THE FOURTH NATIONAL MONSOON FORUM

10-11 June 2012

Dhaka, Bangladesh

Organized by:

Bangladesh Meteorological Department

Regional Integrated Multi-Hazard Early Warning System

Contents

Fourth National Monsoon Forum
10-11 June 2012

SUMMARY REPORT

1. Introduction

Bangladesh Meteorological Department (BMD) organized the 4th National Monsoon Forum on 10-11 June 2012, at BMD Headquarters, Dhaka. The Forum brought together 23 participants from 14 forecast user agencies and organizations and 3 technical agencies involved in generating warning information (Annex 1). The Monsoon Forum is a platform for dialogue between early warning information providers and users at national and local levels to promote the seamless use of hazard risk information of all timescales in planning and decision-making, for resource management and reducing disaster risks.

BMD organized three Forums during 2010 to 2011 to interact with forecast users, for improving the country's early warning system and enhancing coordination and cooperation among early warning stakeholders. The First Forum, held in Dhaka from 5-6 January 2010, recommended:

- Forecast and warning language and format that are easily understood by laymen (e.g. use of graphics)
- Increased weather forecast and warning lead time
- Timely and more frequent dissemination of forecasts and warnings through accessible media (e.g. print and electronic media, SMS, voice mail, toll-free telephone, etc.)

The Second Forum, held in Dhaka from 30-31 May 2010, recommended:

- Identification of focal points in respective agencies for receiving warning and providing feedback
- Establishment within BMD of an effective monitoring cell
- Weekly TV program on hazards, forecasting, warning, risk awareness, and risk reduction

The Third Forum, held in Dhaka from 29-30 June 2011, recommended:

- Densification of/ modernization of existing observing and monitoring stations. As a minimum requirement, each district should have a weather observing station.
- Expansion of dissemination media to include electronic media (e.g. facebook, twitter, billboards, etc.)
- An interactive system at BMD for users' queries
- Demonstrations of forecast application in pilot locations

2. Objectives

The Forum's general objectives are:

- Ensure that forecasts/ warning information products, including their uncertainties and limitations, are communicated to and understood by users.
- Encourage the use of forecasts to mitigate risks in climate-sensitive sectors, including, but not limited to agriculture, water resources, disaster management, and health.
- Receive user feedback for improving usability of forecast products.
- Provide a platform for inter-agency coordination of policies, and sectoral plans and programs for dealing with potential impacts of hydro-meteorological and geological hazards.

- Provide a platform for long-term process of understanding risks posed/opportunities brought about by past, current, and future climate.

The 4th Forum's specific objectives were:

- Review the past season's performance in terms of forecast information issued, impacts, and user responses
- Discuss the climate and hydrological outlooks for the incoming season, and evaluate potential impacts and response options
- Identify difficulties/ challenges/ gaps in the application of forecast information, including recommendations to address these

Annex 2 provides the 4th Forum's agenda.

3. Review of 2011 Monsoon

Bangladesh is a small deltaic land, with the great Himalayan Range in the north, the vast Bay of Bengal to the south, and with many rivers running through it. This unique geographic location makes the weather system complicated in this region. The 2011 monsoon was characterized with:

- On average, 15% above normal rainfall: 6% above normal in June, 12% below normal in July, 55.7% above normal in August, and 17.7% above normal in September (Figure 1). Figure 2 shows the deviation of observed from normal rainfall.
- Four depressions, against the normal of 4-6 depressions

