

# Over view of INCOIS Activities

**Dr. Balakrishnan Nair**  
**Group Director, OSAR**

# Our mission is to:

*“Provide the Ocean Information and Advisory Services to Society, Industry, Government Agencies and Scientific Community through Sustained Ocean Observations and Constant improvements through Systematic and Focussed Research”.*

# Our stake holders are:

*All those who depend on Sea for livelihood and those who leave on the coasts*

- *Fishermen*
- *Coastal population*
- *Navigators*
- *Ports & Harbours*
- *Maritime Industries (oil, shipping, Power..)*
- *Navy, Coast Guard, Marine Police*
- *Disaster Management agencies*
- *Coastal Tourism*
- *State Administration*
- *Academia and Researchers*



# Our services to the Society and Industry

## Marine Fishery Advisories (Potential Fishing Zone & Tuna Fishing Advisories)

- ✓ Advisories to fishermen (guiding them the locations of abundant fish availability)

## Ocean State Forecast (Waves, Currents, SST, Tides, etc.)

- ✓ Fishermen
- ✓ Navigators
- ✓ Ports & Harbours
- ✓ Indian Navy
- ✓ Indian Coast Guard
- ✓ Maritime Industries (Oil & Natural Gas)

## Early Warnings (Tsunami, Storm Surge, High Wave Alerts, Swell surge, Tidal flooding)

- ✓ Disaster Management Agencies
- ✓ Coastal Population
- ✓ Port & Harbours
- ✓ Critical Installations (Nuclear Power Plants, refineries)

## Coral Bleaching Alerts

- ✓ Researchers
- ✓ Ecologist and Environmentalist
- ✓ Policymakers

## Special Services for Indian Navy & Coast Guard

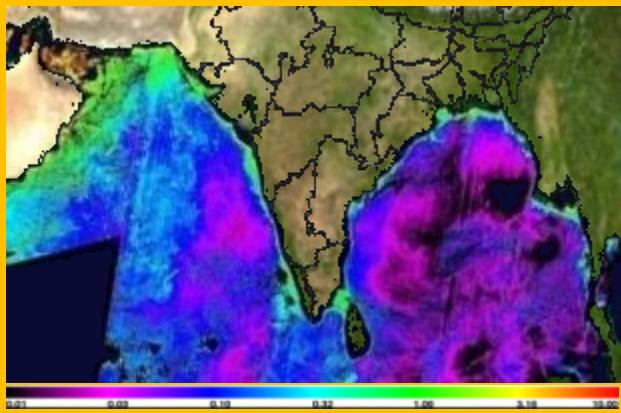
- ✓ Prediction of the trajectory of Oil Spil
- ✓ Search and Rescue Aid Tool (SARAT)
- ✓ Encrypted forecasts for Indian Navel Ships
- ✓ Sound Layer and Mixed Layer Depth for Naval warfare

# Potential Fishing Zone (PFZ) Advisory Services

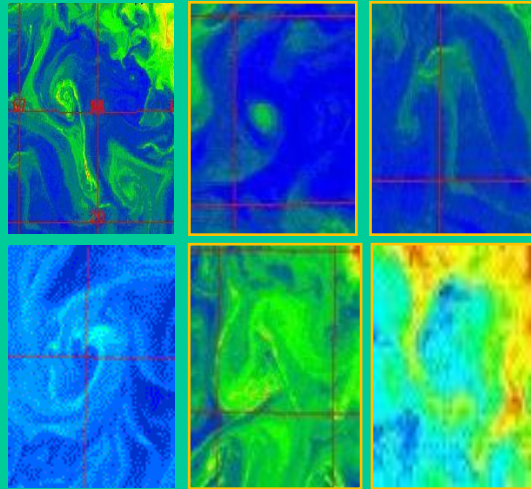
## Sea Surface Temperature



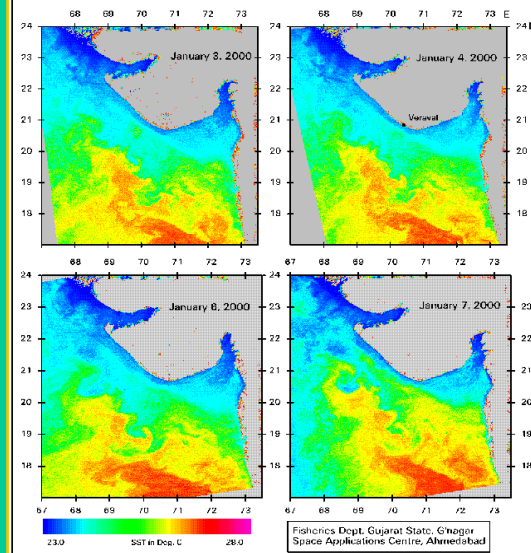
## Chlorophyll



Satellite Data Products



## Monitoring of Thermal features using NOAA AVHRR



Key Indicators



Data updated on: 07/07/2018 15:53:33

Potential Fishing Zone  
NORTH ANDHRA PRADESH  
5000 METERS

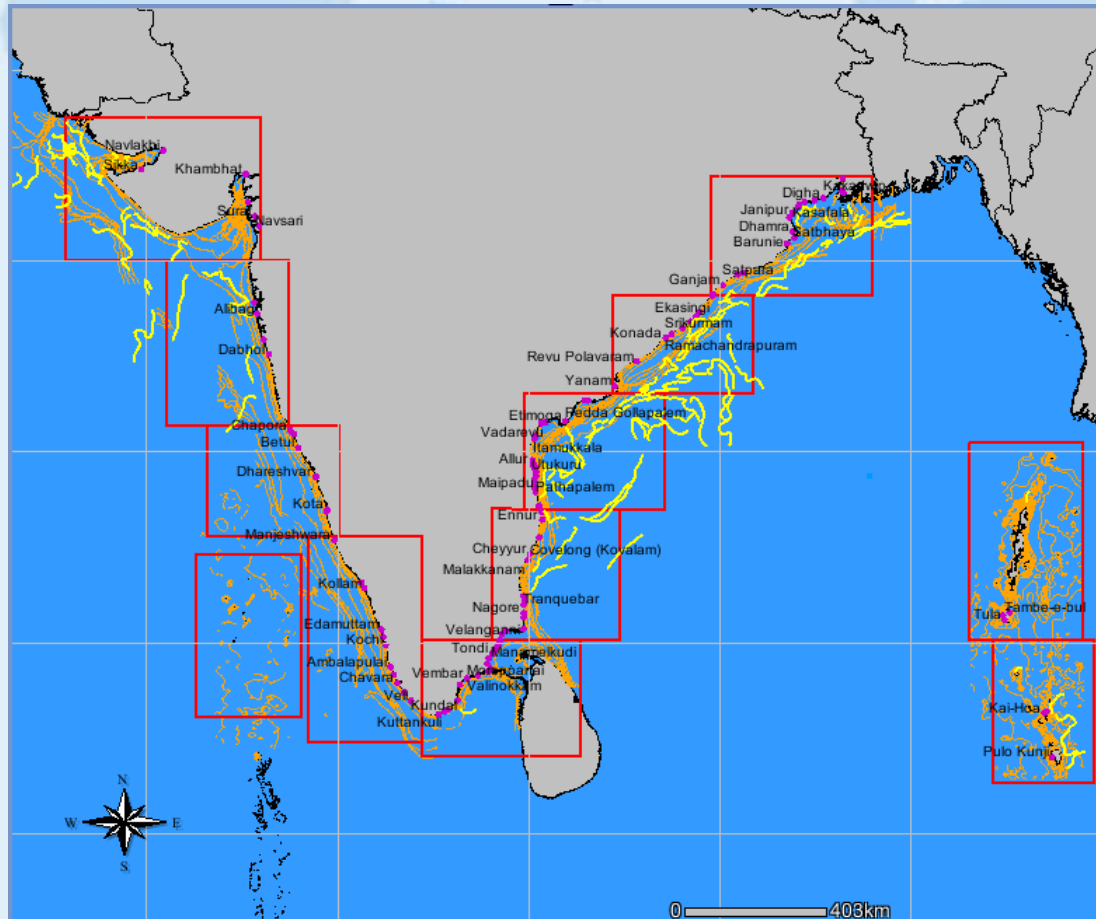
SATELLITE DATA SHOWS LIKELY AVAILABILITY OF FISH STOCK TILL 8 JUL 2018  
સાતેલા ડેટા અનુસાર અગાઉ 8 જુલાઈ 2018 સુધી મીઠા પાણીમાં સુલભતા સંભવિત છે

કેન્દ્રીય નામ	અવકાશ	કેન્દ્રીય (ડિગ્રી)	કેન્દ્રીય (મિટર)	કેન્દ્રીય (ડિગ્રી)	કેન્દ્રીય (ડિગ્રી)	કેન્દ્રીય (ડિગ્રી)
કેન્દ્રીય નામ	અવકાશ	104	104.008	2008.2014	17 14 12 અગા	02 02 20 અગા
કેન્દ્રીય નામ	અવકાશ	106	106.46	2007.210	17 15 04 અગા	04 05 32 અગા
કેન્દ્રીય નામ	અવકાશ	100	100.593	2007.2492	17 15 36 અગા	03 05 07 અગા
કેન્દ્રીય નામ	અવકાશ	103	103.21	2008.131	17 16 09 અગા	04 07 21 અગા
કેન્દ્રીય નામ	અવકાશ	100	100.73	2008.2000	17 16 09 અગા	02 04 02 અગા
કેન્દ્રીય નામ	અવકાશ	08	107.012	2103.2100	17 02 08 અગા	04 04 02 અગા
કેન્દ્રીય નામ	અવકાશ	100	103.018	2008.2000	17 15 36 અગા	02 05 02 અગા
કેન્દ્રીય નામ	અવકાશ	06	104.26	2008.210	18 27 40 અગા	04 06 07 અગા
કેન્દ્રીય નામ	અવકાશ	08	102.07	2001.2100	18 23 32 અગા	04 07 02 અગા
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કેન્દ્રીય નામ	અવકાશ	101	104.74	1008.1000	18 23 21 અગા	04 05 04 અગા
કેન્દ્રીય નામ	અવકાશ	07	100.020	2171.2170	17 04 02 અગા	04 06 04 અગા

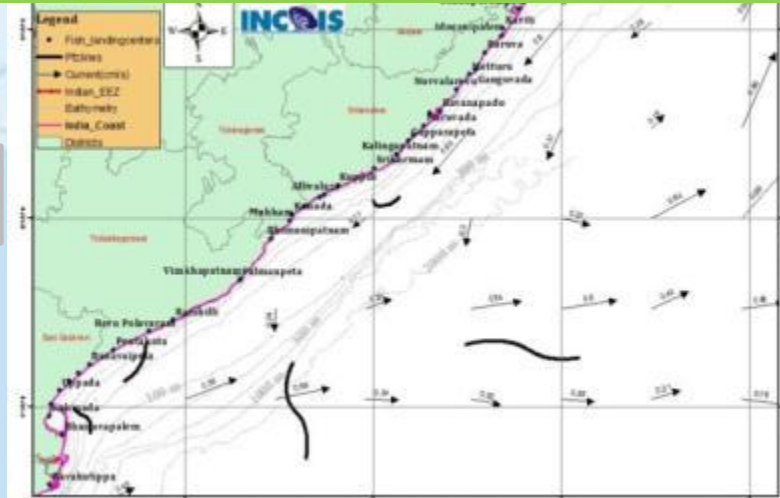
PFZ Advisories

# Potential Fishing Zone (PFZ) Advisory Services

12 sectors covering islands and mainland



Daily advisories referring to 586 specific landmarks/locations on the coast



Please provide your valuable feedback to Director, Indian National Centre for Ocean Information Services (INCOIS), MoS, Govt. of India, Cochin Valley, F-Block, Nizamat (S.O), Hyderabad - 500096.

