Status of Current Ocean-Colour Missions

Indian Remote Sensing Satellite (IRS) P4 OCM

IRS-P4 OCM features

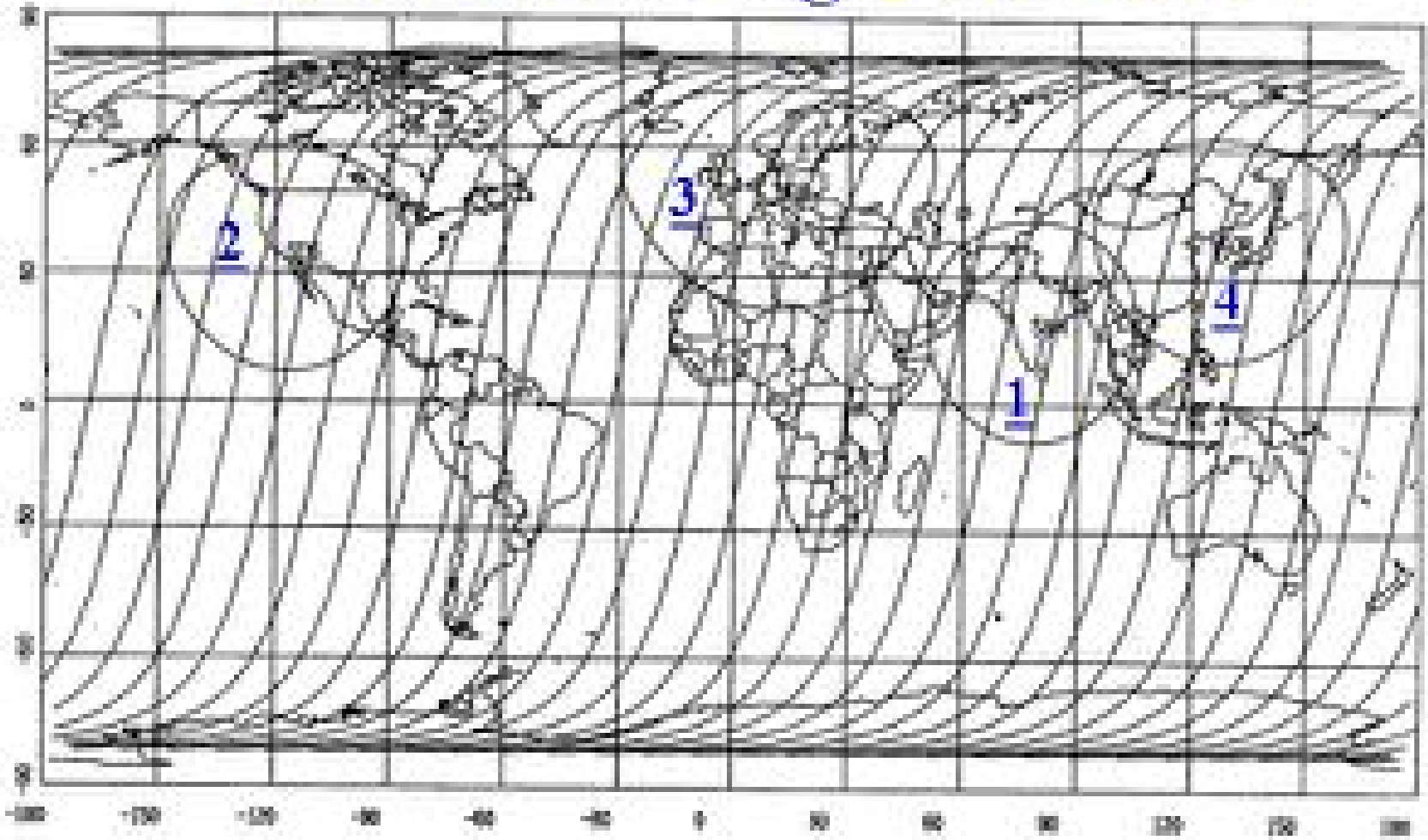
Launch Date: 26 may 1999
Launcher: PSLV, India
Orbit: Sunsynchronous Polar
Altitude: 720 Km
Equatorial crossing time: 1200 h (Descending node)
Along track tilt: $\pm 20^{o}$ (to avoid sunglint)
Ground resolution: 360 x 236 m
Swath : $\pm 43^{\circ}$ (1,420 km)
Quantisation : 12 bits

OCM payload : Main specifications

Channel (band)	Wave length (nm)	Reference ocean radiance*	Desired SNR	Estimated SNR	Desired $NE_{\Delta}L^*$	Est. $NE_{\Delta}L^*$
C1	404-423	9.1	356	340.5	0.0256	0.0267
C2	431-451	8.4	386	440.7	0.0218	0.0191
C3	475-495	6.6	380	427.6	0.0174	0.0154
C4	501-520	5.6	324	408.8	0.0173	0.0137
C5	547-565	4.6	311	412.2	0.0148	0.0112
C6	660-677	2.5	240	345.6	0.0104	0.0072
C7	749-787	1.6	286	393.7	0.0056	0.0041
C8	847-882	1.1	141	253.6	0.0078	0.0043

* in units of $mW/(cm^2\text{-}sr\text{-}\mu m)$.

Global coverage of IRS-P4



Ground Stations for IRS-P4 satellite across the globe

1. India 2. USA 3. Germany 4. North Korea

Standard OCM Data Product

False Color Composite (FCC) of bands 8,6 & 4

OCM Data Products

Level 1: Geo & radiometrically corrected radiances for scenes of sizes

(i) ~ 1420 km x 1420 km

(ii) ~ 710 km x 710 km (quadrant products)

(iii) ~ 100 km x 100 km

Level -2:Standard products over the above scenes of

(i) Chlorophyll

(ii) Suspended sediments

(iii) Yellow substance

(iii) Diffuse attenuation coefficient

(iv) Aerosol optical depth

(v) Normalised water leaving radiance

OCM Data Products

Level -3:

Weekly and monthly averages on a trial basis being generated for

(i) Chlorophyll

(ii) Suspended

(iii) Diffuse attenuation coefficient

(iv) Aerosol optical depth

- OCM coverage around India is available for browsing in the NRSA website
- Level –1 & 2 can be acquired by users directly from NRSA on payment
- The processing s/w developed at SAC is distributed to users for a nominal cost

