Early Warning System in Bangladesh

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Bangladesh

South Asian Association for Regional Cooperation (SAARC)

SAARC Meteorological Research Centre (SMRC)

Map may not reflect actual political boundaries

Dhaka, Bangladesh

Mandates of the Centre and its activities

- To undertake/promote research for better understanding of the various meteorological phenomena of particular interest to the SAARC Region, with a view to enhancing the capability of National Meteorological and Hydrological Services (NMHSs) of the Member States, particularly in the field of early warning to provide support for preparedness and management of natural disasters.
- To undertake research in climate change and related issues in the SAARC Region.
- To undertake collaborative research in the above mentioned fields with the NMSs and research institutions in the SAARC region.
- To develop and enhance linkages with NMHSs of SAARC Region.
- To develop cooperative endeavours with international organizations in pursuance of the above objectives.

Milestones of SMRC

➢ 02 Jan 1995	: Established
➢ 1995 – 2005	: Functioned from BMD Campus
➢ Aug 2005	: Moved to its own Campus/ Building
➢ Sep 2005	: Procured 1st SUN-Sparc Server; 2 CPU
➢ 2005 – 2007	: Experiments with QLM, LAM
➢ 2008 –	: Experiments with WRF Model, PRECIS, RegCM, MM5, CPT
➢ 15 Apr. 2009-	: SAARC STORM Programme
➢ 01 May 2012-	: SAARC Monsoon Initiative Programme

Programme of SMRC

- The Programmes of SMRC are divided into following thematic areas:
  - Monsoon Initiatives
  - Severe Thunderstorm
  - Tropical Cyclones and
  - Climate Change.

Publications Of SMRC

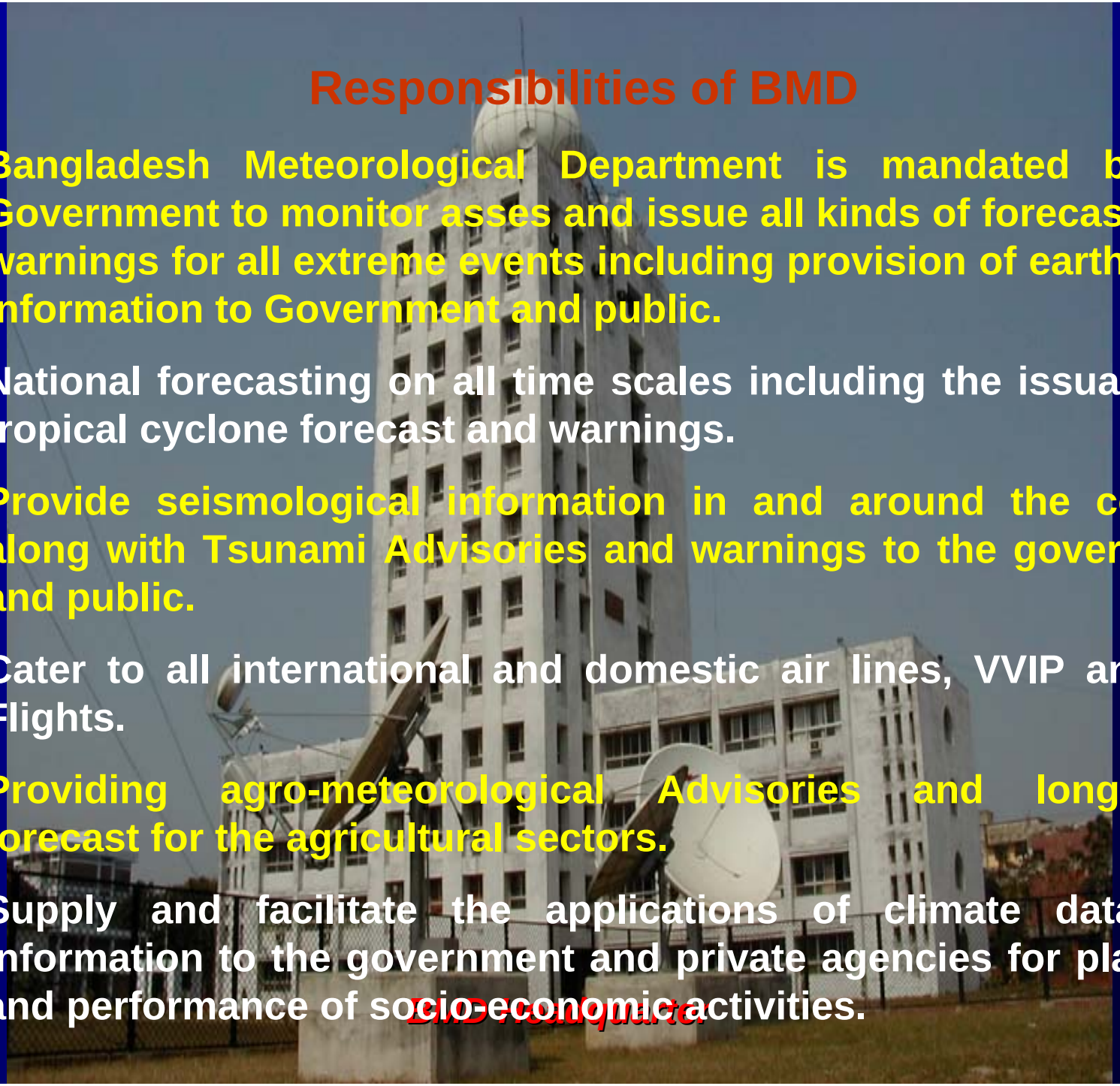
Research Reports Published = 49
To be published = 3
Seminar Proceedings Published = 10

Newsletters published = Vol. 19 (2)

Responsibilities of BMD

Bangladesh Meteorological Department is mandated by the Government to monitor asses and issue all kinds of forecasts and warnings for all extreme events including provision of earthquake information to Government and public.

- **National forecasting on all time scales including the issuance of tropical cyclone forecast and warnings.**
- **Provide seismological information in and around the country along with Tsunami Advisories and warnings to the government and public.**
- **Cater to all international and domestic air lines, VVIP and VIP Flights.**
- **Providing agro-meteorological Advisories and long-range forecast for the agricultural sectors.**
- **Supply and facilitate the applications of climate data and information to the government and private agencies for planning and performance of socio-economic activities.**



Storm Warning Centre

Conventional Observatory

An Observer is taking observation

VSAT Antenna

Moulvibazar Doppler Radar

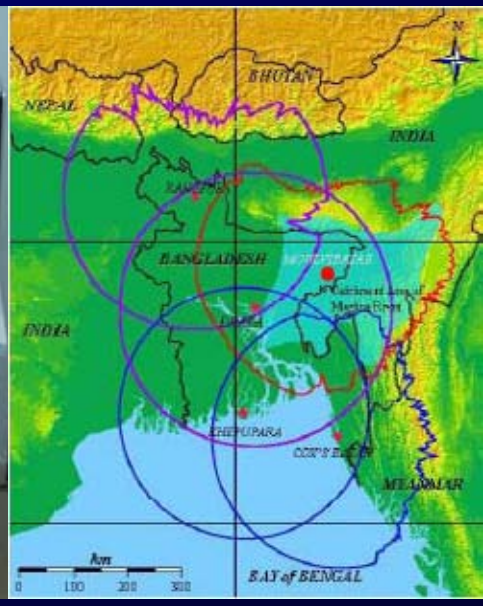
Khepupra Radar

Cox's Bazar Radar

Dhaka Radar

Rangpur Radar

Composite Radar Picture



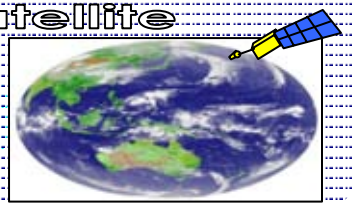
Radar Coverage

Storm Warning Centre-BMD

from Sky

from Space

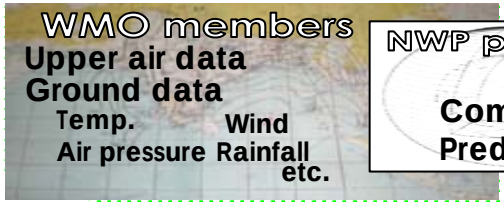
Satellite

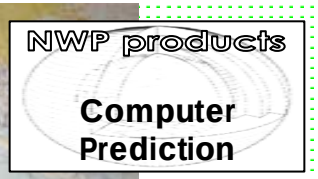


Cloud image

from Ground

from Overseas



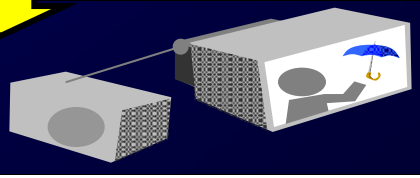


Data Collection

Dissemination

Television. Radio. News paper.

Telephone. Fax. Web page.



