



Marine Weather Forecasting

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**भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT**

Outline

- Present Services rendered by IMD for GMDSS, Sea Area, Fleet, Fisherman, Coastal etc.
- New Initiatives: Development and automatization of MME based NWP Products for the Marine Weather Services.



MARINE WEATHER SERVICES OF IMD

The Marine weather forecasts provided by IMD through its various sub-offices include the following:

- i) Global Maritime Distress Safety System (GMDSS) Bulletins
- ii) Sea Area Bulletin
- iii) Coastal Weather Bulletins
- iv) Bulletins for Indian Navy
- v) Port warnings
- vi) Fisheries warnings

Following are the Stakeholders

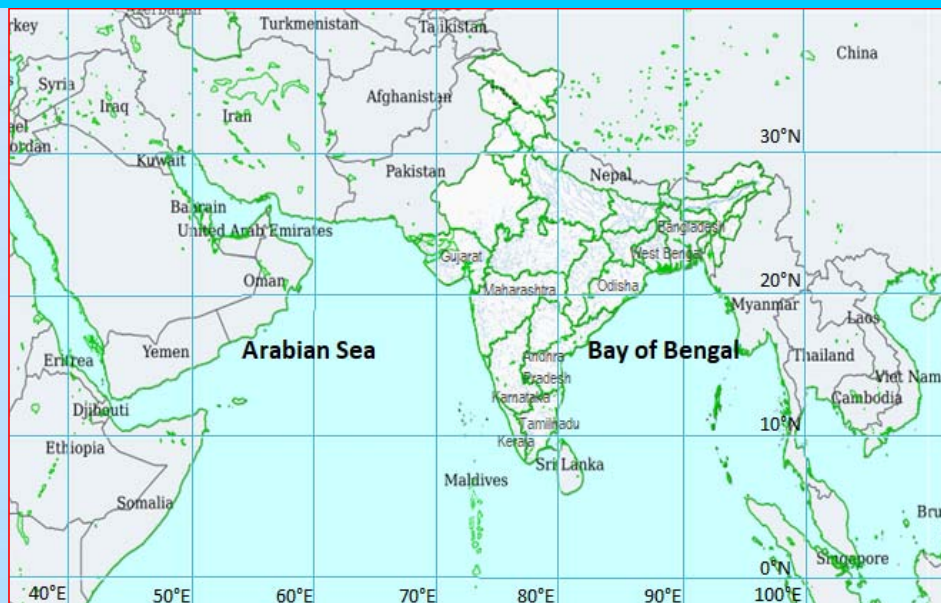
- i) Merchant mariners
- ii) Indian Navy and Coast Guards
- iii) Port authorities
- iv) Harbour managers
- v) Offshore asset managers
- vi) Shipping Industries
- vii) Offshore and Onshore E&P Operators
- Viii) Fisherman and Fisheries



भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT



Weather Forecasting and Cyclone Warning: Organisation and Area Responsibility



Organizational structure

At present, the cyclone warning/ Marine services organization of the India Meteorological Department (IMD) has **three-tier system** to cater to the needs of the maritime states.

There are **Area Cyclone Warning Centres (ACWCs)** at Chennai, Mumbai and Kolkata and **Cyclone Warning Centre (CWCs)** at Thiruvananthapuram, Visakhapatnam, Ahmedabad and Bhubaneswar.

The co-ordination of cyclone warning operations at the national level is done by the **Marine Section of the Cyclone Warning Division (CWD)** at New Delhi.

C.W.D., New Delhi is also functioning as **Regional Specialized Meteorological Centre - Tropical Cyclones (RSMC - TC)**.

Area of Responsibility

Centre	Sea Area	Coastal Area	Coastal states
ACWC Kolkotta	Bay of Bengal	West Bengal, Andaman & Nicobar islands	West Bengal, Andaman & Nicobar islands
ACWC Chennai	-	Tamil Nadu & Puducherry	Tamil Nadu & Puducherry
ACWC Mumbai	Arabian Sea	Maharashtra, Goa	Maharashtra, Goa
CWC Bhubaneshwar	-	Odisha	Odisha
CWC Visakhapatnam	-	Andhra Pradesh	Andhra Pradesh
CWC Thiruvananthapuram	-	Kerala, Karnataka	Kerala, Karnataka & Lakshadweep
CWC Ahmedabad	--	Gujarat, Diu, Daman, Dadra & Nagar Haveli	Gujarat, Diu, Daman, Dadra & Nagar Haveli

1. Fishermen warning:

- (a) **ACWC Kolkata**: West Bengal Coast, Northwest Bay of Bengal, Northeast BoB, North & South Andaman Sea
- (b) CWC Bhubaneswar: North & South Odisha coast.
- (c) CWC Visakhapatnam: North & South Andhra Pradesh coast
- (d) **ACWC Chennai**: North & South Tamil Nadu coast, Comorin Area, Maldives Area, Southeast BoB, Southwest BoB, West Central BoB, and East Central BoB.
- (e) CWC Thiruvananthapuram: Kerala Coast, Karnataka Coast, Lakshadweep area, Southwest Arabian Sea and southeast Arabian Sea.
- (f) ACWC Mumbai: North & South Maharashtra Coast, Goa coast, West Central Arabian Sea, East central Arabian Sea
- (g) CWC Ahmedabad: North Gujarat Coast, South Gujarat Coast, northwest Arabian Sea, northeast Arabian Sea.



2.Port warnings:

- (1) ACWC Kolkata: West Bengal Coast, Andaman and Nicobar Islands**
- (2) ACWC Chennai: Tamil Nadu coast**
- (3) ACWC Mumbai: Maharashtra coast and Goa coast**
- (3) CWC Bhubaneswar: Odisha Coast**
- (4) CWC Visakhapatnam: Andhra Pradesh Coast**
- (5) CWC Thiruvananthapuram: Kerala coast, Karnataka Coast and Lakshadweep Islands**
- (6) CWC Ahmedabad: Gujarat Coast**



3. Sea Area Bulletin

(1) ACWC Kolkata for Bay of Bengal and (2) ACWC Mumbai for Arabian Sea

4.Coastal Bulletin:

(1) ACWC Kolkata: West Bengal Coast, Andaman and Nicobar Islands

(2) ACWC Chennai: Tamil Nadu coast

(3) ACWC Mumbai: Maharashtra coast and Goa coast

(3) CWC Bhubaneswar: Odisha Coast

(4) CWC Visakhapatnam: Andhra Pradesh Coast

(5) CWC Thiruvananthapuram: Kerala coast, Karnataka Coast and Lakshadweep Islands

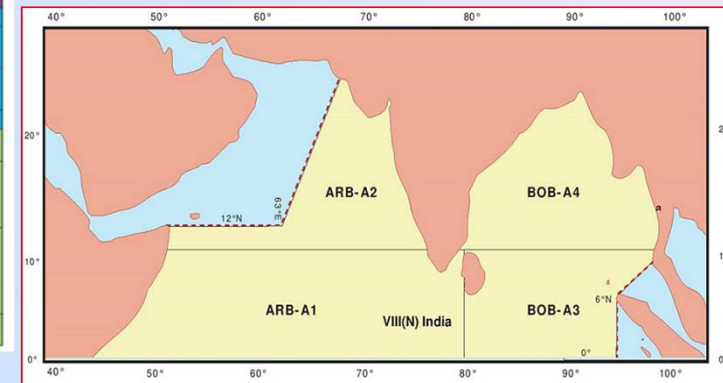
(6) CWC Ahmedabad: Gujarat Coast



AREA OF RESPONSIBILITY AND DESIGNATED NATIONAL METEOROLOGICAL SERVICES FOR THE ISSUE OF WARNINGS AND WEATHER AND SEA BULLETINS FOR THE GMDSS

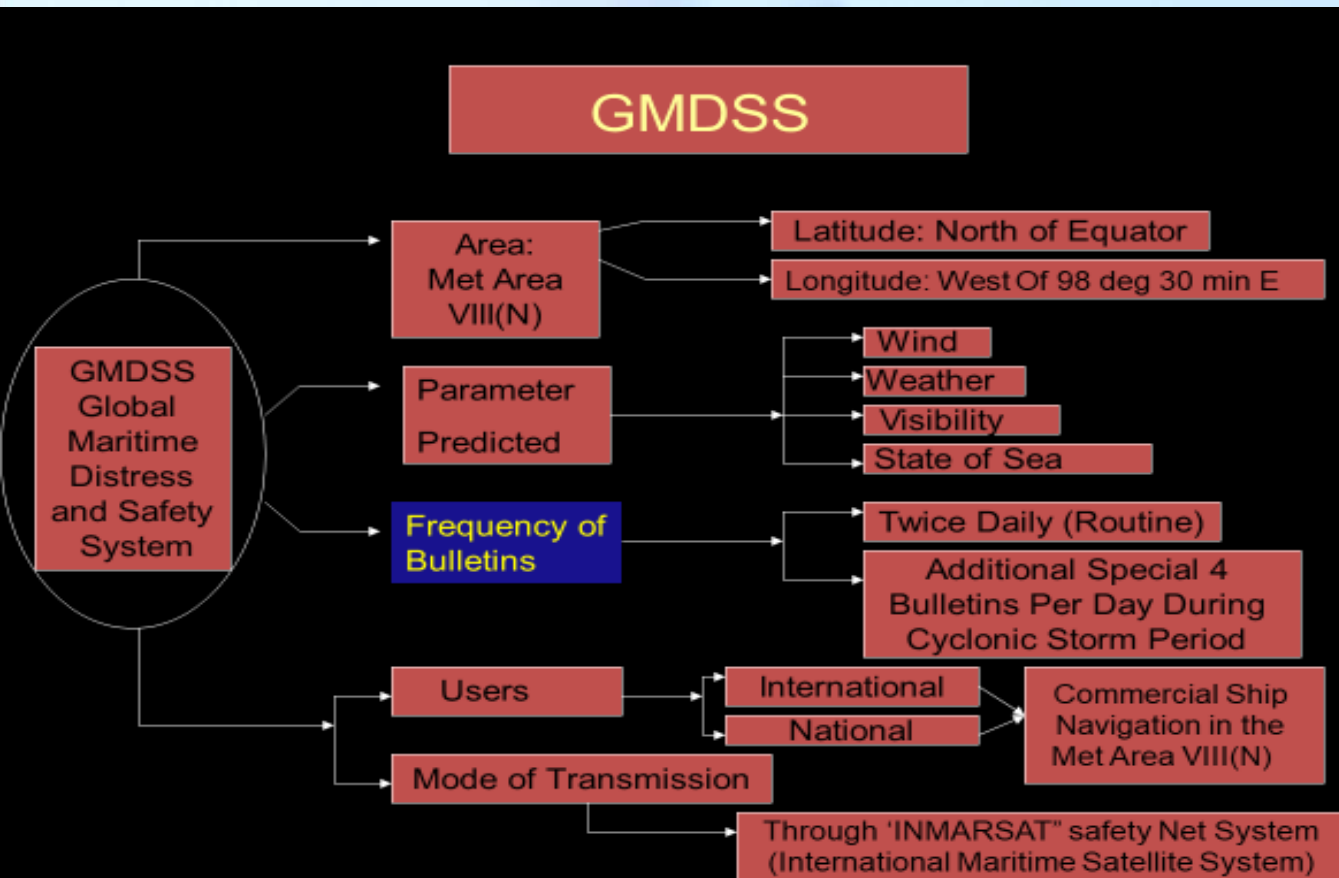


Under Global Maritime Distress Safety System (GMDSS) scheme, India has been designated as one of the 16 services in the world for issuing Sea area bulletins for broadcast through GMDSS for MET AREA VIII (N), which covers a large portion of north Indian Ocean.



Met Area VIII (N) subdivisions

Contents of GMDSS Bulletin



IMD is transmitting daily two GMDSS bulletins for Met. Area VIII(N), at 0900 UTC and at 1800 UTC valid for next 24 and 48 hours under undisturbed weather. During Cyclone period additional bulletins (4) are also issued based on 00, 03, 06, & 12 UTC for GMDSS broadcast depending on the requirement. This bulletin has two parts. Part 1 discusses the significant system and Part 2 discusses wind, weather, visibility, state of sea, port warnings for 24 hours and 48 hours validity period for different sea area under Met Area VIII (N).



GMDSS Sample Bulletin

GLOBAL MARITIME 061300
DATE 06-04-2022 GMDSS BULLETIN-I 060900
FROM:-MARINE FORECAST DIVISION, DGM, NEW DELHI
TO: DGM (ISSD), NEW DELHI

GMDSS BULLETIN FOR MET. AREA VIII (N), NORTH OF EQUATOR
VALID FOR 24/48 HOURS FROM 0900 UTC 06 APRIL 2022.

