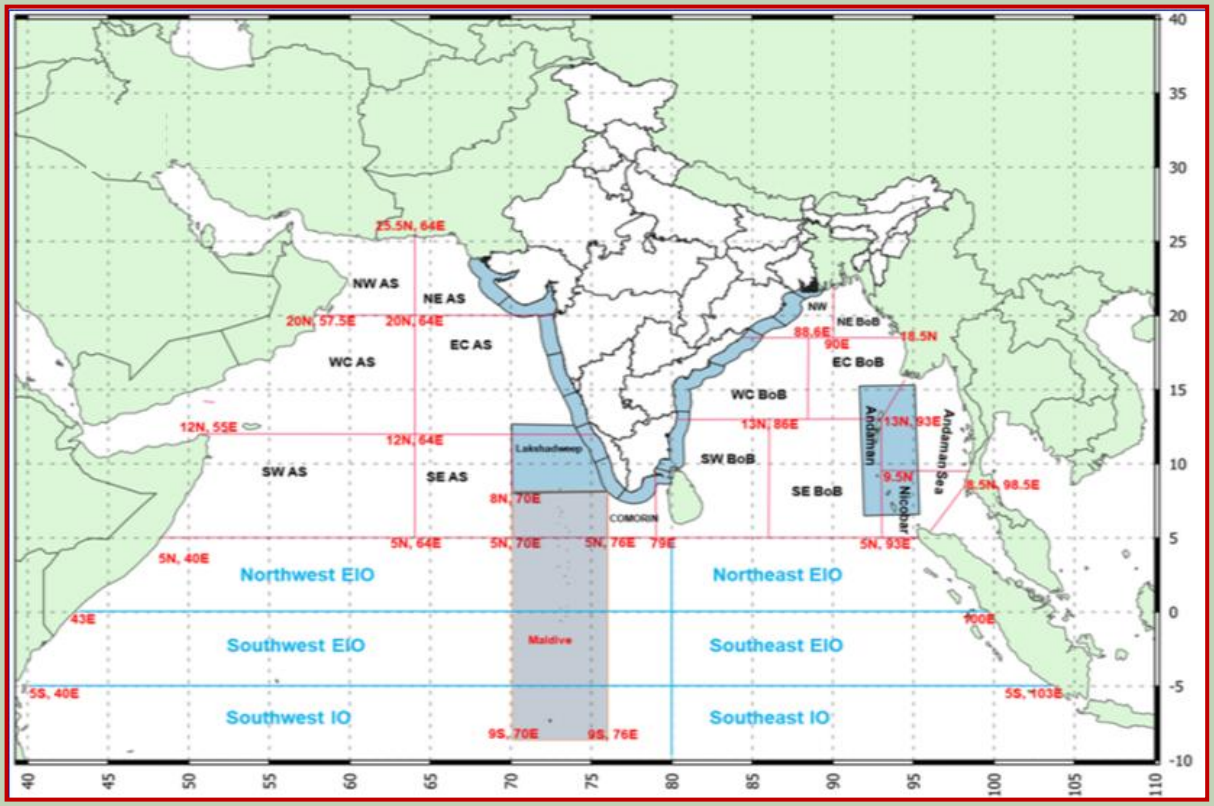
India Meteorological Department
Ministry of Earth Sciences

MinistryofEarthSciences
Government of India

MARINE WEATHER SERVICES STANDARD OPERATION PROCEDURE



INDIA METEOROLOGICAL DEPARTMENT
MINISTRY OF EARTH SCIENCES
GOVERNMENT OF INDIA

CONTENT

Marine Weather Forecast and Cyclone Warning Bulletins: A Standard Operation Procedure

1. General

1.1 Categories of bulletins and warnings

In this chapter, the procedure for the issue of various types of bulletins and warnings by Marine Weather Services Division, Area Cyclone Warning Centres (ACWCs)/ Cyclone Warning Centres (CWCs) has been discussed. The bulletins and warnings may be divided into the following broad categories:

(1) Weather and Sea bulletins:

(a) for shipping on the high seas; and

(b) for ships plying in coastal waters

(2) Bulletins for Indian Navy

(3) Bulletins for departmental exchanges

(4) Port warnings

(5) Fisheries warnings

(6) Four Stage warnings

(7) Bulletins for All India Radio (A.I.R)

(8) Warnings for Designated/Registered users (Album page warnings / warnees)

(9) Bulletins for Press

(10) Aviation warnings

2. Weather and sea bulletins

2.1. Type of bulletins

There are two types of bulletins:

(a) Sea area bulletins for shipping on the high seas, and

(b) Coastal bulletins for ships plying in coastal waters. For the purpose of the second type of bulletin, the coastal area is defined as the sea area upto 75 km off the coast line. by NAVTEX from ACWCs and CWCs through dedicated terminal provided by Directorate General of Lighthouses and Lightships (DGLL).

Fig.1: Flowchart for transmission of sea area and coastal weather bulletins

DGLL: Directorate General of Lighthouses and Lightships, NAVTEX: NAVigational TEleX

2.2 Bulletins for ships in High Sea:

2.2.1. Bulletin under Global Maritime Distress and Safety System

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. As a routine, two GMDSS bulletins are issued at 0900 and 1800 UTC. During cyclone situations, additional bulletins (up to 4) are issued for GMDSS broadcast. The area of responsibility and designated National Meteorological Services for issue of weather and sea area bulletins is shown in **Fig.2**. List of stations issuing cyclone warnings for ships on the high seas is given in **Table 1**.

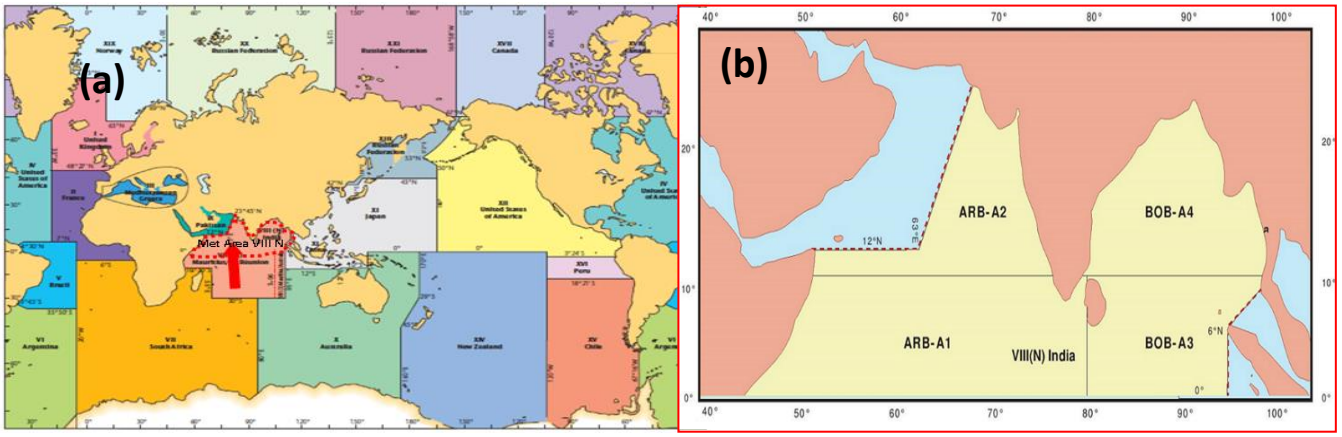


Fig.2: (a) AREA OF RESPONSIBILITY AND DESIGNATED NATIONAL METEOROLOGICAL SERVICES FOR THE ISSUE OF WARNINGS AND WEATHER AND SEA BULLETINS FOR THE GMDSS and (b) Detailed area map

Table1: Stations issuing cyclone warnings for ships on the high seas

Station	**Call sign of Coastal Area covered Radio Station**	**Area covered**
Bangladesh, Chittagong	ASC	Bay of Bengal north of 18^{o}N Lat.
***India,** Mumbai	NAVTEX	Arabian Sea north of Lat. 5^{o}N and east of Long. 60^{o}E excluding the area north of Lat.

		20°N and west of Long. 68°E. The eastern boundary of the Arabian Sea for which these bulletins are issued by Mumbai is Long. 80°E meridian excluding the Gulf of Mannar.
***India,** Kolkata	NAVTEX	Bay of Bengal north of Lat. 5°N except the area between the coastline on the east and the line drawn through the points 18°N 94.5°E, 18°N 92°E, 13.5°N 92°E, 13.5°N 94°E, 10°N 94°E, 10°N 95°E and 5°N 95°E. The western boundary of the sea area for which bulletins are issued by Kolkata is up to and inclusive of the Gulf of Mannar (i.e., 77.5°E meridian).
***India,** Chennai	NAVTEX	Bay of Bengal bulletins issued by ACWC Kolkata are being broadcast through Navtex, Chennai by Narrow Band Direct Printing (NBDP)
Myanmar, Yangon	XYR	Bay of Bengal except area west of Long. 92°E and South of 10°N Lat.
Oman (Sultanate of)	A4M	Muscat Coastal Radio Station
****Pakistan,** Karachi	ASK	Arabian Sea north of 20°N, Gulf of Oman and Persian Gulf.
Sri Lanka, Colombo	4PB	Indian Ocean, Arabian Sea and Bay of Bengal from the equator to 100N between 60°E and 95°E. The area 50°N to 100°N between 60°E and 95°E is an overlap with India.
Thailand, Bangkok	HSA HSS	Gulf of Thailand, west of southern Thailand. Strait of Malacca and South China Sea.

***** Under the new Marine Meteorological Broadcast system, GMDSS (Global Marine Distress Safety System) of IMO/WMO, India issues two bulletins at 0900 and 1800 UTC everyday for broadcast through SAFETY NET SAFETY SYSTEM. Additional bulletins are broadcast during Cyclone period.

****** To comply IMO/WMO GMDSS and marine Meteorological Broadcast System Pakistan issues the high seas forecast / Marine bulletins for met area-IX daily at 0700 UTC for broadcast through SAFETY NET SYSTEM. These bulletins are issued at 1900 UTC if so required.

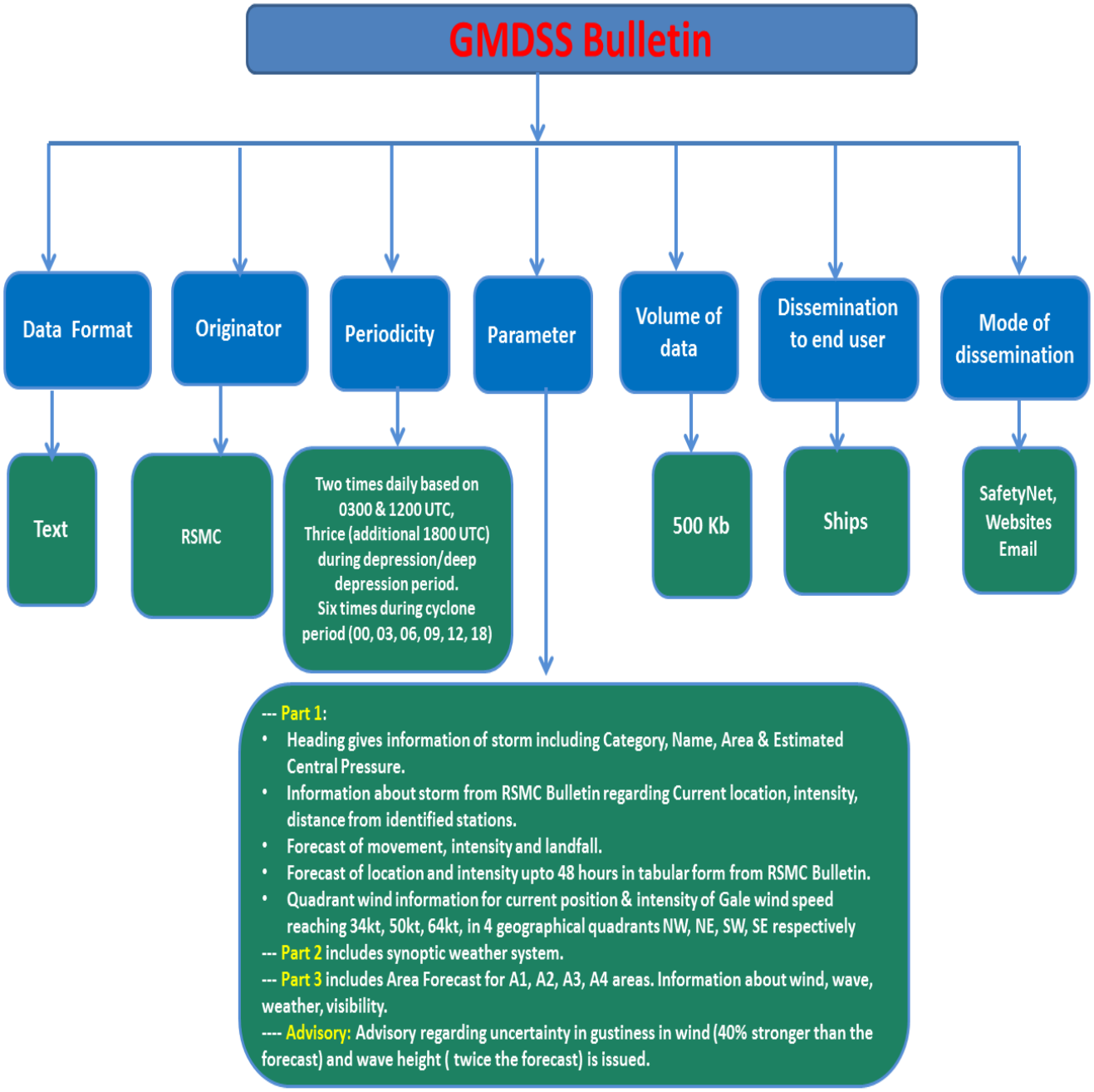


Fig. 3: GMDSS bulletin preparation and transmission

2.2.1.1. Transmission of GMDSS bulletin:

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 RSMC New Delhi for Indian Ocean, North of equator upto 5°N, for its area of responsibility. The bulletins are transmitted through Safety Net as shown in **Fig.4**.

GMDSS Bulletin Transmission

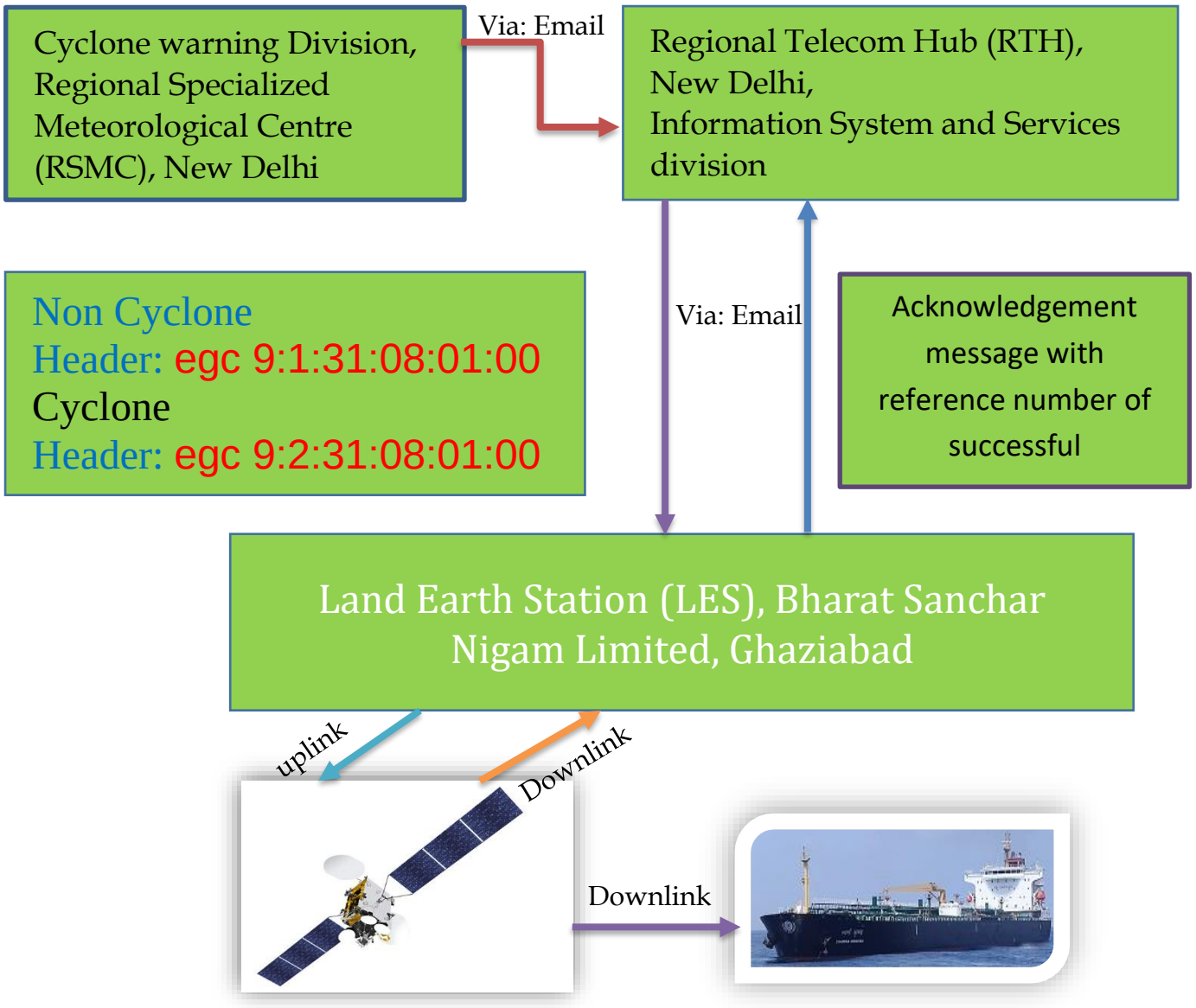


Fig.4.Transmission of GMDSS Bulletin

Inmarsat C is a satellite transmission system after receiving the Message from IMD, NCS Broadcast the EGC message to all available destination terminals in Nav Area VIII (N). The message received from IMD, is automatically processed in server and message is transmitted to the user. No Message can be altered by Inmarsat C System (LES Ghaziabad). Ghaziabad LES cannot see the message content. GZB LES can see the sender address, receiver address and the reference no. of message. Contents of transmitted message can only be seen by receiving destination terminal. In case of Successful transmission, sender receives Positive delivery notification and in case of non-successful transmission, sender receives negative delivery notification. There is no time difference in transmission of message received from IMD.

Inmarsat-C SafetyNET is an internationally adopted, automated satellite system for promulgating weather forecasts and warnings, marine navigational warnings, and

other safety-related information to all types of vessels and is part of the Global Maritime Distress and Safety System (GMDSS). SafetyNET is the international service for the broadcast and automatic reception of maritime safety information (MSI) as well as information related to search and rescue via the Inmarsat satellite system. The Inmarsat C maritime mobile satellite system has an inherent capability, known as Enhanced Group Call (EGC), which allows broadcast messages to be made to selected groups of ship stations located anywhere within a satellite's coverage. Four geostationary satellites provide worldwide coverage for these types of broadcasts. Two types of EGC services are available: SafetyNET and FleetNET. FleetNET is a commercial messaging services offered by Inmarsat, and is not recognized by GMDSS. SafetyNET, along with NAVTEX is recognized by the GMDSS as the primary means for disseminating maritime safety information. Ships regulated by the Safety of Life at Sea Convention travelling outside areas covered by NAVTEX must carry an Inmarsat C SafetyNET receiver.

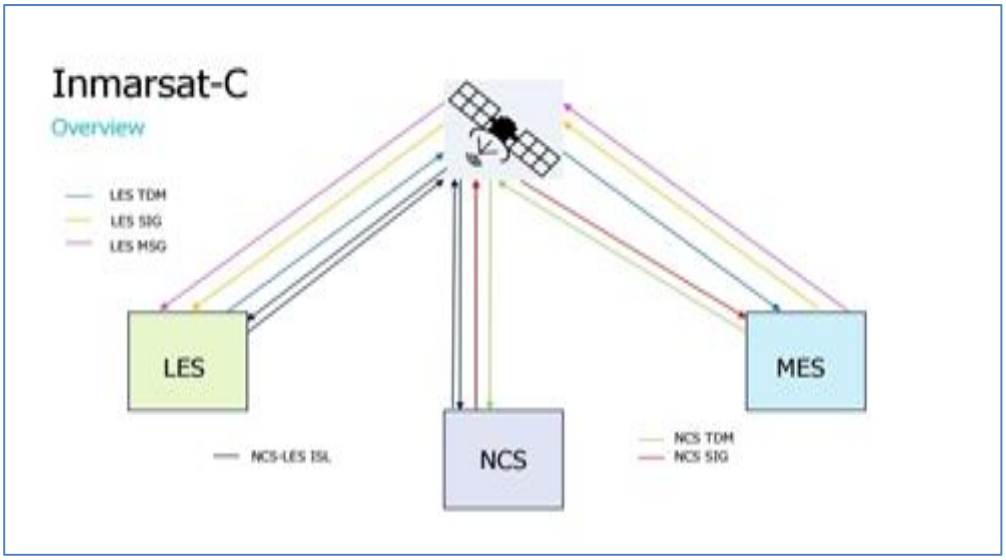


Fig. 5: INMARSAT-C overview

2.2.1.2. Frequency of Broadcasts

To start with as a routine only, one GMDSS bulletin for METAREA VIII (N) was broadcast at 0900 UTC. From October 1998, IMD commenced issue of a second bulletin also broadcast at 1800 UTC. During Cyclone situations, additional bulletins (upto 4) are also being issued for GMDSS broadcast depending on the requirement.

2.2.2. Sea Area Bulletin

2.2.2.1. Offices of issue and area of responsibility

Sea area bulletins for Bay of Bengal are issued by ACWC Kolkata and are broadcast through Porta Nova, Vakalpudi, Balasore and Kealing Point with transmitter identifiers (B1) O, Q S & V respectively and those for Arabian Sea are issued by ACWC Mumbai and are broadcast by Veraval, Vengrula, Muttam Point with transmitter identifiers H, J & L respectively. The schedule of broadcasts of sea area bulletins with details of times

of broadcast etc. through NAVTEX is given in **Table 2**. The area covered by these bulletins which is the area of responsibility assigned to India by the World Meteorological Organisation (WMO), is shown in **Fig.6**.