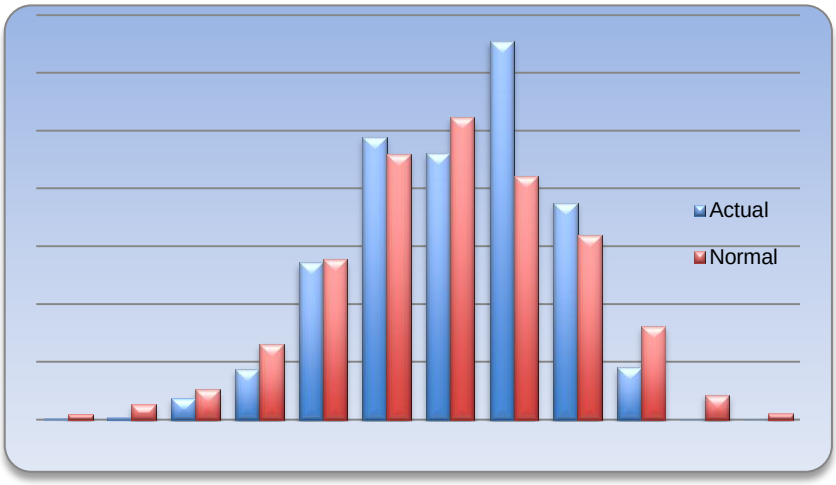

Figure 1: 2011 monthly actual against normal rainfall

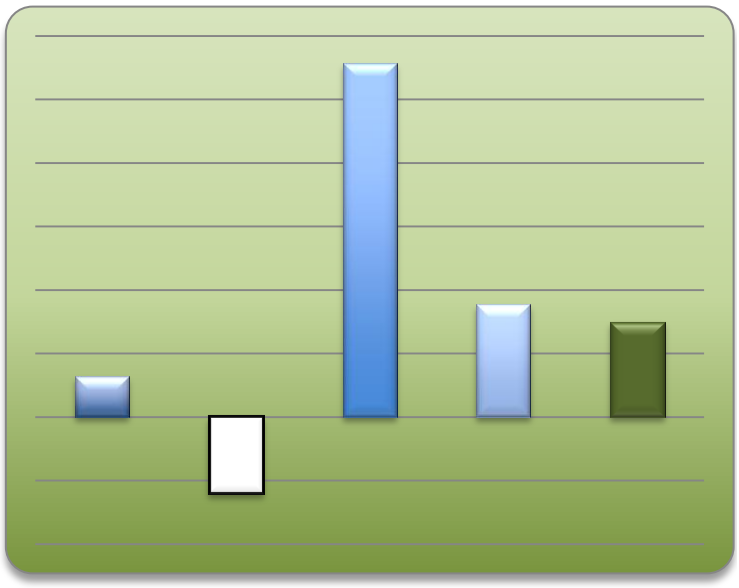

Figure 2: Deviation of observed rainfall from normal during the 2011 monsoon (June-October)

The 2011 flooding was a normal one (Figure 3), with flood durations:

- Shorter along the Brahmaputra-Jamuna and Ganges Rivers (north & northwest)
- Short to moderate in the northeast
- Moderate along the Padma River (central)
- Prolonged along Kobodak River (southwest)
- Flash floods in the northeast and southeast

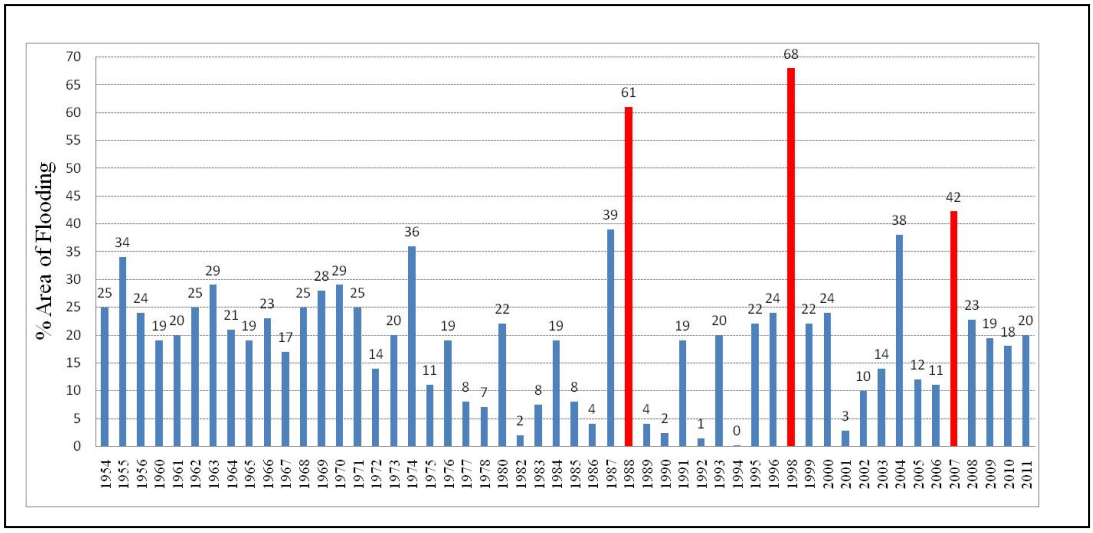

Figure 3: Annual flooded area, 1954-2011 (Source: BWDB)

3.1 Evaluation of Experimental Probabilistic Flood Forecasts

The experimental probabilistic flood forecasts, issued for the 2011 monsoon, were evaluated using statistical analysis (coefficient of determination), as follows (Figure 4):

