INCOIS

MOES

2 -3 April 2014

Marine Forecasts of IMD

An Overview

P.C.S.RAO

O/o DDGM(WF), IMD, Pune

भारत मौसम विज्ञान विभाग

INDIA METEOROLOGICAL DEPARTMENT

OUTLINE

- Present services rendered by IMD
- WMO requirements
- Wave Forecasting
- Scope for improvement

India Meteorological Department (IMD) provides the National Meteorological Service in our country and is the principal government agency for all matters relating to meteorology and allied sciences.

Routine weather forecasts for shipping, fishermen, off-shore oil exploration etc. and issue of special weather warnings for severe weather phenomena like tropical cyclones over the Indian seas form the prime mandate of the department.

❖1. Northern Hemisphere Analysis Centre (NHAC) evolved into Regional Meteorological Centre (RMC), New Delhi in 1968 under the World Weather Watch (WWW) programme of World Meteorological Organisation (WMO).

❖ Round the clock weather surveillance over India and neighbourhood is the main responsibility of this centre.

❖ Under WMO/ESCAP Panel programme, RMC New Delhi was redesignated as Regional Specialised Meteorological Centre (RSMC) Tropical Cyclones, New Delhi in 1988 with the additional responsibilities like

❖ Monitoring Cyclonic Disturbances over North Indian Ocean (Bay of Bengal and the Arabian Sea), Issue of Tropical weather outlook and tropical cyclone advisories to panel members Bangla Desh, Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand.

❖ Collection and archival of data pertaining to Tropical Cyclones over NIO and their exchange with the member countries of the panel.

❖ Research on storm surge, track and intensity prediction etc. In the event of major pollution incidence on high Seas, the necessary meteorological support is provided for Met-area VIII (N) {i.e. Bay of Bengal, Arabian Sea and north of equator} by RSMC, New Delhi, which is designated to function as Area Meteorological Co-ordinator (AMC) under Marine Pollution Emergency Response Support System (MPERSS)

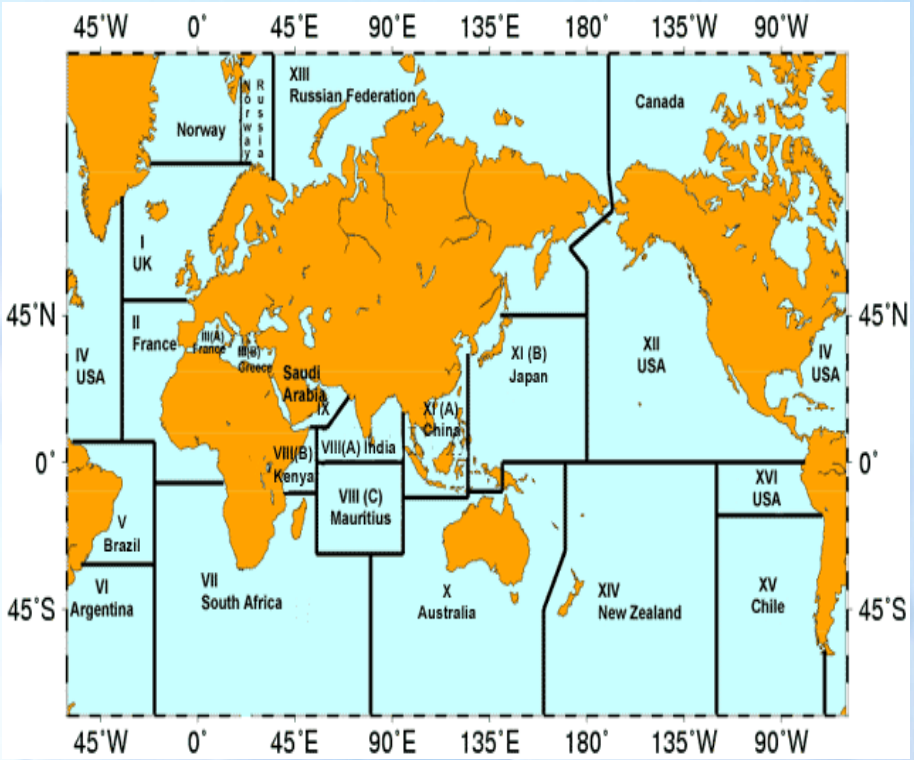
- **2. The Indian Ocean and Southern Hemisphere Analysis Centre (INOSHAC) located at Pune under O/o DDGM (WF) carrying out Marine meteorological forecasting services since 1966 and originates advisories and meteorological forecasts over the Indian Ocean north of 10 S as per WMO requirement. This centre provides following meteorological forecasts:**

- **Fleet forecasts for Indian Navy twice a day over the Indian Ocean to the north of 10 S between Longitude 60 E to 100 E.**

- **Under the Global Maritime and Distress Safety System (GMDSS) weather forecasts are originated twice a day for Indian Ocean area to the north of equator and consolidates the forecast for Met-area VIII(N) with similar inputs for the Arabian Sea and the Bay of Bengal received from Area Cyclone Warning Centres (ACWCs) Mumbai and Kolkata.**
- **The frequency increases during tropical cyclone period.**

MPERSS

- **IMD is the Area Met.Coordinator in WMO Marine Pollution Emergency Support System. In the event of major Marine pollution emergency incident on high seas, the necessary meteorological support will be provided by IMD for Met Area VIII.**



3. Area Cyclone Warning Centres (ACWCs)/ Cyclone Warning Centre (CWCs)

ACWCs are functioning at Kolkata, Chennai and Mumbai and CWCs at Visakhapatnam, Bhubaneswar and Ahmedabad.

The main function of these centres is to keep a watch over the weather developments in the Indian Seas and advise ships, ports, fishing vessels, the government agencies and other concerned officials, general public etc. in time, regarding adverse weather associated with cyclonic storms and depressions. These centres issue warnings and bulletins to the various interests in the maritime states of India, coastal shipping and ships in the high seas for their specified areas of responsibility. These bulletins include:

The 4 stage warnings viz. pre-cyclone watch, cyclone alert, cyclone warning and post land-fall out look during cyclone situations

Weather and sea bulletins both for shipping on the high seas and those plying in coastal waters (twice daily in undisturbed weather and 6 bulletins per day during storm periods)

- **Bulletins for Indian Navy also called Fleet forecasts (twice daily)**
- **Bulletins for GMDSS (ACWC Mumbai & ACWC Kolkata only)**
- **Port Warnings (daily once and more often as and when necessary)**
- **Fisheries warnings (4 times daily)**

4 Marine Climatology Section (MCS) O/o ADGM (R)

Under the Marine climatological summary schemes (MCSS) of WMO (1963), the MCS was established in IMD in 1971. The main responsibilities of MCS are:

Archiving of surface marine data and preparation of Marine climatological summaries on yearly/decadal/30 year basis in the Indian Ocean, north of latitude 15^0S and between 20^0E to 100^0E, which are exchanged with international marine centres.

Disseminates marine data to WMO and other agencies on mutual exchange basis

5 Port Meteorological Office (P.Met.O.)

The functions of the P.Met.O. are varied and global in nature, adhering to universal standards and methods to ensure consistency between nations. The functions provided by the P.Met.O. largely depend on the area or port being served and the type and nature of marine traffic. At present there are six P.Met.O.s functioning at Kolkata, Chennai, Vishakapatnam, Cochin, Mangalore and Mumbai.

- To recruit ships of any nationality and to maintain a national Voluntary Observing Ship (VOS) fleet.

- To regularly visit ships recruited into the national VOS fleet, to provide ongoing training to marine observers, maintain and inspect the meteorological and selected oceanographic instruments.

- To maintain accurate records of ships recruited into the national VOS fleet for publication by World Meteorological Organization (WMO), about supply and recovery of all instrumentations, checks and calibrations of instruments including dates.

- To provide services to ships regardless of nationality and country of recruitment like checking of meteorological instruments for marine observations.