Warning Message Dissemination System of BMD

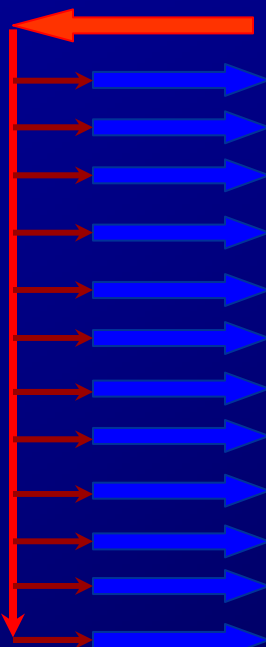
WORLD WEATHER WATCH (WWW)

U.N ENVIRONMENT PROGRAMME (UNEP)

CLIMATE CHANGE MONITORINGSYSTEM

GLOBAL TELECOMMUNICATION SYSTEM (GTS)

NATIONAL METEOROLOGICAL COMMONICATION CENTRE (NMCC)



STORM WARNING CENTRE (SWC)

HON'BLE PRIME MINISTER'S OFFICE

BANGLADESH BETAR (RADIO)

BANGLADESH TELEVISION (BTV)

MINISTRY OF FOOD AND DISASTER MANAGEMENT

CYCLONE PREPAREDNESS PROGRAMME (CPP)

COASTAL VOLUNTEERS

NEWS PAPERS

GENERAL MASS

BANGLADESH ARMY

BANGLADESH NAVY

BANGLADESH AIR FORCE

MARITIME AND RIVERINE PORTS

FLOOD CONTROL AND FORECASTING CENTRE

BMD Website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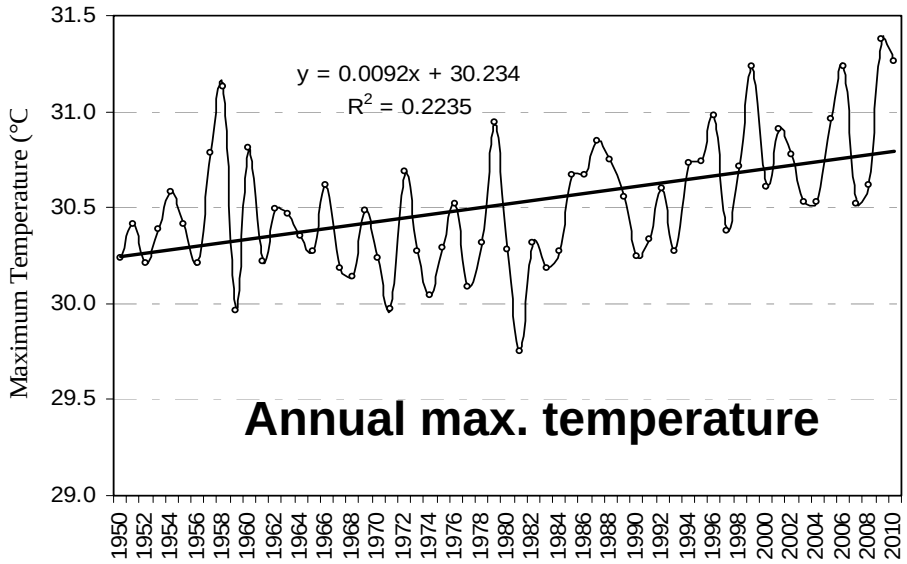
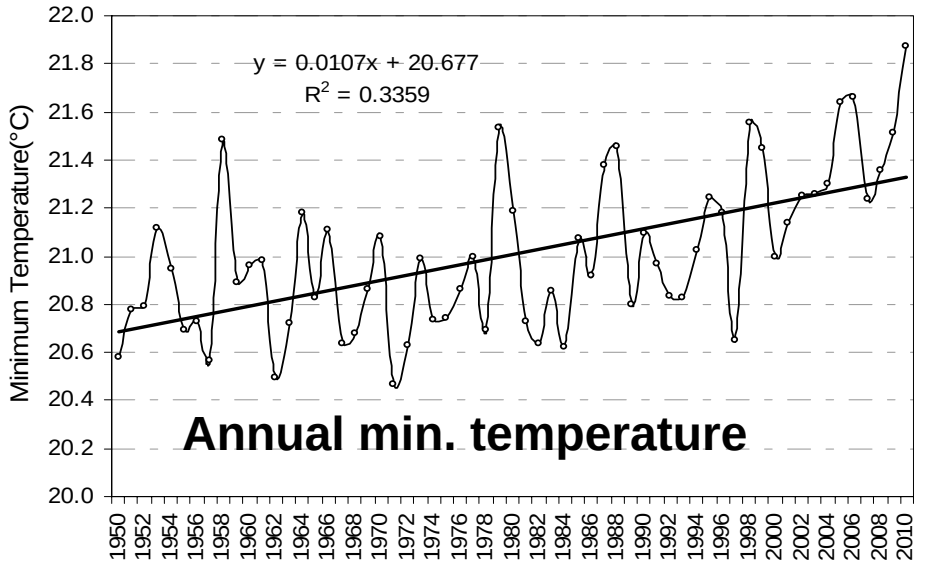
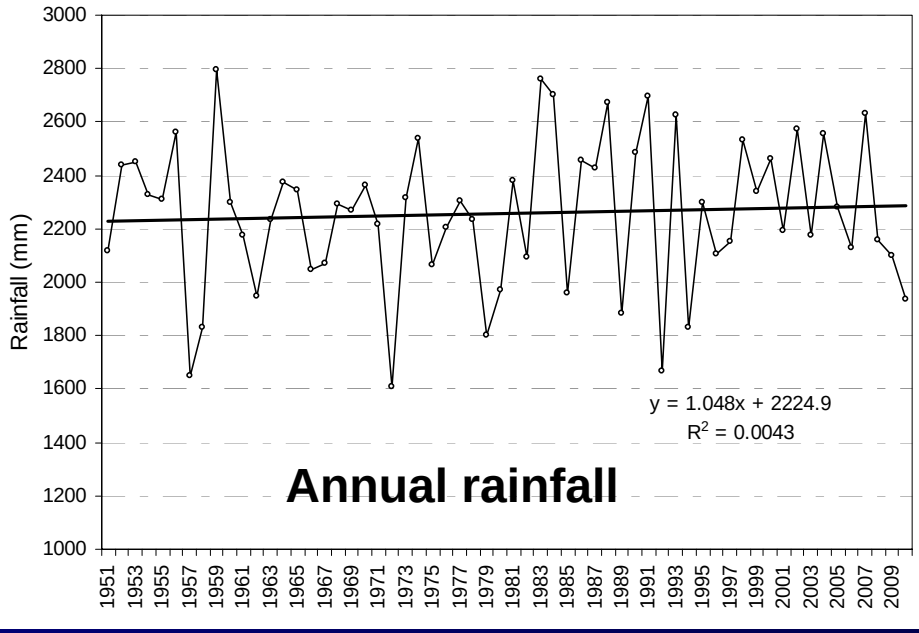
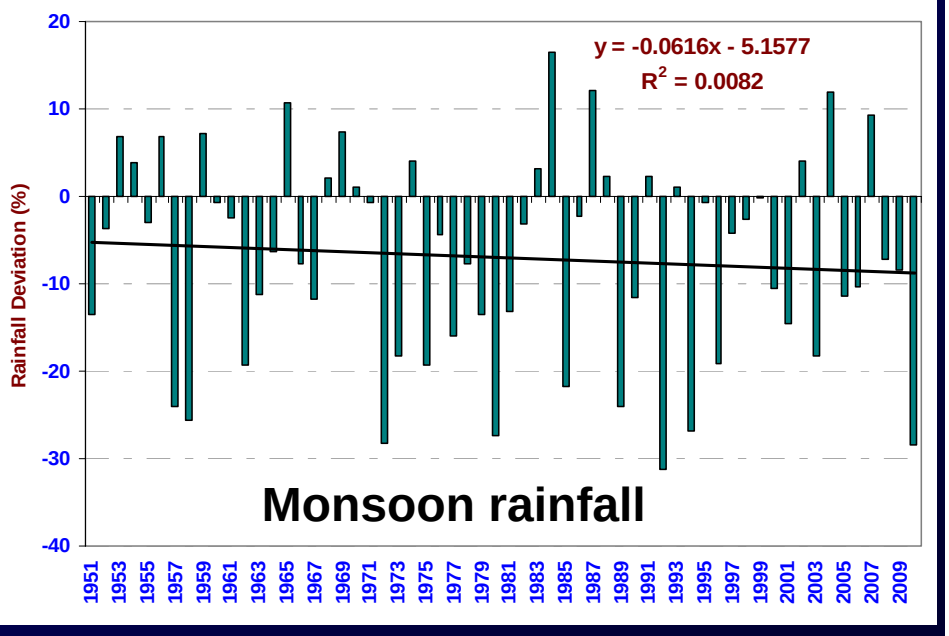
Bangladesh Climate
Weather Chart
Radar Image
Satellite Image
Weather Forecast
Climate Outlook
Weekly Agromet Forecast
Special Weather Bulletin
Bulletin Dissemination
Inland Riverport Warnings
About BMD
"Bangladesh Meteorological Department is the authorised Government organisation for all meteorological a
country. It maintains a network of surface and upper air observatories, radar and satellite stations, agro-n
observatories, geomagnetic and seismological observatories and meteorological telecommunication system.
its Headquarters in Dhaka with two regional centres i.e. Storm Warning Centre (SWC), Dhaka and Meteoro
Centre (M & GC), Chittagong."
http://www.bmd.gov.bd
Internet
125%