Data updated on: 26-08-2017 17:24:56

Potential Fishing Zone  
NORTH ANDHRA PRADESH  
ఆంధ్ర ప్రదేశ్  
అధికారిక

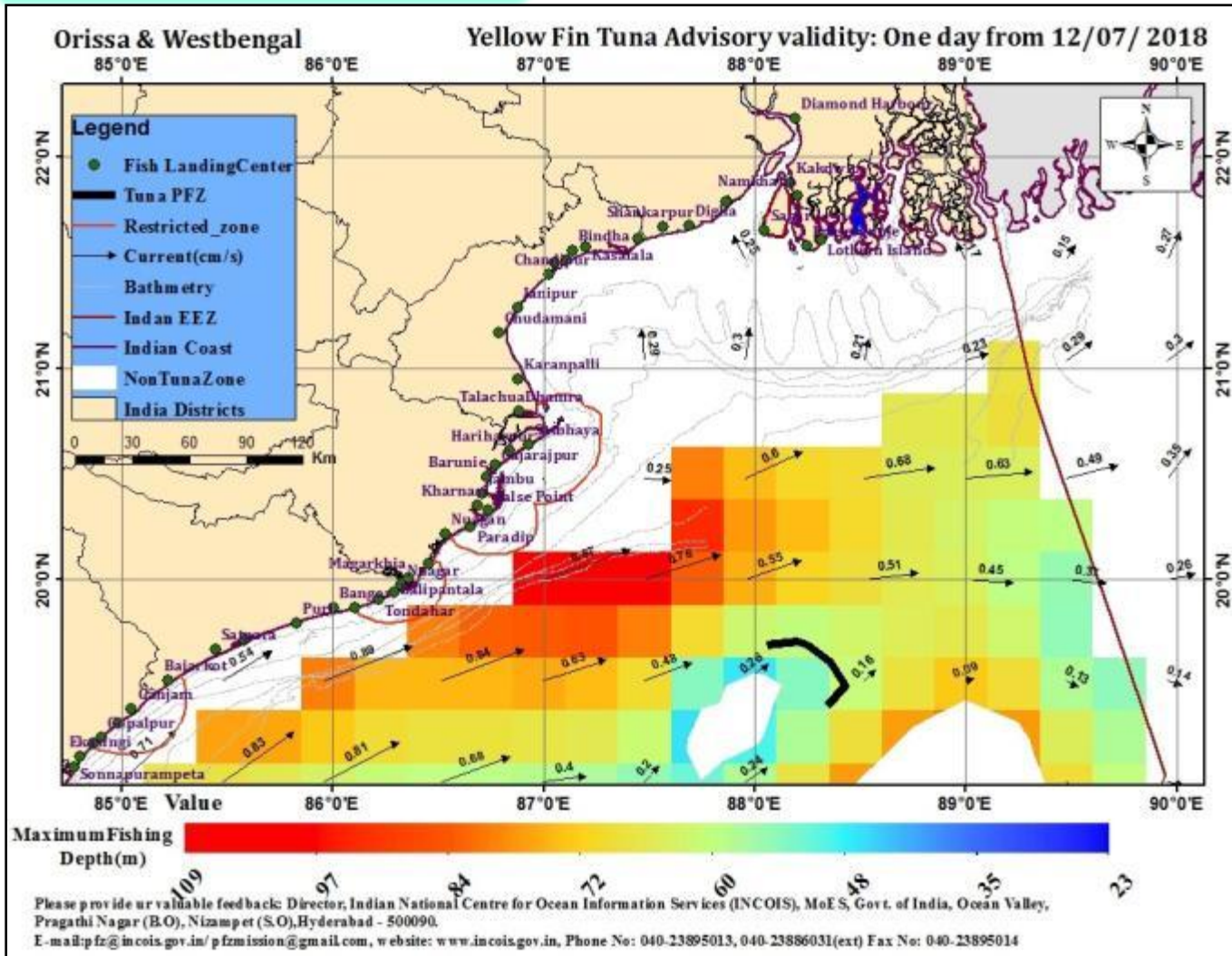
SATELLITE DATA SHOWS LIKELY AVAILABILITY OF FISH STOCK TILL 27 AUG 2017  
సాతలైట్ డేటా ప్రకారం 27 ఆగస్టు 2017 వరకు మత్స్య వనరులు అందుబాటులో ఉంటాయి.

తీరం పేరు	దశ	కొలత (కి.మీ)	దూరం (కి.మీ) సుండ్-వరకు	తీరం (సుండ్-వరకు)	అంచనా (కి.మీ)	విస్తీర్ణం (కి.మీ <sup>2</sup> )
అల్లవలూరు తీరం	సముద్రం	50	35-40	53-58	16.4.8 ఎస్కె	84.4.28 ఎస్కె
కొప్పి తీరం	సముద్రం	106	32-37	55-60	18.5.18 ఎస్కె	84.6.45 ఎస్కె
వకలపాటి తీరం	సముద్రం	119	24-29	49-54	16.53.53 ఎస్కె	82.29.51 ఎస్కె
కొత్త నాపాటి తీరం	సముద్రం	159	142-147	2429-2434	17.19.6 ఎస్కె	84.47.26 ఎస్కె
బావనపాటి తీరం	సముద్రం	159	147-152	2542-2547	17.16.46 ఎస్కె	84.51.53 ఎస్కె
పెనుమలూరు తీరం	సముద్రం	85	27-32	50-55	17.9.25 ఎస్కె	82.42.21 ఎస్కె
పానపాటి తీరం	సముద్రం	157	83-88	2621-2626	16.56.57 ఎస్కె	83.36.22 ఎస్కె
బండమలూరు తీరం	సముద్రం	103	63-68	1331-1336	16.19.8 ఎస్కె	82.33.51 ఎస్కె
పెనుమలూరు తీరం	సముద్రం					

# Tuna Fishing Advisory Services

## Species specific

Demand from the Users – Service by INCOIS



- Tuna Fishery advisories with SST, Chl, Kd-490 (Water Clarity)
- Improvement in advisories through the results of Telemetry studies
- Tuna 3D-advisory with details of max. fishing depth

# Ocean State Forecast (OSF)

## Forecast (10 days) /Analysed Services

- Global Forecast
- Regional – 7 Regions
- Coastal – 9 Coastal states of India
- Island – A&N and Lakshadweep
- Location specific -100 locations
- Tidal forecast system for 178 locations
- Real time validation System
- Forecast dissemination in local languages
- High resolution Forecast on Ocean currents, SST, MLD, D20, Vertical structure .
- Ocean alaysis products
- Tropical Cyclone Heat Potential
- OSF and Tsunami Services for IO countries

## Early Warning Services

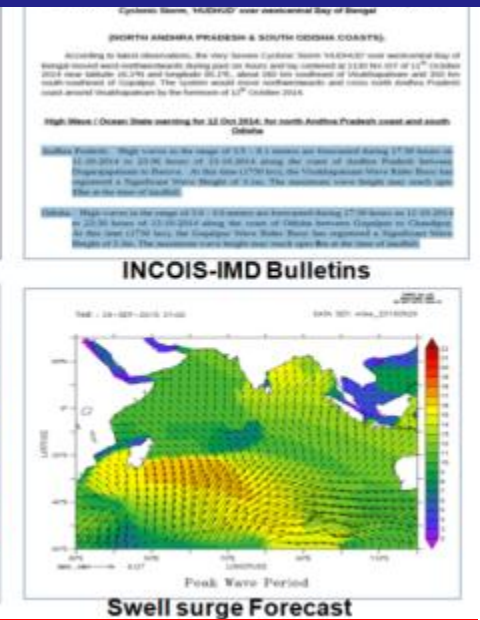
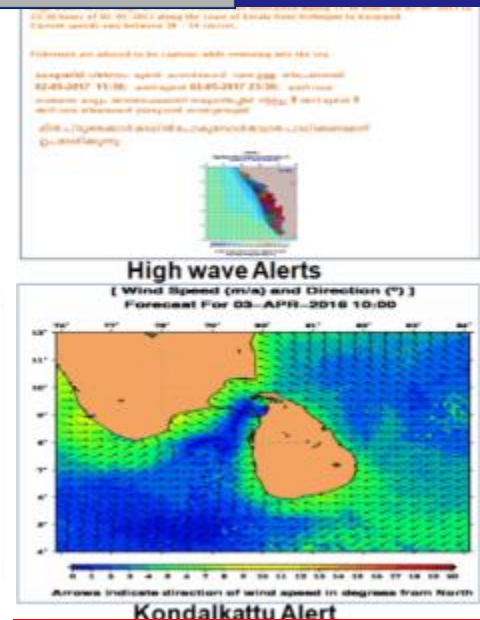
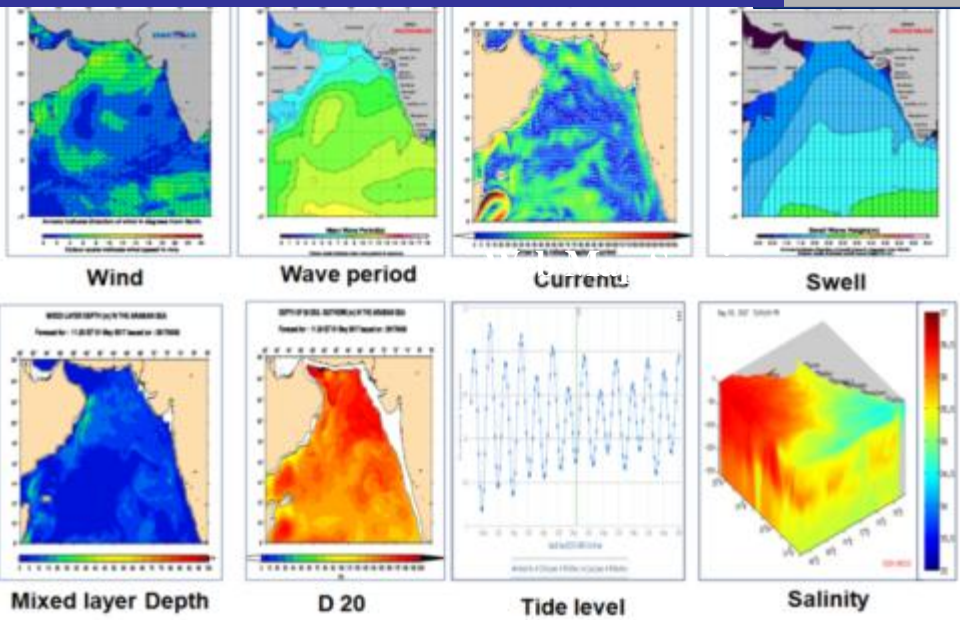
- High Wave/swell/bulletins
- Joint INCOIS – IMD Bulletins
- Tsunami bulletins
- Storm surge bulletins
- Swell Surge (*Kallakadal*)
- Tidal flooding
- Small Craft Advisories

## Value added Services to support blue economy

- Forecast along ship-track
- Sea State Forecast for ports and Harbours
- Online Oil spill advisories (OOSA)
- OSF Web Map Services
- Search and Rescue Aid Tool (SARAT)
- Search and Rescue Aid Tool-Integrated (SARATI)
- Eddy Forecasts
- Navy specific forecast products
- Dynamic IVL for Maritime Boards/DG shipping
- Forecast for Coastal Tourism
- Ocean climate Services

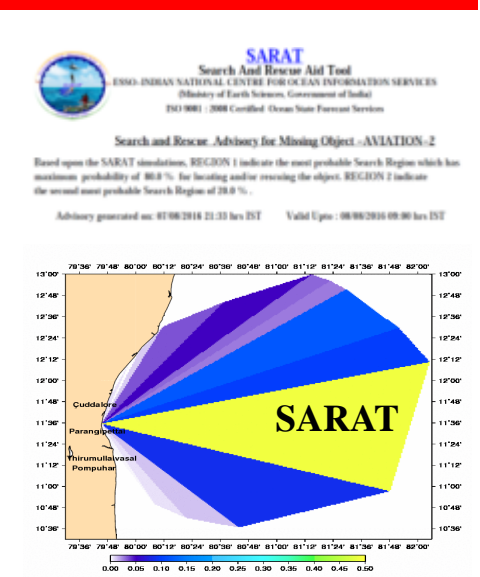
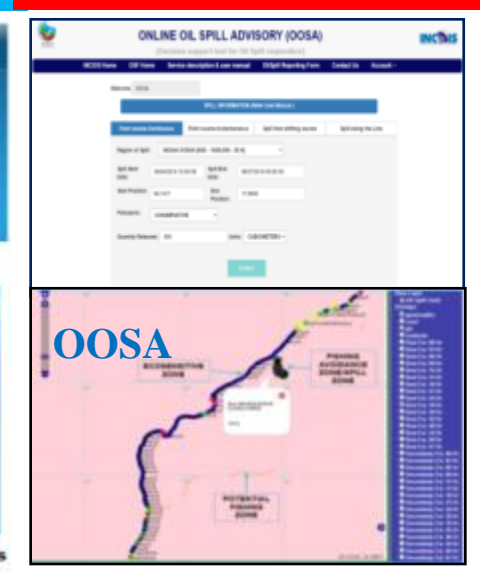
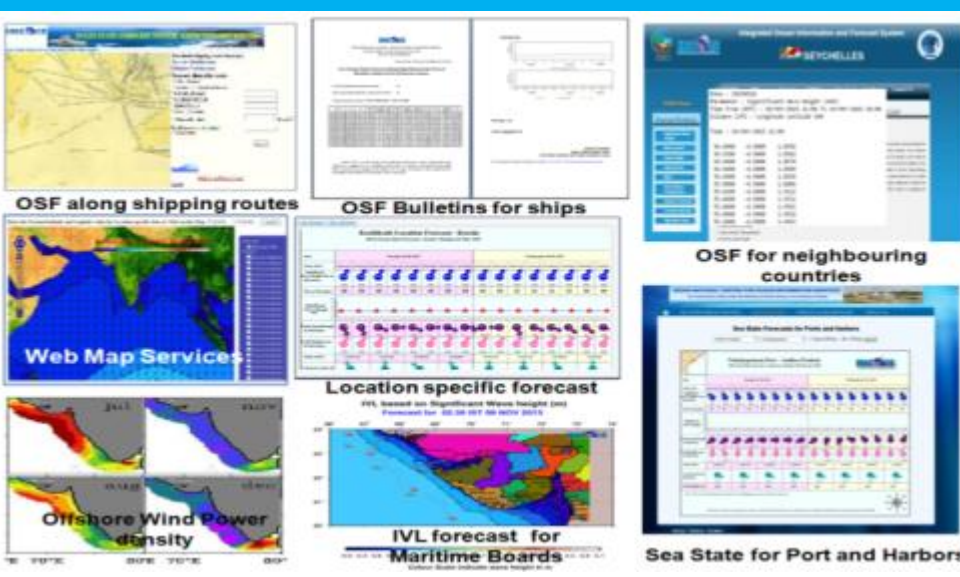
# Ocean State Forecast (OSF)

