



GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCE
INDIA METEOROLOGICAL DEPARTMENT

BULLETINS

SOP

Acknowledgements

I am thankful to all the Scientists and Scientific Assistants of Cyclone Warning Division (CWD) for their coordinated efforts that went into the formulation of the updated Manual entitled "Cyclone Warning in India-Standard Operation Procedure".

I hereby place on record my deep appreciation for the valuable contributions made by Mrs. Monica Sharma, Scientist-D Cyclone Warning Division towards preparation, edition, review and publication of this manual. I also place on record my appreciation to Dr. D R Pattanaik, Head RSMC, Dr. A. K. Das, Head CWD and Dr. P L N Murty, Scientist-E for their overall guidance and scientific support in preparation of this document. I express my sincere thanks and appreciation to Mr. Mukesh Kumar, Met A and Ms Vineeta Bhardwaj, SA for their contribution in preparation and compilation of this manual. I also appreciate Mr. Yashasvi, SA, Ms Neeru Barak, SA, Mr. Gaurav Kumar Srivastav, SA, Mr Ashish Rawat, Mr. Vishal Maurya SA, Mr. Mohm Gulvez, SA and Ms Neelam Meena, SA, Cyclone Warning Division for their technical support in publication of this document.

October 2023



Mrutyunjay Mohapatra

Director General of Meteorology

PREFACE

A tropical cyclone (TC) is one of the most disastrous weather events that affects the coastal population as well as the marine and aviation activities. North Indian Ocean has faced some of the deadliest TCs with Bhola cyclone taking 300,000 lives in Bangladesh (1970), Nargis cyclone taking 148,000 lives in Myanmar (2008), Odisha Super Cyclone taking 10,000 lives in Odisha (1999) and many more. However, there has been a paradigm shift in early warning system of TCs during recent years leading to significant reduction in death toll not only in India but also in 13 WMO/ESCAP Panel member countries. It has earned appreciations and accolades to India Meteorological Department globally and nationally.

This shift in the services of India Meteorological Department could be achieved as all components of early warning system including observations, modeling, communication, warning products generation & dissemination were addressed by the Government of India and India Meteorological Department, Ministry of Earth Sciences.

Standard Operation Procedure (SOP) is an important document that provides the policies, processes and standards needed for the successful completion of task. It plays a pivotal role in reducing errors, increasing efficiencies and producing guidelines for how to resolve issues and overcome obstacles. Considering the fact that TC is a high impact weather event, the operation procedure depicting an end-to-end system from generation of warnings to dissemination has been standardized for effectively managing the preparation and dissemination of bulletins and advisories in a time bound manner to end users.

In this manuscript all terms & terminologies, area of responsibility maps and flow charts for preparation of Cyclone & Marine Bulletins have been compiled for easy use by the forecasters. This document will help in accurate and timely preparation and dissemination of bulletins.

Mrutyunjay Mohapatra

October 2023

Director General of Meteorology

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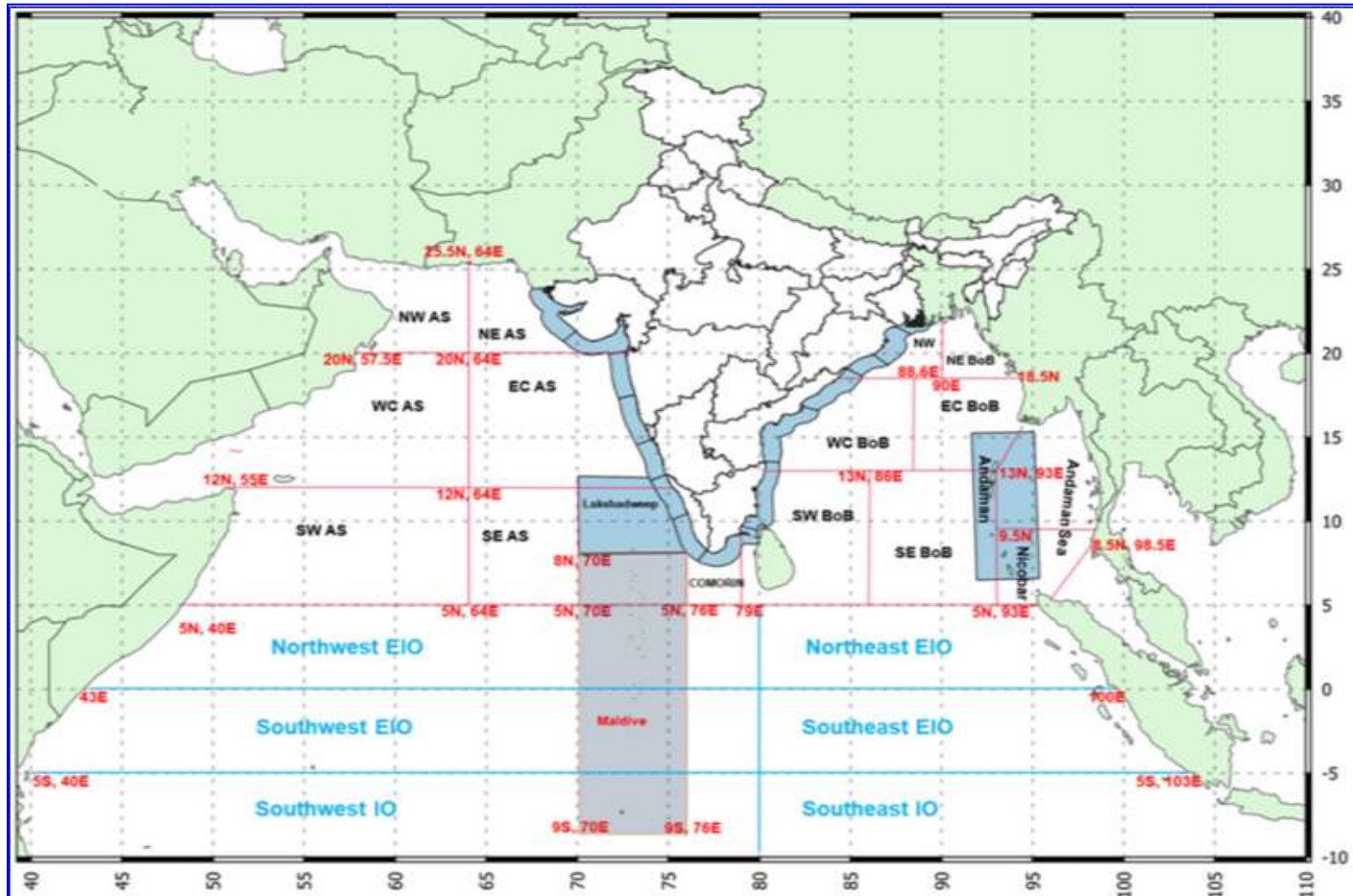
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BULLTEINS ISSUED BY
MARINE
&
CYCLONE WARNING DIVISION
(RSMC NEW DELHI)

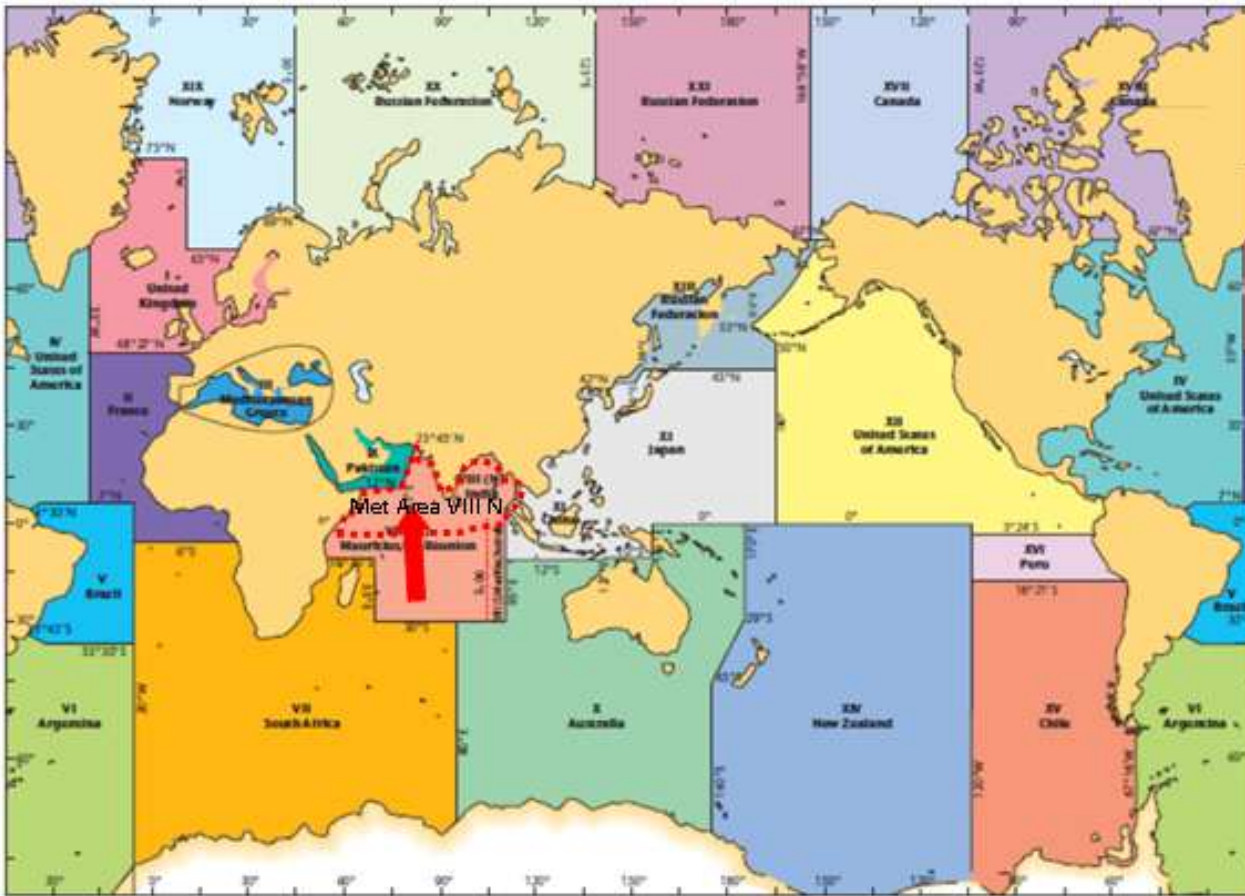
LIST OF BULLETINS ISSUED BY
MARINE & CYCLONE WARNING DIVISION (RSMC NEW DELHI)

S No.	Bulletin Issued
1	Tropical Weather Outlook
2	Special Tropical Weather Outlook
3	Tropical Cyclone Advisory Bulletin for Panel countries
4	GMDSS Bulletin
5	Bulletin for India coast
6	DGM's Bulletin for High Government Officials
7	Bulletin for Press
8	Tropical Cyclone Advisory Centre (TCAC) Bulletin for issue of SIGMET by Met. Watch Offices (Text Bulletin)
9	Graphical TCAC bulletin
10	TCAC Bulletin in coded form
11	TC Vitals (coded form)
12	Quadrant Wind (forecast)
13	Track with Cone of Uncertainty
14	Ship Avoidance Guidance

Area of responsibility map



Area of responsibility for RSMC Bulletin, Sea Area bulletin, Marine Search & Rescue Bulletin
(Areas of Bay of Bengal and Arabian Sea to the North of 5°N)



Area of responsibility for GMDSS Bulletin

11.RSMC Bulletin								
1)Mail(Two groups- WMO/ESCAP members and Offshore groups)								
2) FAX								
3)RSMC website								
4)Mausam website								
12.DGMs Bulletin	X		X	X	X	X	X	X
13.Press Release(Four groups- Disaster managers,Internal Officers,Offshore Operater,Press)	X		X	X	X	X	X	X
14A.Quadrant Wind text email & website								
14B.TC Vital-ftp & email		X		X		X		X
15A.TCAC Text-email to RTH		X		X		X		X
15B.TCAC ADRR-ftp		X		X		X		X
15C.TCAC.png ftp & email to website &RTH		X		X		X		X
16.CAP feed for Google Alert								
Checked by:								
Rechecked By:								

Date:

Time:

Final estimated observed position & other TCVITAL parameters:

<u>Observation/Estimate</u>	System Centre		Intensity (Wind speed /Γ no/ECP/V_{IR}/V_{max})		Po	ECP	Δ P
	<u>Lat</u>	<u>Lon</u>	T . No.	MSW			
<u>IMD Satmet</u>							
<u>NOAA-SSD (satfix)</u>							
<u>NOAA-SSD(Wind)</u>							
<u>CIRA Multispectral</u>							
<u>CIMSS ADT</u>							
<u>JTWC Final</u>							
<u>JTWC Satfix</u>							
<u>Synoptic Analysis</u>							
<u>IMD interpolated</u>							
<u>Average Position</u>							

Parameters		Value	Remark about Parameters
Vorticity	850 hpa		
	700 hpa		
	500 hpa		
	200 hpa		
Shear			
Shear Tendancy			
Upper Level Divergence			
Lower Level Convergance			
SST			
TCHP			
TPW			
<u>Final Estimate</u>			

<u>Wind</u>	<u>Q1 NW</u>	<u>Q2 NE</u>	<u>Q3 SW</u>	<u>Q4 SE</u>

Classification OF Cyclonic Disturbances

Based on Dvorak's Technique

And

Corresponding maximum sustained wind

And

Pressure drop at the centre (ΔP)

T. Number/ C.I. Number	Classification of Cyclonic Disturbance	Wind speed in Knots	Wind speed In Kmph	ΔP	Wind criteria in Knots	Wind criteria in Kmph
T1.0	L	<17	32	2	<17	<31
T1.5	D	25	46.3	3.1	17-27	31-49
T2.0	DD	30	55.6	4.5	28-33	50-61
T2.5	CS	35	64.9	6.1	34-47	62-88
T3.0		45	83.4	10.0		
T3.5	SCS	55	101.9	15.0	48-63	89-117

T4.0	VSCS	64	118	20.9	64-89	118-166
T4.5		77	142.7	29.4		
T5.0	ESCS	90	167	40.2	90-119	167-221
T5.5		102	189.0	51.6		
T6.0		115	213.1	65.6		
T6.5	SuCS	127	235.4	80.0	120 AND ABOVE	222 AND ABOVE
T7.0		140	259.5	97.2		
T7.5		155	287.3	119.1		
T8.0		170	315.1	143.3		

WINDSPEED CONVERSION TABLE

KT	Kmph	Range	Category	T No.
10	28	25-35	WML	1.0
20	37	30-40	WML	1.0
25	46	40-50	D	1.5
30	55	50-60	DD	2.0
35	65	60-70	CD	2.5
40	74	70-80	CS	2.5
45	83	80-90	CS	3.0
50	93	90-100	CS	3.0
55	102	95-105	SCS	3.5
60	111	105-115	SCS	3.5
64	119	115-125	VSCS	4.0
70	130	125-135	VSCS	4.0
75	139	135-145	VSCS	4.5
80	148	145-155	VSCS	4.5
85	157	150-160	VSCS	4.5
90	167	165-175	ESCS	5.0
95	176	170-180	ESCS	5.0
100	185	180-190	ESCS	5.0
105	194	190-200	ESCS	5.0
110	204	200-210	ESCS	5.0
115	213	210-220	ESCS	5.0
120	222	215-225	ESCS	5.0
125	231	225-235	ESCS	5.0

Damage Potential

Damage Potential and Action Suggested Category/T.No/Wind Speed	Structures	Communication & Power	Road/Rail	Agriculture	Marine Interests	Coastal Zone	Overall Damage Category	Suggested Actions
Deep Depression T 2.0 52 – 61 kmph (28-33 knots)	Minor damage to loose / unsecured structures		Some breaches in Kutcha road due to flooding.	Minor damage to Banana trees and near coastal agriculture due to salt spray. Damage to ripe paddy crops.	Very rough seas. Sea waves about 4-6 m high.	Minor damage to Kutcha embankments.	Minor	Fishermen advised not to venture into sea.
Cyclonic Storm T 2.5-T 3.0 62 – 87 kmph (34-47 knots)	Damage to thatched huts.	Minor damage to power and communication lines due to breaking of branches.	Major damage to Kutcha and minor damage to Pucca roads.	Some damage to paddy crops, banana, papaya trees and orchards.	High to very high sea waves about 6-9 m high.	Sea water inundation in low lying areas after erosion of Kutcha embankments.	Minor to moderate.	Fishermen advised not to venture into sea.