OCEAN COLOUR VALIDATION EXPERIMENTS

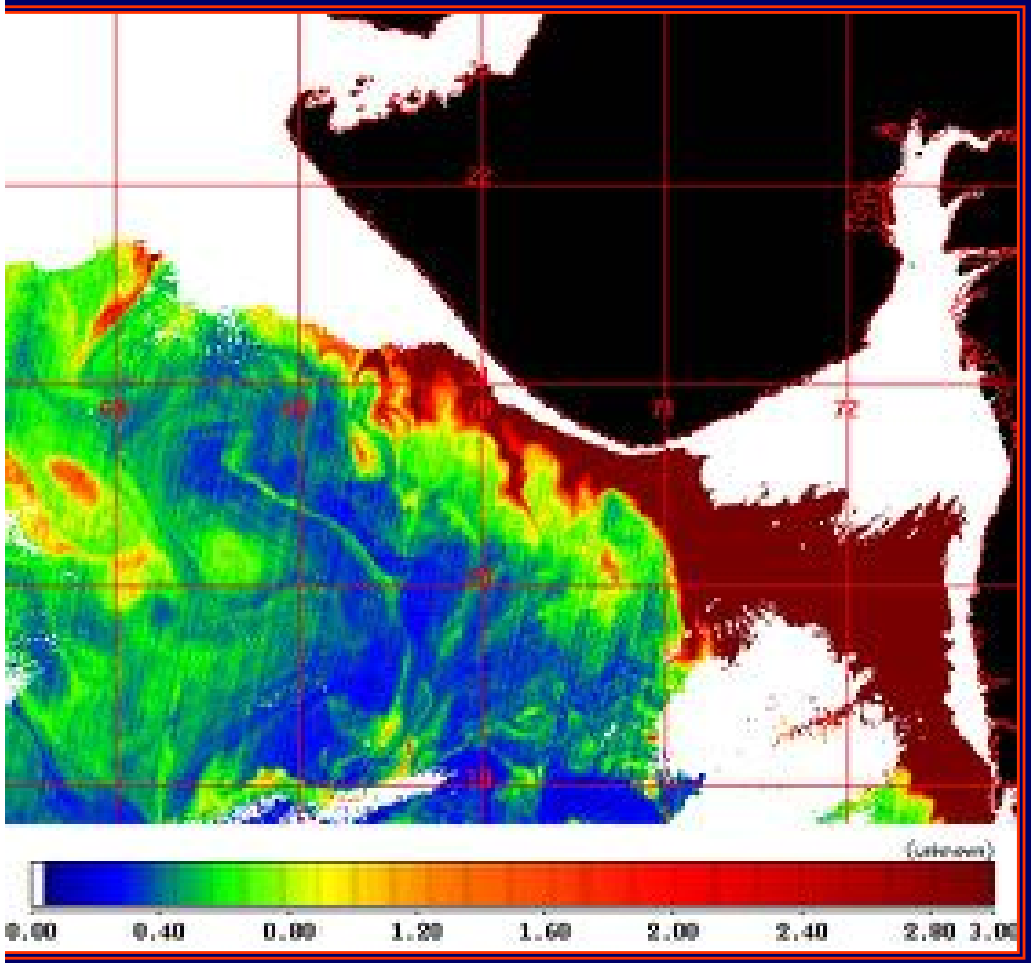
- Five cruises onboard ORV Sagarkanya/Sagarkanya were conducted in the Eastern Arabian Sea.
- A cruise (45 days) from Chennai to Mauritius & back was undertaken in October-November 2002 (IOGOOS).
- Seven cruises in the coastal waters of Bay of Bengal for coastal processes and development of case 2 algorithm.
- SeaWiFS protocols For optical measurements and JGOFS protocols for Oceanographic observations were followed.

PARAMETERS MEASURED

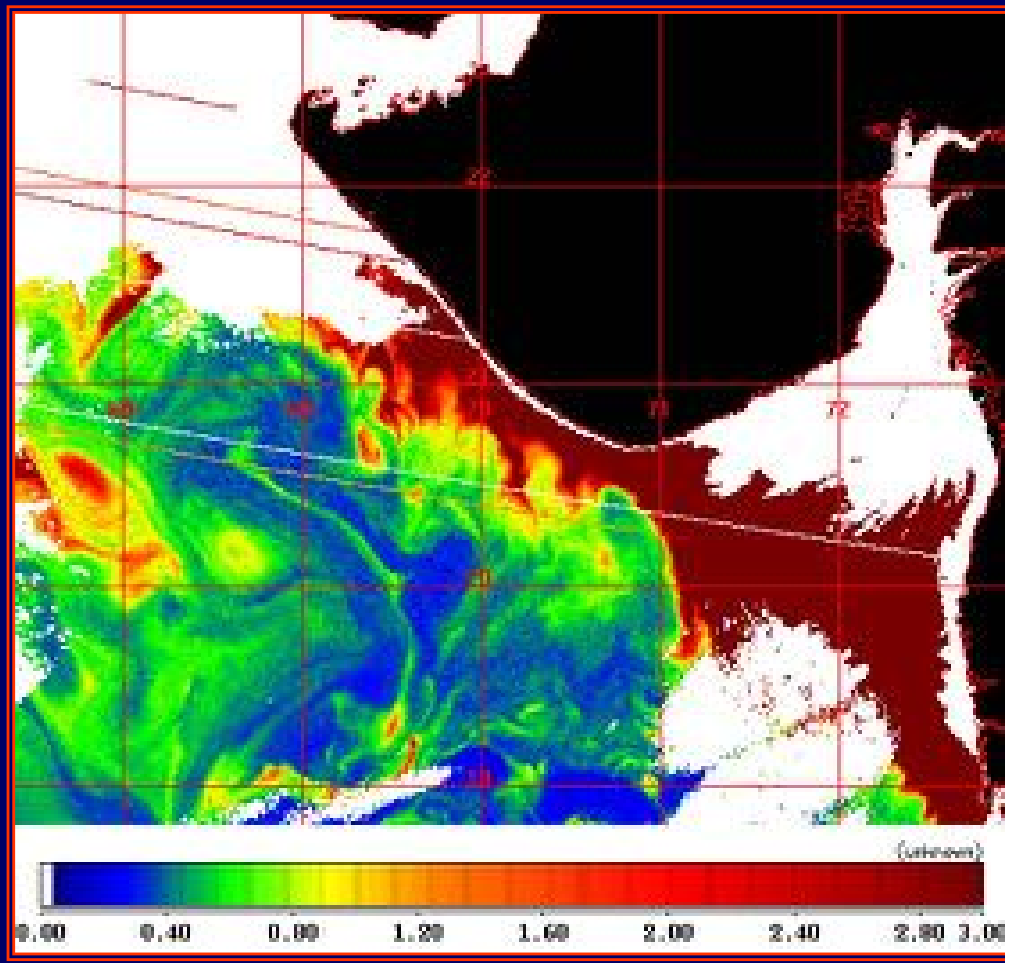
PARAMETERS	INSTRUMENTS	ORGANIZATION
Chlorophyll	Fluorometer, HPLC, CTD	NIO, CMFRI, SAC
Yellow Substance	Spectrophotometer, CTD	NIO,
Suspended Sediment	Balance	NIO, CESS, GSI
Primary Production	Scintillation Counter, CTD	NIO
Zooplankton	Plankton net, Microscope	NIO, CMFRI
Upwelling Radiance & Downwelling Irradiance	SPMR, LUR	SAC, NIO, NRSA
Abs. & Backsact. Coeff.	AC-9 meter	NIO, SAC
Spectral Optical Depth	Sunphotometer	SAC, PRL, SPL
Total Solar Flux	Pyrheliometer	PRL
Aerosol size distribution	QCM	PRL
Wind direction & Speed	Anemometer	IMD, GSI, NIO
SST	Thermometer	SAC

Inter Sensor Merging and Comparison of the Ocean Color Data - OCM & Seawifs

- OCM and SeaWiFS derived chlorophyll images were produced And inter-comparison is done.