FORECASTED PARAMETERS(NEXT10DAYS)      OSF PRODUCTS      WARNING/ALERT SERVICES



CUSTOMIZED PRODUCTS FOR BLUE ECONOMY

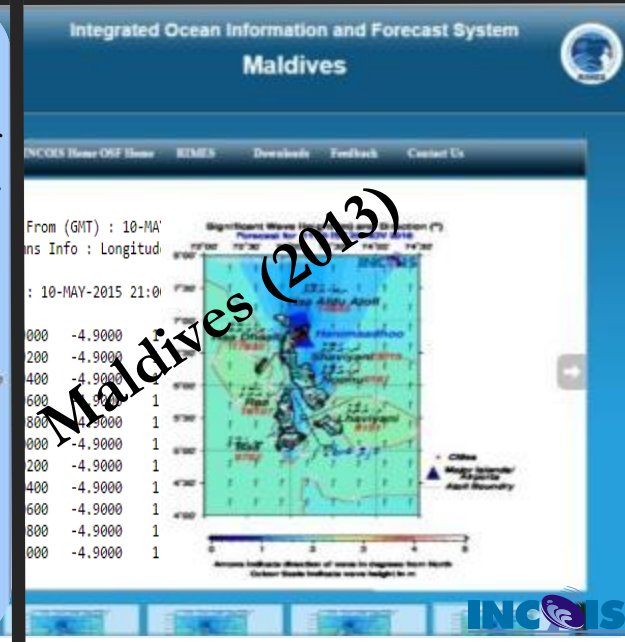
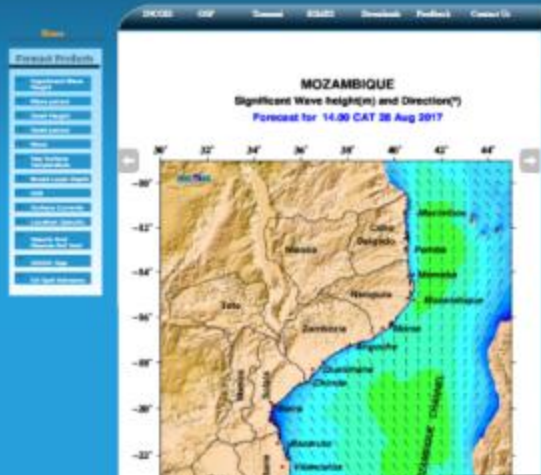
EMERGENCY AID SERVICES





# Ocean State Forecast (OSF)

Ocean State Forecasts for  
Maldives, Sri Lanka, Seychelles, Comoros, Mozambique & Madagascar

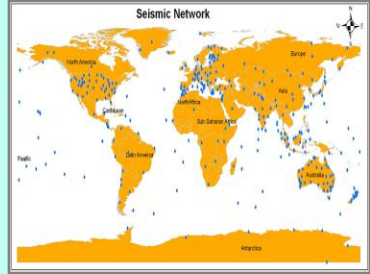


# Early warnings (Tsunami Early Warning System)

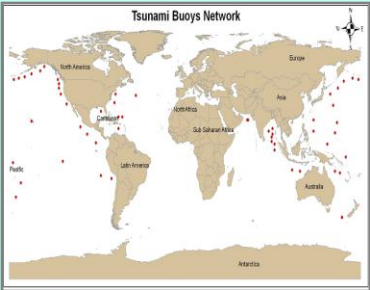
Detection

Warnings

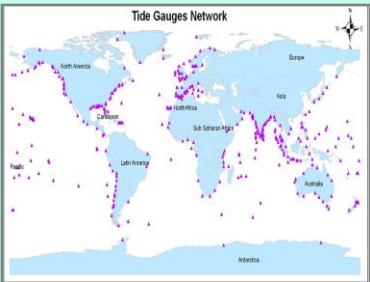
Dissemination



Seismic Network



BPR Network



Tide gauge Network

Observation Networks



VSAT



INSAT

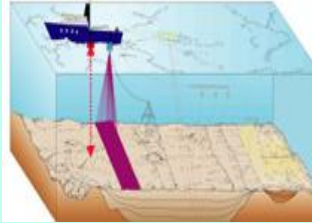


GPRS

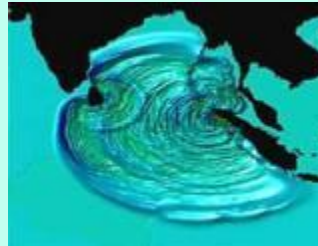


INMARSAT

Communications



Bathymetry



Tsunami Modelling



Topography



Costal Vulnerability

Modelling

COMMS Tests  
Tsunami Drills  
Trainings  
Publicity Material



Capacity Building



R & D

Paleo-tsunami  
Modelling  
GNSS Data Use

Last mile connectivity

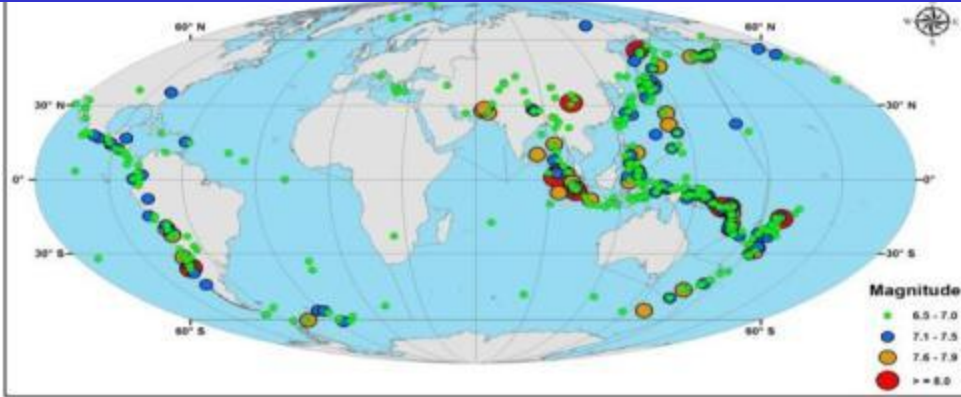
Participating Institutions  
IMD, NIOT, ICMAM, SOI,  
NRSC, INCOIS  
MHA, NDMA, Coastal States



# Early warnings (Tsunami Early Warning System)

## Performance of ITEWC

ITEWC monitored 598 earthquakes ( $M > 6.5$ ) during September 2007 to June 2019



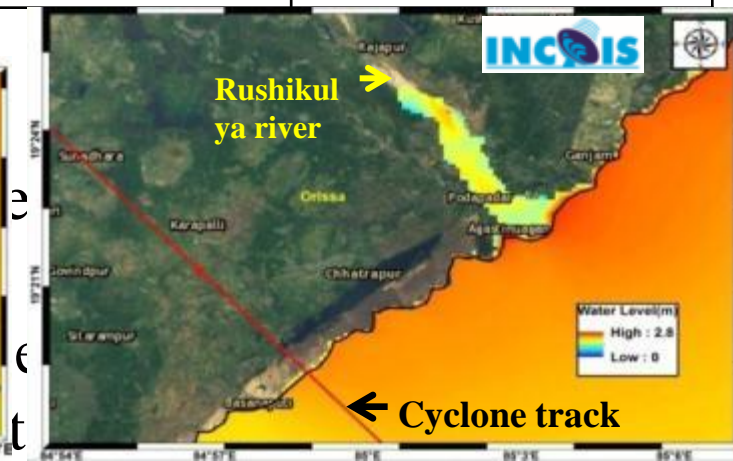
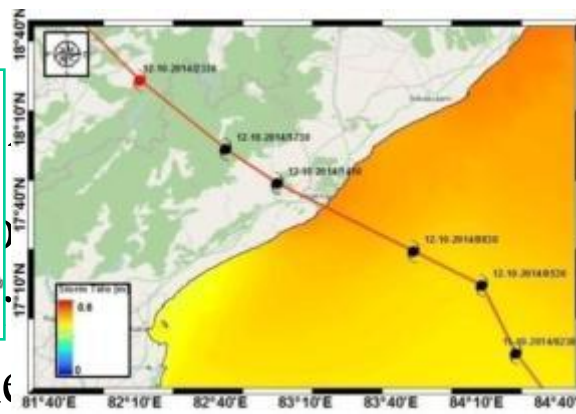
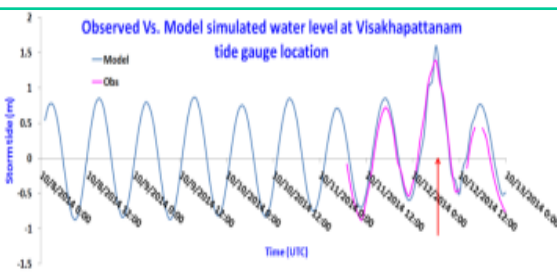
Region	No of Earthquake $M \geq 6.5$
Indian Ocean (IO)	97
Other than Indian Ocean (GO)	501

Parameter	Target (local/distant)	Achievement GO	Achievement IO
Elapse time from earthquake origin time to initial earthquake information issuance	10 min	10.0min	7.7 min
Probability of detection of Indian Ocean earthquakes with $M_w \geq 6.5$	100%	100%	100%
Accuracy of hypocenter location (with respect to USGS final estimates)	Within 30 km	16.5 Km	14.8 Km
Accuracy of hypocentre depth (with respect to USGS final estimates)	Within 25 km	16.9 Km	13.8Km
Accuracy of earthquake $M_w$ magnitude (with respect to USGS final estimates)	0.3	0.19	0.13

# Early warnings (Storm Surge Early Warning Services)

- Storm surge model ADCIRC is customized and operationalized for the Indian Ocean domain to provide storm surge early warnings
- Storm surge advisories were provided for the following cyclones since last 3 years:

Roanu (May, 2016)	Kyant (Oct, 2016)	Nada (Nov, 2016)	Vardah (Dec, 2016)
Maarutha (Apr, 2017)	Titli (Oct, 2018)	Luban (Oct, 2018)	Gaja (Nov, 2018)
Phethai (Dec, 2018)	Pabuk (Jan, 2019)	Fani (May 2019)	Vayu (June 2019)



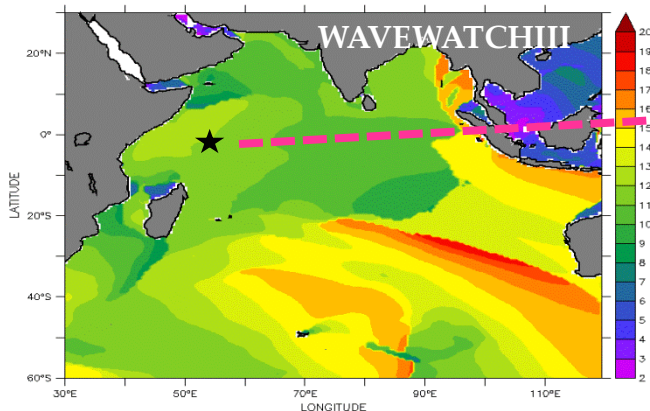
formulated and the

# Early warnings (Kalkadal)

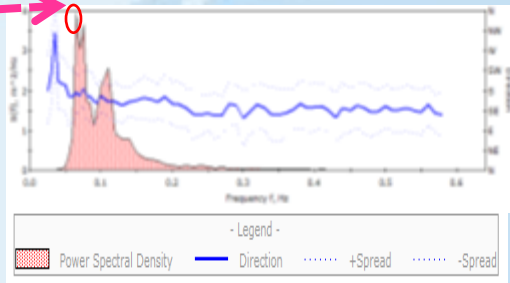
**SWELL SURGE (Kalkadal) Warning: 30 Jul- 03 Aug, 2016**

**Various news paper Reports**

TIME : 28-JUL-2016 06:00



Caught in Seychelles Buoy  
2016-07-31 08:00 UTC

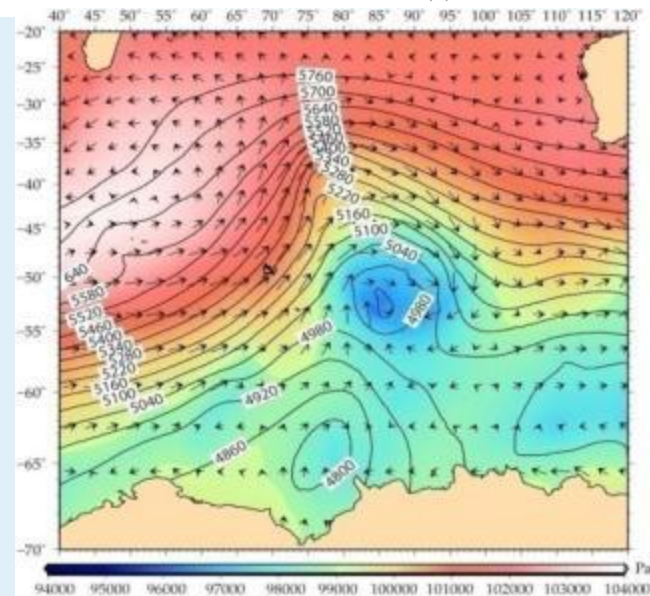


Swell surge during Unexpected sea surge at Alappuzha coast, 27 fishing boats washed away, Indian Express, 2nd August 2016



Malayala Manorama

Peak Wave Period (s)



**INCOIS high wave alert**

➤ **INCOIS has issued wave surge alert for low lying coastal areas of Kerala from 30 Jul. 2016-03 Aug. 2016**

➤ **A high wave, surge alert for the West Bengal Coast valid from 08:30 hours on 02-08-2016 to 23:30 hours of 03-08-2016 was issued by INCOIS.**



The Kollam District administration (DMD) :Wave surge was reported in coastal regions of Alappad Village of Karunagapally Taluk on on 1st and 2nd of August, 2016

➤ This information sent to all concerned disaster Management authorities and directly to fishermen via SMS. Total SMS sent ( Tamilnadu, Orissa, Kerala, West Bengal, Gujarat, Maharastra, Lakshadweep) – 6965 ; Number of SMS sent to Kerala Fishermen – 340; Lakshadweep – 25

The extra-tropical storm in the Southern Indian Ocean (27 Jul. 2016 ). Here, geopotential height at 500 hpa is in contours, sea level pressure is shaded and surface winds are shown as vectors.