Present Scenario of climate change and climatic events





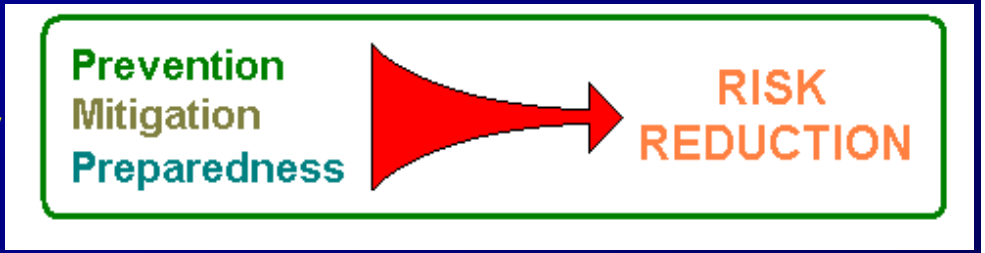


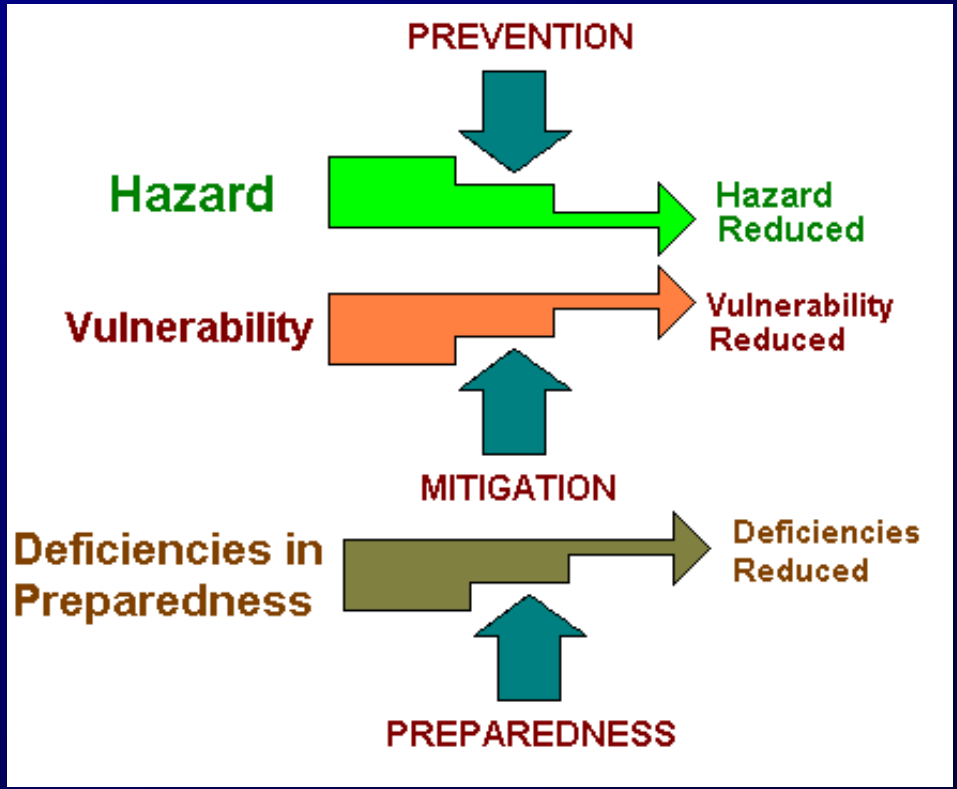


Early Warning Systems (EWS) are the measures related to preparedness, and complement other measures such as the implementation of emergency committees, emergency planning, posting evacuation routes, simulations, and exercises.

Effective warnings allow people to take actions that save lives, reduce damage, reduce human suffering, and speed recovery. Rapid reporting of what is happening during a disaster can be very effective in helping people reduce damage and improve response.

Scientists and emergency managers are developing the capabilities to warn for more hazards and to increase warning accuracy, but our ways of delivering these warnings in a timely manner and to only those people at risk needs significant improvement.





Early Warning Systems: A Tool for Mitigation and Coordination

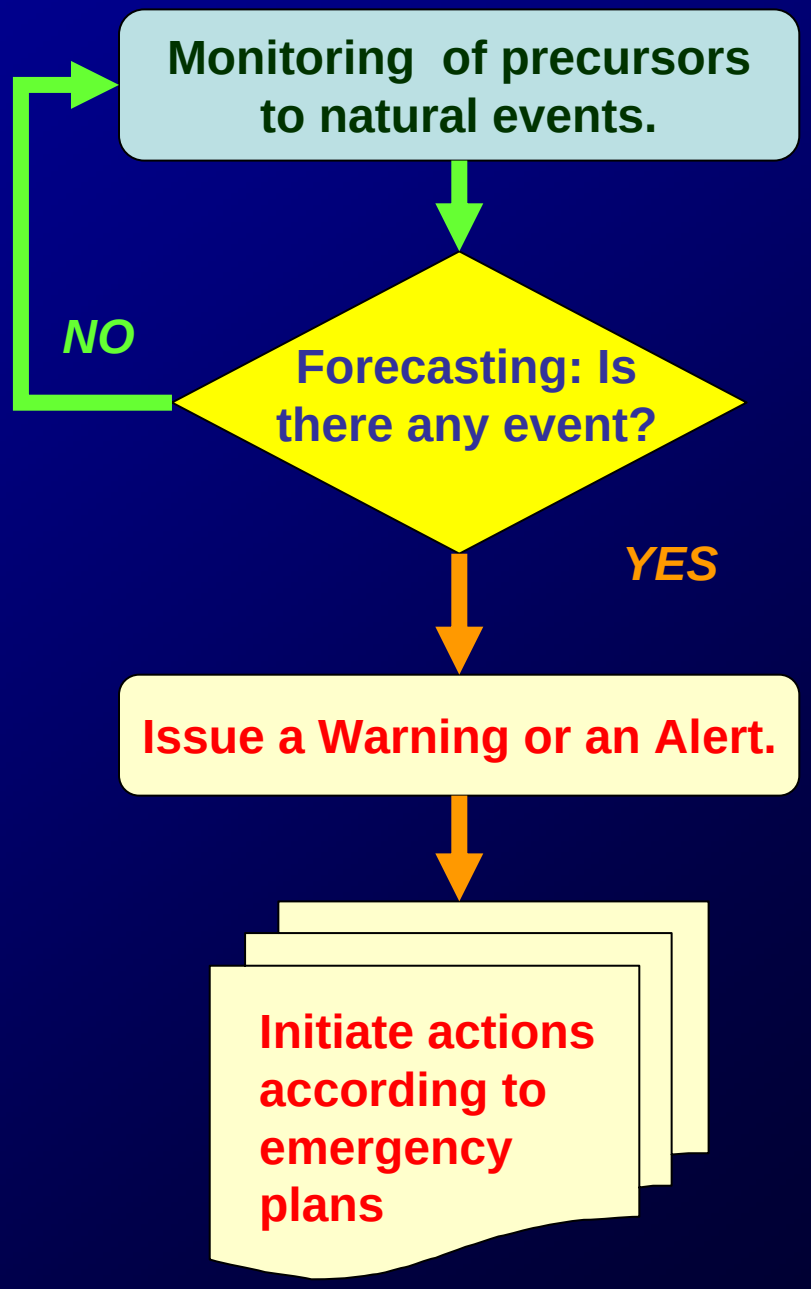
Conceptual framework concerning Early Warning.

Early Warning Systems (EWS) operate on a very simple operational framework.

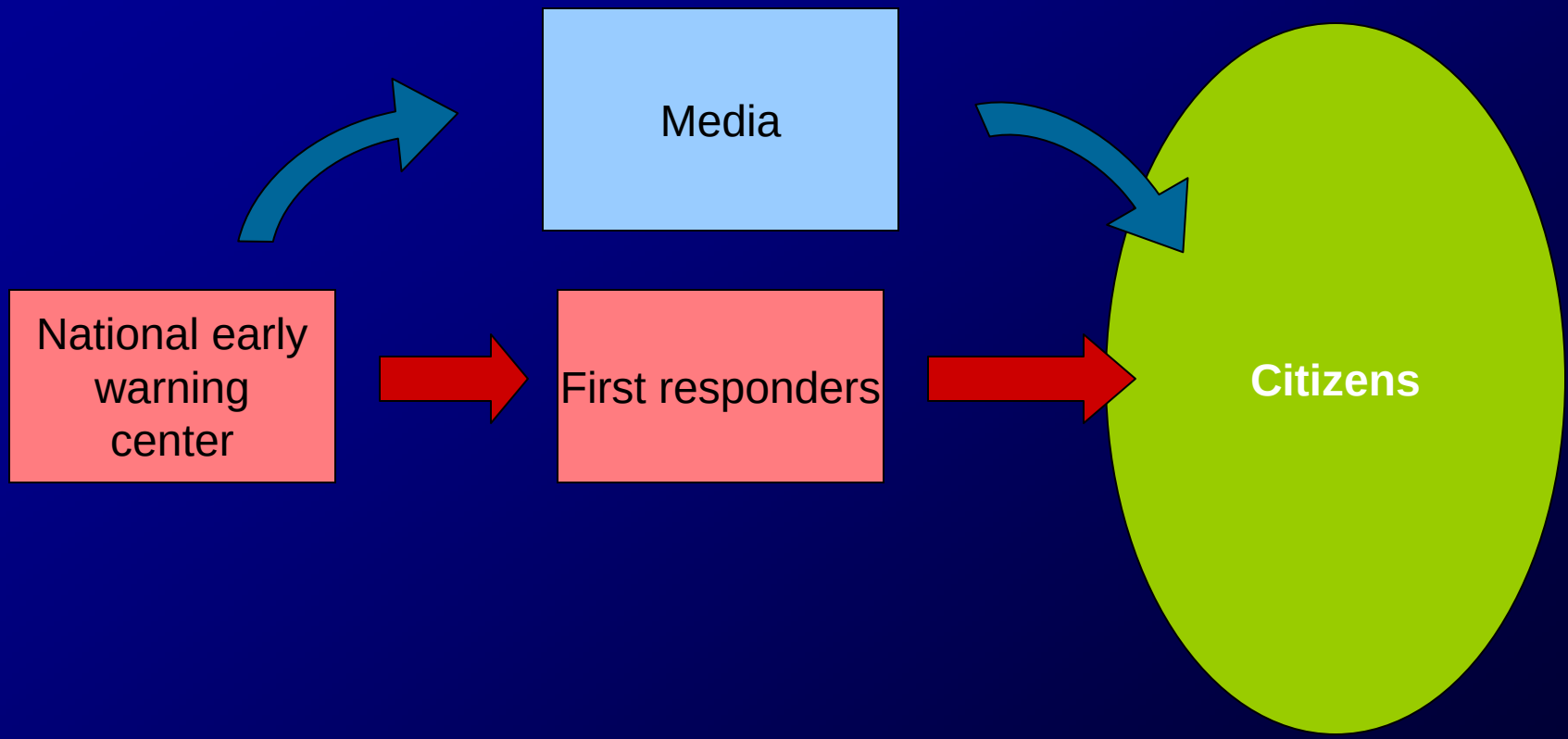
Precursors to events are monitored on a continuous basis. Data is analyzed to generate a forecast.