OCM derived chlorophyll

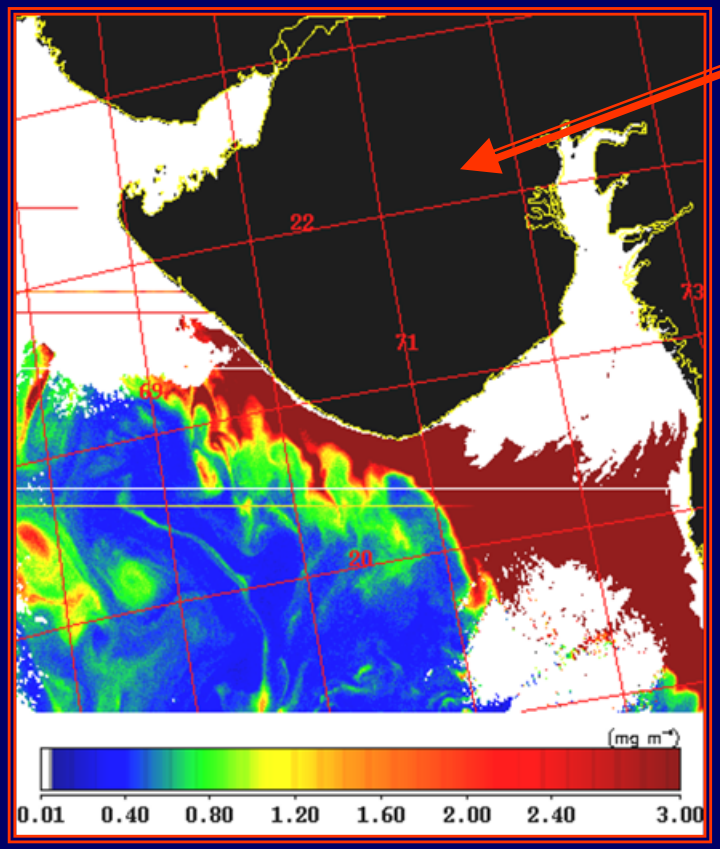


SeaWiFS derived chlorophyll

Inter Sensor merging and comparison

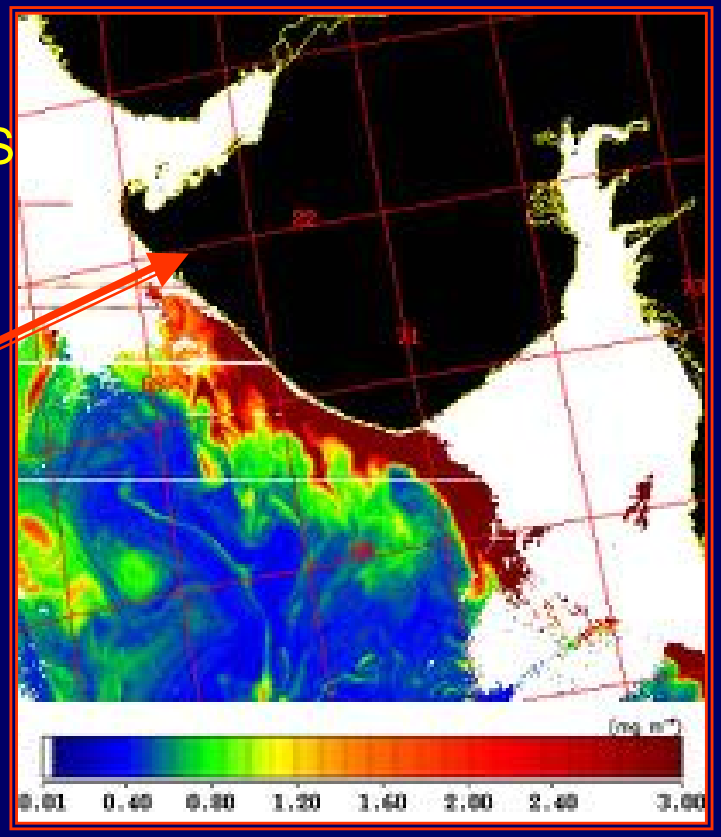
Atmospheric correction procedure developed at SAC is compared with SeaDAS output. Good match is found between chlorophyll images generated by SeaDAS & SAC developed procedure.

The case 2 water mask thresholds are different for SAC developed software and that of SeaDAS.