PART-I STORM WARNING NIL (.)

PART-II

A CYCLONIC CIRCULATION LIES OVER SOUTH ANDAMAN SEA AND NEIGHBOURHOOD AND EXTENDS UPTO MIDTROPOSPHERIC LEVEL. UNDER ITS INFLUENCE, A LOW PRESSURE AREA IS LIKELY TO FORM OVER SOUTHEAST BAY OF BENGAL DURING NEXT 48 HOURS (.)

A1-FORECAST FOR 24 HOURS

ARB A1 ARABIAN SEA: EQUATOR TO 10 DEG. N AND W OF 80 DEG.E (.)

I)WINDSPEED AND DIRECTION: 1)E OF 70 DEG E: NW-LY 05/10 KTS BEC CYCLONIC 05/10 KTS TO THE N OF 6 DEG N TO THE E OF 75 DEG E(.)

2)REST AREA: NE/E-LY 05/10 KTS (.)

II)WEATHER: ISOLATED RA/TS (.)

III)VISIBILITY: 8-6 NM(.)

IV)WAVE HEIGHT: 1.0-2.0 MTR (.)

A1-FORECAST FOR 48 HOURS

I)WINDSPEED AND DIRECTION: 1)N OF 5 DEG N TO THE E OF 68 DEG E: NW-LY 05/10 KTS BEC CYCLONIC 05/10 KTS TO THE N OF 6 DEG N TO THE E OF 75 DEG E(.)

2)N OF 5 DEG N TO THE E OF 60 TO 68 DEG E: NE-LY 05/10 KTS(.)

3)S O 5 DEG N TO THE E OF 60 DEG E: SW/W-LY 05/10 KTS(.)

4)REST AREA: NE/E-LY 05/10 KTS (.)

II)WEATHER: 1)E OF 73 DEG E: FAIRLY WIDESPREAD RA/TS(.)

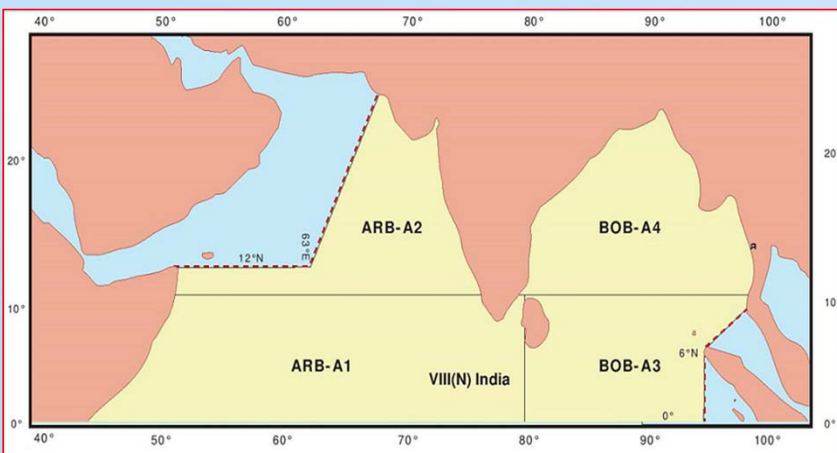
2)REST AREA: SCATTERED RA/TS (.)

III)VISIBILITY: 1)E OF 73 DEG E: 4-3 NM(.)

2)REST AREA: 6-4 NM (.)

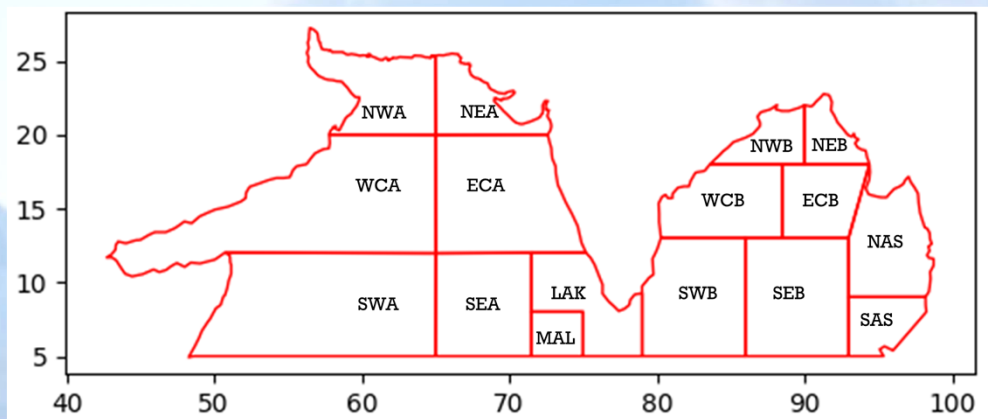
IV)WAVE HEIGHT: 1.0-2.0 MTR (.)

Met Area VIII (N) subdivisions



SEA AREA BULLETINS

- Sea area bulletins for Bay of Bengal are issued by **ACWC Kolkata** and are broadcast by **the coastal radio** stations at Kolkata (VWC) and Chennai (VWM) and those for Arabian Sea are issued by ACWC Mumbai and are broadcast by the coastal radio station at Mumbai (VWB).
- The area covered by these bulletins which is the area of responsibility assigned to India by the World Meteorological Organization (WMO).



Sea Area Bulletin

During undisturbed weather, only **two bulletins** are issued per day, known as **Daily bulletins**.

In the event of disturbed weather, a third bulletin known as extra is broadcast, if considered necessary.

when a depression forms the **Extra** bulletin must be issued.



Sea Area Bulletin

When **cyclonic storm** has developed **three additional bulletins** a day .

The three additional bulletins are known as Storm bulletins make up a **total of six bulletins** a day.

Storm three i.e. GASBAG bulletin (1500 UTC) should be issued on routine basis during cyclone situation.

These bulletins are broadcast at fixed hours according to a schedule. In addition, if any **unexpected development** of weather warrants urgent communication to ships, in between scheduled broadcasts, it is broadcast in the form of a special bulletin, **called Hexagon** which should be issued immediately after the development is noticed.

A **code word** (which is not for broadcast) is prefixed to each of the bulletins as **a preamble for easy identification** by the coastal radio stations on receipt.



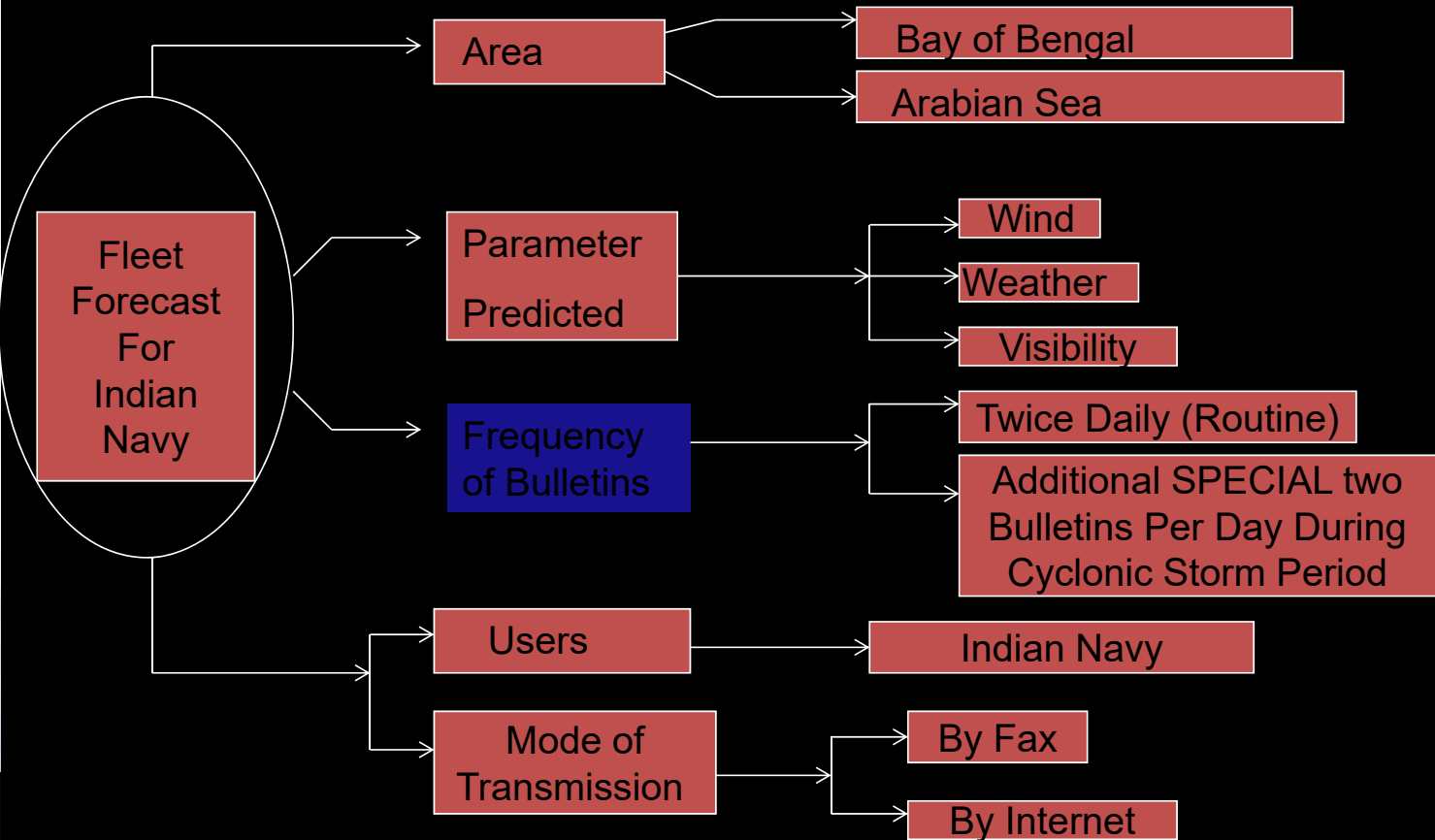
Fleet forecast for Indian Navy

Since Naval ships normally do not keep watch on commercial W/T wavelengths and hence do not listen to the broadcasts from the coastal radio stations, separate weather bulletins for broadcast to the ships of the Indian Navy are issued to the Naval W/T stations.

Fleet Forecasts are issued exclusively for broadcast to Indian Naval ships through Naval W/T stations. They are issued twice daily, corresponding to Aurora and Balloon sea area bulletins.



Sea Area Forecast to Indian Navy (Fleet Forecast)



Warnings to Ports -Hoisting of signals

A uniform system of storm warning signals was introduced at all the ports in India from 1st April 1898.

The salient features:

(i) General System

A **General System with eleven signals** ,

- the first two of which (signals **No. I and II**) indicate the existence of **distant disturbed weather** (Distant signals)
- next eight (**signals III to X**) (Local signals) indicate that **the port itself is threatened** by bad weather and the last one (**signal No. XI**) indicates that the **communication** with the ACWC/CWC had **broken down** and that in the opinion of the local Port Officer, there is danger of bad weather.



Frequency of Issue and contents of **Port Warning** Bulletin

Ports in the maritime States are **warned 5 to 6 times** a day during periods of cyclonic storm by telefax.

The warnings contain information about the **location**, **intensity** and expected **direction of movement** of the storm or depression, the **part of the coast** where it is expected to strike and the **type of signal** which the port should hoist.

As landline communication between the port and the CWC may break down during a cyclone, provision exists for using state and inter-state police W/T channels wherever available for passing on the warnings.



Format for **Port Warning** :

Port Warning No.

Date and Time for Issue

**(i) Information on cyclone: The cyclonic storm lay over Bay of Bengal/Arabian Sea near Lat. __/Long. ____ at a distance _____ km. from _____ at _____ IST
_____ Estimated Central Pressure _____ hPa.**

(ii)Forecast:

Further intensification:

Direction of Movement:

Expected Landfall Area :

Expected Time of Landfall :

Advice for hoisting Storm Warning Signals:

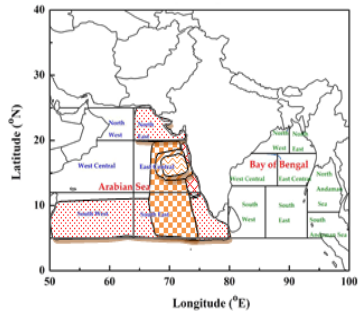
Likely impacts and actions : Depending on intensity of the storm.



