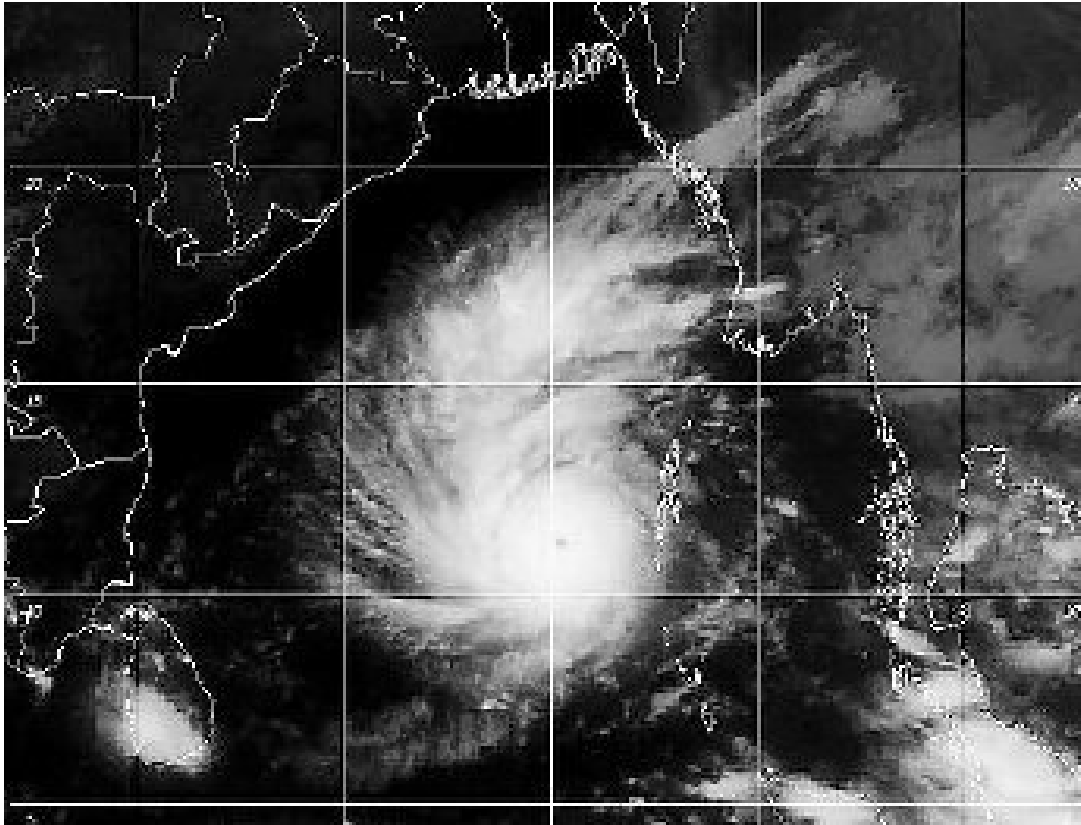


# Cyclone SIDR over Bangladesh Mid November 2007



# Country Report: Bangladesh - GEOSS/AWCI “Demonstration Project”

Md. Abdul Quadir, MoD, Bangladesh  
Dr. Bilqis Amin Hoque, EPRC  
Md. Abdul Mannan, BMD

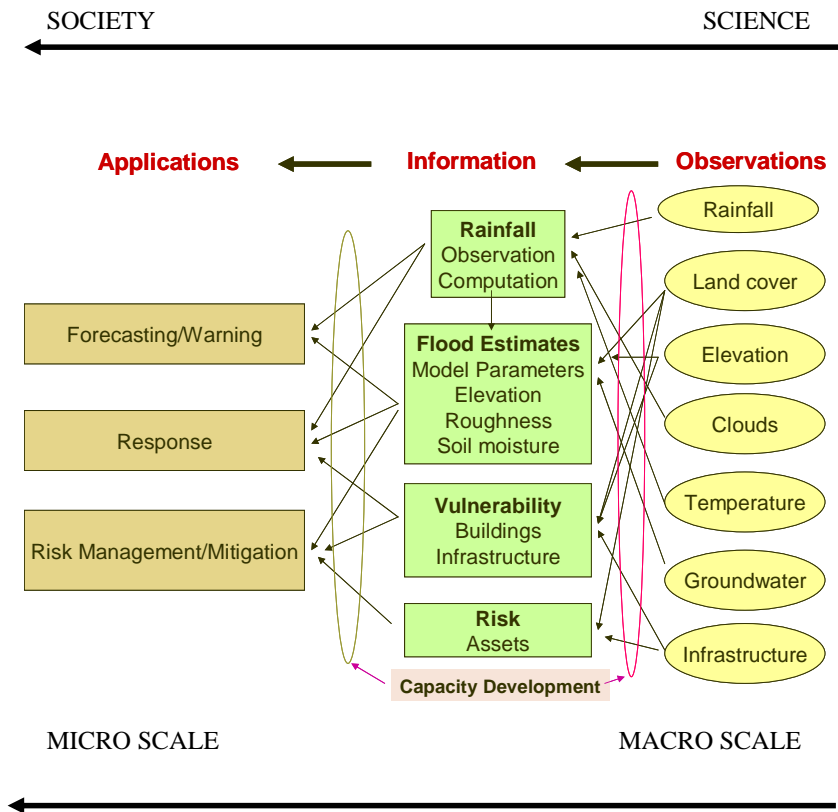
Md. Mafizur Rahman, *Ph.D.*, (Presenter)  
Professor, Dept. of Civil Engg.  
Bangladesh Univ. of Engg. & Tech. (BUET)