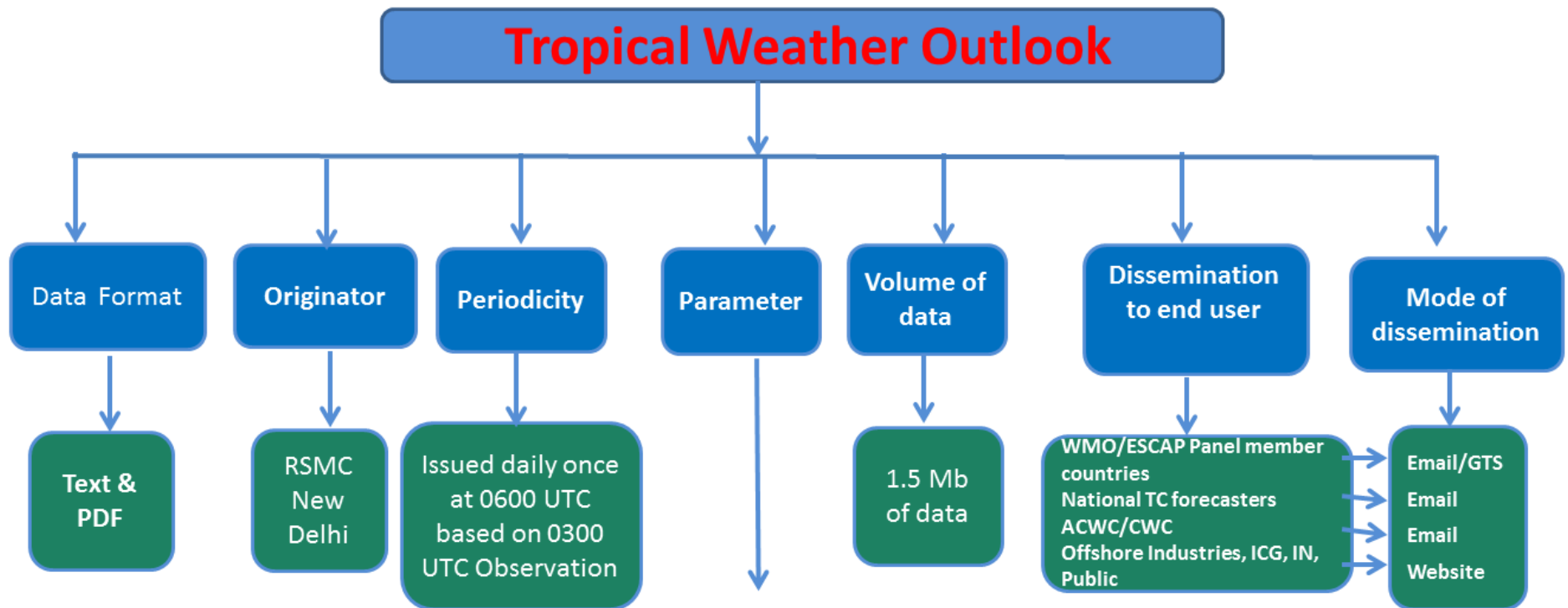
<p>Severe Cyclonic Storm T 3.5 88-117 kmph (48-63 knots)</p>	<p>Major damage to thatched houses/huts. Roof tops may blow off. Unattached metal sheets may fly.</p>	<p>Minor damage to power and communication lines.</p>	<p>Major damage to Kutcha and some damage to Pucca roads. Flooding of escape routes.</p>	<p>Breaking of tree branches, uprooting of large avenue trees. Moderate damage to banana and papaya trees. Large dead limbs blown from trees.</p>	<p>Phenomenal seas with wave height 9-14 m. Movement in motor boats unsafe.</p>	<p>Major damage to coastal crops. Storm surge upto 1.5 m (area specific) causing damage to embankments/salt pans. Inundation upto 5 km in specific areas.</p>	<p>Moderate</p>	<p>Fishermen advised not to venture into sea. Coastal hutment dwellers advised to move to safer places. Other people in the affected areas to remain indoors.</p>
<p>Very Severe Cyclonic Storm T 4.0- T 4.5 118-166 kmph (64-89 knots)</p>	<p>Total destruction of thatched houses/ extensive damage to kutcha houses. Some damage to pucca houses. Potential threat from flying objects.</p>	<p>Bending/ uprooting of power and communication poles.</p>	<p>Major damage to Kutcha and Pucca roads. Flooding of escape routes. Minor disruption of railways, overhead powerlines and signalling systems.</p>	<p>Widespread damage to standing crops, plantations, orchards, falling of green coconuts and tearing of palm fronds. Blowing down of bushy trees like mango.</p>	<p>Phenomenal seas with wave height more than 14 m. Visibility severely affected. Movement in motor boats and small ships unsafe.</p>	<p>Storm surge upto 2 m. Inundation upto 10 km in specific areas. Small boats, country crafts may get detached from moorings.</p>	<p>Large</p>	<p>Fishermen not to venture into sea. Evacuation from coastal areas need to be mobilized. People advised to remain indoors. Judicious regulation of rail and road traffic needed.</p>

<p>Extremely Severe Cyclonic Storm</p> <p>T 5.0- T 6.0</p> <p>167-221 kmph (90-119 knots)</p>	<p>Extensive damage to all types of kutcha houses, some damage to old badly managed Pucca structures. Potential threat from flying objects.</p>	<p>Extensive uprooting of communication and power poles.</p>	<p>Disruption of rail/road link at several places.</p>	<p>Extensive damage to standing crops, plantations, orchards. Blowing down of Palm and coconut trees. Uprooting of large bushy trees.</p>	<p>Phenomenal seas with wave height more than 14 m. Movement in motor boats and small ships not advisable.</p>	<p>Storm surge upto 2-5 m. Inundation may extend upto 10-15 km in specific areas. Large boats and ships may get torn from their moorings.</p>	<p>Extensive</p>	<p>Fishermen not to venture into sea. Evacuation from coastal areas essential. Diversion/suspension of rail and road traffic may be required.</p>
<p>Super Cyclonic Storm</p> <p>T 6.5 and above</p> <p>222 kmph and more (120 knots and more)</p>	<p>Extensive damage to non-concrete residential and industrial buildings. Structural damage to concrete structures. Air full of large projectiles.</p>	<p>Uprooting of communication and power poles. Total disruption of communication and power supply.</p>	<p>Extensive damage to Kutcha roads and some damage to poorly repaired pucca roads. Large scale submerging of coastal roads due to flooding and sea water inundation. Total disruption of railway and road traffic due to major damages to bridges, signals and railway tracks.</p> <p>Washing away of rail/road links at several places.</p>	<p>Total destruction of standing crops/orchards. Uprooting of large trees and blowing away of palm and coconut crowns, stripping of tree barks.</p>	<p>Phenomenal seas with wave heights of more than 14m. All shipping activities unsafe.</p>	<p>Extensive damage to port installations. Storm surge more than 5m, inundation upto 40 km in specific areas and extensive beach erosion. All ships torn from their moorings. Flooding of escape routes.</p>	<p>Catastrophic</p>	<p>Fishermen not to venture into sea. Large scale evacuations needed. Total stoppage of rail and road traffic needed in vulnerable areas.</p>

Category/T.No/ Wind Speed	Overall Damage Category	Consolidated Action Suggested for Bulletin
Deep Depression T 2.0 52 – 61 kmph (28-33 knots)	Minor	<p>Damage Expected:</p> <ul style="list-style-type: none"> ➤ Minor damage to loose / unsecured structures. ➤ Some breaches in Kutcha road due to flooding. ➤ Minor damage to Banana trees and near coastal agriculture due to salt spray. Damage to ripe paddy crops. ➤ Minor damage to Kutcha embankments. <p>Action Suggested:</p> <p>Fishermen are advised not to venture into the open seas.</p>
Cyclonic Storm T 2.5-T 3.0 62 – 87 kmph (34-47 knots)	Minor to moderate.	<p>Damage Expected:</p> <ul style="list-style-type: none"> ➤ Damage to thatched huts. ➤ Minor damage to power and communication lines due to breaking of branches. ➤ Major damage to Kutcha and minor damage to Pucca roads. ➤ Some damage to paddy crops, banana, papaya trees and orchards. ➤ Sea water inundation in low lying areas after erosion of Kutcha embankments. <p>Action Suggested:</p> <ul style="list-style-type: none"> ➤ Total suspension of fishing operations. ➤ Judicious regulation of offshore/onshore operations
Severe Cyclonic Storm T 3.5 88-117 kmph (48-63 knots)	Moderate	<p>Damage Expected:</p> <ul style="list-style-type: none"> ➤ Major damage to thatched houses/ huts. Roof tops may blow off. Unattached metal sheets may fly. ➤ Minor damage to power and communication lines. ➤ Major damage to Kutcha and some damage to Pucca roads. Flooding of escape routes. ➤ Breaking of tree branches, uprooting of large avenue trees. Moderate damage to banana and papaya trees. Large dead limbs blown from trees. ➤ Major damage to coastal crops.

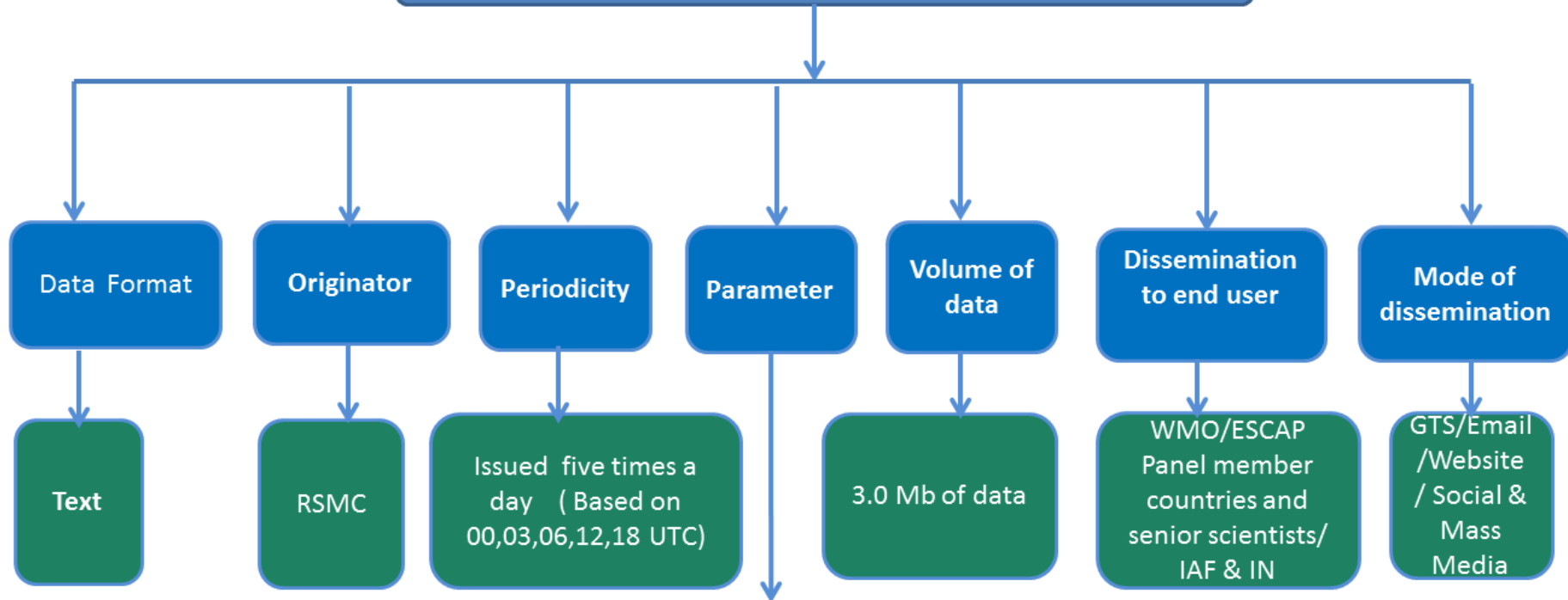
		<ul style="list-style-type: none"> ➤ Damage to embankments/ salt pans. <p>Action suggested:</p> <ul style="list-style-type: none"> ➤ Total suspension of fishing operations. ➤ Coastal hutment dwellers to be moved to safer places. People in affected areas to remain indoors. ➤ Movement in motor boats unsafe. ➤ Judicious regulation of offshore/onshore operations
<p>Very Severe Cyclonic Storm</p> <p>T 4.0- T 4.5</p> <p>118-166 kmph</p> <p>(64-89 knots)</p>	Large	<p>Damage Expected:</p> <ul style="list-style-type: none"> ➤ Total destruction of thatched houses/ extensive damage to kutcha houses. Some damage to pucca houses. Potential threat from flying objects. ➤ Bending/ uprooting of power and communication poles. ➤ Major damage to Kutcha and Pucca roads. Flooding of escape routes. Minor disruption of railways, overhead powerlines and signalling systems. ➤ Widespread damage to standing crops, plantations, orchards, falling of green coconuts and tearing of palm fronds. Blowing down of bushy trees like mango. ➤ Small boats, country crafts may get detached from moorings. ➤ Visibility severely affected. <p>Action Suggested:</p> <ul style="list-style-type: none"> ➤ Total suspension of fishing operations. Mobilise evacuation from coastal areas. ➤ Judicious regulation of rail and road traffic. ➤ People in affected areas to remain indoors. ➤ Movement in motor boats and small ships unsafe. ➤ Total suspension of offshore/onshore operations
<p>Extremely Severe Cyclonic Storm</p> <p>T 5.0- T 6.0</p> <p>167-221 kmph</p> <p>(90-119 knots)</p>	Extensive	<p>Damage Expected:</p> <ul style="list-style-type: none"> ➤ Extensive damage to all types of kutcha houses, some damage to old badly managed Pucca structures. Potential threat from flying objects. ➤ Extensive uprooting of communication and power poles. ➤ Disruption of rail/road link at several places. ➤ Extensive damage to standing crops, plantations, orchards. ➤ Blowing down of Palm and coconut trees. ➤ Uprooting of large bushy trees. ➤ Large boats and ships may get torn from their moorings. <p>Action Suggested:</p> <ul style="list-style-type: none"> ➤ Total suspension of fishing operations. ➤ Extensive evacuation from coastal areas. ➤ Diversion or suspension of rail and road traffic.

		<ul style="list-style-type: none"> ➤ People in affected areas to remain indoors. ➤ Movement in motor boats and small ships not advisable. ➤ Total suspension of offshore/onshore operations
<p>Super Cyclonic Storm</p> <p>T 6.5 and above</p> <p>222 kmph and more (120 knots and more)</p>	<p>Catastrophic</p>	<p>Damage Expected:</p> <ul style="list-style-type: none"> ➤ Extensive damage to non-concrete residential and industrial buildings. Structural damage to concrete structures. Air full of large projectiles. ➤ Uprooting of communication and power poles. ➤ Total disruption of communication and power supply. ➤ Extensive damage to Kutcha roads and some damage to poorly repaired pucca roads. ➤ Large scale submerging of coastal roads due to flooding and sea water inundation. ➤ Total disruption of railway and road traffic due to major damages to bridges, signals and railway tracks. ➤ Washing away of rail/road links at several places. <ul style="list-style-type: none"> ➤ Extensive damage to port installations. ➤ All ships torn from their moorings. <ul style="list-style-type: none"> ➤ Flooding of escape routes. ➤ Total destruction of standing crops/ orchards. ➤ Uprooting of large trees and blowing away of palm and coconut crowns, stripping of tree barks. <p>Action Suggested:</p> <ul style="list-style-type: none"> ➤ Total suspension of fishing operations. Large-scale evacuation of coastal population. ➤ Total suspension of rail and road traffic in vulnerable areas. People in affected areas to remain indoors. ➤ All shipping activities unsafe. ➤ Total suspension of offshore/onshore operations



- Header for transmission through GTS
- Preamble**
- **Region:** a) Bay Of Bengal b) Arabian Sea
- Parameter :**
 - LLCC/LPA(Location & vertical extension) Associated Convection with its intensity & and area of occurrence.
 - Remarks if any information about
 - Thermo dynamical parameters: SST, OTE, VWS, Wind Shear tendency, convergence, divergence over suspect area.
 - Large Scale features including Ridge at 200 hpa with location of cyclonic circulation, trough if any in mid -Lat. Westerly , MJO, cross equatorial flow, equatorial waves, moisture inflow.
 - NWP Model guidance for further movement & intensification of system.
 - Consensus Operational forecast.
- (III) **Table for Probability of Cyclogenesis:** for Day1 to Day7 as Nil, Low (0-33%)/Moderate (34-67%)/High(68-100%)
- (IV) **Graphics:** Satellite imaginary based on 0300 UTC of date.
- **Footer:** Legends and contact details

Special Tropical Weather Outlook



- **Header:** for transmission through GTS

- **Preamble**

- **Region:** a) Bay Of Bengal b) Arabian Sea

- **Parameter:**

(i) Para 1: Information about system including D/DD over area at time/date near Lat./Log., Distance from nearby WMO station with station index, forecast of movement and intensification, forecast of landfall point.

(ii) Para 2: Convective activity as per Dvorak Table.

convection:- area of occurrence, organization of cloud mass during past 24 hr & pattern, lowest CCT

(iii) Para 3: MSW speed in kts gusting to kts around system centre, state of sea, Estimated central pressure.