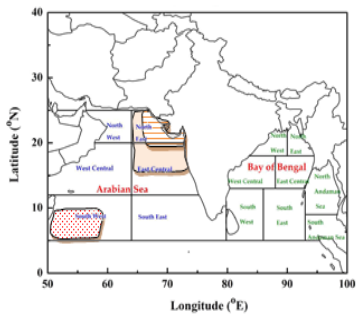
Fishermen Warning Bulletins:

INDIA METEOROLOGICAL DEPARTMENT FISHERMAN WARNING FOR BAY OF BENGAL AND ARABIAN SEA

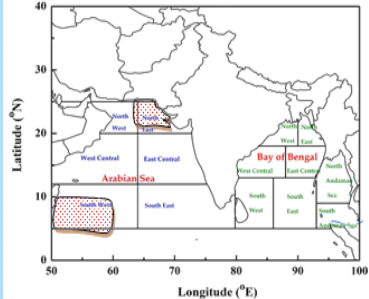
DAY-1: 16.05.2021/0600 UTC TO 17.05.2021/0600 UTC



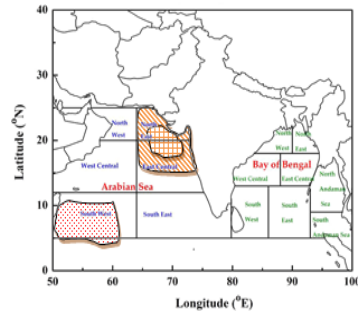
DAY-3: 18.05.2021/0600 UTC TO 19.05.2021/0600 UTC



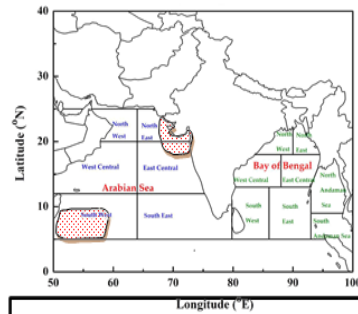
DAY-5: 20.05.2021/0600 UTC TO 21.05.2021/0600 UTC



DAY-2: 17.05.2021/0600 UTC TO 18.05.2021/0600 UTC



DAY-4: 19.05.2021/0600 UTC TO 20.05.2021/0600 UTC



AREA UNDER FISHERMEN WARNING

- (SQ. WEATHER) 40-50 KMPH G TO 60 KMPH
- 50-60 KMPH GUSTING TO 70 KMPH
- 60-70 KMPH GUSTING TO 80 KMPH
- 80-90 KMPH G TO 100 KMPH
- 100-110 KMPH GUSTING TO 125 KMPH
- 110-120 KMPH G TO 125 KMPH
- 120-130 KMPH G TO 145 KMPH
- 145-155 KMPH G TO 170 KMPH
- 150-160 G TO 175 KMPH

- Issued whenever any one of the following is expected
 - (i) Wind speed expected to exceed 45 kmph
 - (ii) State of sea likely to be very rough or above,
 - (iii) Swells are expected,
 - (iv) Squally weather (fairly widespread to widespread rainfall & maximum sustained wind speed of 20 knots or more).
- Warnings are transmitted by telephone/FAX/email to AIR/Doordarshan stations in the maritime states.
- Warnings are broadcast four times a day (morning, mid-day, evening and night) by AIR in local language.
- During cyclone, issued every 3 hour for frequent broadcast.
- Warnings are uploaded on website and appended with other warning bulletins.
- Transmitted to fishery officials and registered fishermen through SMS/WhatsApp/Mobile App

Format of Coastal Weather Bulletin:

As in the case of sea area bulletins, the coastal weather bulletin is issued twice daily based on 03 & 12 UTC in normal weather, thrice a day based on 03, 12 & 18 UTC in case of depression/deep depression stage and 5/6 times a day at 00, 03, 06, 09, 12 & 21 UTC in cyclone stage. In undisturbed weather, the two bulletins issued are based on 0300 and 1200 UTC charts and they are called Daily One and Daily Two, corresponding to Aurora and Balloon sea area bulletins. However, during periods of disturbed weather, when Extra, Storm or Special sea area bulletins are issued, corresponding coastal bulletins are also to be issued for the particular coast which is likely to be affected, necessitating the hoisting of signals of LC-III and above at the ports. If local weather along a coast is not affected by the disturbance, additional coastal bulletins for the coast need not be issued. Each bulletin (*Daily*, *Extra*, *Storm* and *Special*) contains the following information in the order given below:

- (1) Name of coastal Strip
- (2) Synoptic system, if any, affecting the weather over the coastal strip and its movement in the case of depressions and cyclonic storms.
- (3) Period of validity of forecast.
- (4) Forecast of wind, weather, visibility and state of sea for the coastal strip.
- (5) Information about storm warning signals, if any, hoisted at ports on the coastal strip concerned.
- (6) Information on storm surges/tidal waves (whenever necessary).

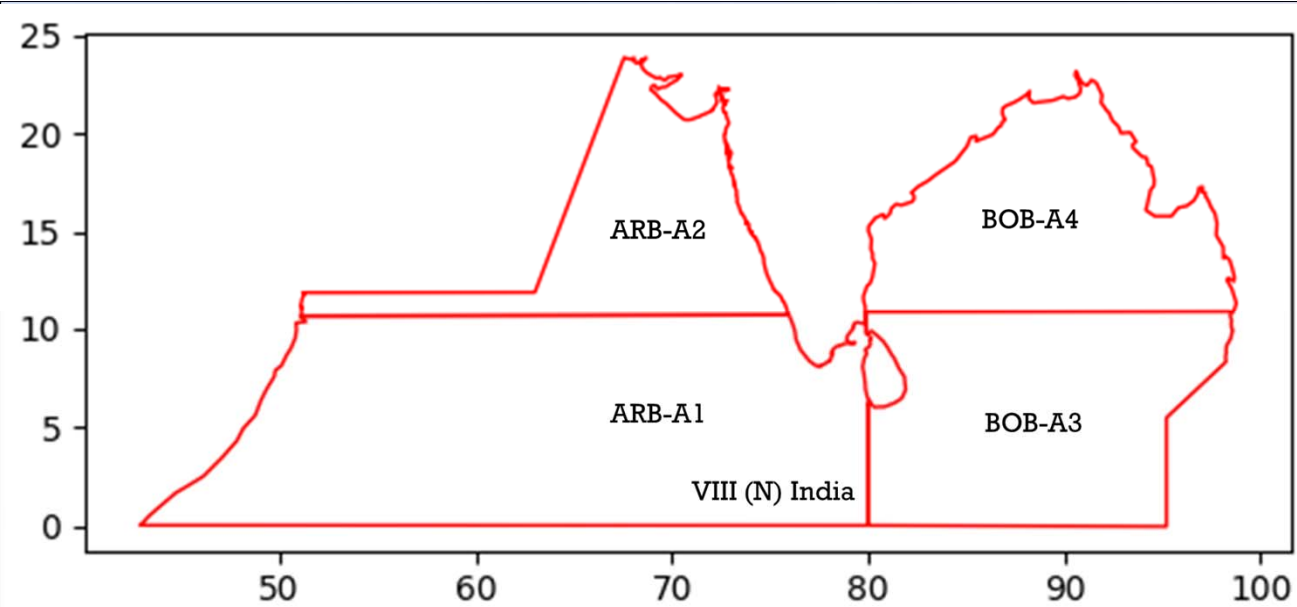
Development of NWP Products for Marine Services



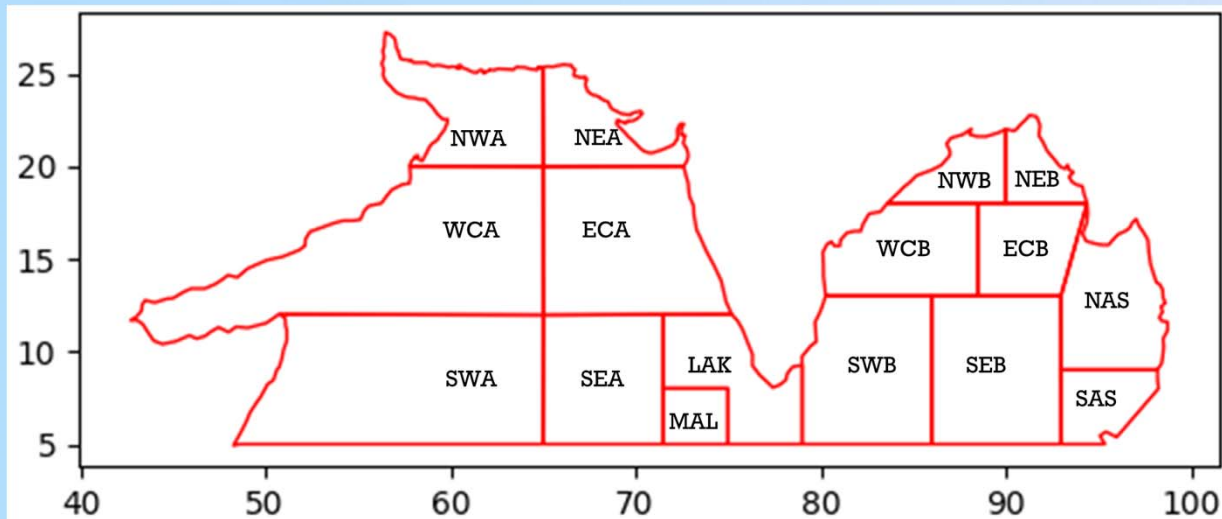
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INDIA METEOROLOGICAL DEPARTMENT



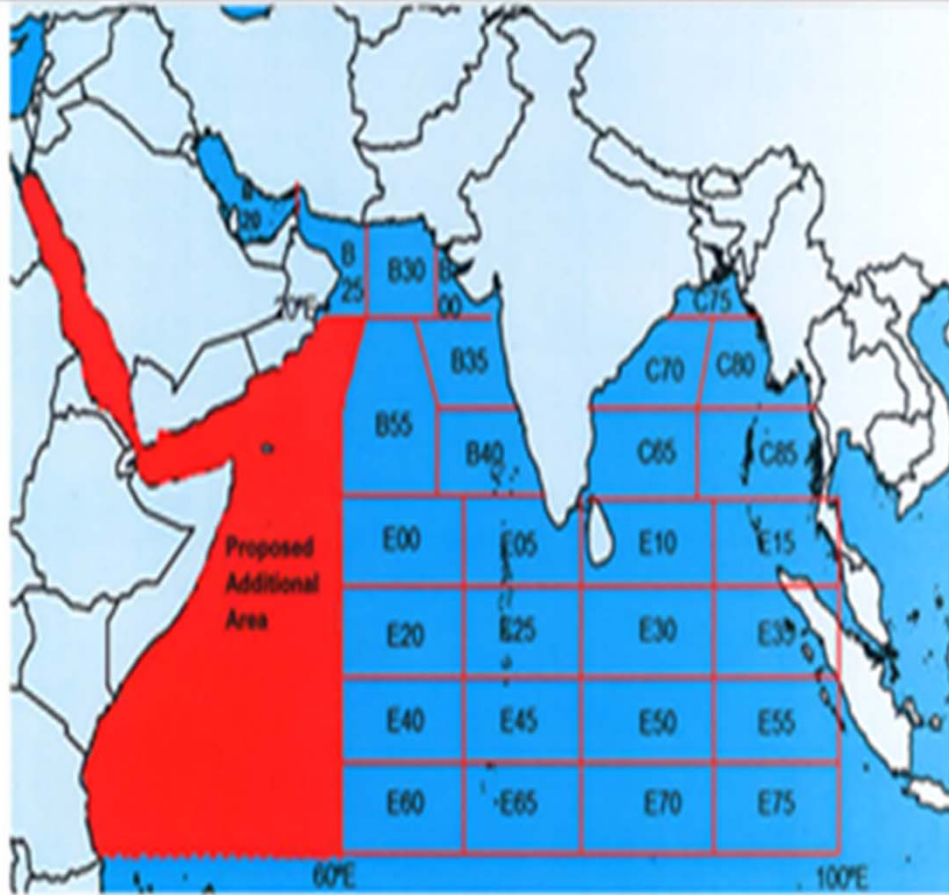
1. Global Maritime Distress Safety System (GMDSS) Domain



