

ORV SAGAR KANYA
CRUISE 224B
(19 May – 25 May 2006)

NATIONAL INSTITUTE OF OCEANOGRAPHY
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REPORT ON THE CRUISE OF 224B OF ORV SAGAR KANYA

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INTRODUCTION

Nitrogen plays an important role in the productivity of the region. Nitrogen fixing organisms, such as the cyanobacterium *Trichodesmium* directly affect the oceanic nutrient inventory through the addition of new nitrogen to the ocean ecosystem and therefore have an important role in the functioning of the biological carbon pump.

Trichodesmium is photosynthetic, nitrogen fixing cyanobacterium widely distributed throughout the tropics and subtropics of the world ocean [Capone, 1997]. They are often found in the coastal water of Arabian Sea during summer. [Quasim, 1970, Devassy, 1978]. It plays a key role in the oceanic N cycle through its conversion of dissolved gaseous to combined nitrogen. At present, it is not clear whether recent estimates of N₂ fixation and denitrification are balanced or imply a deficit of N in the ocean [Codispoti et al., 2001]. Present total marine N₂-fixation is estimated at 110 Tg yr⁻¹ and a major contribution is attributed to *Trichodesmium*.

The ratio of nitrogen to phosphorus in seawater may be the central factor that regulates nitrogen fixation. [Deutsch, 2007]. The nitrogen fixing *Trichodesmium* can tap the immense reservoir of dissolved N₂ gas in seawater, but their growth is often limited by the scarcity of other nutrients such as phosphorus and iron [Mahaffey, 2005]. Thus the study of *Trichodesmium* will also help in better understanding of the role of iron and phosphorus in the Arabian Sea.

Is there an enhancement of the *Trichodesmium* blooms in the Arabian Sea? It is also hypothesized nitrogen fixation may be associated with oxygen minimum zones of the tropical ocean as well. This is of particular relevance in the Arabian Sea. [Capone, 2006]

Hence to detect the *Trichodesmium* bloom from the ocean color satellite such as IRS-P4 OCM , it is essential to measure and model the optical properties.

ITINERARY

ETD Goa 19th May 2006

ETA Goa 25th May 2006

PARTICIPANTS

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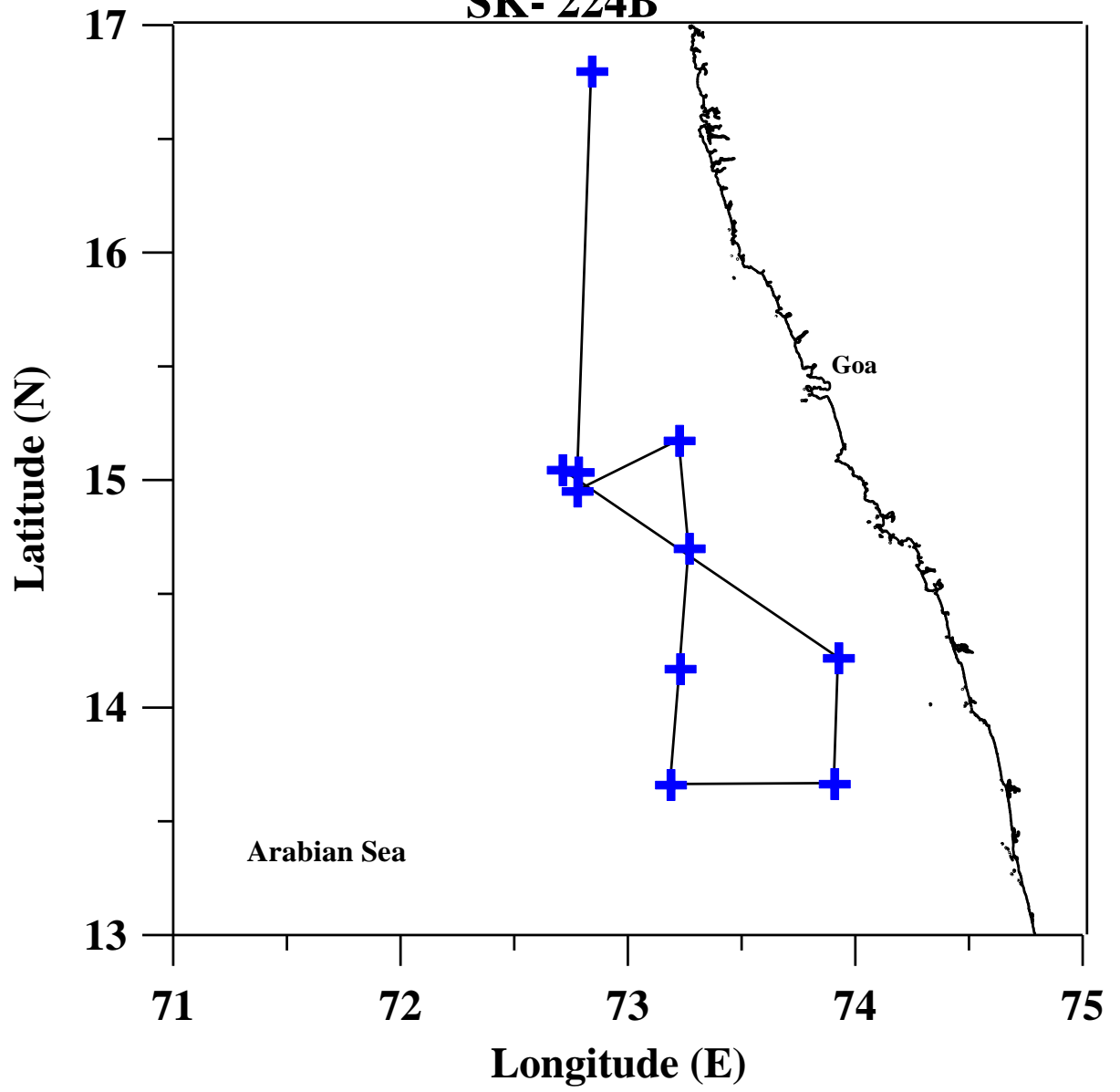
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CRUISE TRACKS