If there is a forecast of a large event, a warning is issued.

In the modern framework of EW the emergency committees will begin actions as proposed in the emergency plans.



Early warning chain (standard form)



Effective Warnings

Warnings are effective only if they are:

- accurate and
- result in appropriate action.

The warning response process is categorized into the following components:

1. Perceiving the warning (hear, see, feel)
2. Understanding the warning
3. Believing that the warning is real and that the contents are accurate
4. Confirming the warning from other sources or people
5. Personalizing the warning
6. Deciding on a course of action
7. Acting on that decision

Further, a distinction is made between sender and receiver characteristics for each of the components. Sender characteristics focus on:

1. The nature of the warning messages
2. The channels through which the messages are given
3. The frequency by which the messages are broadcast
4. The persons or organizations receiving the message

Receiver characteristics are primarily:

1. Environmental (clues, proximity)
2. Social (network, resources, role, culture, activity)
3. Psychological (knowledge, cognition, experience)
4. Physiological (disabilities)

The effectiveness of warnings are:

1. Warnings are most effective when **delivered to just the people at risk. If people not at risk are warned, they will tend to ignore future warnings.** Thus, if tornado or flash-flood warnings, for example, are issued for a county or larger region, but only a small percentage of the people who receive the warning are ultimately affected, most people conclude that such warnings are not likely to affect them.

2. **If warnings that are not followed by the anticipated event are inconvenient, people are likely to disable the warning device.** For example, if you are awakened in the middle of the night to be warned of several events that do not ultimately affect you, you are likely to disable the warning device.

3. **Appropriate response to warning is most likely to occur** when people have been educated about the hazard and have developed a plan of action well before the warning.

4. There is a window of opportunity to capture peoples' attention and encourage appropriate action. Studies of responses to tornado warnings, for example, found that those who sought shelter did so within five minutes of first becoming aware of the tornado warnings (Balluz et al., 1997).

5. A variety of warning devices needs to be used in order to reach people according to what activity they are engaged in.

6. Warnings must be issued in ways that are understood by the many different people within our diverse society.

7. The probabilistic nature of warnings, particularly for natural disasters, needs to be made clear.

The content and style of a warning message are important. An effective message should:

- **Be brief** (typically less than two minutes and preferably less than one minute)
- **Present discrete ideas** in a bulletized fashion
- **Use non-technical language**
- **Use appropriate text/graphics**
- **Provide official basis for the hazardous** event message
- **Provide most important information** first, including any standardized headlines
- **Describe the areas affected and time**
- **Provide level of uncertainty or probability** of occurrence
- **Provide a brief call-to-action statement** for appropriate public response

What is an Effective EWS?

1

National to local governments

supported by DRR plans, legislation and coordination mechanisms

2

COORDINATION AMONG NATIONAL SERVICES

- Meteorological
- Hydrological
- Geological
- Marine
- Health (etc.)

3 warnings

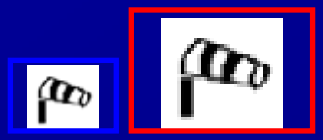
5 feedback

preventive actions

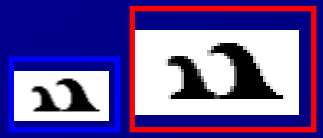
4

Community Preparedness

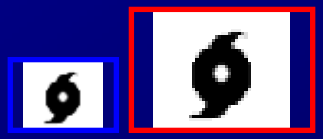
Increasing Risks under a Changing Climate



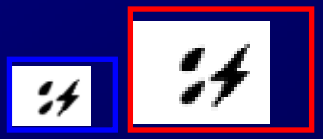
Strong Wind



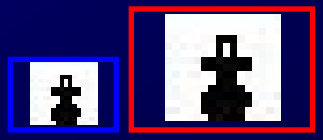
Coastal Marine Hazards



Tropical Cyclones



Heavy rainfall / Flood

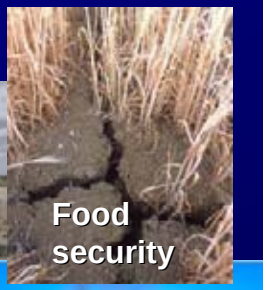


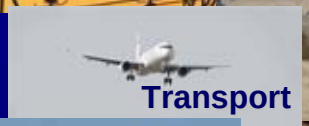
Heatwaves

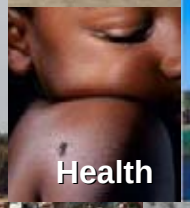
Intensity

Frequency

Hazards' intensity and frequency are increasing







Vulnerability and Exposure on the rise !

Need for disaster risk management

Development of EWS in Bangladesh

British Colonial Rule

- **After the great Bakerganj cyclone of 1876, The India Meteorological Department was established.**
- **The main objective of the of the meteorological services were- focused to military expeditions and commercial shipping.**
- **But the initiation of the meteorological service enhanced later development of modern weather services in the region.**
- **It had little contribution to the public benefit in the risk of disasters.**

Development of EWS in Bangladesh

Pakistan Era

- In 1966, Cyclone Preparedness Programmeon was established.
- But relief and rehabilitation were the notion of the government rather than preparedness and mitigation.
- In 1970 the most devastating cyclone caused no less than 300,000 deaths and enormous economic loss. May be it caught less attention of the government because of political turmoil in the part of the country.

Development of EWS in Bangladesh

EWS in Bangladesh

- Bangladesh got independence in 1971.
- Bangladesh Meteorological Department reorganized.
- Cyclone centers were built but the approach to disaster management remained almost same during the 70's and 80's.
- In 1991 a cyclone killed about 140,000 people and made a colossal economic loss.
- In the 80's and 90's some remarkable floods occurred. Specially the flood of 1998 which stayed longest period and flooded the largest area in the history.

Development of EWS in Bangladesh

After these two catastrophic disasters the government had come to a point we may call 'the phase of paradigm sift'.

- In 1993, the GoB established the Disaster Management Bureau (DMB), Disaster Management Council and Disaster Management Committees from national to field levels and rename the Ministry of Relief and rehabilitation as Ministry of Disaster Management and Relief.
- The DMB has responsibilities:
  - To create public awareness on hazards and preparedness.
  - To formulate programs and projects for vulnerable communities and public officials disaster preparedness.
  - To coordinate all activities related to disaster management from national to grass-root level.
  - To maintain liaison with government agencies, donors and NGOs.

Development of EWS in Bangladesh

- The Ministry of Disaster Management and relief was renamed as the Ministry of Food and Disaster Management in 2004. It has responsibilities:
- Food management.
- Planning, coordination, monitoring and evaluation of all activities related to disaster management.
- Coordination among other organizations.
- Assisting other ministries and organizations in disaster related works.
- Formulation of policy and its implementation for food assisted projects and programmes management of external food aid and other relief assistance.
- Management of all other food and disaster related activities on the government side.

Development of EWS in Bangladesh

- In 2003, a Comprehensive disaster Management Programme (CDMP) of MoFDM was designed to help upgrade capabilities for all disaster management agencies with the help of UNDP and DFID.

