17.5	69:22.5
25	08/03	0730	17:05.5	70:30.1
26	08/03	1030	17:03.6	70:31.5
27	08/03	1330	17:02.1	70:32.5
28	08/03	1630	16:59.8	70:32.9
29	08/03	1920	16:57.1	70:32.6
30	08/03	2230	16:53.8	70:31.4
31	09/03	0900	16:25.4	71:30.3

ORV Sagar Kanya 110  
Annexure-2

Station locations and schedule for ocean colour observations

Sr No	Date (1996)	Time (IST)	Lat (N) (degrees)	Lon (E)
1	01/03	1200-1530	20:30.0	72:36.0
2	02/03	1100-1150	20:49.2	70:18.5
3	04/03	1230-1330	19:44.3	64:59.2
4	05/03	1200-1300	18:55.0	66:23.2
5	06/03	1015-1200	18:28.1	67:31.1
6	07/03	1020-1300	17:31.6	69:30.8
7	07/03	2200-2030	17:19.8	69:23.9
8	08/03	1030-1230	17:03.6	70:31.5
9	09/03	1045-1200	16:25.6	71:29.9

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Annexure-3

Station locations and schedule for aerosol and  
sky radiation observations

Sr No	Date (1996)	Time (IST)	Lat (N) (degrees)	Lon (E)
1	01/03	1137	20:30	72:36
2	01/03	1145	20:31	72:38
3	01/03	1830	20:23	72:35
4	02/03	0730	20:34	70:42
5	02/03	1050	20:49	70:13
6	02/03	1540	20:48	70:05
7	02/03	1815	20:42	69:40
8	03/03	0802	20:15	67:18
9	03/03	1100	20:10	67:01
10	03/03	1550	20:02	66:19
11	03/03	1830	19:59	66:00
12	04/03	0735	19:45	65:12
13	04/03	1116	19:44	64:59
14	04/03	1545	19:44	65:02
15	04/03	1815	19:36	65:22
16	05/03	0740	19:04	66:21
17	05/03	1110	18:57	66:27
18	05/03	1545	18:55	66:22
19	05/03	1823	18:53	66:20
20	06/03	0745	18:34	67:16
21	06/03	1130	18:27	67:31
22	06/03	1545	18:25	67:33
23	06/03	1800	18:24	67:36
24	07/03	0740	17:42	69:09
25	07/03	1115	17:31	69:31
26	07/03	1545	17:26	69:29
27	07/03	1811	17:24	69:27
28	08/03	0740	17:05	70:30
29	08/03	1120	17:03	70:32
30	08/03	1550	17:01	70:33
31	08/03	1705	16:59	70:33
32	09/03	0800	16:25	71:30
33	09/03	1030	16:25	71:30

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Annexure-4

Station locations and schedule for radio sonde observations

Sr No	Date (1996)	Time (IST)	Lat (N) (degrees)	Lon (E)
1	01/03	1730	20.3	72.4
2	02/03	0530	20.5	71.0
3	02/03	1730	20.4	69.5
4	03/03	0530	20.2	62.4
5	03/03	1730	20.0	66.0
6	04/03	0530	19.8	65.5
7	04/03	1730	19.6	65.3
8	05/03	0530	19.1	66.1
9	05/03	1730	18.9	66.3
10	06/03	0530	18.6	66.9
11	06/03	1730	18.2	67.3
12	07/03	0530	17.5	68.4
13	07/03	1730	17.2	69.3
14	08/03	0530	17.1	70.1
15	08/03	1730	17.0	70.3
16	09/03	0530	16.3	71.3