Cruise Track
SK- 224B



OBJECTIVES

- Detection of *Trichodesmium* blooms
- Measurements of optical data at the bloom sites
- Measurements of aerosol optical data

WORK ACCOMPLISHED

- We have covered the ten (10) coastal stations along the west coast of India in the Arabian Sea off Goa from 20 –24 May, 2006.
- *Trichodesmium* blooms were detected at various stations.
- Measurements of marine optical data using AC-9, Hydroscat and LIST-100
- Measurements of aerosol optical depths every 30 minutes.
- The students from the Goa University and Mangalore University were trained in the use and operation of various instruments and also participated in the measurements at stations.

DAILY DIARY

Date: 19 May, 2006

Boarded the ship from the outer-anchorage. Though the sea was bit choppy, all the participants managed to board the ship with the monkey-ladder. Sailed off from Marmagoa 19th May, 2006 at 0:54 UTC. Soon after we sailed, to everyone's satisfaction Miss Puneeta and Mr. Vishal Nigam smoothly executed the task of allocation of rooms. We unpacked the instruments at night, assembled, tested and kept them ready. It was bit tiring. Freshers were just getting the taste of cruise and work on board.

Date: 20 May, 2006

We had the first station just after the fire drill in the evening.

Station 1

Lat: 16° 48.03' N	Long: 72 ° 50.29' E	Depth: 65 m	Time: 1221 UTC
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Were delighted to see *Trichodesmium* blooms at few locations en route and also at the stations. The instruments deployed at the station were CTD, LISST-100 (particle size) AC-9 and Hydroscat.

Date 21 May 2006

Since we were on a hunt for the *Trichodesmium* bloom, we did not have a planned track and wanted to keep on the coastal regions, where they were

usually spotted and reported by others. So we sailed south and parallel to the coast.

Station 2

Lat: 14° 57.29' N	Long: 72° 46.45' E	Depth: 900 m	Time: 0442 UTC
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Trichodesmium bloom was found at the station. The instruments deployed were CTD, AC-9 and Hydroscat-2. Radiometer could not be deployed as a cable fault was detected. Sunphotometer and meteorological data were collected at every 30 minutes. Water samples were collected.

Station 3

Lat: 15° 10.62' N	Long: 73° 13.36' E	Depth: 95 m	Time: 1050 UTC
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The instruments deployed were CTD, AC-9 and Hydroscat-2 and LISST-100, Water samples were collected. Sunphotometer reading were observed at the interval of every 30 minutes. NORINCO engineers (Shri. Viju, Shri. Dias and others) were extremely cooperative in setting up the instruments and their deployment.

Students were split into groups of four and assigned tasks related to station dat, Instruments deployment, sunphotometer measurements and water sample collection. They were also trained in the use of optical oceanography and instruments.

Date : 22 May 2006

Station 4

Lat: 14° 42.16 N	Long: 73° 15.99' E	Depth: 119 m	Time: 0420 UTC
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There were no traces of *Trichodesmium* bloom. Instruments deployed: AC-9, LIST-100, Hydroscat-1, CTD, Sunphotometer and met data were collected.

Station 5

Lat: 14° 10.41' N	Long: 72° 13.60' E	Depth: 560 m	Time: 11:042 UTC
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Apart from the above, radiometer was deployed. All the operations were the same as earlier.

There was slight drizzle in the morning, as could be seen splashed on the window.

Date : 23 May 2006

Station 6

Lat: 13° 39.84' N	Long: 73° 11.08' E	Depth: 1100 m	Time: 02:47 UTC
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Moved to shallow waters

Station 7

Lat: 13° 40.09' N	Long: 73° 54.29' E	Depth: 57 m	Time: 09:55 UTC
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Station 8

Lat: 14° 13.27' N	Long: 73° 53.39' E	Depth: 52 m	Time: 15:35 UTC
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Instruments were deployed and all the operations as given earlier.