The 3<sup>rd</sup> ASIAN WATER CYCLE Symposium  
2-4 December, 2007  
Beppu City, Oita Prefecture, Japan

## Strategic Plan for Bangladesh Reference to GEOSS/AWCI

### Introduction

- The Global Earth Observation System for Systems (GEOSS) is an umbrella project including about 60 countries and 40 international organizations.
- Ministry of Defence, Government of the People’s Republic of Bangladesh has taken the initiative to be the GEO member of Bangladesh.
- Now Bangladesh is one of the GEO member countries.
- In this respect a strategic plan is required to communicate with GEO, local government, make plan, prepare funding, communicate with international organizations, and nominate representative for GEOSS meetings.
- Asian Water Cycle Initiatives (AWCI) is the forum to develop regional cooperation in solving water related problems. Because GEOSS/AWCI will cover different branches of hydro-meteorological phenomena and sectors of social benefit of the country.
- Therefore, BANGLADESH-GEOSS/AWCI is expected target involvement of different disciplines like Climate sector, Agriculture sector, Food & Disaster sector, Health sector and Water resources sector.



- All the top priority sectors in the country are inter-related and in getting benefit from all of them a common national committee is formed.

- The national committee will ask the member in the respective sector to prepare work plan and working group including the specialist in their branches.

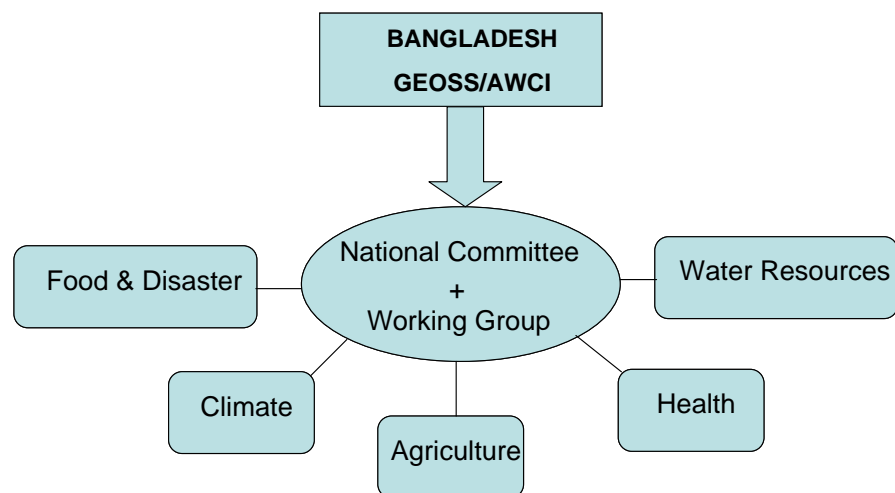


Fig. 1. Top priority sectors in the country for GEOSS/AWCI project in Bangladesh.

## The national committee for GEOSS/AWCI in Bangladesh

<b>1</b>	<b>Mr. Kamrul Hasan, Secretary, Ministry of Defence (MOD), Government of the People's Republic of Bangladesh, Dhaka</b>	<b>Chairman</b>
<b>2</b>	<b>Brigadier General Shah Md. Sultan Uddin Iqbal, BIRPROTIK, Joint Secretary, Ministry of Defence, Government of the People's Republic of Bangladesh, Dhaka (Md. Abdul Quadir, Representative)</b>	<b>Co-Chairman</b>
<b>3</b>	<b>Mr. Md. Nazmul Huda Khan, ndc., Chairman, SPARRSO, Government of the People's Republic of Bangladesh, Dhaka</b>	<b>Member</b>
<b>4</b>	<b>Dr. Md. Shahjahan Biswas, Director General, Health Services, Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh, Dhaka</b>	<b>Member</b>
<b>5</b>	<b>Dr. Samarendra Karmakar, Director (Current Charge), Bangladesh Meteorological Department, Government of the People's Republic of Bangladesh, Dhaka</b>	<b>Member-Secretary</b>
<b>6</b>	<b>Dr. Md. Nazrul Islam, Associate Professor, Department of Physics, Bangladesh University of Engineering and Technology (BUET)</b>	<b>Member</b>