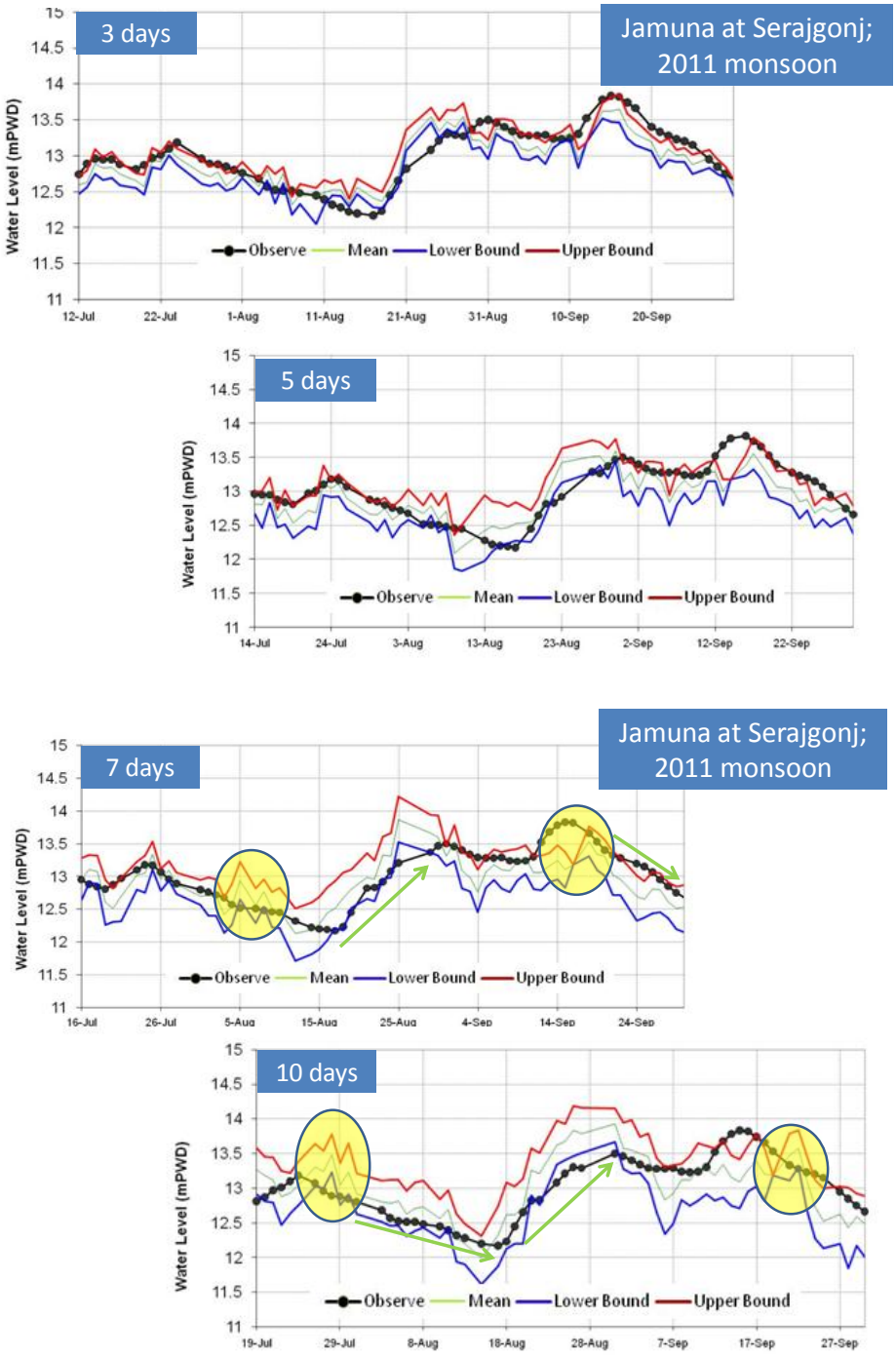

Figure 4: Performance of short- and medium-range flood forecasts

Results show:

- Mean deviation of 5-day flood forecasts from observed values is less than 25%
- Mean deviation of 10-day flood forecasts from observed values is about 35%
- Rising and falling trend of forecast and observed graphs are well-matched for 3-day forecasts; satisfactory, with few minor mismatch, for 5-day and 7-day forecasts; high deviation for 10-day forecasts, hence would need forecast improvement; overall trend is satisfactory

Evaluation of long-range forecasts is presented in Annex 3.

3.2 User Feedback

Table 1 below shows the type of climate and hydrological information that users expected and received from BMD and FFWC, respectively, and the use of these information.

User Department	Information expected	Information received	Use of information
Department of Agriculture Extension (DAE)	Forecasts on: ○ Rainfall ○ Temperature changes ○ Humidity ○ Evapotranspiration ○ Fog/ moist ○ Soil moisture status ○ Monsoon duration ○ Wind speed, direction ○ Depression ○ Cyclone ○ Flash flood ○ Normal flood ○ Upstream tidal information/ water level	All expected information were received	○ Dissemination to stakeholders for awareness ○ Crop production planning ○ Crop variety selection ○ Land management ○ Seed collection, sowing ○ Crop protection and management ○ Crop harvesting ○ Post-harvest management
Department of Fisheries (DoF)		○ Weather/ meteorological information	○ Dissemination to local level offices
Water Supply and Sewerage Authority (WASA)			○ Flood monitoring ○ Flood preparedness
Directorate General of Health Services (DGHS)		○ Warnings and bulletins from BMD and BMD website	For extreme events: ○ Activation of control rooms at DGHS and district hospitals and upazila health complexes at threatened areas ○ Medical/ rapid response/ assessment teams at national and threatened areas are put on stand-by ○ Pre-positioning of emergency drugs (buffer stock) and medical supplies ○ Initiate other

User Department	Information expected	Information received	Use of information
			preparedness actions (e.g. stock generator fuel)
Armed Forces Division		○ Warnings and bulletins ○ Synoptic charts and other graphical information from BMD website	○ Dissemination to downstream units
BRAC		○ Warnings and bulletins from BMD and FFWC ○ Weather, climate, and flood information from international organizations (JF Oberlin University) and secondary sources (CPC NOAA, IMD, JTWC, BBC, etc.) ○ Temperature, precipitation, and humidity from BRAC weather stations ○ Real-time field information from district BRAC representatives and field managers	○ Risk evaluation ○ Dissemination of risk information to BRAC management, field level offices, and communities

4. 2012 Monsoon Outlook

BMD presented its outlook for the 2012 monsoon as follows:

- Most Global Producing Centers (GPCs) show that the southwest monsoon rainfall over Bangladesh shall be normal to below-normal
- The 3rd South Asian Climate Outlook Forum (SASCOF-3) consensus outlook for 2012 indicates that monsoon rainfall over Bangladesh shall be normal
- Any extreme event, like heavy rainfall or depression, could change the above scenario

5. Updates from BMD and FFWC

BMD presented its achievements on enhancing weather forecasts and applications, as follows:

- Increased number of stakeholders that get daily and weekly weather information.
- Latest and other experimental weather and climate information that are available at the BMD website (www.bmd.gov.bd), including tropical cyclone forecasts, Doppler radar echo, satellite imagery, weather map analysis, climate data, etc.