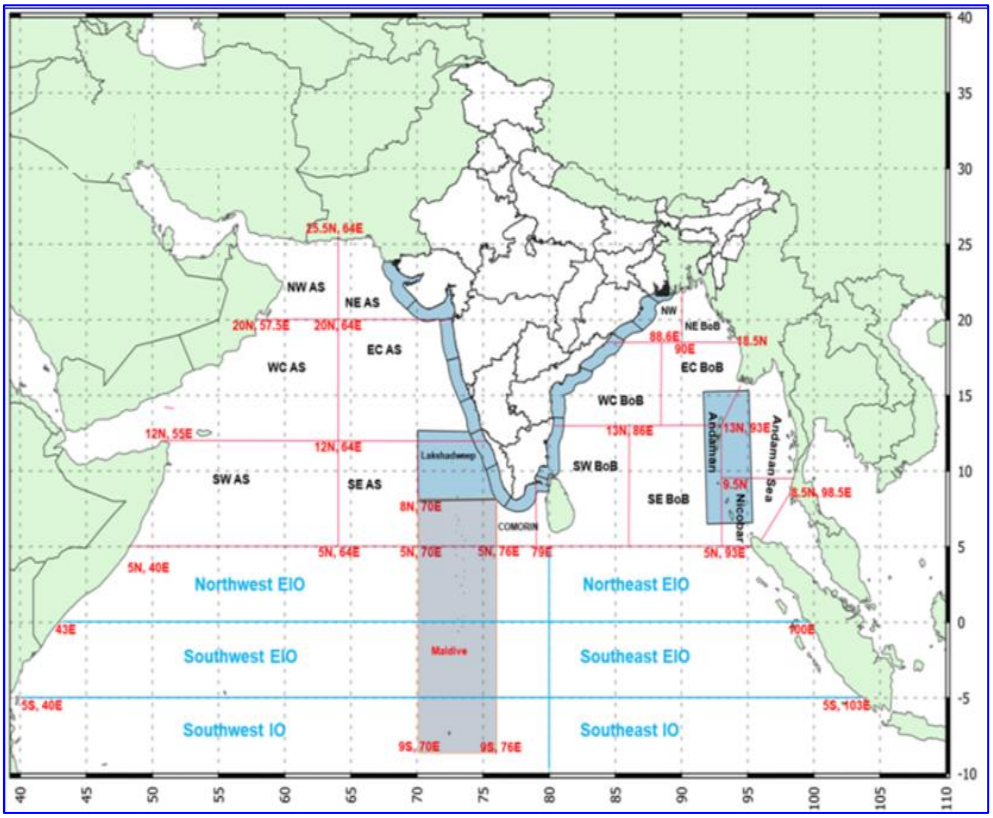


Fig.6: Area of responsibility for Sea Area bulletin
(Areas of Bay of Bengal and Arabian Sea to the North of 5^0N)

Fig. 6 shows the areas for which weather bulletins for merchant shipping are broadcast. Bulletins broadcast from Veraval, Vengrula, Muttam Point cover the Arabian Sea north of Lat 5^0N and east of Long 40ºE excluding the area north of Lat 20ºN and west of Long 68º E. The eastern boundary of the Arabian Sea for which these bulletins are issued by Mumbai is Long.80^OE meridian excluding the Gulf of Mannar. The area in the Arabian Sea north of Lat.20^ON and east of Long.68ºE is an overlapping area between India and Pakistan. However, for national purpose, ACWC, Mumbai will issue forecast for entire Arabian Sea to the north of equator. Bulletins broadcast from Porta Nova, Vakalpudi, Balasore and Kealing Point cover the Bay of Bengal north of Lat 5^0N except the area between the coastline on the east and the line drawn through the points 18ºN /94½ºE, 18ºN/ 92ºE, 13½º N/ 92ºE, 13½ºN /94ºE, 10ºN/ 94ºE, 10ºN/ 95ºE and 5ºN/ 95ºE. The western boundary of the sea area, for which

bulletins are issued by Kolkata, is upto and inclusive of the Gulf of Mannar i.e. Long.77½º E meridian. The area between Lat.10ºN and 13½ºN and Long.92ºE and 94ºE, is an *overlapping area* between India and Myanmar and the area north of Lat.18ºN is an *overlapping area* between India, Myanmar and Bangladesh. Similarly, the area from Lat.10ºN to 5ºN between Long.60ºE and 95ºE is an *overlapping area* between Sri Lanka and India. However, for national purpose, the ACWC, Kolkata will issue the forecast for entire Bay of Bengal to the east of 77.5°E to the north of equator.

Table2: List of NAVTEX stations for India (Met Area VIII(N)), Frequency: 518KHz

NAVTEX Coast Station	Position of Antenna(1)	Range (NM)	B1 Character	Transmission Times (UTC)	Language
Veraval	$20^0$54.6'N/$70^0$21.2'E	250	H	0110,0510,0910,1310, 1710,2110	English
Vengurla Point	$15^0$51.2'N/$73^0$37.0'E	250	J	0130,0530,0930,1330, 1730,2130	English
Muttan Point	$08^0$07.4'N/$77^0$19.1'E	250	L	0150,0550,0950,1350, 1750,2150	English
Porto Novo	$11^0$30.2'N/$79^0$46.2'E	250	O	0220,0620,1020,1420, 1820,2220	English
Vakalpudi	$17^0$00.8'N/$82^0$17.1'E	250	Q	0240,0640,1040,1440, 1840,2240	English
Balasore	$21^0$29'10.8"N/$86^0$55' 01"E	250	S	0300,0700,1100,1500, 1900,2300	English
Keating Point	$09^0$15.4'N/$92^0$46.5'E	250	V	0330,0730,1130,1530, 1930,2330	English

2.2.2.2 Frequency of issue

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. However, when a depression has actually formed, the Extra bulletin must be issued. When a cyclonic storm has developed, every attempt should be made to broadcast three additional bulletins a day. The three additional bulletins are known as Storm bulletins which together with the three bulletins mentioned earlier, make up a total of six bulletins a day **(Table 3)** 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 **Table 2**. 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.

Table 3: Types of bulletins issued by the ACWCs and CWCs

Code word (Not for broadcast)	Type of Bulletin	Weather Condition	Based on chart at UTC	Issue Time	Validity Period
ELECTRON	Storm-One	Cyclonic Storm	0000	0300	0300-1500
AURORA	Daily-One	General Weather	0300	0600	0900-2100
FORMULA	Storm-Two	Cyclonic Storm	0900	1200	1200-0000
BALLOON	Daily-Two	General Weather	1200	1500	2100-0900
GASBAG	Storm-Three	Cyclonic Storm	1500	1800	1800-0600
DEW DROP	Extra	Depression/ Disturbed Weather	1800	2100	2100-0900
HEXAGON	Special	Unexpected Development	Can be issued at any time)	+03 hours of base time	12 hours from issue time

2.2.2.3 Prefix of code word

A code word (which is not for broadcast) is prefixed to each of the bulletins as a preamble for easy identification by the NAVTEX broadcasting station on receipt.[3] The bulletins issued, should have following three lines as preamble as given in Table 2:

1st line: B1 Character (example: B1: P) (B1 is taken from Table 2)

2nd line: B2 Character (example: B2: E) (It can be E for Routine and B for warning)

3rd line: Priority (example: Priority: Routine) (It can be Routine, Important or Vital)

As bulletins issued by IMD are region specific, it has to be transmitted with transmitter identifiers. B1 characters are provided by DGLL for this purpose. B1 characters are required as seven NAVTEX transmitters have different area of coverage and the area of responsibility of ACWCs & CWCs are also different.

B2 is the subject indicator character of one letter**.** B2 Character will be, E for Routine Bulletins and B for Warning Bulletins. Meteorological warnings (B2 = B), e.g., gale warnings, shall be allocated a priority of IMPORTANT and be repeated at subsequent scheduled transmissions for as long as the warning is in force. These messages shall contain only the appropriate warnings and shall be separate from the weather forecasts;

Weather forecasts (B2 = E) shall be broadcast at least twice each day. This service shall be carefully co-ordinated where transmitters are geographically close together;

Priority is to be decided as mentioned below:

a) Meteorological forecast: **Routine**
(Including Coastal weather Bulletin, Sea Area Bulletins issued in routine twice a day under ordinary conditions)

b) Meteorological Warnings: **Important**
(Including squall warning, squally weather warnings, strong monsoon conditions etc.)

c) Cyclone Warnings: **Vital** (including warnings against depressions & cyclones issued three times in case of depressions and five times in case of cyclones)

An example of the bulletin is reproduced below for Bay of Bengal and Arabian Sea:

(ACWC – RMC CHENNAI) DATED 05-07-2015

B1- CHARACTER (L)
B2- CHARACTER (B)
PRIORITY (ROUTINE)

DAILY TWO BULLETIN FOR KERALA COAST FORECAST VALID FOR NEXT 12 HOURS COMMENCING FROM 05/2200 HOURS UTC TO 06/1000 HOURS UTC:

SYNOPTIC SITUATION: NIL.
WIND: NORTHWESTERLY TO WESTERLY 15-20 KNOTS GUSTING TO 25-30 KNOTS OCCASIONALLY.
WEATHER: FAIRLY WIDESPREAD RAIN OR THUNDERSHOWERS.
VISIBILITY: MODERATE BECOMING POOR IN RAIN OR THUNDERSHOWERS.
SEA: MODERATE TO ROUGH.
SIGNALS: NIL.

B1- CHARACTER (O)
B2- CHARACTER (B)
PRIORITY (ROUTINE)

DAILY TWO BULLETIN FOR NORTH TAMILNADU COAST FORECAST VALID FOR NEXT 12 HOURS COMMENCING FROM 05/2200 HOURS UTC TO 06/1000 HOURS UTC:

SYNOPTIC SITUATION: NIL
WIND: NORTHWESTERLY 15-20 KNOTS GUSTING TO 25-30 KNOTS OCCASIONALLY.
WEATHER: ISOLATED RAIN OR THUNDERSHOWERS.
VISIBILITY: GOOD BECOMING POOR IN RAIN OR THUNDERSHOWERS
SEA: MODERATE TO ROUGH.
SIGNALS: NIL.

B1- CHARACTER (L)
B2- CHARACTER (B)
PRIORITY (ROUTINE)

DAILY TWO BULLETIN FOR SOUTH TAMILNADU COAST FORECAST VALID FOR NEXT 12 HOURS COMMENCING FROM 05/2200 HOURS UTC TO 06/1000 HOURS UTC:

SYNOPTIC SITUATION: NIL
WIND: WESTERLY TO SOUTHWESTERLY 15-20 KNOTS GUSTING TO 25-30 KNOTS OCCASIONALLY.
WEATHER: ISOLATED RAIN OR THUNDERSHOWERS.
VISIBILITY: GOOD BECOMING POOR IN RAIN OR THUNDERSHOWERS
SEA: MODERATE TO ROUGH.
SIGNALS: NIL.

ENDS AAA

COASTAL BULLETIN: DAILY ONE
B1: H
B2: E
PRIORITY: ROUTINE.
DAILY ONE BULLETIN FOR GUJARAT COAST DATED 05.07.2015
FORECAST VALID FORNEXT 12HOURS FROM 05/1000 UTC

WIND: - NORTH GUJARAT: MAINLY SOUTH-WESTERLY 15-20 KTS
SOUTH GUJARAT: SOUTH-WESTERLY TO WESTERLY 15-20 KTS
WEATHER: - NORTH GUJARAT: FAIR.
SOUTH GUJARAT: FAIR.
VISIBILITY: NORTH GUJARAT: GOOD
SOUTH GUJARAT: GOOD
STATE OF SEA: - NORTH GUJARAT: MODERATE
SOUTH GUJARAT: MODERATE
PORT WARNING: - NIL
SIGNAL: - NIL

2.2.2.4. **Daily bulletins**

2.2.2.4.1 <u>Contents of 'daily' bulletin</u>

The 'Daily' bulletins consist of six parts. Part I to III are in plain language and the other three in coded form. The six parts are:

Part I	Storm warning
Part II	Synopsis of meteorological conditions in the forecast area
Part III	Forecast
Part IV	Analysis of the surface synoptic chart in IAC Fleet Code.
Part V	A selection of ships' reports.
Part VI	A selection of land reports (surface and upper air).

Generally, parts I and II are issued for broadcast in one message, Parts III and IV in another and parts V and VI in a third message. The two 'Daily' bulletins issued from Mumbai and Kolkata contain all the above six parts and the 'Daily' bulletins issued from Chennai contain parts I, II and III only.

2.2.4.2 Format of 'daily' bulletin

The formats for the three messages are as follows:

i) Aurora/ Balloon OBS Date…….. Part One etc…..Part Two etc. …….....

ii) OBS Date……. Part Three Area Forecast etc. ……....Part Four Analysis etc. …… iii) OBS Date …Part Five Ships' Broadcast etc. …..Part Six **(0300 and 1200 UTC)** synop etc. ……

2.2.2.5 Contents of 'extra', 'storm' and 'special' bulletins

Extra, Storm and Special bulletins are issued from all the three stations, Kolkata, Chennai and Mumbai and consist of only Part I.

2.2.2.6 Format of Part – I

When a depression or a cyclonic storm has formed or is expected to form or when gales are expected, Part I of the bulletin will contain the following items in the order mentioned below:

(1) International Safety Call sign (TTT).

(2) Statement of type of warning (Warning, gale warning, cyclone warning etc.)

(3) Date and time of reference in UTC in the international six figure date-time group.

(4) Type of disturbance (low, when it is expected to intensify into a depression before broadcast of the next bulletin, depression, monsoon gale, cyclonic storm etc.)

with central pressure in hPa in the case of disturbances of cyclonic storm intensity and above.

(5) Location of disturbance in terms of latitude and longitude.

(6) Direction and speed of movement of disturbance during past six hours. (The direction may be given in 16 points of compass or in degrees to the nearest ten; the speed is given in knots.) The departmental practice is to give the direction in sixteen points of the compass.

(7) Extent of area affected. It should be issued based on the Quadrant Wind Forecast issued by the CWD, in the case of DD and above. To be issued subjectively as decided by the ACWCs, in other cases.

(8) Speed and direction of wind in various sections of the affected area. (Wind speeds will be given, for different distances from the centre, in different sectors of the storm area based on the quadrant wind forecast issued by IMD. Wind speeds are given in knots and distances in nautical miles.)

(9) Further indications, if any: Forecast maximum sustained wind and the quadrant wind radii forecast as given by CWD in quadrant wind bulletin should be given upto the forecast validity period of Sea area Bulletin.

2.2.2.7 Important points- Part I

The following are some of the important points to be noted while framing Part I of the message.

2.2.2.7.1 Type of warning

Specifications for the 'Type of Warning' are given below:

Type of Warning	**Type of disturbance**	**Corresponding wind speeds**	
		In knots	*In Beaufort Scale*
Warning	Depression	17-27	5 – 6
	Deep depression	28 – 33	7
Gale Warning	Strong winds under steep pressure gradient etc.	34-47	8 – 9
Cyclone Warning	Cyclonic Storm	34 – 47	8 – 9
Severe Cyclone Warning	Severe cyclonic Storm	48 – 63	10 – 11
Very Severe Cyclone Warning	Very severe cyclonic storm	64 – 89	12

Extremely Severe Cyclone Warning	Extremely Severe Cyclonic Storm	90-119	
Super Cyclone Warning	Super cyclonic Storm	120 and above	

Notes: (i) The term deep depression is not to be used in international bulletins[5]. Hence depression will be used for 17-33 knots or 5-7 BF Scale *and*

(ii) Gale warning conditions (wind speeds of 34 kt or above) occur in Indian sea areas usually in association with vigorous monsoon during the southwest monsoon season.

Strength of monsoon is defined in terms surface winds as below:

Weak: upto 12 kt

Moderate: 13-22 kt

Strong: 23-32 kt

Vigorous: 33 kt and more

2.2.2.7.2 Location of Disturbance

(i) Latitudes and Longitudes are to be given in words and not in figures to avoid errors in transmission. The same procedure should be followed in other parts of the message also where figures such as speed etc. occur.

(ii) Information is to be given as to the degree of certainty with which the centre is located. (Also see para 2.2.2.7.9)

(iii) When the 'eye' is seen in the radar/satellite picture this may be indicated in the bulletin.

2.2.2.7.3 Direction and speed of movement

Direction and speed of movement given under item (6) of Part I are those estimated movement during past six hours of the disturbance. Forecast movement is given under item (9) of the format viz. Further indications.

2.2.2.7.4 System Crossing Coast

When a depression or storm is likely to cross coast, the coastal area and the point and the time of landfall are to be specified along with the forecast direction of movement.

As far as the point of reference of the system position is concerned, this should have a bearing with the probable ultimate landfall. The same reference point should be used in bulletins issued by all centres. However, if necessary, the local impact could be described by the ACWC/CWCs in their own bulletins.

2.2.2.7.5 Mention of High Tide

In the case of a cyclonic storm, this information should be broadcast as early as possible, at least 24 hours in advance from the expected time of landfall. The expected point of landfall may be given with reference to latitude and longitude, nearby port or coastal observatory stations. If the time of crossing is near about the high tide time, mention of this fact should be made.

The ACWCs / CWCs, at their discretion may issue storm surge warning even at depression stage, as it is observed that even during depression stage storm surge may occur in some coastal pockets like deltaic area and area with higher astronomical tide. The range of values of storm surge should be given as mentioned in national bulletin.

2.2.2.7.6 While fixing the center of the system

In the absence of ship's reports over far flunged oceanic areas, more weightage should be given to satellite based observations. If it is within Radar range, radar based centre will be given maximum weightage followed by the satellite data. Kindly refer SOP (IMD, 2021). When the system is near the coast. More weightage should be given to coastal observation followed by Radar and satellite observations.

2.2.2.7.7 Use of Term of Small Extent to be avoided

The qualifying term 'of small extent or of large extent' should not be used in describing a storm as the size is given in the Quadrant Wind Product and the same is reflected in this bulletin.

2.2.2.7.8 Use of the term probably to be avoided

The word probably should not be used while describing the systems. Hence terms like probably deep depressions, Probably Cyclonic Storm etc. should not be used while

describing the low pressure systems. This will help to avoid the uncertainties in the description of the synoptic situation.

2.2.2.7.9 Central Pressure of System

The central pressure of the storm is inferred from the observations of pressure and winds nearest to the center (please follow Cyclone Warning SOP published by IMD, 2021). More objectively, it is derived from satellite pictures through the maximum wind estimates and this method is recommended particularly on occasions of absence of observations very close to the center.

2.2.2.7.10 Time of Reference

The time of reference is the time of the chart (in UTC) on which the centre of the system is determined. However, when the system is tracked by coastal radar, the time of the latest radar fix can be given in the bulletin, but the fact may be mentioned like *Eye* of the storm as determined by radar lay centered at …… UTC over (mention area) near Lat ……and Long …...

2.2.2.7.11 Tolerance of Estimated Location

Whenever possible, the tolerance of the estimated location of the center of the system should be mentioned. If the radar shows the eye of a storm or well-defined bands to enable the forecaster to fix the center of the storm accurately, the center of the storm will be indicated in the bulletins correct to one tenth of a degree latitude and longitude. On occasions when fairly accurate fixing of the center 'lay centered near' may be used. The confidence in fixing the centre and intensity may be mentioned in RSMC Bulletin in Remarks Section.

2.2.2.7.12 Centre when tracked by Radar

When the storm is tracked by radar, all the concerned offices will give the radar center. However, when a cyclonic storm is tracked by more than one Cyclone Detection Radars (CDRs), greater weightage may be given to the observation of the radar nearest to the storm center and the confidence of the report. However, center fixed on the basis of eye seen (closed/open) should always be preferred to that of the fixes based on spiral bands.

2.2.2.7.13 Division of Sea Area

When referring to a system in the sea area, its location in the relevant division of the sea area should be mentioned before specifying the center if any, e.g. The cyclonic storm over southeast Arabian Sea lay centred near Lat. … and Long. …….. Or the low pressure area over south Andaman Sea etc.

2.2.2.7.14 Time of Landfall

When forecast of landfall is included, the day of the week (Like Monday etc.) and the part of the day (like early morning, forenoon, midday etc.) in which the event is anticipated to take place should be stated. In order to have uniformity in the use of expressions, the day may be divided into six parts as given below: The time for RSMC Bulletin, GMDSS bulletin and Sea area bulletin (for all international use) should be given in UTC

Early hours of (date)	*0000- 0400 hrs IST*	*Time in UTC* for RSMC, GMDSS bulletin and Sea area bulletins
Early hours	0000-0400 hrs IST	1830-2230 UTC
Morning	0400 – 0800 hrs. IST	2230-0230 UTC
Forenoon	0800 – 1200 hrs. IST	0230-0630 UTC
Afternoon	1200 – 1600 hrs. IST	0630-1030 UTC
Evening	1600 – 2000 hrs. IST	1030-1430 UTC
Night	2000 – 2400 hrs. IST	1430-1830 UTC

In addition to the above, expressions like early morning (0400-0600) hrs IST (2230-0030), around noon (1100 – 1300 hrs IST/0530-0730UTC), around midnight (1730-1930UTC) may also be used.

2.2.2.8 Part – II

2.2.2.8.1 Strength of Monsoon

When there is no warning in the area, Part I in the Daily bulletin contains the words *No storm warning*. In Part II, Weather is characterized as *Seasonal* when there is no synoptic system in the area. However, during the southwest and northeast monsoon seasons, the strength of the monsoon is described in Part II as per the following specifications. The current strength should be determined based on the available observations from ships, buoys, Scatterometer winds and wind analysis given by

multimodel ensemble technique at the base time. The above is applicable for both the southwest and the northeast monsoons. The forecast strength should be assessed based on the multi-model ensemble technique

Strength of monsoon	*Corresponding wind speed over the area*
Weak	Upto 12 kt
Moderate	13 to 22 kt
Strong	23 to 32 kt
Vigorous	33 kt and above

2.2.2.8.2 Use of Term Weather Seasonal Bay

Forecasters may be cautioned that monsoon conditions do pose problems for marine navigation and hence they should indicate whenever appropriate, the strength of the monsoon as long as it lasts over any sea area. 'Weather seasonal bay' may be used over areas where the monsoon has withdrawn and there is no specific synoptic situation like depression, cyclone etc. Normally sailors do expect smooth sea and settled conditions when we say 'weather seasonal'.