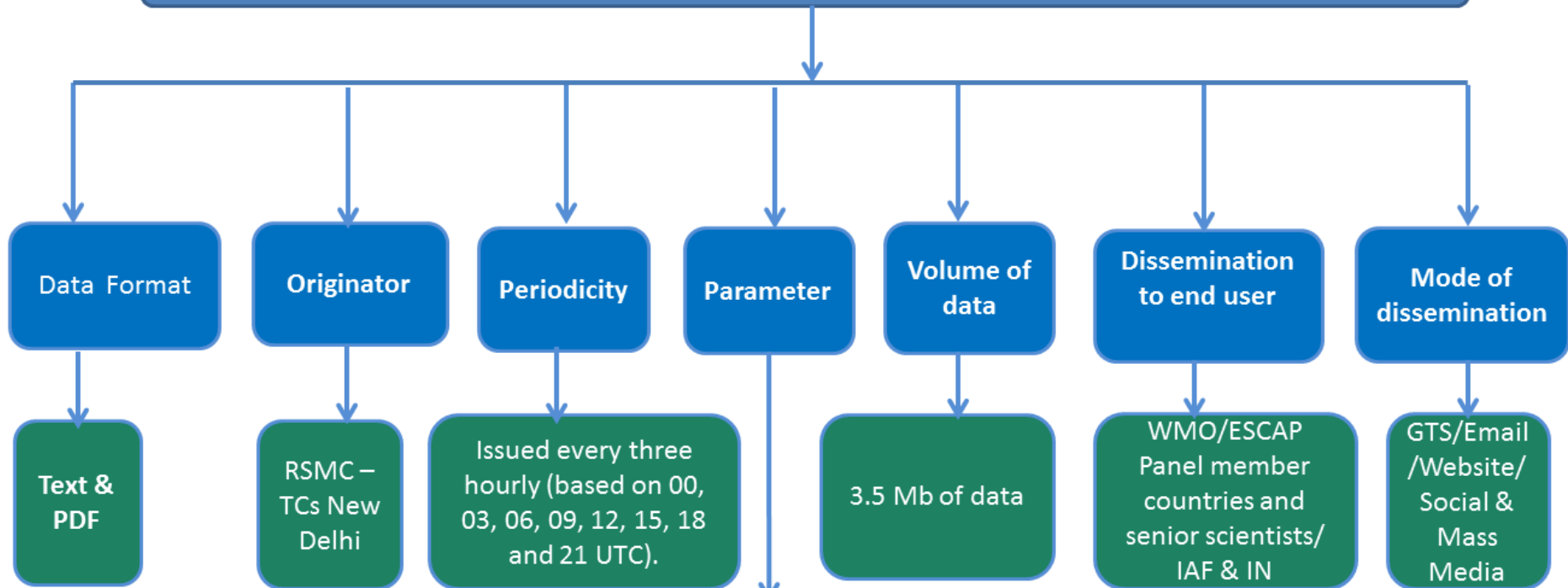
(iv) Para 4: Scatterometer data, Buoy/Ship(Location & observation of wind speed/Direction/MSLP

(v) Remarks: Thermo dynamical features, Large scale features, Model guidance, Consensus forecast

(vi) **Graphics:** Location & Observed & Forecast track of D/DD with Cone of Uncertainty & Wind Distribution, Satellite, Radar imagery, Multi-hazard Warning Map, Fishermen Warning,

- **Footer:** Legends and contact details

Tropical Cyclone Advisory Bulletin for Panel countries



- **Header** for transmission through RTH

- **Preamble** Storm Name and Advisory number

- **Region:** a) Bay Of Bengal b) Arabian Sea

- **Parameter :**

(i) Para 1: Information about system including its classification as per intensity, Name, Direction of movement during past 6 hr with speed, current location in Lat./Log., Distance from known nearest WMO station with station index, forecast of movement, intensification, landfall point & time. Forecast track & intensity quantitatively upto 120 hours

(ii) Para 2: Convective activity as per Dvorak Table including area of occurrence of convection, organization of cloud mass during past 24 hr & pattern, lowest CTT.

(iii) Para 3: MSW speed in kt gusting to kt around system centre, state of sea, Estimated central pressure.

(iv) Para 4: Forecast of Position, MSW range & gusting to in kmph, category of disturbance.

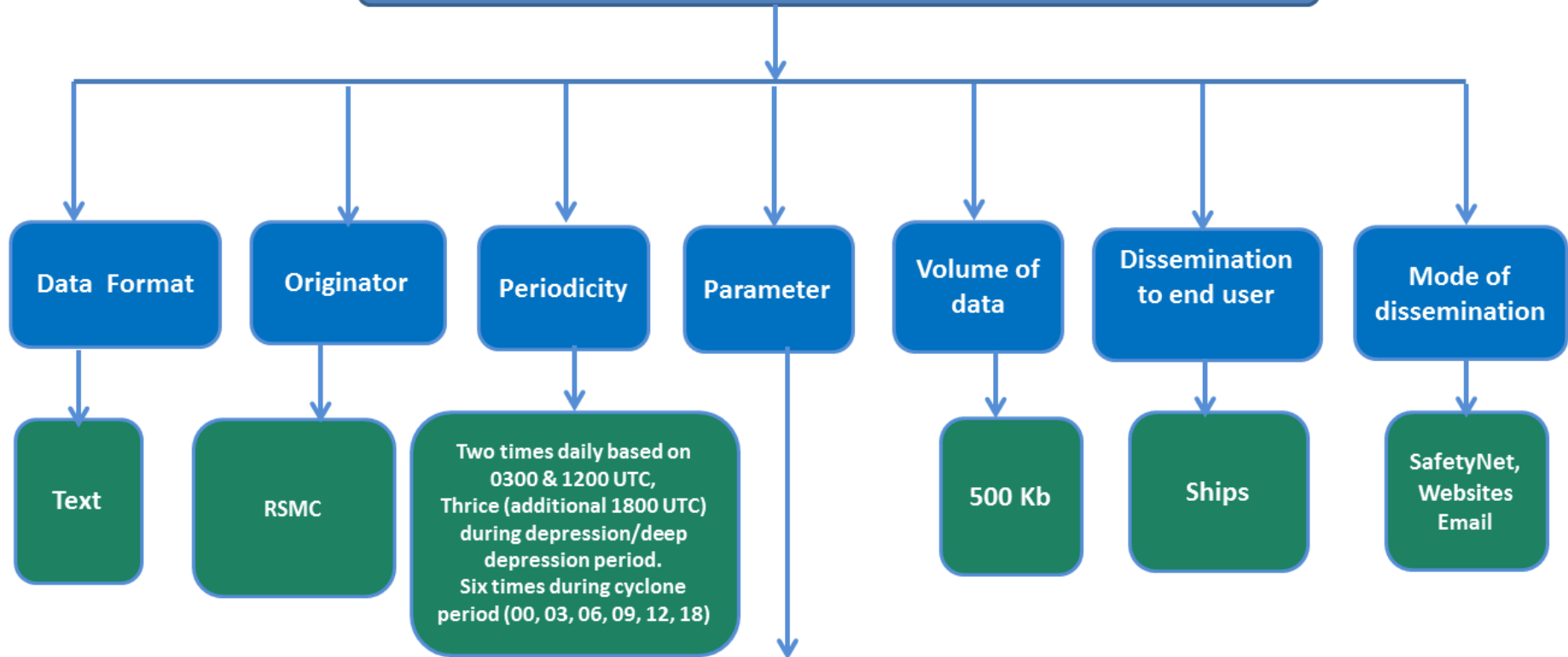
(v) Para 5: Storm Surge guidance if any, height of storm surge above astronomical tide likely to immediate coastal area at the time of landfall.

(vi) Remarks: Scatterometer data, Buoy/Ship(Location & observation of wind speed/Direction/MSLP), thermo dynamical features, Large scale features, Equatorial Waves, Model guidance, Consensus forecast

- **Graphics:** Track with COU & Wind Distribution, Satellite imagery, Multi-hazard Warning map, Fishermen warning graphics.

- **Footer:** Legends and contact details

GMDSS Bulletin



--- Part 1:

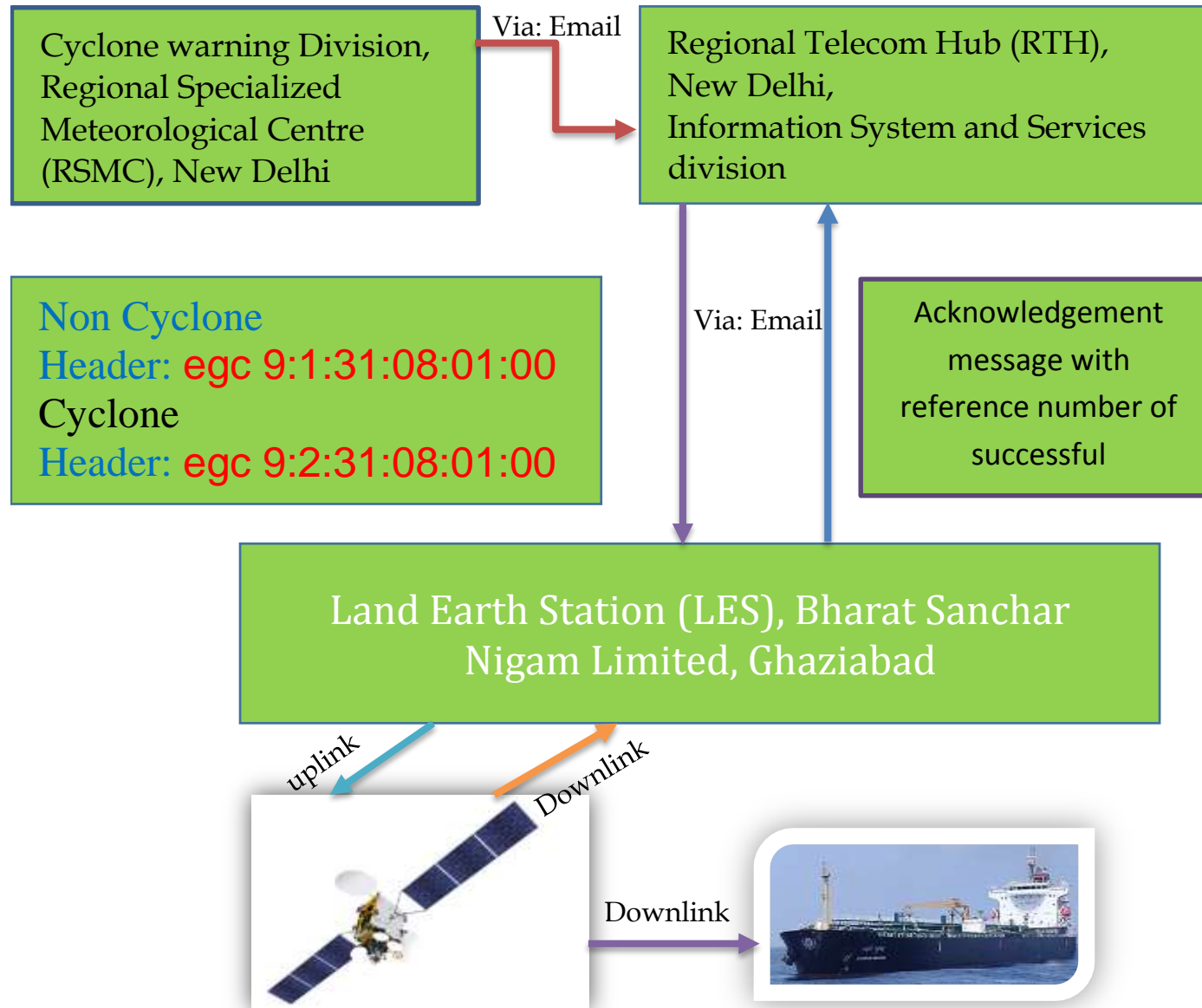
- Heading gives information of storm including Category, Name, Area & Estimated Central Pressure.
- Information about storm from RSMC Bulletin regarding Current location, intensity, distance from identified stations.
- Forecast of movement, intensity and landfall.
- Forecast of location and intensity upto 48 hours in tabular form from RSMC Bulletin.
- Quadrant wind information for current position & intensity of Gale wind speed reaching 34kt, 50kt, 64kt, in 4 geographical quadrants NW, NE, SW, SE respectively

--- Part 2 includes synoptic weather system.

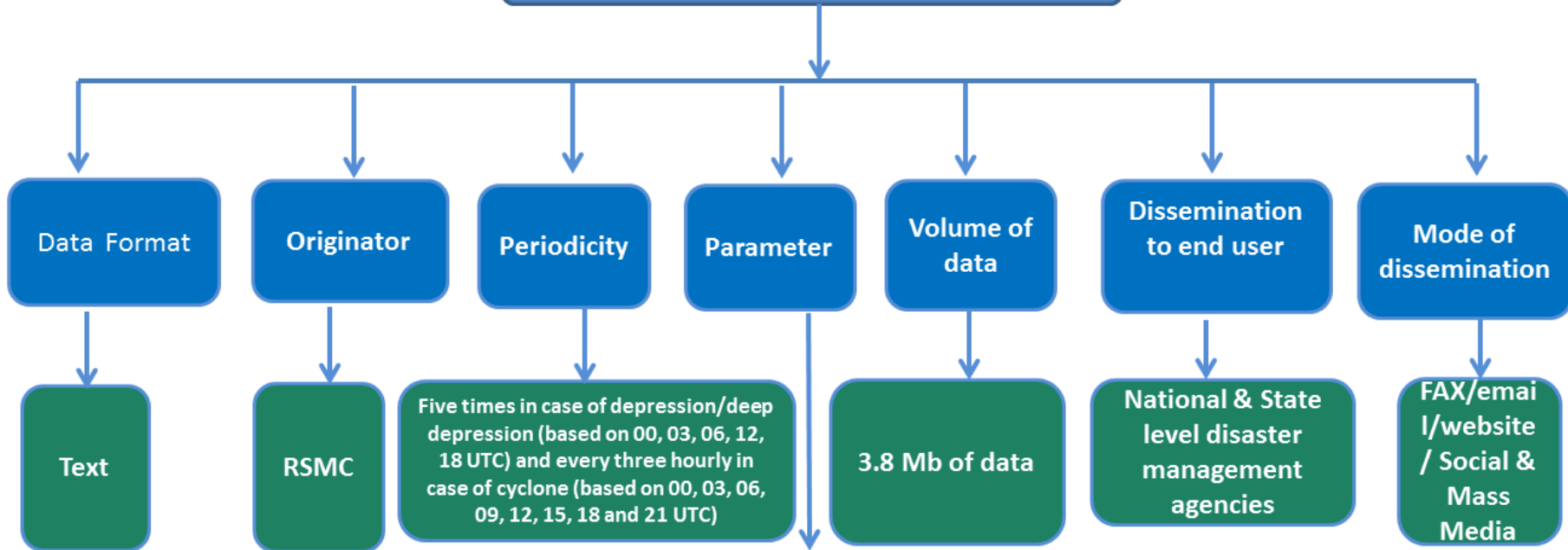
--- Part 3 includes Area Forecast for A1, A2, A3, A4 areas. Information about wind, wave, weather, visibility.

---- Advisory: Advisory regarding uncertainty in gustiness in wind (40% stronger than the forecast) and wave height (twice the forecast) is issued.