- To promote and maintain liaison with National Meteorological Service; neighbouring P.Met.O.s; Harbour authorities and shipping companies

- To enquire from ship's officers of any problems experienced concerning transmission of meteorological oceanographic observations to a Land Earth Station (LES – Arvi for India) or other facilities, including reception and adequacy of forecasts, bulletins and facsimile broadcasts etc.

- To support related national, regional and international marine meteorological and oceanographic programs, such as VOS, VOSClim, *SOOP, *ASAP, *DBCP, *SOLAS, *WRAP and Argo programmes.

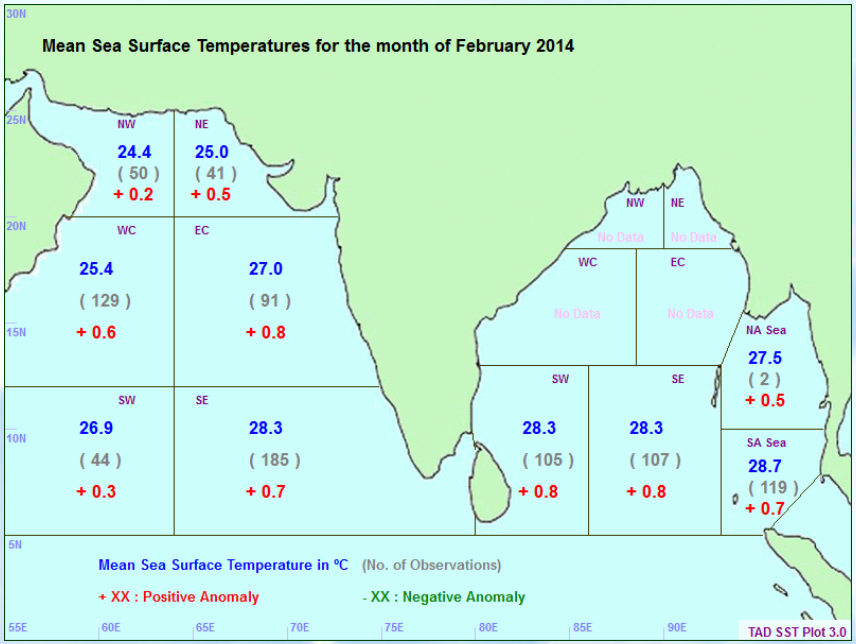
*

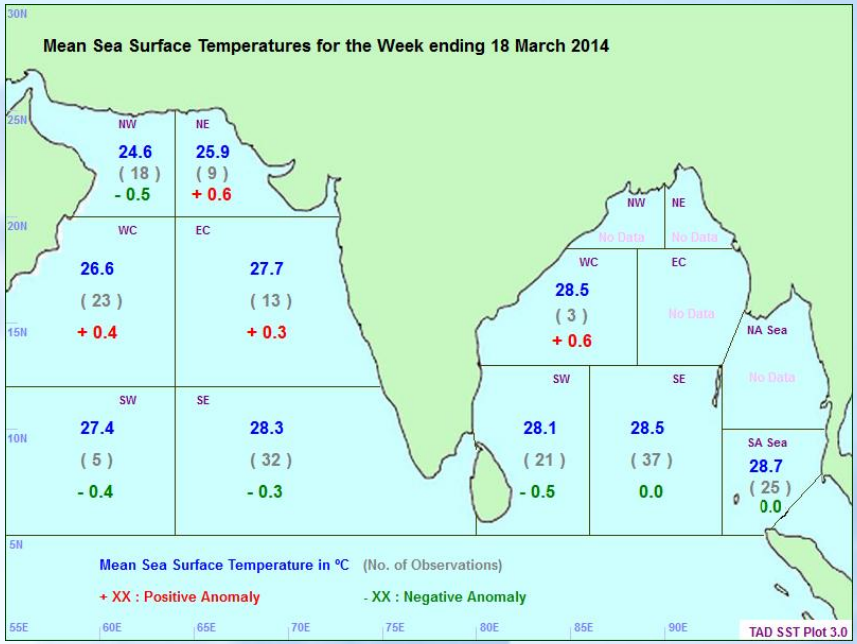
{ SOOP – Ship of Opportunity programme, ASAP – Automated Shipboard Aerological Programme, SOLAS – Safety Of Life At Sea, DBCP – Data Buoy Co-operation Panel, WRAP – World wide Recurring ASAP Programme}

6. Marine Division of O/o DDGM (WF)

The main marine related activities of this division in IMD at present covers the following major disciplines:

- Observational support through coastal observatories and Indian Voluntary Observing Fleet (IVOF) on high seas.
- Collection, quality control of Marine Meteorological data regularly through Ships requirement by 6 Port Meteorological Offices.
- Instrumentation support to IVOF including regular check/inspection after installation of Meteorological and marine equipments.
- Evaluates performance of individual ships, who have transmitted and submitted their ship log books in time and also transmitted real time data during depression/ cyclonic storms.
- Maintains liaison with WMO in implementing its various schemes within the countries.
- Preparation of weekly/monthly mean/anomaly of sea surface temperatures.
- Training to Antarctica/Sagarkanya Expedition members.


Mean Sea Surface Temperatures for the month of February 2014
NW
24.4
(50)
+ 0.2
NE
25.0
(41)
+ 0.5
WC
25.4
(129)
+ 0.6
EC
27.0
(91)
+ 0.8
SW
26.9
(44)
+ 0.3
SE
28.3
(185)
+ 0.7
NW
NE
No Data
No Data
WC
EC
No Data
No Data
SW
28.3
(105)
+ 0.8
SE
28.3
(107)
+ 0.8
NA Sea
27.5
(2)
+ 0.5
SA Sea
28.7
(119)
+ 0.7
Mean Sea Surface Temperature in °C (No. of Observations)
+ XX : Positive Anomaly
- XX : Negative Anomaly
TAD SST Plot 3.0


Mean Sea Surface Temperatures for the Week ending 18 March 2014
NW
24.6
(18)
- 0.5
NE
25.9
(9)
+ 0.6
WC
26.6
(23)
+ 0.4
EC
27.7
(13)
+ 0.3
SW
27.4
(5)
- 0.4
SE
28.3
(32)
- 0.3
NW
NE
No Data
No Data
WC
28.5
(3)
+ 0.6
EC
No Data
SW
28.1
(21)
- 0.5
SE
28.5
(37)
0.0
NA Sea
No Data
SA Sea
28.7
(25)
0.0
Mean Sea Surface Temperature in °C (No. of Observations)
+ XX : Positive Anomaly
- XX : Negative Anomaly
TAD SST Plot 3.0

Marine Data


5500
5000
4500
4000
3500
3000
Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec
Non IVOF
Total

Reports and Advisories from INOSHAC

1. a) Reports : INOSHAC Bulletin and Sea Weather Report
   b) Warnings : Storm Warnings under Global Maritime Distress and Safety System (GMDSS)
   c) Advisories/: GMDSS Bulletin
   Forecast Fleet Forecast
2. Time of Issue a) Sea Weather Report : 0600UTC
   b) INOSHAC Bulletin : 0900UTC & 1900UTC
   c) GMDSS Bulletin : 0600UTC & 1500UTC
   d) Fleet Forecast Bulletin: 0700UTC & 1600UTC
3. Frequency a) Sea Weather Report : Once in a day
   b) INOSHAC Bulletin : Twice a day
   c) GMDSS Bulletin : Twice a day
   d) Fleet Forecast Bulletin: Twice a day
   e) Storm Warnings : Two additional bulletins in case of Depressions in addition to routine bulletins Increasing to four as per the stages of Cyclones

TYPES OF BULLETINS AND WARNINGS

- Sea Area bulletins
- for shipping on high seas
- for ships plying in coastal waters (up to 75 kms. off the coast line)
- Bulletins for Indian Navy
- Bulletins for departmental exchanges
- Port warnings.
- Fisheries warnings
- Four stage warnings.
- Bulletin for AIR
- Warnings for Designated/Registered users.
- Bulletins for Press

Sea Area Bulletins for shipping on high seas

Office of Issue and broadcast by

For Bay of Bengal	ACWC Kolkata
For Arabian Sea	ACWC Mumbai
For Arabian Sea and Bay of Bengal and for Departmental exchanges Bay of Bengal	ACWC, Chennai

Contents of Daily Bulletins

Part I	Storm Warning
Part II	Synopsis of Met. Condition
Part III	Forecast
Part IV	Surface Analysis in IAC Fleet Code
Part V	Ship Reports
Part VI	Surface and U.A. Data

Bulletins of Kolkata and Mumbai contain all the six parts while same of Chennai contain only Part I, Part II and Part III.