# Early warnings (Cyclones)

TIME : 29-APR-2019 00:00

DATA SET: data



MESSAGE

FROM: ESSO-INDIAN NATIONAL CENTRE FOR OCEAN INFORMATION SERVICE  
System Science Organisation, Ministry of Earth Sciences, Government of India)  
oai@incois.gov.in, Website: www.incois.gov.in, FAX NO. +91-40-2385291

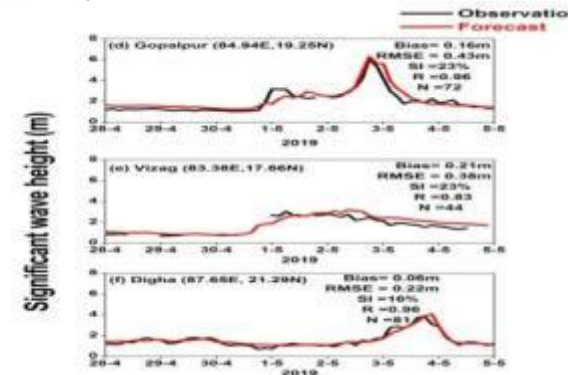
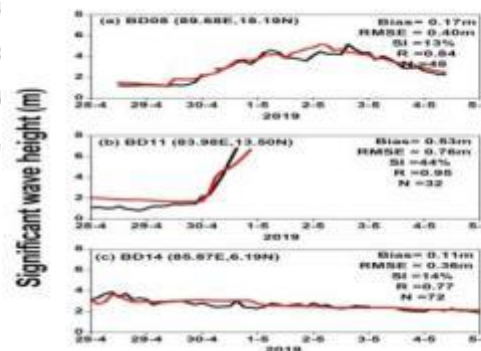
## INCOIS-IMD JOINT BULLETIN

To: Senior MET Officer, Eastern Naval Command, Indian Navy  
Navy Commandant, Indian Coast Guard, East Region  
Commandant, Indian Coast Guard, North East Region  
Commandant, Indian Coast Guard, A & N Region  
Commandant, Indian Coast Guard, West Region  
Chief Secretary, Government of Andhra Pradesh  
Chief Secretary, Government of Tamil Nadu  
Chief Secretary, Government of West Bengal  
Chief Secretary, Government of Odisha  
Chief Secretary, Andaman & Nicobar Islands  
Chief Secretary, Puducherry  
Chief Secretary, Government of Kerala  
State Disaster Management Authority, Andhra Pradesh  
State Disaster Management Authority, Tamil Nadu  
State Disaster Management Authority, Odisha  
Chilika Development Authority (CDA, INCOIS Project), Bhubaneswar  
Andhra University (INCOIS Project), Visakhapatnam  
Basanti Devi College (INCOIS Project), Kolkata  
IKSL - Odisha, Andhra Pradesh and West Bengal  
State Disaster Management Authority, Kerala  
Commandant, Indian Coast Guard, Southern Region  
DNOM, Indian Navy  
Reliance Foundation, Mumbai  
MSRF (INCOIS Project), Chennai  
PMSIS, Puducherry  
Administrator, UT Puducherry  
Kannara College, Tuticorin  
Ports in Andhra Pradesh, Tamil Nadu, Andaman & Nicobar, West Bengal,  
Odisha Shipping Corporation of India.  
TV & Radio channels and newspapers of relevant states/UT

Time of issue: 21:00 IST Dated: 02.05.2019, Bulletin No.: INCOIS/02/0M

Subj: INCOIS-IMD Joint Bulletin - Ocean State Forecast associated with Severe Cyclonic Storm "FANI" over Westcentral Bay of Bengal: Cyclone V Odisha, West Bengal and Sriakulam, Vijayanagaram & Visakhapatnam | Andhra Pradesh Coasts: Red Message

The Extremely Severe Cyclonic Storm "FANI" (pronounced as "FONI") over West Bengal moved northwards with a speed of about 15 kmph in last six hours and lay on lat 17.5°N over Westcentral Bay of Bengal near longitude 84.8°E, about 275 km south-southwest of Puri (Odisha), 160 km east-sr Visakhapatnam (Andhra Pradesh) and 570 km south-southwest of Digha (West Bengal



The current wind speed of the cyclone is 200-210 kmph gusting to 225 kmph. Light to moderate rainfall has already started in coastal districts of North Andhra Pradesh and South Odisha. Squally wind speed reaching 50-60 kmph reported over south coastal Andhra Pradesh and strong wind speed reaching 30-40 kmph reported over south coastal Odisha.

It is very likely to move north-northeastwards and cross Odisha Coast between Gopalpur and Chandbali, south of Puri during tomorrow the 3<sup>rd</sup> May forenoon with maximum sustained wind speed of 170-180 kmph gusting to 200 kmph. Landfall process is very likely to continue till noon/afternoon of tomorrow the 3<sup>rd</sup> May.

After the landfall the system is very likely to continue to move north-northeastwards, weaken gradually and emerge into Gangetic West Bengal as a Severe Cyclonic Storm with wind speed of 90-100 kmph gusting to 115 kmph by early morning of 4<sup>th</sup>. It is very likely to move further north-northeastwards and emerge into Bangladesh on 4<sup>th</sup> May evening as a Cyclonic Storm with wind speed 60-70 kmph gusting to 80 kmph.

## High Wave/Ocean State warning/alert for Andhra Pradesh, Odisha, West Bengal and Tamil Nadu

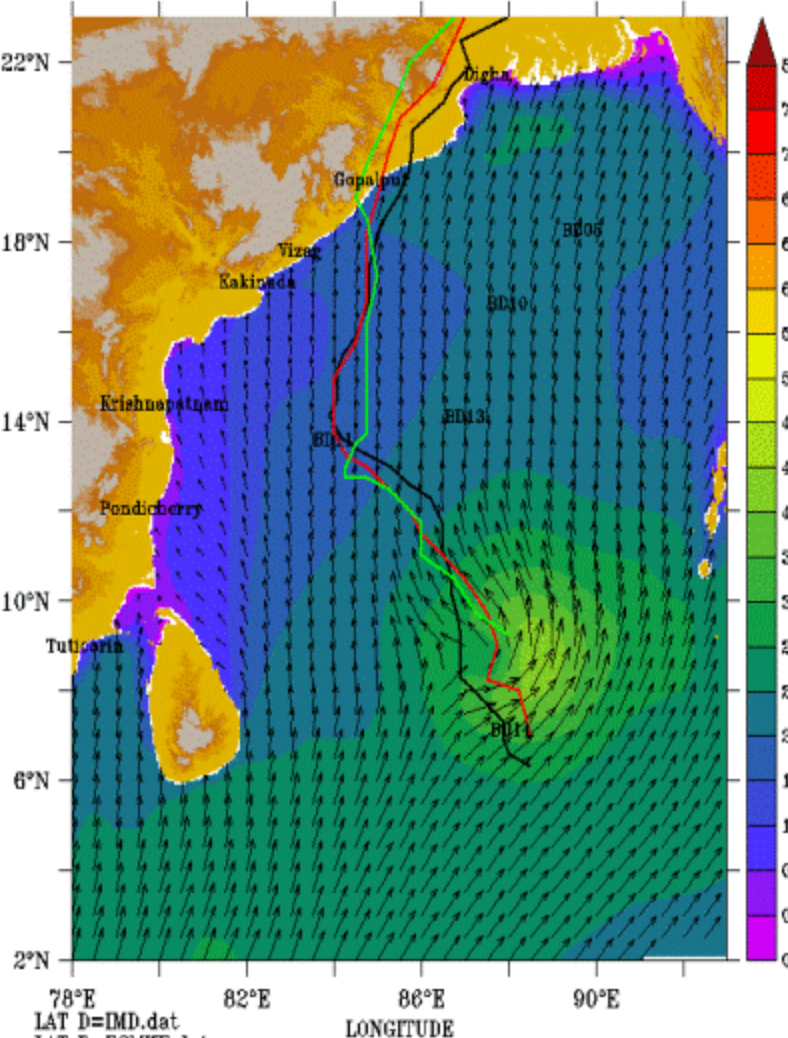
Andhra Pradesh:  
Table: Forecasted wave height and swell height for coastal region into the ocean upto 10 km off Andhra Pradesh

Location	From (IST)	To (IST)	Significant Wave Height (m)	Swell Height (m)
Srikulam	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	4.5-7.5	1.6-2.4
Vizayanagaram	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	3.3-4.9	2.5-3.0
Visakhapatnam	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	3.3-4.9	2.5-4.1
Godavari (East & West)	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	3.1-3.5	2.0-2.9
Krishna	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	3.0-3.5	1.5-2.5
Guntur	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	2.0-2.5	1.5-2.5
Prakasam	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	2.0-2.5	1.5-2.0
Nellore	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	1.6-2.2	1.5-2.2

Offshore: High Ocean State associated with the cyclone Fani in the open ocean (off Andhra Pradesh). Waves heights in the range of 3.0 - 7.5 meters (approximately 100 Km away from the coast) are forecasted during 23:30 hours on 02-05-2019 to 23:30 hours of 03-05-2019. Surface Current speeds vary between 140 - 220 cm/sec.

Odisha:  
Table: Forecasted wave height and swell height for coastal region into the ocean upto 10 km off Odisha

Location	From (IST)	To (IST)	Significant Wave Height (m)	Swell Height (m)
Balasore	2330hrs, 02-05-2019	2330 hrs, 03-05-2019	3.5-4.8	1.0-1.5



78°E 82°E 86°E 90°E  
LAT D=DMD.dat  
LAT D=ECMWF.dat  
LONGITUDE

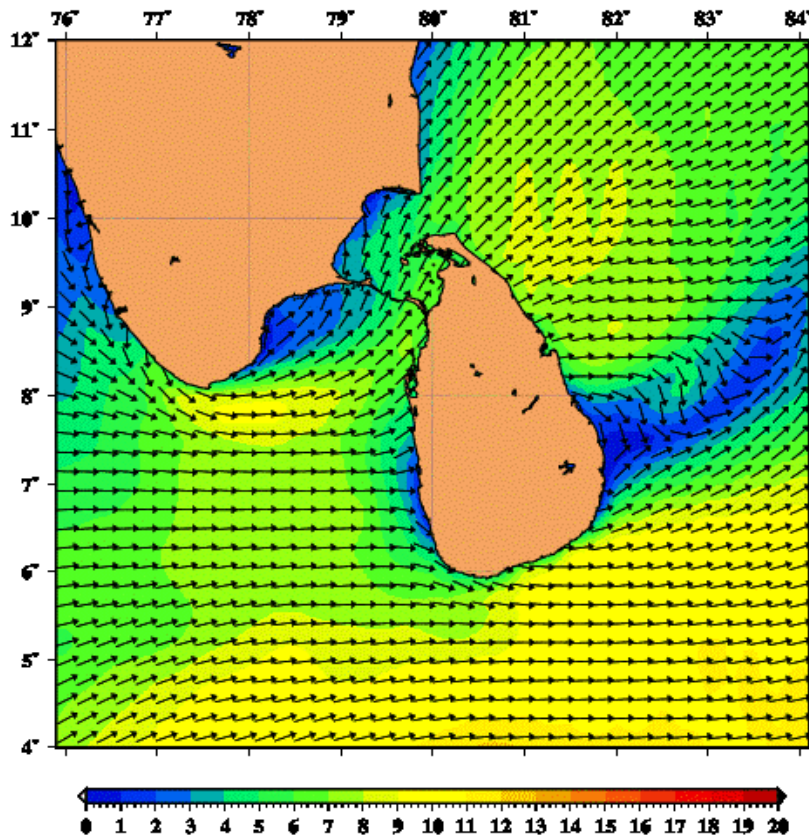
## Significant Wave Height

# Early warnings (High Wave Alert-Kondal Kattu)

## Kondalkattu forecasting (Location Specific Forecast) on high winds (for 18<sup>th</sup> May 2017)

Kondal Kattu is a Gusty wind that occurs near Rameswaram Coast during April - May. During this event wind suddenly increases to nearly 25 m/s. This gusty wind sustains for 2-3 hours or less. This gusty winds cause lot of damage to the boats which are moored at coast. The low pressure forms over Salem or west coast of Sri Lanka region is the cause for these gust winds. To forecast these gusty winds, high resolution WRF model was setup for southern peninsular India).