GMDSS Bulletin Transmission

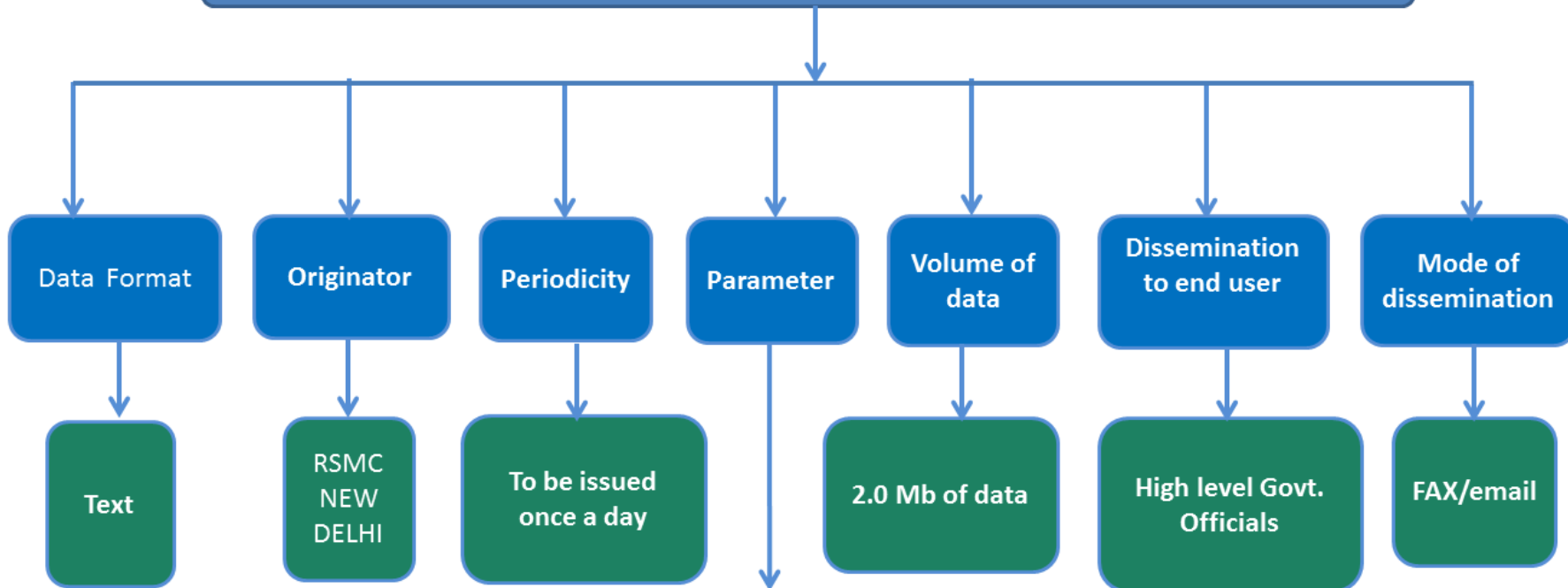


Bulletin for India coast



- **Header From:** IMD TO: National & State level disaster management agencies, CS of concerned states, Doordarshan, AIR and Railways
- **Preamble** Storm Name and Advisory number
- **Region:** a) Bay Of Bengal b) Arabian Sea
- **Parameter :**
 - (i) Para 1: Information about system including its classification as per intensity, Name, Direction of movement during past 6 hr with speed, current location in Lat./Log., Distance from known nearest WMO station , forecast of movement, intensification, landfall point & time.
 - (ii) Para 2: Table of Forecast of Position, MSW range & gusting to in kmph, category of disturbance upto 120 hr.
 - (v) Para 3:
 - Adverse weather warning, Heavy Rainfall, Gale wind(Intensity, Area , duration of occurrence), Storm surge(Height, Area & time of occurrence)
 - Sea condition,
 - Damage expected and action suggested
- **Graphics:** Track with COU, Quadrant wind distribution, Satellite/RADAR imagery, Heavy Rainfall warning, Fishermen Warnings, South Asian Flash Flood Guidance, Web DCRA Map, District Level Warning, Storm Surge Warning.
- **Footer:** Legends and contact details

DGM's Bulletin for High Government Officials



• **Preamble** Advisory number, Time & date of issue.

• **Parameter :**

(i) Para 1: Summary of past 24 hrs development, information about system including its classification as per intensity, Name, speed, current location in Lat./Log., Distance from known nearest WMO station, forecast of movement, intensification, landfall point & time.

(ii) Para 2: Table of Forecast of Position, MSW range & gusting to in kmph, category of disturbance upto 120 hr.

(v) Para 3:

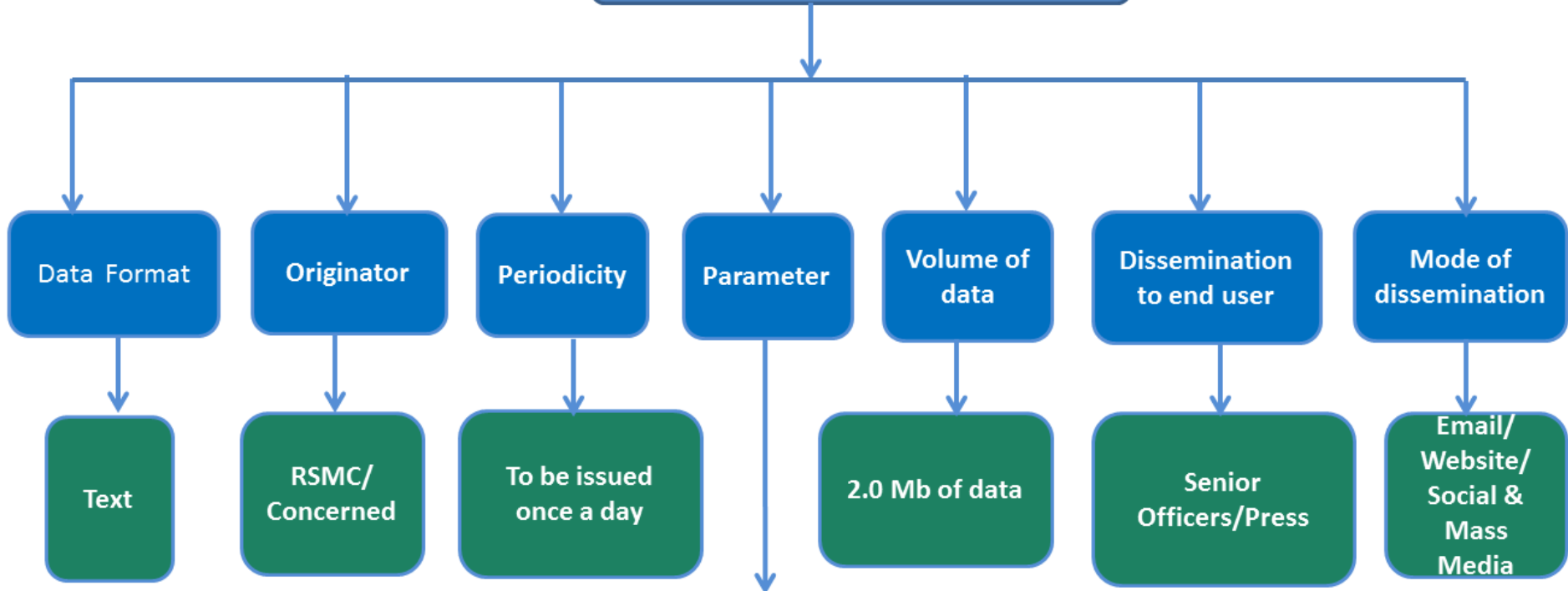
- Adverse weather warning, Heavy Rainfall, Gale wind(Intensity, Area , duration of occurrence), Storm surge(Height, Area & time of occurrence)
- Sea condition,
- Damage expected and action suggested

• **Graphics:** Track with COU, Quadrant wind distribution, Satellite/RADAR imagery, Heavy Rainfall warning.

• Contact details of end users

Footer: Legends and contact details

Bulletin for Press



• **Preamble** Advisory number, Time & date of issue.

• **Parameter :**

(i) Para 1: Summary of past 24 hrs development, information about system including its classification as per intensity, Name, speed, current location in Lat./Log., Distance from known nearest WMO station, forecast of movement, intensification, landfall point & time.

(ii) Para 2: Table of Forecast of Position, MSW range & gusting to in kmph, category of disturbance upto 120 hr.

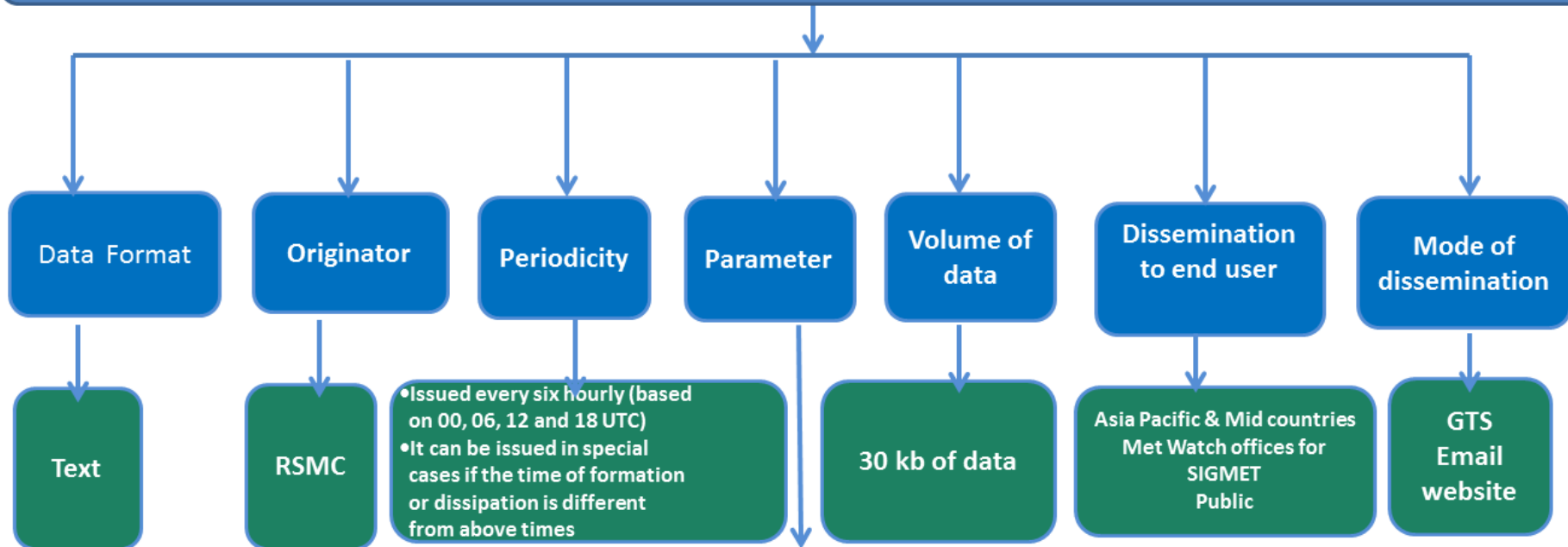
(v) Para 3:

- Adverse weather warning, Heavy Rainfall, Gale wind(Intensity, Area , duration of occurrence), Storm surge(Height, Area & time of occurrence)
- Sea condition,
- Damage expected and action suggested

• **Graphics:** Track with COU, Quadrant wind distribution, Satellite/RADAR imagery, Heavy Rainfall warning.

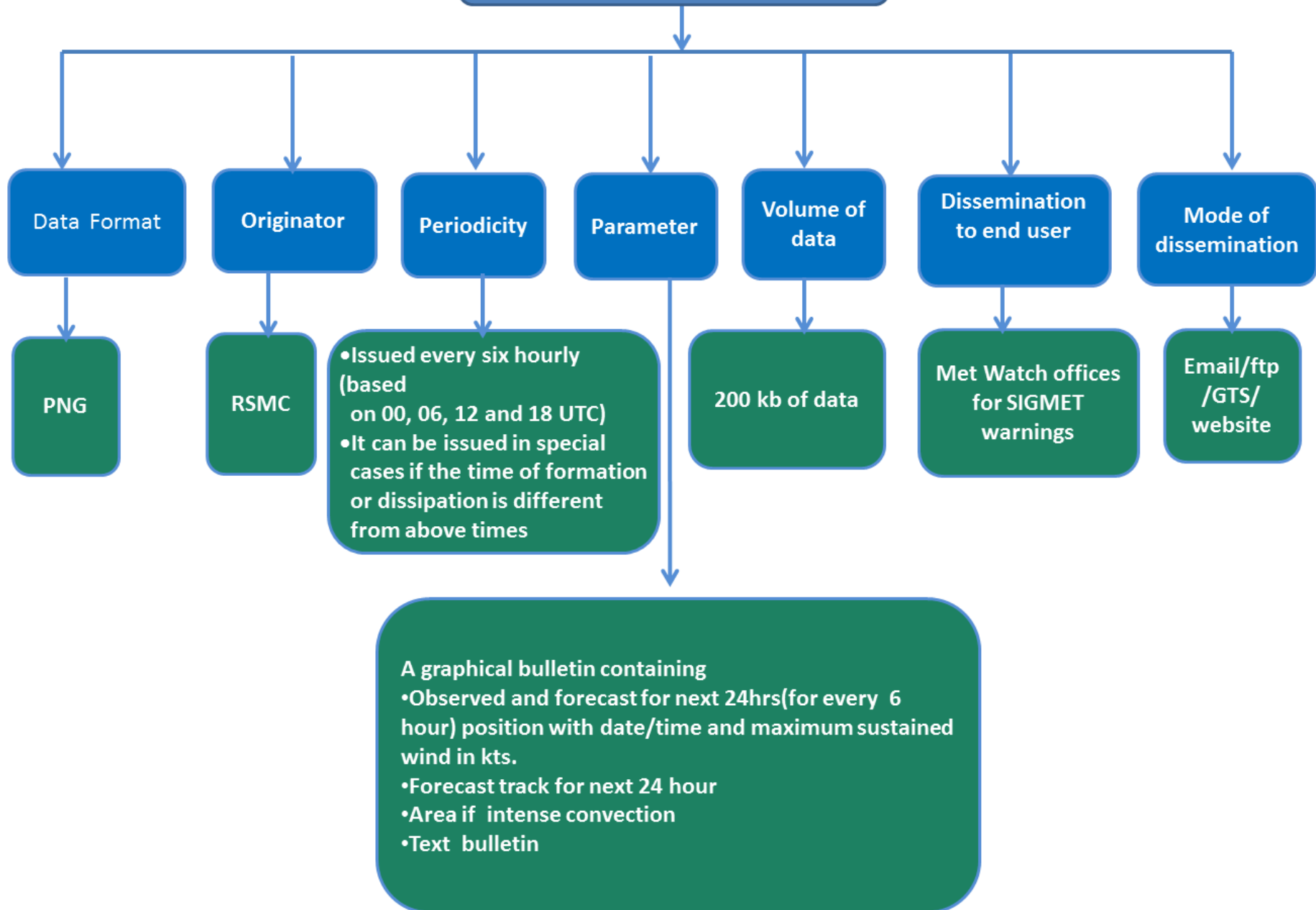
Footer: Legends and contact details

Tropical Cyclone Advisory Centre (TCAC) Bulletin for issue of SIGMET by Met. Watch Offices (Text Bulletin)