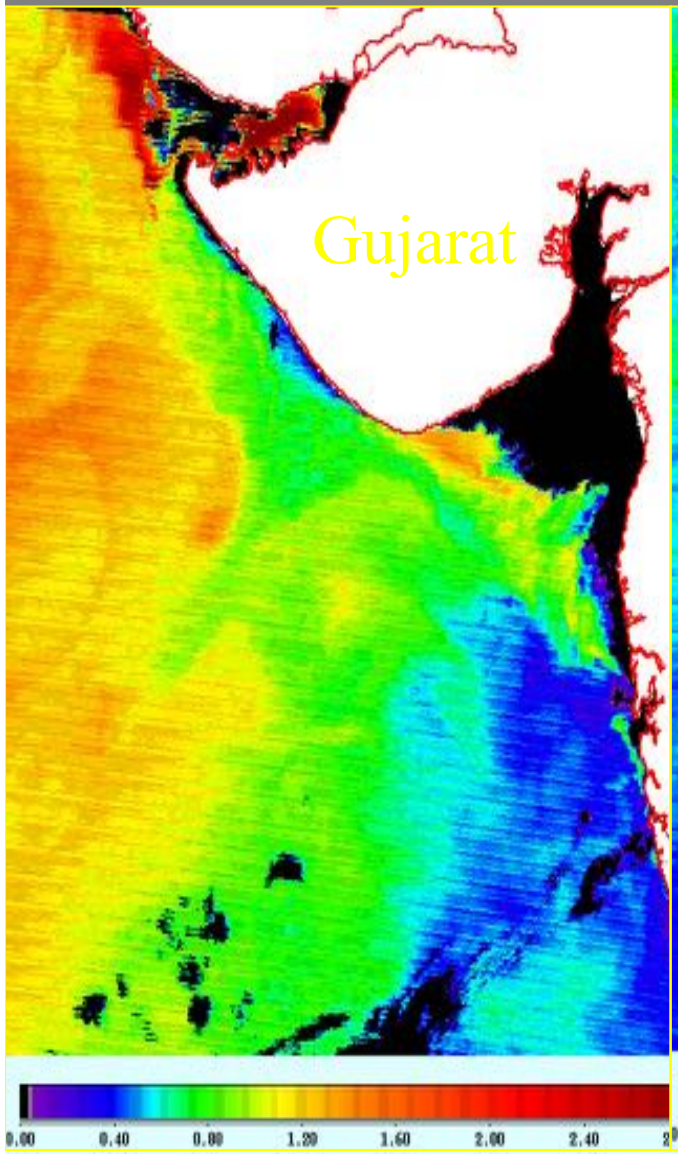


Chlorophyll image generated by SAC Software for SeaWiFS Data

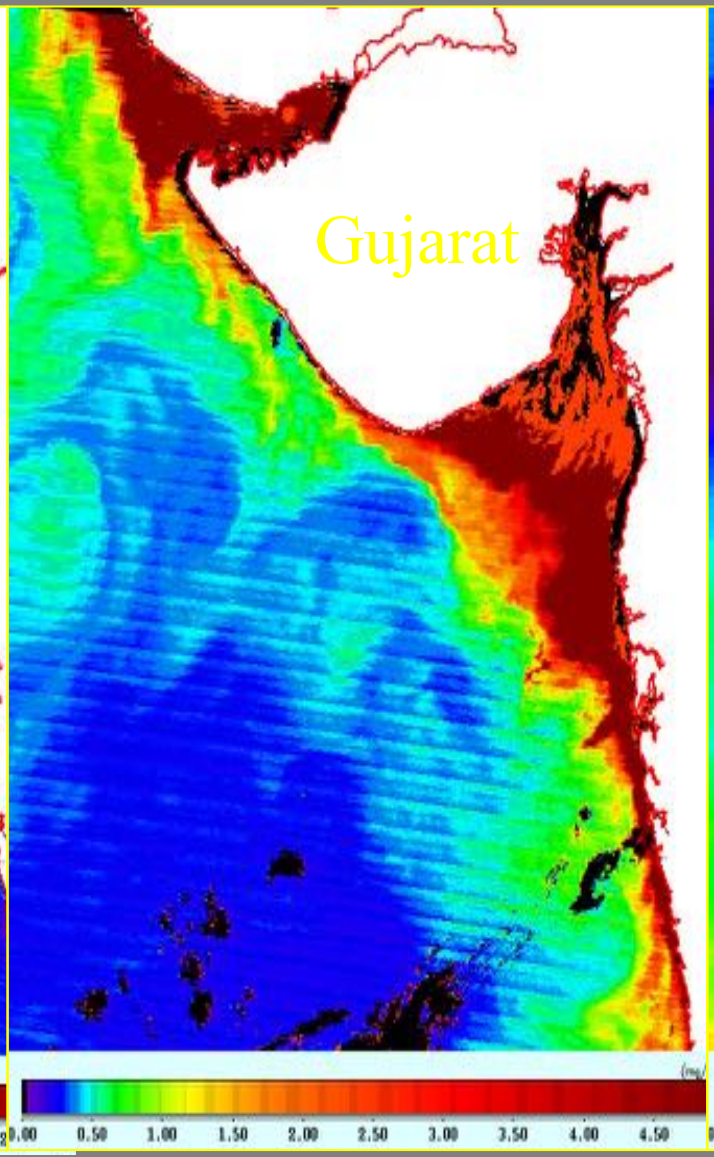
Chlorophyll image generated by SeaDAS software For SeaWiFS data



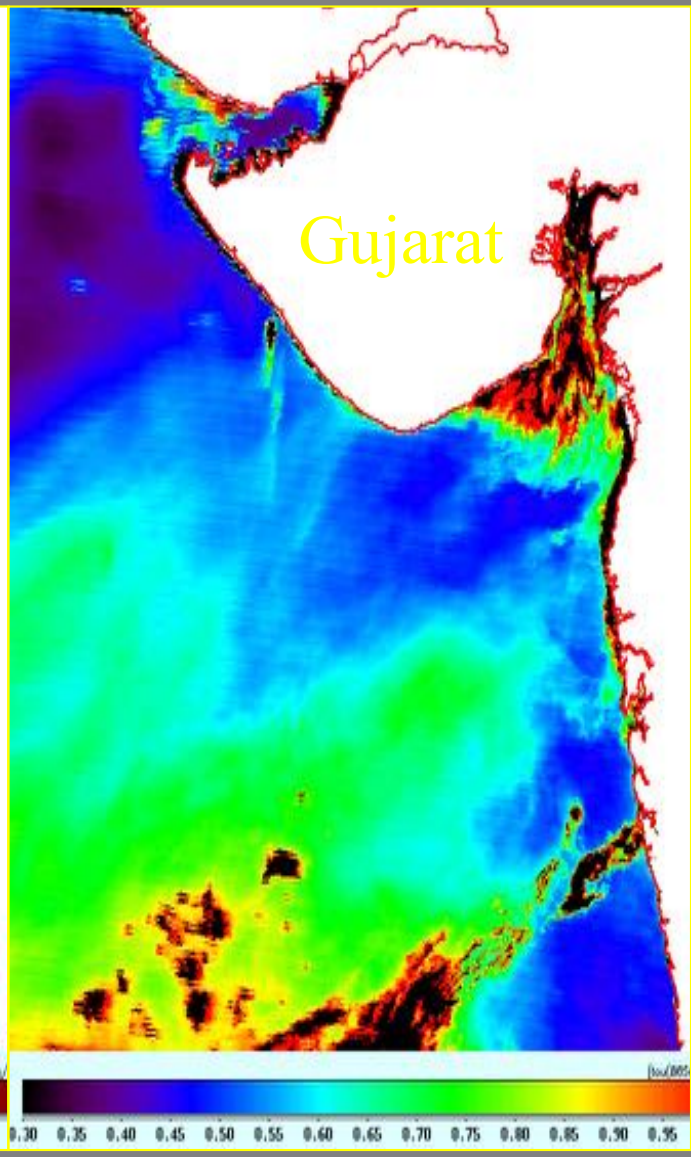
First MODIS-TERRA OCEAN Products generated at SAC/ISRO