<b>7</b>	<b>Dr. Md. Mafizur Rahman, Professor, Department of Civil Engineering, Bangladesh University of Engineering and Technology (BUET)</b>	<b>Member</b>
<b>8</b>	<b>Dr. Bilqis Amin Hoque, Executive Director &amp; Head of Research, Environment &amp; Population Research Centre (EPRC)</b>	<b>Member</b>
<b>9</b>	<b>Dr. Wais Kabir, Director, SAARC Agricultural Centre (SAC), Bangladesh, Dhaka</b>	<b>Member</b>
<b>10</b>	<b>Mr. Md. Sazedul Karim Chowdhury, Superintendent Engineer/Director, Processing and Flood Forecasting Circle, Bangladesh Water Development Board (BWDB), Ministry of Water Resources, Government of the People's Republic of Bangladesh, Dhaka</b>	<b>Member</b>
<b>11</b>	<b>Mr. Md. Abu Sadeque, PEg., Director (Admin), Bangladesh Disaster Management Bureau (DMB), Ministry of Food and Disaster Management, Government of the People's Republic of Bangladesh, Dhaka</b>	<b>Member</b>
<b>12</b>	<b>Mr. Sardar M. Shah-Newaz, Principal Specialist, Irrigation Management Division, Institute of Water Modeling (IWM), New DOHS, Mohakhali, Dhaka.</b>	<b>Member</b>

*Title: "To develop a hydro-meteorological prediction system for flood monitoring and forecasting in the Meghna river basin in Bangladesh".*

**Component Project: GEOSS/AWCI in Bangladesh (GEOSS/AWCI-BD)**

## **Activities of GEOSS/AWCI - BD**

### **A. Group Members:**

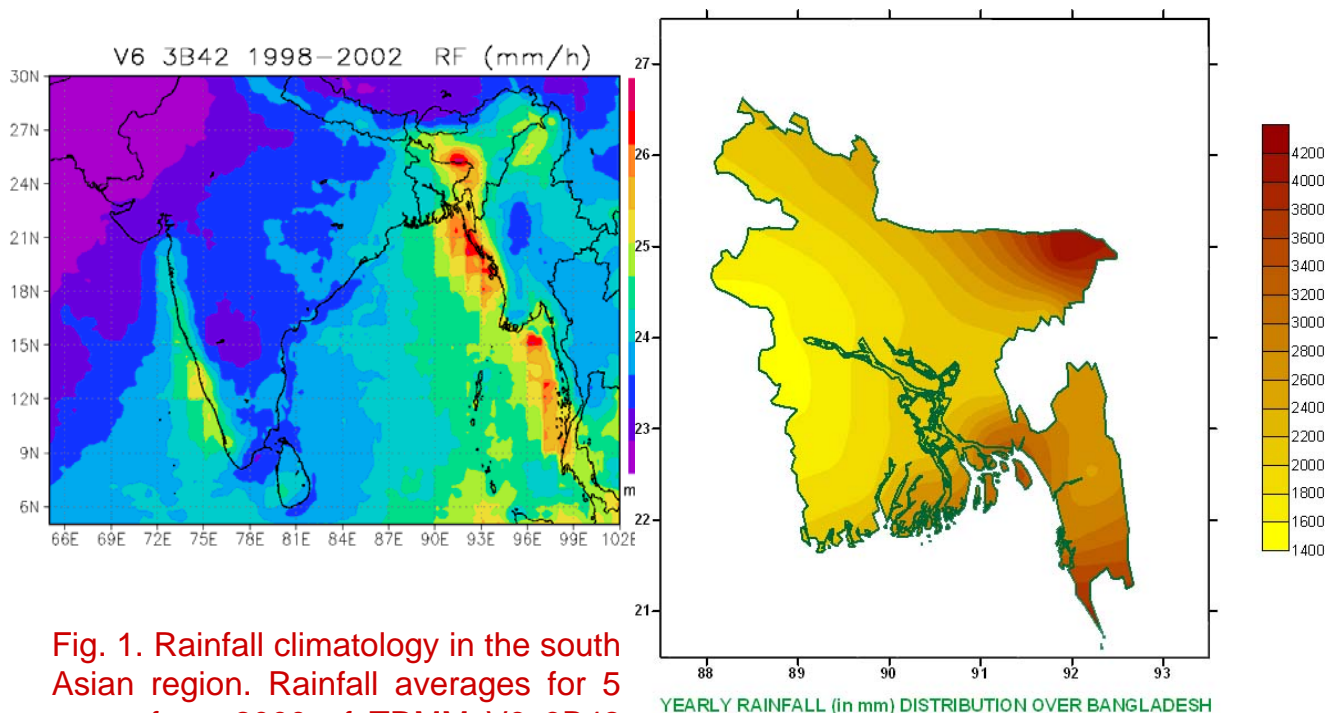
- i) Dr. Md. Nazrul Islam, Associate Professor, Department of Physics, BUET
- ii) Dr. Md. Mafizur Rahman, Professor, Department of Civil Engineering, BUET
- iii) Dr. A. K. M. Saiful Islam, Assistant Professor, IWFM, BUET
- iv) Md. Abdul Mannan, Meteorologist, BMD
- v) Md. Quamrul Hasan, Assistant Meteorologist, BMD
- vi) Md. A. K. M. Zeaul Hoque, Senior Specialist, IWM

### **B. Working Activities:**

- a) Rain-gauges data collection
- b) Radar data collection
- c) Flood monitoring
- d) Flood forecasting
- e) Feasibility study