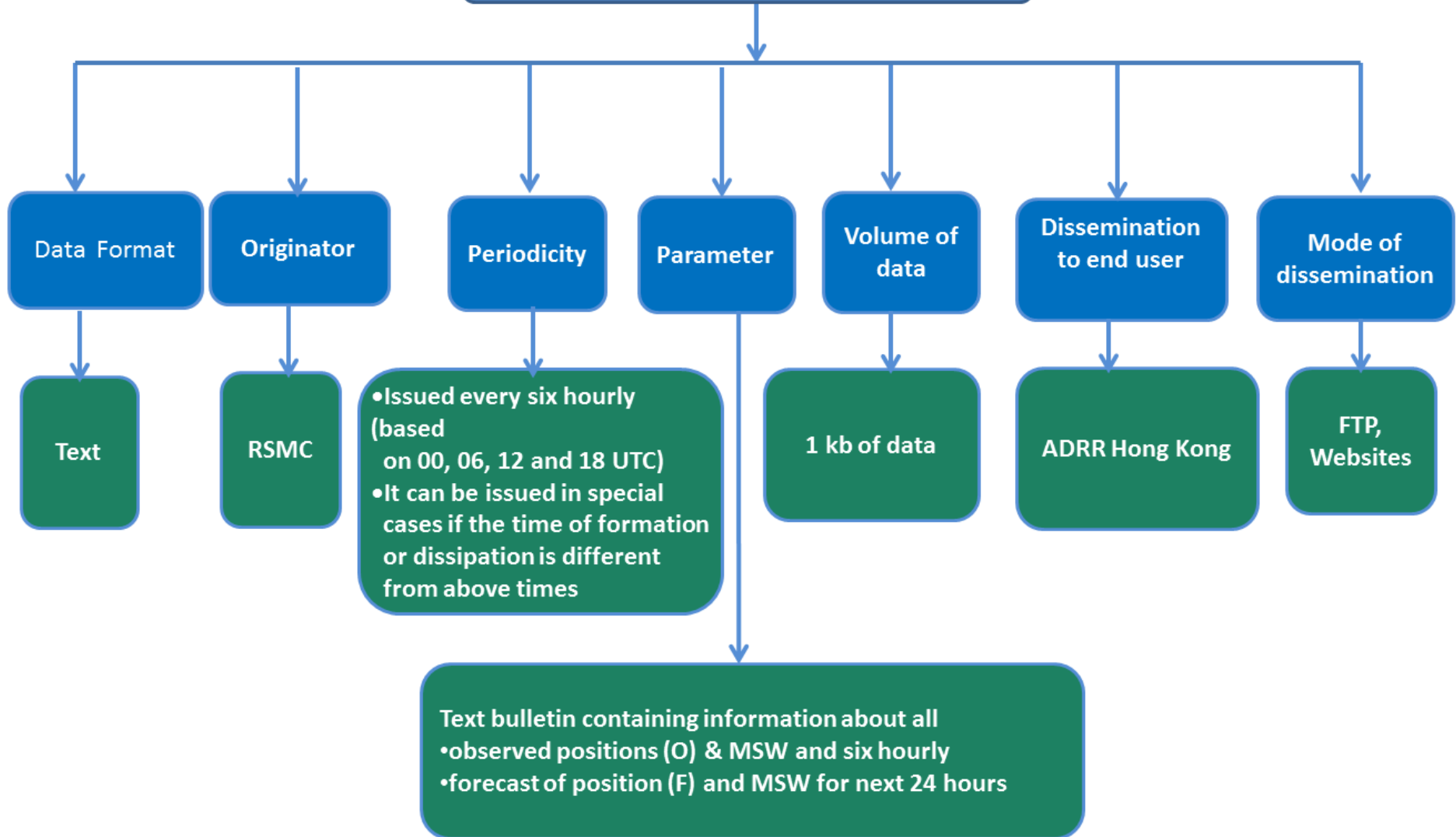


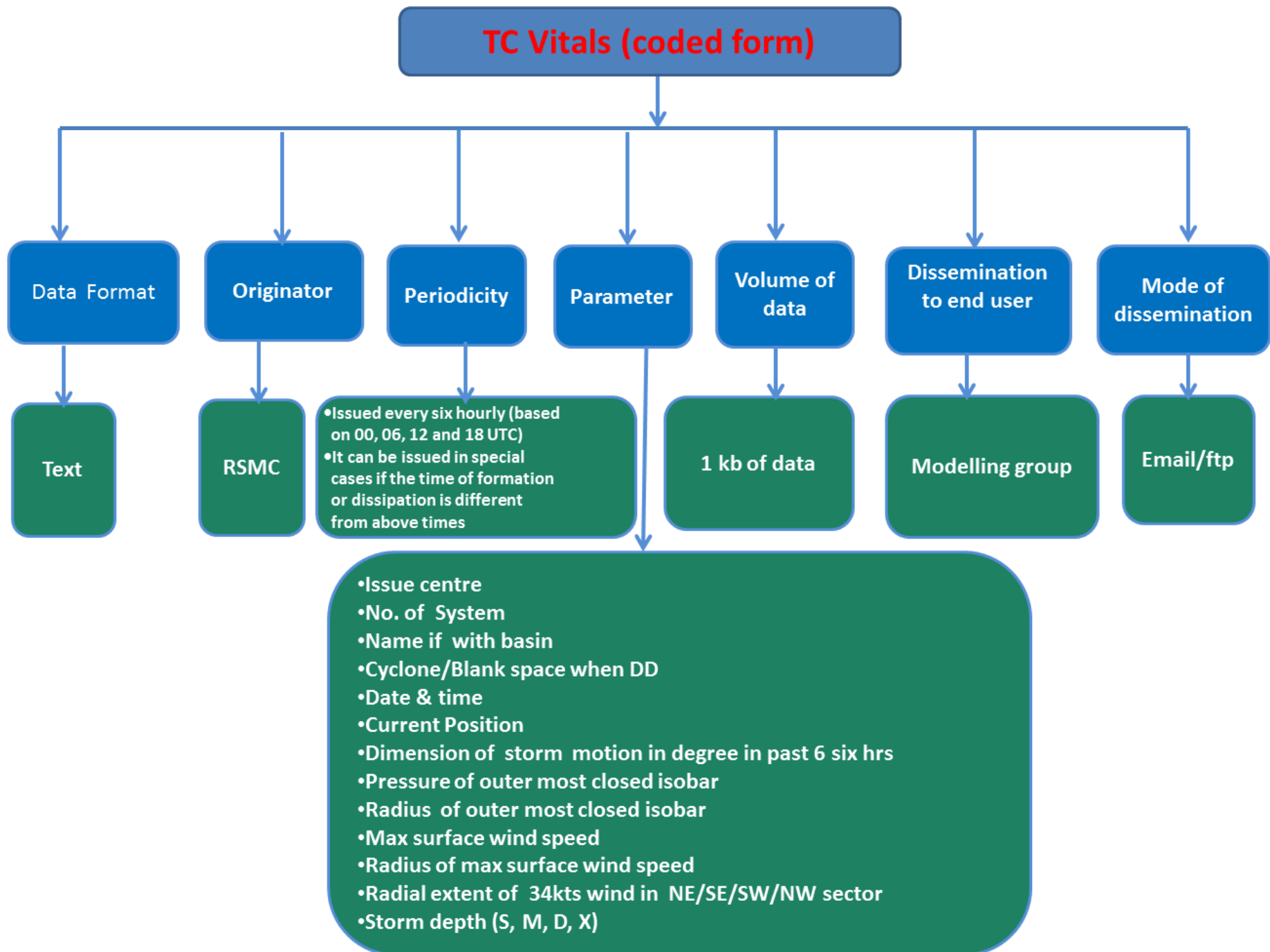
- Header
- Observation Date/Time
- Issuing office
- TC Name/No Name
- Number of bulletin
- Position
- Movement
- Central pressure
- Max. sustained surface wind
- Forecast Position +06 hrs: Time and Lat./Log.
- Forecast Max. wind +06 Hrs in kts
- Forecast Position +12 hrs: Time and Lat./Log.
- Forecast Max. wind +12 Hrs in kts
- Forecast Position +18 hrs: Time and Lat./Log.
- Forecast Max. wind +18 Hrs in kts
- Forecast Position +24 hrs: Time and Lat./Log.
- Forecast Max. wind +24 Hrs in kts
- Next Message : YYYYMMDD/TTTT
- Issuing time of current message DDTTTT HRS IST

Graphical TCAC bulletin



TCAC Bulletin in coded form





File Name: gdas1.ddttz.syndata.tcvitals
--

Description of characters:**Example**

character*4	tcv_center	! Hurricane Center Acronym	IMD (give one space)
character*3	tcv_storm_id	! Storm Identifier (02B, etc)	01B
character*9	tcv_storm_name	! Storm name	MAHASSEN (give2space)
integer	tcv_century	! 2-digit century id (19 or 20)	20
integer	tcv_yymmdd	! Date of observation	130515
integer	tcv_hhmm	! Time of observation (UTC)	1800
integer	tcv_lat	! Storm Lat (*10), always >0	190 (for 19.0 ⁰)
character*1	tcv_latns	! 'N' or 'S'	N
integer	tcv_lon	! Storm Lon (*10), always >0	0885 (for 88.5 ⁰)
character*1	tcv_lonew	! 'E' or 'W'	E
integer	tcv_stdir	! Storm motion vector (in degr)	030 (from Syn.in 3 digits)
integer	tcv_stspd	! Spd of storm movement (m/s*10) the multiply by 10 as per format and reported in 3 digits)	050. (from syn in KT's divide by 2 to convert to m/s)
integer	tcv_pcen	! Min central pressure (mb)	0990 (from bulletin in 4 digits)
integer	tcv_penv	! val outrmost closed isobar(mb)	1000
integer	tcv_penvrad	! rad outrmost closed isobar(km)	0250
integer	tcv_vmax	! max sfc wind speed (m/s) in mps)	022 (from Bulletin in kph and multiply by 0.3 to get)
integer	tcv_vmaxrad	! rad of max sfc wind spd (km) 64 kts/50kts/34kts as the case be i.e.1/2((r1+r2+r3+r4)/4)	060 (from Syn half of average quadrant wind say)

integer	tcv_r15ne	! NE rad of 15 m/s winds (km)	0170 (rad of 34 kts winds in nm and multiply by 1.85)
integer	tcv_r15se	! SE rad of 15 m/s winds (km)	0130 (-do-)
integer	tcv_r15sw	! SW rad of 15 m/s winds (km)	0120 (-do-)
integer	tcv_r15nw	! NW rad of 15 m/s winds (km)	0170 (-do-)
character*1	tcv_depth	! Storm depth (S,M,D) X=missing	M

S stands for shallow (for Dep), M stands for Medium (for DD), D stands for Deep (for CS and above) and X stands for missing

Thus the TC Vital message for the above example is given below.

IMD 01B MAHASSEN 20130515 1800 190N 0885E 030 050 0990 1000 0250 022 060 0170 0130 0120 0170 M

N.B.:

1. Century and yymmdd are given in one column (column number 4)
2. Latitude of centre of TC is given in three digits alongwith N/S (column 6)
3. Longitude of the centre of TC is given in four digits alongwith E/W (column 7)
4. Starts from DD stage and in place of storm name give 9 blank spaces
5. Storm identifier is system No. in particular basin and reported as NNB or NNA (reported in 3 digits as 01B)