2.2.2.8.3 Synoptic Situation

The synoptic situation already described in Part I need not be repeated under Part II. Disturbances lying outside the area of responsibility (even lying over the land area, but affecting the marine area) may also be mentioned in Parts I and II when it is necessary for describing the weather situation properly. Similarly, the analysis in Part IV may be extended to neighbouring areas whenever it is necessary for giving a complete picture of the isobaric configuration.

2.2.2.9 Positions and areas In Parts I, II & III

In parts I, II and III, the positions and areas may be given in terms of latitude and longitude or with reference to well-known land stations or divisions of sea areas.[1]

2.2.2.10 Part III

2.2.2.10.1 Contents of Part III

Part III contains a forecast of (i) weather, (ii) wind, (iii) Visibility and (iv) sea condition with significant wave height. The period of validity of the forecast should be till the broadcast time of the next routine *Daily* One or Two bulletins. The message should

begin with a preamble on the period of validity of the forecast, which will be indicated by the phrase *Forecast valid till …… UTC of …….. (date)*. Forecast of weather (such as rain, rainsqualls, thunderstorms etc.) is given only for areas over which it is expected to occur. No forecast is included for areas where no weather is expected. Wind direction is given in eight points of the compass and the wind speed in knots.

2.2.2.10.2 Visibility

The following terminology will be used for describing visibility: [20]

Code Fig.	**Descriptive term**	**In km**
90 – 94	Very poor	Less than 2
95	Poor	2 – 4
96	Moderate	4 – 10
97	Good	10 – 20
98	Very good	20 – 50
99	Excellent	50 or more

2.2.2.11 Contents of Part IV

Part IV of the bulletin contains surface analysis encoded in the abridged form of the International Analysis Code for marine use (IAC FLEET) and includes essential isobars. ACWC Mumbai issues analysis for the area from Lat. 5°N – 25°N and Long 40° – 80°E and ACWC Kolkata for the area from Lat. 5° – 30°N and Long. 75° – 100°E.

2.2.2.12 'Hexagon' messages

2.2.2.12.1 Issue Of 'Hexagon'

When information received between two consecutive broadcasts reveals any unexpected developments necessitating a drastic change in the assessment of the location or intensity of the system, a special bulletin is issued to concerned NAVTEX with the prefix Hexagon, which will be broadcast almost immediately.

2.2.2.12.2 Occasions of Issue

The unexpected developments referred to in the previous para may be either a rapid intensification of a depression into a cyclonic storm or of a storm into a severe storm. Sometimes, it may happen that due to lack of observations at the time of issue of a

routine bulletin, there is uncertainty in locating the center of the storm. Observations received later may give a fix for the center which may be appreciably different from the one indicated in the earlier bulletin. In such cases hexagon bulletins should be issued. Hexagon message should not, however, be issued unless the weather situation is of a sufficiently serious nature so as to make the ships which receive the broadcast regard it as a warning message.

2.2.2.12.3 Change In Position of Center

If ship's reports or radar or satellite information received subsequent to the issue of a particular bulletin indicate that the center of the storm given earlier required a change, say by a degree or more, the center of the storm should be changed accordingly in the next bulletin, which may be worded *Latest ships* reports/latest satellite pictures indicate that the cyclonic storm is centred ……. etc."

2.2.2.12.4 Application of 2.2.2.12.2 Or 2.2.2.12.2.3

The application of either of the above instructions (in 2.2.2.12.2 or 2.2.2.12.3) in a particular situation is left to the discretion of the storm warning Officer at CWD with the approval of Head RSMC and DGM. Also it may be noted that a depression/deep depression may be declared at any synoptic hour, if situation so warrants.

2.2.2.13 *Information To Ships*

On occasions of severe cyclonic storms, whenever reports are received from ships within 200 km of the storm centre, message through NAVTEX may be sent to these ships individually indicating the latest position of the storm and its expected course. When continuous reports are received from the same ships over a period of some hours, NAVTEX messages need be addressed to the ship only once in 12 hours provided there is no unforeseen development within the 12 hours period.

2.2.2.14 *Requisitions For Ships' Observations*

Requisitions for ships' observations should not be included in the sea area bulletins sent to NAVTEX. A separate CQ message should be originated for this purpose. Requisitions for ships' observations should generally be made sparingly and the intervals (viz. 3 hourly, hourly etc.) at which such observations are required should be

indicated in the message. Requisitions to the concerned NAVTEX stations will be classed XXW.

2.2.2.15. Procedures for uploading the bulletins on the website (http://rsmcnewdelhi.imd.gov.in)

The Sea Area Bulletin issued by ACWC Kolkata and Mumbai can be accessed & uploaded by ACWC Kolkata and Mumbai only.

To upload this bulletin following steps are to be taken.

1. Login in Admin (with proper username and password assigned)
2. Go to main menu and select bulletin to be added. Simply upload on RSMC website.
3. Click add and check website.

3. Coastal Bulletins

3.1 Schedule of broadcasts

In addition to the sea area bulletins for shipping on the high seas, coastal bulletins are also issued for broadcast through NAVTEX for the various coastal strips (upto 75 km. from the coast-line). These broadcasts are meant for coastal shipping and are broadcast from NAVTEX in the national languages mentioned in Table 1a. In addition, the bulletin should be uploaded in website and sent by email to all concerned. The coastal strips are shown in **Fig. 7** and the schedule of broadcasts of coastal bulletins is given in **Table 2a**.

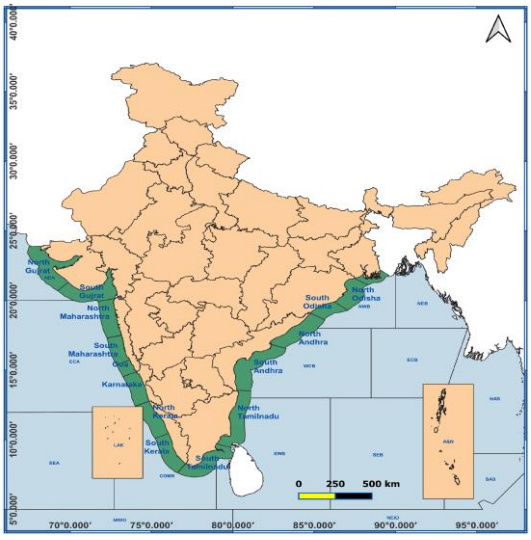


Fig.7: Area or responsibility for coastal area bulletin

3.2 Offices of issue and areas of responsibility

The ACWCs/CWCs issuing the coastal bulletins together with their areas of responsibility are given below.

ACWC/CWC issuing the bulletin	Coast for which issued
ACWC Kolkata	West Bengal and Andaman and Nicobar Islands
CWC Bhubaneswar	Odisha
CWC Visakhapatnam	Andhra Pradesh and Yanam
ACWC Chennai	Tamil Nadu, Puducherry and Karaikal
CWC Thiruvananthapuram	Kerala, Mahe, Karnataka and Lakshadweep.
ACWC Mumbai	Goa, Maharashtra
CWC Ahmedabad	Gujarat, Diu and Daman.

3.3 Frequency of issue

As in the case of sea area bulletins, coastal bulletins are also issued twice a day in normal weather and more frequently (upto six times a day) on occasions of disturbed weather along the coastal strips. 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. Coastal bulletins are also to be transmitted to the appropriate NAVTEX stations (See Para 4.8)

3.4 Identification preambles

The preambles *Daily One* and *Daily Two* are prefixed to the coastal bulletins based on 0300 and 1200 UTC charts respectively. *Extra*, *Storm* and *Special* bulletin messages issued on occasions of depressions or storms, also similarly begin with words *Extra*, *Storm One*, *Storm Two*, *Storm Three* and *Special* respectively (vide para 2.2.2.3). These distinguishing words are prefixed to the bulletins only to help the NAVTEX to

identify the times at which they are to be broadcast; these code words themselves are not broadcast.

3.5 Contents of the bulletins

Each bulletin (*Daily*, *Extra*, *Storm* and *Special*) contains the following information in the order given below: [1]

(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 '**along with significant wave height**' 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). State of sea and significant wave height should be given based on the INCOIS products in normal day and based on national bulletin during the period of cyclonic disturbance

3.6 Some Important points

3.6.1 TTT and type of warning

International safety call sign TTT and type of warning should be given after the identification prefix, whenever a depression/ cyclonic storm is expected to affect the weather along the coast e.g. *Storm One TTT Cyclone Warning(.) Bulletin for Andhra Coast* etc.

3.6.2 Wind Speed

All elements except wind speed are to be given in metric units. Wind speeds will be in knots.

3.6.3 Period of validity of forecast

The period of validity of the forecast (item (3) of the bulletin) will be from the broadcast time of the coastal bulletin to the broadcast time of the next routine *Daily* coastal weather bulletin; e.g. in the case of *Daily One* and *Storm Two*, the validity period will

be till the broadcast time of *Daily Two* and in the case of *Daily Two*, *Storm Three*, *Extra* and *Storm One*, it will be till the broadcast time of *Daily One*.[29]

3.6.4 *Visibility*

Visibility will be given as per para 2.2.2.10.2

3.6.5 *State of Sea*

The terminology used for state of sea is given below:

Descriptive term	***Significant wave height in metres***
Calm (glassy)	0
Calm (rippled)	0 – 0.1
Smooth (wavelets)	0.1 – 0.5
Slight	0.5 – 1.25
Moderate	1.25 – 2.5
Rough	2.5 – 4
Very rough	4 – 6
High	6 – 9
Very high	9 – 14
Phenomenal	Over 14

State of sea can be given based on the significant wave height given by the INCOIS, Hyderabad and the wind warning issued by MSD during normal and monsoon condition. Over the area of cyclonic disturbance, it should be given based on the quadrant wind forecast and the wind forecast issued by CWD/MSD.

4. ***Bulletins for the Indian Navy***

4.1 Two Types Of Bulletins For Navy

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

I] Those issued exclusively for broadcast to Indian Naval ships, called the *Fleet Forecasts*

II] Those which are issued for merchant shipping and also sent for broadcast to Indian Naval ships, viz·

(a) Coastal bulletins for Indian coastal areas.

(b) *Extra*, *Storm*, and *Special* Sea area bulletins for Bay of Bengal and Arabian Sea.

4.2 Fleet Forecasts - Frequency And Areas of Responsibility

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. The areas of responsibility for Fleet Forecasts are larger than those for merchant shipping. In the forecast portion, the designation of the sea areas used in the Fleet Forecasts are different from those used for merchant shipping; the areas and sub areas are indicated by letters and numbers as shown in **Fig. 8**.

4.3 Offices of Issue of Fleet Forecasts

The offices which issue the Fleet forecasts and their areas of responsibility are given below:

S. No.	***Office of issue***	***Area of responsibility***	***Sub-areas***
1	ACWC Mumbai	Arabian Sea to the north of Lat. 5°N and East of Long. 40°E, Gulf of Oman and Persian Gulf	B 00, 20, 25, 30, 35, 40, 55 & E 00, 05
2	ACWC Kolkata	Bay of Bengal and Andaman Sea to the north of Lat. 5° N	C65, 70, 75, 80, 85 and E10 and West half of E15.
3.	Marine Service Division, New Delhi	Indian Ocean between Lat. 35° S and 30°N and Long.30°E and 115°E	A 00, 05,10,15,20, 25 B 00, 00, 20, 25, 30, 35, 40, 55, C 65,70, 75, 80, 85 D 00, 05,10,15,20,25,20,35,40, 45, 50,55,60,65,70,75,80,85,90

			E 00,05,10,15,20,25,30,35,40, 45, 50, 55, 60, 65, 70, 75, 80, 85,90,95. F 00,05 G 00,05,10,15,20,25,30,35

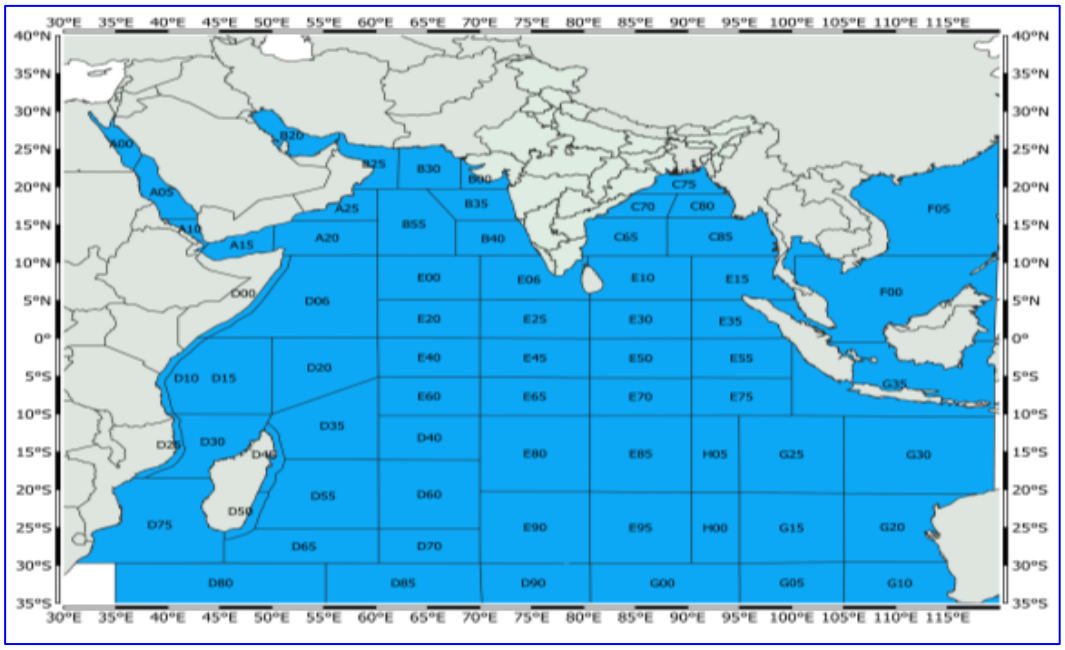


Fig.8: Fleet Forecast Area of responsibility

4.4 Items In Fleet Forecast

The Fleet Forecast is in plain language and contains the following items:

I] A brief general inference for the area. In the case of Bay of Bengal and Arabian Sea, the inference will conform to the *Aurora* and *Balloon* bulletins issued by ACWCs Mumbai and Kolkata. However, unlike the merchant shipping bulletins, the inference portion will not be divided into Parts – I and II and also will not include the identification prefixes such as *Aurora* etc. But the type of warning – viz. – *Cyclone Warning* etc. forming part of the message, will be included.

II] Forecast for the numbered sections of the area. The forecast will cover

(a) Surface wind (b) visibility and (c) state of Sea on all occasions.

III] An *outlook* for the next 12 hours.

4.5 Times of Origin and Broadcast

Fixed times of origin are given to the Fleet Forecast messages – 0800 UTC in the case of day bulletin and 1700 UTC in the case of the night bulletin based on 0300 and 1200 UTC respectively. However, the bulletins should be originated sufficiently early to allow for their timely reception at MCC Mumbai. These Fleet Forecasts are broadcast by Naval W/T station, Mumbai, during weather broadcast periods commencing from 0930 UTC and 1830 UTC respectively.

4.6 Important Instructions

The following are some of the important instructions that should be followed while framing the Fleet Forecasts.

4.6.1 *Forecasts to Be Brief*

Fleet Forecast messages should be brief. It should be borne in mind that the requirements of ships at sea are principally wind (direction and speed) and visibility and hence the area forecasts must contain only these two elements and their variations. Weather is of importance only in so far as visibility is affected, as for example by heavy rain; if no rain is forecast or only light showers are expected, no mention need be made of weather at all as visibility is not likely to be affected. State of sea can be generally estimated from the wind speed; however, if it is likely to be different as when a cyclone or swell exists, reference should be made to the fact. For the sake of brevity, sections may be combined wherever possible. *Swell forecast can be given based on the INCOIS forecast.*

4.6.2 *Wind Speed And Direction*

Wind speed is given in knots and wind direction in sixteen points of the compass.

4.6.3 *Visibility and State of Sea*

Visibility and state of sea will be given as per paras 2.2.2.10.2 and 3.6.5 respectively.

4.6.4 *Central Pressure*

The central pressure will be given from Depression onwards.

4.6.5 *Validity*

The two daily forecasts are valid for 12 hours from 1000 UTC and 2200 UTC respectively.

4.6.6 *Outlook And 'FOLC'*

Outlook for next 12 hours in clear terms from the termination of the forecast period should be appended to both day and night bulletins as a routine. The preamble may be *Further outlook subsequent 12 hrs*. etc. The abbreviation ***FOLC (Further Outlook – Little change)*** can be used when no change is expected.

4.6.7 *Modification to Previous Forecast*

When weather conditions are reasonably stable, the evening forecast may be abbreviated with reference to the previous morning forecast; for example, such of those sections where the evening forecast is not different from the morning forecast, the phrase *no modification Sections …….* Or *is as from 1000 UTC/date for Sections ……* may be used.

4.7 Mode of Transmission of Fleet

ACWC Kolkata, ACWC Mumbai and MSD New Delhi send their Fleet Forecasts to Naval W/T Office, Mumbai and Naval W/T Office Visakhapatnam.

4.8 Coastal Bulletins

All the coastal bulletins (routine as well as non-routine) issued by ACWCs/CWCs for Indian coastal areas will also be passed on to the Navy for broadcast. As already mentioned in para. 3.3, in normal weather, there will be only two bulletins daily and the frequency will be increased to six times a day on occasions of cyclonic storms. The coastal bulletins for West coast are broadcast by Naval W/T station Mumbai and those for East coast by Naval W/T station Visakhapatnam. The ACWCs/CWCs will address the coastal bulletins to either the Naval W/T stations Mumbai or Visakhapatnam as given below:

S. No.	***Office of Issue***	***For coast***	***Addressed to***	***Mode of Transmission***
1	ACWC Mumbai	(i) Goa (ii)Maharashtra	Naval W/T Mumbai	Through RCC Mumbai
2	CWC Ahmedabad	(i) Gujarat	. Naval W/T Mumbai	Through RCC Mumbai
3	ACWC Chennai	(i) Tamil Nadu (ii) Puducherry & Karaikal	Naval W/T Mumbai Naval W/T Visakhapatnam	Through Naval W/T Chennai - do -
4	CWC Visakhapatnam	(i) Andhra Pradesh and Yanam	Naval W/T Visakhapatnam	On Phone
5	CWC Bhubaneswar	(i) Odisha	- do -	Through W/T Kolkata
6	ACWC Kolkata	(i)West Bengal (ii)Andaman & Nicobar Islands	- do - - do -	- do - - do -
7	CWC, Thiruvananthapuram	Kerala, Mahe, Karnataka and Lakshadweep	Naval W/T Mumbai	Through RCC Mumbai

4.9 Extra Storm And Special Sea Area Bulletins

Whenever *Extra*, *Storm* or *Special* sea area bulletins are issued for merchant shipping During disturbed weather for Arabian Sea and Bay of Bengal by ACWC Mumbai and ACWC Kolkata respectively, these are also sent to the Navy. While the above bulletins for Arabian Sea issued by ACWC Mumbai are passed on to Naval W/T station Mumbai for broadcast, similar bulletins (*Extra*, *Storm* and *Special*) in respect of Bay of Bengal issued by ACWC Kolkata are sent to Naval W/T station Kolkata.

5. ***Bulletins for Departmental Exchanges***

5.1 Format, Transmission and Exchange of Information

The sea area bulletins issued by the ACWCs are sent to all the departmental offices over email. The format of these bulletins for departmental exchanges is different from that for broadcast by NAVTEX for ships as the former contains information relating to only Parts I and II. Also, unlike the messages for broadcast, they will be continuous without being divided into Part I and Part II. When information in respect of Part I is nil, only the portion of the text relating to Part II will be sent. However, they will contain the preamble Aurora, Balloon etc. for easy identification of the messages.

5.2 Sea Area Bulletins Issued By ACWC Chennai

In addition to ACWC Mumbai and Kolkata, ACWC Chennai also issues sea area bulletins (twice daily in undisturbed weather and six times a day on occasions of cyclonic storms) for both the Arabian Sea and Bay of Bengal. These messages are not for broadcast by NAVTEX but meant only for departmental exchanges. ACWC Chennai may follow the same timings in transmitting all sea area bulletins to CWC Visakhapatnam as followed by ACWC Kolkata.

5. 3 Discontinuance of Issue of Special Sea Area Bulletins By ACWC Chennai

Special sea area bulletins by ACWC Chennai (*Dew Drop*, *Electron*, *Formula* and *Gas Bag*) for the Bay of Bengal and the Arabian Sea may be discontinued whenever the systems are not likely to affect the coast of Chennai region during their subsequent life history. DGM office (CWD) as well as ACWCs Kolkata and Mumbai should be kept informed when these special bulletins are discontinued. However, if the situation warrants, DGM's office (CWD) will request ACWC Chennai to continue the special bulletins for such time as may be necessary.

5.4 Transmission to Naval and Air Force Met. Offices

Parts I and II of all the sea area bulletins issued by the ACWCs are also distributed to Naval and Air Force Meteorological Offices by email wherever such facilities exist.

5.5 Inclusion of Forecast Position Of The System

Whenever there is a depression or a cyclonic storm in the sea area, the *Aurora* and *Balloon* bulletins sent to the departmental offices will contain the forecast position of the disturbance at the next two main synoptic hours – i.e., the *Aurora*, message will contain the forecast positions at 1200 UTC of the day and 0000 UTC of the next day, while the *Balloon* message will contain the forecast positions at 0000 UTC and 1200 UTC of the next day. Such forecasts will be included till the depression or cyclonic storm crosses coast. *Forecast Table on track and intensity upto 120 hrs or till the system crosses coast should be given* in the India Weather Bulletins originated by National Weather Forecasting Centre, New Delhi and all concerned ACWCs and CWCs in conformity with that issued by CWD.