[ Wind Speed (m/s) and Direction (°) ]  
Forecast For 18-MAY-2017 00:00



### High Wave Alert (Associated with this Kondalkattu) issued on 17<sup>th</sup> May 2017:

There is a possibility of higher waves (2.5 to 3.5 m) particularly off the coast from Kolachal to Rameswaram from 20.30 hrs on 18-05-17 to 05.30 hrs of 19-05-2017 due to higher wind speeds. Fishermen are advised to be cautious while venturing into the sea.

### Feedback from MSSRF, Tamilnadu:

**Rameswaram:** Fishermen observed heavy wind speed started from 6 pm to 8 pm on 18.05.2017 at 65 km speed per hour after that it was reduced upto 40 to 45 km per hour. During this time wave height was very high in Pamban region. **Livelihood damage is minimum because fishermen were alerted on time and safely tanchored their boats.** Only few of the vessels were damaged in sea shore near rocky substrates.

**Timely Alert:** MSSRF alerted fishermen in all the coastal districts immediate after the alert from **INCOIS** on 17<sup>th</sup> May 2017 through its multiple communication tools (Audio, SMS, FFMA, Public Address System etc).

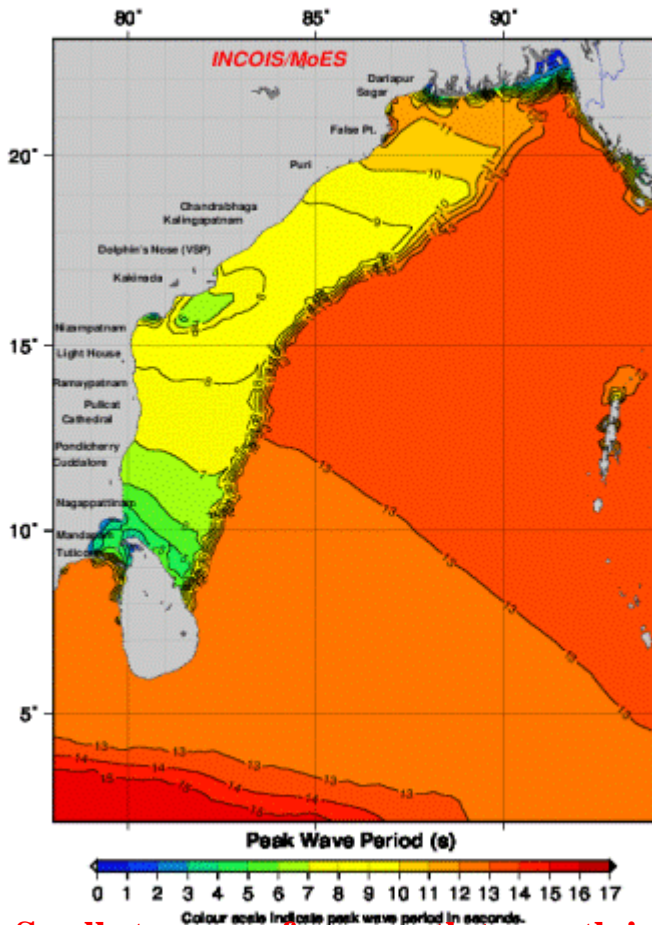
# Early warnings (Wave Surge Alert)

*Wave Surge Alert issued for the West Bengal coast  
(for July 21-22, 2017)*

[ BAY OF BENGAL ]

Peak Wave Period (s)

Forecast for 02:30 IST 20 Jul 2017



Swells traverse from south to north is well evidenced in Peak wave period

High Wave Bulletin:

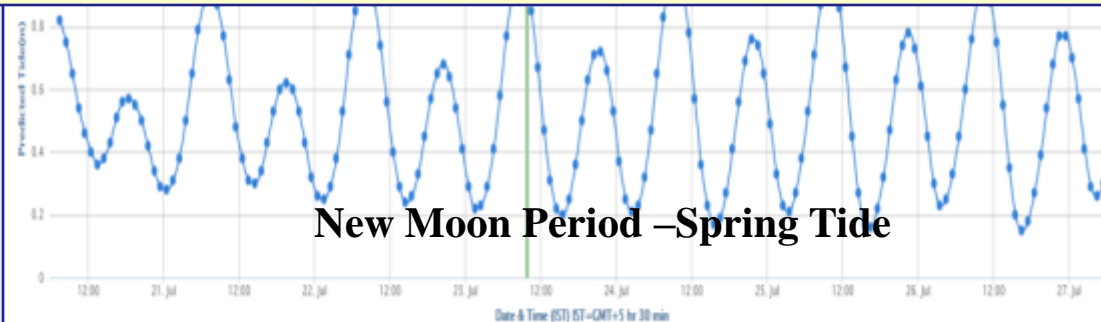
EVENT-TYPE: Warning DATE OF ISSUE: 20-07-2017

REGION: West Bengal

**MESSAGE:** High waves in the range of 3.0 - 4.5 meters are forecasted during 17:30 hours on 20-07-2017 to 23:30 hours of 22-07-2017 along the coast of West Bengal from Digha to Bakkhali. Current speeds vary between 67 - 87 cm/sec.

**MESSAGE:** There is a possibility that sea will be rough nearshore along the coast during 15:30 hours of 21-07-2017 to 23:30 hours of 22-07-2017 due to the combined effect of high period (13-17 sec) swell waves and spring tide.

**MESSAGE:** Fishermen are advised to be cautious while venturing into the sea.



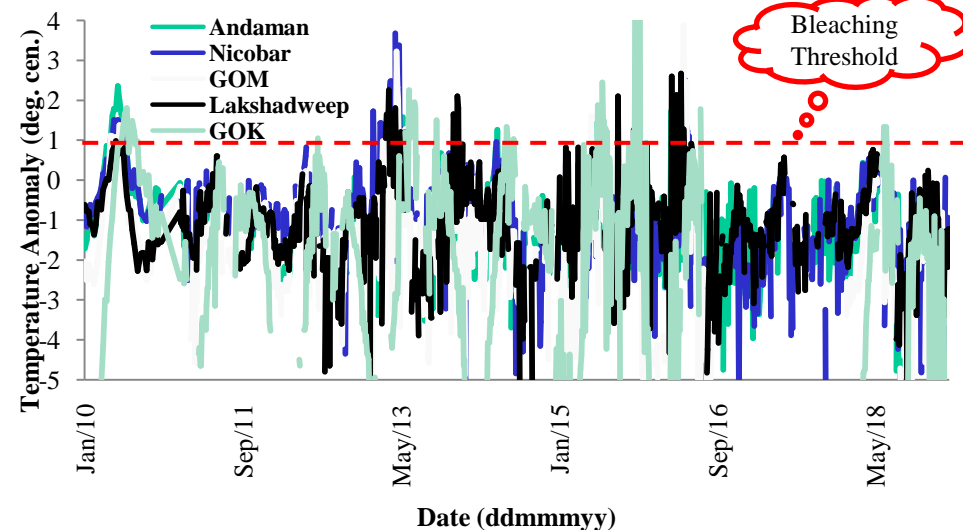
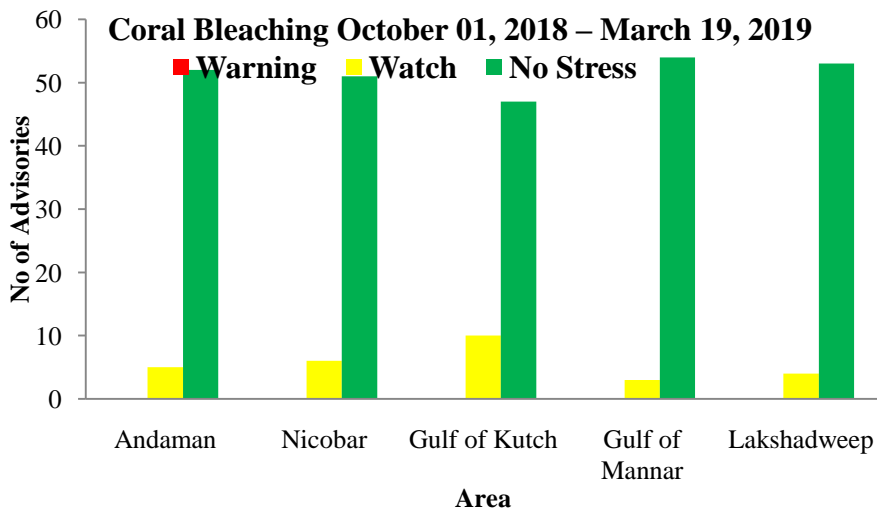
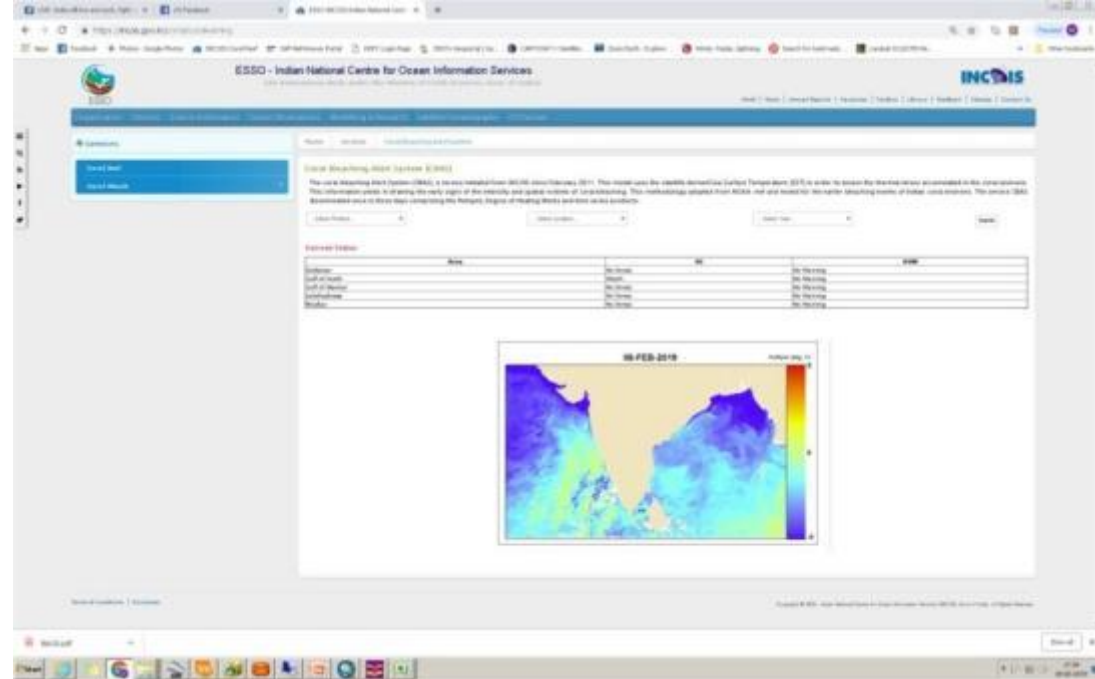
New Moon Period - Spring Tide



# Coral Bleaching Alert System

“Satellite based coral bleaching alert service to assess the thermal induced coral health”

The Coral Bleaching Alert System (CBAS) was developed and sustained. Provided 57 advisories during Oct2018 to Mar 19, 2019. No warning was recorded in this period.