For Checking: Internet explorer

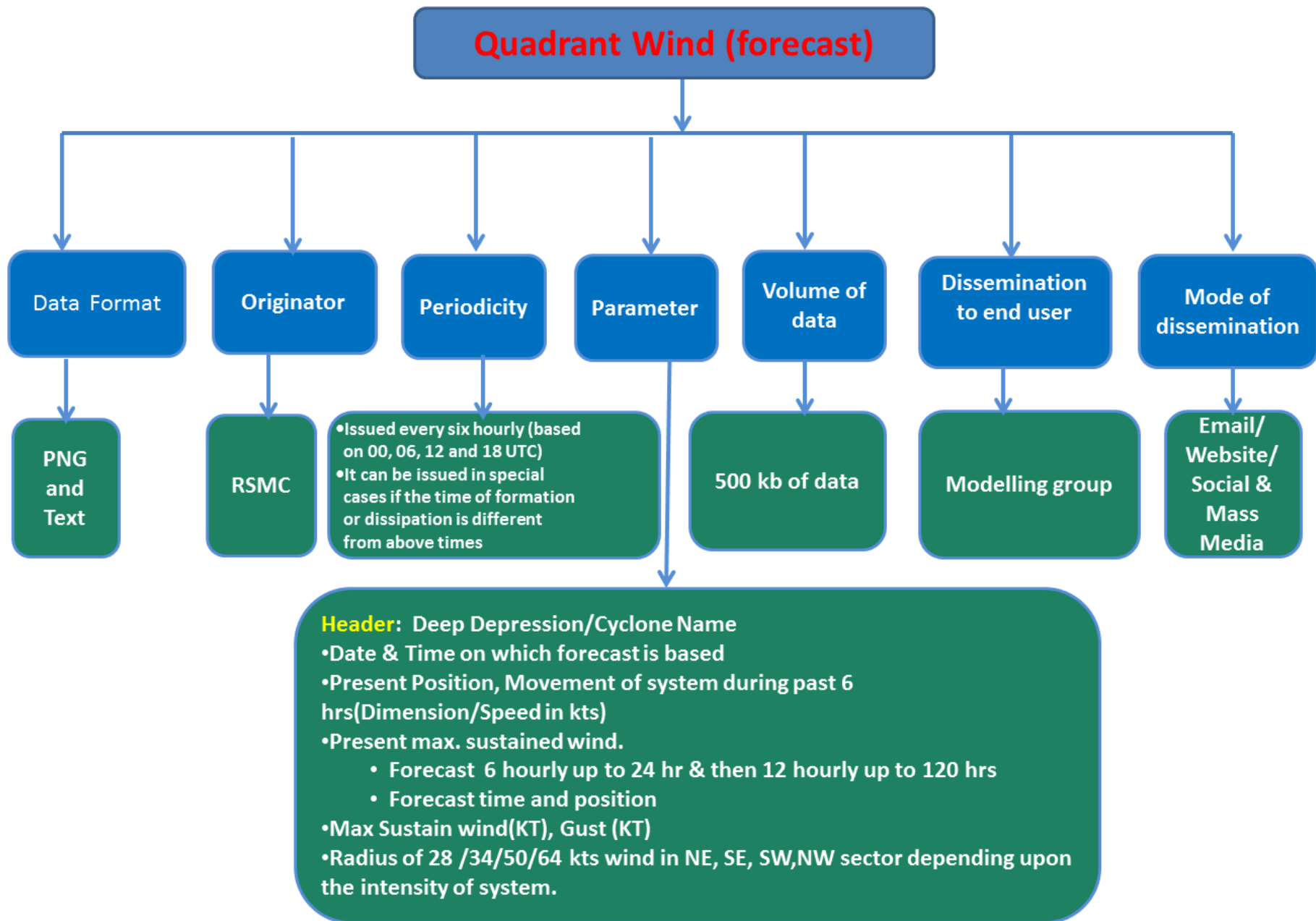
ftp://192.168.12.159

U/N: adrr

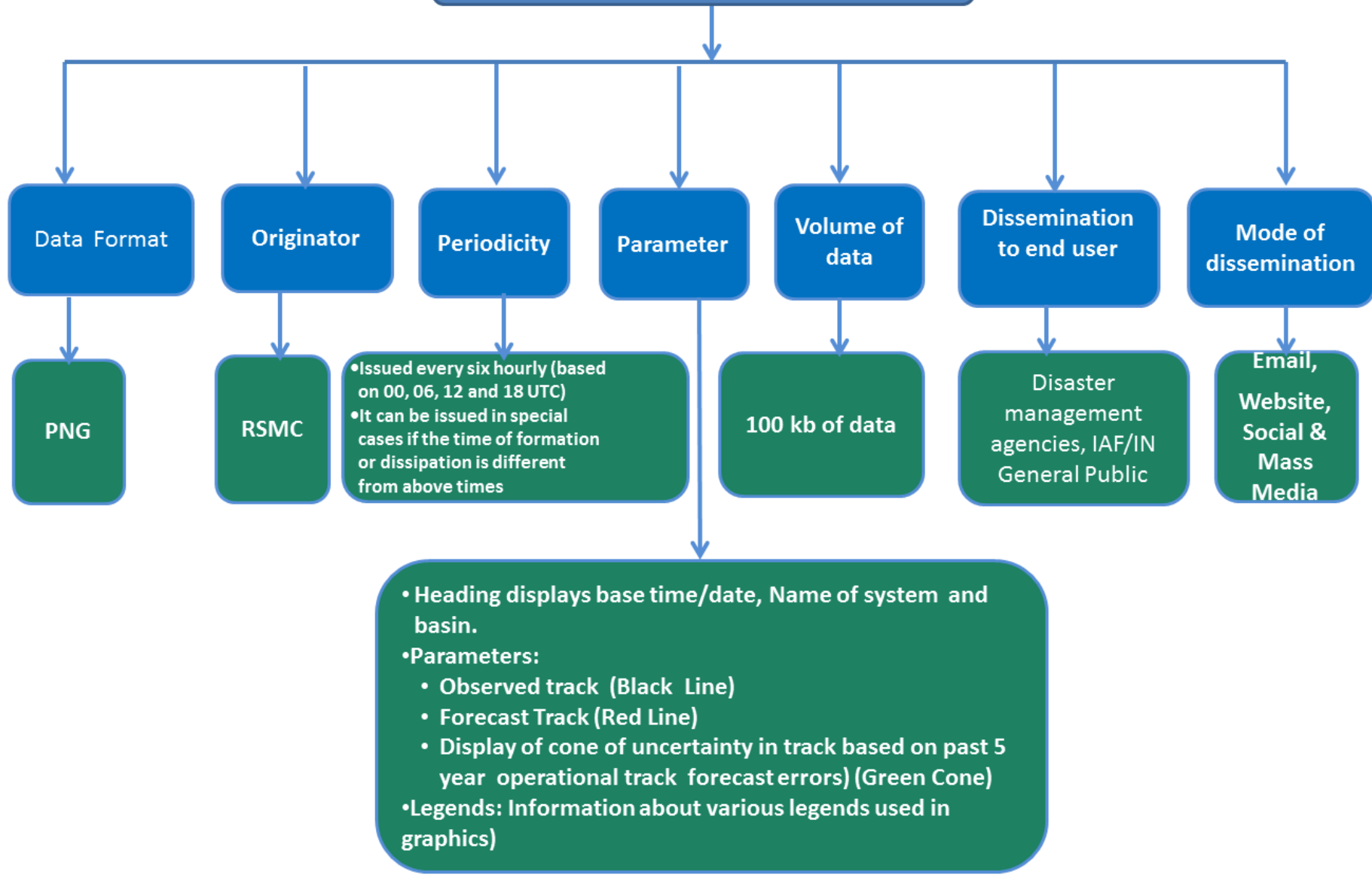
P/W: riskreduction

Folder: rsmcnd

View file sent



Track with Cone of Uncertainty



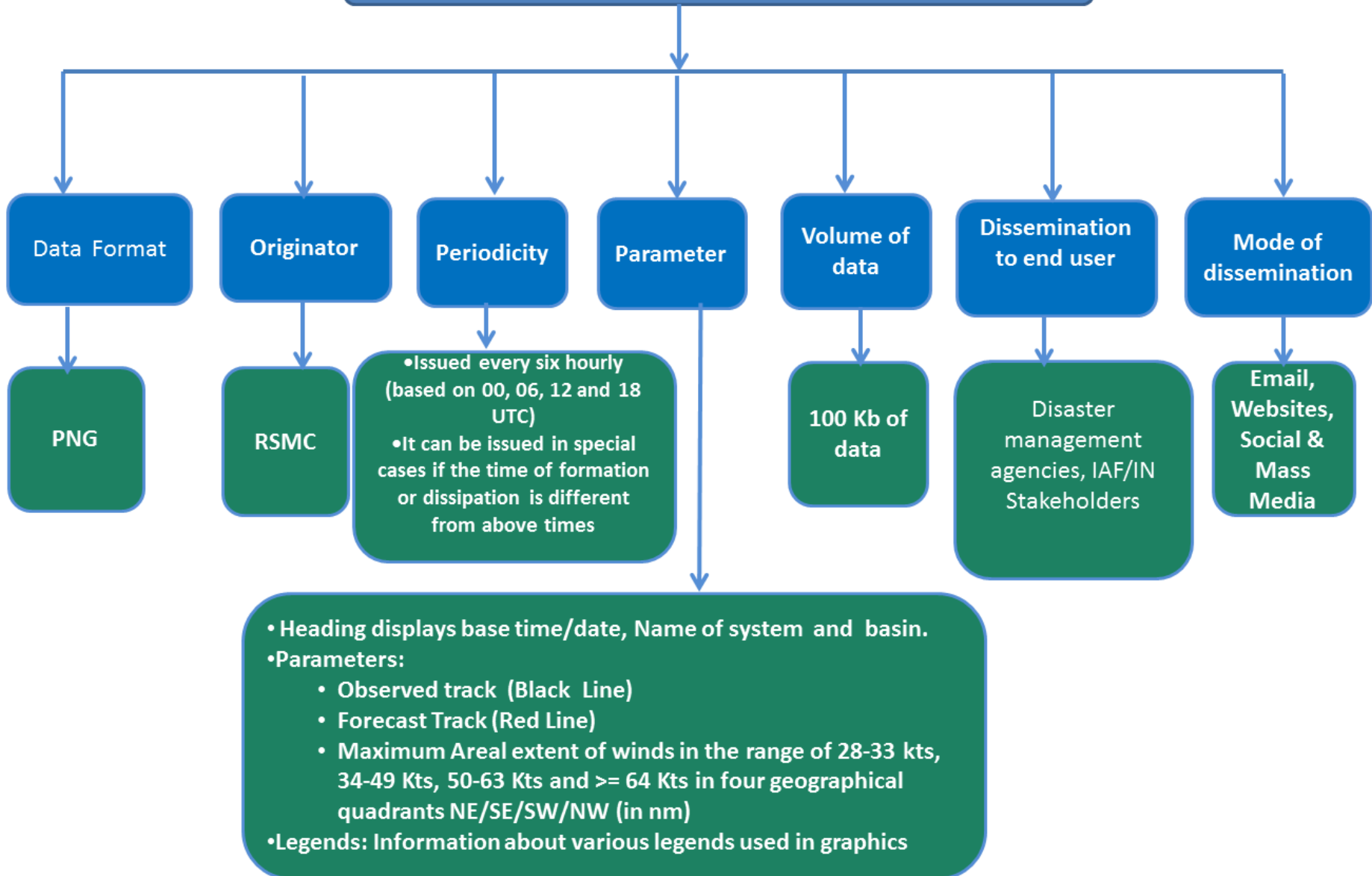
COU Values

F/C Period	Radius of the circle to construct cone of uncertainty (km/nm) w.e.f. 2019
00 hr	20/10
06 hr	40/20
12 hr	55/30
18 hr	75/40
24 hr	85/45
36 hr	105/55
48 hr	130/70
60 hr	160/85
72 hr	175/95
96 hr	240/130
120 hr	295/160

COU Values**(For Pre-Genesis Track)**

F/C Period	Radius of the circle to construct cone of uncertainty (km/nm) w.e.f. March 2022 (Pre-Genesis Track)
00 hr	20/10
06 hr	40/20
12 hr	65/35
18 hr	95/50
24 hr	120/65
36 hr	150/80
48 hr	175/95
60 hr	205/110
72 hr	230/125
84 hr	260/140
96 hr	285/155
108 hr	315/170
120 hr	345/185

Ship Avoidance Guidance



BULLETINS ISSUED BY
AREA CYCLONE WARNING
CENTRES (ACWC)

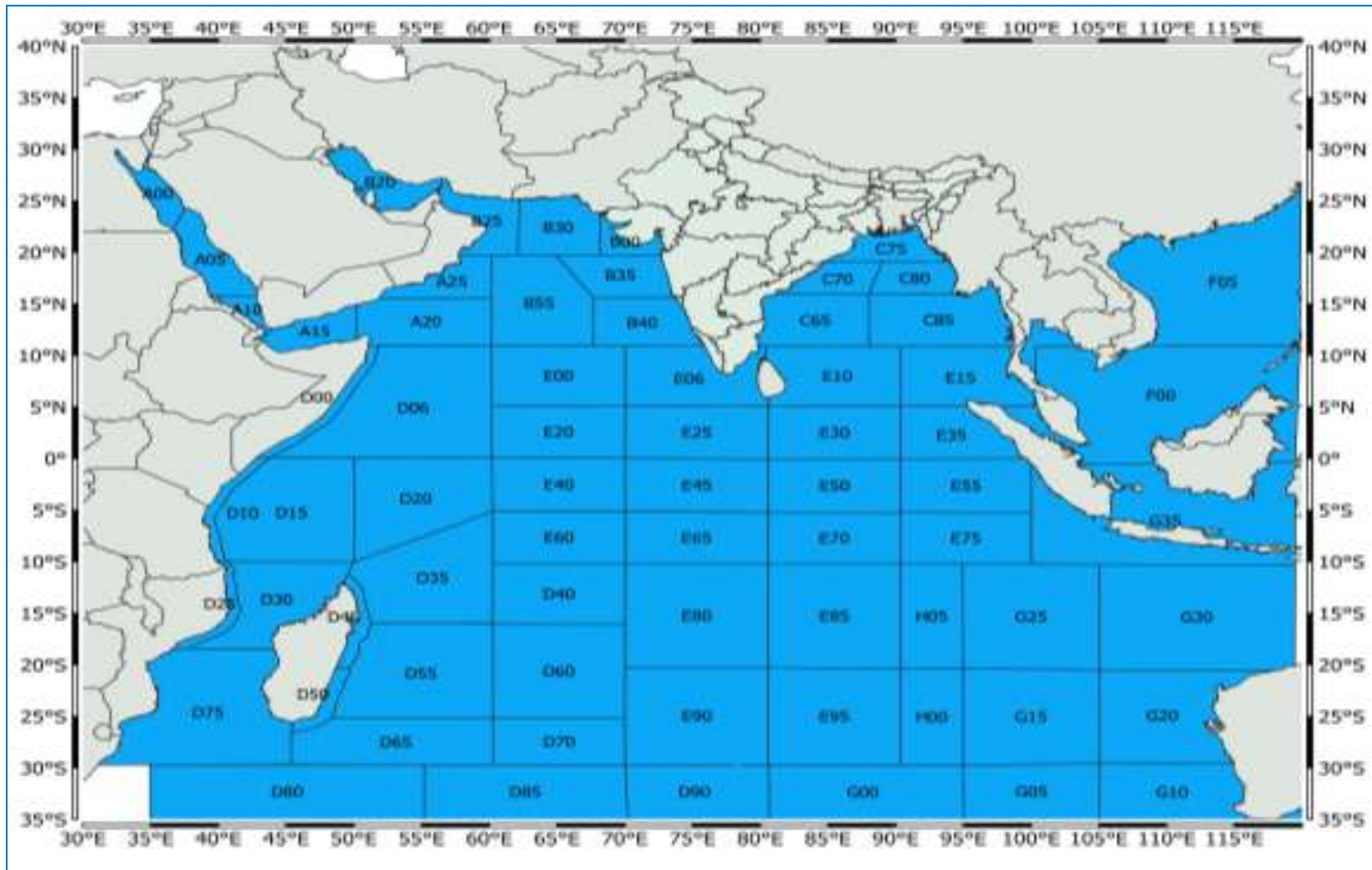
&

CYCLONE WARNING
CENTRES (CWC)

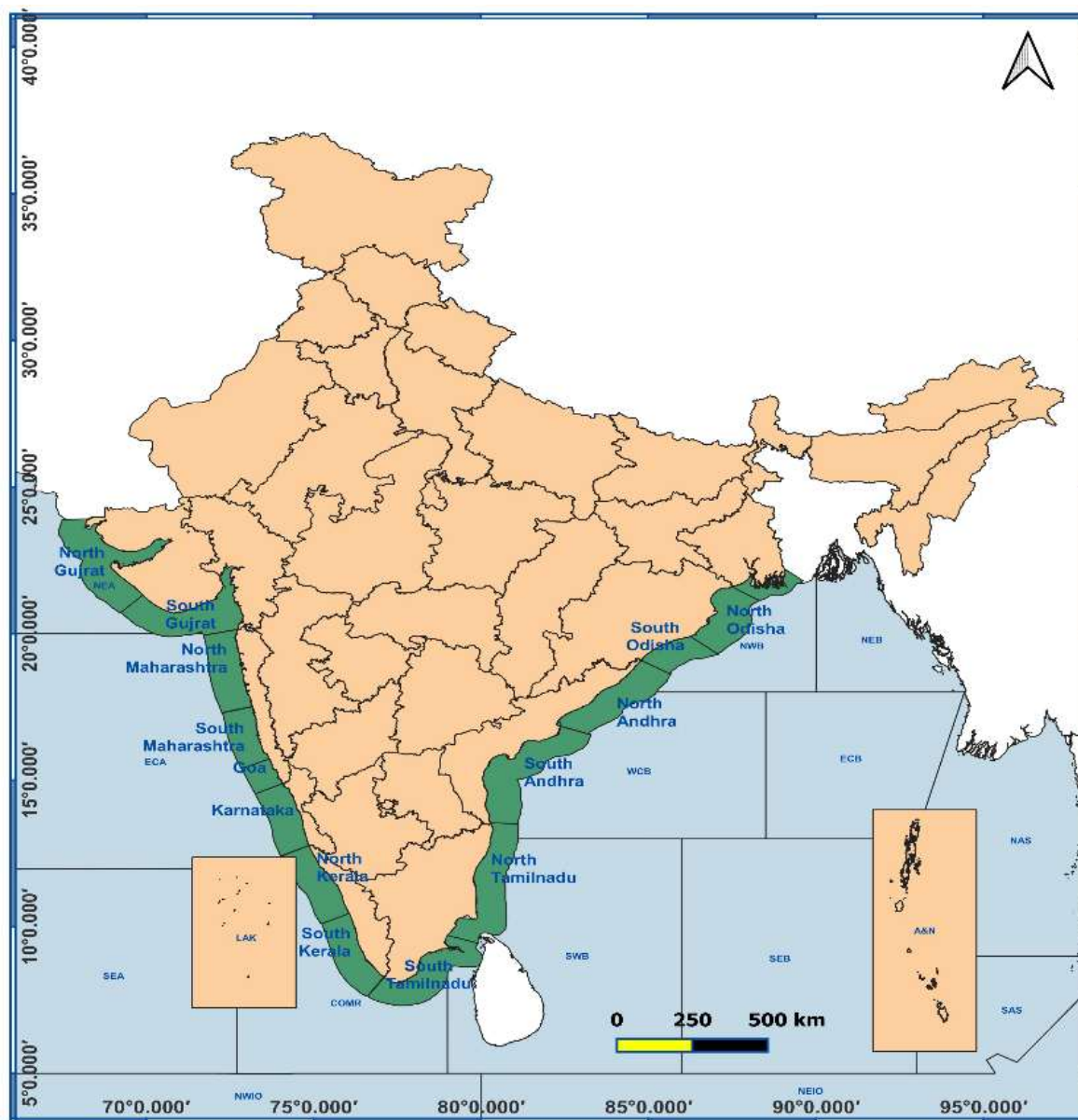
LIST OF BULLETINS ISSUED BY
CWC & ACWC

S No.	Bulletins Issued
1	Four Stage Warning by ACWCs/CWCs to State Govt Officials
2	Sea Area Bulletin and Fleet Forecast
3	Coastal Weather Bulletin
4	Port Warning
5	Warnings for Fishermen and fishery officials
6	Bulletins for all India Radio/TV/FM Radio/Community Radio
7	Coastal Bulletins for AIR news cycle
8	Registered/designated warnees

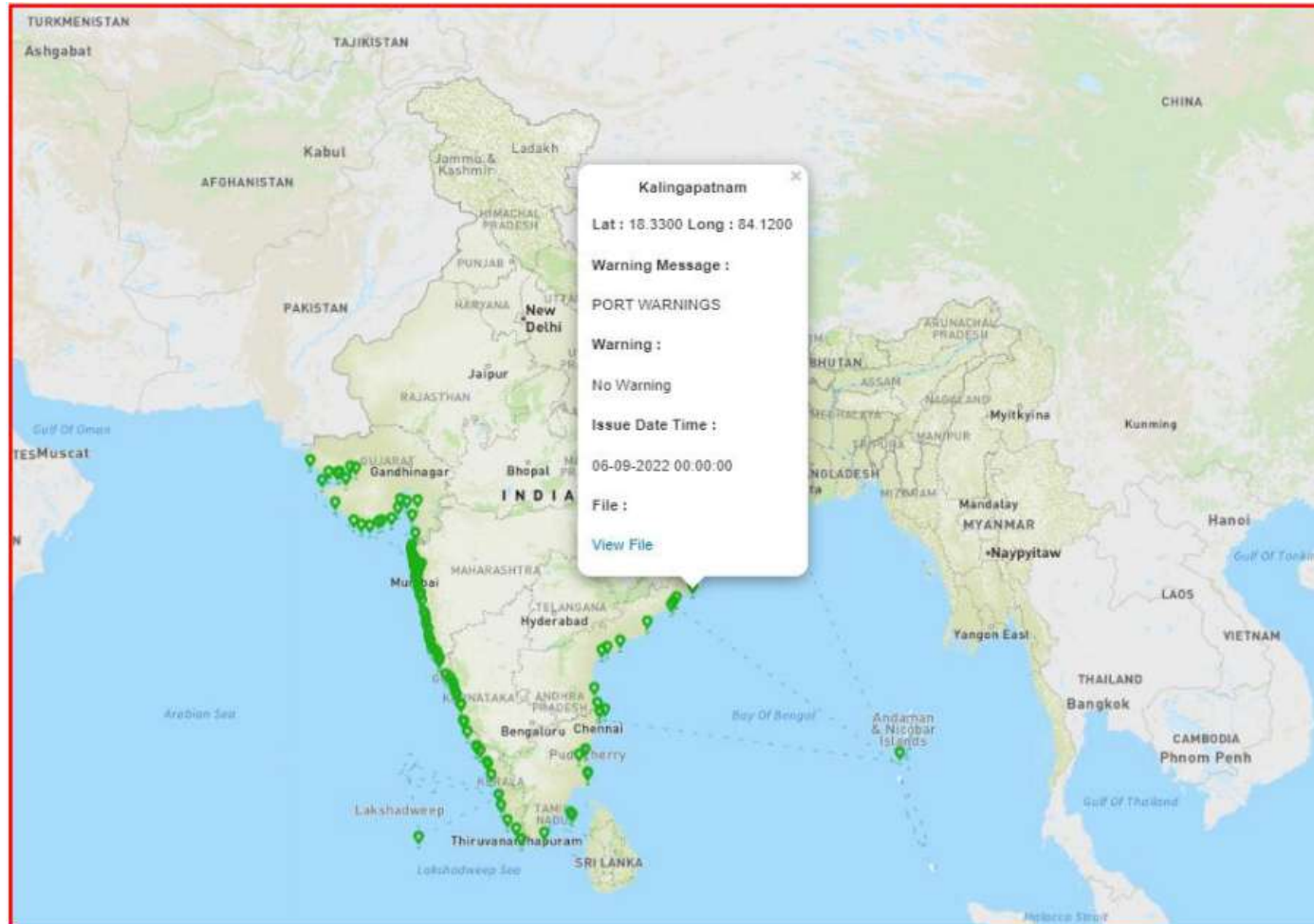
Area of responsibility map



Area of responsibility for Fleet Forecast



Area of responsibility for coastal area bulletin (Green shaded region)



Port Warning Page on IMD and RSMC website

TERMINOLOGY

1. Code Word for Bulletin-Prefixed as Preamble

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. Contents of Daily Bulletin

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.

3. Time of Occurrence of event

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.

4. Terminology for describing visibility

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

5. Type of Warning

Type of Warning	Type of disturbance	Corresponding wind speeds	
		<i>In knots</i>	<i>In Beaufort Scale</i>
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	

6. Strength of Monsoon

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

7. Area of Responsibility for Coastal Weather Bulletin:

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.

