Marine Weather Forecasting

Amit Bhardwaj

IMD, NEW DELHI
Outline

- Present Services rendered by IMD for GMDSS, Sea Area, Fleet, Fisherman, Coastal etc.

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
Organizational structure

At present, the cyclone warning/Marine services organization of the India Meteorological Department (IMD) has a 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).
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
(4) CWC Bhubaneswar: Odisha Coast
(5) CWC Visakhapatnam: Andhra Pradesh Coast
(6) CWC Thiruvananthapuram: Kerala coast, Karnataka Coast and Lakshadweep Islands
(7) 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
(4) CWC Bhubaneswar: Odisha Coast
(5) CWC Visakhapatnam: Andhra Pradesh Coast
(6) CWC Thiruvananthapuram: Kerala coast, Karnataka Coast and Lakshadweep Islands
(7) CWC Ahmedabad: Gujarat Coast
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.
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).
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 (.)
1) 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 (.)
III) WEATHER: ISOLATED R/A/T/S (.)
III) VISIBILITY: 8-6 NM (.)
IV) WAVE HEIGHT: 1.0-2.0 MTR (.)

A1-FORECAST FOR 48 HOURS
1) 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 OF 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 R/A/T/S (.)
2) REST AREA: SCATTERED R/A/T/S (.)
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 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.
Fleet Forecast For Indian Navy

Area
  - Bay of Bengal
  - Arabian Sea

Parameter Predicted
  - Wind
  - Weather
  - Visibility

Frequency of Bulletins
  - Twice Daily (Routine)
  - Additional SPECIAL two Bulletins Per Day During Cyclonic Storm Period

Users
  - Indian Navy

Mode of Transmission
  - By Fax
  - By Internet

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:

- 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

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.

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

<table>
<thead>
<tr>
<th>Spatial distribution of rainfall/Intensity of rainfall</th>
<th>Estimated Visibility (Nautical Miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fair</td>
<td>8-10</td>
</tr>
<tr>
<td>Isolated</td>
<td>6-8</td>
</tr>
<tr>
<td>Scattered</td>
<td>4-6</td>
</tr>
<tr>
<td>Fairly widespread</td>
<td>3-4</td>
</tr>
<tr>
<td>Widespread</td>
<td>2-3</td>
</tr>
<tr>
<td>Fairly widespread/widespread with heavy rainfall</td>
<td>&lt;2</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>Significant wave height</th>
<th>Descriptive term</th>
<th>Height Meters</th>
<th>Wind speed Knots(kmph)</th>
<th>Beaufort Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>0.1</td>
<td>0-0.1</td>
<td>1-3 (2-6)</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>0.5</td>
<td>0.1-0.5</td>
<td>4.10 (7-19)</td>
<td>2-3</td>
</tr>
<tr>
<td>4.</td>
<td>1.25</td>
<td>0.5-1.25</td>
<td>11-16 (20-30)</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>2.5</td>
<td>1.25-2.5</td>
<td>17-21 (31-39)</td>
<td>5</td>
</tr>
<tr>
<td>6.</td>
<td>4</td>
<td>2.5-4.0</td>
<td>22-27 (41-50)</td>
<td>6</td>
</tr>
<tr>
<td>7.</td>
<td>6</td>
<td>4.0-6.0</td>
<td>28-33 (52-61)</td>
<td>7</td>
</tr>
<tr>
<td>8.</td>
<td>9</td>
<td>6.0-9.0</td>
<td>34-40 (63-74)</td>
<td>8</td>
</tr>
<tr>
<td>9.</td>
<td>14</td>
<td>9.0-14.0</td>
<td>41-63 (76-117)</td>
<td>9-11</td>
</tr>
<tr>
<td>10.</td>
<td>20</td>
<td>Over 14</td>
<td>64 or above (119 or above)</td>
<td>12</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Rainfall</th>
<th>Rain amount (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Very Light to light Rainfall</td>
<td>0.1-15.5</td>
</tr>
<tr>
<td>2. Moderate Rainfall</td>
<td>15.6-64.4</td>
</tr>
<tr>
<td>3. Heavy Rainfall</td>
<td>64.5-115.5</td>
</tr>
<tr>
<td>4. Very Heavy Rainfall</td>
<td>115.6-204.4</td>
</tr>
<tr>
<td>5. Extremely Heavy Rainfall</td>
<td>&gt;=204.5</td>
</tr>
</tbody>
</table>
## Data from FIVE Operational Global Models

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>OPERATIONAL GLOBAL MODELS</th>
<th>RESOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IMD-GFS</td>
<td>~12km</td>
</tr>
<tr>
<td>2.</td>
<td>IMD-GEFS</td>
<td>~12km</td>
</tr>
<tr>
<td>3.</td>
<td>JMA</td>
<td>~25km</td>
</tr>
<tr>
<td>4.</td>
<td>NCEP-GFS</td>
<td>~25km</td>
</tr>
<tr>
<td>5.</td>
<td>NCUM (NCMRWF)</td>
<td>~12km</td>
</tr>
<tr>
<td>S. No.</td>
<td>Operational Global Models</td>
<td>Variables (CSV) Format</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------</td>
<td>------------------------</td>
</tr>
</tbody>
</table>
| 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 |
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/

Implemented for 00 UTC and 12 UTC
Global Maritime Distress Safety System (GMDSS)

Bulletin

Demo Link for GMDSS product

http://103.215.208.18/dwr_img/GIS/gmdss/
Sea Area Bulletin Graphics

http://103.215.208.18/dwr_img/GIS/seaarea/
Fleet forecast graphics for Indian Navy

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

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
- Coastal stations forecast for about 150 places
- Broadcast by 7 NAVTEX stations through Control Centre, Mumbai.