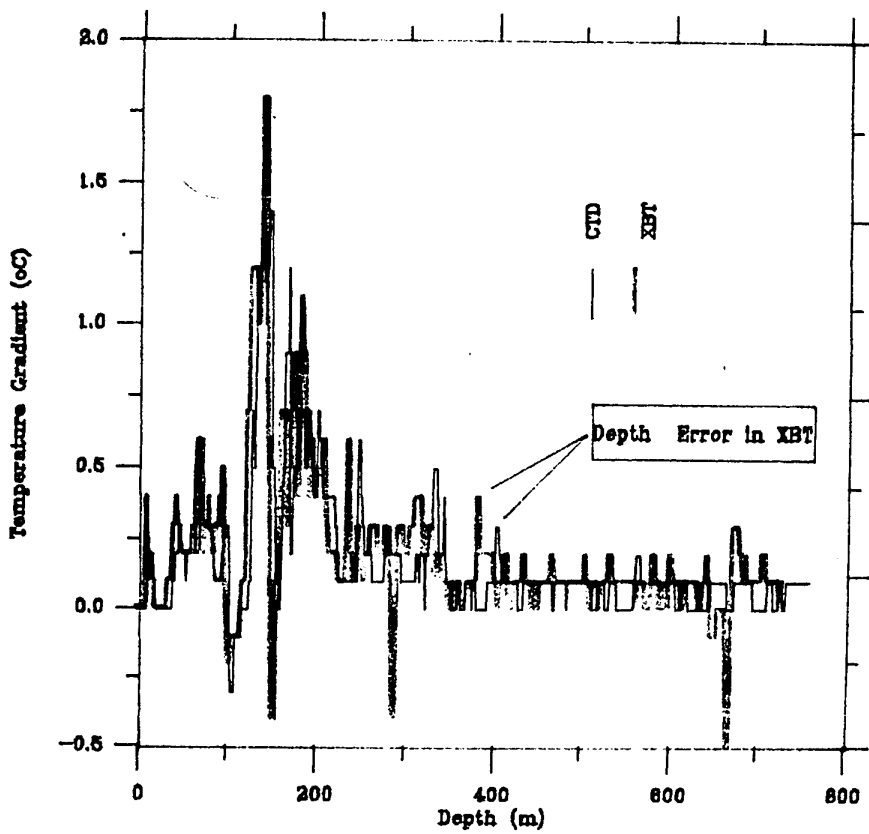
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**Annexure-5**

Sr No	Date (1996)	Time (IST)	Lat (N) (degrees)	Lon (E)	SST
35	05/03	1130	18.9	66.4	26.5
36	05/03	1430	18.9	66.4	27.2
37	05/03	1730	18.9	66.3	27.3
38	05/03	2030	18.8	66.3	26.8
39	05/03	2330	18.8	66.2	26.2
40	06/03	0230	18.7	66.3	25.8
41	06/03	0530	18.6	66.8	24.5
42	06/03	0830	18.5	67.3	24.6
43	06/03	1130	18.4	67.5	26.8
44	06/03	1430	18.4	67.5	26.7
45	06/03	1730	18.4	67.5	26.8
46	06/03	2030	18.2	67.9	27.0
47	06/03	2330	18.2	68.0	26.2
48	07/03	0230	18.0	68.2	26.0
49	07/03	0530	17.8	68.7	25.8
50	07/03	0830	17.6	69.2	26.7
51	07/03	1130	17.5	69.5	27.2
52	07/03	1430	17.4	69.4	27.6
53	07/03	1730	17.4	69.4	27.5
54	07/03	2030	17.3	69.4	27.0
55	07/03	2330	17.3	69.4	26.4
56	08/03	0230	17.2	69.6	26.5
57	08/03	0530	17.1	70.1	26.5
58	08/03	0830	17.0	70.5	27.4
59	08/03	1130	17.0	70.5	27.5
60	08/03	1430	17.0	70.5	27.8
61	08/03	1730	16.9	70.5	27.2
62	08/03	2030	16.9	70.5	27.0
63	08/03	2330	16.9	70.5	27.0
64	09/03	0230	16.6	70.9	26.8

SK-110

Fig.-1

XBT - CTD Temperature Gradient from simultaneous  
Observations and the observed depth error





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Fig.2

Back scatter plot for two wave lengths (440 and 675 nm)

5-2

Day :5 March, 09 00 GMT  
Lat. 18 55 Lon. 66 23