5.6 Crucial Observations

It is desirable that on the first declaration of a cyclonic storm or of a cyclonic storm intensifying into a severe one, particularly when the development is sudden, the bulletin exchanged between the offices should draw attention to the crucial observations on which it is decided to upgrade the system. The full text of the crucial observations may also be added with advantage at the end of such bulletins, as it may happen that in some cases the observations may not be available in the other office(s). This practice should be treated as mandatory in the case of a *Hexagon* message.

5.7 Tentative Aurora

5.7.1 *Occasions of Issue*

On days of disturbed weather over the sea area, an additional bulletin known as *Tentative Aurora* is originated by the concerned ACWC as well as Weather Central, Pune and exchanged between the ACWCs, CWCs, Weather Central, Pune and RSMC New Delhi. *Tentative Aurora* will be issued from the stage of the formation of a depression onwards till the system crosses coast.

5.7.2 *Time and Purpose of Issue*

The tentative bulletin will be issued by 1100 hrs. IST based on 0300 and all other information available by that time after the all India VC at 1030 IST. The center of the system in the message should refer to 0300 UTC. This exchange of views through the

tentative bulletin is meant to ensure uniformity in the assessment of the position, intensity and forecast movement among the various centers responsible for the cyclone warning work so that the final *Aurora* messages issued by different offices are not divergent and issued in time.

5.7.3 *Text*

The text of *Tentative Aurora shall include* brief containing information about (i) intensity (ii) position and (iii) forecast movement (position) of the system; as mentioned in para 5.6, it should also contain crucial observations, if any, on which the inference is based.

5.7.4 *Exchange of position and intensity of Cyclonic disturbances*

Location and intensity of the system will be decided through discussion among NWFC, RSMC, RMCs, and CWC/ACWCs through video/teleconferencing.

This is being done to ensure the uniformity in regard to the position of the system between RSMC and concerned ACWCs. Divergence of opinion in the position of center and intensity of cyclonic systems should not exist in any bulletin.

5.8 Exchange of Information and Mutual Consultations by phone/VC on Occasions of Disturbed Weather

5.8.1 *Personal Discussion by Telephone/video conferencing*

In addition to the exchange of *Tentative Aurora* messages, personal discussion by means of telephone calls/ VC is also availed of, whenever required, to narrow down the differences of opinion in the assessment of the intensity of the systems, their future movements etc.

Even when the storm is within radar range, there is mutual discussion between the various offices and a consensus is reached on the center, intensity and its direction of movement etc. These phone calls should also be utilized for exchange of the latest observations.

When the storm is tracked by radar all the concerned offices will give the same centers i.e. with maximum weightage to the radar center as decided by CWD in consensus.

5.8.2 ***FAX/Internet***

Wherever FAX/Internet facilities are available, these may also be used on occasions of cyclonic storms by the Scientist-in-charge at his discretion to obtain vital data or to have important brief mutual consultations with other ACWCs/CWCs/ Weather Central, Pune, RSMC New Delhi etc.

5.8.3 ***Position of the Centre & Intensity of Storm in Storm Warning Bulletins***

IMD operates at various points like RMC/ACWC/CWC's and officials of these centers have to interact with other officials at their level. There is a need to have complete uniformity in bulletins issued from various centers. This could be achieved through telephonic consultations or VC. However, if the consensus view is not arrived at, the view of the HQ will prevail.

For all storms, the speed and direction of movement should also be indicated in the bulletin. Based on the available information, decisions of positions and intensity of cyclone should be taken as fast as possible by mutual consultations without losing time in collecting more evidence. In rapid moving systems where weather sometimes moves much ahead of storm, RSMC should also alert other RMCs as found necessary. This will help in gaining the vital lead time in real time operations.[47]

5.9 Exchange Over AFTN

Part I of Sea area bulletins, whenever issued is sent by ACWCs Mumbai/ Kolkata/ to MWOs Mumbai/Kolkata on GTS, email, lease line or telephone (in order of priority) for inclusion in SIGMET message which are transmitted over AFTN channel to foreign countries.

The present schedule of distribution is as follows:

(a) **From MWO MUMBAI**

1	ADDIS ABABA	HAABYM	**13**	NAIROBI	HKNAYM
2	COLOMBO	VCCCYM	**14**	BANGKOK	VTBDYM
3	RANGOON	VBRRYM	**15**	DHAHRAN	OEDRYM
4	BAHRAIN	OBBIYM	**16**	OFFENBACH	EDZWYM
5	DAMASCUS	OSDSYM	**17**	BAGHDAD	ORBBYM
6	SINGAPORE	WSSSYM	**18**	DACCA	VGDCYM
7	CAIRO	HECAYM	**19**	JEDDAH	OEJDYM
8	MAURITIUS/ PLAISANCE	FIMPYM	**20** **21**	TEHRAN DJIBOUTI	OIIIYM HFFFYM
9	BASRAH	ORMMYM	**22**	PERTH	APPHYM

10	KARACHI	OPKCYM	**23**	MASIRAH	OOMAYM
11	LAHORE	OPLHYM	**24**	MUSCAT	OOMSYM
12	BEIRUT	OLBAYM	**25**	MALE	VRMMYA

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(b) ***From MWO KOLKATA***

1	BANGKOK	VTBDYM	**8**	SINGAPORE	WSSSYM
2	DACCA	VGDCYM	**9**	JAKARTA	WIIIYM
3	CHITTAGONG	VGEGYM	**10**	KARACHI	OPKCYM
4	RANGOON	VBRRYM	**11**	LAHORE	OPLHYM
5	SAIGON	VVVSYM	**12**	SURKHET	VNKTYM
6	PHNOM-PENH	VDPPYM	**13**	COLOMBO	VCCCYM
7	HONGKONG	VHHHYM	**14**	OFFENBACH	EDZWYM

(c) FROM MWO DELHI

1	AMERICAN SAMOA (UNITED STATES)	KWBCYMYX
2	BULGARIA	LBSFYMFF
3	AUSTRIA	LOWMYBYX
4	FIJJI	NFZZRFXX
5	IRAN	OIIIYPYX
6	OMAN	OOMSYMYX
7	PAKISTHAN	OPKCYMYX
8	JAPAN	RJTDYPYX
9	SRI LANKA	VCBIYMYX
10	BANGLADESH	VGHSYMYX
11	MALE	VRMMYMYX

12	THAILAND	VTBBICOX VTBDYMYX VTBSYMYX
13	MYANMAR	VYYYYMYX
14	INDONESIA	WIIIYPYX
15	CHINA	YBZZSQJX
16	RUSSIA	UUEEYMYX
18	BEIRUT	OLBAYMYX
19	AUSTRIA	LOWMYBYX
20	NEPAL	VNKTYMYX
21	AFGHANISTAN	OAKBYMYX

(D) FROM RTH NEW DELHI

01	THAILAND	10	BHUTAN
02	CHINA	11	OMAN
03	SRI LANKA	12	IRAN
04	BANGLADESH	13	JAPAN
05	PAKISTAN	14	FRANCE
06	MALDIVES	15	UK
07	MYANMAR	16	MYANMAR

5.10 International Exchange

Part I of sea area bulletins containing warning (Warning, Cyclone, severe cyclone warning, etc.) is also sent by the ACWCs Mumbai and Kolkata to ISSD New Delhi for inclusion in the International Exchange.

6. ***Port Warnings***

6.1 Systems of Storm Warning Signals

A uniform system of storm warning signals was introduced at all the ports in India from 1st April 1898 and it is still in vogue. The system consists of:

(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, the next eight (signals III to X) 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. Signals No. I and II are called *Distant Signals* and the rest *Local signals*. The ports where this system of signals is in use are called *General ports*.

(ii) ***Extended System***

An *Extended System* which in addition to the eleven signals of the General System, has six Section signals to indicate the location of the disturbance. These additional signals are hoisted along with Distant Signals. This system is a special case of the General System and is in use only at a few ports on the east coast (Bay of Bengal). These ports are: Sagar Island, Kakinada, Chennai, Cuddalore and Nagapattinam. These ports are called *extended ports*. There is no port under the *Extended System* on the west coast.

(iii) ***Brief System***

A *Brief System* consisting of only five of the signals of the General System (viz. Signal Nos. III, IV, VII, X and XI). These are hoisted in association with prospects of bad weather at the port itself caused by disturbances out at sea. This system of signals is in use in ports frequented mainly by smaller vessels engaged in local traffic and these ports are called *Brief ports*.

6.2 Ports Without Signals

In addition, there are some minor ports where no signals are hoisted but which get a special type of warning message; they are called *Ports without signals*. For the

purposes of warning, these ports are treated as Brief ports and corresponding port warnings are issued when adverse weather threatens them although no signals are advised to be hoisted. These warning messages will contain information on the location and direction of movement of the disturbance along with forecast Table and the expected weather over the port.

6.3 Meanings of Signals and List of Ports

The meanings of the various signals and a list of ports under the different systems and the ACWCs/CWCs from which they receive the warnings are given in Appendix II. Details of the specifications of the visual signals used during day time and lamp signals used during night are given in the departmental publication *Code of Storm Warning Signals for use at Indian maritime Ports* – Sixth edition, 1984. List of Ports is given in Annexure-1.

6.4 Distant Signals

6.4.1 *DC I and DW II*

Distant signals are hoisted only at ports under General and Extended Systems and not at Brief ports. There are two Distant Signals: Distant cautionary signals no. I (DC I) and Distant Warning signal No. II (DW II).

6.4.2 *Hoisting of DC I & DW II*

DC I is hoisted at a port when the system out at sea is a depression or a deep depression and while the local weather at the port itself is not likely to be affected immediately, ships leaving the port may run into danger during their voyage. Discretion has, therefore, to be exercised while assessing such a probability, taking into account the location of the weather system out at sea with reference to the port and the estimated direction and speed of movement of the system. When the system has intensified into a storm and still out at sea Distant Warning signal no. II (DW II) is to be hoisted. If there is a risk of the port itself experiencing bad weather, the appropriate local signal is to be hoisted in preference to the distant signals. Thus, when a port having a distant signal is also likely to have squally weather although the depression/storm is still away, the obvious action will be to change the distant signal to LC-III. Nothing precludes hoisting of LC-III at a port where distant signal is to be hoisted if the port is expected to have squally weather. In general, when a weather situation warrants more than one signal, the highest numbered signal will be hoisted.

6.4.3 *Appropriate Signals When Systems Cross The Peninsula And Enter Arabian Sea*

Unless one of the Local signals is more appropriate and hoisted, the Distant signal will also be hoisted at Arabian Sea Ports when a disturbance from the Bay is crossing the peninsula and may develop into a depression/cyclone after entering the Arabian Sea.

6.4.4 *Sections Signals*

6.4.4.1 Section of Bay

When a Distant signal (DC I or DW II) is hoisted at an Extended port, an appropriate Section (or Locality) signal must also be hoisted. For the purpose of Locality signals, Bay of Bengal has been divided into six sections as given below:

Section I : North Bay area to the north of Lat. 18½º N

Section II : West Central Bay – lies south of I and is bounded on the south by Lat 13º N and on the east by Long. 88½ºE.

Section III : East Central Bay – lies south of I and east of II. It is bounded on the south by Lat. 13º N and on the east by a line from the Point, Lat. 13º N, Long. 93ºE to Diamond Island, the Arakan Coast and thence upto Lat.18½º N.

Section IV : Southwest Bay – lies south of II, and west of Long. 86º E

Section V : Southeast Bay – lies east of IV, south of II, III and west of Long.93º E.

Section VI : Andaman Sea – lies east of III and V.

The southern boundary for Sections IV, V and VI is lat. 0ºN.

6.4.4.2 Change In Section Signals

The section signal will be changed when the center of the system moves from one section into another, even if there is no material change in other respects. Similarly, if DC I is changed to DW II or vice versa, Section signals are also to be repeated in the message, even if there is no change in the Section signal(s).

6.4.4.3 Number of Section Signals

Generally, the Locality signal Number is of that section in which the center of the depression/storm is situated. If, however, the center is near the boundary of a division,

two Locality signals are asked to be hoisted, the first indicating the division in which the center is actually situated and the second the division nearest to the first. In the event of a center being near the corner where three divisions meet, three Locality signals are asked to be hoisted, the first indicating the division in which the storm is estimated to be centred, the second the nearest adjoining division and the third, the remaining division.

Examples:

Storm Centre	**Locality Signals**
Lat. 16°N – Long. 86°E	II
Lat. 16°N – Long. 88°E	II and III
Lat. 16°N – Long. 89°E	III and II
Lat. 18°N – Long. 87½°E	II, I & III
Lat. 19°N – Long. 89½°E	I, III & II

6.5 Local Cautionary Signal Number Three (LC – III)

6.5.1 When To Hoist LC – III

LC – III is a signal very frequently hoisted at the ports. It is hoisted at a port which is likely to experience squally weather.

6.5.2 *Definition of Squally Weather*

Squally weather is meant to cover occasional or frequent squalls with rain or persistent type of strong gusty winds (mean wind speed not less than 20 kt.) accompanied by rain. Such conditions are associated with low pressure systems or onset and strengthening of monsoon. Mean wind speed exceeding 33 kt. associated with cyclonic storms are generally covered by signals higher than LC-III. The significance of the word *generally* in the previous sentence is to permit the hoisting of LC-III at ports outside the inner storm area where wind speed may exceed 33 kt.

6.5.3 *LC-III In Association With The Monsoon*

The general convention not to keep LC-III hoisted too long requires an amplification in the case of squally weather associated with the monsoon. LC-III should be hoisted (a)

when squally weather is expected in the port due to the first advance of the monsoon or (b) whenever after the monsoon has been established, it is expected to strengthen markedly following a period of weak or moderate monsoon and cause associated markedly squally weather at the port. If the occasions of hoisting this signal are regulated by these considerations, then it will follow that the signal should also remain hoisted for such time as the associated threat of squally weather at the port remains. The criterion followed for hoisting LC-III under condition (b) above is that the expected wind speed should be 30 kt. or more. This minimum limit of 30 kt has been adopted with a view to restrict the number of occasions on which LC-III will have to be hoisted. The term *markedly squally weather* will always be used in all such messages.

6.6 Local Warning Signal Number Four (LW IV)

6.6.1 When To Hoist LW- IV**?**

When a cyclonic storm has actually formed, LW IV is hoisted at ports which could possibly be struck later by the storm, since the existence of a storm can often be determined before its direction of motion can be fixed. It is a preliminary stage when the direction of motion of the system is yet to be fixed with certainty and serves as a prelude to the possibility of Danger or Great Danger signals at a later time. From the specification of the signal, it is evident that LW IV by itself is not associated with any particular severity of weather. When the direction of movement becomes definite (i.e. when the coast and the ports where the storm will strike is indicated in the sea area bulletin), LW IV will be replaced by Danger or Great Danger signals as appropriate at the ports expected to be affected directly by the storm and LC-III at ports where squally weather associated with the storm is expected to prevail. (Refer to para 6.5.2). Hence, normally Great Danger or Danger signals at some ports and LW IV at other ports at the same time for the same disturbance will not be hoisted.AS, at present, the forecast track and intensity are given from the Deep Depression stage onwards, and this possibility is remote. Hence, LWIV should have minimum use.

6.6.2 *Co-Existence of LW IV With Higher Signals*

The note under LW-IV in the *Code of Storm Warning Signals* was interpreted to mean in different ways, for and against the co-existence of LW-IV with higher signals. In

order to have uniformity, the matter was examined in the F.O's Conference 1960 and on the basis of its recommendations, the following instructions were issued.

Because of some uncertainties in forecasting the direction of movement of a storm, simultaneous hoisting of Danger or Great Danger signals and LW-IV are allowed, the former (Danger or Great Danger) within the sector covered by the most probable direction of movement of the storm and latter (LW-IV_ within the adjoining sector or sectors covered by less possible direction of movement of the storm. Under such special circumstances, Danger or Great Danger signals can co-exist with LW-IV. However, when the direction of movement of the storm can be definitely determined, LW-IV will not be kept hoisted.

However, considering the current status of forecast and its accuracy, once the track forecast is generated LW-IV should be avoided. Hence, it should be used in rarest of rare cases only.

6.6.3 LC-III To Be Hoisted In Outer Area Of Storm

After DW II has been hoisted at a port, only if there is a probability of the storm moving towards the port, it is necessary to change DW II to LW IV or Danger signal. Otherwise LC-III can be hoisted, for the likelihood of squally weather at the port, whether such squally weather is due to some local cause unconnected with the storm (such as advance of the monsoon) or it is due to squally weather in the outer area of the storm (Refer para. 6.5.2) and the storm is not likely to strike the port later.

6.7 Danger and Great Danger Signals

6.7.1 *When to Hoist Danger & Great Danger Signals – Co-Existence of Danger And Great Danger Signals Inconsistent*

Danger signals are hoisted when the storm is of slight or moderate intensity and Great Danger Signals when the storm is severe. The intensity refers to the intensity of the storm at and about its center and not to the intensity or severity of the weather in different parts of the cyclone. In the circumstances, hoisting of Great Danger signals at some ports and Danger signals at other ports at the same time to convey the varying severity of the effect of the cyclone at the different ports is inconsistent with the existing specifications of the signals. While Danger or Great Danger signals should be hoisted at such ports which will be affected by the inner storm area (where wind speed may

exceed 33 kt.), LC – III may be hoisted at the same time at such of the ports outside the inner storm area as may be considered necessary (Refer para. 6.5.2)[55]. The Quadrant wind radii forecast (text and graphics) issued by the CWD should be used as basis to determine the ports in inner storm area and outer storm area.

6.8 Some General Rules regarding Signals

6.8.1 *Signals Conform to Intensity of Systems*

As a general rule, signals have to conform strictly to the existing intensity of the system.

If some rapid development is expected, the office should keep a careful and continuous watch on the basis of the special observations and issue suitable modifications as and when necessary. They (the signals) are stepped up or down, as and when necessary, depending upon the intensity of the system.[56]

6.8.2 *Typical Progression of Signals*

A typical progression of signals is the Distant Cautionary (DC I), Distant Warning (DW II), Local Warning (LW IV) and Danger or Great Danger. During such a succession of signals, it is essential that the change from Cautionary to Warning be accompanied by a verbal description of the change of the system from a depression or area of squally weather or disturbed weather to a storm. This progression does not however over-rule the practice of having LC III with the declaration of storm at ports towards which the storm is not heading but which may still experience squally weather. This progression does not also over-rule if occasion demands, the changing of signals by two stages like replacing of DW II by Danger or LC III by Great Danger. Similarly, there is nothing to preclude replacing an existing Danger/Great Danger signal by LC-III, when the threat to the port is removed by the system moving away but squally weather is still likely over the port for some more time.

6.8.3 *Signals Not To Be Kept Hoisted Longer than Necessary*

Signals should not be kept hoisted longer than necessary, so as not to adversely affect the operations at a port. When a storm is crossing or crossed the coast, in general, discretion is allowed in stepping down from Danger signal to LC-III or no signal at all

depending upon whether the return of the weather to normal is foreseen to take place through successive stages or quickly. [58]

Note: When the system is over land and the port is likely to continue to experience bad weather with same severity, appropriate signals can be kept hoisted at that port.

6.9 Informatory messages

6.9.1 Steep Pressure Gradient

Informatory messages are sent to ports about strong winds in association with steep pressure gradients but no signals are hoisted. However, as per local practice at the ACWC Kolkata, the CWC Bhubaneswar and the ACWC Mumbai and the CWC Ahmedabad, LC-III is hoisted under such condition also.

6.9.2 *Informatory Messages For Brief Ports*

Informatory messages are also sent to Brief ports without any advice to hoist any signal when disturbances currently out at sea, are likely to affect the ports during the next 48 hours.

6.10 Text of Warnings to Ports

6.10.1 *Relevant Portion Of Sea Area Bulletins To Be Used*

Ports under General, Extended and Brief systems should receive warning messages consisting of relevant portions of sea area bulletins along with instructions to hoist the appropriate signals. The port warning messages are expected generally to conform to the radio weather messages issued to shipping. The bulletins issued by RSMC, New Delhi are to be the basis on which port warnings and other action will be initiated by the CWCs at Bhubaneswar, Visakhapatnam and Ahmedabad respectively

6.10.2 *Important Points*

The following are some of the points to be noted in preparing the warning messages.

6.10.2.1 Time of Reference

The time of reference should be given in IST and not in UTC.

6.10.2.2 Position as Bearing From Well Known Land Marks or Ports

In addition to the positions of the center (of the storm or depression) given in terms of latitude and longitude, they may also be given with reference to the distance and bearing from well-known land marks such as ports or coastal observatories. Villages which may not be well known should not be selected. When the port or ports where the storm may strike becomes definite, the center may be given with reference to such port(s).

6.10.2.3 Inclusion of Central Pressure of System

For the benefit of ships lying at ports which may not receive sea area bulletins, the central pressure of the system is also included in the port warning messages from the stage of Depression onwards.

6.10.2.4 LC-III - Mention of Squally Weather

When advice to hoist LC III or to keep LC III hoisted is given to a port, there should be a reference in the message to the likelihood (or continuance) of squally weather at the port, like *squally weather likely (or likely continue) at your port next …….. hours*. However, in messages to hoist higher signals, no such elaboration is made and the associated weather in such cases is to be inferred by the Port Officer.

6.10.2.5 Giving Number of Signal In Plain Language

The number of the signal to be hoisted is given in plain language to avoid errors in transmission. Similar procedure should also be followed for other items such as latitude and longitude of center of the storm etc.

6.10.2.6 Mention Of Keep Signal Hoisted

In all messages to ports subsequent to the one advising the hoisting of a signal, the words *keep signal number ----- hoisted* should be mentioned till the signal is lowered or replaced by another signal.

6.10.3 *Text Of Message To Ports Without Signals*

The ports without signals also receive messages whenever adverse weather threatens them due to a disturbance. These messages may be similar to the one to the adjoining ports with signals and will contain information on the location and direction of movement of the system and the expected weather over the ports in brief. Only the advice to hoist any signal is omitted in the messages.

6.11 Transmission of messages to ports

6.11.1 *By email*

Port warning messages are normally sent by *FAX / e-mail.* Whenever Danger or Great Danger Signals are to be hoisted at a port, the warning should be conveyed to the concerned Port Officer by email, SMS/Whatsapp and Telephone at the first hoisting of these signals. *Immediate* telephone calls may also be made under emergent conditions. It should then be possible to get useful information from the Port Officers regarding the disturbed weather at their ports.