Water-leaving rad.
490 nm



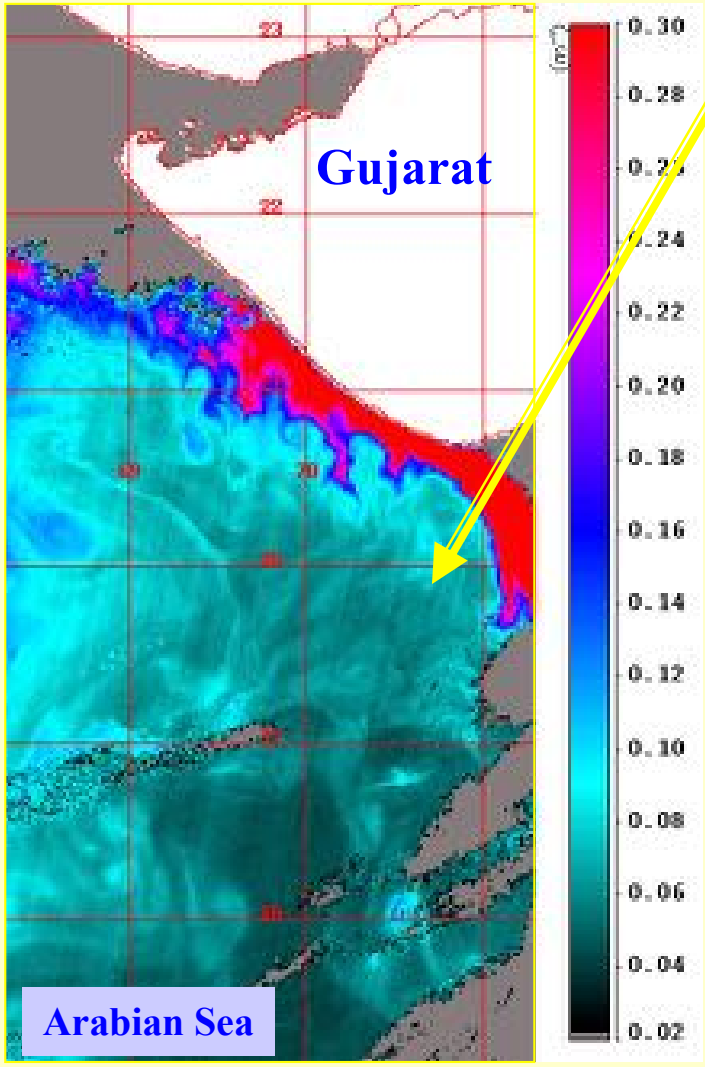
Chlorophyll-a
mg/m^3



Aerosol optical depth
865 nm

MODIS-TERRA data of October 7, 2002 over the Arabian Sea

Remote Sensing of Diffuse attenuation of Light in upper ocean layer (water clarity) using OCM data of 22 March 2000



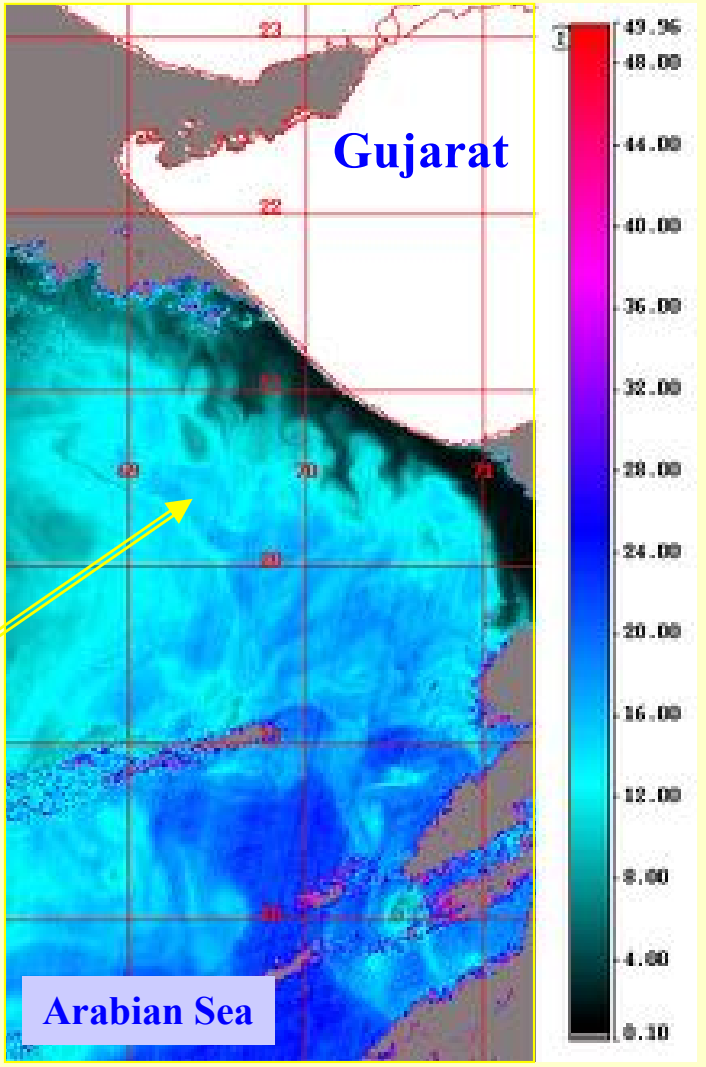
K(490) image in 1/m

K(490) image shows Diffuse attenuation of Light in upper layer of Ocean at 490 nm.

This is an indicator of Visibility in the upper Oceanic layer

Z_{90} image is inverse of K490 image and shows The depth of light Penetration upto which Surface light field Reduces to 33%

This information is Useful for sub-marine Navigation, Divers visibility, Ocean surface heating



Z_{90} image in meters

Ocean Modelling

Joint studies with IISc:

- Time evolution of OCM derived chlorophyll concentration and total suspended matter in the Bay of Bengal for the study of seasonal general circulation features in the southern bay adjoining Sri Lanka

- ARMEX Phase II – Analysis of OCM, MODIS and TRMM data on chlorophyll, TSM, SST and in-situ measurements on surface fluxes of heat, momentum, moisture depth profiles of solar short wave radiation penetration to understand the dynamics of *Arabian warm pool*

Ocean Colour Validation Future Plans

A Cal-Val site near Lakshadweep Islands has been approved. Detailed plans are being worked out.

A Data buoy/platform to be deployed to collect visible and NIR radiation entering and emanating from the ocean, temperature along with other meteorological and oceanographic parameters about 4-5 times a day.