## Introduction

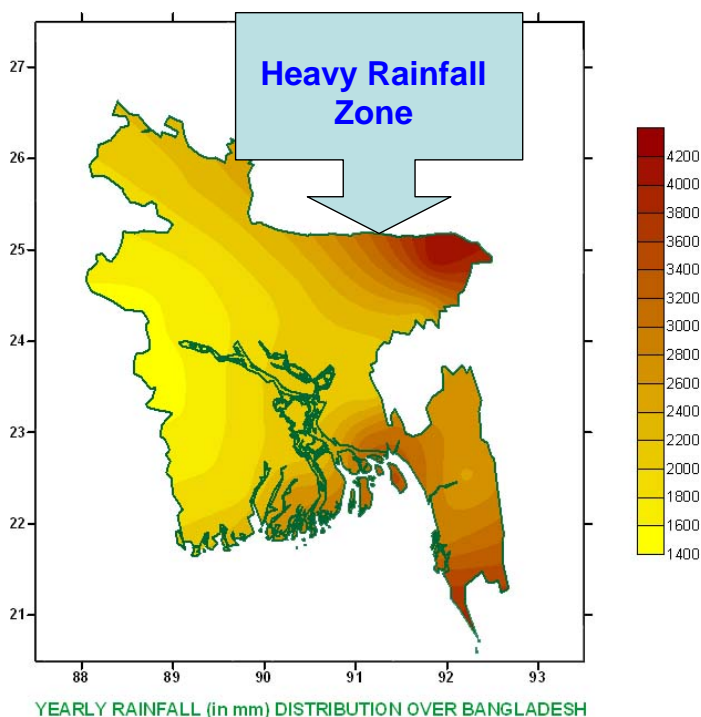
Bangladesh is one of the heavy rainfall countries (Fig. 1). So, intensive sounding and multiple Radar/Doppler radar observations in order to understand the structure of mesoscale convective systems (MCSs) are necessary. Additionally, there have been very less statistic studies on the MCSs. Some statistical analyses of the structure, duration time, top height, and diurnal variation of the MCSs in Bangladesh by using the observation results are also expected through GEOSS/AWCI.



❑ Not only that, Sylhet region gets heavy rain within a short span of time, which caused flash flood during the pre-monsoon and southwest monsoon seasons.

❑ Upper air observations (Rawinsonde Observations) are carrying out in MAHASRI Project during the pre-monsoon and southwest monsoon seasons in Bangladesh.

These data will be very useful for the study of different hazardous weather events of this region.



## Improve Weather Forecasting

Once the estimation of rainfall using satellite and model data in the upper catchments (**GMB basins of Fig. 2**) is done for real time, the information may be used for the flood monitoring and forecasting purposes. It may also be useful in weather forecasting of the country.

# GANGES BRAHMAPUTRA MEGHNA BASINS

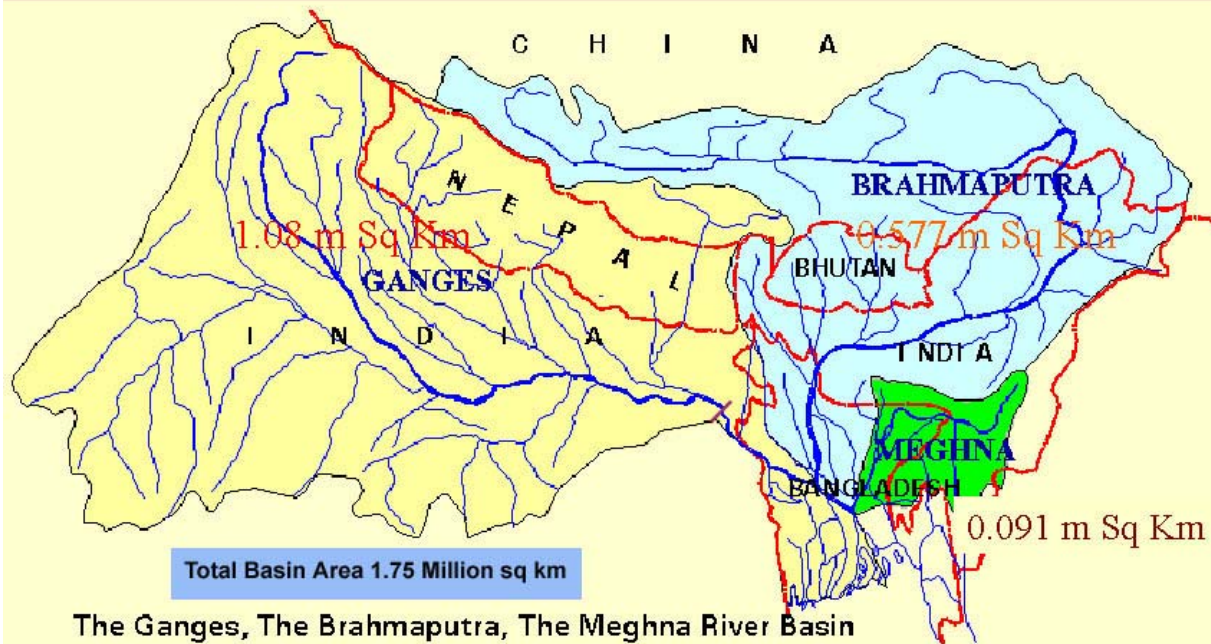


Fig. 2. The GBM (Ganges Brahmaputra and Meghna) basins.