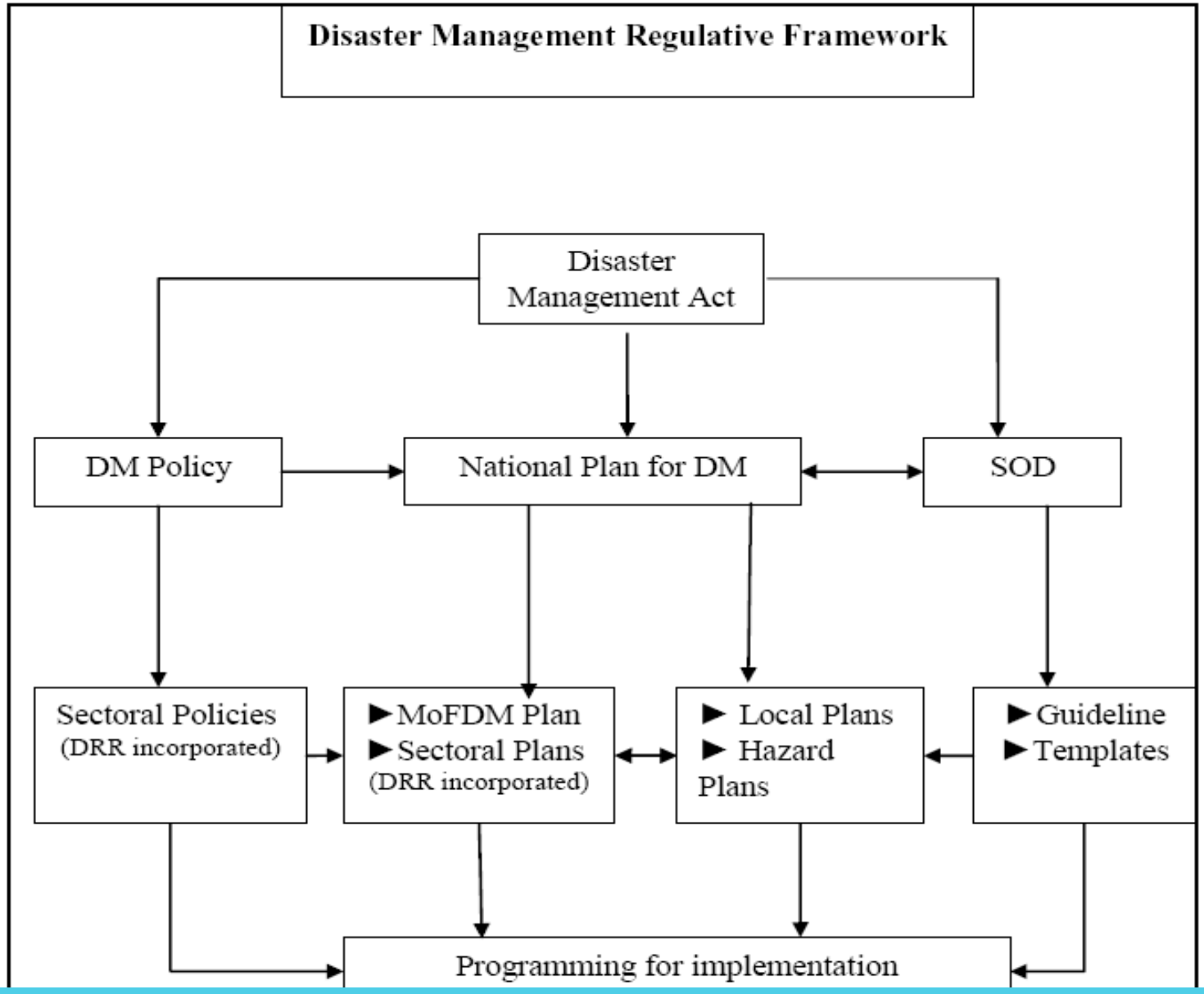
After liberation of Bangladesh from Pakistan in 1971 the International Federation of Red Cross and Red Crescent withdrew from direct implementation through CPP.

CPP turned out to be a joint venture programme of the government and Red Crescent society. In which the implementation part is mainly maintained by CPP through its community based preparedness programme.

Governance and Institutions

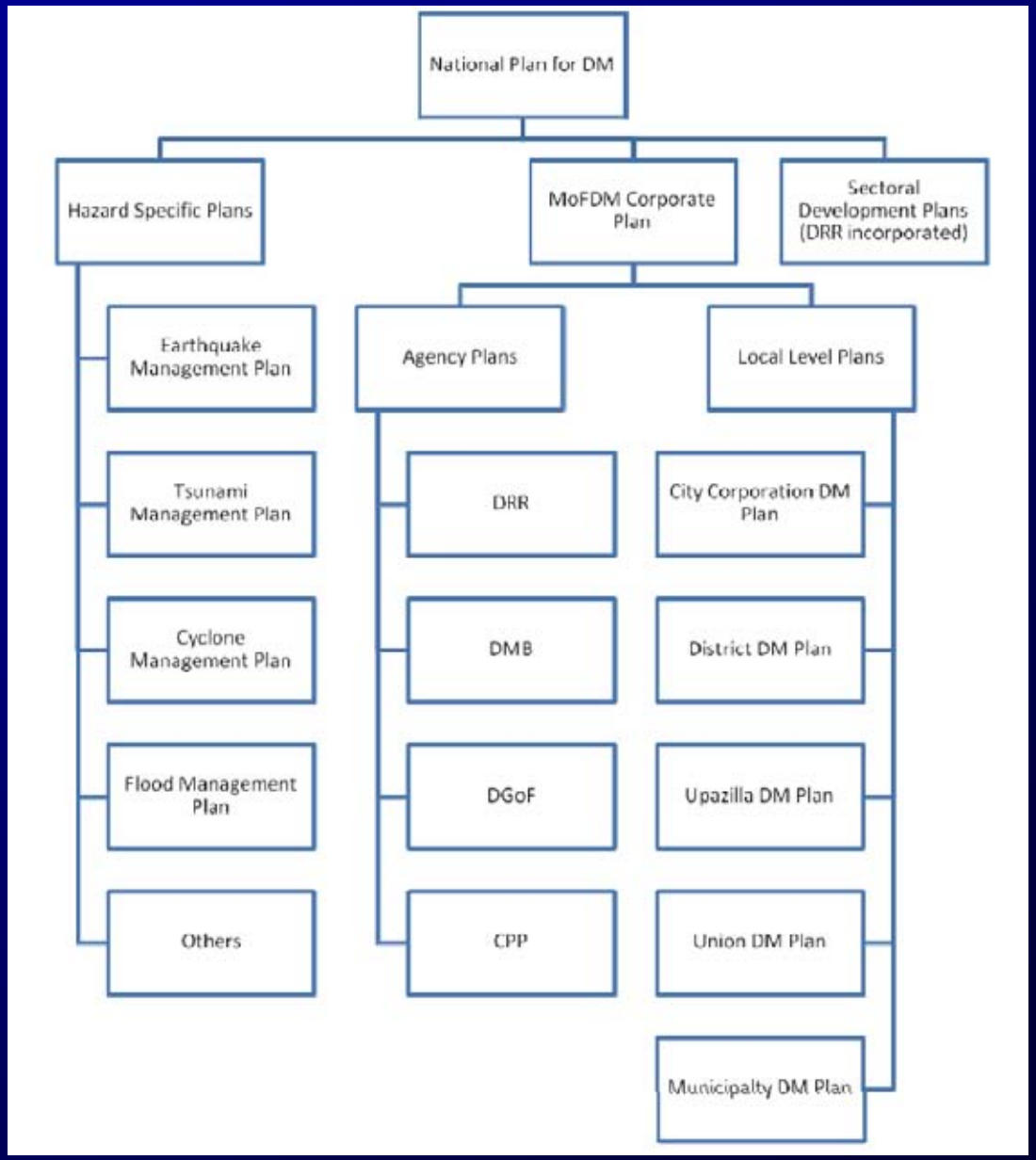
Legal Framework had been done for fostering the activities for Disaster Risk reduction and Emergency Management in Bangladesh. Which includes:

1. **Disaster Management Act.**
2. **National Plan for Disaster Management.**
3. **National Disaster management policy.**
4. **Standing Orders on Disaster (SOD).**
5. **Guidelines for government at all Levels.**
6. **National to local emergency planning.**
7. **Disaster Management Plans**

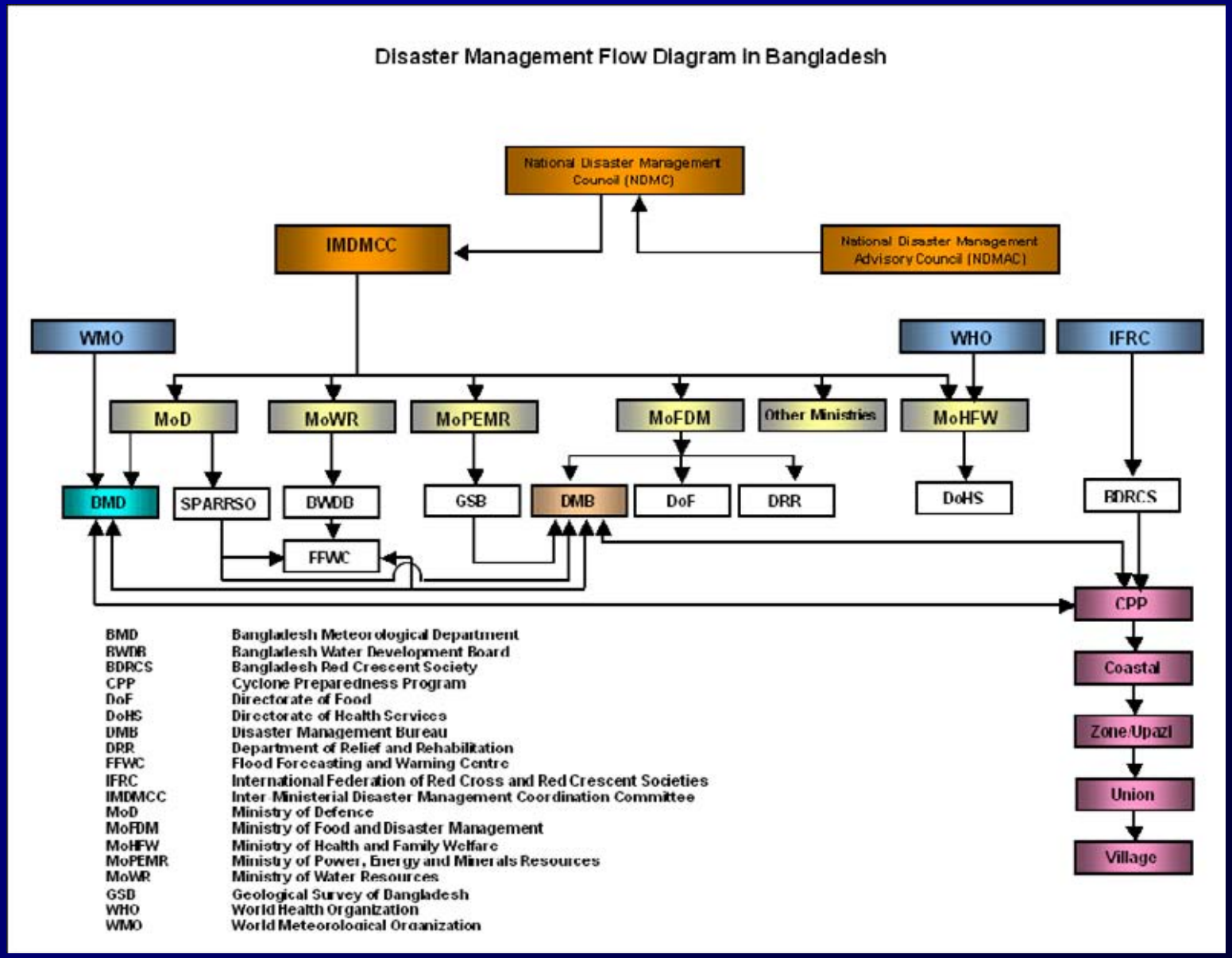


•Inter-linkages between various regulative instruments and programming for implementation.