# Algal Bloom Information Service

## Satellite Indicators

- Chlorophyll-a (OCM algorithm)
- ABI (Algal Bloom Index) Chlorophyll
- Sea Surface Temperature
- Bloom Indices
- 30-Day Rolling Chlorophyll-a anomaly
- Bloom Types (Noctiluca and Diatom)
- Plankton Size (Micro, Nano, Pico)

## Stakeholders

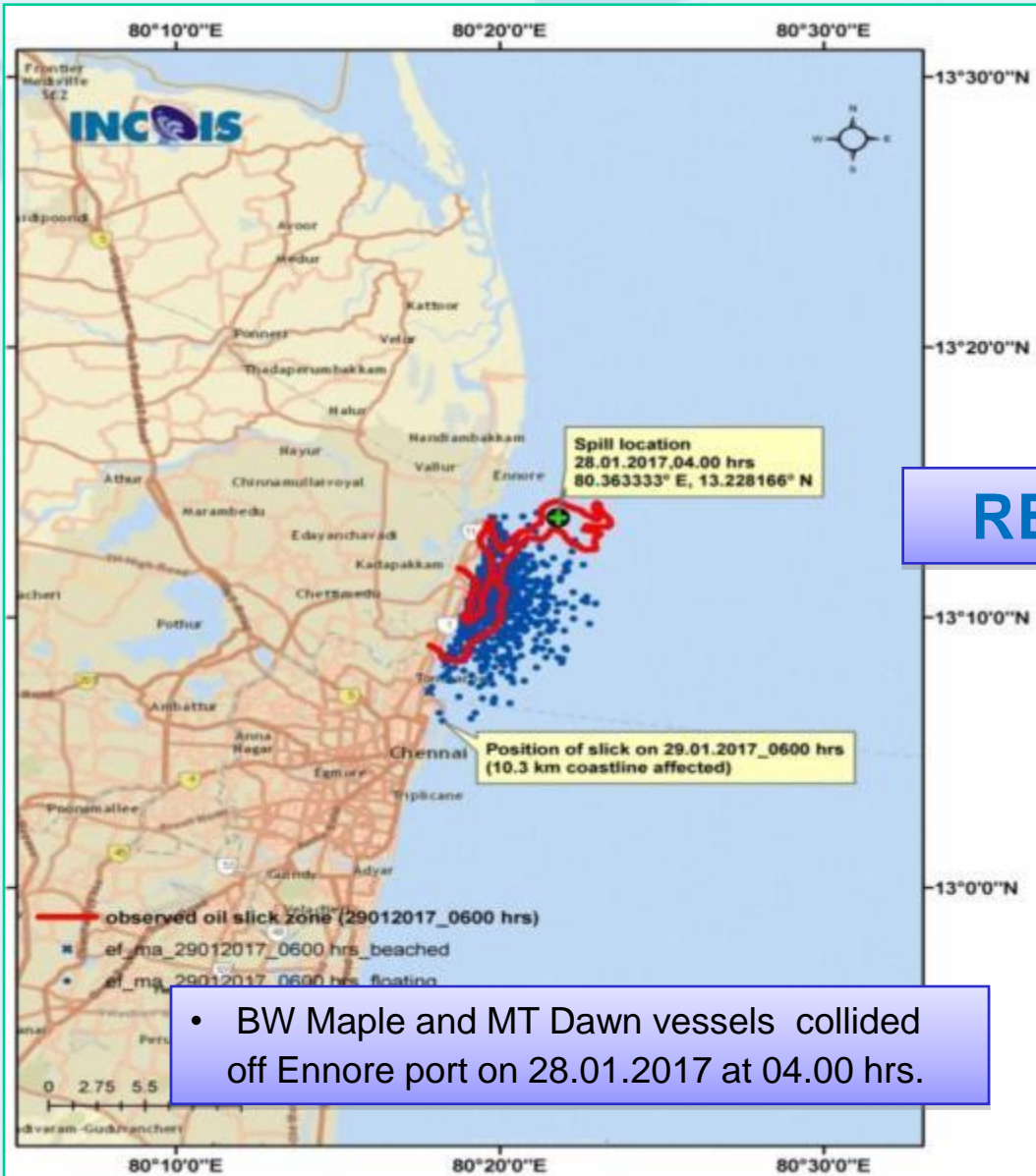
- ✓ Researchers
  - to conduct scientific research programs aimed to generate knowledge on source and sink of bloom)
- ✓ Ecologist and Environmentalist
  - to study the impact of algal bloom on environment and subsequent to human health
- ✓ Policymakers
  - for sustainable ocean management and decision-making
  - to design marine protected areas
- ✓ Service Organization
  - complement the existing ecosystem based services like Potential Fishing Zone indicating safer zone for fishing.

The screenshot shows the ESO - Indian National Centre for Ocean Information Services website. The main heading is 'HARMFUL ALGAL BLOOM (HAB) Information Service'. Below this, there is a 'SELECT REGION' dropdown menu with options: Northern Arabian Sea, Kerala Coast, Gulf of Mannar, and Odisha Coast. There are also 'SELECT DATE' and 'SUBMIT' buttons. The main content area displays a 'Northern Arabian Sea Harmful Algal Bloom Bulletin' for Thursday, February 05, 2020. It includes a map of the region, a table of parameters, and a funnel diagram labeled 'HAB Information Service' showing inputs like CHL, SSI, SST, PSM, and ABI.

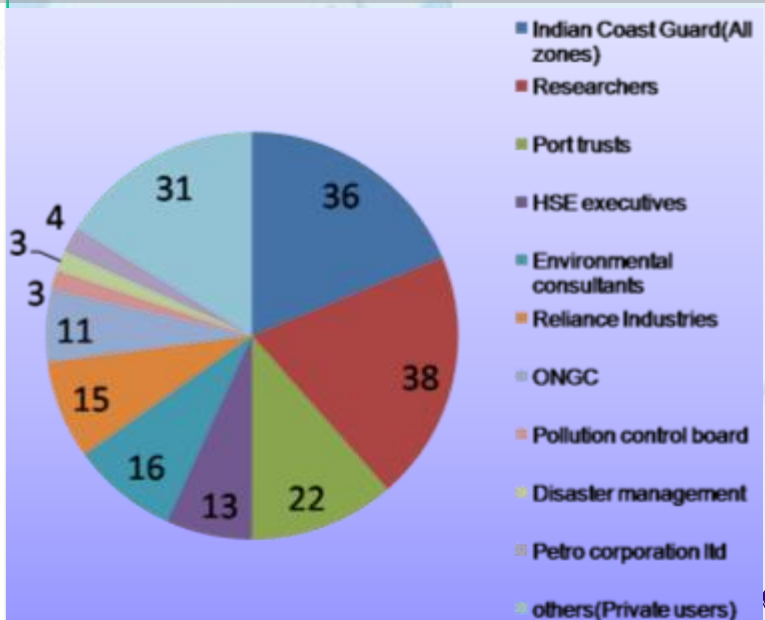
Phase	Service Type	Remarks
Phase-I	Information Service	Based on Satellite data Now-casting / Near real-time Spatial and Temporal extent of the bloom
Phase-II	Advisory Service	Based on Satellite data Now-casting / Near real-time Spatial and Temporal extent of the bloom Probable impact on ecosystem (fisheries, water quality etc.)
Phase-III	Predictive Advisory Service	Based on Satellite and Model data Forecasting Spatial and Temporal extent of the bloom Probable impact on ecosystem (fisheries, water quality etc.)

# Special Services for Indian Navy & Coast Guard – Oil Spill

## Prediction of the movement of Oil Spill - CHENNAI OIL SPILL



### REGISTERED USERS (192)



- BW Maple and MT Dawn vessels collided off Ennore port on 28.01.2017 at 04.00 hrs.

# Special Services for Indian Navy & Coast Guard - SARAT

## Search and Rescue Aid Tool (SARAT)



### Mobile App – SARAT (multilingual)

Saving screenshot...

Select Missing Object

Person In Water (PIW-1) ▼

Enter Missing Place

73.992

12.549

Enter Missing Time

2016-07-26 [📅]

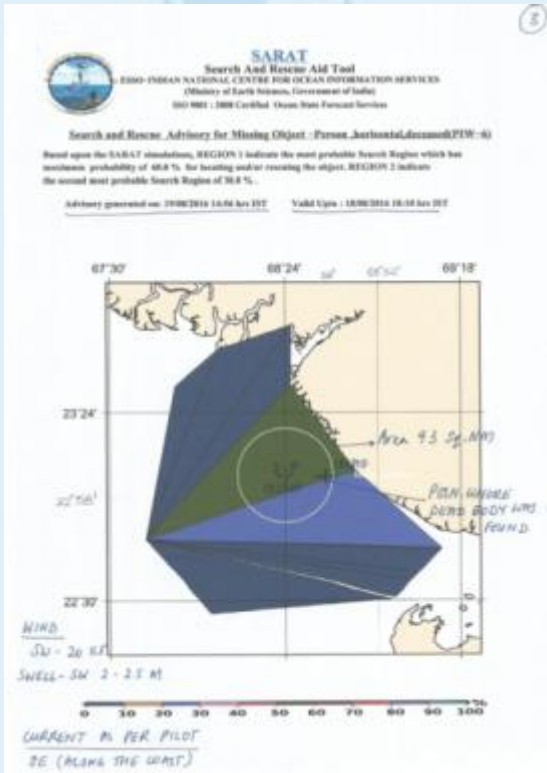
05:30:00 [🕒]

Enter Search Time

2016-07-27 [📅]

12:00:00 [🕒]

SUBMIT

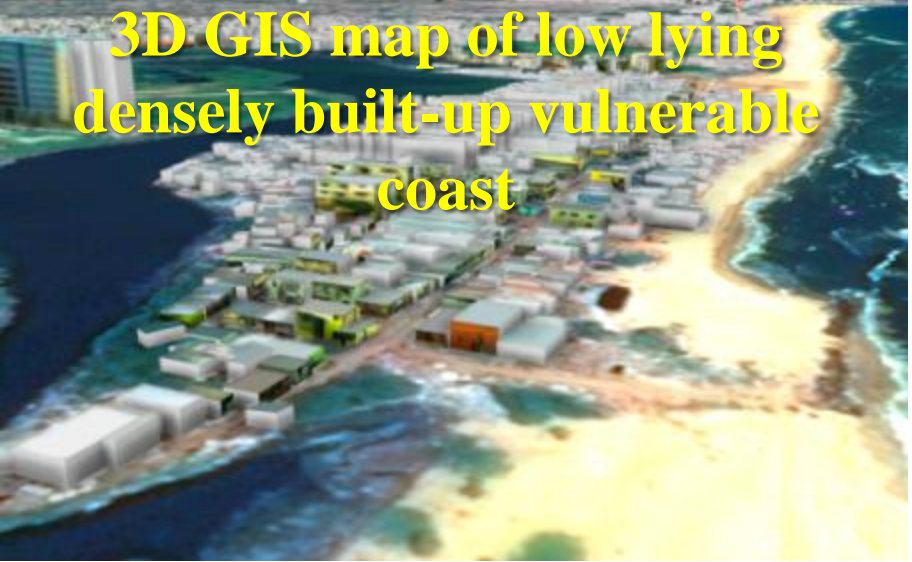
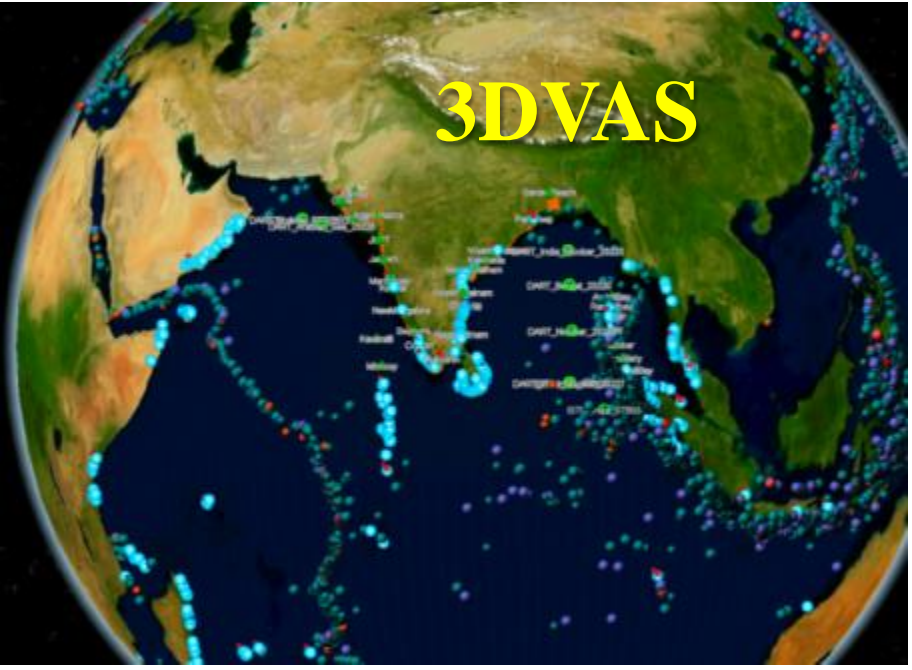


The Coast Guard used SARAT to restrict the search area and found the dead body of a fisherman within the highest probability area predicted by the model.