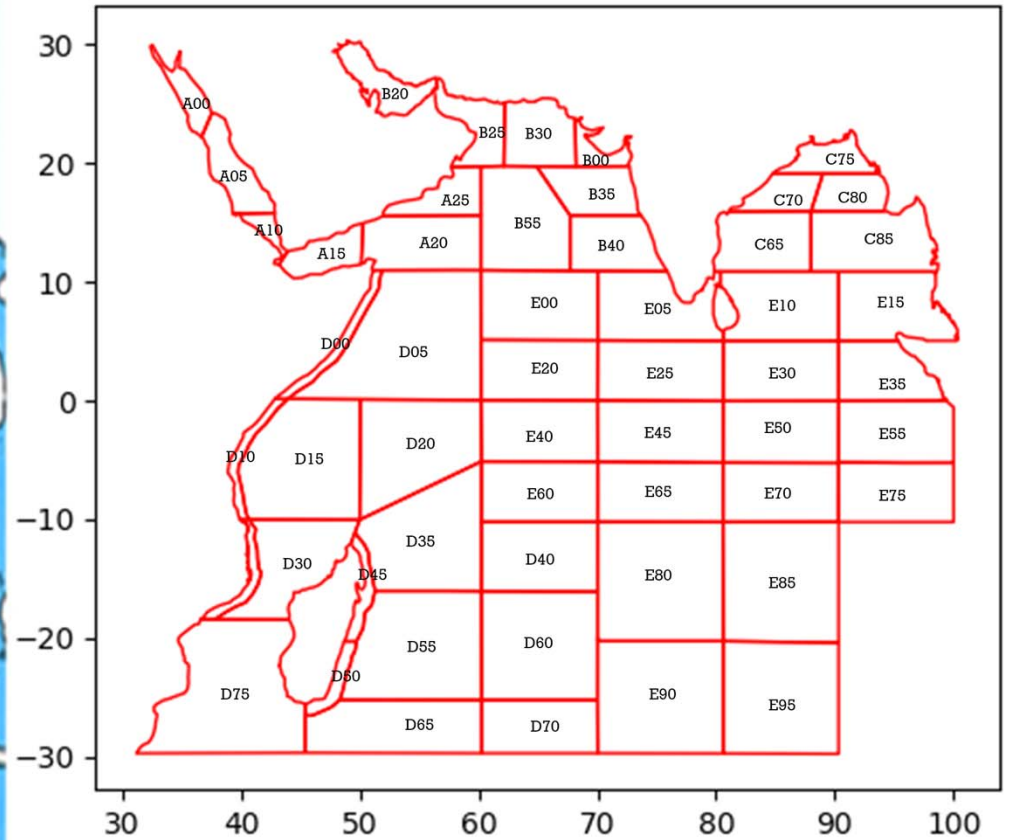
2. Sea Area



Additional proposed Area (Red) of responsibility of IMD included for fleet forecast



3. Fleet Domain for India Navy



PARAMETERS

- 1. Rainfall Intensity:** It is the average rainfall amount over the shape regions of the domain
- 2. Wind Speed and Direction:** Wind speed is the average values over the region and their average instant direction.
- 3. Rainfall Distribution:** It is defined as the percentage rainfall over the grid points exceeds the 2.5 mm rainfall over the shape of the regions.

Spatial Distribution of Rainfall	Descriptive term used	Criteria for observed
Dry	Dry	No stations/grid points reported/expected rainfall
Isolated	One or two places	<25% of stations/grid points to get rainfall
Scattered	At a few places	(26-50) % of stations/grid points to get rainfall
Fairly Widespread	At many places	(51-75) % of stations/grid points to get rainfall
Widespread	At most place	(76-100) % of stations/grid points to get rainfall

4. Horizontal Visibility: It is estimated based on the Rainfall distribution as Table 10.5. The range of estimated Visibility is given in Nautical Miles.
Horizontal Visibility estimation from Rainfall distribution

Spatial distribution of rainfall/Intensity of rainfall	Estimated Visibility (Nautical Miles)
Fair	8-10
Isolated	6-8
Scattered	4-6
Fairly widespread	3-4
Widespread	2-3
Fairly widespread/ widespread with heavy rainfall	<2

5. Wind Driven Significant Wave Height: Some important terminology used in the bulletin pertain to description of sea Conditions, amount/intensity of heavy rainfall, distribution of rainfall

	Significant wave height	Descriptive term	Height Meters	Wind speed Knots(kmph)	Beaufort Scale
1.	0	Calm (Glassy)	0	0	0
2.	0.1	Calm (Rippled)	0-0.1	1-3 (2-6)	1
3.	0.5	Smooth (Waveless)	0.1-0.5	4-10 (7-19)	2-3
4.	1.25	Slight	0.5-1.25	11-16 (20-30)	4
5.	2.5	Moderate	1.25-2.5	17-21 (31-39)	5
6.	4	Rough	2.5-4.0	22-27 (41-50)	6
7.	6	Very Rough	4.0-6.0	28-33 (52-61)	7
8.	9	High	6.0-9.0	34-40 (63-74)	8
9.	14	Very High	9.0-14.0	41-63 (76-117)	9-11
10.	20	Phenomenal	Over 14	64 or above (119 or above)	12

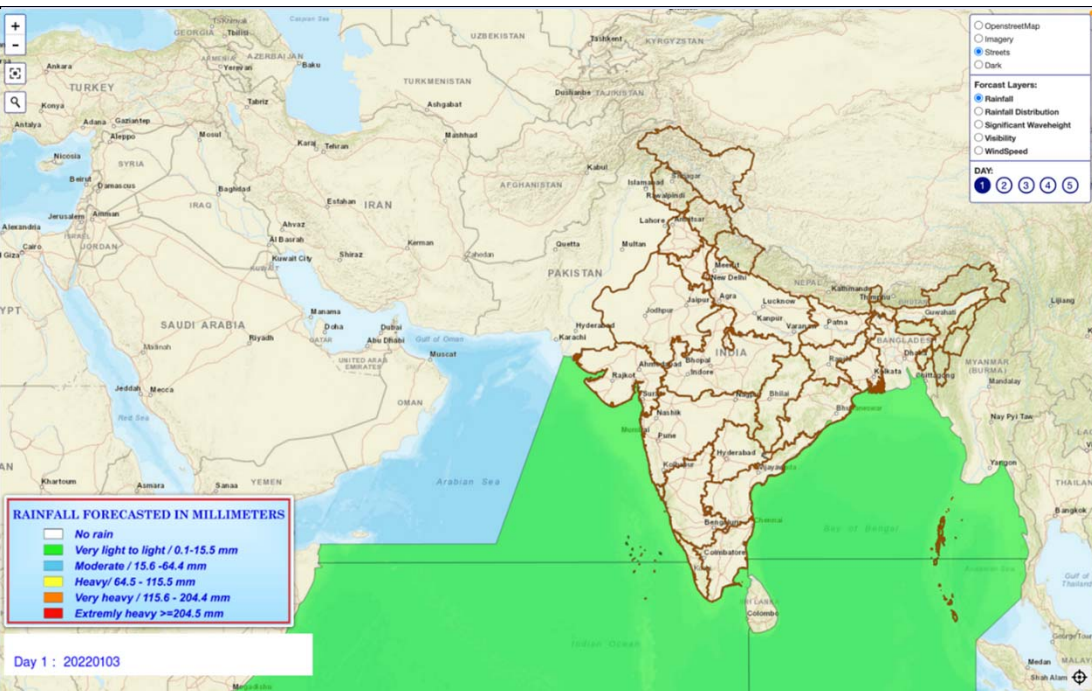
6. Heavy Rainfall Distribution: It is based on the rainfall intensity greater than the maximum range values of rain amount given in the table:

	Rainfall	Rain amount (mm)
1.	Very Light to light Rainfall	0.1-15.5
2.	Moderate Rainfall	15.6-64.4
3.	Heavy Rainfall	64.5-115.5
4.	Very Heavy Rainfall	115.6-204.4
5.	Extremely Heavy Rainfall	>=204.5

Data from FIVE Operational Global Models

S. NO.	OPERATIONAL GLOBAL MODELS	RESOLUTION
1.	IMD-GFS	~12km
2.	IMD-GEFS	~12km
3.	JMA	~25km
4.	NCEP-GFS	~25km
5	NCUM (NCMRWF)	~12km

S. No.	Operational Global Models	Variables (CSV) Format
1.	IMD-GFS	1. Wind speed & direction, 2. Rainfall Intensity, 3. Rainfall Distribution, 4. Significant Wave Height, 5. Visibility, 6. Heavy Rainfall Distribution
2.	IMD-GEFS	1. Wind speed & direction, 2. Rainfall Intensity, 3. Rainfall Distribution, 4. Significant Wave Height, 5. Visibility, 6. Heavy Rainfall Distribution
3.	JMA	1. Wind speed & direction, 2. Rainfall Intensity, 3. Rainfall Distribution, 4. Significant Wave Height, 5. Visibility, 6. Heavy Rainfall Distribution
4.	NCEP-GFS	1. Wind speed & direction, 2. Rainfall Intensity, 3. Rainfall Distribution, 4. Significant Wave Height, 5. Visibility, 6. Heavy Rainfall Distribution
5.	NCUM (NCMRWF)	1. Wind speed & direction, 2. Rainfall Intensity, 3. Rainfall Distribution, 4. Significant Wave Height, 5. Visibility, 6. Heavy Rainfall Distribution



Implemented for 00 UTC and 12 UTC

1. Sea Area

http://103.215.208.18/dwr_img/GIS/seaarea/

2. Fleet forecast

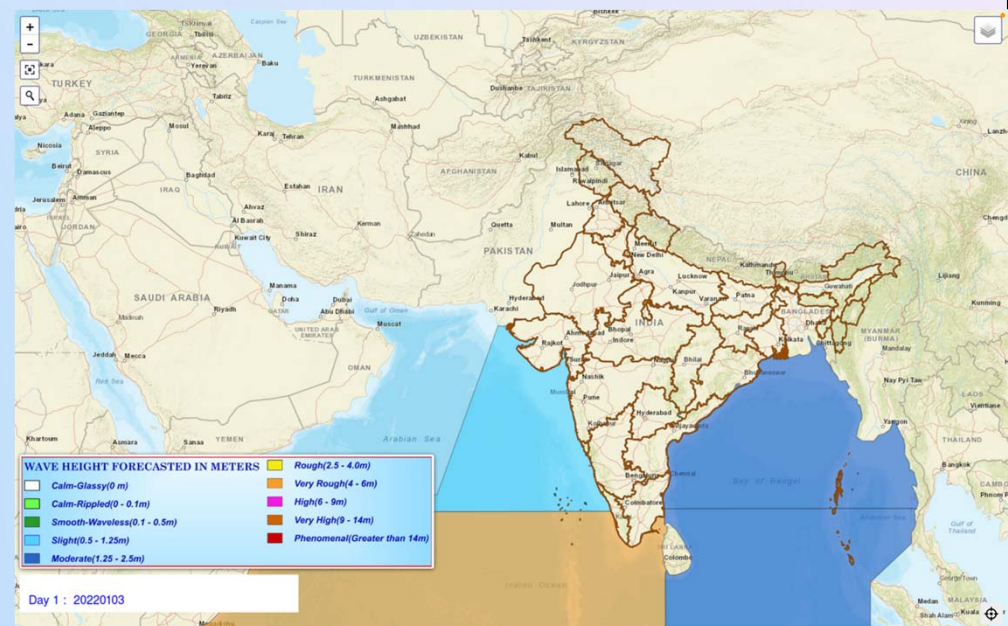
http://103.215.208.18/dwr_img/GIS/fleet/

3. GMDSS

http://103.215.208.18/dwr_img/GIS/gmdss/

4. 2X2 degree

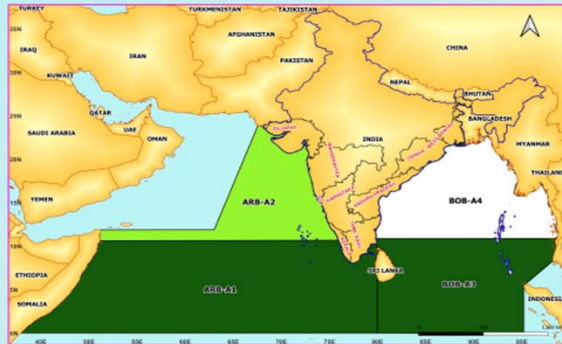
http://103.215.208.18/dwr_img/GIS/two/



GRAPHICAL GMDSS FORECAST GUIDANCE

RAINFALL SPATIAL DISTRIBUTION

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



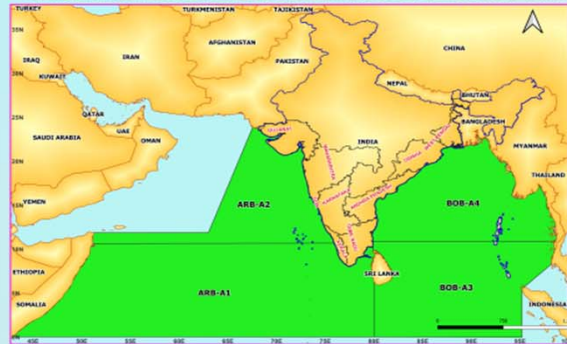
RAINFALL SPATIAL DISTRIBUTION FORECASTED IN PERCENTAGE

- White: Dry/at no places
- Light Green: Isolated/at one or two places(1-25%)
- Medium Green: Scattered/at a few places(26-50%)
- Dark Green: Fairly Widespread/at many places(51-75%)
- Dark Blue: Widespread/at most places(76-100%)