Disaster management planning framework



Organizational structure for implementing the plans



Hazard Monitoring, Forecasting and Mandates of Warning Generation.

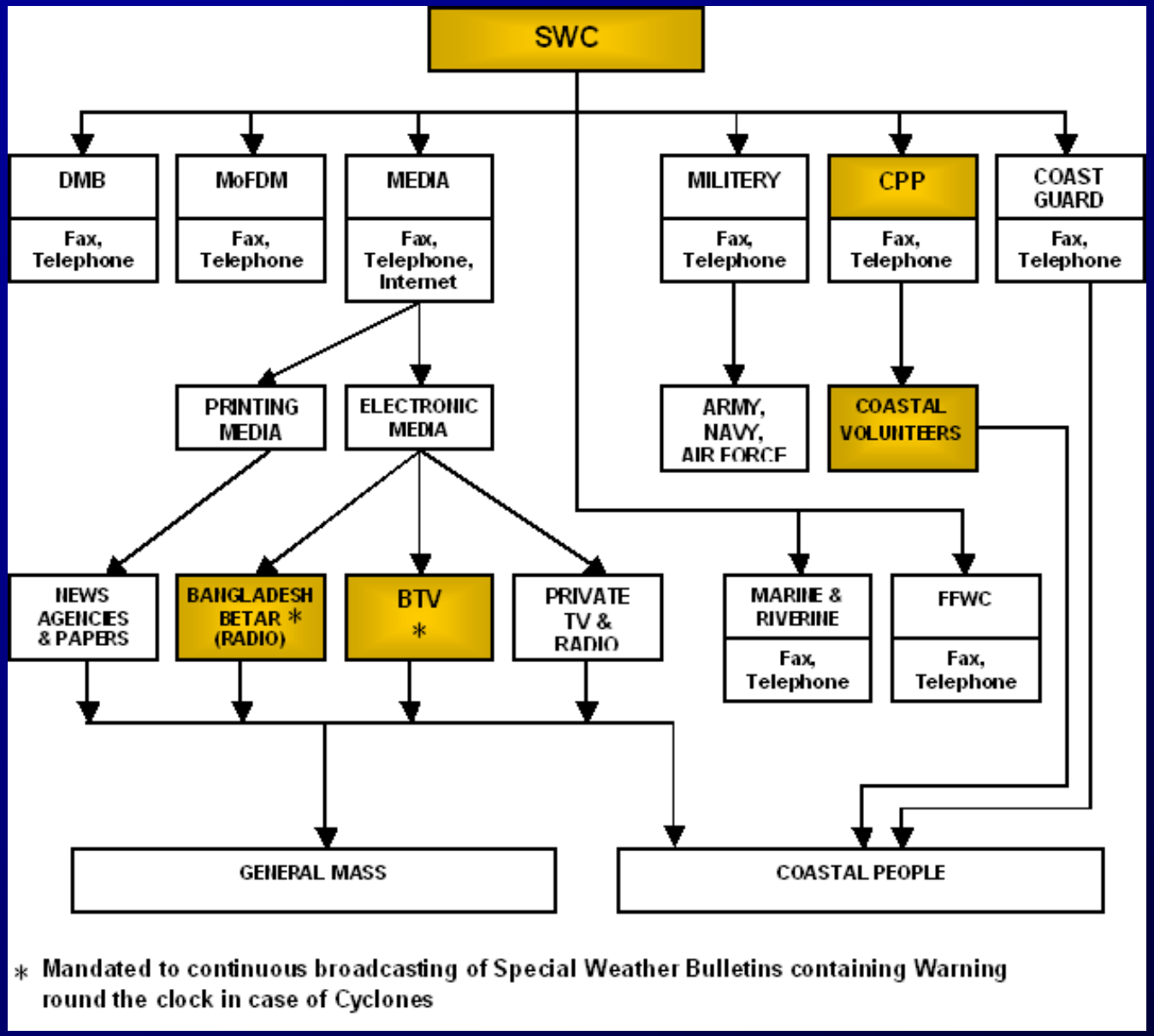
- **Type I: Has sole mandate for development of warning for the hazard,**
- **Type II: Has joint mandate for the development of the warning hazard,**
- **Type III: Provides information to other agencies that have the mandate for the development of the warning)**

Hazard Rank	Hazard	National Agency for Mandate	Type of the Hazard	Remarks
1	Cyclones	BMD	I	
2	Storm surge	BMD	I	
3	Thunderstorm (Nor'wester), Lightning	BMD	I	
4	Tornado	BMD	I	
5	Hailstorm	BMD	I	
6	River flooding	FFWC (BWDB), BMD, SPARRSO	II	
7	Flash flood	FFWC (BWDB), BMD, SPARRSO	II	
8	Coastal flooding (due to storm surge/tsunami)	BMD	I	
9	Drought	BMD, BWDB, DAE	II	
10	Heat Wave	BMD	I	
11	Cold Wave	BMD	I	
12	Dense Fog	BMD	I	
13	Landslide/Mudslide (due to heavy rain)	BMD	I	
14	Earthquake	BMD	I	
15	Tsunami	BMD	III	Tsunami Watch Information (TWI) Bulletins are received from PTWC and JMA
16	Turbulance/Icing	BMD	I	
17	Strong winds	BMD	I	
18	Wind driven surge	BMD	I	
19	Air pollution	DoE, AEC	II	
20	Waterborne hazards	ICDDRB, DoE	II	
21	River Erosion	BWDB	I	

Hazard Warning programme by SWC of BMD

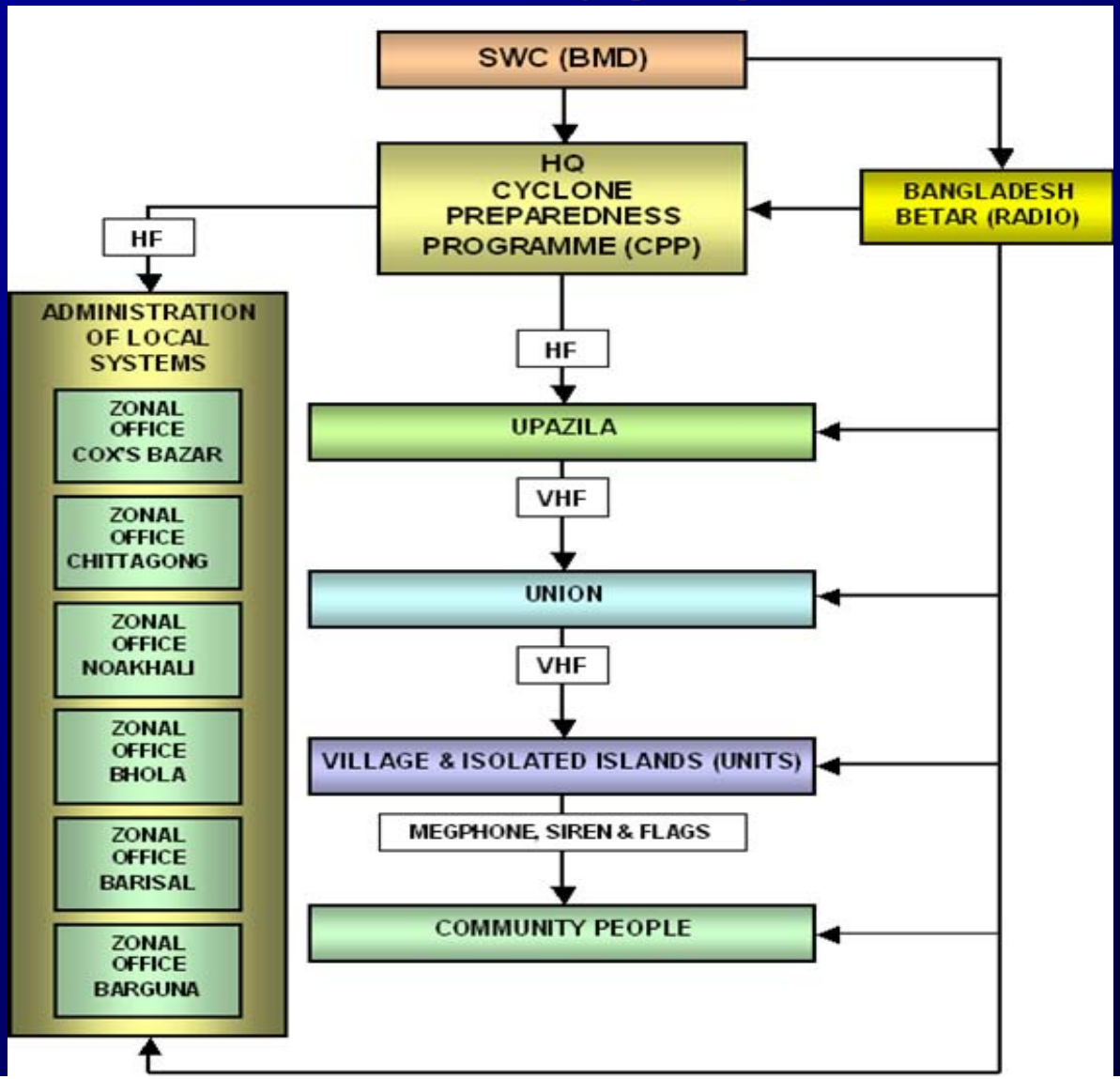
Warnings for		Issued before				
		As needed	12 Hrs	24 Hrs	18 Hrs	10Hrs
Cyclone	Alert	X				
	Warnings			X		
	Danger				X	
	Great Danger					X
Storm Surge						X
Heavy Rainfall/Heat Wave & Cold Wave		X				
Inland River port		X				
Thunderstorms/Squalls		X				