<table>
<thead>
<tr>
<th>NAVTEX Coast Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Veraval</td>
</tr>
<tr>
<td>Vengurla Point</td>
</tr>
<tr>
<td>Muttan Point(TN)</td>
</tr>
<tr>
<td>Porto Novo(TN)</td>
</tr>
<tr>
<td>Vakalpudi(AP)</td>
</tr>
<tr>
<td>Balasore(Odisha)</td>
</tr>
<tr>
<td>Keating Point(A&amp;N)</td>
</tr>
</tbody>
</table>

**Day-1 Forecast for Gopalpur**
- Date: 2021-11-03
- Wind Direction: North-Northwesterly
- Wind Speed: 10-15 gusting to 25 knots
- Weather: NIL
- Visibility: Very good
- Sea Conditions: Slight to moderate
- Port Signal: Nil
Coastal Weather Forecast

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

<table>
<thead>
<tr>
<th>North Odisha coast</th>
<th>South Odisha coast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td><strong>Wind</strong></td>
</tr>
<tr>
<td>MAINLY NORTH-EASTERNLY 10-15 KTS.</td>
<td>MAINLY NORTH-EASTERNLY 10-15 KTS.</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td><strong>Weather</strong></td>
</tr>
<tr>
<td>RAIN OR THUNDERSHOWER AT MOST PLACES.</td>
<td>RAIN OR THUNDERSHOWER AT MOST PLACES.</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td><strong>Visibility</strong></td>
</tr>
<tr>
<td>GOOD EXCEPT IN RAIN OR THUNDERSHOWER.</td>
<td>GOOD EXCEPT IN RAIN OR THUNDERSHOWER.</td>
</tr>
<tr>
<td><strong>Sea Condition</strong></td>
<td><strong>Sea Condition</strong></td>
</tr>
<tr>
<td>SLIGHT.</td>
<td>SLIGHT.</td>
</tr>
<tr>
<td><strong>Port Signal</strong></td>
<td><strong>Port Signal</strong></td>
</tr>
<tr>
<td>NIL at all Ports</td>
<td>NIL at all Ports</td>
</tr>
</tbody>
</table>

- Around 325 Coastal Station Forecast valid for next 5 days is being generated dynamically.
Coastal Weather Bulletin Graphics

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.
(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 mm)
- Moderate (15.6-64.4 mm)
- Heavy (64.5-115.5 mm)
- Very Heavy (115.6-204.4 mm)
- Extremely Heavy (≥ 204.5 mm)

(iii) Winds over coastal water

(iv) Wave Height
- Moderate to Rough (1.25 - 4.0 m)
- Very Rough (4.0 - 6.0 m)
- High (6.0 - 9.0 m)
- Very High (9.0 - 14.0 m)
- Phenomenal (Greater than 14.0 m)

(v) Visibility

Interactive maps for coastal weather

http://103.215.208.18/dwr_img/GIS/coastal.html
<table>
<thead>
<tr>
<th><strong>India Meteorological Department</strong></th>
<th><strong>भारत घस्त विज्ञान विभाग</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACWC MUMBAI</strong></td>
<td><strong>र. सी. इण्डिया, सी. गुवाहाटी</strong></td>
</tr>
</tbody>
</table>

**Sea Area Bulletin**

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

<table>
<thead>
<tr>
<th><strong>North West Arabian Sea</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>East North-Eastly (Dir Value: 52.4), 10 to 15 Knots gusting to 25 Knots (Mean Value (Kts):10 Max Mean Value (Kts):15)</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td>No Rain (Value: 0.0)</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td>Excellent (Value: 10.0)</td>
</tr>
<tr>
<td><strong>Sea Condition</strong></td>
<td>Smooth to Slight</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>North East Arabian Sea</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>East North-Eastly (Dir Value: 64.4), 10 to 20 Knots gusting to 30 Knots (Mean Value (Kts):10 Max Mean Value (Kts):20)</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td>No Rain (Value: 0.0)</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td>Excellent (Value: 10.0)</td>
</tr>
<tr>
<td><strong>Sea Condition</strong></td>
<td>Smooth to Moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>West Central Arabian Sea</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>North North-Eastly (Dir Value: 29.7), 5 to 20 Knots gusting to 30 Knots (Mean Value (Kts):5 Max Mean Value (Kts):20)</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td>No Rain (Value: 0.0)</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td>Excellent (Value: 10.0)</td>
</tr>
<tr>
<td><strong>Sea Condition</strong></td>
<td>Smooth to Moderate</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th><strong>East Central Arabian Sea</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>East North-Eastly (Dir Value: 68.0), 10 to 20 Knots gusting to 30 Knots (Mean Value (Kts):10 Max Mean Value (Kts):20)</td>
</tr>
<tr>
<td><strong>Weather</strong></td>
<td>Isolated Rain/Thunderstorm (Value:2.0)</td>
</tr>
<tr>
<td><strong>Visibility</strong></td>
<td>Excellent (Value: 10.0)</td>
</tr>
<tr>
<td><strong>Sea Condition</strong></td>
<td>Smooth to Moderate</td>
</tr>
</tbody>
</table>
...Thank You