# Coastal Multi-hazard Vulnerability Assessment

Composite of Coastal flooding due to Oceanogenic hazards: **Tsunami, cyclone, floods, sea level rise and erosion**

Parameters	Data Source
Extreme Water level	Hourly Mean SOI Tide Data and events from published data sources
Sea-level Change	Monthly Mean from PSMSL
Shoreline Change	Landsat/IRS
Topography	ALTM/Carto DTM



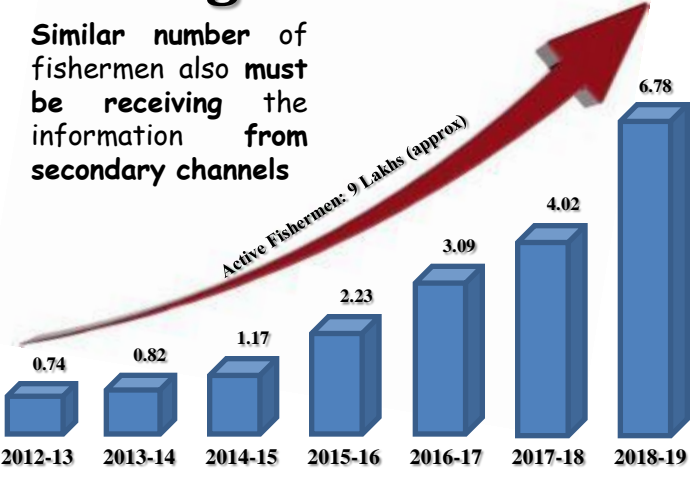
# ICT to Reach End Users



## GAGAN & NAVIC

## Serving ~6.78 Lakhs of Registered Fishermen

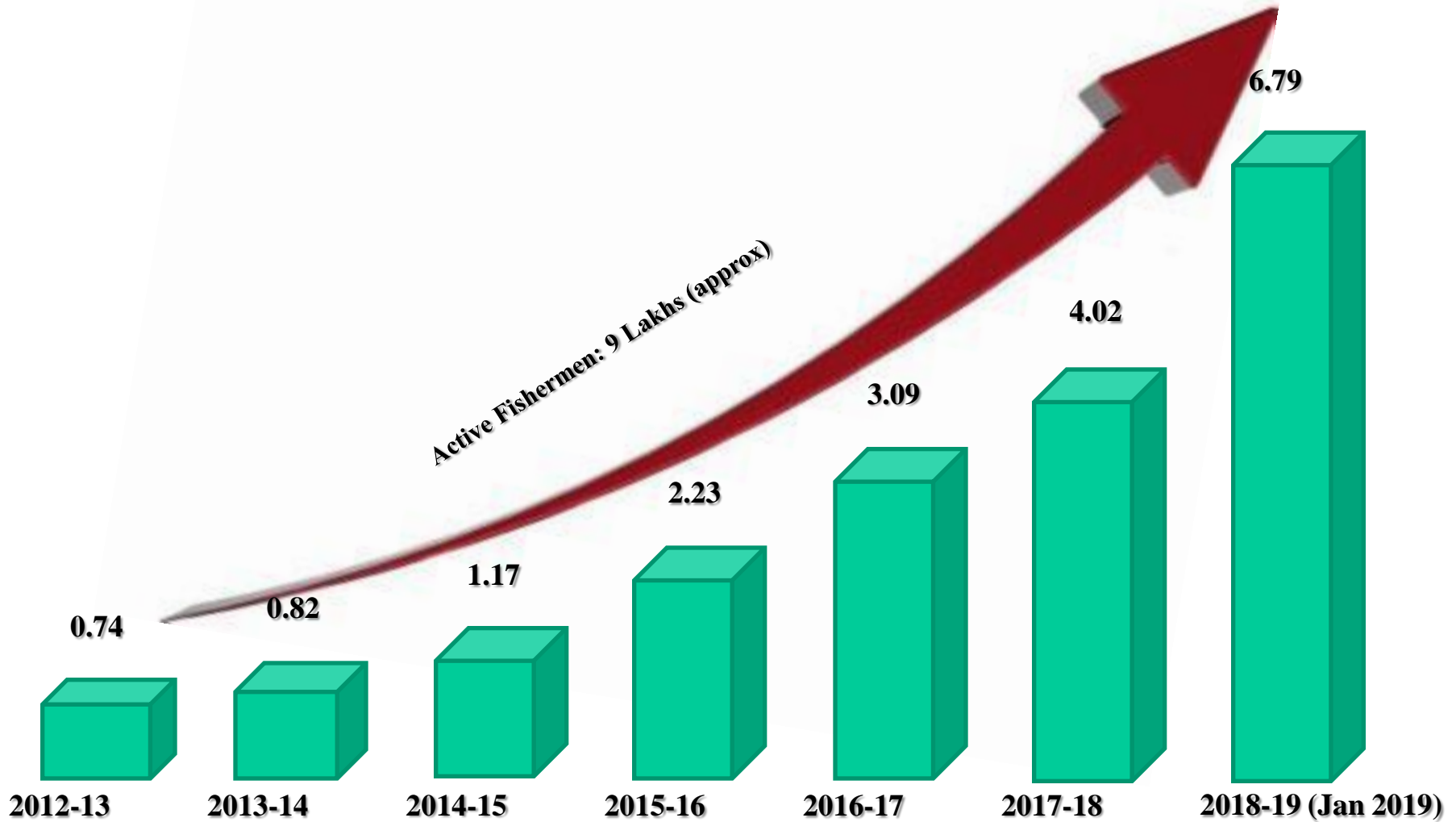
Similar number of fishermen also must be receiving the information from secondary channels



### Near Future: Integrated Platforms

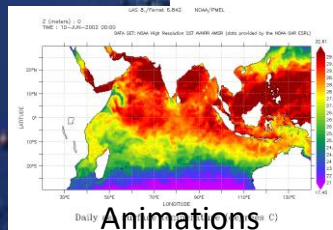
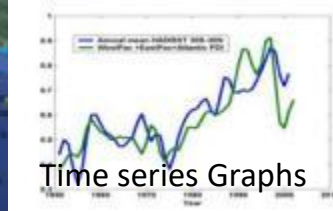
Speech Synthesis using AI & ML

# Number of Registered Users



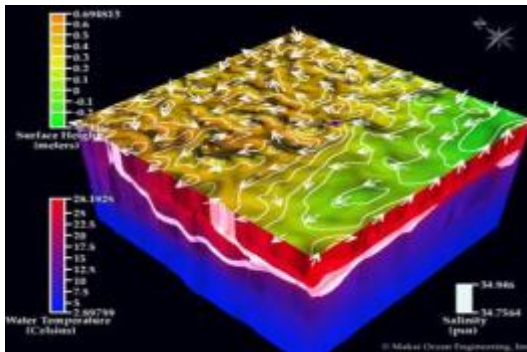
# Digital Ocean

Digital Ocean is a dynamic framework of set of applications to efficiently integrate and manage heterogeneous ocean data and to provide advanced visualization and analysis tools that facilitate to of oce

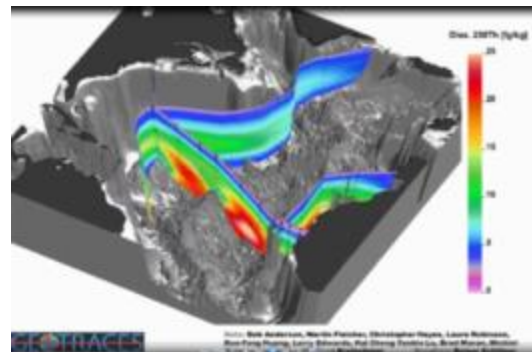


## Objectives

- Organize and present heterogeneous oceanographic data by adopting rapid advancements in Information and Communication Technology
- Implement Data Warehouse and Data Mining concepts for efficient management of data
- Develop Metadata System
- Provide platform for display and visualization of disparate data in a common way
- Provide advanced on-line visualization and analysis tools to analyse the data in multi-disciplinary approach. (3D and 4D representation of Oceanographic Data - past, present and future)
- Implement E-Commerce for on-line data sale
- Implement analytical tools on data usage



3D/4D Visualisation



Cross Sections



# Observation Systems for Services

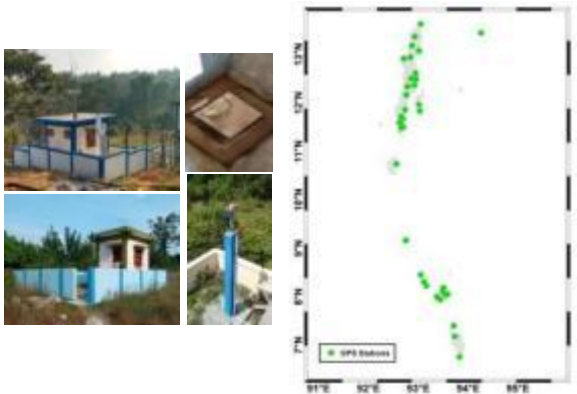
Tsunami Buoy



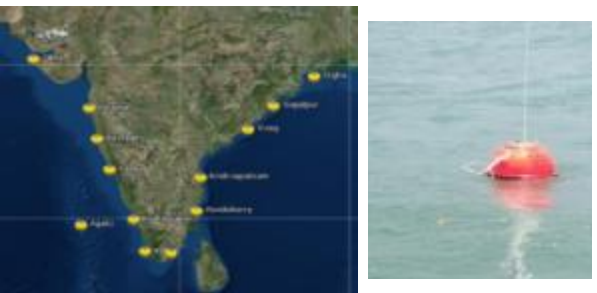
Tide gauges



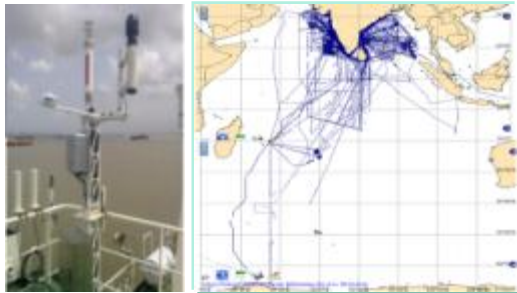
GNSS & SMA



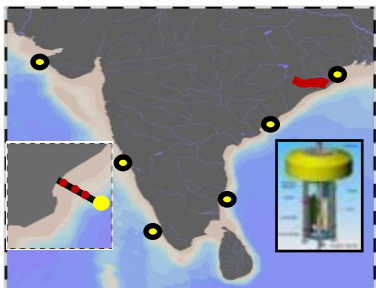
Wave rider buoy



AWS



Water quality buoy



# Process Specific, Data Assimilation & Research

Argo



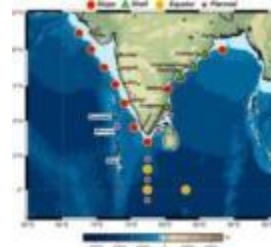
Drifters



XBT/XCTD



Current meter



Glider



uCTD



ASIMET



Flux mooring



VMP



ECFS



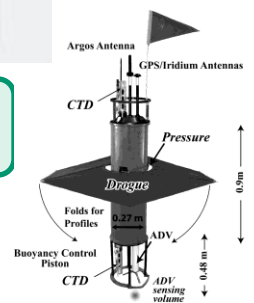
Radiometer



CTD



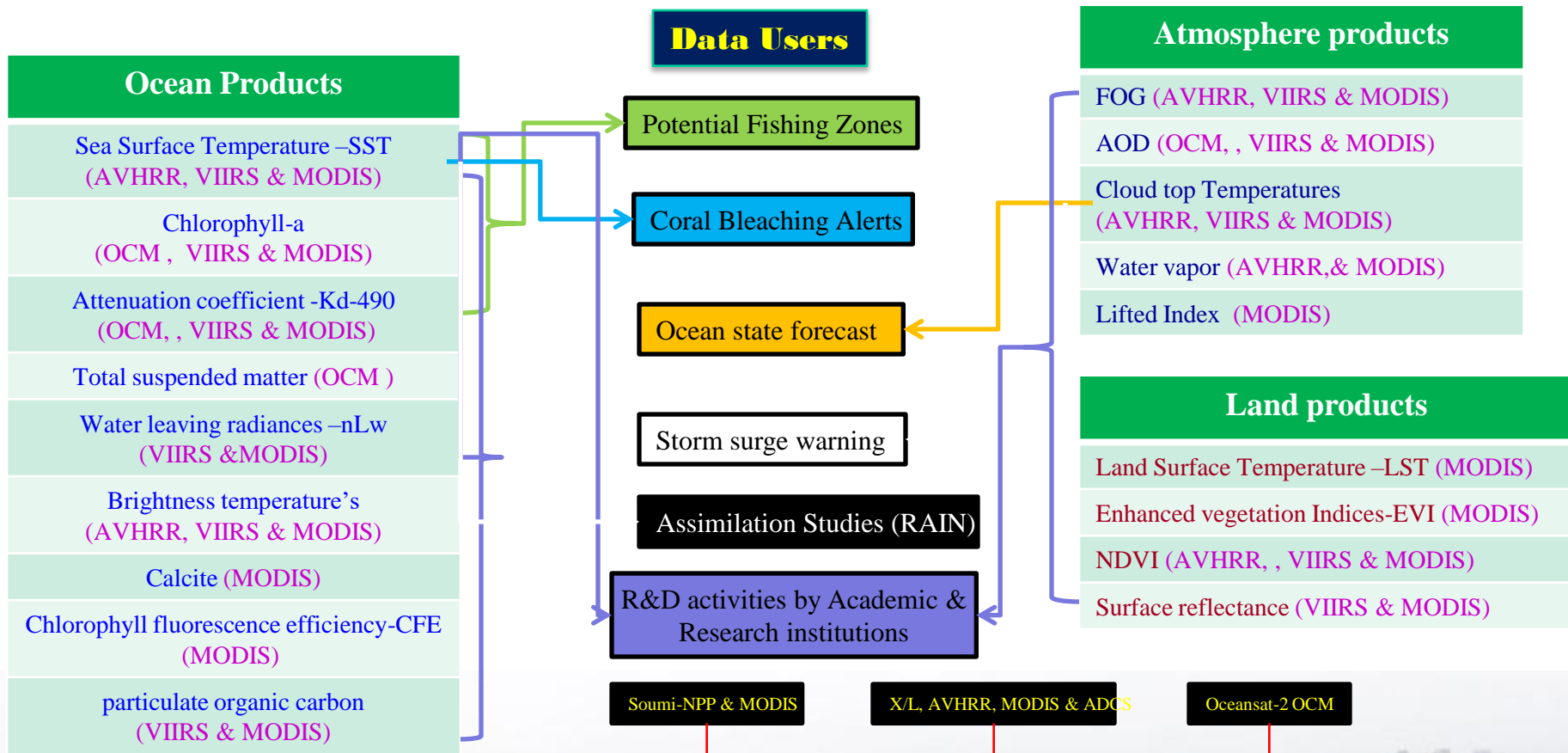
Lagarangian float



# Operational Remote sensing data products

**INCOIS established 3 Groundstation's to meet the in-house operational advisory services.**

Acquiring **AVHRR** (Metop-1, Metop-2, NOAA-18 & NOAA-19), **VIIRS** (Soumi-NPP), **MODIS** (AQUA & TERRA)&**OCM**(Oceansat-2).