BMD also introduced participants to the Weather Research and Forecasting (WRF) model, Global Spectral Model by the Japan Meteorological Agency (GSM/JMA), WAVE model data analysis, and Tokyo Climate Center's (TCC) 1-month model visualization outputs (Figure 5).

WRF Model at BMD

- WRF model run by BMD since July 2010, with assistance from RIMES
- Model run for 72 hours, including district boundaries have been added
- Model is run automatically:
  - Time: 72 hours at 00 UTC
  - Resolution: 27 km
  - Starts at: 10:00 AM
  - Time required: about 1 hour 20 min
  - Products generated: Rainfall forecast for 24, 48, and 72 hours, district-wise

GSM (JMA) Model at BMD

- JMA provides GSM output data to BMD four times in a day, at 00,06,12 and18 UTC
- Surface data resolution is 25 km; upper air is at 50 km resolution
- 00 UTC data download and processing start at 10:20 in the morning, and takes about 10 min to process, visualize, and upload to BMD website
- Data are processed for the same domain as the WRF model

NHM Model at BMD

- NHM model run by BMD from April 2012, with assistance from JICA
- Model runs for 72 hours
- Model runs manually:
  - Time: 72 hours at 00 UTC
  - Resolution: 20 km
  - Starts at: 10:30 AM
  - Time required: about 1 hour 30 min
  - Products generated: Rainfall forecast for 24, 48, and 72 hours, Bangladesh boundary-wise

WAVE Model at BMD

- WAVE model run by BMD from August 2011, with assistance from RIMES and JMA
- Model runs for 24 hours
- Model runs automatically:
  - Time: 36 hours at 00 UTC
  - Resolution: 25 km
  - Starts at: 10:30 AM
  - Time required: about 20 min
  - Products generated: Wave height for 03, 06, 09, 12, 15, 18, 24, 30, 33, and 36 hours for the Bay of Bengal

TCC Model Product Visualization at BMD

- TCC model product visualized and uploaded on the BMD website since December 2011, with assistance from JMA
- Product is uploaded manually:
  - Time: 1 month at 00 UTC
  - Resolution: 100 km
  - Starts: Saturday, every week
  - Products generated: mm/day rainfall and mm rainfall anomaly

Figure 5: Details of forecasting models at BMD

Storm Surge Modeling

The long continental shelf, shallow bathymetry in the North Bay of Bengal, the northward-converging nature of the Bay, complex coastal geometry with many kinks and islands, high astronomical tides, and long tidal range between the east and west coasts of Bangladesh are the main causes of the highest and longest duration of storm surge in this region. BMD uses a high-resolution hydro-dynamical numerical model (IIT-D Storm Surge model) for storm surge forecasting:

- The model is PC-based.
- Both LINUX and Windows versions of the model are used in BMD.
- Operational meteorologists received several trainings on this model.
- Model inputs include:
  - Vector motion of the storm center
  - Radius of maximum wind
  - Pressure drop
  - Topographic & bathymetric data (ETOPO2)
- Generic Mapping Tool (GMT) software is used for model product visualization.

Resolution of the IIT-D model is high (Δx= 3.7 km, Δy = 3.5 km, and Δt = 60 sec); model performance is good. Predicted maximum surge height is found to be in good agreement with the observed surge height. Yet, further development may be made in respect of refinement and inclusion of water discharge from the Meghna estuary. Very high resolution topographic data for the coastal zone is needed for producing inundation maps. Also, automatic tide gauges are needed along the coastal belt, for monitoring and validating surge height.

In December 2010, BMD forecasters trained on a new model, JMA's MRI storm surge model, in collaboration with JMA and RIMES. The model makes use of the same input data as for the IIT-D model. Performance of the MRI model is quite good, but under-estimates the peak surge height. Model outputs include:

- Significant wave height (m)
- Significant wave period (sec)
- Wave direction
- Sea surface wind (m/s)
- Swell height (m)
- Sea surface pressure (hPa)

The model is run for the Bay of Bengal area once a day; products are uploaded to the BMD website (www.bmd.gov.bd).

BMD Agro-Meteorological Services

BMD delivers weekly agro-meteorological forecasts, containing the following information:

- Distribution of last 7 days' actual rainfall
- Deviation from the normal rainfall by GIS map
- 7-day accumulated rainfall forecast with geospatial distribution
- 15 days (next 7 days) extended outlook
- No. of rainy days in last 7 days
- Average maximum temperature of last week

- Normal maximum temperature of last week
- Minimum temperature of last week
- Normal minimum temperature of last week
- Temperature outlook next week
- Average evaporation of last week
- Average sunshine hours of last week
- Evaporation and bright sunshine hour forecast for next week
- Advisories for farmers for next week

BMD's System Improvement Efforts

BMD shared its ongoing efforts and planned initiatives for improving forecasting and warning as follows:

- Telemetry of all observing stations
- Increased modeling capacity
- NWP project shall increase BMD's computing capacity
- Improvement of GIS and remote-sensing facility at BMD's agro-met division
- Development of agro-met advisory tool
- Development of separate website for the agro-met division
- BMD – stakeholder interactions have been initiated
- Training programs targeting end users

FFWC shared its flood forecasting and warning workflow, as shown in Figure 6. FFWC also shared its ongoing initiatives in collaboration with RIMES and with support from USAID through CARE Bangladesh:

- Expansion of the coverage area of the 10-day flood forecast
- Improvement of 10-day forecast quality
- Introduction of seasonal flood forecasts in limited pilot sites, on experimental basis

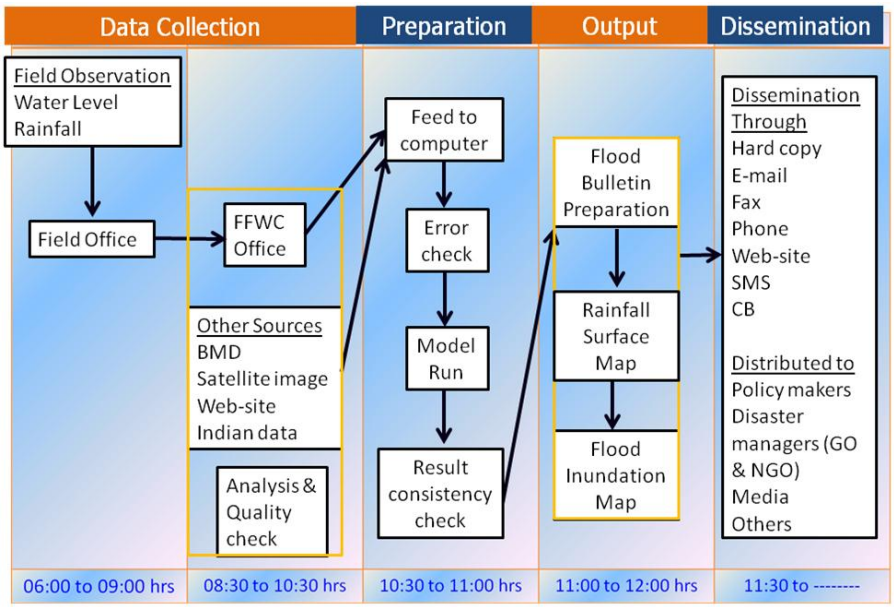

Figure 6: FFWC flood forecasting & warning activities

6. Recommendations

Hydro-meteorological observations

- Densification of/ modernization of existing observing and monitoring stations. As a minimum requirement, each district should have a weather observing station. For urban areas, distribution could be zone-wise.
- More frequent observations of flood water level vis-à-vis peripheral river water level during heavy rainfall
- Provide radar observations at least 1-1.5 hours before impact of Nor'westers
- Establish radar link with Cox's Bazar weather radar to improve weather forecasts

Forecast and warning generation

- Hourly rainfall forecasts
- 6-hour rainfall forecast, including rainfall intensity and duration, per zone during the peak monsoon period
- At least 48 hours forecast lead time for extreme rainfall events
- Ensure regular forecast updates
- Improved spatial and temporal resolutions of long-term forecasts
- Fortnightly updates of long-term forecasts
- Use of graphics and simple language, with detailed description, in communicating forecasts
- Introduce use of monsoon indicators
- Include hazard thresholds (correlation between rainfall and flooding) in communicating forecasts, particularly in urban areas
- Training/ capacity building of forecasters
- Receive and evaluate user feedback

Forecast/ warning dissemination

- Send forecast products to DAE, WASA, DGHS, and Fisheries departments, including the National Crisis Management Center, and to regional/ district offices for further dissemination to farmers, irrigation managers, and other users
- Provide BMD and FFWC contact details, including website addresses, to all government user departments
- Make BMD and FFWC websites more interactive with users
- Use mass media as partner for disseminating key meteorological information
- Introduce a weather channel on television, to air during the monsoon (July-September)
- Use electronic billboards, maximize use of print media in warning/ forecast dissemination

Forecast interpretation and translation

- Develop rainfall thresholds for urban areas
- Training on forecast interpretation and translation

Forecast producers-users interaction

- Organize inter-department forum/ workshop/ training

Warning response, preparedness

- BMD and FFWC to recommend required depth, width, and velocity of peripheral rivers
- Earmark retention reservoirs, flood plains, and flood flow areas to keep them non-structured
- Awareness building of stakeholders
- Incorporate meteorological and seismological studies in national curriculum

Research

- Detailed research on climate impacts on public health, in collaboration with World Health Organization (WHO), International Center for Diarrheal Disease Research-Bangladesh (ICDDRB), etc.