Date: 24 May 2006

Thought that with the onset of monsoon and wind speed having picked-up, there would be no traces of *Trichodesium*, but we were proved wrong, as it was observed that some broken patches of *Trichodesmium*, as sawdust sprinkled on the sea surface. This was very heartening and felt glad to see the bloom still there. It was decided to measure the parameters at the station all through the day.

Station 9

Lat: 15° 2.9' N	Long: 72° 42.54' E	Depth: 110	Time: 0337
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Station 10

Lat: 15° 2.9' N	Long: 72° 42.54' E	Depth: 895	Time: 0908
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In the evening Captain Pandian informed that we would be disembarking from Karwar as no berths were available at Goa and authorities had discontinued the boat service.

This was the last station. Cleaned up all the instruments and packed them at night.

Date : 25 May 2006

After a gap of five days we were able to sight the land at a close distance off Karwar.

Thanks to the Captain and his team, NORINCO for their unfailing support and timely assistance when required and the students who assisted in the deployment of instruments.

DAILY LOG OF OPERATIONS

Stn. No.	Date	GMT	Position		Depth in mts		Instruments Deployed			Remarks
			Lat	Long	Stn	Sec hi	Name	GMT	Depth in mts	
1.	20/5/06	12:21	16°48.03'	72°50.29'	65		CTD	12:31		Deployment problem
							LISST-100	14:33	28.6	
							Hydroscat	14:33	28.6	
							AC-9	14:46	30	
						Sunphotometer	All day			
2	21/5/06	04:42	14°57.29'	72°46.45'	900		CTD	06:23		
							AC-9	06:58	64	
							LISST-100	7:21	38.2	
							Hydroscat	7:21	38.2	
						Sunphotometer	All day			
3	21/5/06	10:50	15°10.62'	73°13.36'	95	20	LISST-100	11:00	36	Tricho spotted
							Hydroscat	11:00	36	
							LISST-100	11:31	35.7	
							Hydroscat	11:31	35.7	
							AC-9	11:57	58	
							CTD	12:27	20	
						Sunphotometer	All day			
4	22/5/06	04:20	14°42.16'	73°15.99'	119	21	CTD	04:33	21	
							LISST-100	05:14	32	
							Hydroscat	05:14	32	
							AC-9	05:51	58	
							Sunphotometer	All day		
5	22/5/06	11:10	14°10.41'	73°13.6'	700	17	LISST-100	11:26	30	Profiling only with Lu sensor
							Hydroscat	11:26	30	
							Radiometer	11:11		
							AC-9	12:06	58.7	
							CTD	12:40		
							Sunphotometer	All day		
6	23/5/06	02:47	13°39.84'	73°11.08'	1100	23	AC-9	03:00	68.9	
							LISST-100	03:30	36	
							Hydroscat	03:30	36	
							CTD	04:20		
							Radiometer		37	
							Sunphotometer	All day		
7	23/5/06	09:55	13°40.09'	73°54.29'	57	17	LISST-100	10:20	35	
							Hydroscat	10:20	35	
							Radiometer	10:19		
							AC-9 (A)	10:48	41.1	
							AC-9 (B)	11:10	39.8	
							CTD	11:50		
						Sunphotometer	All day			
8	23/5/06	15:35	14°13.27'	73°55.39'	52	15	CTD	15:50		
							AC-9	16:56	32	
							LISST100	16:12	32.6	
							Hydroscat	16:12	32.6	

Stn. No.	Date	GMT	Position		Depth in mts		Instruments Deployed			Remarks
9	24/6/06	03:37	15°02.89'	72°42.54'	110	20	LISST100	03:50	35	Tricho spotted
							Hydroscat	03:50	35	
							CTD	04:48		
							Radiometer	05:05		
							AC-9	06:08	65	
							AC-9	06:32	0	
							Sunphotometer	All day		
10	24/6/06	09:08	15°02.29'	72°46.73'	895	21	CTD	09:16		
							Radiometer	09:18		Time series
							LISST100	10:00	35	Tricho Spotted
							Hydroscat	10:00	35	
							AC-9	10:47	35	

PERFORMANCE OF EQUIPMENTS

- All the instruments were operated and measurements were taken. Offsets in channels of AC-9 were observed and it was thought prudent to calibrate the instrument on land to obtain better calibration coefficients under clean environment.
- The pump of the instrument AC-9 had failed, which was repaired and made to work by the NORINCO engineers (Mr. Biju).

CONCLUSION

We were glad to have accomplished the mission of measuring optical parameters and detection of the *Trichodesmium* bloom.

Would like to state that nitrogen fixing, diazotrophic *Trichodesmium* blooms are not a phenomenon observed in the coastal waters off Goa and some locations as assumed from the earlier observed, but all along the eastern Arabian Sea and probably many other regions of Arabian Sea. They have been found in the shallow and deep waters. Thought it is understood to be seasonal, we have observed it earlier even during the winter period and during this cruise we have observed it even now, just before the monsoon. We have found them even after the pre-monsoon showers. It is thus important to study this in detail, their spatial extent, occurrence and their impact.

ACKNOWLEDGEMENTS

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