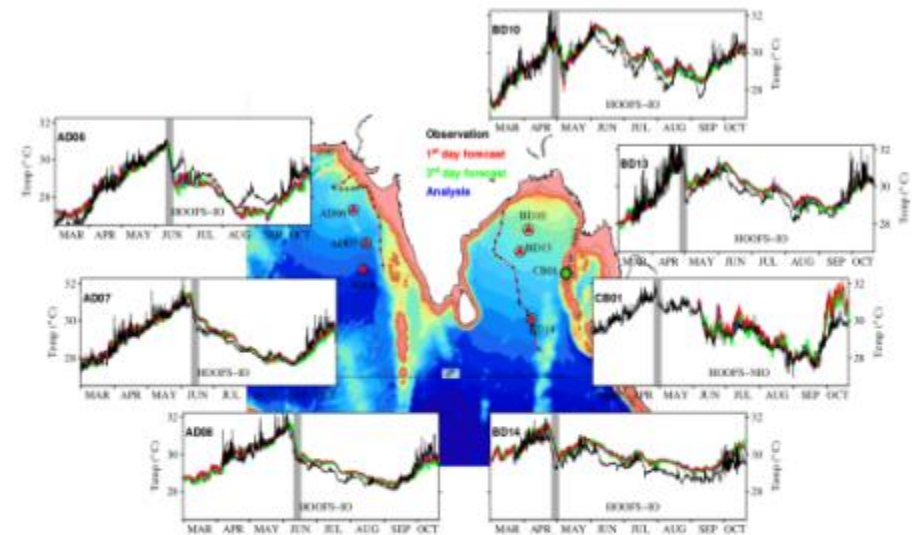
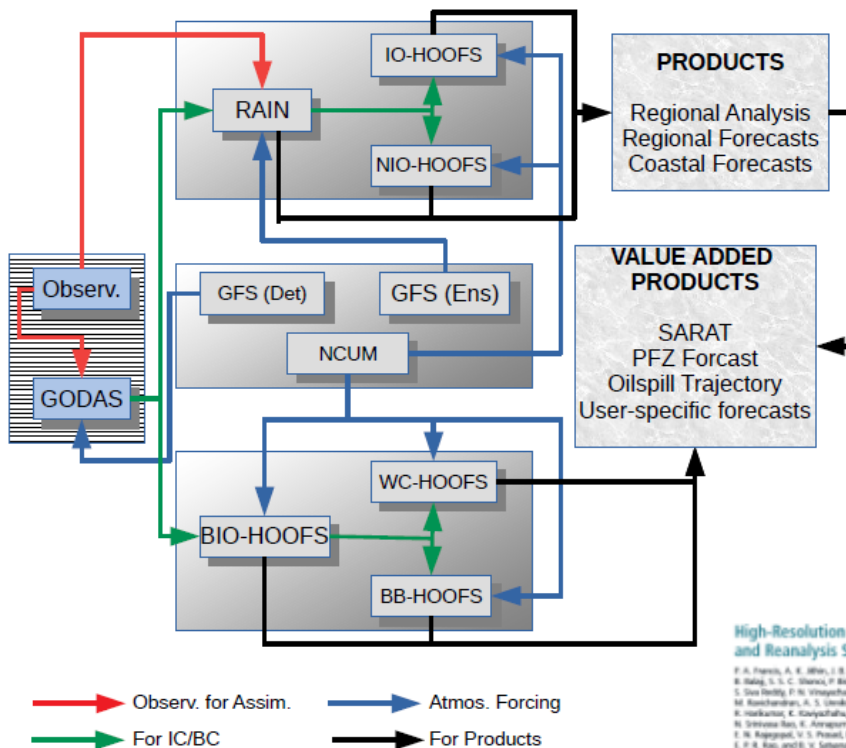


# Ocean Modelling and Data Assimilation

## • Activities

- **Global/regional models** for simulation of Ocean General Circulation for ocean analysis/ reanalysis
- **Coastal/shelf sea/estuary models** for specific applications
- **Biogeochemical modeling** for global, regional and coastal applications
- **Downscaling of atmospheric forcing** to force high-resolution models
- **Couple ocean models** with regional atmosphere models, wave models, etc.
- **Data assimilation** in ocean general circulation and wave models
- **Evaluation and synthesis** of observations and model simulations for model improvements

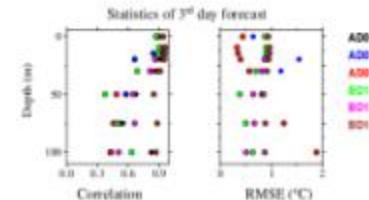
## High-resolution Operational Ocean Forecast and reanalysis System (HOOFS)



**BAMS**  
Article

High-Resolution Operational Ocean Forecast and Reanalysis System for the Indian Ocean

P. A. Francis, A. K. Shetye, J. S. Elly, A. Chatterjee, K. Chatterjee, A. Paul, B. Sahoo, S. S. C. Sarin, P. Ramesh, A. Shankar, P. Singh, D. Subrahmanian, S. Venkatesh, P. N. Vinayachandran, M. S. Ghosh-Kulkarni, S. V. S. Unnikrishnan, M. Rajendran, A. S. Unnikrishnan, D. Shankar, A. Prasad, S. G. Ayres, K. Sankaranarayanan, K. Sagar, E. V. Suresh, P. Vinayachandran, S. Venkatesh, K. Arora, P. Ramesh, A. S. Sarin, J. N. Rajagopal, V. S. Prasad, M. D. Gupta, T. M. Balachandran, M. S. Ghosh, K. S. Suresh, V. S. Unnikrishnan



# Impact and socio-economic benefits of OSF and PFZ services



NCAER

## Economic Benefits of Dynamic Weather and Ocean Information and Advisory Services

in India  
and

Cost and Pricing of Customized  
Products and Services of  
ESSO-NCMRWF & ESSO-INCOIS

National Council of Applied Economic Research

2015

- “The economic analysis indicates that the real growth rate of gross value added in marine fisheries can go up to 7.8% per annum from the current level of 3.9% once the PFZ-OSF is operationalised uniformly across the country in all coastal areas”.
- “Since **five 'no go ahead mission' advisories were provided since 2013** till date the net , the net benefits during 2013-2015 works out to be Rs. 4161.9 crore”.  
(Indian Navy)

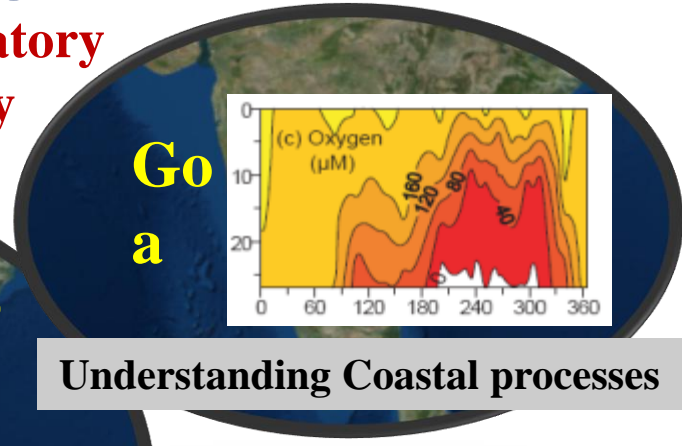
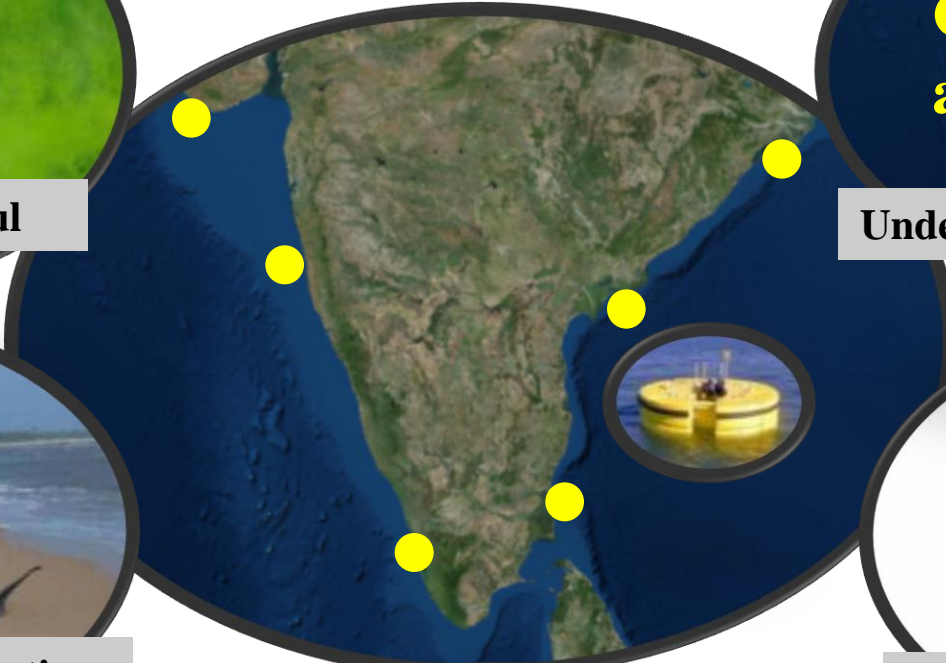
- The environmental effect of savings in diesel consumption computed as **carbon credit would work out to an annuity of Rs 36,200 crore** or a present value of around Rs. 2.84 trillion over the 25-year useful life, which is quite significant.

# Coastal Monitoring

Establishment of coastal observatory  
for monitoring Water quality



Monitoring Harmful  
Algae

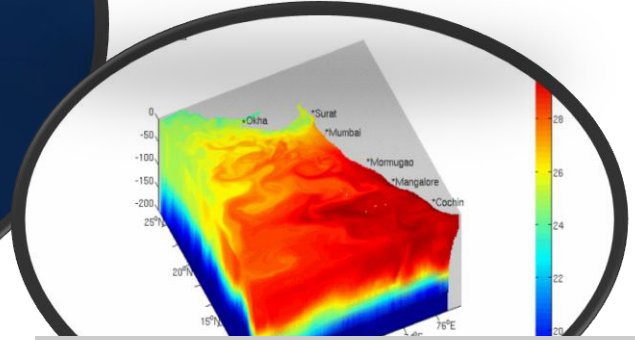


Go  
a

Understanding Coastal processes



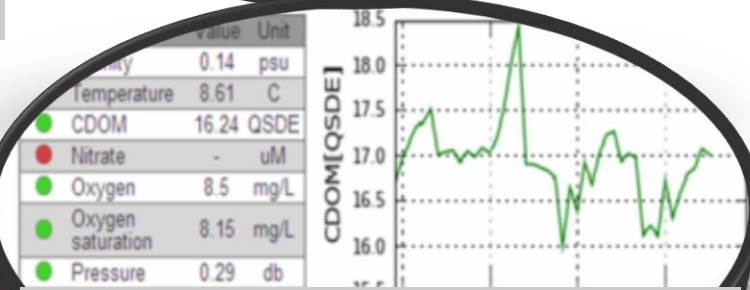
Mitigate coastal pollution



Improving Ocean  
Modeling



Coastal Water Quality



Nowcasting and  
forecasting of coastal  
water quality



Promoting Coastal  
tourism

# International Training Centre for Operational Oceanography

## Objectives

- Provide advanced training in operational oceanography in
  - Generation of ocean *in situ* and satellite platforms data.
  - Transmission, reception, processing to operational centre.
- To provide ship board experience and training in observational oceanography, preparedness for now-casting and forecasting.
- Collaborate and sign MoU with various state and central universities and become centre of excellence in the field of operational oceanography.



# International Interface



United Nations  
Educational, Scientific and  
Cultural Organization



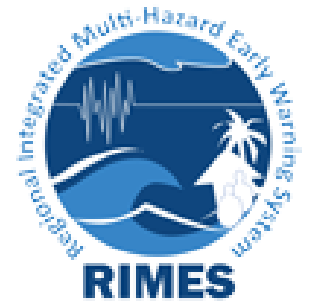
Intergovernmental  
Oceanographic  
Commission



**2021** United Nations Decade of  
the Ocean for Sustainable  
**2030** Development



**International Training  
Centre for Operational  
Oceanography  
(ITCOOcean)**



**SIBER**  
Sustained Indian Ocean Biogeochemistry  
and Ecosystem Research



**Indian  
Ocean**



**A GLOBAL  
ECOSYSTEM**



**Thanks**