8. Area of Responsibility for Fleet Forecast

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

9. Area of Responsibility for Sea Area Bulletin

Area	Issued by	Broadcast By
BOB	ACWC Kolkata	NAVTEX
AS	ACWC Mumbai	NAVTEX

10.State of Sea

Descriptive Term	Height Meters	Wind Speed knots (kmph)	In Beaufort Scale
CALM (GLASSY)	0	0	0
CALM (RIPPLED)	0 - 0.1	1 - 3 (2 - 6)	1
SMOOTH (WAVELESS)	0.1 - 0.5	4 - 10 (7 - 19)	2 - 3
SLIGHT	0.5 - 1.25	11 - 16 (20 - 30)	4
MODERATE	1.25 - 2.5	17 - 21 (31 - 39)	5
ROUGH	2.5 - 4.0	22 - 27 (41 - 50)	6
VERY ROUGH	4.0 - 6.0	28 - 33 (52 - 61)	7
HIGH	6.0 - 9.0	34 - 40 (63 - 74)	8
VERY HIGH	9.0 - 14.0	41 - 63 (76 - 117)	9 - 11
PHENOMENAL	OVER 14	64 or above (119 or above)	12

Details of Code Word for transmission through NAVTEX Stations

A code word (which is not for broadcast) is prefixed to each of the bulletins (Sea Area and Coastal Weather) as a preamble for easy identification by the NAVTEX broadcasting station on receipt. The bulletins issued, should have following three lines as preamble:

1st line: B1 Character (example: B1: H) (Details given on next Slide)

2nd line: B2 Character (example: B2: E)

E for Routine Bulletins and **B for Warning Bulletins**)

3rd line: Priority (Example: Priority: **Routine**)

Priority is to be decided as mentioned below:

Meteorological forecast: **Routine (This message is broadcast twice a day)**

(including Coastal Weather Bulletin, Sea Area Bulletins issued in routine twice a day under ordinary conditions)

Meteorological Warnings: **Important (This message is broadcast repeatedly at subsequent scheduled transmissions till the warning is in force)**

(including squall warning, squally weather warnings, strong monsoon conditions etc.)

Cyclone Warnings: **Vital (This message is broadcast 3 times in case of Depression and 6 times in case of cyclone)**

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

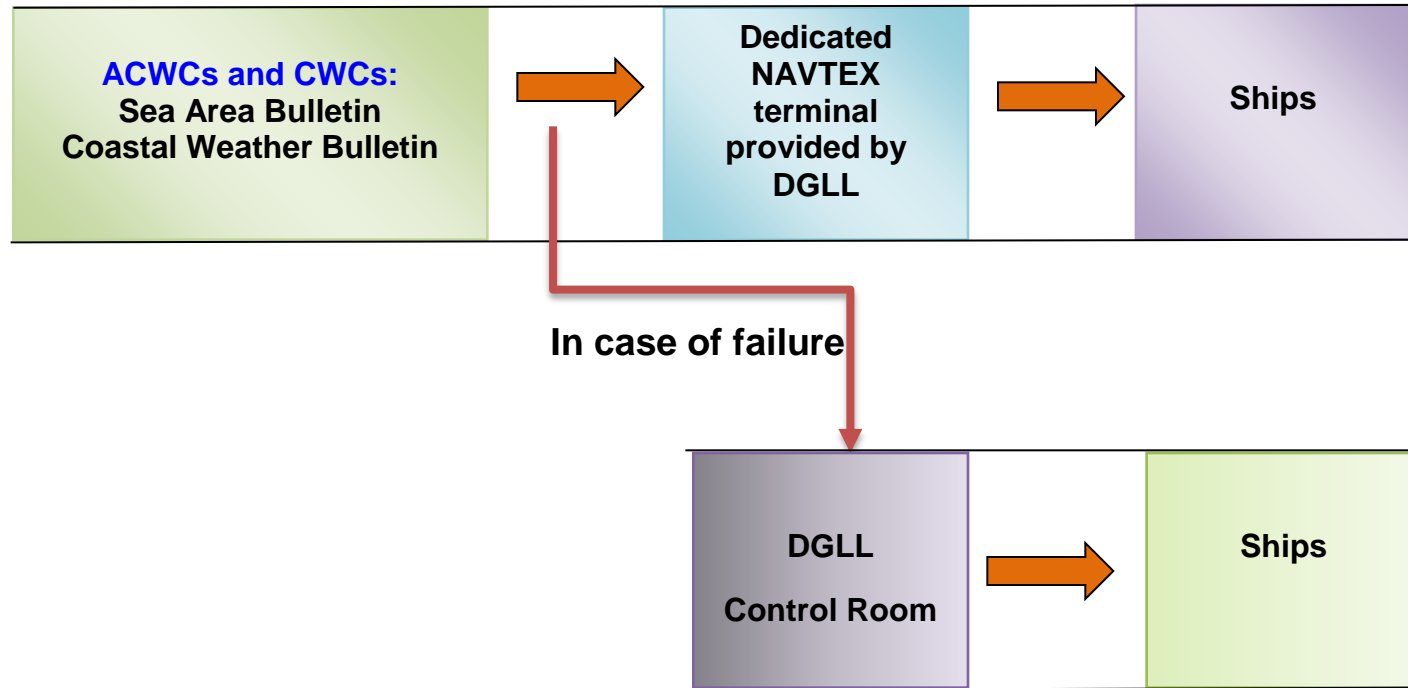
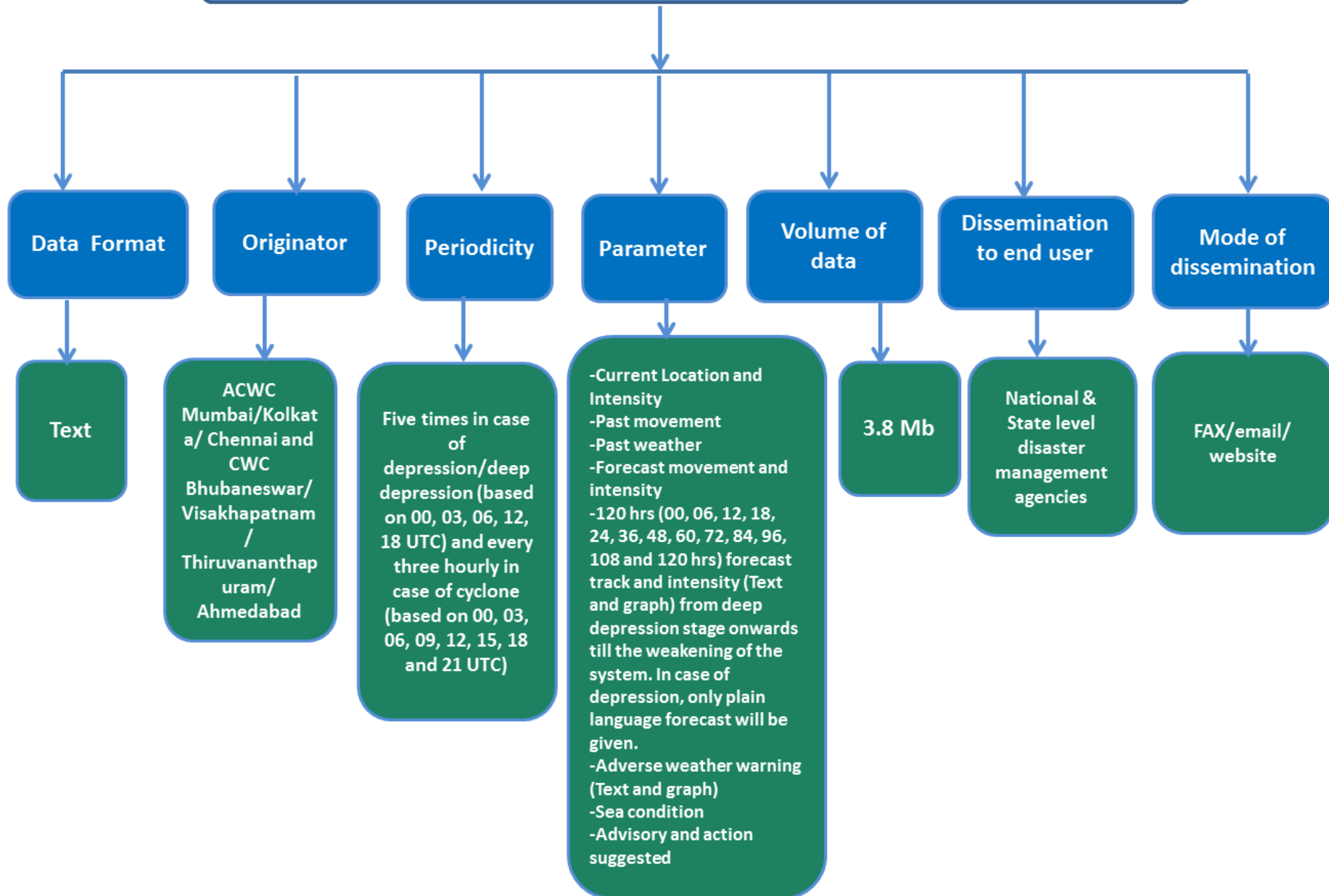
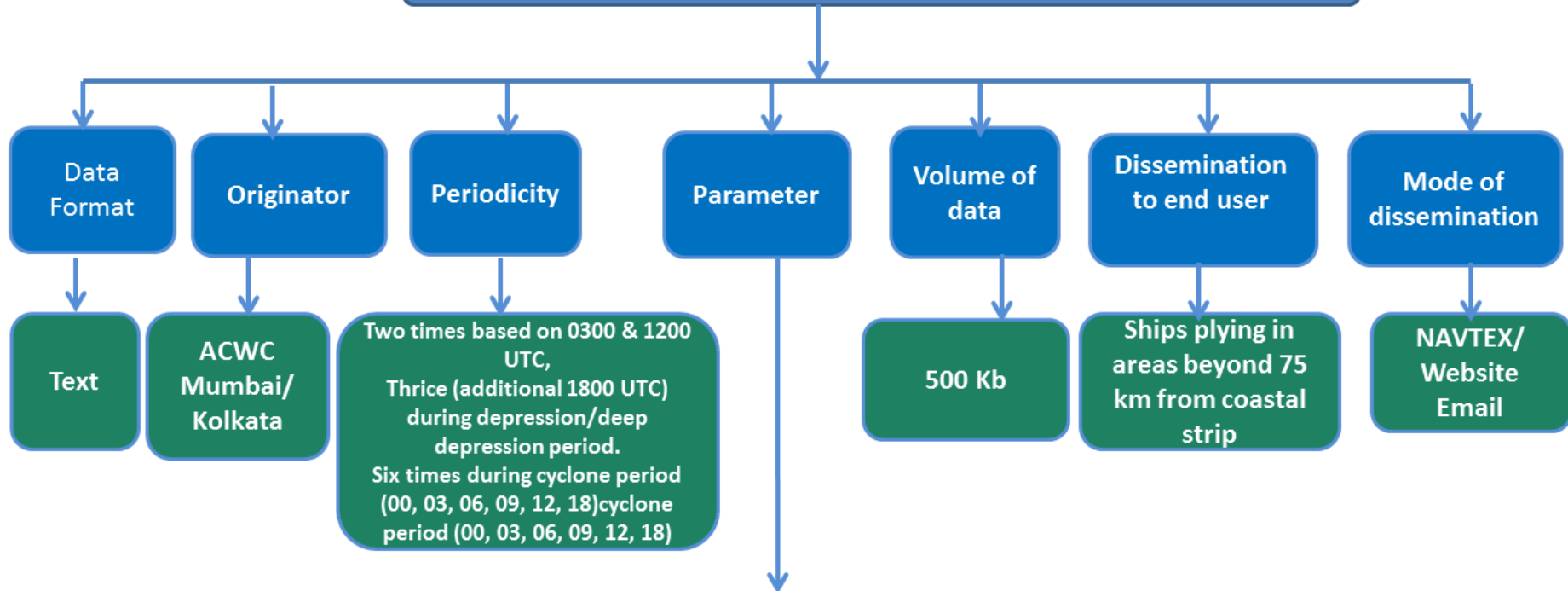


Fig: Flowchart for transmission of sea area and coastal weather bulletins
DGLL: Directorate General of Lighthouses and Lightships,
NAVTEX: NAVigational TEleX