Coastal Weather Bulletin
For Karnataka Coast Daily One bulletin valid from 30/1000 UTC to 30/2200 UTC

Synoptic situation	NIL
Wind	Southeasterly to Easterly15-20 knots gusting to 25 knots occasionally.
Weather	Mainly fair.
Visibility	Good.
Sea	Generally moderate .
Port Signals	Nil.

Coastal Weather Bulletin

For North Tamil Nadu and Puducherry coast Daily One bulletin valid from 31/1000 UTC to 31/2200 UTC

Synoptic situation	NIL
Wind	Southeasterly to Easterly15-20 knots gusting to 25 knots occasionally.
Weather	Mainly fair.
Visibility	Good.
Sea	Generally moderate .
Port Signals	Nil.

FISHERMEN WARNING

WARNING FOR
MAHARASHTRA AND GOA COAST

DATED **30/3/2014**

Date : 30/3/2014 **Time: 13:00HRS IST**

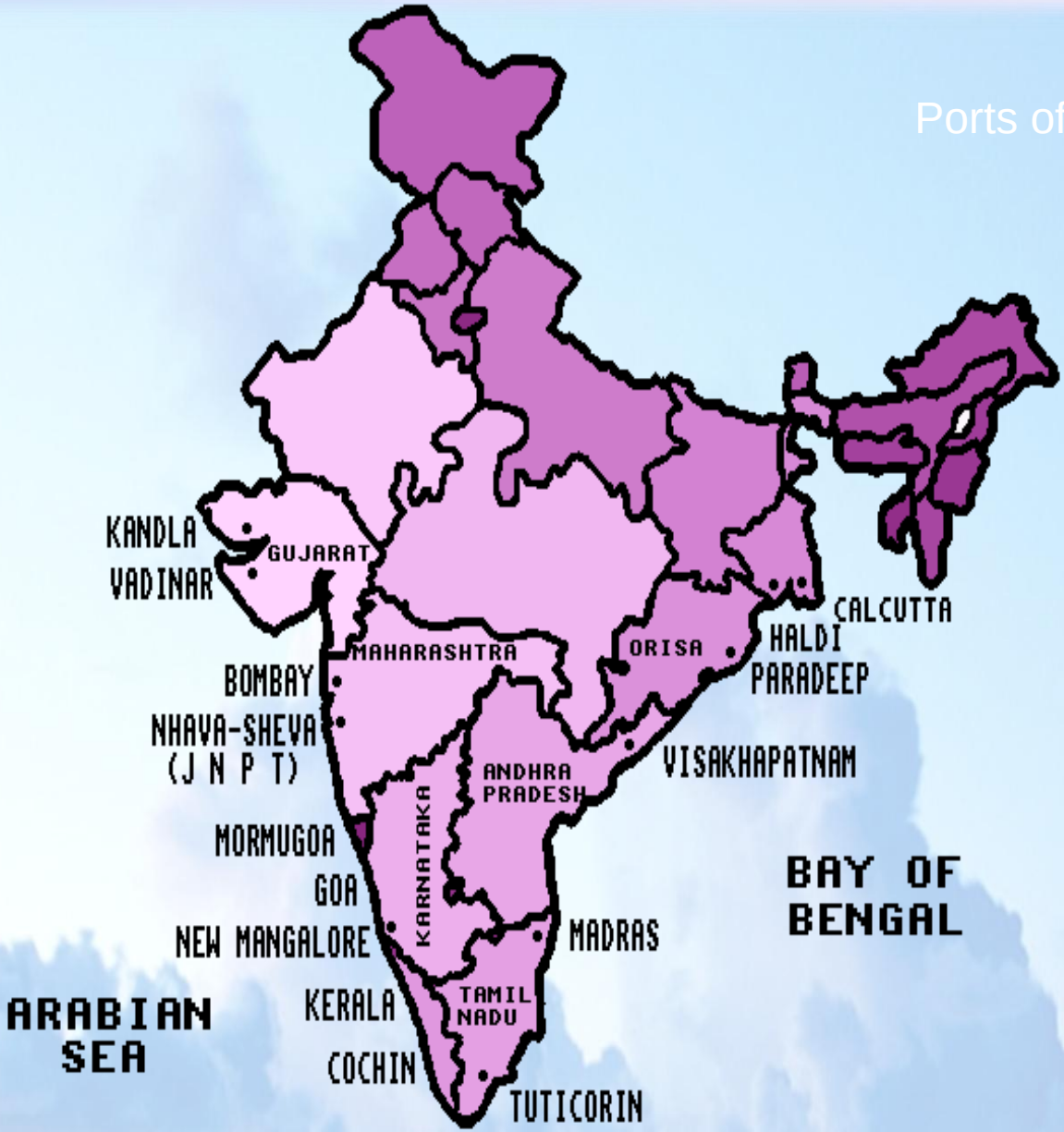
NIL

PORT WARNINGS

A uniform system of storm warning signals for ports introduced at all parts from 1st April 1898 is still in vogue. It consists of

- **General System** with eleven signals
- **Extended system** with all the eleven signals plus six section signals. These are available in the following ports only; Sagar Island, Kakinada, Chennai, Cuddalore and Nagapattinam.
- **Brief system** with five signals only viz Signal Nos III, IV, VII, X and XI. These ports are frequented mainly by smaller vessels.
- **Ports without Signals** -These ports are treated as brief ports and get corresponding warnings but are not to hoists signals.