GRAPHICAL GMDSS FORECAST GUIDANCE

RAINFALL INTENSITY

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



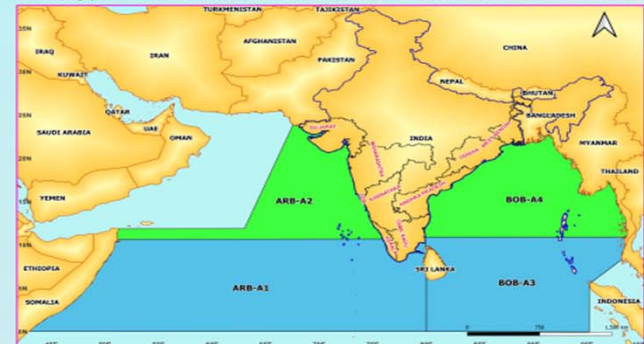
RAINFALL FORECASTED IN MILLIMETERS

- White: No Rain
- Light Green: Very light to light (0.1 - 15.5 mm)
- Medium Green: Moderate (15.6 - 64.4 mm)
- Dark Green: Very heavy (64.5 - 115.5 mm)
- Dark Blue: Extremely heavy (>=204.5 mm)

GRAPHICAL GMDSS FORECAST GUIDANCE

HORIZONTAL VISIBILITY

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



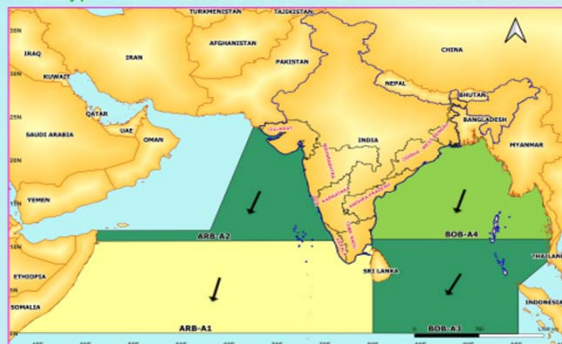
HORIZONTAL VISIBILITY FORECASTED IN NAUTICAL MILES/METERS

- White: 10 - 8 NM/19-15km
- Light Green: 8 - 6 NM/15-11km
- Medium Green: 6 - 4 NM/11-7km
- Dark Green: 4 - 3 NM/7-6km
- Dark Blue: 3 - 2 NM/6-4km
- Dark Blue: Less than 2NM/4km

GRAPHICAL GMDSS FORECAST GUIDANCE

MEAN MAXIMUM SUSTAINED SURFACE (10 m) WIND

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



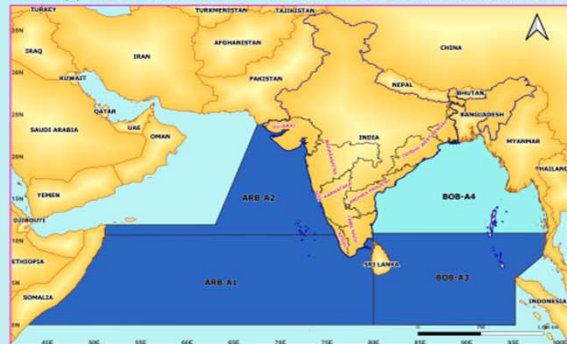
MEAN MAXIMUM SUSTAINED SURFACE WIND

- White: Less than 17 knots/Less than 31kmph
- Light Green: 17-21 knots/31-39kmph
- Medium Green: 22-27 knots/40-49kmph
- Dark Green: 28-33 knots/50-61kmph
- Dark Blue: 34-47 knots/62-87kmph
- Dark Blue: 48-63 knots/88-117kmph
- Dark Blue: 64-89 knots/118-167kmph
- Dark Blue: 90-119 knots/168-221kmph
- Dark Blue: 120 knots and more/222kmph and more

GRAPHICAL GMDSS FORECAST GUIDANCE

SIGNIFICANT WIND GENERATED WAVE HEIGHT

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



WAVE HEIGHT FORECASTED IN METERS

- White: Calm-Glassy (0 m)
- Light Green: Calm-Rippled (0 - 0.1m)
- Medium Green: Smooth-Waveless (0.1 - 0.5m)
- Dark Green: Slight (0.5 - 1.25m)
- Dark Blue: Moderate (1.25 - 2.5m)
- Dark Blue: Rough (2.5 - 4.0m)
- Dark Blue: Very Rough (4 - 6m)
- Dark Blue: High (6 - 9m)
- Dark Blue: Very High (9 - 14m)
- Dark Blue: Phenomenal (Greater than 14m)

Global Maritime Distress Safety System(GMDSS) Bulletin

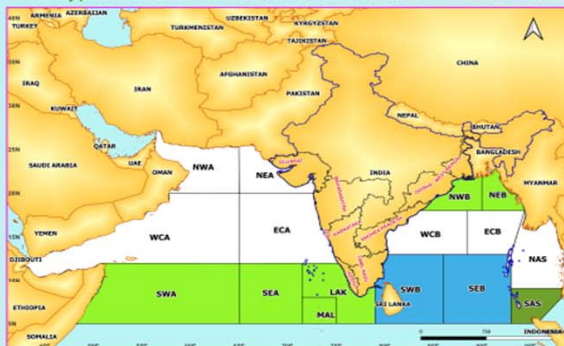
Demo Link for GMDSS product

http://103.215.208.18/dwr_img/GIS/gmdss/

GRAPHICAL SEA AREA FORECAST GUIDANCE

RAINFALL SPATIAL DISTRIBUTION

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



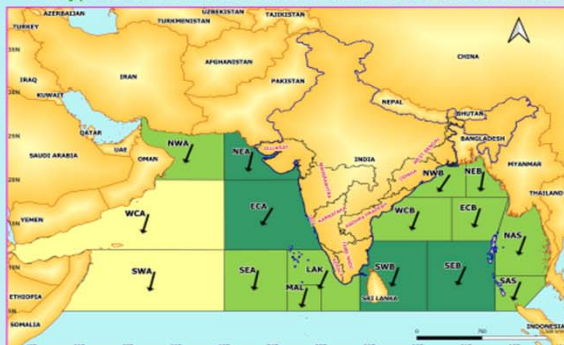
RAINFALL SPATIAL DISTRIBUTION FORECASTED IN PERCENTAGE

- White: Dry/at no places
- Light Green: Isolated/at one or two places(1-25%)
- Medium Green: Scattered/at a few places(26-50%)
- Dark Green: Fairly Widespread/ at many places(51-75%)
- Blue: Widespread/at most places(76-100%)

GRAPHICAL SEA AREA FORECAST GUIDANCE

MEAN MAXIMUM SUSTAINED SURFACE (10 m) WIND

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



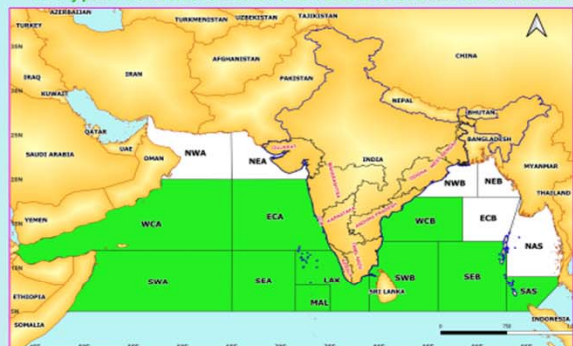
MEAN MAXIMUM SUSTAINED SURFACE WIND

- White: Less than 17 knots/Less than 31kmph
- Light Green: 17-21 knots/31-39kmph
- Medium Green: 22-27 knots/40-49kmph
- Dark Green: 28-33 knots/50-61kmph
- Yellow: 34-47 knots/62-87kmph
- Orange: 48-63 knots/88-117kmph
- Red: 64-89 knots/118-167kmph
- Dark Red: 90-119 knots/168-221kmph
- Blue: 120 knots and more/222kmph and more

GRAPHICAL SEA AREA FORECAST GUIDANCE

RAINFALL INTENSITY

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



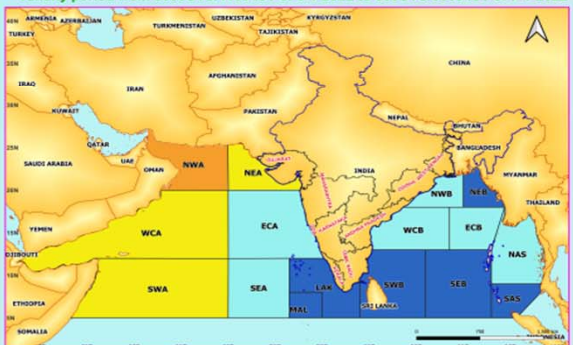
RAINFALL FORECASTED IN MILLIMETERS

- White: No Rain
- Light Blue: Moderate (15.6 - 64.4 mm)
- Medium Blue: Very light to light (0.1 - 15.5 mm)
- Dark Blue: Very heavy (115.5 - 204.4 mm)
- Red: Extremely heavy (>=204.5 mm)

GRAPHICAL SEA AREA FORECAST GUIDANCE

SIGNIFICANT WIND GENERATED WAVE HEIGHT

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



WAVE HEIGHT FORECASTED IN METERS

- White: Calm-Glassy (0 m)
- Light Green: Calm-Rippled (0 - 0.1m)
- Medium Green: Smooth-Waveless (0.1 - 0.5m)
- Dark Green: Slight (0.5 - 1.25m)
- Blue: Moderate (1.25 - 2.5m)
- Yellow: Rough (2.5 - 4.0m)
- Orange: Very Rough (4 - 6m)
- Red: High (6 - 9m)
- Dark Red: Very High (9 - 14m)
- Blue: Phenomenal (Greater than 14m)

GRAPHICAL SEA AREA FORECAST GUIDANCE

HORIZONTAL VISIBILITY

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



HORIZONTAL VISIBILITY FORECASTED IN NAUTICAL MILES/METERS

- White: 10 - 8 NM/19-15km
- Light Green: 8-6 NM/15-11km
- Medium Green: 6-4 NM/11-7km
- Dark Green: 4-3 NM/7-6km
- Blue: 3-2 NM/6-4km
- Red: Less than 2NM/4km

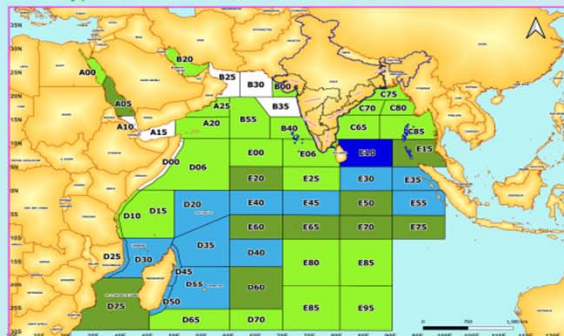
Sea Area Bulletin Graphics

http://103.215.208.18/dwr_img/GIS/seaarea/

GRAPHICAL FLEET FORECAST GUIDANCE

RAINFALL SPATIAL DISTRIBUTION

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



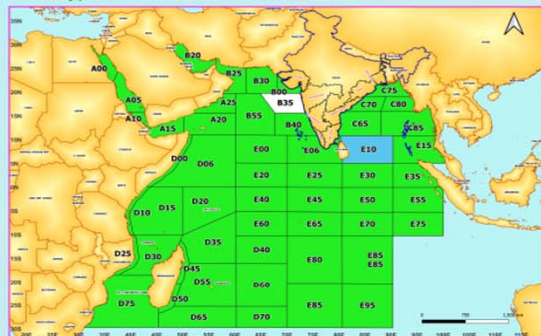
RAINFALL SPATIAL DISTRIBUTION FORECASTED IN PERCENTAGE

- White: Dry/at no places
- Light Green: Isolated/at one or two places(1-25%)
- Medium Green: Scattered/at a few places(26-50%)
- Dark Green: Fairly Widespread/ at many places(51-75%)
- Blue: Widespread/at most places(76-100%)