Four Stage Warning by ACWCs/CWCs to State Govt Officials

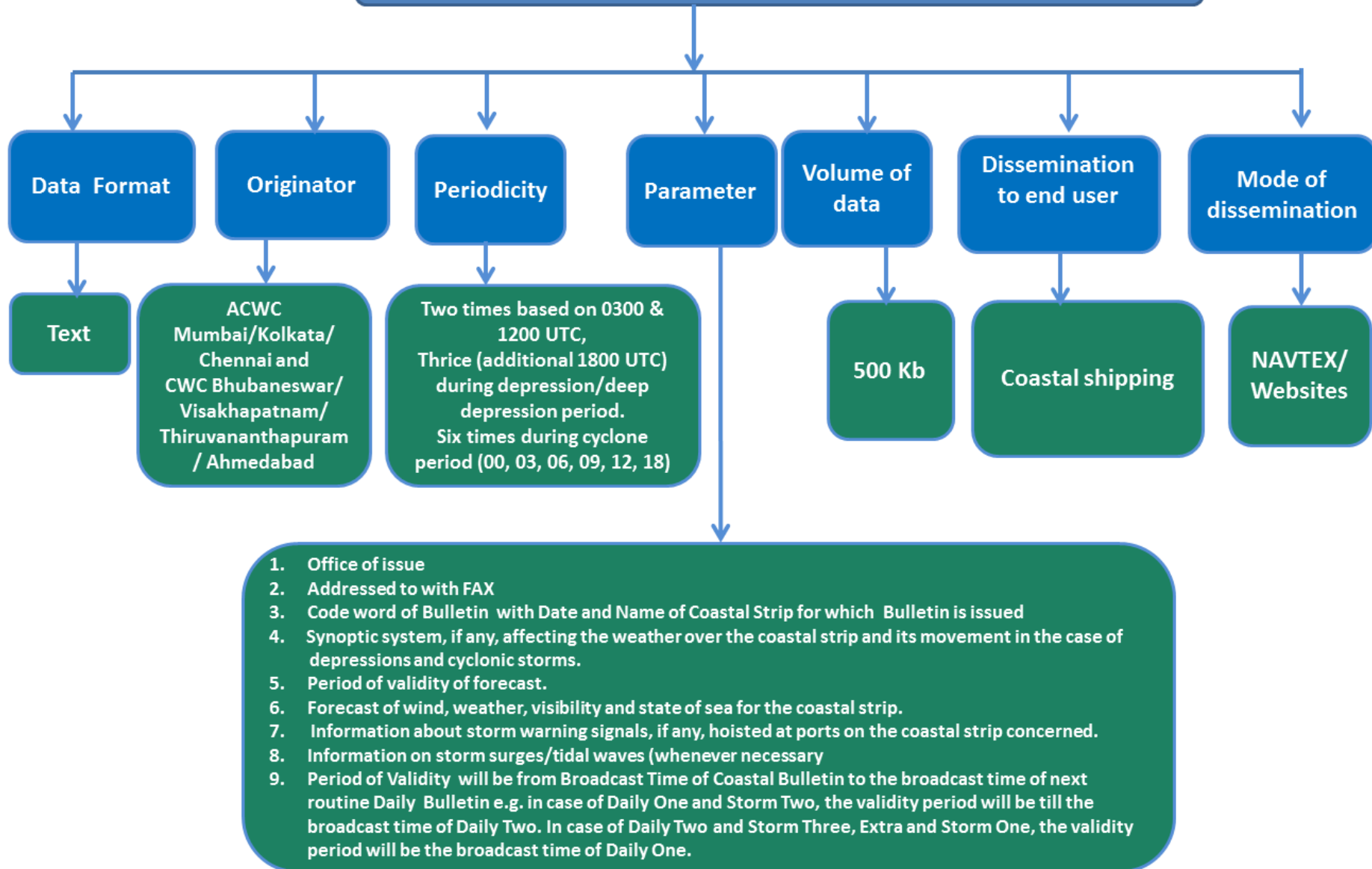


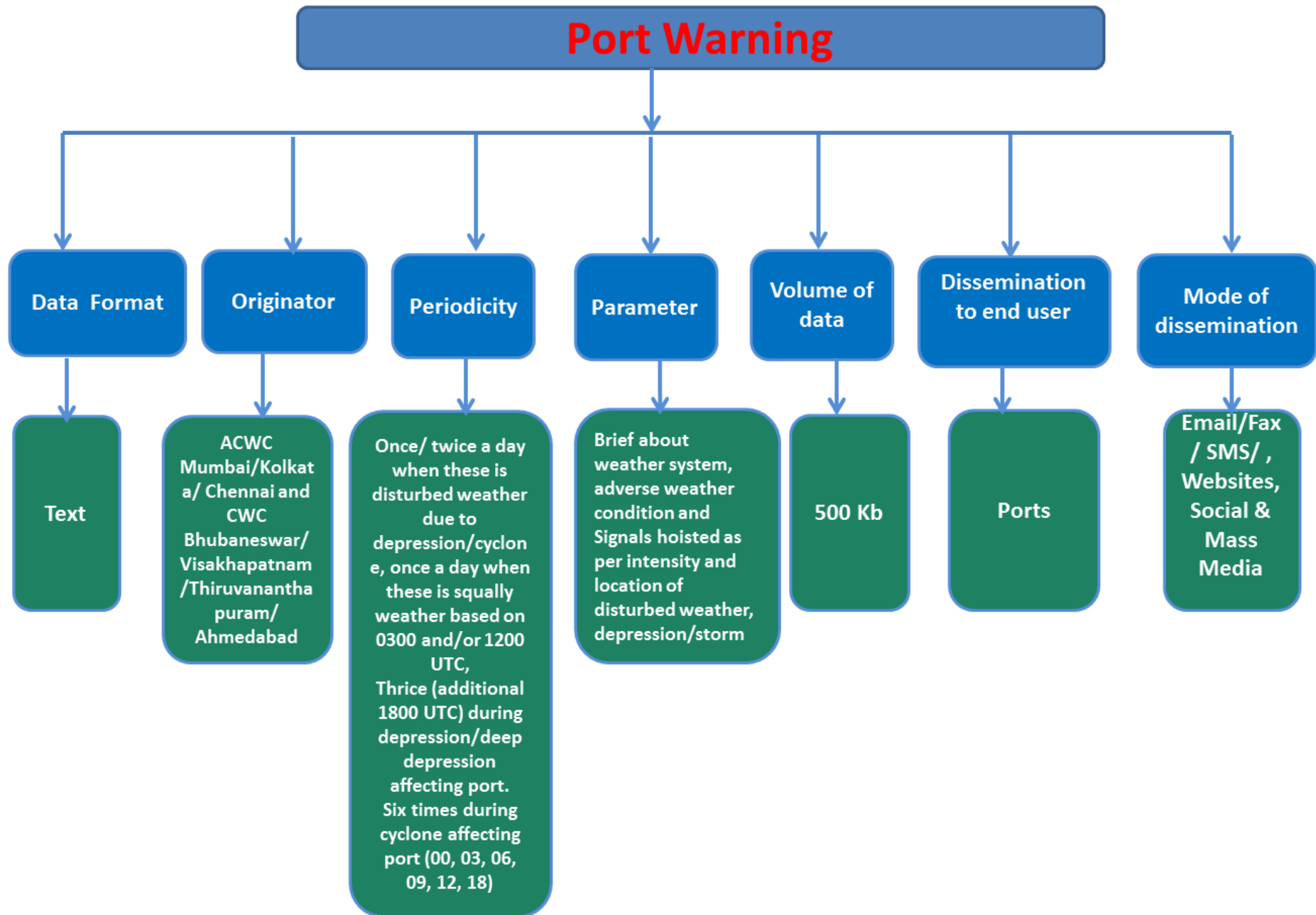
Sea Area Bulletin and Fleet Forecast




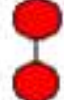







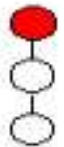












1. Office of issue
 2. Addressed to with FAX
 3. Code word of Bulletin with Date
 4. Part-I (International safety Sign (TTT), Type of Warning, Date & Time of reference in UTC DDTTTT)
 5. Description of system, movement during past six hours, base time and location of disturbance, (When eye is seen in radar/satellite picture, this may be indicated), ECP, Extent of Area affected, Speed and direction of wind in various sections of affected area (speed in KTS and distance in NM), further indications, if any.
 6. Part-II: (i) When there is no warning of Storm, Part-I in Daily Bulletin contains the words No Storm Warning. In Part II, weather is characterised as Seasonal when there is no synoptic system. However, during monsoon, strength of monsoon is described. During monsoon strength is described as weak (upto 12 Kt), Moderate (13-22 kt), Strong (23-32 Kt) and Vigorous (more than 33 Kt). (ii) Weather Seasonal Bay is used over areas where the monsoon has withdrawn and there is no synoptic situation. (iii) In case of cyclonic disturbance, Synoptic situation described in Part-I need not be described here.
- Part-III: It contains forecast of weather, wind, wave and visibility. Period of validity will be the broadcast time of next routine Daily One or Two bulletin.
- Part IV: Contains Surface Analysis encoded in abridged form of the International Analysis Code for Marine (IAC Fleet) and includes essential isobars. Area of Analysis for ACWC Mumbai (Lat. 5-25 Deg. North/ Long. 60-80 Deg East) and ACWC Kolkata (Lat. 5-30 Deg. North/ Long. 75-100 Deg East)

Coastal Weather Bulletin

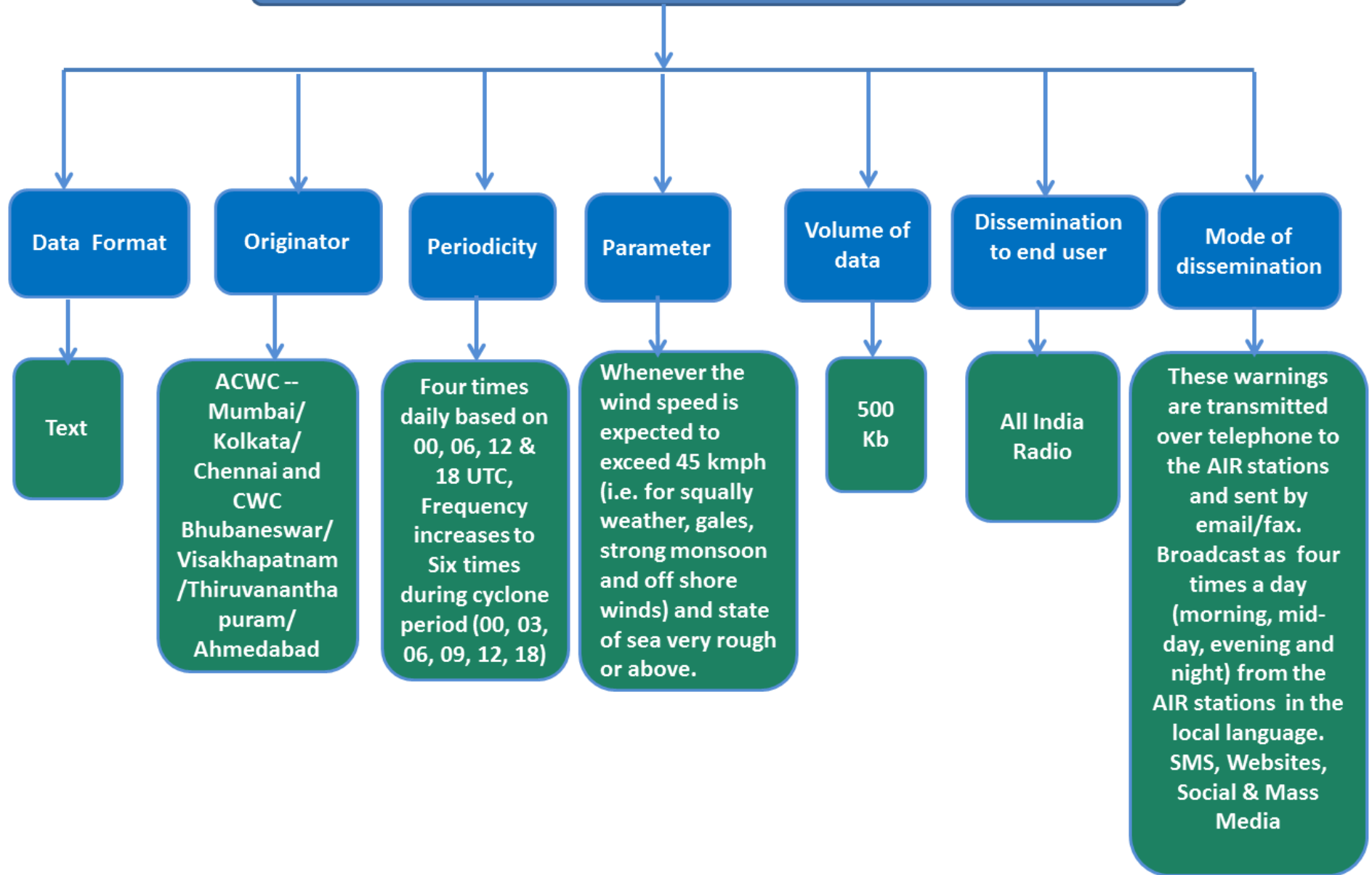


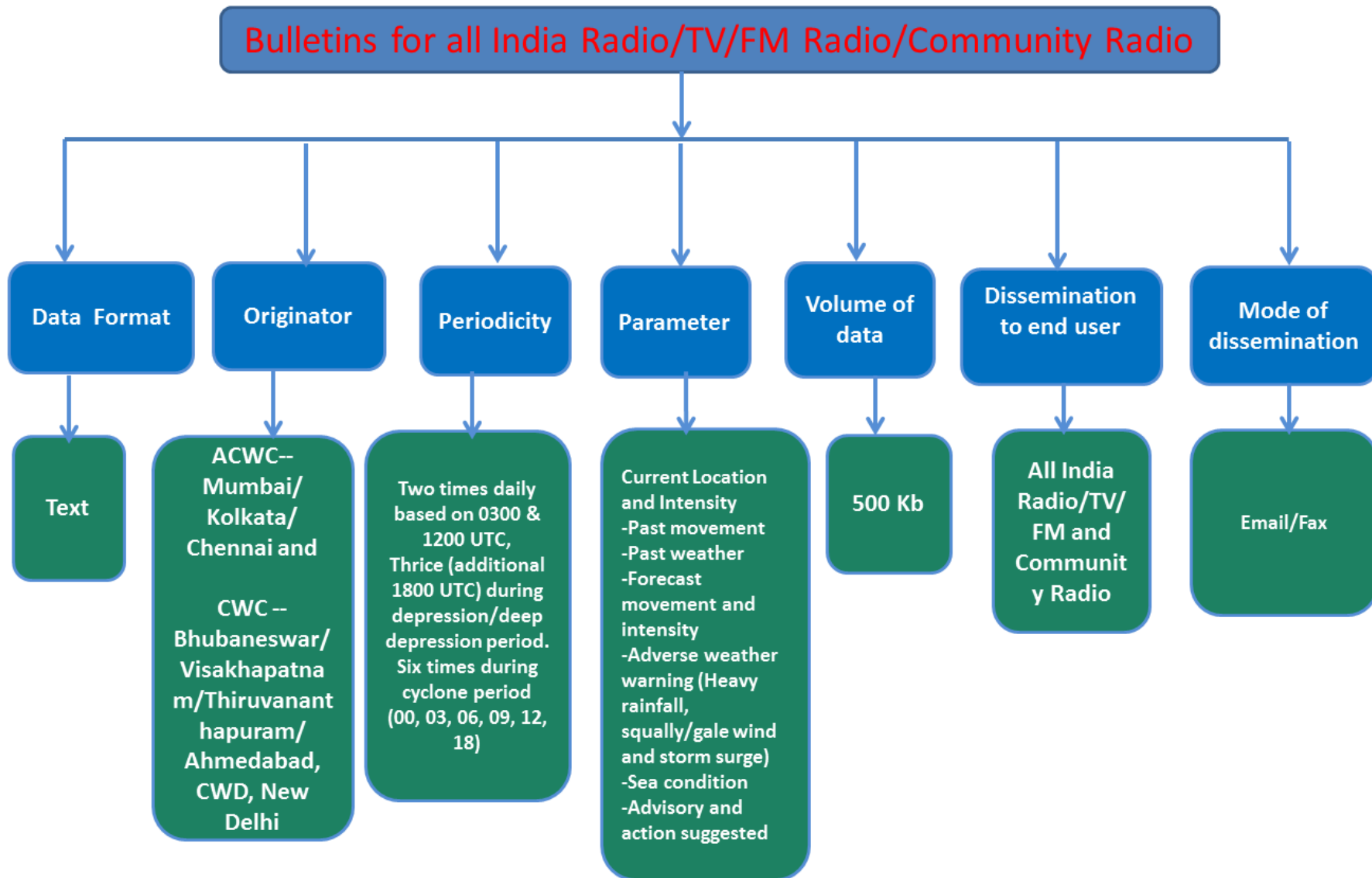


PORT WARNING SIGNALS					
Signal/ Flag No.		NAME	Symbols		Description
			Day	Night	
1.	Distant bad weather	DC1			Depression far at sea. Port NOT affected.
2.		DW2			Cyclone far at sea. Warning for vessels leaving port.
3.	Local bad weather	LC3			Port Threatened by local bad weather like squally winds.
4.		LW4			Cyclone at sea. Likely to affect the port later.
5.	Danger	D5			Cyclone likely to cross coast keeping port to its left
6.		D6			Cyclone likely to cross coast keeping port to its right.
7.		D7			Cyclone likely to cross coast over/near to the port.

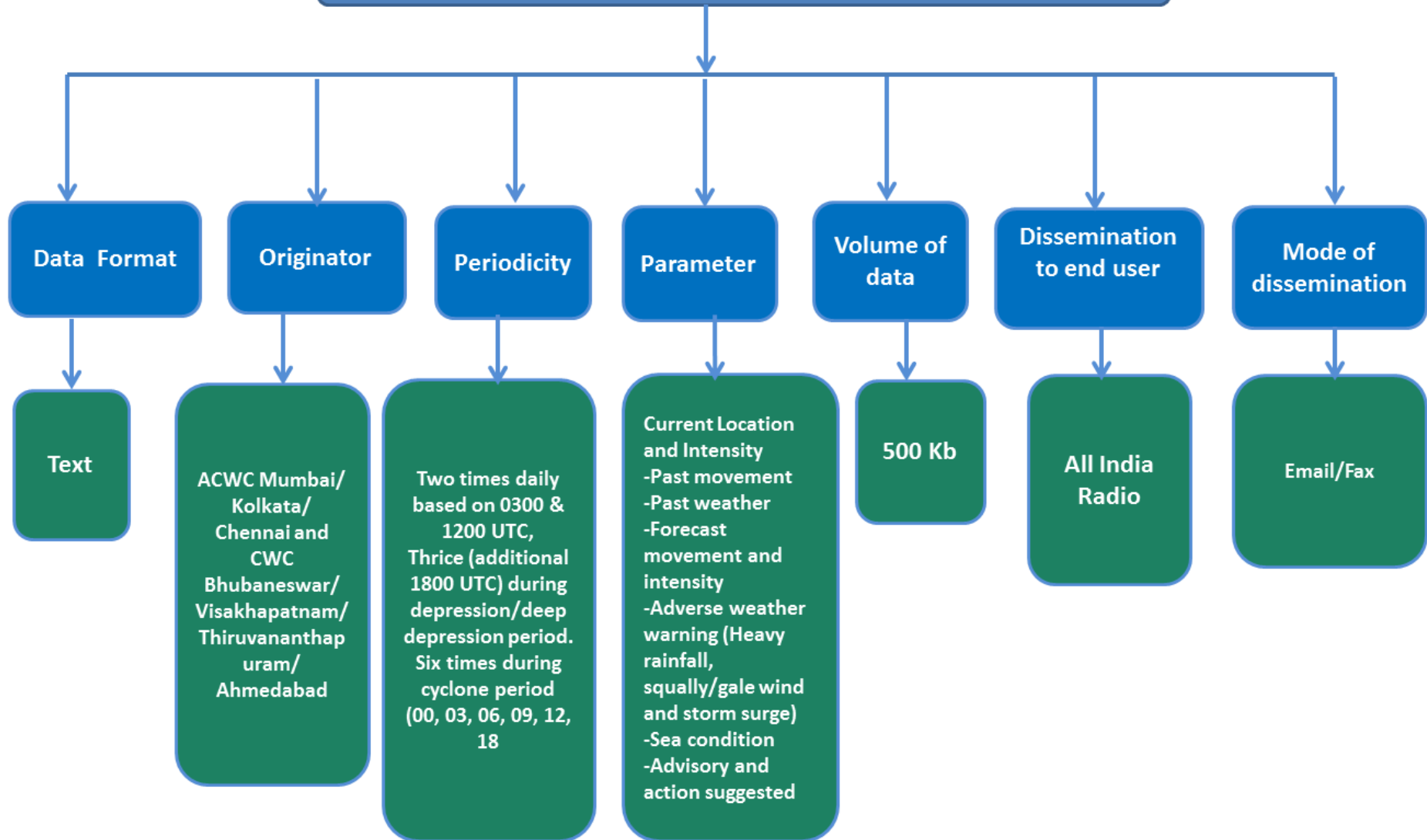
8.	Great danger	GD8			Severe cyclone to cross coast keeping port to its left
9.		GD9			Severe cyclone to cross coast keeping port to its right
10.		GD10			Severe cyclone to cross over /near to the port.
11.		XI			<u>Communication failed with cyclone warning office.</u>

Warnings for Fishermen and fishery officials





Coastal Bulletins for AIR news cycle



Registered/designated warnees