Ports of India



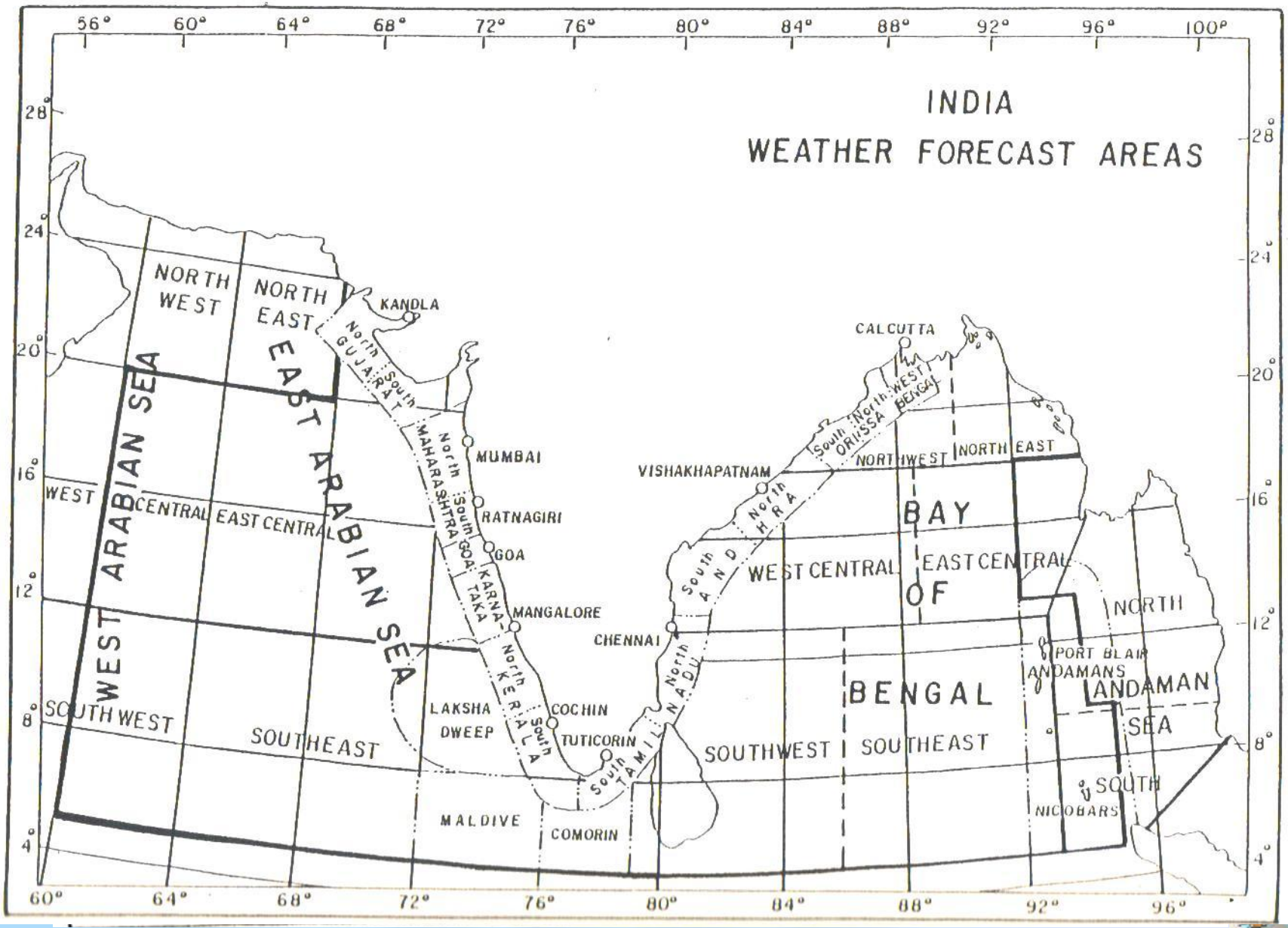
PORTS - WEST COAST

General System	Mandvi (kachchh), New Kandla, Navlakhi, Jamnagar (Bedi), Okha, Porbander, Veravel, Mumbai, Mormugao, Karwar, Mangalore, Panambur (New Mangalore), Calicut, Beypore, Cochin(Kochi) and Alleppey.
Brief System	Jakhau, Mundra, Sikka, Salaya Dwarka (Rupen), Mangrol, Diu, Madhwad, Navabander, Jafarabad, Rajula (Pipavav), Mahuva, Talaja, Gogha, Khambhat, Dahej, Bharuch, Surat (Magdala), Bilimora, Valsad, Daman, Maroli, Umbergaon, Dahanu, Tarapur, Nawapur (Boisar), Satpati, Kalve Mahim, Dantiware (Palghar), Arnala (Agashi), Bassein (Vasai),Uttan (Bhayandar), Manori (Malad), Versova (Andheri), Bandra, Trombay, Thane, Kalyan, Mora (Uran), Thal, Alibag, Revdanda, Murud (Janjira), Rajpuri, Shrivardhan, Bankot, Harnai, Dabhol, Jaigad, Varoda (Malgund), Ratnagiri (Bhagawati Bunder), Purnagad, Jaitapur, Vijaydurg, Devgad, Achara, Malvan, Nivti (pat), Vengurla, Redi, Kiranpani, Panaji Honavar, Kasaragod, Bhatkal, Gangoli (Coondapoor), Malpe, Azhikal
Ports which receive information but hoist no signal at present	Koteshwar, Pindhara, Bhagwa, Onjal, Wansi Borsi, Umarsadi, Kolak, Ulwa, Belekeri (Avarsa), Tadri (Gokram), Kumta, Murdeshwar, Mahe, Kodungallur, and Vadinar

PORTS - EAST COAST

General System	Tuticorin, Pamban, Pondicherry, Nizamapatnam, Machilipatnam, Vishakhapatnam, Gopalpur, Paradip, Diamond Harbour, Budge Budge, Calcutta and Port Blair.
Brief System	Kolachal, Kilakarai, Rameswaram, Krishnapatnam, Vadarevu, Bhimunipatnam, Kalingapatnam, Puri and Chandbali.
Extended System	Nagapattinam, Cuddalore, Madras, Kakinada and Sagar Island.
Ports which receive information but hoist no signal at present	NIL

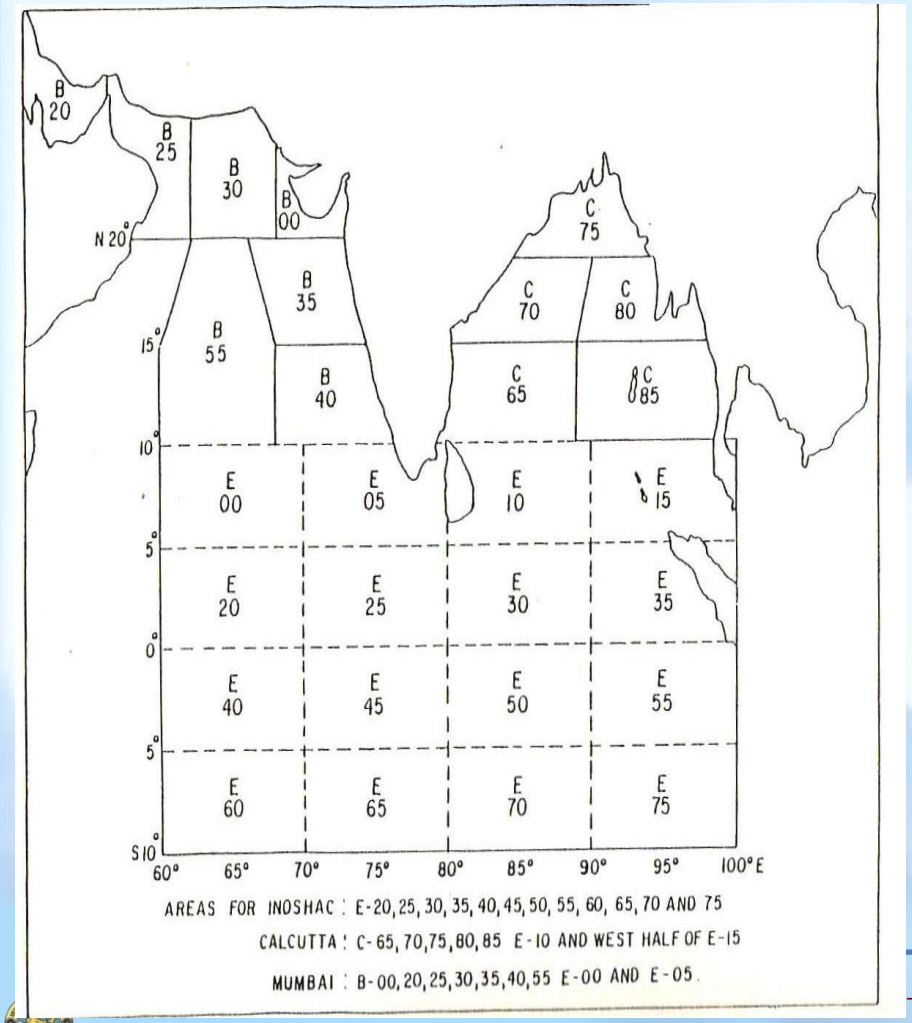
MAP A: BOUNDARIES OF AREAS USED IN WEATHER BULLETINS FOR MERCHANT SHIPPING AND COASTAL WEATHER