Warning message/ bulletin distribution flow chart



* Mandated to continuous broadcasting of Special Weather Bulletins containing Warning round the clock in case of Cyclones

Dissemination of warnings and signals from the Storm Warning Centre (SWC) of BMD through the CPP to the community people



Early Warning saves millions in Bangladesh

In respect of raising public awareness, motivation and effective early warning dissemination at the community level, the loss of lives and properties of the community could reduced.

- **November 1970 cyclone: 223 km/hr, causalities-almost 500,000**
- **April 1991 cyclone: 225 km/hr, causalities- only 140,000, although the population in the coastal area has doubled since 1970.**
- **November 2007: cyclone 'SIDR', 220 km/hr and causalities-only 3,347 people lost their lives.**

Gradual reduction of death tolls for tropical cyclone

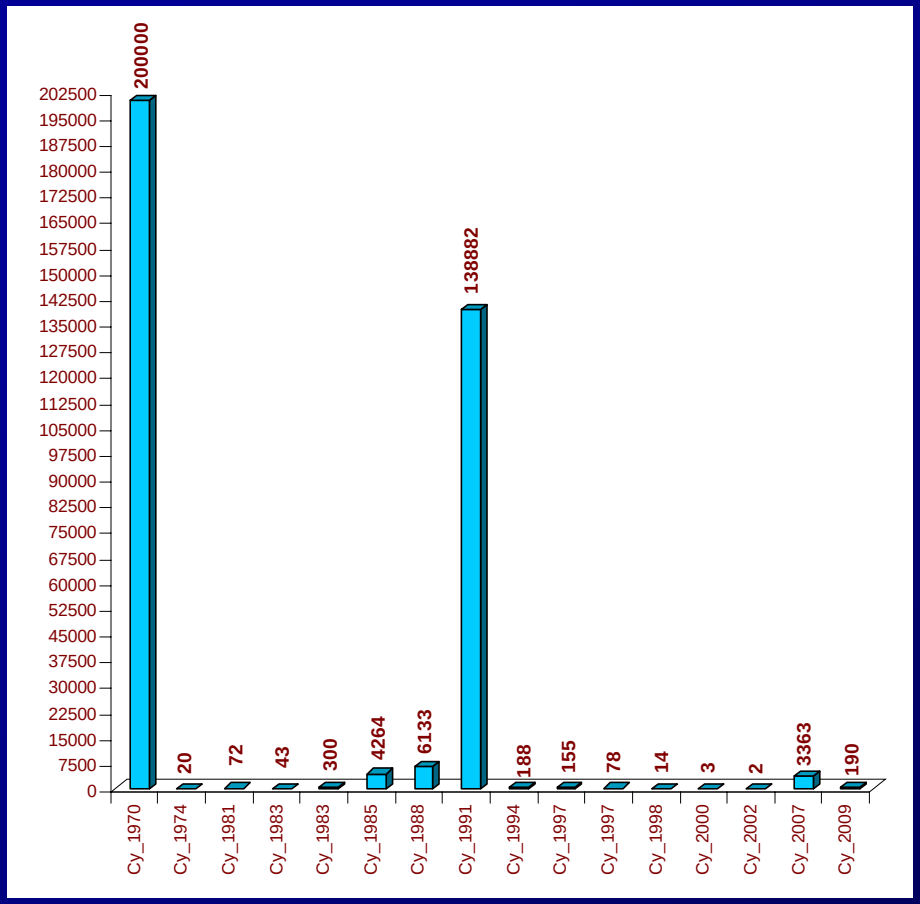


Figure 1: Causalities along with recorded cyclones in Bangladesh during 1970-2009

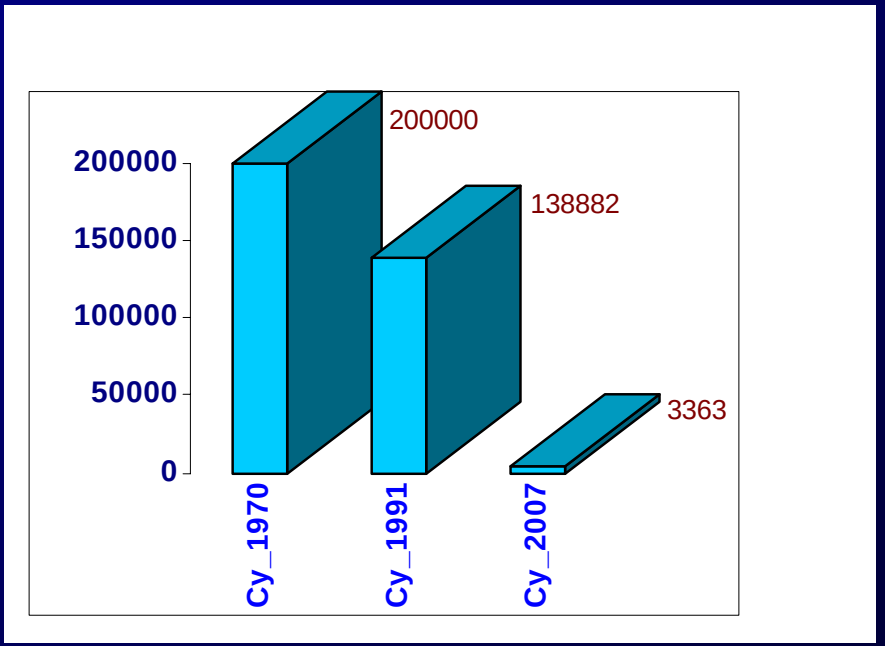
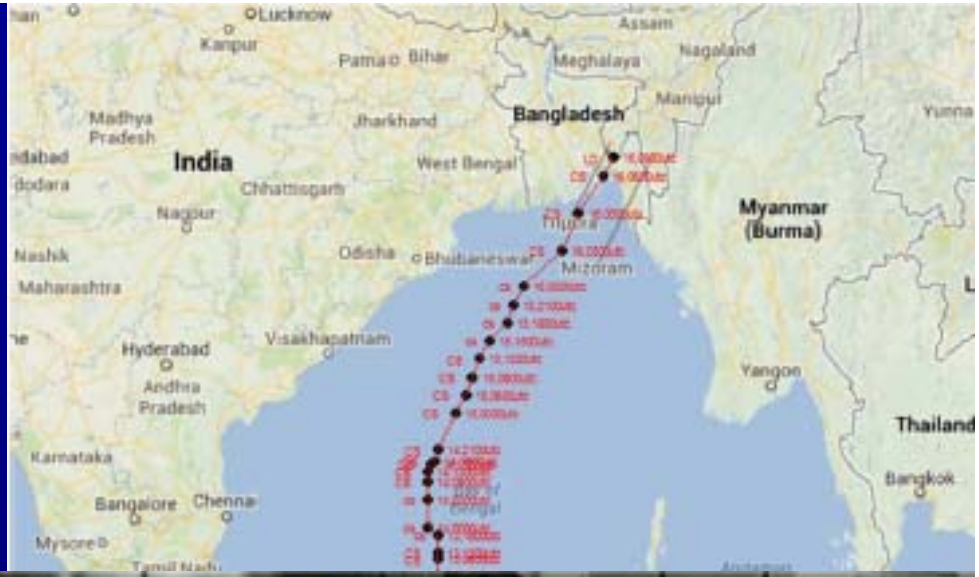


Figure 2: Trend of reduction of causalities during similar intensity cyclones in Bangladesh

Cyclone ‘Mahasen’ (afternoon of 16th May 2013)