## General Information of Meghna Basin

### A. Boundary Extent

Extent, Total (India + Bangladesh) ,

Min Longitude:  $90^{\circ} 30'$ , Latitude :  $23^{\circ} 10'$

Max Longitude:  $94^{\circ} 25'$ , Latitude :  $25^{\circ} 40'$

Extent, Bangladesh Part

Min Longitude:  $90^{\circ} 30'$  Latitude :  $23^{\circ} 15'$

Max Longitude:  $92^{\circ} 32'$  Latitude :  $25^{\circ} 15'$

Basin Outlet Chandpur (close to District town)

Longitude:  $90^{\circ} 40'$  Latitude :  $23^{\circ} 10'$

### B. Basin Area

Total (India + Bangladesh) : 61,021 Km<sup>2</sup>

Bangladesh Part : 20,530 Km<sup>2</sup>



# Flood monitoring and forecasting in Meghna Basin of Bangladesh

Country: Bangladesh

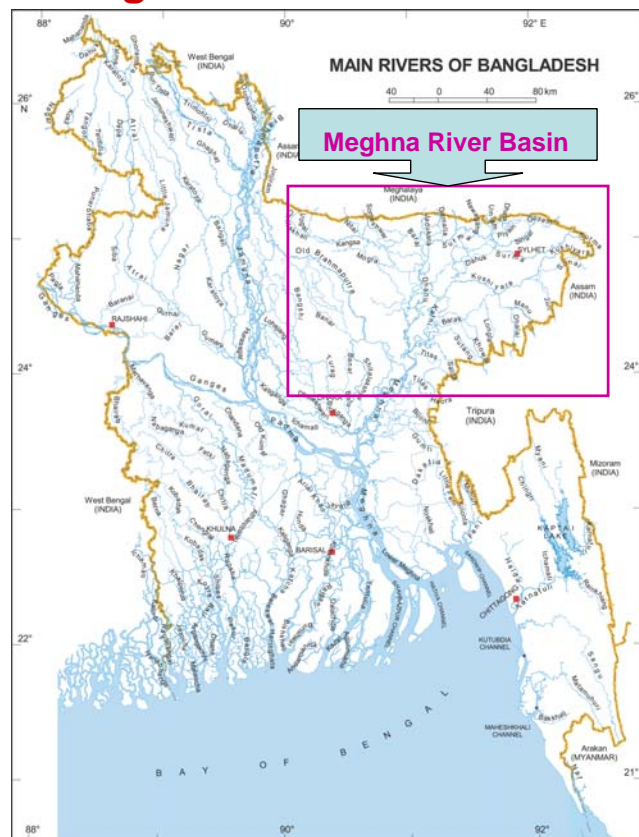
River basin name: Meghna

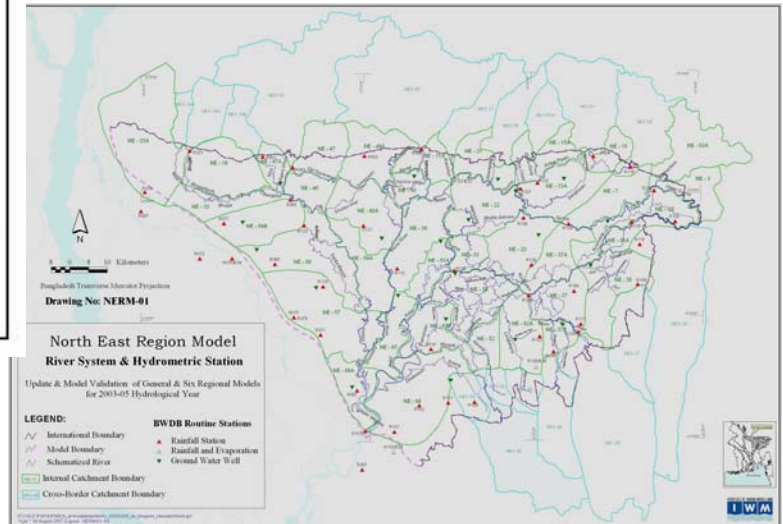
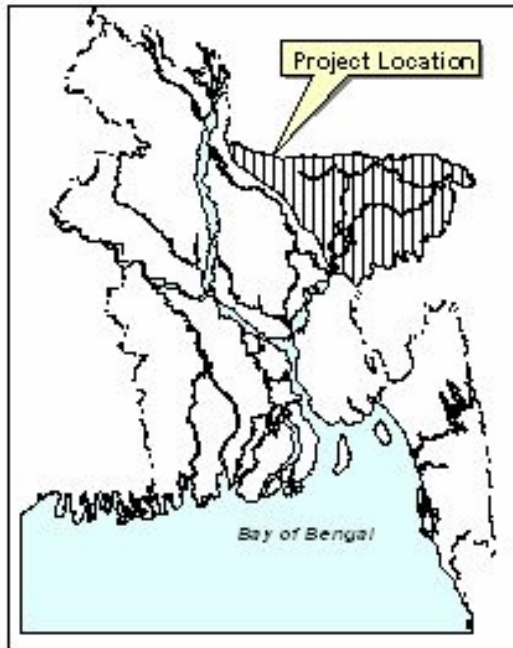
Basin Area: 20530 km<sup>2</sup> inside Bangladesh out of 61021 km<sup>2</sup> including India

1. Background, targeted issues and objectives Natural disasters like flood and drought occurs almost every years in Bangladesh.
  - Employment of satellite data to estimate rainfall for a wide area is important for monitoring flood and drought situations.
  - The Geostationary Meteorological Satellite (GMS, currently MTSAT) datasets can play an important role in providing rainfall information for Bangladesh especially in Meghna basin where shortage of observational data hampers proper monitoring of flood situation and utilization of forecasting techniques.
  - The Meghna basin is proposed for pilot study of flood forecasting using a Hydrological model because in recent years (2004 and 2007) the occurrence of flood in this basin hampers the development of the country.
  - To drive the Hydrological model rainfall in the upper catchment is essential that can be obtained from GMS datasets.