GRAPHICAL FLEET FORECAST GUIDANCE

RAINFALL INTENSITY

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



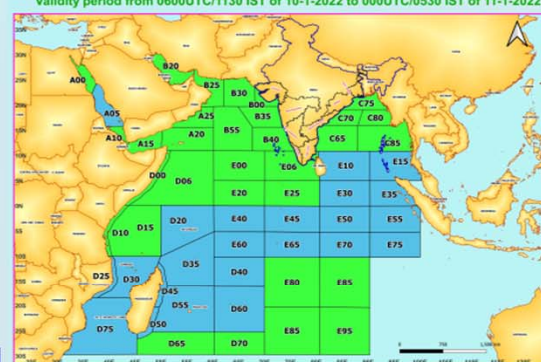
RAINFALL FORECASTED IN MILLIMETERS

- White: No Rain
- Light Green: Very light to light (0.1 - 15.5 mm)
- Medium Green: Moderate (15.6 - 64.4 mm)
- Dark Green: Heavy (64.5 - 115.5 mm)
- Orange: Very heavy (115.5 - 204.4 mm)
- Red: Extremely heavy (≥ 204.5 mm)

GRAPHICAL FLEET FORECAST GUIDANCE

HORIZONTAL VISIBILITY

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



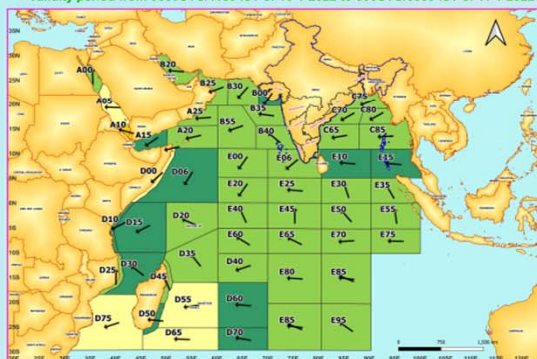
HORIZONTAL VISIBILITY FORECASTED IN NAUTICAL MILES/METERS

- Light Green: 10 - 8 NM/19-15km
- Medium Green: 8-6 NM/15-11km
- Dark Green: 6-4 NM/11-7km
- Orange: 4-3 NM/7-6km
- Red: 3-2 NM/6-4km
- Dark Red: Less than 2NM/4km

GRAPHICAL FLEET FORECAST GUIDANCE

MEAN MAXIMUM SUSTAINED SURFACE (10 m) WIND

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



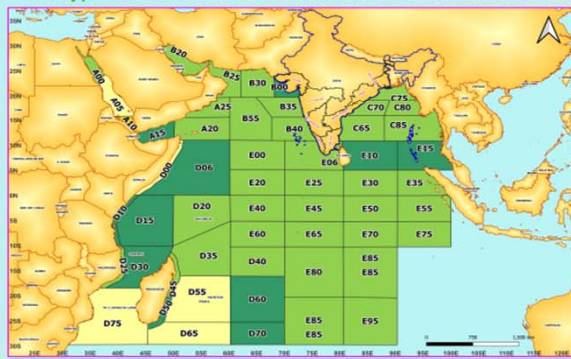
MAXIMUM SUSTAINED SURFACE WIND

- Light Green: Less than 17 knots/Less than 31kmph
- Medium Green: 17-21 knots/31-39kmph
- Dark Green: 22-27 knots/40-49kmph
- Orange: 28-33 knots/50-61kmph
- Light Orange: 34-47 knots/62-87kmph
- Dark Orange: 48-63 knots/88-117kmph
- Red: 64-89 knots/118-167kmph
- Dark Red: 90-119 knots/168-221kmph
- Dark Red: 120 knots and more/222kmph and more

GRAPHICAL FLEET FORECAST GUIDANCE

SIGNIFICANT WIND GENERATED WAVE HEIGHT

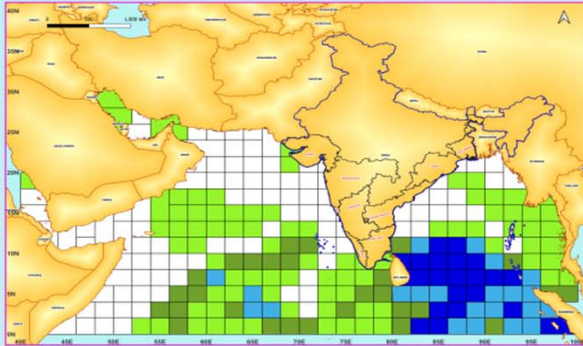
Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



GRAPHICAL 2x2 DEGREE FLEET FORECAST GUIDANCE

RAINFALL SPATIAL DISTRIBUTION

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



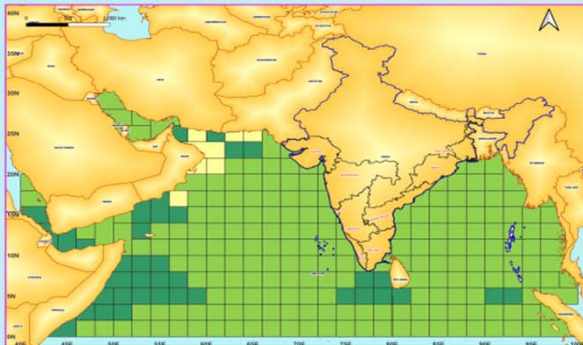
RAINFALL SPATIAL DISTRIBUTION FORECASTED IN PERCENTAGE

- White box: Dry/at no places
- Light green box: Isolated/at one or two places(1-25%)
- Medium green box: Scattered/at a few places(26-50%)
- Dark green box: Fairly Widespread/ at many places(51-75%)
- Blue box: Widespread/at most places(76-100%)

GRAPHICAL 2x2 DEGREE FLEET FORECAST GUIDANCE

MAXIMUM SUSTAINED SURFACE (10 m) WIND

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



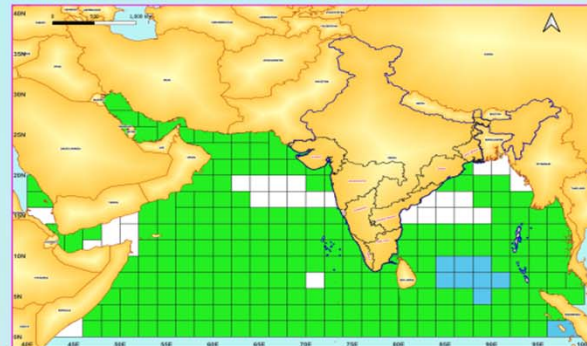
MAXIMUM SUSTAINED SURFACE WIND

- Light green box: Less than 17 knots/Less than 31 kmph
- Medium green box: 17-21 knots/31-39 kmph
- Dark green box: 22-27 knots/40-49 kmph
- Blue box: 28-33 knots/50-61 kmph
- Orange box: 34-47 knots/62-87 kmph
- Red box: 48-63 knots/88-117 kmph
- Dark red box: 64-89 knots/118-167 kmph
- Dark blue box: 90-119 knots/168-221 kmph
- Black box: 120 knots and more/222 kmph and more

GRAPHICAL 2x2 DEGREE FLEET FORECAST GUIDANCE

RAINFALL INTENSITY

Validity period from 0600UTC/1130 IST of 10-1-2022 to 000UTC/0530 IST of 11-1-2022



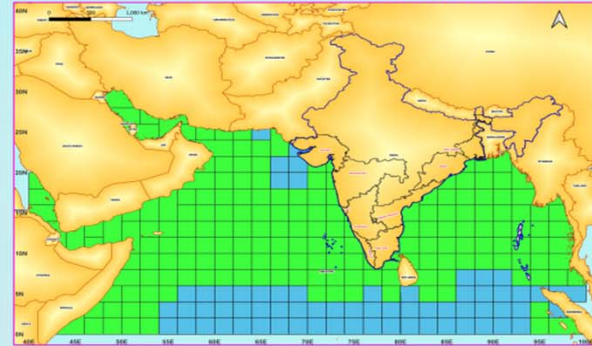
RAINFALL FORECASTED IN MILLIMETERS

- White box: No Rain
- Light green box: Very light to light (0.1 - 15.5 mm)
- Medium green box: Moderate (15.6 - 64.4 mm)
- Dark green box: Heavy (64.5 - 115.5 mm)
- Red box: Very heavy (115.5 - 204.4 mm)
- Dark red box: Extremely heavy (≥ 204.5 mm)

GRAPHICAL 2x2 DEGREE FLEET FORECAST GUIDANCE

HORIZONTAL VISIBILITY

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



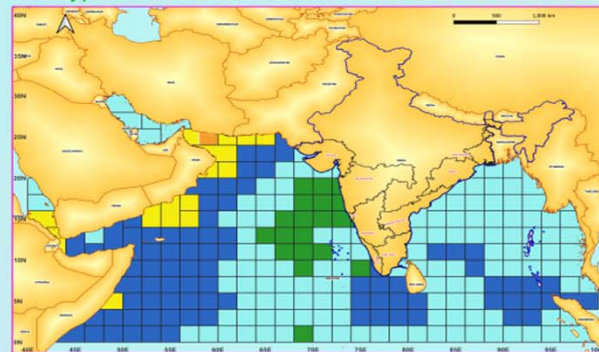
HORIZONTAL VISIBILITY FORECASTED IN NAUTICAL MILES/METERS

- Light green box: 10 - 8 NM/19-15km
- Medium green box: 8 - 6 NM/15-11km
- Dark green box: 6 - 4 NM/11-7km
- Blue box: 4 - 3 NM/7-6km
- Dark blue box: 3 - 2 NM/6-4km
- Red box: Less than 2NM/4km

GRAPHICAL 2x2 DEGREE FLEET FORECAST GUIDANCE

SIGNIFICANT WIND GENERATED WAVE HEIGHT

Validity period from 0600UTC/1130 IST of 6-1-2022 to 000UTC/0530 IST of 7-1-2022



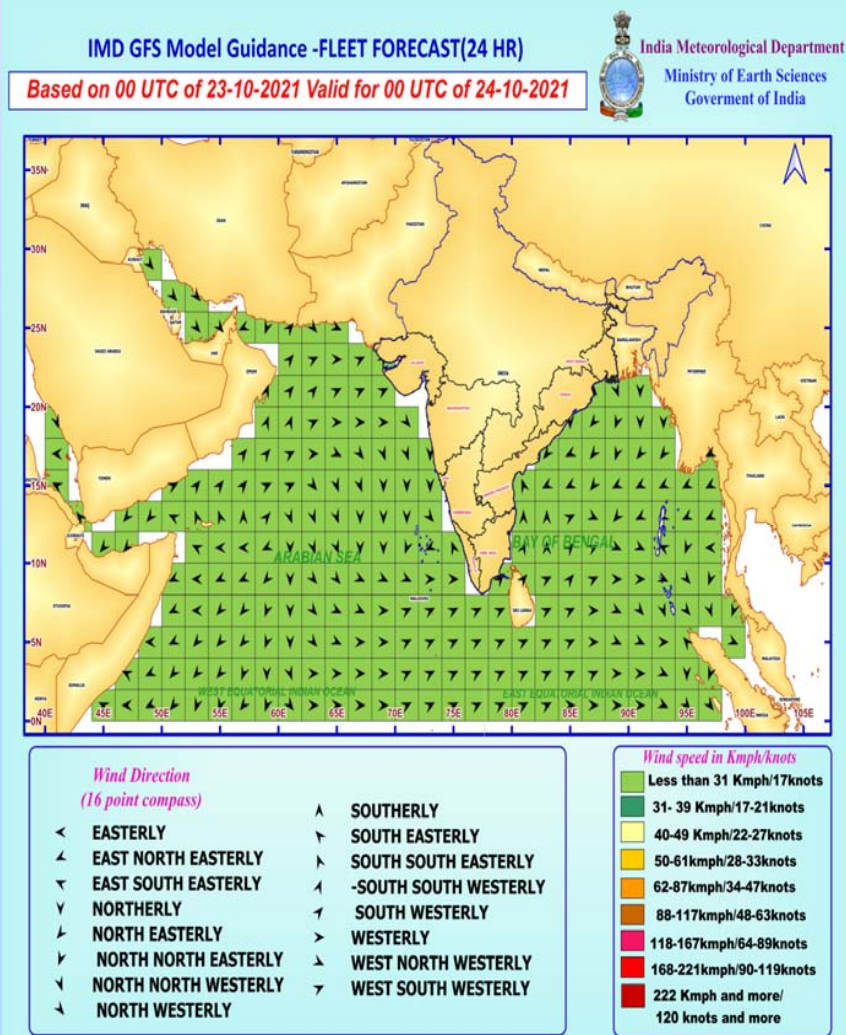
WAVE HEIGHT FORECASTED IN METERS

- White box: Calm-Glassy(0 m)
- Light green box: Calm-Rippled(0 - 0.1m)
- Medium green box: Smooth-Waveless(0.1 - 0.5m)
- Dark green box: Slight(0.5 - 1.25m)
- Blue box: Moderate(1.25 - 2.5m)
- Orange box: Rough(2.5 - 4.0m)
- Red box: Very Rough(4 - 6m)
- Dark red box: High(6 - 9m)
- Dark blue box: Very High(9 - 14m)
- Black box: Phenomenal(Greater than 14m)