The following strategies/ mechanisms were recommended by the 3rd National Monsoon Forum for implementing recommendations and monitoring the implementation of recommendations:

Strategies for implementing Monsoon Forum recommendations

- Sustained inter-departmental coordination and collaboration, for synergy of actions
- Capacity building of BMD
- Establishment of a weather ship
- Establishment of community weather radio
- Establishment of weather information display systems at railway stations, airports, river ports, sea ports, and other important public places
- Capacity building of stakeholders

Monitoring mechanism

- Report actions taken by concerned agencies, during the Forum
- Bi-monthly meeting among stakeholders, convened by BMD
- Regular early warning system performance evaluation
- Wider dissemination of successes and lessons at regional and local levels

Annex 1
Participant List

No.	Participant Name	Position, Organization	Contact Address
1	Md. Dalil Uddin	Ministry of Disaster Management and Relief	daliluddin1121@gmail.com
2	Md. Isa Faragi	Disaster Management Bureau	i_faragi@yahoo.com
3	Dr. Golam Ambia	Department of Agriculture Extension	ambiadae1955@yahoo.com
4	Mohammad Mamunur Rashid	Department of Fisheries	
5	Kazi Habib Ullah	Water Supply and Sewerage Authority	habibullah_kazi@yahoo.com
6	Tariq Abdullah	Bangladesh Power Development Board	
7	Dr. Md. Shakhawat Hossain	Directorate General of Health Services	controlroomdghs@yahoo.com
8	Abdullah Harun Pasha	Bangladesh Bureau of Statistics	pasha051263@yahoo.com
9	Maj. Rezaul Karim	Bangladesh Army	reza5190@yahoo.com
10	M Shamsul Alam	Squadron Leader, Bangladesh Air Force	Shamsul&687@gmail.com
11	Lt. Cdr. M Shahidul Haque	Bangladesh Navy	shahidul1115@yahoo.com
12	Lt Cdr Ahamed Amin Abdullah	Bangladesh Navy	gso2_navy@afd.gov.bd
13	Cdr Md. Aminul Islam Khan	Deputy Director –Operations Bangladesh Coast Guard Headquarters	
14	Nabila Imam	Sector Specialist, BRAC	nabila.im@brac.net
15	Tanzeba A Huq	BRAC	tanzeba.ah@brac.net
16	Md. Shafiqur Rahman	Humanitarian Assistance Coordinator CARE Bangladesh	shafiqur@bd.care.org
17	Md. Abdur Rahim	Consultant, Climate Change Program	rahimdae@gmail.com
18	Md. Shah Alam	Space Research and Remote Sensing Organization	alamshah9142@yahoo.com
19	Mozammel Haque Sarker	Space Research and Remote Sensing Organization	mhsarker2@yahoo.com
20	Ayesha Khatun	BMD	ayeshabmd@gmail.com
21	Taslima Imam	BMD	timam63@gmail.com
22	S.M Quamrul Hassan	BMD	
23	Md. Amirul Hossain	Flood Forecasting and Warning Center	Amirulbd63@yahoo.com
24	Md. Arifuzzaman,	Flood Forecasting and Warning Center	arif81_bwdb@yahoo.com
25	Md. Shahmim Hassan Bhuiyan		shameem_dd@yahoo.com
26	Shamsuddin Ahmed		
27	S.H.M Fakhruddin	RIMES	fakhruddin@rimes.int
28	Tonmoy Sarkar	RIMES	tonmoy@rimes.int
29	Md. Jabed Hossain	RIMES	jabed@rimes.int

Annex 2
Agenda

Day 1: Sunday, 10 June 2012

9:30- 10:00 Registration

Inaugural Program

10:00-11:00 Recitation from Holy Quran

Welcome Address: Ms. Arjumand Habib
Director, Bangladesh Meteorological Department

Opening Remarks: RIMES

1100- 11:15 Group Photo & Tea Break

SESSION 1: INTRODUCTION AND FORECAST BRIEFING

11:15-11:45 Weather Forecasting, Applications, Training, and Research
Shamsuddin Ahmed, Assistant Director, BMD

11:45-12:05 Public Awareness Building
Ms. Taslima Imam, Meteorologist, BMD

12:05-12:25 Review of Seasonal Outlook with Focus on Monson 2011
S.M. Quamrul Hassan, Meteorologist, BMD

12:25-12:45 Review of Long-range Flood Forecasts Application
Presentation by –FFWC

12:45-13:00 RIMES contribution to Bangladesh on Weather and Flood Forecast Applications
RIMES

13:00-14: 00 LUNCH BREAK

SESSION 2: FORECAST OUTLOOKS & USER (STAKEHOLDER) EXPECTATIONS

14:00-14:30 Visit to Installation

14:30-15:45 Each stakeholder will present on the forecast outlook for last season according to expectations, receiving mechanism, usefulness, and application, including lessons learned from using/not using weather/climate/flood information, as well as recommendations.

- Presentation by Disaster Management Bureau (DMB)

- Presentation by Department of Agriculture Extension (DAE)
- Presentation by Department of Fisheries (DoF)
- Presentation by Directorate General of Health Services (DGHS)

15:45-16:00 Tea Break

16:00- 17:00 Continuation of Stakeholder Presentations

- Presentation by Dhaka WASA
- Presentation by Armed Force Division (AFD)
- Presentation by a NGO (BRAC) on community level actions

Day 2: Monday, 11 June 2012

SESSION 3: Latest Technology & Development

10:00-10:20 Development of Ago-Meteorological Services
Shamim Hassan Bhuiyan, Meteorologist, BMD

10:20-10:40 Review of Storm Surge Modeling
Mrs. Ayesha Khatoon, Assistant Director, BMD

10:40-11:00 Coastal Inundation Forecasting Development (WMO-BMD-FFWC Program)
Mr. S.H.M Fakhruddin, RIMES