## Reasons for selection of Meghna River Basin

- ❑ In Bangladesh there are about 230 rivers including 3 major rivers (Ganges, Brahmaputra and Meghna).
- ❑ Trans boundary rivers affect climatic conditions of the country.
- ❑ Earlier frequency of flood year was less but recently it is higher (1954, 1961, 1974, 1987, 1988, 1998, 2004 and 2007).
- ❑ Due to the establishment of certain infrastructural facilities such as digitized rain gauges, Doppler radar (with Japanese assistance)
- ❑ Discharge and water level data also available in this area.





Meghna River Basin, a closure view

## Models, GIS, Data Integration System, Prediction System

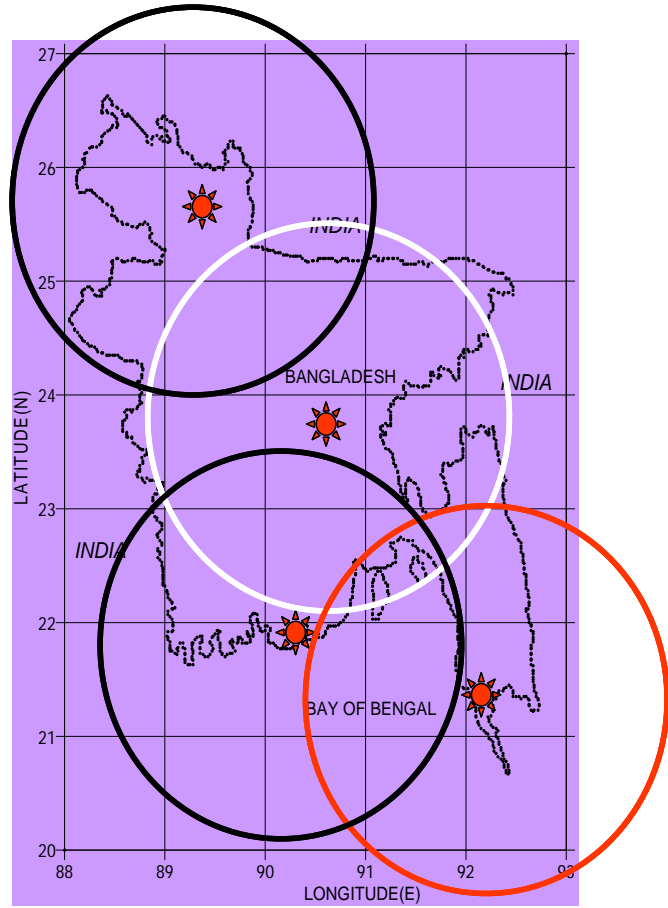
- **Convective Stratiform Technique (CST) method is to be used to estimate precipitation from Geostationary Meteorological Satellite (GMS, currently MTSAT) datasets.**
- **In CST algorithm the cloud coverage is converted into rainfall using the respective convective and stratiform rain rate.**
- **The rainfall calculated by CST will be calibrated with the rain-gauge (GR) rainfall obtained at different regions of Bangladesh**

- On an average over 12 stations, daily GR and CST calculated rainfall were 14 mm and 14.5 mm respectively.
- This indicates that **CST is more reliable method in calculating surface rain from satellite data.**
- **The similar technique will be applied for GMS real time data** in Meghna basin and its upper catchment areas.
- The output will be gridded in 0.1° meshes to use as the input of Hydrological modeling.
- **The model outputs will be analyzed for projecting inundation map and to provide the Government organization FFWC (flood forecasting and warning center) of the country in dissemination to the end users.**
- The employment of Regional Climate Models (RCMs) is also in consideration.

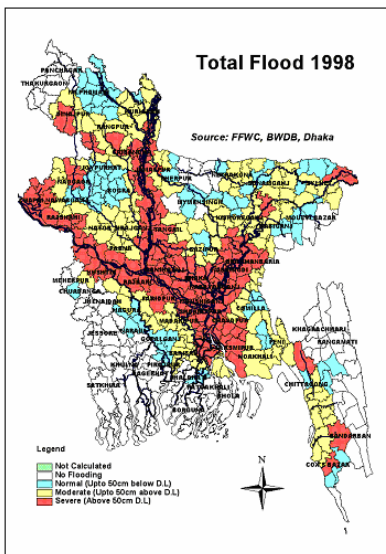
### **Available Infrastructure**

There are 4 radar systems of Bangladesh Meteorological Department existed in Bangladesh (Fig. 3). At present, 3 radars are in functioning and one more radar (in the southwestern side of the country) is committed to replace with Doppler one very soon. Beside of this radar network, one more new Doppler radar at the Meghna Basin is proposed and expected to be installed by the year 2008. At present, there are 34 First Class Observatory and 10 PBO (Pilot Balloon Observatory) exist in Bangladesh. There are more 11 new First Class Observatory proposed to set in different locations throughout the country.