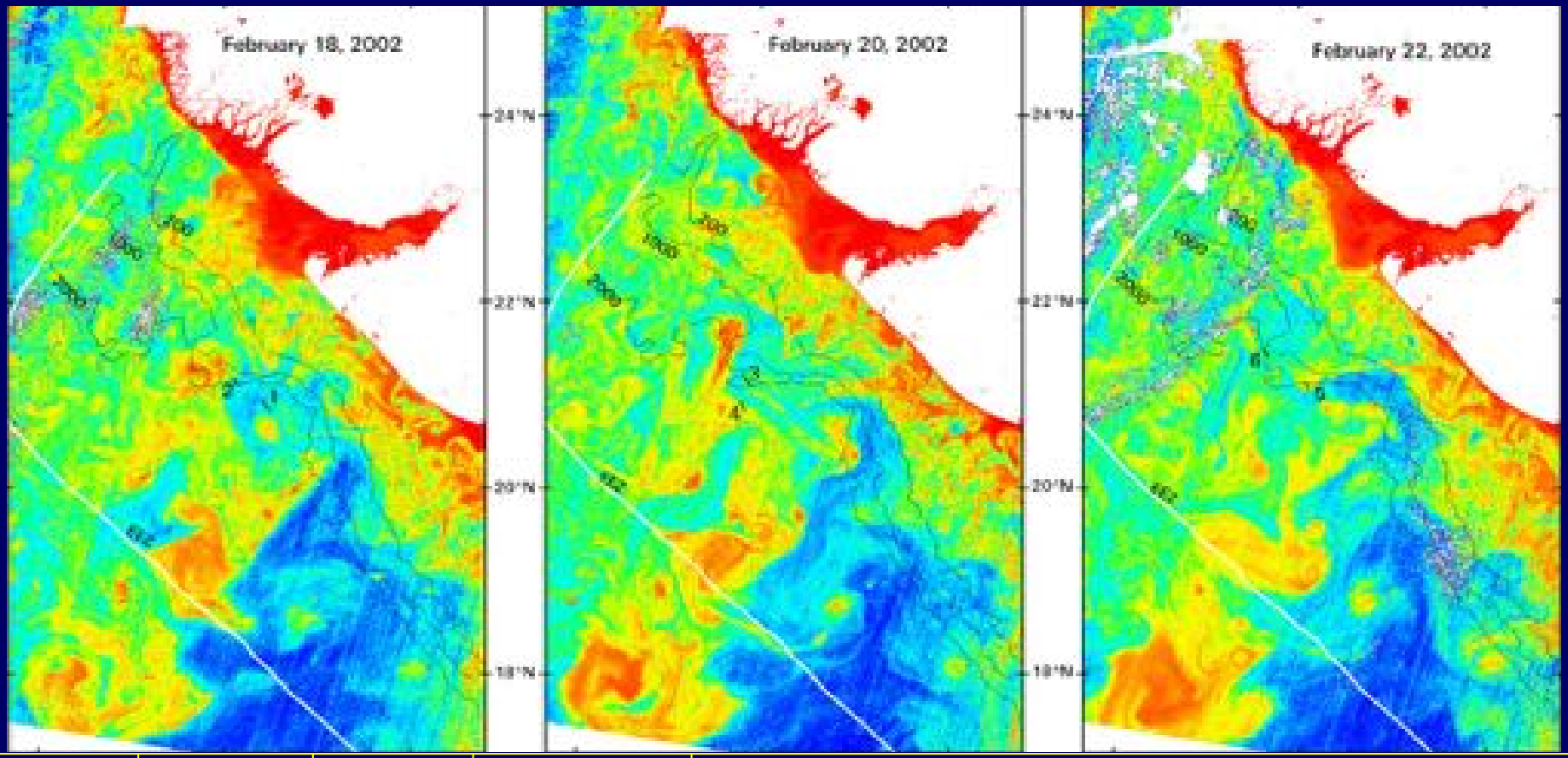
Marine Fisheries Short Term Forecasts

- An approach developed through integration of SST with chlorophyll
- Validation experiment carried out for three years (1999-2002)
- 70-90 per cent success rate (reliability)
- 70-200 per cent increase in catch
- Benefit to cost ratio has increased from 1.25 to 1.45 for bottom trawling and 1.3 to 2.25 for gill-netting.
- Efforts are ongoing to improve the validity period by incorporating information on surface wind. Oceansat II will provide surface wind along with colour information from same platform.
- Approach transferred to INCOIS/DOD. Operationised for the entire country.

Marine Fishery – Short-term forecast

- Forecast are generated every third day and are valid for three-four days.
- The forecast helps in reducing catch per unit effort.
- Forecast contains information about distance, direction and depth of potential fishing zones from nearest fishing harbour in local language. This information is also disseminated through local newspaper, radio, etc.
- Forecast is sent all major fishing harbours, fishing cooperatives, free of cost by INCOIS.

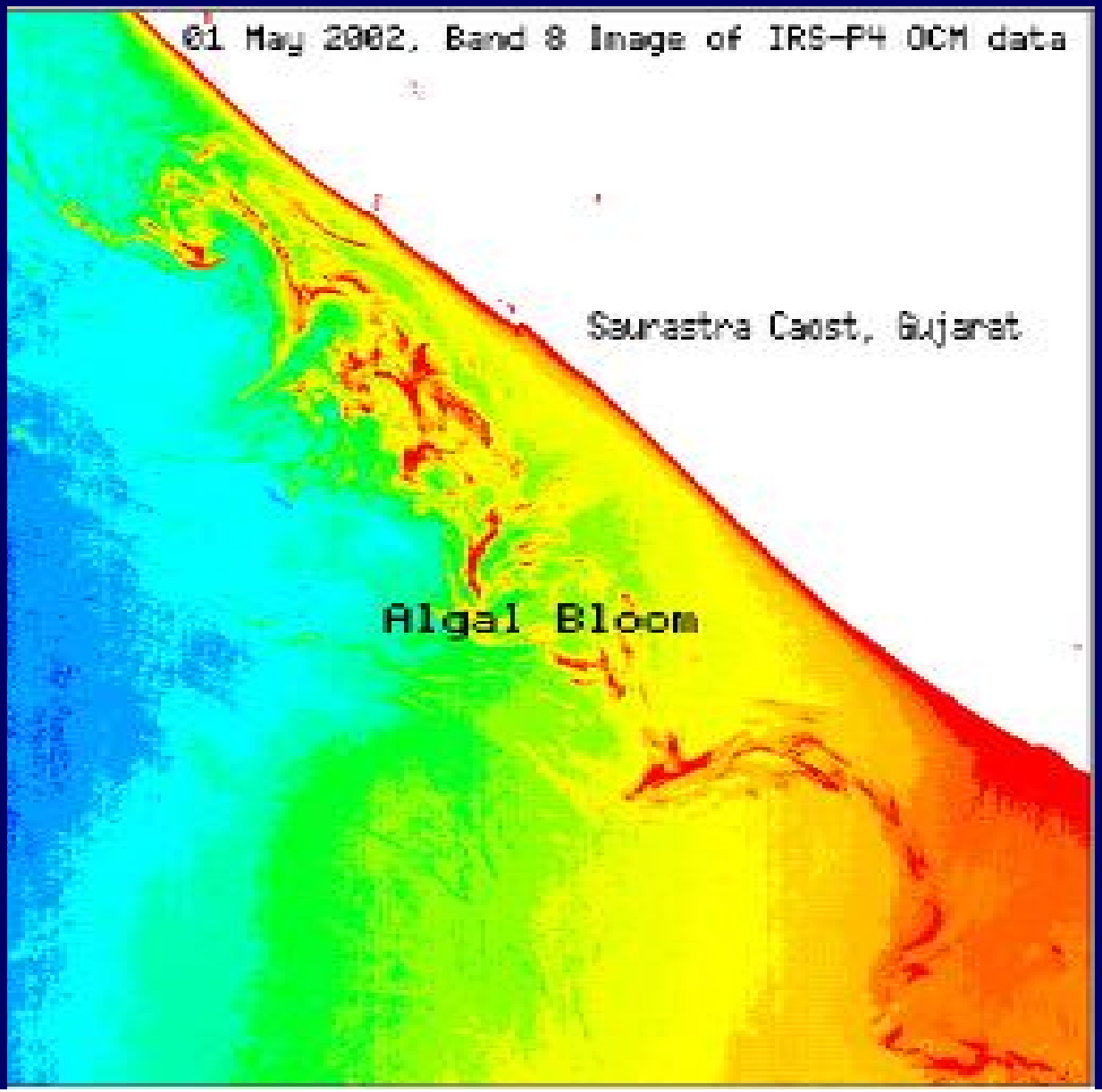
Marine Fishery - Feedback from FSI



Track No.	Depth(m)	HR (%)	Date	species
1	2589	3.8	18-02-02	Thunus albacore
2	1701	1.9	19-02-02	Thunus albacore, Yellow fin
3	1876	1.0	20-02-02	Thunus albacore
4	2727	1.2	21-02-02	Thunus albacore, Shark
5	1791	2.1	22-02-02	Thunus albacore, Yellow fin
6	1860	1.9	23-02-02	Thunus albacore, Yellow fin