11:00-11:15 Tea Break

11:15-12:15 Working group discussions
The working group will discuss on the:

- Current status of application of weather, water and climate information for managing risks
- Past, ongoing, and planned climate and disaster related initiatives in the sector
- Future initiatives requirement on hydrology & meteorology
- Actions or priority initiatives necessary for each sectors

12:15-13:00 Working Group Presentation: Each working group will have 15 minutes to present a summary of their discussions and recommendations

13:00-14:00 LUNCH

14:00-14:30 Working Group Presentation: Continuation

SESSION 4: PRESENTATION OF RECOMMENDATIONS

14:30-16:30	Discussion on the Recommendations (By rapporteur) Shamsuddin Ahmed, Assistant Director, BMD & Mrs. Ayesha Khatoon, Assistant Director, BMD
16:30-17.00	Closing

Annex 3
Evaluation of Long-Range Weather Forecasts

Performance of monthly forecasts for 2011 were evaluated against observed values as follows:

Forecast	Observed
January 2011 ○ Normal Rainfall may occur over the country ○ Two to three spells of moderate (06-08°C) to severe (04-06°C) cold wave may sweep over Northern and Central part of the country, and two to three spells of mild (08-10°C) to moderate (06-08°C) cold wave may sweep elsewhere over the country ○ Moderate to thick fog may occur over the river basins, Northern and Central part, and light to moderate fog elsewhere over the country ○ Agro-met forecast: Average evaporation may be at 2.0-3 mm/day, and average sunshine 6-7 hrs/day ○ River situation: In January all rivers of the country would remain normal	○ Below normal rainfall recorded over the country ○ Severe cold wave swept everywhere from 12-13 January and the lowest minimum temperature of 4.5°C was recorded at Jessore (12 Jan) ○ Thick fog occurred over the river basins and Northern, Eastern and Central part, and light to moderate fog elsewhere over the country; the fog persisted till noon from the second week ○ Temperature and river condition were found consistent with the forecast
February 2011 ○ Normal Rainfall may occur over the country ○ A spell of mild (08-10°C) cold wave may sweep over the country ○ Moderate to thick fog may occur over the river basins, Northern and Central part, and light to moderate fog elsewhere over the country ○ From the second half of February the temperature may rise gradually ○ Agro-met forecast: Average evaporation may be at 2.85-3.85 mm/day and average sunshine 7.2-8.25 hrs/day ○ River situation: In January all rivers of the country may remain normal	○ About 86.3% below normal rainfall was recorded over the country ○ Western low pressure that crossed the northern region became weak; rain did not happen due to non-conjugation with easterly low ○ Mild cold wave swept in the first week of February and the lowest minimum temperature of 9.1°C was recorded at Chuadanga and Sremongal (03 & 12 February) ○ Thick fog occurred over the river basins and Northern, Eastern, and Central parts, and light to moderate fog elsewhere over the country; the fog persisted till noon from the second week ○ Temperature and river condition were found consistent with the forecast
March 2011 ○ Overall normal rainfall may occur over the country ○ 2-3 days moderate/severe Nor'wester/thunderstorm may occur in the Northern and Central area, and 2-3 days light/moderate Nor'wester/thunderstorm may occur elsewhere of the country ○ Day temperature may rise gradually to normal state (34-36°C), but in northern and western area it may go to 37-38°C ○ Agro-met forecast: Average evaporation may be at 7.6-8.6 mm/day and average sunshine at 6.25- 7.25 hrs/day ○ River situation: Normal	○ Overall, about 17% below normal rainfall was recorded over the country ○ Western low pressure that crossed the northern region became weak, and rain did not happen due to non-conjugation with easterly low ○ Intermittent Nor'wester occurred in different parts of the country ○ Mild cold wave swept in the first week of February, and the lowest minimum temperature of 9.1°C was recorded at Chuadanga and Sremongal (03 & 12 February) ○ Temperature and river condition were found consistent with the forecast