6.11.2 *Utilisation of Police W/T*

Police W/T facilities can also be utilized for passing on the port warning messages to such of the ports where Police W/T stations are existing, in the following cases: (i) when the meteorological telecommunication channels have either failed or (ii) when there is a likelihood of the messages getting unduly delayed. The procedure for dissemination of storm warning messages over Police W/T grid has been laid down in DDGF Forecasting Circular No. 3/1969.

6.12 Frequency of messages to ports for hoisting the signals

6.12.1 *For Distant Signals*

It is sufficient if ports with Distant signals (DC I or DW II) get a message once a day, usually based on 0300 UTC chart. However, in between, if there is a necessity to change the section to another, fresh messages are to be sent to the concerned extended ports. Or, if the system changes in intensity from depression to storm (or vice versa), even without change of position necessitating change of signal from DC I

to DW II (or vice versa), fresh messages are to be sent to the General and Extended ports concerned.

6.12.2 *For LC III or Higher Signals*

When LC III or higher signals are hoisted, the concerned ports should get a message each time a sea area bulletin is issued i.e. thrice a day in the depression stage and at least six times a day when the system is a cyclonic storm.

6.12.3 *For Ports without Signals*

Ports without signals should be informed at least once in 24 hours or whenever there is a change in signals in the nearby Brief port.

6.12.4 *For Informatory Messages*

Informatory messages covered by 6.9.1. may be sent as and when the period of the warning expires.

6.13 Storm Warning Signal Display Board

A storm warning display board is maintained in ACWCs/CWCs showing the various divisions of the sea areas and the ports of the different types under the responsibility of the centers. Suitably coloured flags are displayed against each port as soon as messages to hoist signals are sent to the ports. This helps to keep under visual review the various signals at different ports. The signals displayed on the board are checked by the Duty Assistant immediately after the transmission of the message to port authorities.

6.14 Procedures for uploading the bulletins on the website (http://rsmcnewdelhi.imd.gov.in)

1. Go to Admin Panel
2. Login in Admin (with proper username and password assigned)
3. Select specific bulletin to be uploaded
4. Add
5. Fill up details as asked in the panel
6. Choose file to be uploaded
7. Add

7. Fisheries Warnings

7.1 Criteria for fishermen warnings

Fishermen get an idea of the adverse weather likely to affect the ports from the signals hoisted at the ports as well as from the information available with the Port Officers through the port warning messages. In addition to this, special warnings are also sent for the use of fishermen during periods of disturbed weather by phone, fax, email, whatsapp to the various fisheries officials who are on the warning list of the ACWCs/CWCs. The criteria for the issue of the warnings are:

(i) Squally weather (maximum sustained wind speed (MSW) ≥ 20 knots alongwith fairly widespread (51-75% area receiving rainfall) to widespread (76-100% area receiving rainfall) rainfall over a region

(ii) Strong of-shore and on-shore (or with appropriate direction) winds, speed exceeding 45 kmph.

(iii) Significant wave height ≥ 4.0 m i.e. state of sea is very rough and above

(iv) There is a depression or above intensity cyclonic disturbance over an area

7.2 Warnings for fishermen through AIR

7.2.1 *Time of Broadcast and Air Stations to Whom Issued*

Weather warnings for fishermen are also issued by the ACWCs/CWCs for broadcast four times daily in the morning (0600 hrs.), mid-day, in the evening (1800 hrs.) and in the midnight. 4th fisheries bulletin for midnight broadcast is issued by CWC Ahmedabad only during disturbed weather condition. (Res. No. 2 – ACR 1991). Morning fishermen bulletin by the concerned ACWC/CWC should be framed in accordance with the National AIR news Bulletin.

The fisheries warnings issued in mid-day are incorporated in the ‘General Weather bulletin’ by the Forecasting offices in the maritime states (vide para 9.1.1.). These warnings are broadcast in the local language of the coastal area concerned. The areas of responsibility of the ACWCs/CWCs and the selected AIR stations to which the warnings are issued are given below:

S. No.	AIR Station	Office of issue of the warnings	Coast for which warnings are issued
1	Ahmedabad and Baroda	CWC Ahmedabad	Gujarat, Diu, Daman
2	Bhuj	- do -	- do -
3	Rajkot	- do -	- do -
4	Mumbai	ACWC Mumbai	Maharashtra
5	Ratnagiri	- do -	Maharashtra
6	Goa	- do -	Goa
7	Bengaluru	ACWC Chennai	Karnataka
8	Mangaluru	- do -	- do -
9	Dharwad	- do -	- do -
10	Kozhikode	. - do -	Kerala and Lakshadweep
11	Thiruvananthapuram	- do -	- do -
12	Trissur	- do -	- do -
13	Tiruchirapalli	- do -	Tamil Nadu
14	Chennai	- do -	- do -
15	Pudducherry	- do -	Puducherry
16	Karaikal	ACWC Chennai	Delta districts
17	Madurai	ACWC Chennai	South Tamilnadu
18	Tirunelveli	ACWC Chennai	Tirunelveli
19	Nagercoil	ACWC Chennai	Kanyakumari
20	Thoothukudi	ACWC Chennai	Thoothukudi
21	Kadal Osai FM	ACWC Chennai	Rameswaram island
22	CRS Radio 90.0 FM Nagai	ACWC Chennai	Nagapattinam
23	Vijayawada	CWC Visakhapatnam	Andhra Pradesh
24	Hyderabad	- do -	- do -
25	Visakhapatnam	- do -	- do -
26	Cuddapah	- do -	- do -
27	Cuttack	CWC Bhubaneswar	Odisha
29	Kolkata	ACWC Kolkatta	West Bengal
30	Port Blair	. - do -	Andaman & Nicobar Islands

INCOIS, Hyderabad also disseminates warnings through SMS and Electronic Display Boards (EDB) to coastal population especially meant for fishermen. Cyclone Warnings issued by India Meteorological Department is also incorporated in the bulletins issued by INCOIS.

7.2.2 *Extent Of Coastal Area*

For the purpose of the fisheries warnings, the coastal area is defined as extending 75 Km. out into the sea from the coast line.

7.2.3 *Reference Charts For Issue*

Normally, the bulletin for mid-day broadcast is issued based on the 0300 UTC chart and for the evening transmission (at 1800 IST), it is based on 0600 and 0900 UTC Charts. The bulletin for midnight broadcast is based on 1200 UTC and for early morning broadcast it is based on 1800 UTC charts. In case of disturbances (depression and above), latest charts should be used.

7.2.4 *Text Of Bulletin*

Each bulletin should be full and complete by itself and should not be worded as a modification to the earlier bulletin.

7.2.5 *Time Of Issue*

The bulletin for mid-day and midnight broadcast should reach the AIR station well ahead of the broadcast time. The bulletin for evening broadcast should reach before 1800 hrs IST and for the morning broadcast well before 0600 hrs IST.

7.2.6 *Format Of Bulletin*

The weather bulletins for fishermen issued to AIR stations for broadcast will be in the nature of a warning and contain the following particulars:

7.2.6.1 Preamble

The message will begin with a preamble: *Weather warning for fishermen for …… coast valid for next five days commencing from …. Hrs. IST issued at ….. hrs IST of …… (date).* The period of validity of the warning will be from the time of the AIR broadcast.

7.2.6.2 Synoptic Situation

Synoptic situation, if any, like depression, cyclonic storm, advance of monsoon, strong and vigorous monsoon etc. should be included in the beginning of the message immediately after the preamble.

7.2.6.3 Criteria For Warning

The criteria for warning will be as under:

(a) Strong off-shore and on-shore (or with appropriate direction) winds exceeding 45 kmph.

(b) Squally weather

(c) Gales

(d) State of sea very rough or above as case may be.

The speed of the wind should be mentioned in kmph. Direction of wind may also be indicated whenever possible. In the case of off-shore winds, it should be specifically stated.

7.2.6.4 Signals

Information regarding signals (LC III and above) hoisted at different ports along the coast should be given.

7.2.6.5 Advice

Advice to fishermen not to go out in the sea, whenever hazardous conditions prevail should also be included (refer to para 9.2.3).

7.2.7 Nil Warning

When there is no warning, the bulletin for fishermen will be worded as *Weather warning for fishermen for _____ coast for next 24 hours commencing _____ NIL*:

7.2.8 Informing Concerned M.Cs.

The M.Cs. in whose coastal regions where the fishermen are warned should also be kept informed by the ACWCs/CWCs issuing the warnings; this applies to 'NIL' warning also.

8. PRE-CYCLONE WATCH AND FOUR STAGE WARNINGS

8.1 Four Stage Warnings

In view of fast developments in information technology, the first information about the storm should be given at the earliest to the Central / State Govt. authority, general public and media persons. Therefore, the existing two stage warning system is amended by pre-fixing it with a bulletin called *Pre-Cyclone Watch*.

8.2 **Pre Cyclone Watch**

Pre-Cyclone Watch is being issued about at least 72 hrs. in advance implemented with effect from the beginning of the cyclone season (April – May) of 1999. However, as per the recommendations of Annual Cyclone Review Committee in 2018, this is not applicable in case of the genesis taking place close to coast or in case of rapid intensification near the coast. In such situation, the cyclone alert or warning can be issued directly without issuing the pre-cyclone watch. This bulletin contains early warning about the development of a cyclonic disturbance in the North Indian Ocean, its likely intensification into a tropical cyclone and the coastal belt likely to experience adverse weather. This early warning bulletin is issued by the Director General of Meteorology himself and is addressed to the Cabinet Secretary and other Senior Officers of the Government of India including the Chief Secretaries of concerned Maritime states, media persons and ACWCs/CWCs. Pre-cyclone Watch Bulletin will also be issued by the CWD and concerned CWCs and ACWCs till it is upgraded to Cyclone Alert Bulletin.

The limit of 72 hours will not be a binding and this procedure will not be followed for monsoon depressions.

8.2.1 *Issuing Offices*

According to the *Four stage warning Scheme,* the Collectors of coastal districts and the Chief Secretary of the concerned maritime state are to be warned in *Four* stages whenever any coastal belt is expected to experience adverse weather (heavy rain/gales/tidal wave) in association with a cyclonic storm or a depression expected to intensify into a cyclonic storm. List of Coastal Districts prone to cyclone hazard are given in **Table 4**

The ACWCs/CWCs which issue the *Four* stage warnings and their areas of responsibility are given below:

ACWCs/CWCs issuing Four Stage warnings and their areas of responsibility

1	ACWC Kolkata	Coastal districts of West Bengal and Andaman & Nicobar Islands.
2	CWC Bhubaneswar	Coastal districts of Orissa
3	CWC Visakhapatnam	Coastal districts of Andhra Pradesh and Yanam
4	ACWC Chennai	Coastal districts of Tamil Nadu, Puducherry

5	ACWC Mumbai	Coastal districts of Maharashtra and Goa.
6	CWC Ahmedabad	Coastal districts of Gujarat, Diu and Daman, Dadra & Nagar Haveli
7	CWC Thiruvananthapuram	Coastal districts of Kerala, Karnataka and Lakshadweep.

Table 4: List of Coastal Districts prone to cyclone hazard

State	Districts
Andhra Pradesh (AP)	Nellore
	East Godavari
	Krishna
Odisha	Balasore
	Kendrapara
	Jagatsinghpur
	Bhadrak
	PURI
	GANJAM
Puducherry	Yanam
West Bengal	South 24-Praganas
	North 24-Praganas
	Medinipur
AP	Srikakulam
	Guntur
	Visakhapatnam
	West Godavari
	Prakasam
	Vizianagaram
Daman & Diu	Diu
Gujarat	Junagadh
	Kachchh
Lakshadweep	Lakshadweep
Puducherry	Karaikal
Tamil Nadu	Pudukkottai
	Cuddalore
	Kanchipuram
	Tiruvarur
	Nagappattinam
	Chennai

Karnataka	Udupi
	Uttar Kannada
	Dakshin Kannada
Kerala	Kozhikode
	Malappuram
	Thrissur
	Kannur
	Kollam
	Alappuzha
	Thiruvananthapuram
Maharastra	Thane
	Mumbai suburban
	Ratnagiri
	Raigarh
	Sindhudurg
Puducherry	Puducherry
	Mahe
Tamil Nadu	Tiruvallur
	Chennai
	Chengalpattu
	Villupuram
	Puducherry
	Cudddalore
	Mayiladuthurai
	Karaikal
	Nagapattinam
	Tiruvarur
	Thanajvur
	Pudukottai
	Ramanathapuram
	Thoothukudi
	Tirunelveli
	Kanyakumari
Kerala	Kasargod
	Ernakulam
Total districts : 84	

8.2.1.1 Besides the coastal districts of the maritime states, on some occasions a few immediate interior districts are also threatened by the adverse weather like heavy rain and gale force winds when the storm is out at sea but close to the coast or at the time of the landfall. The following districts have been identified as prone to such adverse weather and may need warnings under Four stage warning system. When the occasion would arise those districts should also be warned along with the coastal districts. List of Cyclone hazard prone districts not touching the coast is given in the following **Table 5**.

Table 5: Cyclone hazard prone districts of India not touching (31) the coast

State	Districts
West Bengal	Hoogly
	Kolkata
	Howrah
	West Medinipur
AP	Chittor
Dadra & Nagar Haveli	Dadra & Nagar Haveli
Odisha	Mayurbhanj
	Cuttack
	Nayagarh
	Gajapati
	Jajpur
	Keonjhar
Gujarat	Surendra Nagar
	Kheda
Kerala	Wayand
	Palakkad
	Kottayam
	Idukki
	Pathanamthita
Odisha	Balasore
	Kendrapara
	Jagatsinghpur
	Bhadrak
	PURI
	GANJAM
Tamil Nadu	Kancheepuram
	Ranipet
	Thiruvannamalai

	Kallakurichi
	Ariyalur
	Sivagangai
Total Districts (31)	

ACWCs/CWCs issuing Four Stage warnings and their areas of responsibility of the immediate interior districts

1	ACWC Kolkata	Kolkata Howrah and Hooghly districts of West Bengal.
2	CWC Bhubaneswar	Balasore, Kendrapara, Jagatsinghpur, Bhadrak, Puri, Ganjam.
3	CWC Visakhapatnam	Chittoor district of Rayalaseema
4	ACWC Chennai	Kancheepuram, Ranipet, Thiruvannamalai, Kallakurichi, Ariyalur, Sivagangai
5	ACWC Mumbai	NIL
6	CWC Ahmedabad:	Rajkot, Surendranagar, Baroda, Panchmahal districts of Gujarat and Dadra and Nagar Haveli.

8.2.1.2 Whenever the occasion demands, warnings (By CWC Visakhapatnam) should also be sent to Government of Puducherry for their enclaves at Yanam)

8.3 'Cyclone Alert' And 'Cyclone Warning'

The second stage warning known as *Cyclone Alert* will be issued at least 48 hrs. in advance of the expected commencement of adverse weather over the coastal areas. The Third stage warning known as *Cyclone Warning* will be issued at least 24 hrs. in advance. However, in case of

The forecast position of the depression/storm for the next **120** hrs or till the weakening of the storm in forecast period whichever is less are now routinely included in the bulletins from the stage of deep depression. It is updated every six hours in deep depression stage and every three hours in the stage of Cyclone. In the case of deep depression/cyclonic storm, the forecast position and intensity will be given in the interval of every six hours upto 24 hrs and every 12 hrs interval thereafter. In the stage of depression the forecast track and intensity will be provided upto 72 hrs in the interval

of every 12 hrs and updated every six hours. In the pre-genesis track forecast issued in the stage of low or well-marked low, the track and intensity forecasts will be issued once a day valid upto 72 hrs in the interval of 12 hrs. The cone of uncertainty will be provided based on the climatological average error of rack forecast for different lead periods. Considering the higher uncertainty in the stage of low/ depression, the radii of cone of uncertainty will be increased by 25% and 50% respectively in case of depression and low respectively. The intensity forecast will be given in the range of 10 kmph. The gustiness of wind will be given as 10 to 20% higher than the maximum sustained wind speed. While the intensity will be written in kmph in national bulletins, it will be given in knots in international bulletins.

8.3.1 For fast moving or rapidly intensifying cyclones, alert and warning can be issued simultaneously. In such cases mutual consultations between the operational offices should be much faster so that reaction time could be reduced.

8.4 Mode Of Transmission

The **bulletin with** the preamble as *Cyclone Alert* will be issued by Fax and email classed **Urgent** to the Collectors of the Coastal districts expected to be affected and to the Chief Secretary of the concerned state. The **bulletin with** the preamble as *Cyclone Alert* will be issued by Fax and email classed **Urgent** to the Collectors of the Coastal districts expected to be affected and to the Chief Secretary of the concerned state. The alert messages would also be sent to the concerned AIR stations for broadcast in order to keep the public informed about the possible adverse weather either by **Fax and hotline/phone**–**Bulletin with** the preamble *Cyclone Warning* will **also** be issued by **Fax classed as urgent** to all the above officials viz. the coastal district Collectors and the Chief Secretary to whom **Cyclone Alert Bulletin** was sent and concerned AIR stations either by Fax/Phone/Hotline a request to broadcast the warning at repeated hourly/half hourly intervals. In the first alert bulletin message, the recipients will be informed that subsequent warnings on the storm will be broadcast by designated AIR stations (see also para 9.2.9). The bulletins will be sent by other means also like email, whatsapp etc.

Cyclone alert and warning messages will be reviewed and updated at the time of issue of sea area bulletins. These messages will be numbered serially to avoid confusion.

CWD will, however, issue bulletins every three hours during cyclone stage. In addition to the above, the alert and warning bulletin will also be issued to all concerned as stated above by e-mail. At least one SMS per day will be sent to designated officials in district and state level by the concerned CWC/ACWC and at national level to including MHA, Ministry of Agriculture and MOWR etc and concerned chief secretaries /state disaster Management authorities by the CWD, New Delhi.

8.4.1 Departmental Communication of Alert / Warning Messages*:*

Whenever a cyclone alert/warning is issued by CWC/ACWC they have to communicate the text of the alert/warning to ACWC/CWC of the region and neighbouring CWC. Besides that they have to send the same to DGM **RSMC** New Delhi and Weather Central, Pune. The CWCs/ACWCs should consult RSMC, New Delhi before issue of Cyclone Alert /warning for the coastal districts. It would ensure uniformity in warning including rainfall, wind, storm surge and wave height apart from track and intensity and landfall point and time forecast by IMD.

In the rare event of total breakdown of communication between CWCs and ACWCs during a cyclone situation **(e.g., Odisha Super Cyclone, 1999)** ACWC will originate necessary warning on its own as an emergency measure, covering the responsibility of CWC for dissemination through **TV/AIR/Email/FAX/ Whatsapp and social media**

Four stage warnings issued to the Chief Secretary and other Government officials may be simultaneously transmitted to **CWD/RSMC** New Delhi on mail for information to all concerned **including** Ministry of Home Affairs. Ministry of Agriculture and Co-operation, other central ministries and agencies, press and electronic media as per the list of warnees for the national bulletin issued by CWD.

Note: Whenever any disastrous weather event takes place/ expected, the forecasting offices may take the state authority in confidence as a matter of information. A similar action could be taken at H.Q. level also.

8.5 Warnings Through A.I.R.

After the issuance of alert message for broadcast, the concerned AIR stations should be requested to maintain round-the-clock watch to receive and broadcast the subsequent numbered cyclone alert/warning bulletins as and when received by them.

Alert/ warnings will be issued to the concerned AIR stations at the time of every sea area bulletin, **hourly update on location and intensity will be issued as finalised by the CWD in consultation with radar and satellite divisions as well as coastal observations** Radar is given more weightage, if the storm is tracked by radar with a high degree of confidence. The alert will have the preamble *Cyclone Alert* and the warning the preamble *Cyclone Warning*. Both Alert and Warning messages issued to the AIR will be serially numbered. Subsequent to the **Cyclone** warning, the cyclone warnings based on 0300 UTC and 1200 UTC charts and any other crucial warning will also be sent to the concerned Collectors and the Chief Secretary by **Fax, email and whatsapp.** These cyclone warnings sent to the Collectors and the Chief Secretary by may also be given separate serial numbers. The purpose of giving the serial numbers is to ensure that the recipient of these warnings (viz. the Collectors, the Chief Secretary and the AIR stations) understand the proper sequence of the warnings and to avoid any confusion by an earlier warning occasionally reaching the recipient later than a subsequent warning due to delay in communication channels.

During special weather situations like cyclones, ACWCs and CWCs **will** disseminate information to media through private channels **FM and community radios** also, in addition to Doordarshan and AIR.

8.6 Utilization Of Police W/T

All the warnings will be passed on to the Collectors, the Chief Secretary and the concerned AIR stations by Police W/T whenever the normal telecommunication channels break down or expected to break down. For passing AIR bulletins, HAM Radio also can be made use of.

8.7 Highest Priority

Warnings to the Chief Secretary and coastal District Collectors should be handled with the highest priority by the ACWCs/CWCs.

8.8 Use Of Telephone To Pass The Warnings

In addition to **Fax/e-mail/SMS/whatsapp**, the Chief Secretary should also be kept informed over phone about the warnings issued viz., the subsequent warnings issued based on 0300 and 1200 UTC charts and any other crucial warnings. If the Chief

Secretary cannot be contacted on telephone, the warnings will be passed on to his Personal Assistant over phone. In crucial situations, the concerned Collectors may also be contacted over phone and the warnings passed on in addition to the normal **e-mail/Fax/SMS/whats app**. A suitable entry shall be kept in the log book in all these cases. For special arrangements, in the case of the Chief Secretary, Andhra Pradesh, refer to para 8.11.

8.9 Dewarning

Sometimes an area for which the *Cyclone Alert* was issued may not require to be warned in the light of subsequent developments. In such a case, a dewarning message should be issued to the concerned Collectors and the Chief Secretary indicating that occurrence of heavy rain/gales etc. is unlikely in their area. Conversely, an area for which *Cyclone Alert* was not issued, may have to be warned urgently in the light of subsequent rapid developments, in which case the second stage warning viz. *Cyclone Warning* may have to be issued straightway without any *Cyclone Alert* message.