Pictorial form of Visual Storm Warning Signals In Use

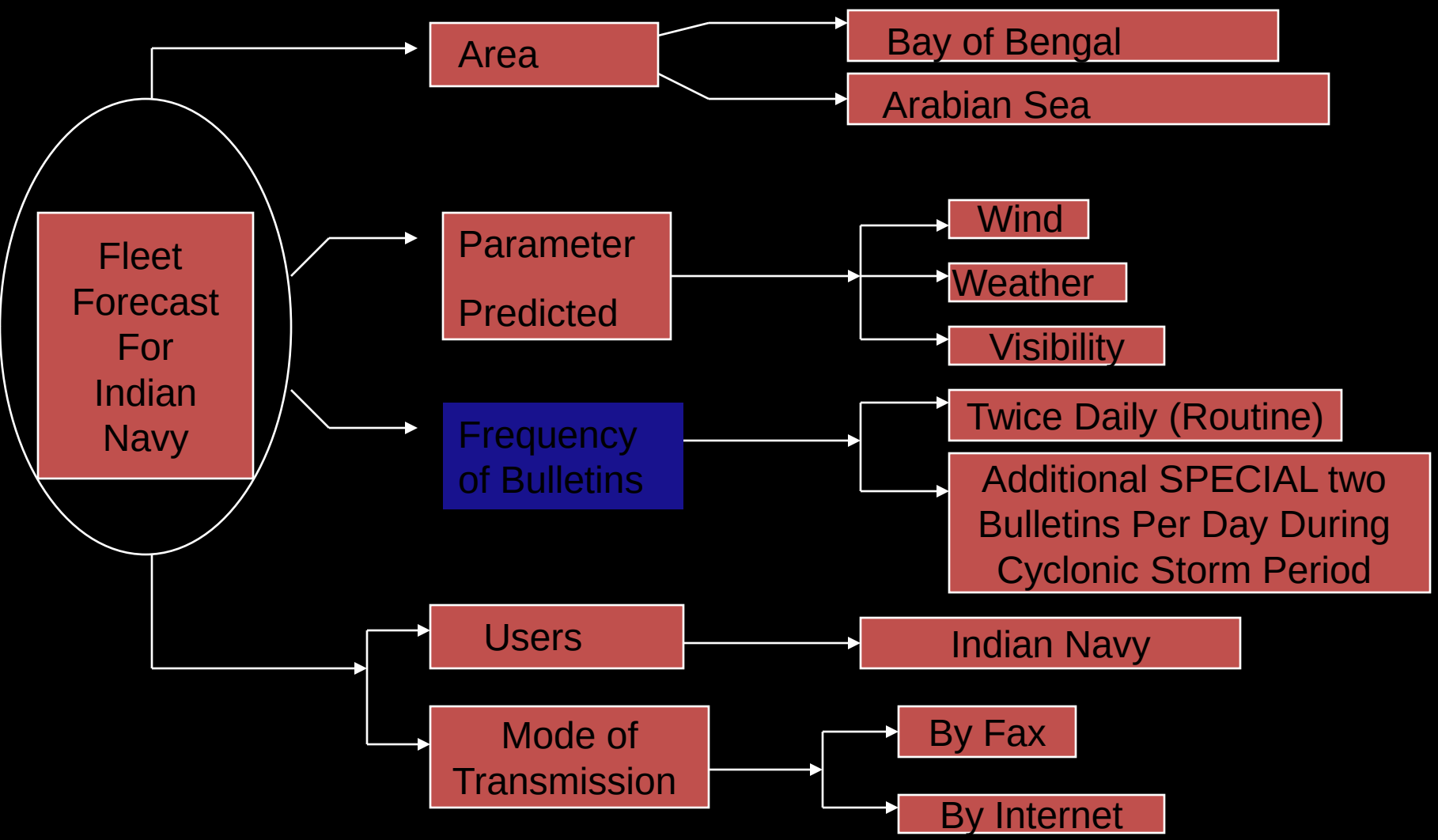
Signal Number	Description	Day Signal	Night Signal
I	DISTANT CAUATIONARY. There is a region of squally weather in which a storm may be forming.		
II	DISTANT WARNING. A storm has formed.		
III	LOCAL CAUTIONARY. The port is threatened by squally* weather.		
IV	LOCAL WARNING. The port is threatened by a storm but it does not appear that the danger is as yet sufficiently great to justify extreme measures of precaution		
V	DENGER. Port will experience severe weather from a cyclone expected to move keeping the port to the *left* of its track.		
VI	DENGER. . Port will experience severe weather from a cyclone expected to move keeping the port to the *right* of its track.		
VII	DENGER. . Port will experience severe weather from a cyclone expected to move *over or close* the port. *Note: This signal is also hoisted when a storm is expected to skirt the coast without (actually) crossing it.*		
VIII	GREAT DENGER. Port will experience severe weather from a *severe* cyclone expected to move keeping the port to the *left* of its track.		
IX	GREAT DENGER. Port will experience severe weather from a severe cyclone expected to move keeping the port to the *right* of its track.		
X	GREAT DENGER. Port will experience severe weather from a severe cyclone expected to move *over or close* to the port. *Note: This signal is also hoisted when a severe storm is expected to skirt the coast without (actually) crossing it.*		
XI	FAILURE OF COMMUNICATION. Communications with the meteorological warnings centres has broken down and the local officer considered that there is a danger of bad weather.		

FLEET FORECAST

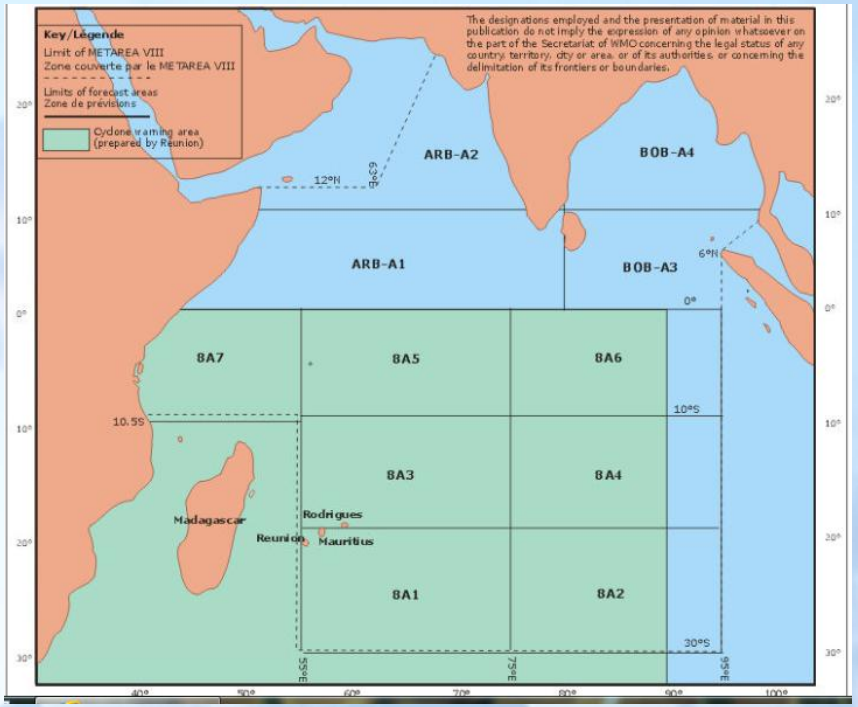


Office of issue	Area of responsibility	Sub-areas
ACWC Mumbai	Arabian sea to the north of Latitude 50N and East of long. 600E, Gulf of Oman and Persian Gulf	B 00, 20, 25, 30, 35, 40, 55 & E 00, 05
ACWC Kolkata	Bay of Bengal and Andaman Sea to the north of Lat. 50N	C 65, 70, 75, 80, 85 E 10 and West half of E 15
INOSHAC, Pune	Indian Ocean between Lat.50N and 100S and Long 600E to 1000E	E 20, 25, 30, 35, 40, 45,50, 55, 60, 65, 70,75.