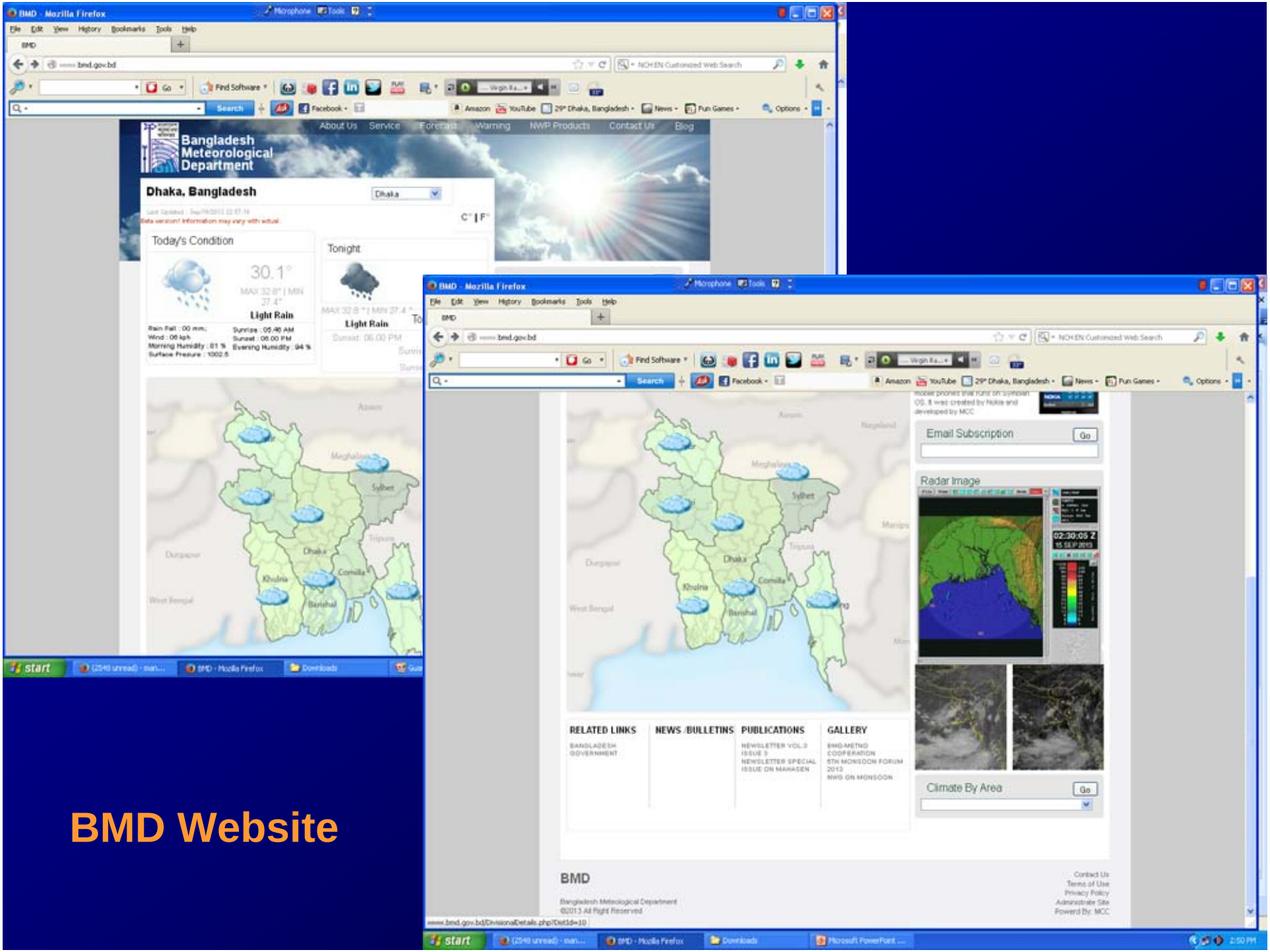
- **Maximum Wind: 100 km/hr at Khepupara**
- **Death toll: 17**
- **Injured: about 2066**



Three hourly media briefing was arranged at BMD during Cyclone Mahasen.

BMD Initiatives to improve Early Warning System in Bangladesh

1. Improvement of Observational Network
   - Surface and upper air observation
   - Satellite receiving system
   - Radar System and communication link
2. Introduction of NWP technique
3. Enhancement of Human Capacity
4. Installation of media centre for live and quick dissemination of forecast and warning
5. Dissemination of forecast and warning through voice record
6. Dissemination of forecast and warning through mobile phone SMS
7. Dissemination of forecast and warning through interactive and dynamic web site (www.bmd.gov.bd)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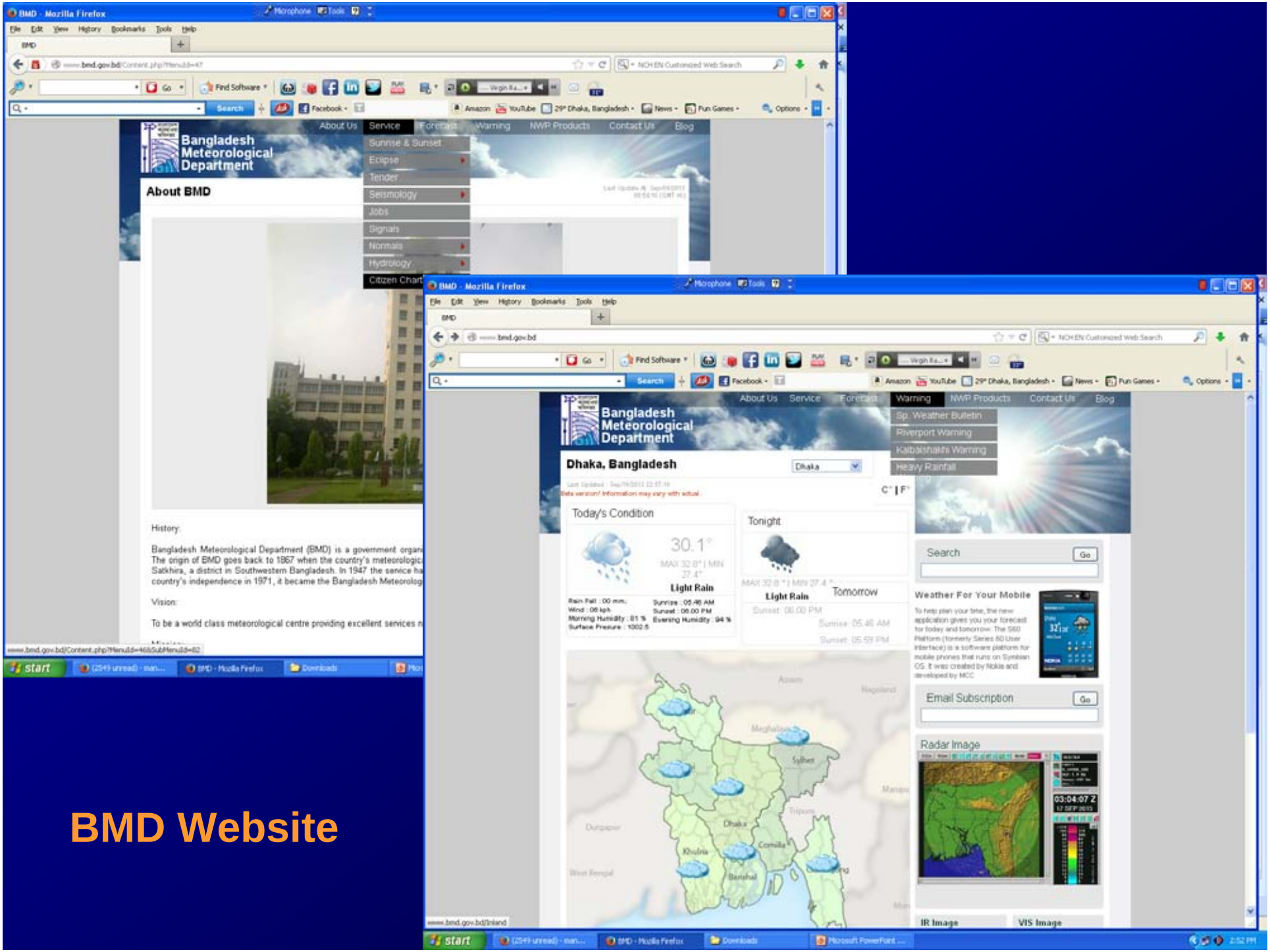
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BMD Website

BMD Initiatives to build awareness about Disasters that affect Bangladesh

1. **Human Capacity Building Project**
   - **Installation of AWS**
   - **Enhancement of NWP technique and PC Cluster**
   - **Calibration Radar data**
   - **Quality control of observed data**
   - **Briefing the school students through open class**
   - **Preparation booklet (in Bengali and English)**
   - **Preparation of cartoon ‘Megdut’**
   - **Broadcast the cartoon ‘Megdut’ through Electronic Media**
   - **Organizing seminar/ symposium at local level on different disasters with the participation of all sector people.**
   - **Organizing seminar/ symposium at district and national level**

BMD Initiatives to build awareness about Disasters that affect Bangladesh

1. CDMP Project
   - Impart training about disaster to the employee at all levels of BMD specially those who works at field levels
   - Established internet connection between BMD to all observatory for quick dissemination of warning and collection of observed data
   - Improvement of computing facilities of BMD
   - etc.
2. Organizing monsoon Forum collaborating with RIMES
   - Two times in a year
   - Stakeholders of BMD including media
   - Explain forecast and warnings
   - Seeking gaps between forecast and observation

BMD Initiatives to build awareness about Disasters that affect Bangladesh

3. National Working Group Meeting collaborating with SMRC
   - Two times in a year (before and after monsoon)
   - Stakeholders of BMD including media
   - Explain monsoon forecast and related warnings
   - Seeking feedback from the stakeholders for improvement.
4. Initiation of project under climate change trust fund of Bangladesh Government
5. Initiate collaboration with Metno., JMA and KMA
6. Participating actively in all activities of Disaster management and Climate Change in Bangladesh.

Thanks for your kind attention