8.10 Special Instructions To CWC Visakhapatnam / M. C. Hyderabad

The **Four** stage warnings issued by CWC Visakhapatnam will also be passed on to M.C. Hyderabad by Fax/e-mail/whatsapp telephone or Police W/T as the situation demands. On receipt of warnings, the Officer-In-Charge at the M. C in addition, to Chief Secretary, SRC, District Collectors. will contact the Chief Secretary of Andhra Pradesh and pass on the warnings to him over telephone. The message may be sent to the Personal Assistant, if the Chief Secretary is not available.

8.11 Format for Cyclone Alert and Cyclone Warning Bulletins

The formats for *Cyclone Alert* and *Cyclone Warning* bulletins are given below:

8.11.1 <u>Format For Cyclone Alert</u>

Cyclone Alert: Issued by Meteorological Office _____ at _____ IST on _____(date). Depression/Cyclonic storm over _____ Bay of Bengal/Arabian Sea lay centred at _____ hours IST _____ (day)

_____ (date) near Lat. ____^{o}N Long._____^{o}E about _____ km. _____ (direction) of _____ (Place) (.) It would intensify further and move in _____ (direction). Under its influence widespread rain with scattered heavy to very heavy falls likely (probability) commence _____ districts from _____ (day) _____ (date/time) (forenoon etc.) (.) Gale winds speed reaching _____ km. per hour likely (probability) commence along coastal areas of _____ districts _____ (day) _____ (date) (forenoon/afternoon etc.) (.) Subsequent warnings on this depression/cyclone will be broadcast by AIR Stations _____ (names of AIR stations).

Insert the quantitative forecast Table given by the CWD/RSMC

8.11.2 Format For Cyclone Warning

The format for 'Cyclone Warning' will be as per the examples given under *Special Weather Bulletin*.

NOTE:

I Coastal districts and other authorities should be kept informed of the expected severe weather conditions in association with Depression/Deep Depression/ Strong monsoon conditions etc. ACWCs/CWCs should establish close liaison with the State Govt. Officials and media.

II Information about storm surge need be given only when they are expected to cause inundation of coastal areas. Wherever possible a range of values of storm surge may also be given.

III Advice for evacuation is included only when the storm is severe and the forecaster is fairly sure about the place and time of landfall.

IV For minor surges of the order of 1 to 1.5 m. advice for evacuation of people need not

Be given. However, the concerned Government authorities should be asked to keep measures ready for evacuation of people at short notice.

V Information about storm surge will be supplied to ACWCs/CWCs by CWD/RSMC BY MENTIONING IN ITS 3-HOURLY BULLETINS.

VI Based on the available information's decisions on positions and intensity of cyclone should be taken as fast as possible by mutual consultations without losing time in collecting more evidence. In such rapid moving systems where weather sometimes moves much ahead of the storm, RSMC should also alert other RMCs as found necessary. This will help in gaining the vital lead time in real time operations. Speed and direction of past movement will be given in all bulletins based on past six hours movement.

VII Post-landfall outlook will be issued as a part of cyclone warning at least 12 hours in advance of the landfall by the CWC and concerned ACWCs/CWCs. On the basis of this outlook, the concerned RMCs/MCs which are likely to be affected will also issue cyclone warnings for the interior areas. This is part of the regular cyclone warning.

8.12 Action To Be Taken When System Comes Closer To Coast

Since the **Cyclone Alert is** to be issued 48 hours in advance, sometimes even when the system is in the depression stage, there will be some uncertainty in the forecast track of the storm and therefore in the estimated landfall point, with the result that the areas to be alerted could be fairly large. By the time the **Cyclone** warning is issued, the forecast direction may become more definite and the areas likely to be affected will be consequently narrowed down to a shorter strip along the coast. The other areas included in the **Cyclone Alert** must be dewarned now.

8.13 Discussion With State Government Authorities

CWCs and ACWCs will have discussion with the State Government authorities before the beginning of each cyclone season about the systems that are likely to form in the sea areas and affect the coastal districts eventually. Of course, climatological information and the experience in the recent past and the recent improvement and preparedness of the IMD will form a large part of the basis of these discussions. Many

State Governments designate a cell for dealing with cyclone warnings during cyclone seasons and a close liaison should be kept with these cells.

8.14 Action In Respect Of Railway Officials In CDMC States

Railway officials of coastal districts of maritime states where C.D.M.C. recommendations are implemented are also to be warned under the Four stage warning system. The form and contents of these messages and the procedure for sending them to these designated railway officials will be the same as for the coastal District Collectors, whenever the area under their jurisdictions are expected to be affected by adverse weather due to cyclonic storms.

At present the designated Railway officials are: Comment:

(1) Dy. Controller, H. Q. Office, S. E. Railway Garden Reach, Kolkata.

(2) Dy. Controller, Central Control, H. Q., Office, S. R. Chennai –3

(3) Chief Controller, Vijayawada Division, S.C.R. Vijayawada.

(4) Chief Controller, H. Q. Office, Rail Nilayam, S.C.R. Secunderabad.

(5) Chief Operating Superintendent, Emergency, Eastern Railway, Fairly place Kolkata.

(6) Dy. Controller, Eastern Railway, Howrah.

(7) Dy. Controller, Eastern Railway, Sealdah.

8.15 Defence Officials In Andhra Pradesh

As a special case, the local Defence authorities stationed in Andhra Pradesh, are also to be warned under the Four stage warning scheme. They are:

(1) Commander, H. Q. Sub-Area Command, Secunderabad.

(2) Station Commander Air Force Station, Begumpet.

(3) Officer commanding, Eastern Naval Command, Visakhapatnam.

CWC Visakhapatnam will be issuing the warnings to these three authorities on the same lines as to the Chief Secretary, Hyderabad.

8.16 For Commander Tamil Nadu and Kerala

Similarly, warnings are issued to the Commander, ATNK & K area under the Four stage warning system by ACWC. Chennai, CWC, Thiruvananthapuram and CWC Visakhapatnam.

8.16.1 For Commandant, Proof And Experimental Establishment, Chandipore and ITR, Chandipore

Warnings are also issued to the Commandant, Proof and Experimental Establishment, ITR Defence R & D organization, Chandipore under the **Four** stage warning system by CWC Bhubaneswar to enable them to take necessary precautionary measures to safeguard personnel and equipment engaged for the launching of the vehicles.

8.16.2. For NDRF

CWD will issue numbered bulletins and special bulletins as issued for disaster managers to the NDRF authorities at HQ and others as per the list provided by NDRF. Similar four stage bulletins issued by CWCs and ACWCs will be issued to state level NDRF and SDRF official as per their list. The list of addressees will be updated twice a year by CWD, ACWCs and CWCs

8.17 Action When A System Is Out In The Sea And Not Likely To Affect Coast Within Next 72 Hours

When a **depression or a storm is located in the Indian Seas but not likely to affect the coastal areas within the next 48 hours, NWFC will issue the Press/AIR News bulletin in general terms in consultation** with/intimating concerned ACWCs, and CWCs as may be necessary. On receipt of the same, concerned ACWCs and CWCs will issue local press/ AIR news bulletins under intimation to CWD/RSMC, New Delhi, and NWFC. But when the Indian coasts are likely to be affected within next 72 hours of detection, the bulletins will be issued by concerned ACWCs/CWCs as per items 8.2 and 8.3.

8.18. Press release:

CWD, New Delhi will issue one press release per day from the day of issue of Special Bulletin at the stage of low pressure area or well-marked low pressure area till the

dissipation of the system. Copy of this release will be provided to the CWCs/ACWCs/Weather Central, Pune. Accordingly, All ACWCs, CWCs and concerned state MCs will issue press release with further details of expected adverse weather, warnings, damage expected and action suggested at district level. The district specific impact will be provided as per the dynamic web DCRA and the impact matrix developed by concerned MCs, CWCs and ACWCs.

8.19. Press Conference:

At least one or more press conferences will be held at New Delhi under the chairmanship of the DGM at appropriate time. Following this, concerned CWCs/ACWCs will organise similar Press Conference/Briefing.' Warning graphics should be included in the press release. The press release issued by CWD &7 ACWC/CWCs should not contradict each other.

9. BULLETIN FOR A.I.R.

9.1 Routine bulletins

9.1.1. *General Weather Bulletins*

General weather bulletins are issued by the meteorological offices to the AIR stations for broadcast in mid-day transmissions. These are based on 0300 UTC charts. The areas covered by the bulletins are the areas served by the respective AIR stations. These bulletins include (i) a summary of the past weather, (ii) special weather warnings for public services such as P.W.D., Irrigation, P & T, Railways etc. and (iii) a general forecast including warnings. (ii) and (iii) are valid till the morning of the second day. The summary of weather will include information about storms and depressions affecting the area. The center of the system should be included with reference to a nearest well known place. In addition the Latitude and Longitude of the center should also be given

in the bulletins. Warnings in the bulletins, once issued, will be repeated in the subsequent daily bulletins also as long as adverse weather is anticipated. Meteorological Centres in the maritime states will in addition, include in this bulletin suitable warnings, if any, for fishermen. These general weather bulletins are broadcast at a fixed time in the midday by the AIR stations and are intended to meet the

requirements of the public in general and the needs of the various categories of officials in particular.

9.1.2 Farmers Weather Bulletins

Similar information and warnings are also issued in the Farmers Weather Bulletins. The Farmers Weather Bulletin will be issued by all MCs, RMCs, CWCs and ACWCS and will contain cyclone advisories and impact and Advisories on agriculture valid upto five days , besides the usual forecast, an *Outlook* for the subsequent two days. Care should be taken to indicate deterioration or improvement of weather on occasions of cyclonic storms in the *Outlook* portion.

Agricultural Meteorology Division, IMD, Pune in coordination with Agromet Division, HQ, Agromet Field Units, DAMUs, concerned state Govt Agriculture Department, State Agriculture University and Cyclone Warning Division, IMD, New Delhi disseminates Alert and Agromet Advisory to **the farmers and local people** in the affected states through IMD website, Kisan Portal, whatsapp, SMS, mobile app and state mobile apps etc.

9.1.3 Weather Information In Regional News

Sometimes, weather information over a region is also broadcast in the *Regional News* item of AIR in the evening if the situation warrants. However, this is prepared by the AIR and no special bulletin for this purpose is issued by the meteorological offices.[113]

Note: Whenever a well-marked low pressure area forms over the sea, it will be included as an information item in AIR news bulletins.

9.2 **Special Weather Bulletins**

9.2.1 Four Stage Warnings

In addition to the routine bulletins, the requirement of Four stage warnings (as referred in 8.4) demand the issue of special AIR bulletins which should commence at least 72 hours prior to the commencement of adverse weather in the coastal areas due to an approaching cyclone. These broadcasts serve the general public and other officials also, in addition to the district Collectors and the Chief Secretary.

9.2.2 Frequency Of Issue

Special Weather bulletins will be issued at the time of each sea area bulletin. If the AIR station is closed at that time, no special AIR bulletin need be issued at this hour. These bulletins will be serially numbered for identification by the AIR station. They are sent by Fax/e-mail /whatsapp/SMS Police W/T facilities will also be availed of whenever necessary. If there is an M.C. at the AIR station, the ACWC/CWC originating the bulletin will send a copy of the message to the M. C. also through e-mail for their information.[115]

9.2.3 *Form And Contents*

The language and contents of the bulletin will be as per the latest instructions contained in DDGM (WF) UOI No. W-72201 dt. 6.1.1979 reproduced below.

The following procedure will be followed by ACWCs/CWCs in framing storm warning Bulletins to AIR stations:

(i) Depression, Deep Depression Cyclone, *Severe Cyclone*, *Very Severe Cyclone, Extremely Severe Cyclonic Storm, and Super Cyclonic Storm will be used to* in*dicate the four stages of the growth of the storm.*

*(ii) The coastal districts likely to be affec*ted by the Depression, deep depression or storm will be mentioned in the *first sentence of the bulletin and the s*ame repeated again at the end of the bulletin for the benefit of the listeners tuning in late.

(iii) The type of damage likely to be caused by strong winds of various magnitudes, along with the expected wind speed will be indicated.

For the purpose of indicating the type of damage the following table* will be used.

Expected wind speed	Expected damage
50-60 kmph (Deep Depression)	Tree branches broken off; small trees like banana, Papaya, drumstick etc uprooted minor damage to Kutcha houses
60-90 kmph (Cyclone.)	Tree branches broken off; small trees like banana, Papaya, drumstick may

	get uprooted some damage to Kutcha houses.
90-120 kmph (Severe cyclone)	Trees uprooted, Pucca houses damaged; Communications disrupted.
120 kmph and above (Very Severe Cyclonic storm and Super Cyclonic Storm)	Big trees uprooted; widespread damage to houses and installations; Total disruption of communications.

(iv) The height of the storm surge may continue to be expressed in metres as at present and it will be above the normal tide. This instruction supercedes those contained in DDGF UOI No. W-72002(78)/9755-61 dt. 10.5.1978 wherein the instruction was to indicate the total height of the tide. Wherever possible a range of values of storm surges may also be given. (Rec. 5 of ACR 1997) In addition the coastal inundation based on the INCOIS ADCERC model will be given indicating location specific storm surge and coastal inundation. CWC, ACWCs and CWCs will provide same information in text, graphics and web GIS.

(v) While indicating adverse weather in these bulletins, a certain order depending upon the intensity and proximity of the system to the coast will have to be followed. In the case of a super cyclone about to strike coast in about 12 hours, the order will be Storm Surge/Coastal inundation gales and heavy rain. In the case of a super cyclone expected to strike coast in the next 12 to 24 hours, the order will be gales, Storm Surge/Coastal inundation and heavy rain. In the case of a super Cyclone expected to strike the coast beyond 24 hours, the order will be heavy rain, gales and Storm Surge/Coastal inundation waves. The same order will be applicable for very severe cyclone/ severe
cyclone/ cyclone also.

(vi) A general advice for fishermen not to go out in the sea and state of sea should be incorporated in the bulletin. However, the routine warnings for fishermen four times a day at the fixed times will continue to be issued.

(vii) Storm warning signals (LC III and above) hoisted at various ports will be included in these bulletins.

(viii) Three specimen formats as examples for the cyclone warning bulletin are given below. These will be used for all the cyclone bulletins issued to AIR stations and the recipients of the Four stage warnings from the second stage warning onwards.

(ix) Distance of the radar center of cyclone should be rounded off to the nearest ten km. and direction of movement should be in 16 points of compass.

(x) As far as possible the distance of the storm center should be mentioned by all

ACWCs/CWCs from same city.

(xi) Information about the "Cyclone crossing the coast near ---- (landfall point) at ---- hrs. IST may also be given in the bulletin when the cyclonic storm is likely to cross the coast.

(xii) The speed and direction of movement during the past six hours should also be indicated in the bulletin

Examples of cyclone bulletins:

(i) Very Severe Cyclonic Storm situated at 18 0300 UTC about 350 km southeast of Nellore, likely to strike coast between Nellore and Ongole in about 24 hours.

Cyclone bulletin No. _____ issued by the Cyclone Warning Centre _____ at ____ hrs IST of _____ (date) for repeated broadcast (.) Cyclone Warning for Chingleput, Nellore, Prakasam, Guntur, Krishna, West and East Godavari districts (.) Very severe cyclonic storm located 350 km southeast of Nellore Lat.___ ºN, Long.___º E this morning (.) Expected strike coast between Nellore and Ongole Saturday nineteenth morning (.) Very heavy rain likely cause floods in these districts. Gales reaching 150 kmph uprooting big trees and causing widespread damage to houses and installations and total disruption of communication ~~likely~~ Nellore, Prakasam and Guntur districts from this evening (.) Storm Surge five metres above normal tide likely inundate coastal areas these districts Saturday morning (.) State of sea likely to be very rough/high/very high/phenomenal (as the case may be) Fishermen are not to go out in the sea (.) Information about storm warning signals (LC

III and above) is also appended in the bulletin (.) Above warning is for Chingleput, Nellore, Prakasam, Guntur, Krishna, West and East Godavari districts.

(ii) Very Severe Cyclonic Storm situated at 18 1200 UTC about 250 km. southeast of Ongole likely to strike coast between Ongole and Machilipatnam in the next 12 to 24 hours.

Cyclone bulletin No. _____ issued by Cyclone Warning Centre _____ at _____ hrs IST of _____ (date) for repeated broadcast (.) Cyclone Warning for Nellore, Prakasam, Guntur, Krishna, West and East Godavari and Visakhapatnam districts (.) Very severe cyclonic storm located 250 km southeast of Ongole Lat.___^{0}N, Long.___^{0}E this evening (.) Expected strike coast between Ongole and Machilipatnam by midday Saturday nineteenth (.) Gales reaching 150 kmph uprooting big trees and causing widespread damage to houses and installations and total disruption of communication Prakasam, Guntur, Krishna and West Godavari districts from Saturday early morning (.) Storm surge five metres above normal tide inundate coastal areas these districts midday Saturday (.) Very heavy rain causes floods in these and Nellore, East Godavari and Visakhapatnam district (.) State of sea to be very rough/high/very high/phenomenal (as the case may be) Fishermen are not to go out in the sea (.) Information about storm warning signals is also appended in the bulletin (.) Above warning is for Nellore, Prakasam, Guntur, Krishna, West and East Godavari and Visakhapatnam districts.

(iii) Very Severe Cyclonic Storm situated at 19 0300 UTC about 100 km. southeast of Ongole likely to strike coast between Ongole and Machilipatnam in the next 9 hours.

Cyclone bulletin No. _____ issued by Cyclone Warning Centre _____ at ___ hrs IST of _____ (date) for repeated broadcast (.) Cyclone Warning for Nellore, Prakasam, Guntur, Krishna, West and East Godavari and Visakhapatnam districts (.) Very severe cyclonic storm located 100 km southeast of Ongole Lat.___ ºN , Long.___ º E this morning (.) Expected strike coast between Ongole and Machilipatnam this afternoon (.) Tidal waves five metres above normal tide inundate coastal areas Prakasam, Guntur and Krishna districts within next nine hours

(.) People in these coastal areas advised to take shelter in high buildings (.) Gales reaching 150 kmph likely uproot big trees and cause widespread damage to houses and installations and total disruption of communication in these districts (.) Very heavy rain likely cause floods in Nellore, Prakasam, Guntur, Krishna, West and East Godavari and Visakhapatnam districts (.) State of sea likely to be very rough/high/very high/phenomenal (as the case may be) Fishermen are not to go out in the sea (.) Information about storm warning signals is also appended in the bulletin (.) Above warning is for Nellore, Prakasam, Guntur, Krishna, West and East Godavari and Visakhapatnam districts.

9.2.4 Frequency Of Broadcast

As mentioned in para 8.4 under Four stage warnings, the AIR station should be requested to broadcast the warning at repeated hourly or half-hourly intervals. When the storm is 200 to 400 km from the coastline, the AIR may be requested to broadcast at hourly intervals and when it is within 200 km of the coastline, the frequency will be stepped upto half hourly intervals. The frequency of the broadcasts will be indicated in the preamble of the bulletin as follows:

Cyclone Warning Bulletin No. _____ for broadcast at hourly/half hourly interval etc.

9.2.5 Time Of Next Broadcast

At the end of each broadcast, the time of the next broadcast will be announced by the A.I.R. station as per standing instruction on the subject.

9.2.6 Hourly Issue Of Bulletins

Where the storm is followed by a radar confidently and frequent radar fixes are available, bulletins will be issued to AIR stations at hourly intervals giving the latest position of the storm for broadcast at hourly/ half hourly intervals. These hourly bulletins will also be complete with a preamble, forecast movement and warnings to coastal areas etc. as per format given in para 9.2.3

Above and as finalised by CWC in consultation with concerned CWC/ACWC/Satellite division/Radar stations and coastal observations.

9.2.7 Provision For Extending Watch Hours Of A.I.R. Stations

During cyclone situations, the working hours of AIR stations may be extended round the clock for broadcasting special weather bulletins. For this purpose, the Station Director of A.I.R. station should be requested to extend the watch. This may be treated as a mandatory procedure

9.2.8 Monitoring Of The Bulletins

ACWCs/CWCs concerned should monitor all the storm warning bulletins broadcast by A.I.R. and keep a record of (i) how many of the bulletins issued were broadcast, (ii) with what frequency and (iii) with what accuracy. Discrepancies and lapses should be brought to the notice of A.I.R. authorities immediately for corrective action. [123]

9.2.9 Radio Stations Broadcasting The Bulletins

The radio stations which broadcast these special warnings are indicated in the "Cyclone Alert" messages. These AIR stations and the coastal areas served by them are given below :

S.No.	AIR Stations	Coastal Areas
1	. Port Blair	Andaman & Nicobar Islands.
2	. Kolkata	West Bengal
3. 4. 5. 6. 7. 8. 9.	Bolangir Cuttack Sambalpur Baripada Keonjhar Berhampur Jeypur	Odisha
10. 11. 12. 13.	Visakhapatnam Hyderabad Vijayawada Cuddapah	Andhra Pradesh Telangana Andhra Pradesh Andhra Pradesh

14. 15. 16. 17. 18	Chennai Puducherry Tiruchirapalli Tirunelveli Karaikal	Tamil Nadu
19. 20. 21.	Thiruvananthapuram Trissur Kozhikode	Kerala
22. 23. 24.	Bengaluru Mangaluru Dharwad	Karnataka
25.	Goa	Goa
26. 27.	Ratnagiri Mumbai	Maharashtra
28. 29. 30. 32. 33.	Ahmedabad & Baroda Bhuj Rajkot Surat	Gujarat

9.2.10 Inclusion Of Local Forecast

When cities like Kolkata, Bhubaneswar, Visakhapatnam, Chennai, Mumbai, Thiruvananthapuram or Ahmedabad where an ACWC or CWC is located or any major city in the coastal district are themselves affected by the cyclonic storm, a brief summary and forecast of local weather may also be included in special weather bulletins sent to A.I.R. at the discretion of the Head of ACWC/CWC Director. The concerned MC will transmit the same bulletin.

9.2.11 Warning Messages To Departmental Staff

Cyclone warning messages shall be passed on by available communication channels (email, whatsapp) to our departmental staff in coastal observatories and aerodromes which are likely to be affected by the cyclonic storms. For this purpose, copies of four

stage warning bulletin may be sent, as and when it is issued and also at any other crucial hour.