Sea Area Forecast to Indian Navy (Fleet Forecast)



LIMITS OF GMDSS AREAS

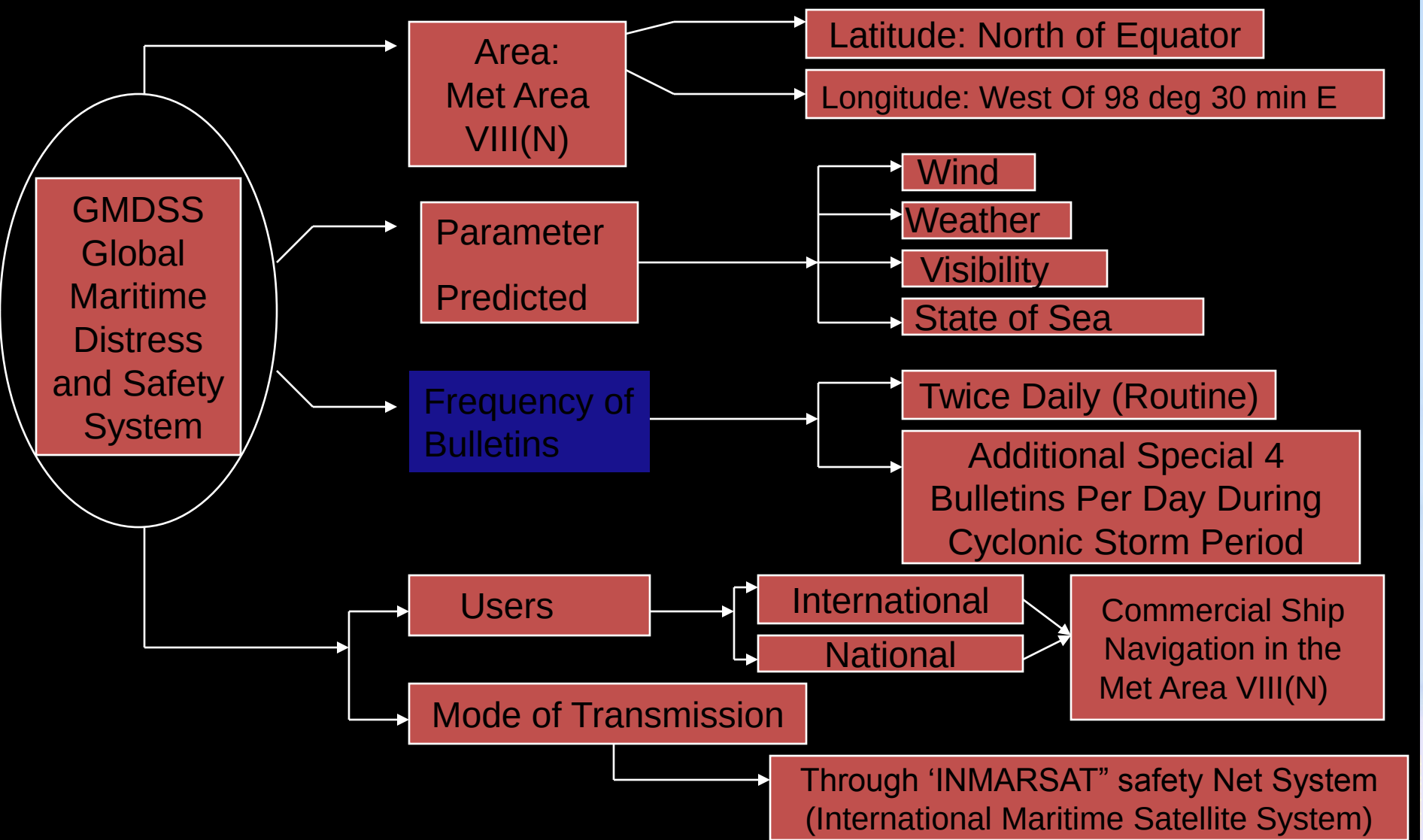


India is one of the issuing services of Met area VIII (N) among the 16 issuing services of WMO Marine broadcast system under the GMDSS. In India, the weather forecast and warning bulletin is prepared by ACWC (Area Cyclone Warning Centre) Mumbai for the Arabian sea, by ACWC, Calcutta for the Bay of Bengal and INOSHAC (Indian Ocean & South Hemispheric Centre) , Pune for Indian Ocean, North of equator upto 5°N, for their areas of responsibility. The bulletins are compiled by INOSHAC, Pune and transmitted to NHAC(Northen Hemisphere Analysis Centre), New Delhi. NHAC edits the final bulletin and transmits to Telecom (RTH, New Delhi) for further transmission through CES, Arvi.

Broadcast Schedules :

IMD started issuing two GMDSS bulletin daily at 0900 UTC w.e.f. 1st June,1996. The second daily GMDSS bulletin issued at 18UTC. IMD has been issuing NAVTEX broadcast from Mumbai and Chennai.

GMDSS


GMDSS Global Maritime Distress and Safety System
Area: Met Area VIII(N)
Latitude: North of Equator
Longitude: West Of 98 deg 30 min E
Parameter
Predicted
Wind
Weather
Visibility
State of Sea
Frequency of Bulletins
Twice Daily (Routine)
Additional Special 4 Bulletins Per Day During Cyclonic Storm Period
Users
International
National
Commercial Ship Navigation in the Met Area VIII(N)
Mode of Transmission
Through 'INMARSAT" safety Net System (International Maritime Satellite System)

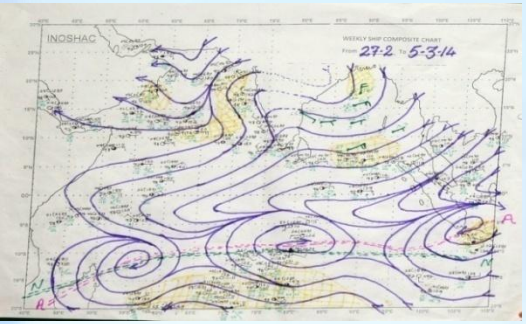
Wave forecasting by INCOIS

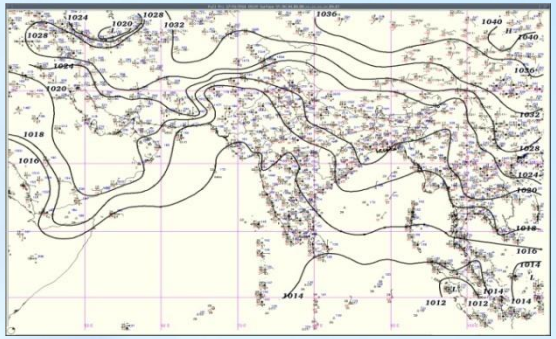
The Indian National Centre for Ocean Information Services (INCOIS), provide

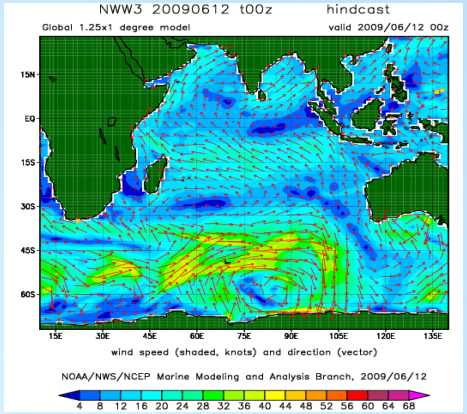
1. Location Specific forecast (3 days - 3 hourly interval)
2. Coastal forecast (7 days - 3 hourly interval)
3. Regional forecast (7 days - 3 hourly interval)
4. Indian Ocean forecast (5 days - 6 hourly interval)
5. Global forecast (5 days - 6 hourly interval)
6. Value added services.

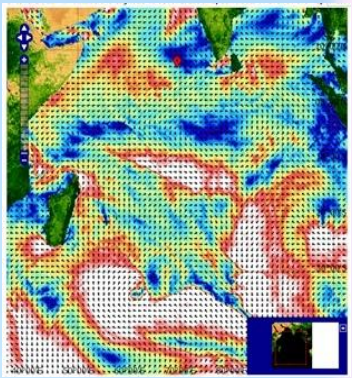
FORECAST ARE ISSUED FOR SOME OF THE PARAMETRS LIKE

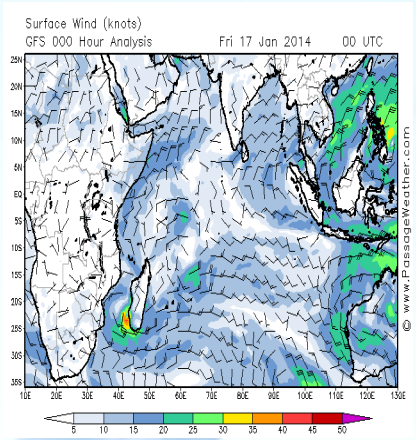
- WAVE HEIGHT AND DIRECTION
- WIND SPEED AND DIRECTION
- SWELL HEIGHT AND DIRECTION
- WAVE PERIOD AND SWELL PERIOD