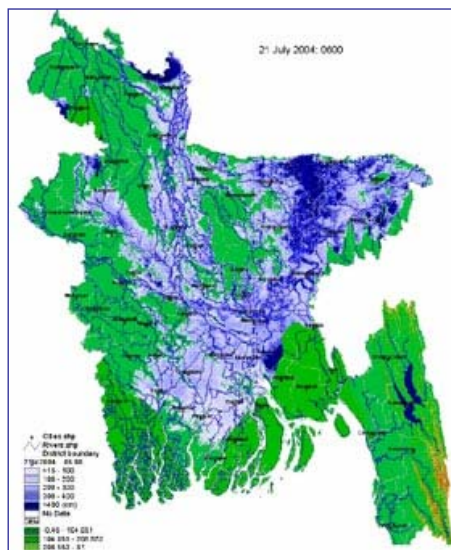
Fig. 3. Coverage of BMD radar systems.



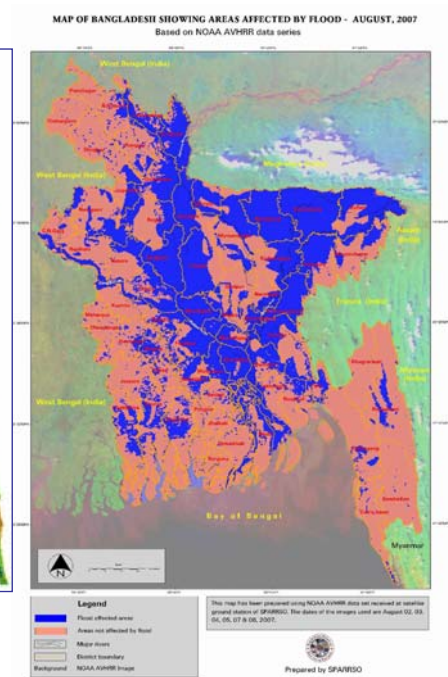
### Flood 2000



### Flood 2004



### Flood 2000



## Flood forecasting with local data input

- Flood inundation in the Meghna basin will be predicted with the help of a **Geomorphology based hydrological model**.
- Appropriate **spatial parameterization** scheme with the physically based description of the hydrological processes will be modeled.
- 50m resolution **DEM data** will be incorporated for the model. This will determine the runoff generation and the flow accumulation in the catchments. The parameters that will be determined with the input data are elevation & slope, river channel network and geomorphology properties.
- **Sub-basin delineation** will also be performed with the DEM data.
- Locally available **soil map** will be incorporated in the simulation model.

- Soil units, saturation hydraulic conductivity, saturation soil moisture will be items in the list of **soil data** that will be used in the simulation model.
- Digital **land use data** will be collected and will be utilized in the model.
- The land use data will be used to **determine the max. canopy storage, ,max. surface storage and vegetation coverage**.
- A thorough **field investigation** will be made in order to obtain vegetation indices data.
- The **maximum leaf area index** will be the parameter that will be used in the model.
- **Spatially distributed rainfall data** will be added as already mentioned.
- Data on the **river cross section** will be used in simulation of flood for specific seasons.
- River stream flow, as observed at different location by Bangladesh Water Development Board will be used to **validate the output of the model**.
- The **model parameters** will be calibrated based on the data of BWDB.
- **Finally the flood inundation map** of the basin area will be developed for the months of July, August and September based on the real data and some of the historic flood events.

## **MISSION AND VISION:**

- **The mission of this project is to facilitate hydro-meteorological aspect in Bangladesh both in observational and research activities for sectors of social benefit like Agriculture, Climate, Food and Disaster Management, Health and Water resources.**
- **Climate change and natural hazards do not maintain the political boundary of the country. Therefore, work with international community like GEOS/AWCI project is the better way in solving the climate and water related issues for Bangladesh.**
- **The GEOS/AWCI will provide benefit for the peoples around the world by improving our ability to monitor, understand, and predict changes to the Earth.**
- **The international cooperation along with the national development of new monitoring, assessing, and predicting environmental changes, will enable development of capabilities to predict drought and flood, prepare for weather emergencies and other natural hazards, plan and protect crops, manage coastal areas and fisheries, and monitor air and water quality and other socio-economic aspects of the country.**

## **LINKS TO INTERNATIONAL ACTIVITIES:**

- **Hydro-meteorological phenomena are not confined to the local geography. Sometimes there are long-term and large-scale events occurred.**
- **Therefore, only local information may not be enough to solve the hydro-meteorological problems. For example, flood is a very common natural disaster in Bangladesh and we know that about 93% of flood water comes from outside the country.**
- **Therefore, we need information from the upper catchment which is out of Bangladesh.**
- **So, cooperation with international community through this project will help in getting information from neighboring countries.**
- **Therefore, link-up with international community is one of the top priorities of the nation.**

## **WORK PLAN AND WORKING GROUP:**

**Climate sector:** The story of climate change is now not the imagination, it is the fact that global climate is changing and peoples have to be prepared themselves to protect from the impacts of climate change. Huge scope is there to develop climate related sectors in the country.