9.2.12 Emergency Occasion – Supply Of Information By Radar Stations

Dissemination of information on the position of the storm, its expected movement and associated weather is the responsibility of the ACWC and CWC concerned and not that of the cyclone detection radar. The CDRs should avoid briefing the Media and advise them to contact concerned ACWC/CWC to know about the latest regarding the cyclone. If, however on an unusual situation like breakdown of communications, a party is not able to contact the ACWC/CWC for information on the storm but contacts the CDR, then the CDR can supply to the party the latest storm center as seen in the radar.

As the landfall point and cyclone crossing time are different the party/media should be briefed properly about the cyclone crossing the coast and landfall of cyclone as per the consensus bulletin issued by CWD. Necessary liaison arrangements between the recipients of the warnings and Cyclone Detection Radars shall be worked out on each individual case to pass on the weather information to the warnees as long as the danger due to cyclone to that area continued to exist or until communication channels are restored.

9.3 Fisheries warnings through AIR

These have been dealt with in Section 7.

9.4 Coastal Weather Bulletin for AIR news cycles

9.4.1 Frequency And Languages Of Broadcast

In addition to the special weather bulletins issued by the ACWCs/ CWCs to the AIR stations in their regions or states, special coastal weather bulletins are also issued to AIR New Delhi, whenever a cyclonic storm is likely to affect the Indian coastal areas. These are included in the three main news cycles – morning, midday and night which will be broadcast in English, Hindi and the regional languages of the coast affected. These bulletins are meant for the benefit of ships and sailing vessels in coastal waters and fishermen as well as the general public in the maritime states.

9.4.2 Offices Of Issue And Area Of Responsibility

These coastal weather bulletins will be issued by the ACWCs/ CWCs as given below:

S. NO.	Office of Issue	Coast for which issued
1	ACWC Kolkata	West Bengal and Andaman & Nicobar Islands.
2	CWC Bhubaneswar	Odisha
3	CWC Visakhapatnam	Andhra Pradesh and Yanam district of Puducherry
4	ACWC Chennai	Tamil Nadu, Puducherry UT
5	ACWC Mumbai	Goa and Maharashtra
6	CWC Ahmedabad	Gujarat, Diu & Daman, Dadra and Nagar Haveli
7	CWC Thiruvananthapuram	Kerala, Mahe of Puducherry UT, Karnataka & Lakshadweep

9.4.3 Procedure For Transmission Of Messages

The CWC will originate the coastal weather bulletin and send it to (i) the concerned ACWC, (ii) Weather Central, Pune and (iii) RSMC New Delhi. The ACWC will check the bulletin and pass it on to Weather Central Pune with amendments, if any; it will also be repeated to RSMC New Delhi. Similarly, the ACWC will send the bulletin it originates, to (i) Weather Central Pune, Pune and (ii) RSMC New Delhi. Weather Central, Pune will edit the bulletin and pass it on to RSMC New Delhi. When more than one CWC/ACWC is involved e.g. when Andhra and Orissa coasts are simultaneously affected and more than one bulletin is received at Pune, the bulletins will be combined into a single bulletin by Weather Central Pune and transmitted to RSMC, New Delhi for broadcast. For this purpose, Pune Weather Section will keep additional necessary watch, during cyclonic storm periods. As far as practicable in formulating the final AIR bulletins by RSMC, the difference of opinion should be reduced to the minimum and the modification carried out by RSMC should be communicated most expeditiously to the concerned ACWCs/CWCs and Weather Central Pune. Bulletins sent to RSMC New Delhi by ACWC/CWC/Weather Central Pune should also be repeated to Met. Safdarjung.

9.4.4 Time Of Issue Of The Bulletins

The times of issue of the various bulletins by ACWC/CWC are given below:

Time of issue by C.W.C. (IST)	Time of issue by A.C.W.C. (IST)	Time of issue Pune (IST)	Latest time of receipt at RSMC New Delhi (IST)	Earliest time of commencement of AIR newscycle broadcast (IST)
0400(on basis of 'Dew Drop')	0430	0530	0600	0700
0930 (on basis of 'Electron')	1000	1100	1130	1230
1600 (on basis of 'Formula')	1630	1730	1800	1900

9.4.5 Action By ACWC, DDGM (WF), Pune Or RSMC On Occasions Of Communication Breakdown

If due to communication breakdown, the ACWC does not receive the bulletin in time from the CWC, the ACWC will originate the coastal weather bulletin and send it to DDGM (WF), Pune but indicate in the message the non-availability of the CWC's bulletin. Similarly, if Pune does not receive the bulletin in time from the CWC or ACWC, Weather Central, Pune, will originate the bulletin on the basis of the available data. If the coastal weather bulletin is not received at RSMC, New Delhi in time from DDGM (WF), Pune, RSMC, New Delhi will issue the coastal weather bulletin to AIR New Delhi on the basis of the information available with them.

9.4.6 Contents Of The Bulletin

As the duration of broadcast of this bulletin is to be restricted to about a minute, the length of the message to be broadcast normally should not exceed about 150 words and the contents will include the following information useful for coastal shipping as well as to the general public:

(i) Time and date of issue of bulletin.

(ii) Languages in which to be broadcast.

(iii) Coastal strip for which bulletin is issued and period of validity. The minimum period of validity will be 24 hrs. However, the period may be extended depending on the degree of confidence of the forecaster.

(iv) Position, intensity and expected direction of movement of cyclonic storm.

(v) Forecast for heavy rain, squalls and gale force winds, state of sea if expected. Whenever possible a range of values of storm surge and coastal inundation may also be given.

(vi) Signals hoisted at different ports.

9.4.7 Specimen Format

A specimen format of the coastal weather bulletin is given below:

Immediate (.) Coastal Weather Bulletin for inclusion in AIR News Cycle in English, Hindi and (regional language/ languages concerned) for _____ coast/coasts (.) Issued at _____ IST ____(date) (.) Cyclonic storm centred at _____ IST about _____ kms. _____ Lat.__º N/Long.__ º E(direction) of _____ (Place) (.) Likely (intensify further) and move in a _____ (direction) or cross_____ coast near _____ (morning/evening/ night etc.)(.) Forecast for next 24 hours (.) In association with this storm, scattered/isolated heavy/very heavy rain will/would occur in _____ (districts) (.) Gale force winds reaching _____ kmph will/would prevail along and off the coastal areas of _____ districts (.) State of Sea rough/very rough/high etc. off _____ coast (.) Tidal waves/surge reaching _____ metres above normal tide also would inundate low lying coastal areas of _____ districts Up to ------Km from the coast (.) _____ signals Hoisted at _____ ports.

9.4.8 *Centre Of The Storm & Direction Of Movement*

The center of the storm in these bulletins may be given to the nearest 10 km.. The direction of movement may be given in 16 points of compass.

9.5 Procedure for sending the dewarning message to regional AIR stations and Air New Delhi is given below:

(a) <u>*Dewarning messages to regional AIR Stations*</u>

(i) When a storm has moved away from the coast or having crossed the coast has weakened or moved far inland so as to not to cause any adverse weather in any of the coastal districts, dewarning message will be issued to all the AIR stations in the State/States concerned as the last message in the cyclone bulletin series using the following format :

Cyclone bulletin No._____ issued by cyclone warning center _____ at hrs. IST of _____ (date) (.)Cyclone dewarning for _____ districts (.)_____ has weakened over _____ (area)/ has moved away from _____ coast (.)Tidal waves/gales/heavy rain no longer likely over _____ (area) (.)No further bulletin will be issued on this system.

(j) There may be occasions when a storm may be changing course of having crossed the coast may still be intense over some coastal area. In such cases, some coastal districts may require to be de-warned while warning will still have to be kept on for some other districts. On such occasion, it may not be advisable either to issue two separate bulletins – one a cyclone warning bulletin for certain districts and the other a dewarning bulletin for some other districts or one bulletin containing two parts–the first part a warning message and the second part a dewarning message. Both types of these messages may cause some confusion in the minds of the public who listen to the AIR bulletin. It is enough if only the Chief Secretary and the concerned Collectors are dewarned by email/Fax/whatsapp on such occasions for the districts requiring dewarning. Cyclone warning bulletins will continue to be issued to the AIR for the districts requiring warning. The public listening to this cyclone warning bulletin will automatically know that only certain districts are now under cyclone threat and the others (for which dewarning is issued to the Collectors) are free from the threat.

(b.) *Dewarning messages to AIR New Delhi for inclusion in the News cycle*

(i) At present cyclone warning bulletins to AIR New Delhi are sent by ACWC/CWC with the preamble *Coastal Weather bulletin for _____ coasts etc*. Those

bulletins are serially numbered by RSMC New Delhi and passed on to AIR as cyclone warning bulletin No. _____. As long as there is a warning for some part of the coastal area, no dewarning message need be issued for AIR News Cycle, although some other part of the coast for which warning was given earlier may be required to be dewarned. This procedure has to be followed to avoid confusion in the minds of the public for reasons given in para (a) (ii) above.

(ii) When a storm has moved away from the coast or having crossed the coast, either weakened or moved far inland so as not to cause any adverse weather to any part of the coastal areas, a dewarning bulletin will be issued by the ACWC/CWC as the last bulletin in the coastal weather bulletin series for inclusion in the News cycle from AIR New Delhi. The format for this may be on the same lines as that given under Para a (i) above. In addition, information on the lowering of signals at the ports may be included.

10. **DESIGNATED / REGISTERED USERS (ALBUM PAGE WARNEES)**

The Album page warnees are re-named as 'Designated/ Registered Users'.

10.1 Warnings For Gales/Heavy Rains For Public Utility Services Etc.

Warnings for gales/heavy rains are to be sent to the public utility services like Irrigation, Railway, PWD, P & T etc. for taking adequate precautions. A list of such users is maintained in Designated/ Registered Users (album page) forms in ACWCs/CWCs/MCs concerned. These forms

(album pages) contain the requirements of the individual warnees. When adverse weather is forecast for different coastal districts in association with depressions and cyclonic storms these users also should get the appropriate warnings if their areas are expected to be affected. In the case of cyclonic storms, particular care should be taken to see that inland warnees for gales are suitably warned if it is anticipated that even after crossing the coast the storm may maintain its intensity for sometime.

11. BULLETINS FOR PRESS

11.1 ***Occasions of Issue And Contents***

Press bulletins are to be issued when a low pressure area has formed in the sea area and there are indications that it will intensify into a cyclone and affect the weather over

any part of the country. The press bulletins will be originated by CWD/RSMC, New Delhi .Based on this, CWCs and ACWCs will issue district specific press bulletins. These bulletins will contain the present position of the system in terms of distance from a known city and in terms of Latitude and Longitude, its intensity, the forecast track and areas which are likely to be affected by the system and will be on lines similar to the bulletins broadcast over A.I.R. Detailed forecasts for the various districts with salient points of warnings sent to the state authorities and the public interests, ports, fisheries etc. may be included. If heavy rain has already commenced, significant amount of rainfall that have been recorded should be included. Some historical data from climatological records may also be included, if necessary, bringing out a comparison with past storms or significant peculiarity of the present storm. The bulletin should be worded in a language easily understood by the general public avoiding technical terms as far as practicable. In the press release, warning graphics should be included. If the state capital is also affected a local forecast should also be included. In addition, para 8.18 may be referred to.

11.2 *Publication Of Photographs*

In order to make the bulletins interesting newspapers may be encouraged to publish satellite or radar pictures of the storm. Along with actual and forecast track in the case of intensity and Quadrant Wind Graphics. All these procedures will be part of the press bulletin.

11.3 *Timeliness Of Warnings*

Immediately after the system has crossed the coast, a special press bulletin highlighting the timely warnings given by the Department should be issued.

11.4 *Sending To RSMC, New Delhi*

Copies of all press bulletins should be sent to ***RSMC*** New Delhi by e-mail for release to the different Newspapers at New Delhi. Weather Central, Pune should also be kept informed and consulted when necessary.

12. AVIATION WARNINGS

12.1 *SIGMET And Air Field Warnings*

Tropical revolving storm is also one of the criteria for the issue of SIGMET Warning. Air Field Warnings are also to be issued for cyclonic storms. These warnings will be issued by the concerned Aviation Meteorological Offices. IMD is one of the seven Tropical Cyclone Advisory Centres across the globe. The tropical cyclone advisory bulletin is issued every six hourly by Tropical Cyclone Advisory Centre (TCAC), New Delhi for the purpose of international civil aviation valid for next 24 hours in textual, graphical and coded format. These bulletins are transmitted by email, GTS and website. The tropical cyclone advisory bulletin in coded format is also issued every six hourly through ftp by TCAC New Delhi to WMO's ADRR centre, Hong Kong to ensure secure international civil aviation.

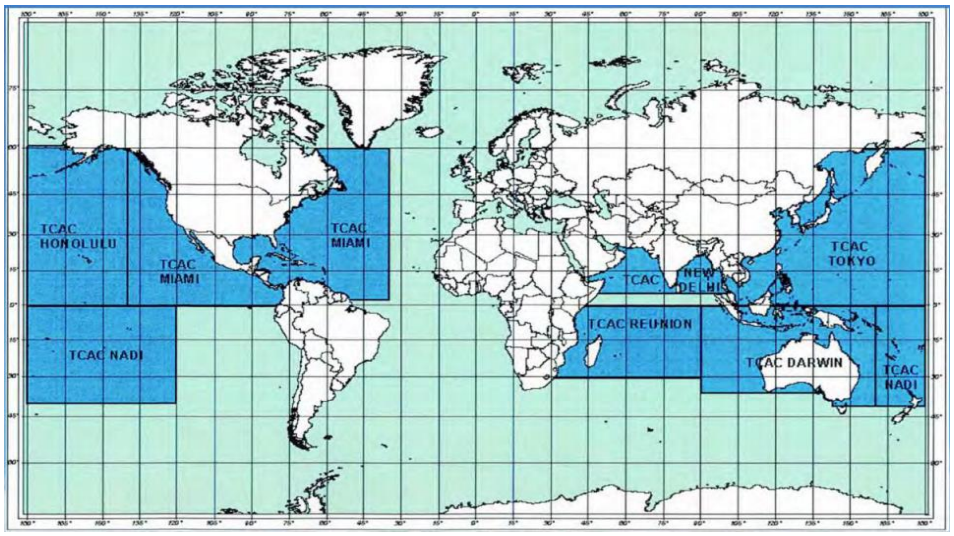


Fig. 9: Area of responsibility of TCAC New Delhi

The designated TCAC, New Delhi shall monitor the development of tropical cyclones in its area of responsibility, in accordance with the Asia Pacific Air Navigation Plan (ASIA/PAC ANP) and issue advisory information concerning the positions of the centre of the cyclone, its direction and speed of movement, central pressure and maximum surface wind near the centre. These advisories are disseminated to the MWOs in the TCAC New Delhi area of responsibility, to be used in the preparation of the OUTLOOK appended to SIGMETs for tropical cyclones. In addition, the tropical cyclone advisories shall be disseminated to the other TCACs, whose areas of responsibility may be affected, to the World Area Forecast Centers (WAFC) London and Washington and

international OPMET data banks and centers operating the satellite distribution systems (SADIS and ISCS). The data type designator to be included in the WMO abbreviated header of such messages shall be T1T2 = FK (WMO-No. 386, Manual on GTS, refers). TCAC New Delhi is issuing Tropical Cyclone Advisories for its area of responsibility, for each tropical cyclone, as necessary, in the format specified by ICAO every six hourly since 2003 and alongwith graphics from 2012. Sample TCAC bulletin is presented below:

TC ADVISORY
TCAC: NEW DELHI
DTG: 20230511/0600Z
TC: MOCHA
NR: 06
PSN: N1136 E08800
MOV: NNW06KT
INTST CHANGE: INTSF
C: 996HPA
MAX WIND: 45KT
FCST PSN+06HR: 11/1200Z N1212 E08754
FCST MAX WIND +06HRS: 50 KT
FCST PSN+12HR: 11/1800Z N1242 E08754
FCST MAX WIND +12HRS: 55 KT
FCST PSN+18HR: 12/0000Z N1312 E08800
FCST MAX WIND +18HRS: 65 KT
FCST PSN+24HR: 12/0600Z N1348 E08818
FCST MAX WIND +24HRS: 70 KT
RMK: NIL
NEXT MSG: 110523/1500Z
TOO: 111420HRS IST

(**) Change in intensity in past six hours at the time of observation hours is reported as ”INTSF” (intensifying), “WKN” (weakening) and “NC” (no change). This has been introduced in May 2020.

13. Warnings for onshore and offshore industries

Customised location specific bulletins and advisories are issued for offshore and onshore locations since October, 2022. These bulletins are issued every six hourly/ three hourly from the stage of depression/cyclone respectively based on the objective track and intensity forecast prepared by CWD. These are valid upto next 120 hours. These are numbered bulletins issued by email to the list of offshore industries provided by DG Hydrocarbons. The bulletin contains following information:

- Bulletin No.
- Information about the system (First para of National Bulletin)

✔ Location, intensity, speed of movement, distance from important stations, estimated central pressure

✔ Forecast track, intensity and landfall

- Tabular Form:

✔ Table 1: Information about forecast track, maximum sustained wind speed and gust, speed and direction of movement, uncertainty in path & intensity, significant wave height, state of sea.

✔ Table 2: Information about the forecast location, intensity and wind distribution in 4 geographical quadrants

✔ Table 4: Customised location specific information about:

➢ current distance & direction of rig from centre of storm

➢ Forecast parameters when the storm would come closest to rig:

▪ Date/Time when storm would be closest

▪ Distance and direction when storm would be closest alongwith uncertainty

▪ Intensity at that time alongwith uncertainty

▪ State of Sea

➢ Color coding as per ONGC guidelines

➢ Graphical products including observed and forecast track alngwith cone of uncertainty & wind distribution and rig locations

➢ Uncertainty in path is based on operational track forecast errors during last 5 years

➢ Uncertainty in intensity is approximately 20% of predicted intensity

Color Code for generating impact based forecast:

ZONE	PARAMETERS
GREEN	NORMAL SITUATION, NO FORECAST OF CYCLONE
YELLOW	(1) A TROPICAL CYCLONE FORECAST: THE STORM CENTRE WITHIN 800 NM FROM LOCATION AND (2) THE FORECAST TRACK IS FORECAST TO BE WITHIN 300 NM FROM LOCATION
ORANGE	(1) A TROPICAL CYCLONE FORECAST: THE STORM CENTRE WITHIN 600 NM FROM LOCATION AND (2) THE FORECAST TRACK IS FORECAST TO BE WITHIN 200 NM FROM LOCATION AND (3) SUSTAINED WIND SPEED ALONG THE PATH IS FORECAST TO EXCEED 50 KTS
RED	(1) A TROPICAL CYCLONE FORECAST: THE STORM CENTRE WITHIN 300 NM FROM LOCATION AND (2) THE FORECAST TRACK IS FORECAST TO BE WITHIN 150 NM FROM LOCATION AND (3) SUSTAINED WIND SPEED ALONG THE PATH IS FORECAST TO EXCEED 65 KTS

Notes:
(1) Under each zone, all three parameters are to be fulfilled to declare the rig under that zone
(2) The distance from Forecast Track in Sl No.2 of each zone is the minimum distance of the rig from the track/path when it is passing through i.e., when it is closest to the rig

Typical graphical products issued in this regard are presented:

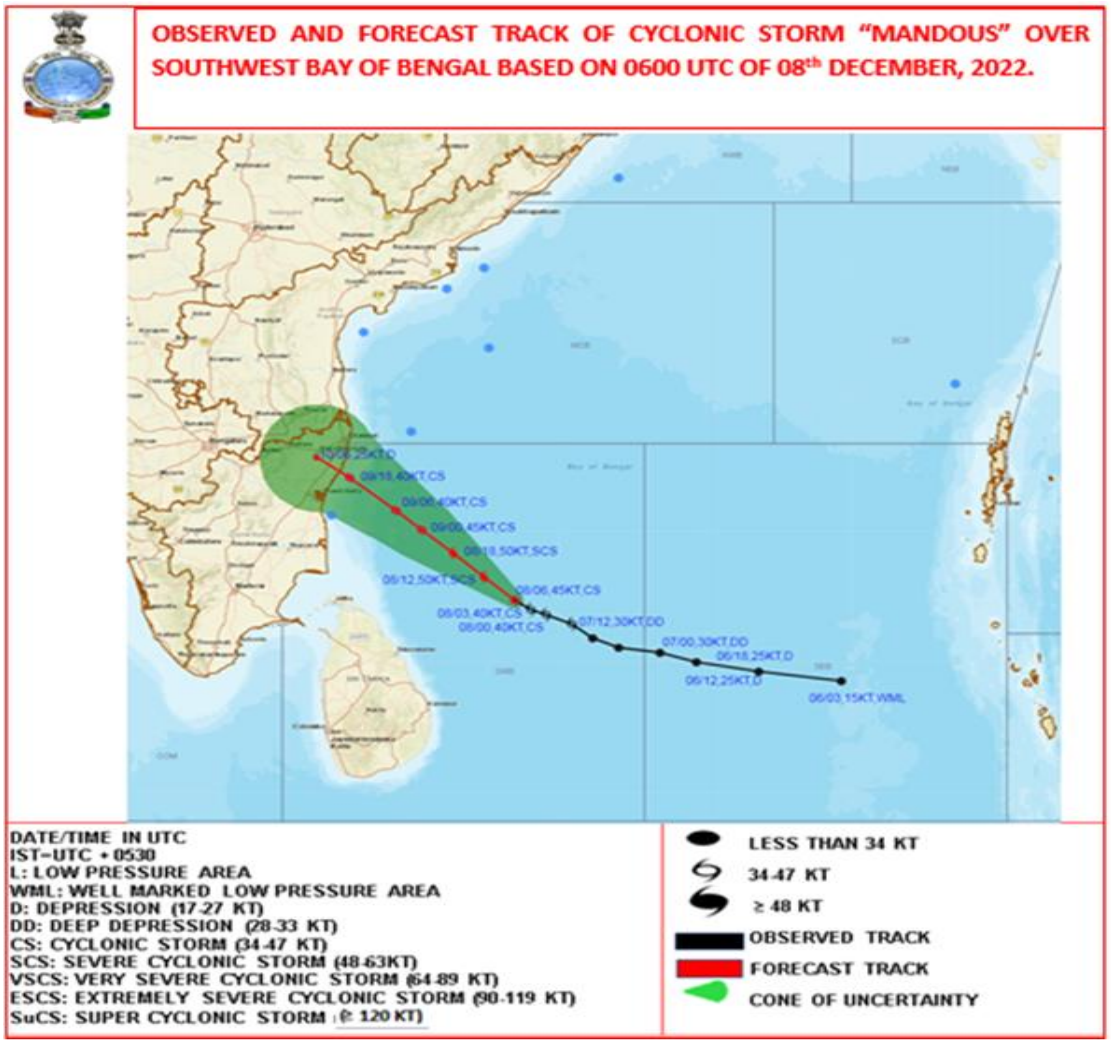


Fig 10(a): Typical track alongwith cone of uncertainty with (blue dots represent rig locations)