2 deg X 2 deg forecast

http://103.215.208.18/dwr_img/GIS/two/

Sea Area bulletin



- Issued twice daily at 1430) & 2330 IST by IMD Kolkata for Bay of Bengal & IMD Mumbai for Arabian Sea.
- During Depression, additional bulletin at 0430 IST.
- During cyclone, additionally at 0830, 1730 IST.
- Bulletin has primarily six parts.
- ❖ **Part 1:** Information on type of weather system, location, speed of movement, extent of area affected, wind speed & direction in various sections of affected area
- ❖ **Part II :** Synoptic weather situation
- ❖ **Part III:** Forecast of (i) weather, (ii) wind and (iii) visibility.
- ❖ **Part IV:** Weather analysis.
- ❖ **Part V:** Observational data from ships in WMO codes.
- ❖ **Part VI:** Selected stations data & upper air reports.
- Broadcast by Navtex stations.
- Uploaded on IMD websites

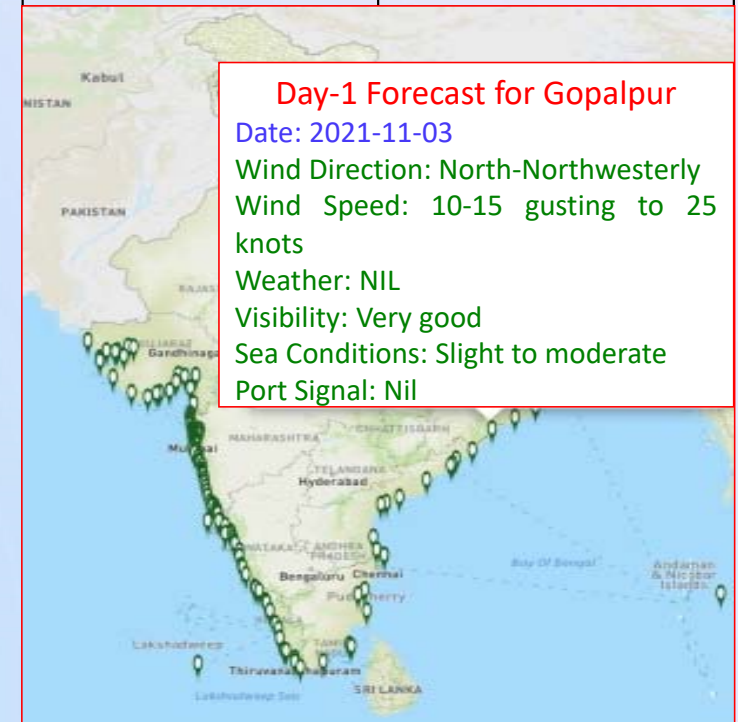
www.rsmcnewdelhi.imd.gov.in, www.mausam.imd.gov.in.

Coastal weather bulletins:

- For ships plying in coastal waters (within 40 nm from shoreline).
- Issued twice daily at 1430 & 2330 IST respectively
- During Depression, additional bulletin at 0430 IST.
- During cyclone, additional bulletin at 0830, 1730 IST.
- Bulletin has three parts:
 - ❖ Part 1: Information about storm
 - ❖ Part II: Synoptic weather situation
 - ❖ Part III: Information about wind, weather, visibility, sea condition and port warning
- Websites of IMD www.rsmcnewdelhi.imd.gov.in and www.mausam.imd.gov.in .
- Coastal stations forecast for about 150 places

- Broadcast by 7 NAVTEX stations through Control Centre, Mumbai.

NAVTEX Coast Station	
Veraval	Vakalpudi(AP)
Vengurla Point	Balasore(Odisha)
Muttan Point(TN)	Keating Point(A&N)
Porto Novo(TN)	



Coastal Weather Forecast



India Meteorological Department/ भारत मौसम विज्ञान विभाग
CWC BHUBANESWAR / सी.डब्ल्यू.सी भुवनेश्वर

Coastal Weather Bulletin

Daily One Bulletin Valid for 12 hrs from 00 UTC of 0000-00-00 to 12 UTC of -0001-11-30

Synoptic Situation	NIL
--------------------	-----

North Odisha coast

Wind	MAINLY NORTH-EASTERLY 10-15 KTS .
Weather	RAIN OR THUNDERSHOWER AT MOST PLACES.
Visibility	GOOD EXCEPT IN RAIN OR THUNDERSHOWER .
Sea Condition	SLIGHT.
Port Signal	NIL at all Ports

South Odisha coast

Wind	MAINLY NORTH-EASTERLY 10-15 KTS .
Weather	RAIN OR THUNDERSHOWER AT MOST PLACES.
Visibility	GOOD EXCEPT IN RAIN OR THUNDERSHOWER
Sea Condition	SLIGHT.
Port Signal	NIL at all Ports

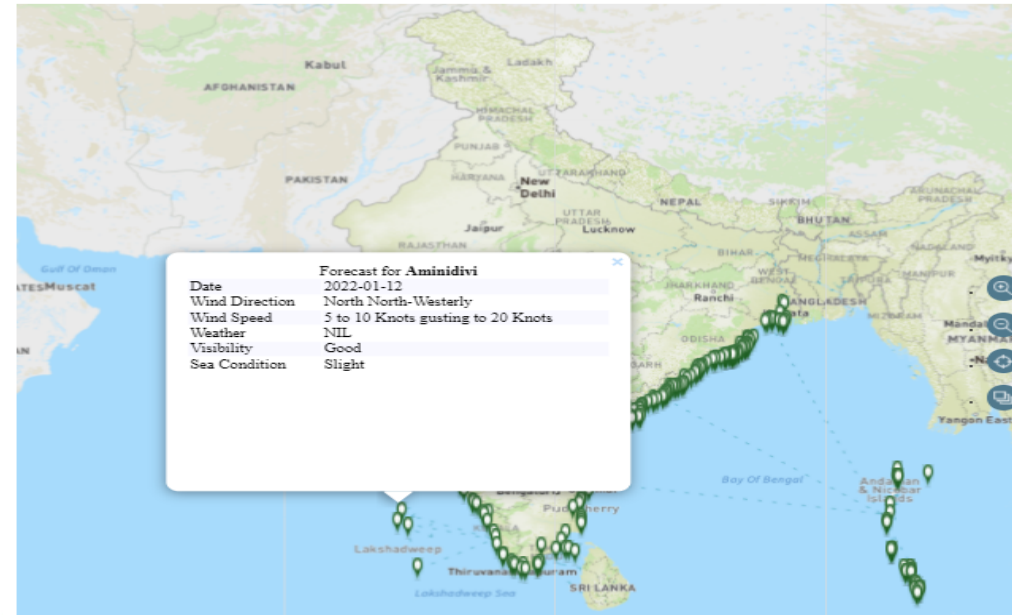
Time of Issue	07:50 UTC of 2022-01-12
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Print

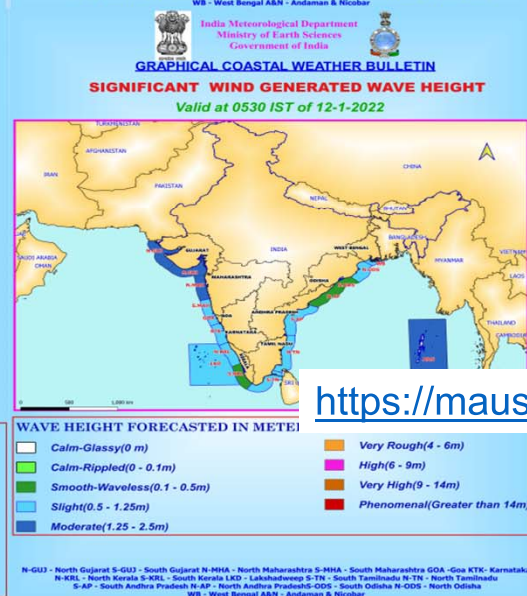
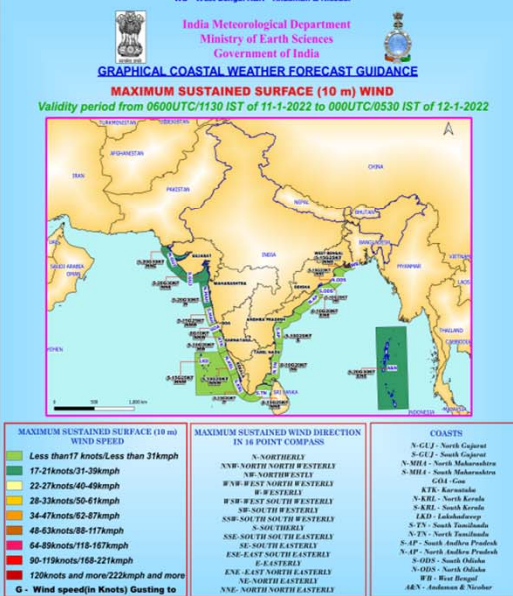
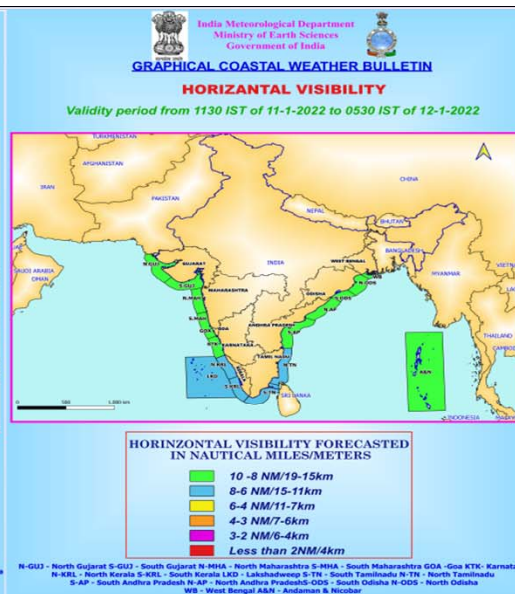
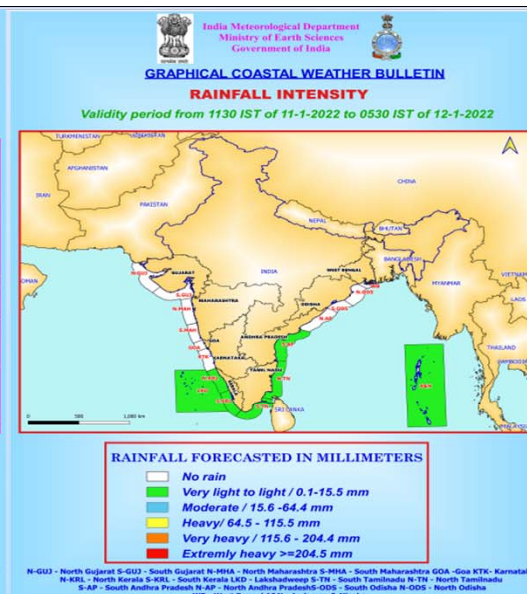
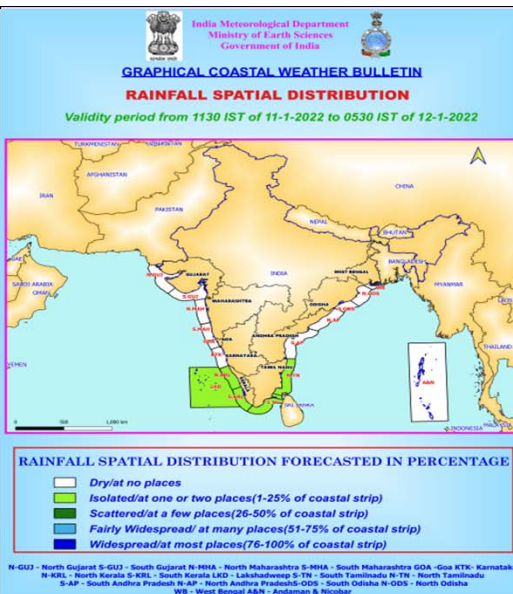
➤ Coastal Weather Bulletin valid for next 12 hours is being dynamically generated in real time basis by all ACWCs and CWCs