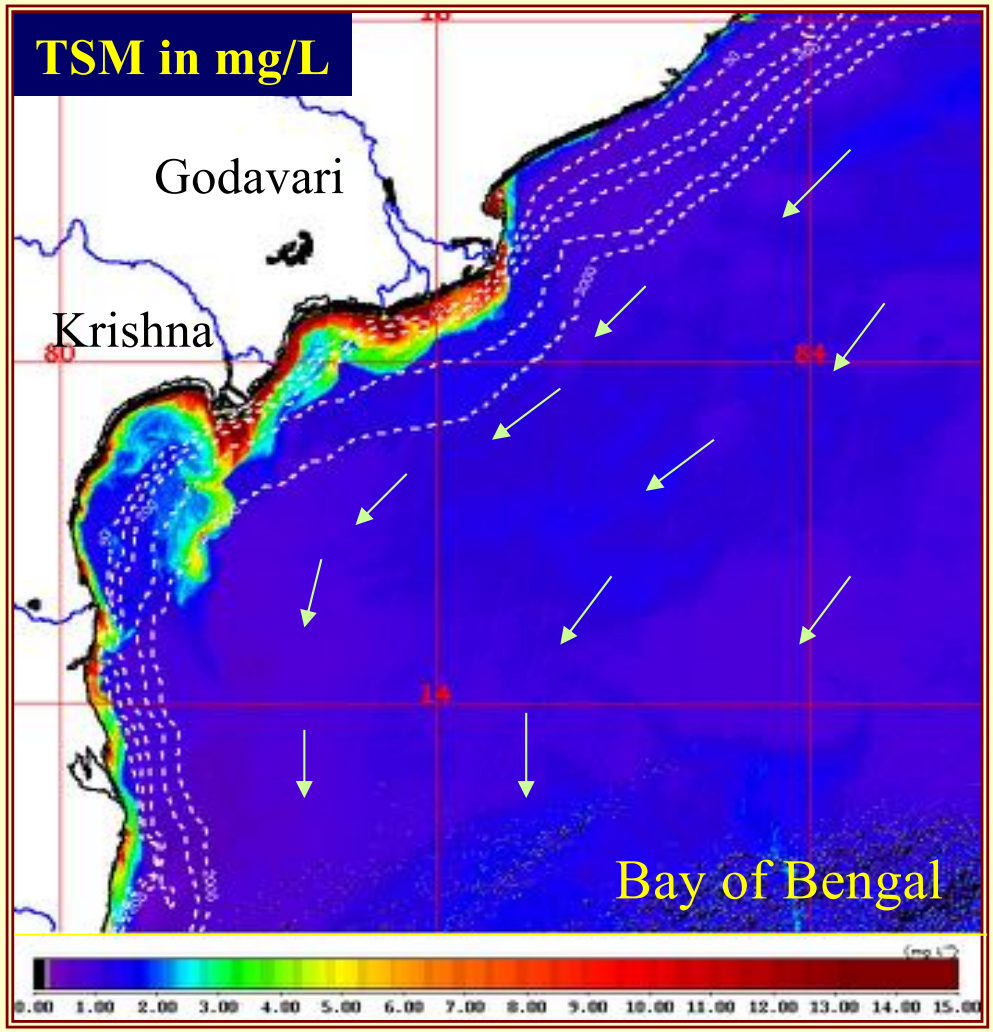
Average HR before bloom : 0.2 %

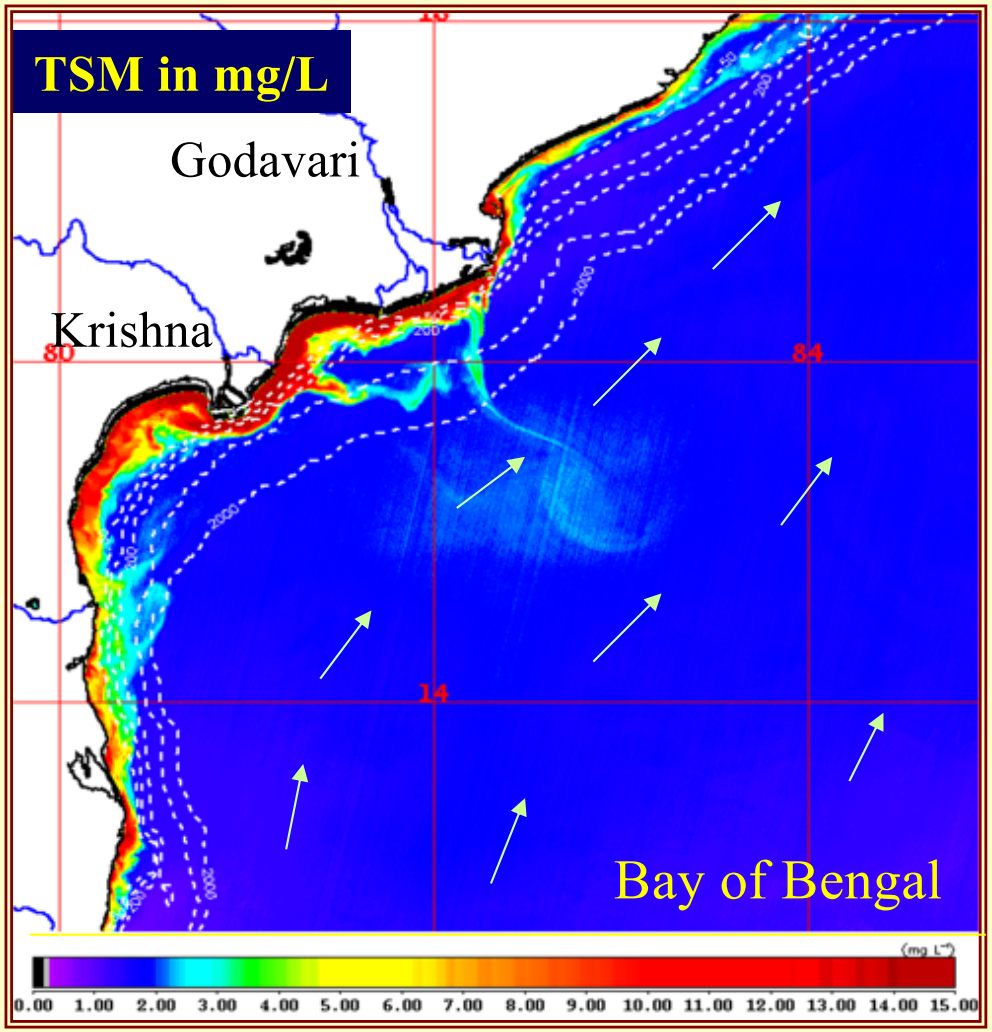
Detection of Algal Bloom



Tricodesium bloom observed on the Saurashtra coast, during the month of May.