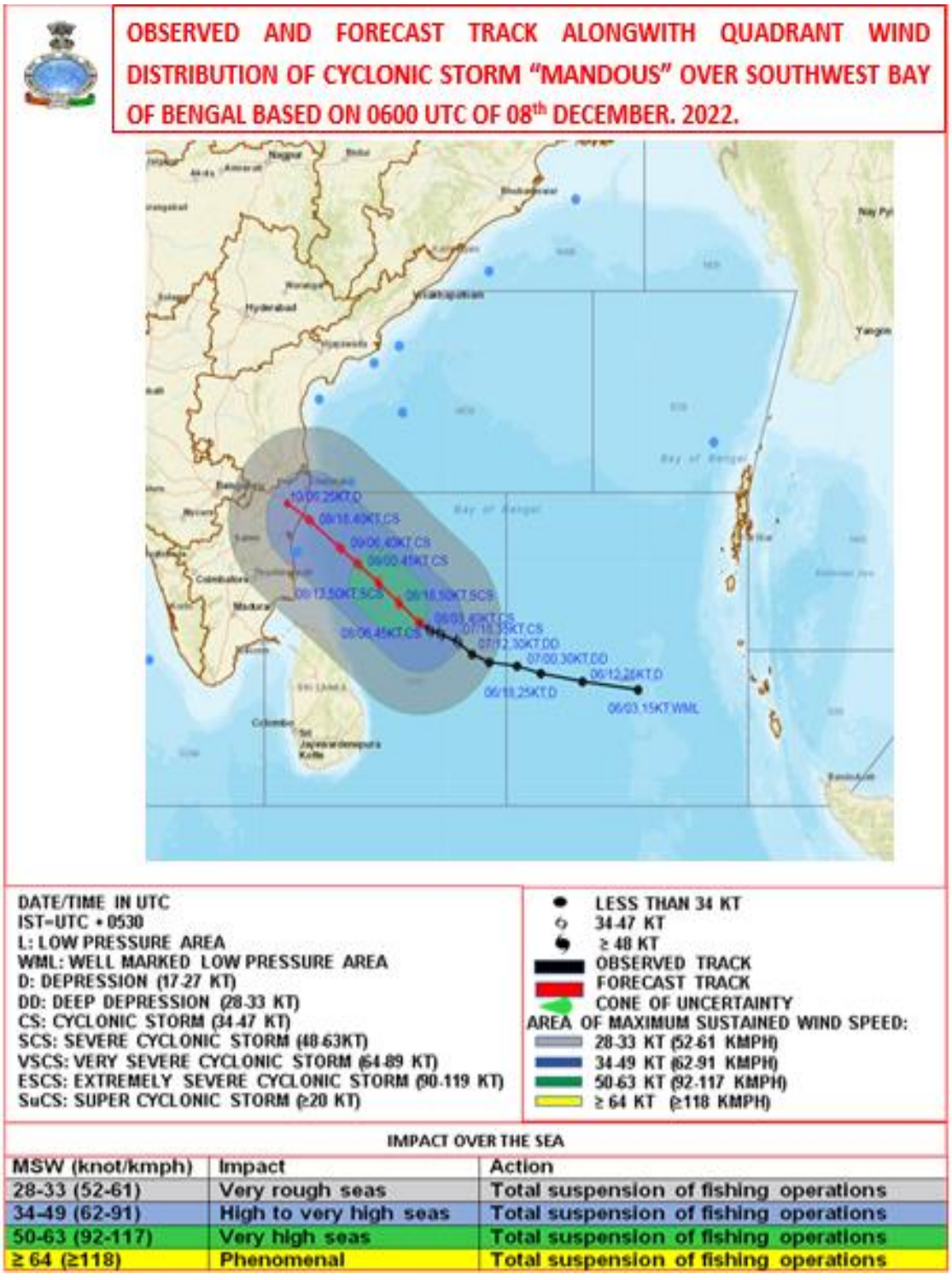


Fig. 10(b): Typical track alongwith quadrant wind distribution (blue dots represent rig locations)

14. MISCELLANEOUS INFORMATION AND INSTRUCTIONS

14.1 *Reference Publications*

Relevant reference publications such as *Code of storm warning signals for use at Indian*

Maritime Ports and *Weather Services to shipping, fishing vessels and Marine Interests*, the Tide Tables for the year, storm track Atlas, code books, compilation of storm warning procedures and instructions etc. and Cyclone Manual, SOPs and Check lists should be kept readily available.

14.2 *Telephone (land line and Mobile),Fax Nos, Whatsapp Nos and e-mail addresses.*

All the important telephone (land line and mobile) and *Fax* numbers and email addresses of ACWCs/ CWCs/CDRs, DGM (Sat. Met.), Radar, UAID New Delhi, Weather Central *Pune, RSMC*, AIR Stations, state and central level disaster management agencies including Cabinet Secretary, PMO, Home Secretary, MHA, NDRF, Coast Guard, IN, IAF, CDS, Chief Secretaries, coastal District Collectors, Port Officers, warnees to whom telephonic warnings are to be conveyed etc. should be at hand for immediate use. The list of numbers should be updated regularly twice a year in the months of March and September every season.

14.3 'Over All' Storm Warning Officer

The officer-in-charge will ordinarily attend all charts from the time a depression is developing. DDGM, RMCs will no doubt give the necessary guidance and advice to the Officer-in-charge of Storm Warning Centres especially on occasions of disturbed weather.

Head, RSMC will be over all responsible officer for storm warning work under the guidance of DGM for national and international coordination and decision making. He will be supported by the scientists working on duty. No one should deny to perform duty when called for during the cyclone period. The scientists working outside the CWC, ACWC and RSMC will work in cyclone duty as and when required. The leaves to scientists and officials working in these offices will be restricted and not granted unless otherwise there is emergency. The leave of the Gr A officers will be granted

only with the consultation Head of Office at CWC and ACWC level and DGM at RSMC level during that period

14.4 Orders To Be Indicated In Action Book

After examination of each set of charts, the orders as approved by the Head of Office will be entered in the Action book by the Duty Officer. He will also go through the Action Book to verify that the orders cover all the aspects of storm warning that are expected to be taken. He should also see that all actions are consistent with the declared intensity of the system, its forecast movement etc.

14.5 Duties Of Storm Warning Assistant/ Met A / Met B at ACWC/ CWC/RSMC

The duties of the Assistant(s) of CWC and ACWC in each shift attending to storm warning work will cover the following:

(i) He/They should see:

(a) That the working table is clear of all things that are unnecessary for storm warning work.

(b) That all message/bulletin forms are reasonably fresh.

© All observations from coastal stations and from all ships are properly and quickly plotted and also transmitted to the RSMC, New Delhi.

(iii) He should bring immediately to the notice of the officer on duty any message of Importance from coastal stations or ships i.e. observations containing weather, wind speed of B.F. 7 and above etc.

(v) He should write the storm warning messages according to the orders given by the officer on duty and get them signed by him before passing them on for transmission.

(vi) After the issue of all messages according to the orders in the Action Book, he should check the copies of the warning bulletins to see whether there are any mistakes. If mistakes are detected he should at once bring them to the notice of the Duty Officer for issue of correction messages. He should also see whether all the

warnings issued viz., coastal/sea/fisheries/port warnings are duly uploaded in the RSMC website.

(vii) He should also plot in a separate continuity map the successive broadcast positions of the disturbance and keep it handy for reference. Similar continuity charts for radar and satellite positions of the disturbance should also be maintained.

14.6 Entries In Action Book by CWC/ACWC/RSMC

All entries for a particular chart in the Action Book should be completed before the action on the next chart begins. The times of issue from the ACWC/CWC and transmission time of email/fax should also be entered in the Action Book.

14.7 Display On The Storm Warning Board by ACWC/CWC

The flags exhibited on the storm warning board should be changed as per warnings sent to the ports.

14.8 Website Updation by ACWC, CWC, RSMC

All the warnings issued by RSMC viz., National, RSMC, Quadrant wind forecast, TCAC bulletins alongwith graphics and by CWCs/ACWCs viz., Coastal Weather /Sea area/Port/Fishermen should be uploaded in the RSMC website http://www.rsmcnewdelhi.imd.gov.in as per the procedures described in the respective headings. It should be uploaded also in MC/RMC level website. The RSMC will also upload relevant information in public website of IMD (mausam.imd.gov.in)

APPENDIX - I

Enclosure – I

Final Format of Rec. No. 5 of ACR – 1999/ Rec. No.14 ACR – 2002

I. Format for State/Central Govt. Officials/Vital installations / Registered User Cyclone Alert/ Cyclone Warning Bulletin No.

Date and Time of Issue:

(i) Information on cyclone :

The cyclonic storm lay over..... Bay of Bengal/Arabian Sea Center ..... kms. ..... (Direction) of ..... place.

(ii) Forecast

Further intensification:

Direction of Movement:

Expected landfall area:

Expected time of landfall:

Forecast Table should be given as issued by RSMC

(iii) Weather Warning

(a) Rainfall ..... in ..... Districts (Names)

(b) Gales reaching ..... in ..... Districts (Names)

(c) Gale force winds reaching 35 knots in ..... Districts

(d) Tidal waves ..... above the astronomical tide in coastal areas of ..... Districts (Names)

(e) Sea condition:

(f) Damage/impact expected over ..... Districts (Names)

Likely impacts as per IMD Monograph on “DAMAGE POTENTIAL OF TROPICAL CYCLONE”, Impact matrix of the district and Web DCRA.

The graphical warning products at district level for rainfall, wind and storm surge/ coastal inundation to be include in bulletin and uploaded in website. Also the graphics on damage expected based on Web DCRA to be included in the bulletin and in the website.

(iv) Storm Warning Signals:

(v) Advice and action: (give as applicable as per IMD Monograph on “DAMAGE POTENTIAL OF TROPICAL CYCLONE”)

[Depending on Intensity of Storm]

(a) Fishermen not to venture into open sea.

(b) Evacuation of people from low lying areas to safer places/Cyclone Shelters.

(c) General public in the threat area advised to be indoors.

(d) Rail & road transport to be regulated.

(e) Advice for protection of agriculture, infrastructure etc as per current practice based on decision through VC and based on inputs from Agromet and Impact Matrix for each district and Web DCRA guidance

For warning graphics, kindly visit website (www.rsmcnewdelhi.imd.gov.in)

2. **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:

Forecast Table

(iii) Advice for hoisting Storm Warning Signals:

(iv) Likely impacts and actions : Depending on intensity of the storm as per IMD Monograph on “DAMAGE POTENTIAL OF TROPICAL CYCLONE”, Web DCRA and impact matrix of the district

For warning graphics, kindly visit website (www.rsmcnewdelhi.imd.gov.in)

(vi) Fishermen warning issued for the coast in which port is located.

(vii)

3. **Format for Cyclone Warning Bulletin for AIR/Press / Public :**

Cyclone Watch/Alert / Warning Bulletin No. _____ issued by _____ at _____ Hrs. IST on _____ (Date) for repeated broadcast at hourly / half hourly intervals.

Cyclone Alert / Warning for _____ Districts. Cyclone centred at _____ hrs. IST of _____ (date) about _____ kms. _____ of (direction) _____(Place).

It moved---------- direction with a speed of ---------- kmph during the past six hours.

Expected to intensify further and move in a _____ direction and cross _____ coast

near / between _____ (Place)_____ (day/time). Under its influence heavy to

very heavy rain **likely** caus**ing** floods **would/will occur** in _____ districts commencing from _____

(time/day). Gales speed reaching _____ kmph causing _____ damage _____in

districts commencing from _____ (Date/Time) Gale force winds reaching 70 kmph

would/will extend into _____ Districts, causing damage _____ in _____

districts. Tidal wave of _____ m **above astronomical tide would/will** inundate low lying area of _____ Districts upto ---------- km from the coast at the time of crossing coast.

Storm Warning Signals at Ports.

Forecast and warning graphics (Track, intensity, rainfall, wind, storm surge, wind impact, flood impact, surge impact graphics

Fishermen warning graphics

Fishermen advised not to venture out.

Public advised to cooperate with the State authorities in disaster management efforts.

4] Format for fisheries Warning

Fisheries warning No. _____

Date and Time of Issue _____

(i) Information on Cyclone:

Cyclonic Storm lay over _____ Bay of Bengal / Arabian Sea at a distance _____ kms. _____ from _____ at _____ IST on _____ (date)

(ii) Forecast:

Further intensification

Direction of Movement

Expected landfall area

Expected time of landfall

(iii) Warnings:

Wind

Sea Condition

Storm Surge & Coastal Inundation (as in the AIR Bulletin)

(viii) Storm Warning Signals at ports

Advice and Action:

i) Fishermen not to venture into open seas

ii) Fishermen at Sea not to come to the ports (names)_____ in coast.

FORMAT FOR POST LANDFALL OUTLOOK

(Rec. 2(c) of ACR 1999 and Rec. 11 of ACR 2002)

(To be appended at the end of the Cyclone Bulletin issued 12 hrs before estimated landfall time)

POST LANDFALL OUTLOOK FOR States……..

1. EVEN AFTER LANDFALL, THE SYSTEM would/will MAINTAIN ITS INTENSITY FOR ……. HOURS AND WEAKEN GRADUALLY AAA UNDER ITS INFLUENCE RAINS AT MOST/MANY PLACES WITH HEAVY TO VERY

HEAVY FALLS AT ……..…… would/will COMMENCE/CONTINUE IN …… (COASTAL DISTRICTS) FROM …… (TIME)……. (DAY) …… (DATES) CAUSING INUNDATION OF LOW-LYING AREAS AAA GALE WINDS/SQUALLY WINDS SPEED REACHING ……. KMPH would/will COMMENCE/CONTINUE IN ……..(COASTAL DISTRICTS) FROM …… (TIME) ON……(DAY)…… (DATE) CAUSING DAMAGES TO ……. (PROPERTY AS INDICATED IN IMD MONOGRAPH ON "DAMAGE POTENTIAL OF TROPICAL CYCLONE") AND …… (VEGETATION) AND GENERAL DISRUPTION OF COMMUNICATION AND POWER SUPPLY FOR ……

2. AS THE CYCLONE MOVES INLAND …….. INTERIOR DISTRICTS would/will ALSO EXPERIENCE HEAVY/VERY HEAVY RAIN ACCOMPANIED WITH GALE WITH SPEED REACHING ……. KMPH COMMENCING FROM …… (TIME) ON ……. (DAY) ……. (DATE) FOR …….. HRS, CAUSING FLOODING OF LOW LYING AREAS AND DAMAGE TO PROPERTY AS INDICATED IN IMD MONOGRAPH ON "DAMAGE POTENTIAL OF TROPICAL CYCLONE" (AS PER IMD INSTRUCTION)

3. PEOPLE ARE ADVISED TO REMAIN INDOORS/IN SAFE PLACES AND COOPERATE WITH STATE GOVERNMENT OFFICIALS AND DISASTER MANAGEMENT AGENCIES

APPENDIX – II
LIST OF PORTS UNDER THE DIFFERENT SYSTEMS AND ACWCs/ CWCs FROM WHICH THEY RECEIVE PORT WARNINGS
(Vide Para 6.3)

ACWC/CWC	***Extended Ports (District)***	***General Port (District)***	***Brief Port (District)***	***Ports without signals***
ACWC Kolkata	1.Sagar Island (South 24 Parganas)	1. Kolkata (Kolkata) 2.Haldia (Haldia) 3. Port Blair (A & N Admn.)	-	-
CWC Bhubaneswar	-	1. Paradeep (Jagatsinghpur) 2. Chatrapur (Ganjam)	1. Chandbali (Bhadrak) 2. Puri (Puri)	-
CWC Vishakhapatnam	1. Kakinada (East Godavari	1. Vishakhapatnam (Vishakhapatnam) 2. Machilipatnam (Krishna) 3. Nizamapatnam (Guntur) 4. Krishnapatnam (Nellore)	1.Kalingapatnam (Srikakulam) 2.Bhimunipatnam (Vishakhapatnam) 3.Vadarevu (Prakasam)	-
ACWC Chennai	1.Chennai (Chennai) 2.Cuddalore (Cuddalore) 3.Nagapattinam (Nagapattinam)	1.Pamban (Ramanathapuram) 2.Tuticorin (Turicorin) 3.Pondicherry (Pondicherry) 4. Alapuzha (Alapuzha) 5. Kochi (Ernakulam) 6. Baypore (Kozhikode) 7. Kozhikode (-do-) 8. Mangalore (Dakshin Kannada) 9.Panambur (Dakshin Kannada) 10. Karwar (Uttar Kannada)	1 Minicoy (Lakshadweep) 2 Kolachel (Kanyakumari) 3 Rameswaram (Ramanathapuram) 4.Thiruvananthapuram (do) 5. Nee Port (Kollam) 6. Ponnai (Malapuram) 7.Thalaseery (Kannur) 8. Kannur (do) 9. Azhikkal (Kannur) 10. Kasargod (do) 11Honavar (Uttar Kannada) 12.Bhatkal (Uttar Kannada) 13.Gangoli (Udupi) 14 Malpe (Udupi)	1.Murdeshwar 2.Kumta 3.Tadri (Gokarn) 4.Belekeri (Aversa) (All Uttar Kannada)

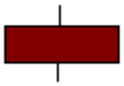
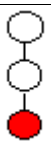
ACWC Mumbai	-	1. Mumbai 2. Mormugao (Goa) 3. Jawar Lal Nehru Port (J.N.P.T). (Raigad)	1. Dahanu (Thane) 2. Tarapur (Thane) 3. Nawarur (Thane) 4. Satpati (Thane) 5. Kelva Mahim (Thane) 6. Dantiware (Palghar) 7. Bassein (Vasai) 8. Uttan (Bhyandar) 9. Kalyan (Thane) 10. Thane (Thane) 11. Manori (Malad) 12. Versova (Andheri) 13. Bandra (Mumbai) 14. Trombay (Devnar) 15. Mora (Uran) (Raigad) 16. Karanja (Raigad) 17. Mandwa (Raigad) 18. Thal (Raigad) 19. Revas(Raigad) 20. Alibag (Raigad) 21. Revdanda (do) 22. Murud (Janjira) 23. Rajapuri (Raigad) 24. Shrivardhan (Raigad) 25. Bankot (Ratnagiri) 26. Harnai (Ratnagiri) 27. Dabhol (Ratnagiri) 28. Jaigad (Ratnagiri) 29. Varoda (Malgund) 30. Ratnagiri (Ratnagiri) 31. Purnagad (Ratnagiri)	1. Ulwa Belapur (Thane)

			32. Jaitapur (Sindhudurg) 33. Devgad (Sindhudurg) 34. Achra (Sindhudurg) 35. Malvan (Sindhudurg) 36. Nivti (Sindhudurg) 37. Vengurla (Sindhudurg) 38. Kiranpani (Aronda) 39. Redi (Sindhudurg) 40. Panjim (Goa)	
CWC Ahmedabad	-	1. Kutch Mandvi (Kutch) 2. New Kandla (Kutch) 3. Navlakhi (Rajkot) 4. Bedi Rozi Peir (Jamnagar) 5. Okha (Jamnagar) 6. Porbandar (Porbandar) 7. Veraval (Junagarh) 8. Bhavnagar (Bhavnagar) 9.Magdalla (Surat) 10 Alang (Bhavnagar) 11 Jafrabad (Amreli) 12.Mangrol (Junagarh) 13.Sikka (Jamnagar) 14. Salaya (Jamnagar)	1. Jakhav (NSPO) 2. Mundra (Kutch) 3.. Dwarka (Rupen)(NSPO) 4. Dahej (Bharuch) 5. Bharuch (NSPO)	1.Koteshwar (Kutch) 2.Pindhara (Jamnagar 3. Onjal (Navsari) 4. Wansi Borsi (Surat) 5.Umarsadi (Surat) 6.Kolak (Suart) 7.Valsad (Valsad) 8. Umbergaon (Valsad) 9. Maroli (Surat) 10.Billi-mora (Navsari) 11.Kham-bhat (Anand) 12.Ghogha (Bhavnagar) 13.Mahu-va (Amreli) 14.Rajpara (Amreli) 15.Madhvad (Junagarh)

				16.Kotada (Junagarh) 17 Mul Dwarka (Junagarh) 18 Nav Bandar (Junagarh) 19 Beyt (Porbandar) 20 Iodia (Jamnagar) 21Sach-ana (Jamnagar)

Annexure-II

Port Warning Signals (General System) used in India

Signal/Flag No.		NAME	Symbols		Description
			Day	Night	
1	DISTANT BAD WEATHER	DC1			Depression far at sea. Port NOT affected.
2		DW2			Cyclone far at sea. Warning for vessels leaving port.
3	LOCAL BAD WEATHER	LC3			Port Threatened by local bad weather like squally winds.
4		LW4			Cyclone at sea. Likely to affect the port later.
5		D5			Cyclone likely to cross coast keeping port to its left.

6.	**DANGER**	**D6**			**Cyclone likely to cross coast keeping port to its right.**
7.		**D7**			**Cyclone likely to cross coast over/near to the port.**
8.	**GREAT DANGER**	**GD8**			**Severe cyclone to cross coast keeping port to its left.**
9.		**GD9**			**Severe cyclone to cross coast keeping port to its right.**
10.		**GD10**			**Severe cyclone to cross coast over or very near to the port.**
11.		**XI**			**Communication failed with cyclone warning office.**