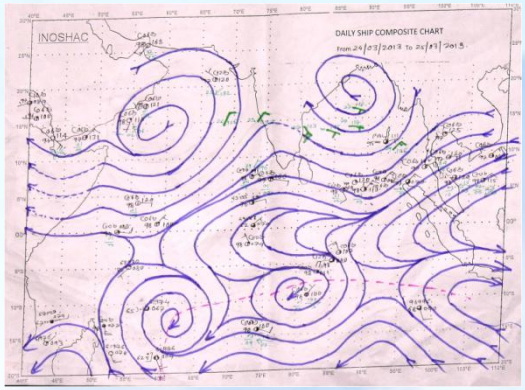


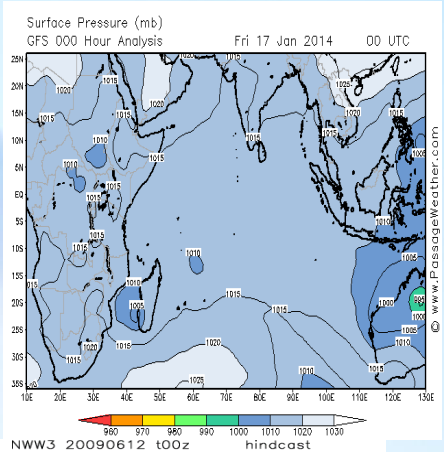


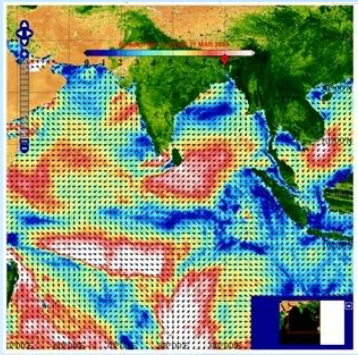


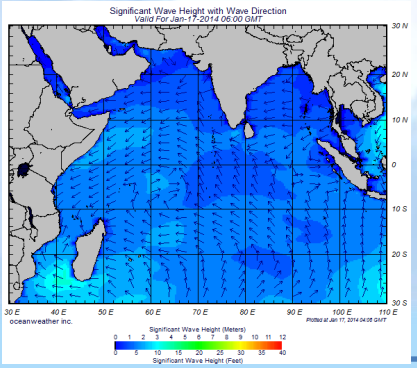


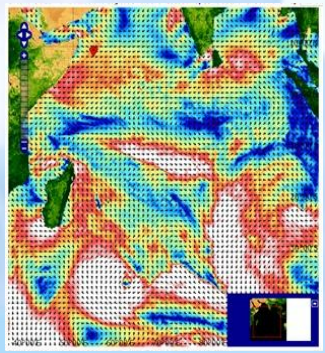


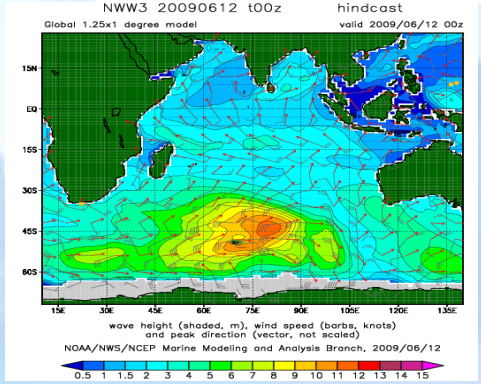


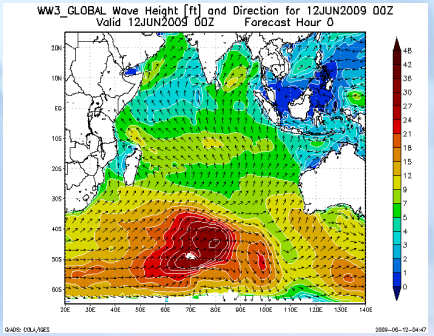












भारत मौसम विज्ञान विभाग

INDIA METEOROLOGICAL DEPARTMENT

Forecast

A1 ARABIAN SEA EQUATOR TO 10 N AND W OF 80 E

A1-FORECAST FOR 24 HOUR

I)WINDSPEED AND DIRECTION:-

1)E OF 70 E:NE-LY 10/15 KTS BEC N-LY CLOSE TO EQUATOR

2)W OF 70 E:CYCLONIC 05/10 KTS

II)WEATHER:-FAIRLY WIDESPREAD RA/TS TO THE W OF 70 E

REST AREA SCATTERED RA/TS

III)VISIBILITY:4-3 NM TO THE W OF 70 E

REST AREA 6-4 NM

IV)WAVE HEIGHT:-1-2 M

A2 ARABIAN SEA :-23 45 MIN N 68 E TO 12 N 63 E

TO CAPE GARDAFUI TO N OF 10 N

A2-FORECAST FOR 24 HOURS

I)WINDSPEED AND DIRECTION:-N/NE-LY 10/15 KTS

II)WEATHER:-FAIR/ISOLATED FOG TO THE W OF 65 E

III)VISIBILITY:10-8 NM/IT MAY REDUCE <1 KM

A3-FORECAST FOR 24 HOURS

I)WINDSPEED AND DIRECTION:-

1)N OF 05 N:E/NE-LY 10/15 KTS

2)S OF 05 N:NE/N-LY 10/15 KTS BEC CYCLONIC TO THE E OF 90 E

.ii)WEATHER :SCTTERED RA/TS TO THE E OF 90 E

REST AREA ISOLATED RA/TS

III)VISIBILITY:-6-4 NM TO THE E OF 90 E. REST AREA 8-6 NM

IV)WAVE HEIGHT:1-2 M

BOB: A4:- BAY OF BENGAL N OF 10 N AND E OF 80 E

A4-FORECAST FOR 24 HOURS

I)WINDSPEED AND DIRECTION:-

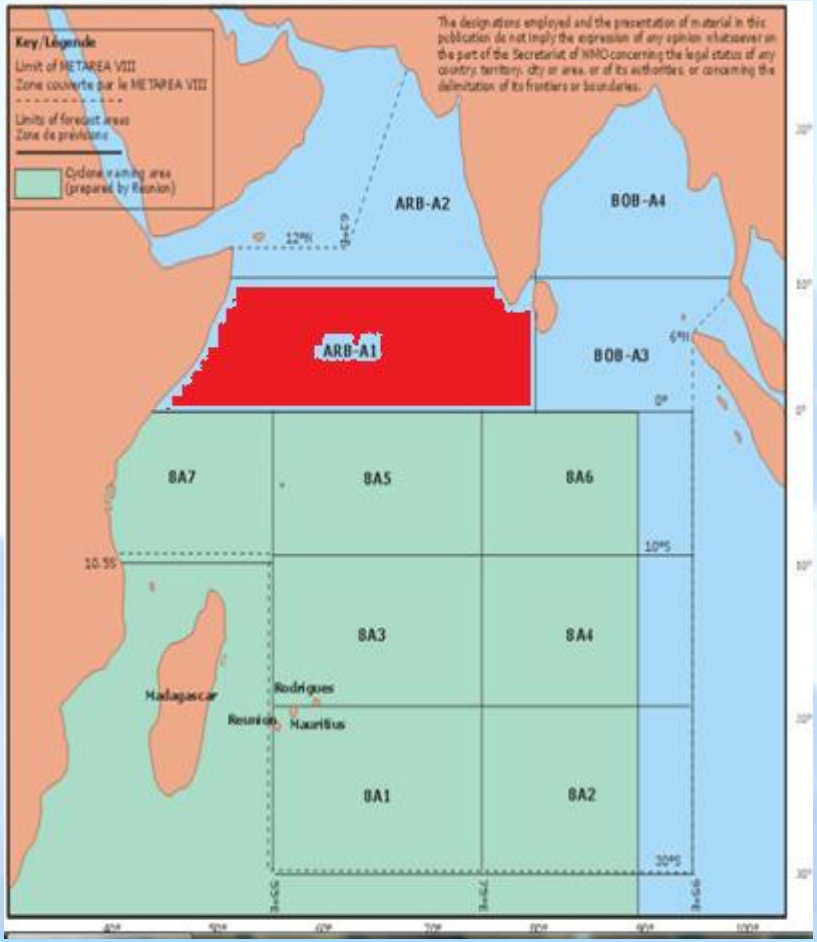
1)N OF 15 N:N/NE-LY 10/15 KTS

2)S OF 15 N:ENE-LY 10/15 KTS

II)WEATHER:-FAIR

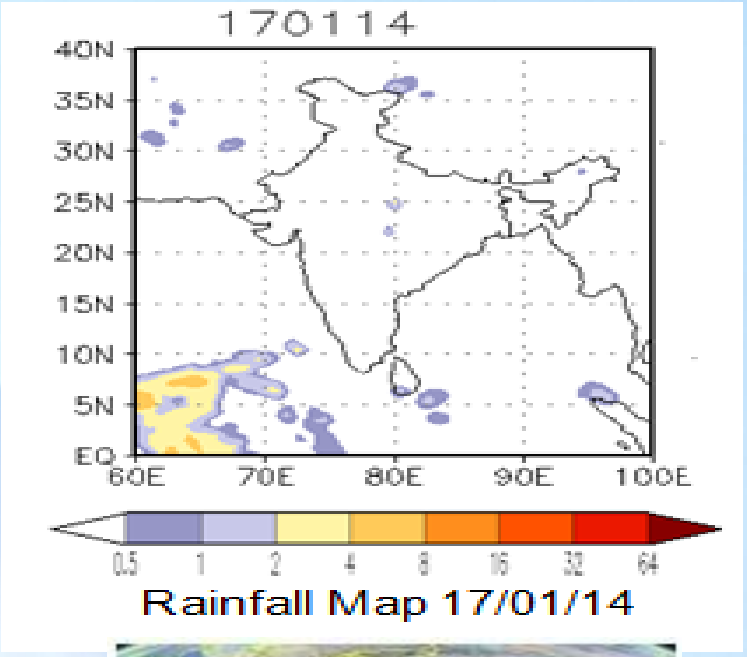
III)VISIBILITY:-10-8 NM

IV)WAVE HEIGHT:-1-2 M

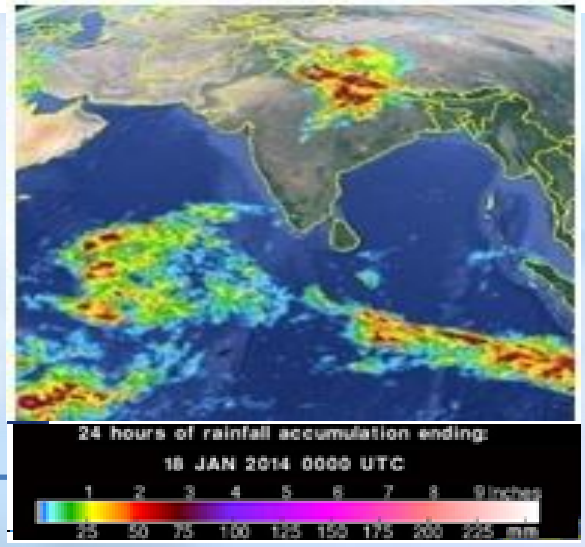


- **A1-FORECAST FOR 24 HOUR I)WINDSPEED AND DIRECTION:- 1)N OF 5 DEG N:NE-LY 05/10 KTS BEC E-LY 10/15 KTS TO THE W OF 57 DEG E(.) 2)S OF 05 DEG N:E/NE-LY 10/15 KTS(.) II)WEATHER:-ISOLATED RA/TS TO THE E OF 90 DEG E(.)REST AREA FAIR(.) III)VISIBILITY:-8-6 NM TO THE E OF 90 DEG E(.)REST AREA 10-8 NM(.) IV)WAVE HEIGHT:- 1-2 M (.)**

Analysed Chart



Rainfall Map 17/01/14



Verification of Wind Speed and Direction

17-Jan-14 (24 hrs)

	Speed							Direction		Sp & overall accuracy			
	Ac	Fc	Diff	%dev	%acurcy	mean		Ac	Fc	%dev	%acurcy	mean	
A1	8	13	4.5	56.3	44.7		A1	NE	NE	0	100		
	8	13	4.5	56.3	44.7	51.8		NNE	N	13	87.5	77	65
	13	7.5	5	40	60			NW	CYCLO	50	50		
A2	14	13	1.2	8.76	91.240876		A2	N/NE	N/NE	0	100		
	14	13	1.2	8.76	91.240876	91.24088		N/NE	N/NE	0	100	100	96