Forecast	Observed
April 2011 ○ Normal rainfall may occur over the country ○ 1-2 depressions may form; one may develop into a cyclone ○ Thunderstorm/severe Nor'wester/thunder-storm may occur 4-6 days in the Northern and Northeastern parts, and 4-5 days light/moderate Nor'wester/thunder storm may occur elsewhere of the country ○ Severe heat wave (>40^{0}C) may occur at the northern and central area and 1-2 mild heat wave (36-38^{0}C) and moderate heat wave (38-40^{0}C) may occur elsewhere of the country ○ Agro-met forecast: Average evaporation may be at 4.75-5.25 mm/day, and average sunshine at 7.00- 8.00 hrs/day ○ River situation: Normal	○ Overall, about 39%below normal rainfall was recorded over the country, at division level, rainfall was 37% more than the forecast ○ Many places, including Rajshahi, were affected by Nor'wester/thunder storm, with heavy rainfall ○ Mild heat wave swept in April; highest temperature of 37.5°C was recorded at Issordi (14 April) ○ Temperature, Norwester, and river condition were found consistent with the forecast
May 2011 ○ Overall, normal rainfall may occur over the country ○ 1-2 depressions may form in the Bay of Bengal; one may develop into a cyclone ○ Thunderstorm/severe Nor'wester/thunderstorm may occur 2-3 days in the Northern and North-eastern parts, and 4-5 days light/moderate Nor'wester/thunderstorm may occur elsewhere in the country ○ May 01-02 moderate heat wave (38-40^{0}C)/severe heat wave (40-42^{0}C) may occur at the northern and central area, and 1-2 mild heat wave (36-38^{0}C) may occur elsewhere in the country ○ Agro-met forecast: Average evaporation at 4.25-5.25 mm/day and average sunshine 6.25- 7.25 hrs/day ○ River situation: River condition may be normal, but flood may occur at the second half of the month	○ Overall, about 4% above normal rainfall recorded over the country, except in Barishal and Dhaka region ○ Mild heat wave swept over Rajshahi and Khulna regions on the 2nd and 3rd week of May ○ Highest temperature of 37.8°C was recorded at Jessore (09 & 15 May) ○ Temperature, Norwester, rainfall, and river condition were consistent with the forecast
June 2011 ○ The monsoon may extend all over the country from 10 June ○ 1-2 monsoon depressions may form in the Bay of Bengal ○ Normal rainfall may occur ○ Agro-met forecast: Average evaporation at 3.75-4.75 mm/day and average sunshine 4.00-5.00 hrs/day ○ River situation: sudden flood may occur due to heavy rainfall; flash flood may occur at eastern and north-eastern parts	○ Low pressure formed in the Bay of Bengal, and developed into a coastal depression on 16 June, which persisted for 2 days, with cyclonic wind flow over the coastal and neighboring areas ○ Above normal rainfall was recorded at Dhaka, Khulna, and Chittagong regions; normal rainfall occurred in Sylhet and Rajshahi; below normal rainfall occurred in Rangpu and Barishal. Overall, rainfall was 10.1% above normal. ○ Temperature, Norwester, rainfall, and river condition were consistent with the forecast
July 2011 ○ 1-2 monsoon depressions may form in the Bay of Bengal ○ Normal rainfall may occur; above normal rainfall may occur in the upper catchment region of Ganges, Bramaputra, and Megna basins ○ Agro-met forecast: Average evaporation at 3.00-4.00	○ One depression was formed in the bay of Bengal in the first week of the month ○ Below normal rainfall recorded all over the country ○ Temperature, Norwester, rainfall and river condition were consistent with the forecast

Forecast	Observed
mm/day and average sunshine at 3.00-4.50 hrs/day ○ River situation: normal flood may occur in the north-eastern and central parts of the country	
August 2011 ○ 3 monsoon depressions may form in the Bay of Bengal ○ Normal rainfall may occur ○ Agro-met forecast: Average evaporation at 3.00-4.00 mm/day; average sunshine 3.00-4.50 hrs/day ○ River situation: Normal flood may occur in the north-eastern and central parts of the country	○ No coastal depression formed in the bay of Bengal ○ Rainfall was about 55% above normal due to the active monsoon flow ○ Temperature, Nor'wester, no. of rainy days, and river condition were consistent with the forecast
September 2011 ○ 1-2 monsoon depressions may form in the Bay of Bengal ○ Normal rainfall may occur in the southern area; but below normal rainfall may occur in the northern and central areas ○ Agro-met forecast: Average evaporation at 3.50-4.50 mm/day; average sunshine 4.75-5.75 hrs/day ○ River situation: Situation in flood-affected areas may improve within September; other areas may not be affected by flood	○ No depression formed ○ Rainfall was about 12 % above normal ○ Temperature, Nor'wester, rainfall, and river condition were consistent with the forecast
October 2011 ○ Normal Rainfall may occur over the country ○ 2-3 monsoon depressions may form in the Bay of Bengal ○ Southwest monsoon (rainy season) may withdraw from the country within 1st half of October ○ Day and night temperatures may decrease gradually ○ Agro-met forecast: Average evaporation at 3.25-3.75 mm/day; average sunshine 6.25- 7.25 hrs/day ○ River situation: Normal	○ Rainfall was 56% below normal ○ 2 monsoon lows developed in the Bay of Bengal; one was formed on 6th October and became inactive on 10th October in the sea; the other was formed on 16th October and developed into a severe depression and crossed the Myanmar-Cox's Bazaar area on 19th October ○ Rainfall days, temperature, and river condition were consistent with the forecast
November 2011 ○ Above normal Rainfall may occur over the country ○ 1-2 monsoon depressions may form in the Bay of Bengal; 1 of these may develop into a cyclone ○ Night temperature may decrease gradually ○ Agro-met forecast: Average evaporation at 2.75-3.75 mm/day; average sunshine 7.00-8.00 hrs./day ○ River situation: Normal	○ Rainfall was 98% above normal ○ No depression found in the Bay of Bengal region ○ Rainfall days, temperature, and river condition were consistent with the forecast
December 2011 ○ Overall, normal rainfall may occur over the country ○ Night temperature may decrease gradually ○ After the second half of December, 1-2 mild (8-10^{0}C)/ moderate (6-8^{0}C) cold wave may sweep in the Nothern, North-East areas ○ Agro-met forecast: Average evaporation at 2.00-2.50 mm/day; average sunshine 6.75-7.75 hrs./day ○ River situation: Normal	○ Rainfall was 89% above normal ○ No depression was found in the Bay of Bengal region ○ Rainfall days, temperature, and river condition were consistent with the forecast