Coastal Circulation & Plume Dynamics using OCM Sediment images in Krishna-Godavari Delta, Bay of Bengal





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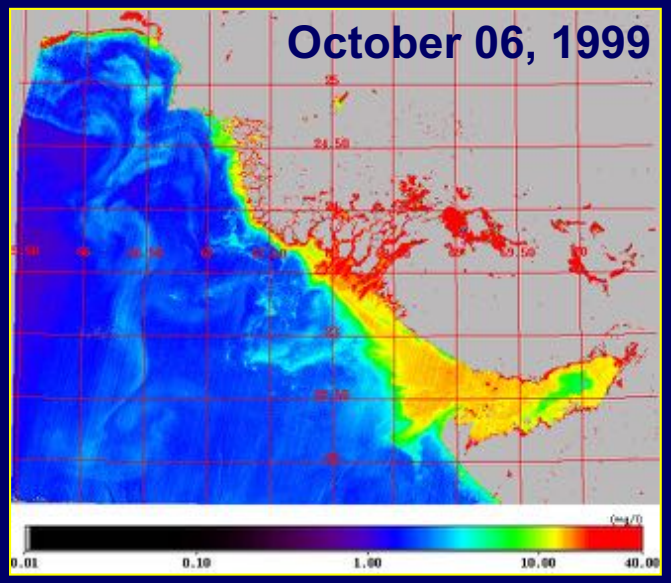
12 Dec 1999 **1 Mar 2000**

Wind Vectors are plotted using QuickScat data of NASA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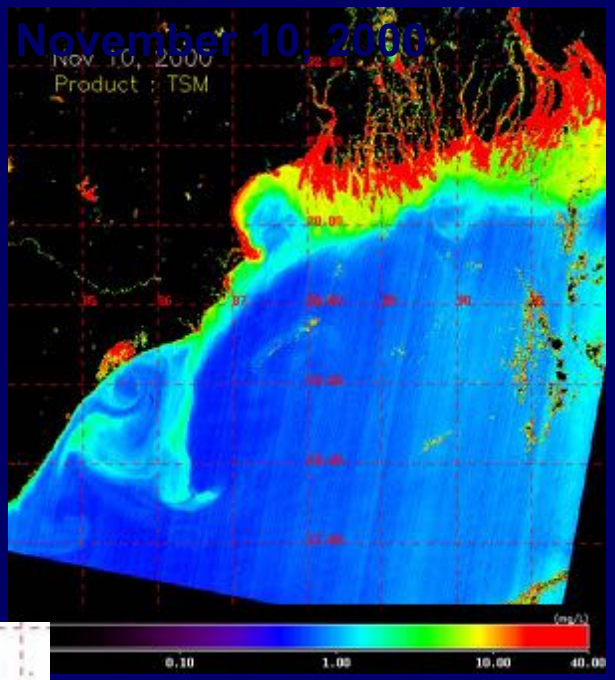
0.10
1.00
10.00
40.00


November 10, 2000
Nov 10, 2000
Product : TSM
0.10
1.00
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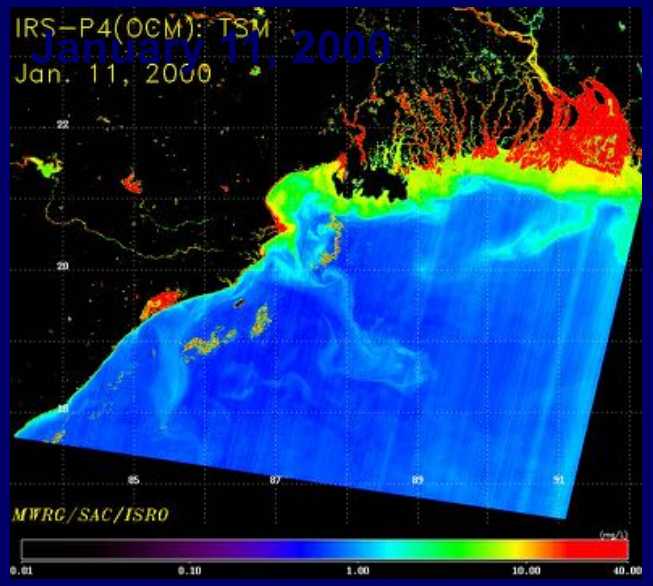
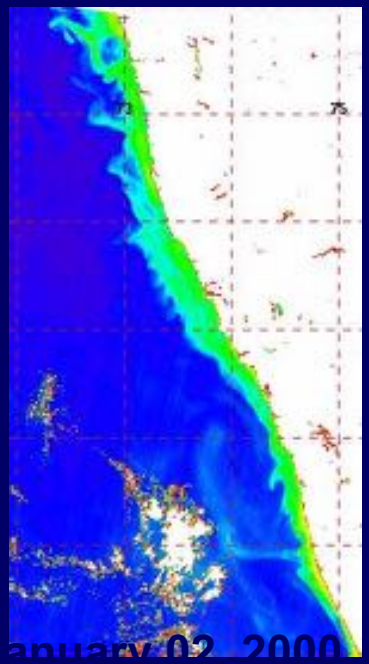
40.00


January 11, 2000
IRS-P4(OCM): TSM
Jan. 11, 2000
MWRC/SAC/ISRO
0.01
0.10
1.00
10.00
40.00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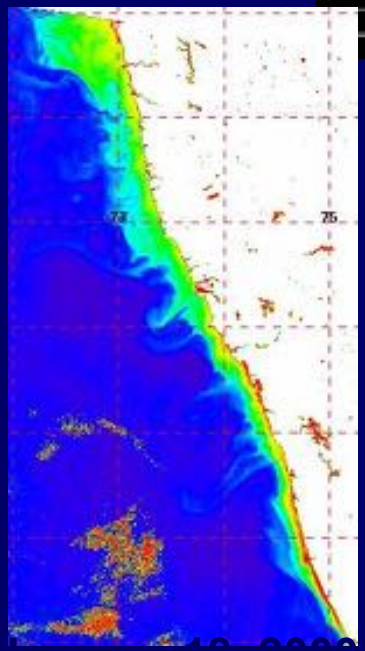

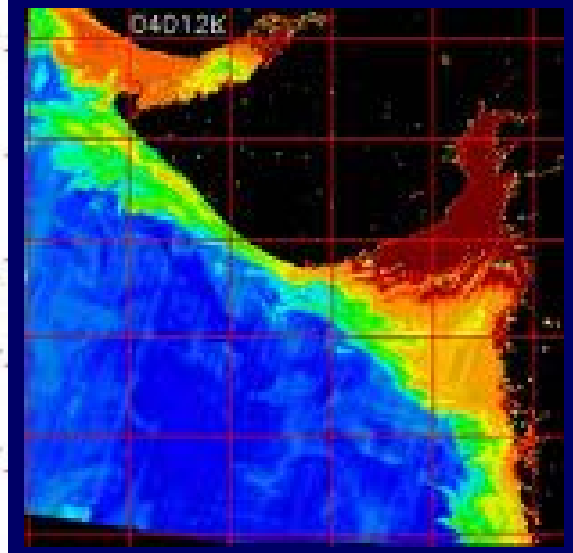
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