A3	20	13	2.5	12.5	87.5		A3	E/NE	E/NE	0	100		
	15	13	2.5	16.7	83.333333	84.05		NE/N	NE/N	0	100	83	84
	15	12	2.5	16.7	83.333333			NE/N	CYCLO	50	50		
A4	10	13	2.5	25	75		A4	NE	N/NE	50	50		
	10	13	2.5	25	75	75		ENE	ENE	100	100	75	75
												Avg.	80

	*	speec	Ac	Fc	dev	acurcy						
			5kt	10kt	0.5	0.5				% ver	79.8	
		Dir	W	E	1	0						
			w	WSW	0.125	0.875						
			W	WNW	0.125	87.5						

A Report on realized weather, wind, visibility and wave height over Indian Seas, dated 25th MARCH' 2014.

A1: ARABIAN SEA: EQUATOR TO 10° N AND W OF 80° E.

1] WINDSPEED AND DIRECTION: -1] E OF 65°E: ENE-LY, 05-10 KTS
2] W OF 65° E: NE/E-ly, 05-10 KTS
II) WEATHER: - FAIR
III) VISIBILITY: - 10-8 NM
IV) WAVE HEIGHT: - 0.5-1 MTR

A2: ARABIAN SEA: N OF 10° N & CAPE GARDAFUI TO 12 °N/63°E & THENCE TO THE EAST UPTO 23° 45'N/68°E.

I) WINDSPEED AND DIRECTION: ANTICYCLONIC, 05-10 KTS
II) WEATHER: - FAIR
III) VISIBILITY: - 10-8 NM
IV) WAVE HEIGHT: - 0.5-1 MTR

A3: BAY OF BENGAL: EQUATOR TO 10°N BETWEEN E OF 80°E AND WEST OF 10°N/98° 30'E TO 6°N/95°E AND THENCE S WARDS TO EQUATOR.

I) WINDSPEED AND DIRECTION: - 1] E OF 90° E: NE-LY, 20-25 KTS
2] W OF90° E: E/SE-LY, 20-25 KTS
II) WEATHER: - ISOLATED RA/TS
III) VISIBILITY: - 8-6 NM
IV) WAVE HEIGHT: - 3-4 MTR.

A4: BAY OF BENGAL: N OF 10° N AND E OF 80° E.

I] WINDSPEED AND DIRECTION: ANTICYCLONIC 05-10 KTS
II) WEATHER: - FAIR
III) VISIBILITY: 10-8 NM
IV) WAVE HEIGHT: 0.5-1 MTR

*KTS: Knots, NM: Nautical Mile, MTR: Meter, RA/TS: Rain/Thundershower

WMO Requirements

- The presently offered services by IMD are designed to meet the WMO requirements
- WMO members are obliged to recruit ships in the WMO Voluntary Observing Ships' Scheme

  -PMOs need to be strengthened(Additional manpower)
- WMO has assigned a specific set of duties to each PMO
- WMO emphasis the need for

  -consultation with users regarding their requirements

  -continued evaluation and monitoring to ensure the standards of service

Scope for Improvement

- **Under Collaborative Projects**

-Location specific forecasts of Wind, SST,Weather and Visibility

-Quantitative Sea State Forecast, including Period and Height of Sea and Swell Waves

- Automation of Ship data under VOS and VOSClim Project in collaboration with Merchant Navy/Indian Navy/International Liners/WMO/IOC etc.

-Forecasts of increased validity period upto 72hrs with an outlook for next 48 hrs, with 12 hourly updation

…Thanks