**Agriculture sector:** Respectable member in the national committee is requested to prepare the work plan and working group including specialists in this branch.

**Water resources sector:** Respectable member in the national committee is requested to prepare the work plan and working group including specialists in this branch.

**Food and Disaster Management sector:** Respectable member in the national committee is requested to prepare the work plan and working group including specialists in this branch.

**Public Health sector:** Respectable member in the national committee is requested to prepare the work plan and working group including specialists in this branch.

## **DATA COLLECTION:**

Data collection is the **pre-requisite** for the research in any field of interest. The **metadata will be collected** in each sector **and derived data will be the key resources** for other sectors, especially in the **application purposes**. Details of the data collection are to be cited in the work plan of each sector.

## **DATA MANAGEMENT:**

Data management is one of the important parts in the research and application community.

- **Data will be archived and stored in digital format as well as metadata (data of data) format.**
- **In the archive system data collected in the local observation and gathered from the international community will be there.**
- **These data will be within the browsing facilities with some terms and condition for the users defined the purposes where to be used.**
- **The archive will be maintained in data category, data quality check, data disciplinary and data gallery. This will enable the users to effectively locate data and information relevant to their needs.**

Main part of data management activity should be done by the **BANGLADESH GEOSS/AWCI data center** which is consisted of a data management core group and sub-groups for satellite, model data, etc. In addition, linkage with some international and regional centers and sub-centers should be established to share their work.

### **Data management group:**

- |    |   |                    |
|----|---|--------------------|
| 1. | <b>Dr. Md. Mafizur Rahman, Professor, Civil Engg. Dept., Bangladesh University of Engineering and Technology (BUET)</b> | <b>Team leader</b> |
| 2. | <b>Dr. A. K. M. Saiful Islam, Assistant Professor, IWFM, Bangladesh University of Engineering and Technology (BUET)</b> | <b>Member</b>      |
| 3. | <b>Md. Abdul Mannan, Meteorologist, Bangladesh Meteorological Department (BMD)</b>                                      | <b>Member</b>      |
| 4. | <b>Mr. Zakir Hossain, Institute of Water Management (IWM), New DOHS, Mohakhali, Dhaka</b>                               | <b>Member</b>      |



## Data management components:

### Data management of GEOS/AWCI will have the following components:

- 1) **Data control:** Target data includes observational (operational and experimental) and processed data. Quality control should be done as an obligation of data provider. Appropriate meta data should be provided with data.
- 2) **Data opening:** Data are provided fundamentally by on-line, sometimes with DVD/CD. All the data eventually will be opened to the international research community. Turn-around period for data release should be applied for experimental data.
- 3) **Data center:** Data center should operate data server and web pages for data dissemination.
- 4) **Other issues:** Assistance in data rescue work is also important as a part of data management activity.

## Specific Needs of Capacity Building

- **Real Time flood forecasting**  
Obtaining improved RS data (BMD),  
Integration of the real-time data for flood forecasting on a public domain software (BUET)
- **Development of Flood inundation scenarios**  
**Hazard mapping, Vulnerability assessment, Risk assessment** (BUET)  
Teaching manual
- **Data Management**  
Universal strategy for data management, archiving and retrieval

# Capacity Building Programs (CBP)

- **Rainfall Downscaling and Forecast (UNU)**
- **Data Integration Service (CEOP)**
- **Flood Hazard Map Training (ICHARM)**
- **Flood Simulation (UT)**

- **Roving seminar model -> Regional**  
**Three participants** (University Faculty, Implementing official, Policy maker)  
**External funding needed**

**More Emphasis is on the**

- **Case study modules (manuals):**  
**At least three** (University Faculty, Implementing official, Policy maker)  
**for period of three weeks**  
**External funding is required**
- **Web based learning :**  
**Approximately 10-15**  
**Facilities of high speed Internet communication**  
**Local funding can be provided**

### **Budget for GEOSS/AWCI-BD:**

- i) Rain-gauges maintenances and radar operation cost**
- ii) Powerful computers with printers- one for Monitoring and another for Forecasting**
- iii) Data storage devices**
- iv) Hydrological models-**
- v) Papers publication/presentation cost**
- vi) Miscellaneous**

### **CONCLUSIONS:**

- **The BANGLADESH GEOSS/AWCI will provide the nation with a unique platform to identify and solve the climate and water related problems.**
- **This Strategic Plan defines the purpose and vision of the priority sectors of the country.**
- **It outlines a practical approach with a societal benefits focus, identifying key issues in integration and governance.**
- **This plan highlights specific opportunities developed for near-term action by the participating organizations.**
- **An evolving system, taking into account emerging technologies and scientific advances in and around the country, is necessary to meet the changing needs of society.**
- **Implementing the BANGLADESH GEOSS/AWCI offers an exciting opportunity to make permanent improvements in local capacity to deliver specific benefits to our people and our economy.**



Shock of Destruction and Thoughts for future