Coastal Station Forecast - Day 1

January 12, 2022 January 13, 2022 January 14, 2022 January 15, 2022 January 16, 2022



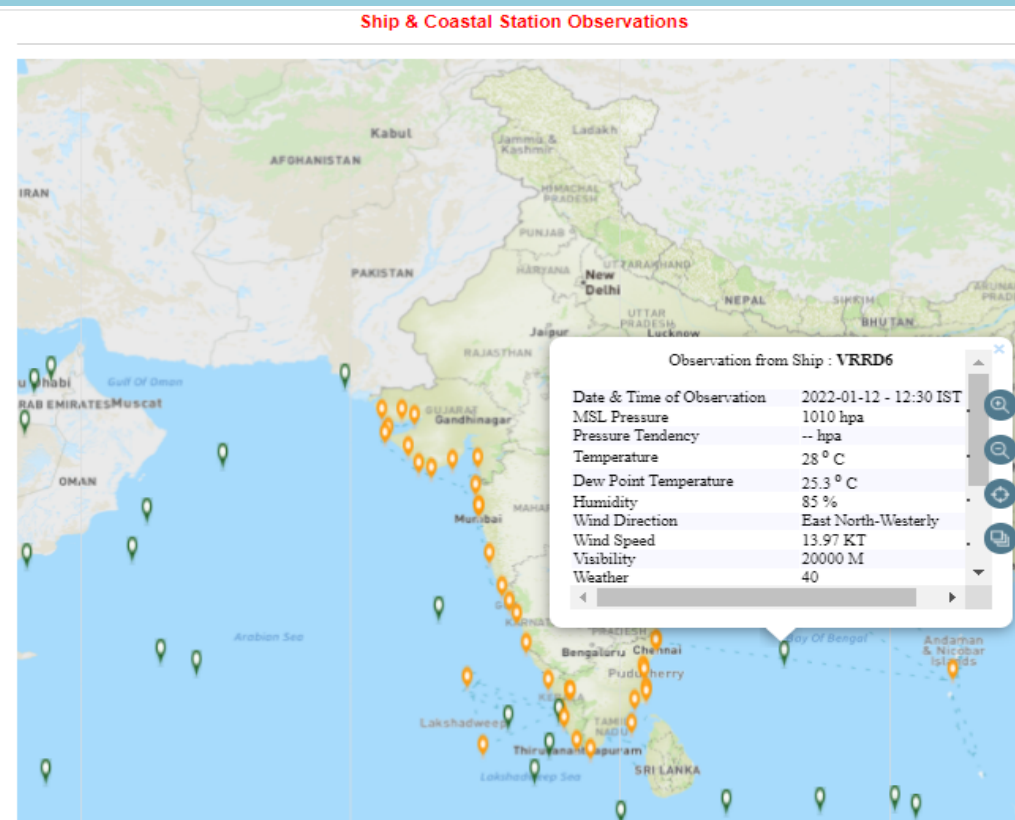
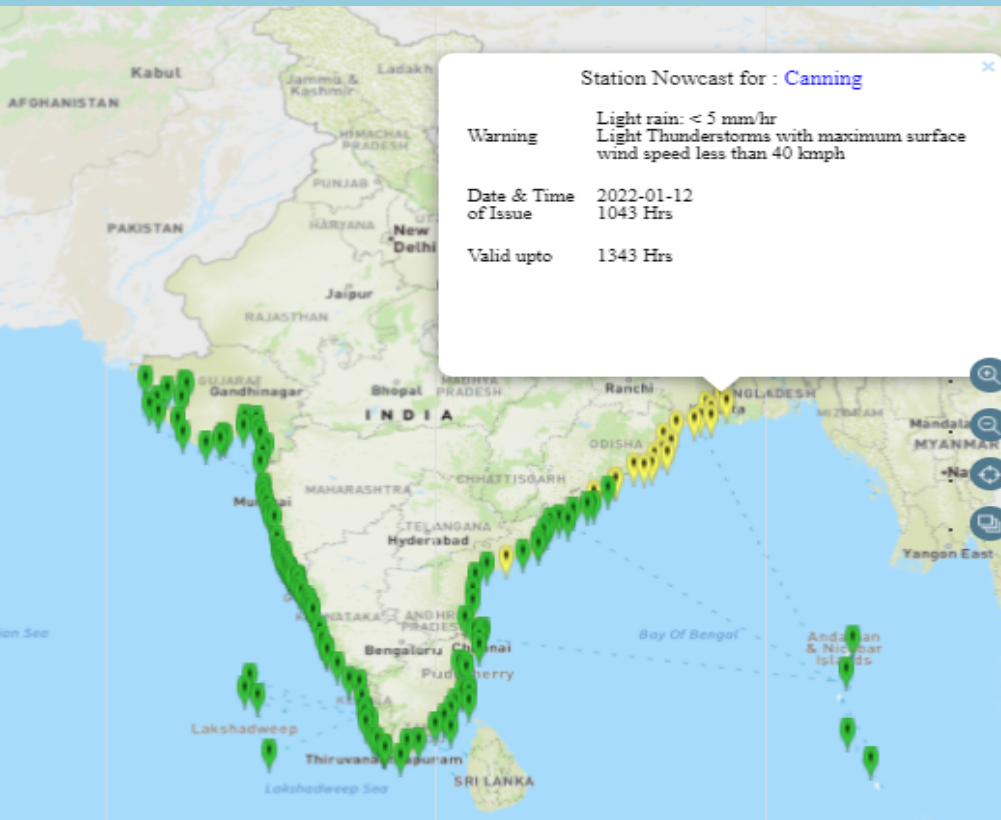
➤ Around 325 Coastal Station Forecast valid for next 5 days is being generated dynamically



Coastal Weather Bulletin Graphics

https://mausam.imd.gov.in/imd_latest/contents/coastal_forecast.php

Coastal Weather Forecast



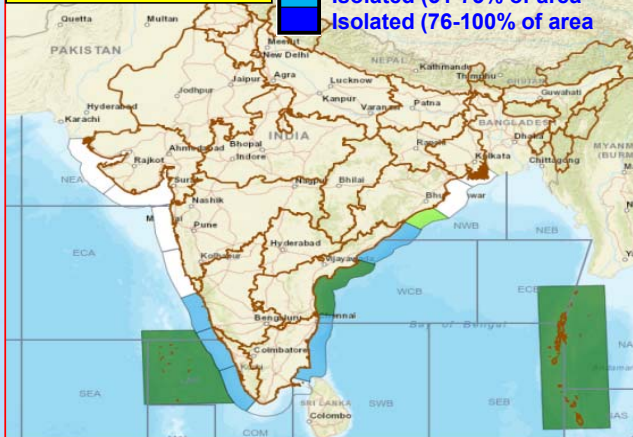
➤ Around 138 Nowcast Stations Forecast valid for next 3 hours is being issued.

➤ Ship and Coastal Weather observations for 75 stations are being displayed near real-time basis.

Interactive maps for coastal weather

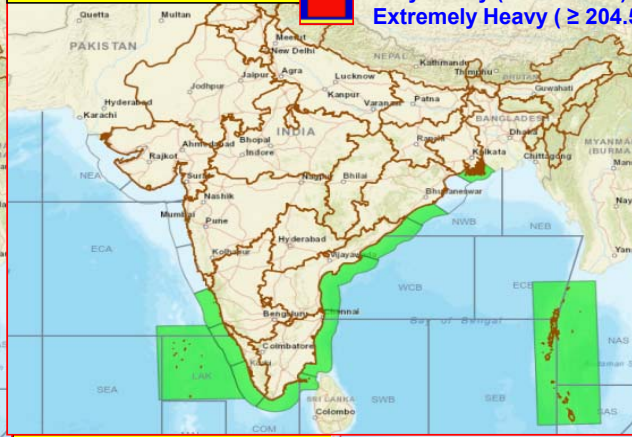
(i) Rainfall Distribution

Dry (Rainfall at no place
 Isolated (1-25% of area
 Scattered (26-50% of area
 Isolated (51-75% of area
 Isolated (76-100% of area



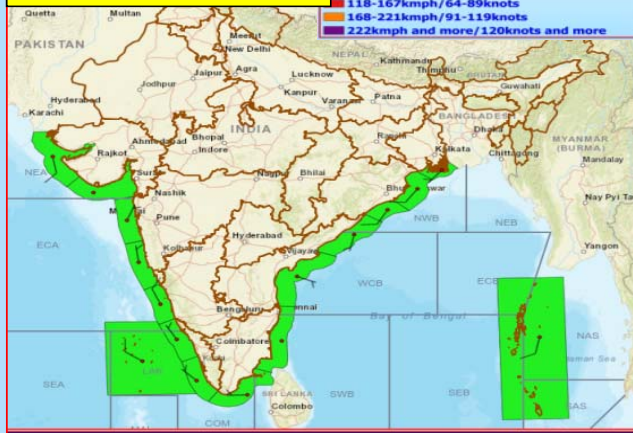
(ii) Rainfall Intensity (in mm)

Very light to light (0.1-15.5
 Moderate (15.6-64.4)
 Heavy (64.5-115.5
 Very Heavy (115.6-204.4)
 Extremely Heavy (≥ 204.5)



(iii) Winds over coastal water

forecast of wind over the coasts in Km/h/knots
 Less than 31kmph/17 knots
 31-39kmph/17-21knots
 40-49kmph/22-27knots
 50-61kmph/28-33knots
 62-87kmph/34-47knots
 88-117kmph/48-63knots
 118-167kmph/64-89knots
 168-221kmph/91-119knots
 222kmph and more/120knots and more



(iv) Wave Height

Wave height in meters
 Moderate to Rough (1.25 - 4.0 m)
 Very Rough (4.0 - 6.0m)
 High (6.0 - 9.0m)
 Very High (9.0 - 14.0m)
 Phenomenal (Greater than 14.0 m)



(v) Visibility

Forecasted Visibility for Coasts in Meters/ Nautical miles
 Greater than 2000 meters/ Greater than 1.08 nautical miles
 1000 - 2000 meters/ 0.54 - 1.08 nautical miles
 500 - 1000 meters/ 0.27 - 0.54 nautical miles
 less than 500 meters/ less than 0.27 nautical miles



http://103.215.208.18/dwr_img/GIS/coastal.html



India Meteorological Department/ भारत मौसम विज्ञान विभाग
ACWC MUMBAI / ए .सी .डब्ल्यू .सी मुंबई

Sea Area Bulletin

Bulletin Valid for 12 hrs from 05 UTC of 2022-04-06 to 17 UTC of 2022-04-06

TTT Warning	NIL
-------------	-----

Synoptic Situation	NIL
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North West Arabian Sea

Wind	East North-Easterly (Dir Value:52.4), 10 to 15 Knots gusting to 25 Knots (Mean Value:(Kts)10 Max Mean Value:(Kts) 15)
Weather	No Rain (Value:0.0)
Visibility	Excellent (Value :10.0)
Sea Condition	Smooth to Slight

North East Arabian Sea

Wind	East North-Easterly (Dir Value:64.4), 10 to 20 Knots gusting to 30 Knots (Mean Value:(Kts)10 Max Mean Value:(Kts) 20)
Weather	No Rain (Value:0.0)
Visibility	Excellent (Value :10.0)
Sea Condition	Smooth to Moderate

Raise hand (Ctrl + Shift + R)

West Central Arabian Sea

Wind	North North-Easterly (Dir Value:29.7), 5 to 20 Knots gusting to 30 Knots (Mean Value:(Kts)5 Max Mean Value:(Kts) 20)
Weather	No Rain (Value:0.0)
Visibility	Excellent (Value :10.0)
Sea Condition	Smooth to Moderate

East Central Arabian Sea

Wind	East North-Easterly (Dir Value:68.0), 10 to 20 Knots gusting to 30 Knots (Mean Value:(Kts)10 Max Mean Value:(Kts) 20)
Weather	Isolated Rain/ Thunderstorm (Value:2.0)
Visibility	Excellent (Value :10.0)
Sea Condition	Smooth to Moderate

...Thank You