

United Nations/Germany Expert Meeting on the Use of
Space Technologies for Flood and Drought Risk Reduction;
5-6 June 2014, UN Campus, Bonn, Germany

Preparedness strategies, local administration and the role of space-based data in reduction of flood risk in Bangladesh.

AKM Monowar Hossain AKHAND
Joint Secretary, Ministry of Public Administration, Bangladesh.
Email: makhand14@yahoo.com

Floods in Bangladesh

- Unusual water flow above normal surface
 - inundate high lands/grounds/flood plains
 - water - exceeds the river carrying capacity
 - big problem, hazard, affects urban-rural areas
 - affects all most every year
 - starts normally July, and ends August
- some times starts earlier, stayed longer
e.g. 1998 July-September
- total rivers- 300, originated outside- 93 %, inside-7 %
 - Main: Ganges-Padma, Brahmaputra-Jamuna,
 - Tista- Brahmaputra-Jamuna,
 - Meghna, Surma-Kushiyara, Karnafuli

Flood- local name

- **Borsha** - annual flood, *flood* due to heavy rainfall, normal river water over flow, growth of delta and economy
- **Bonna** - low frequency but high magnitude, sudden river over flow, flash water from outside the country, damaging / destructive to lives-properties house-field-road, inundated, disrupt people become homeless.
(i.e. 1974, 1984, 1988, 1998)
- **Baan** - flash water, over flow, storm/tidal surge damage embankment, houses, properties, agricultural products. (1991, 2007)

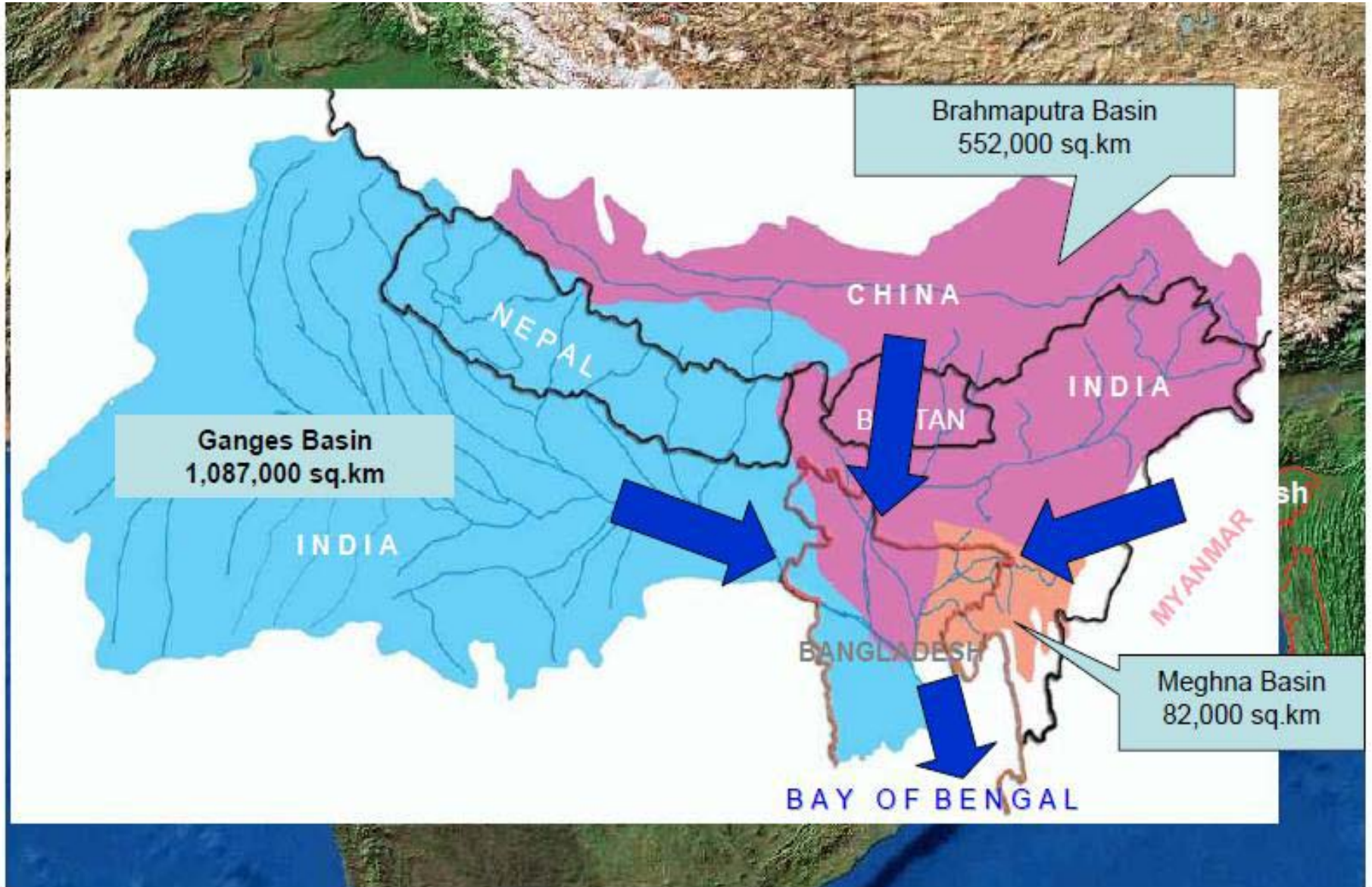
Flood Photographs-1



River basin flow

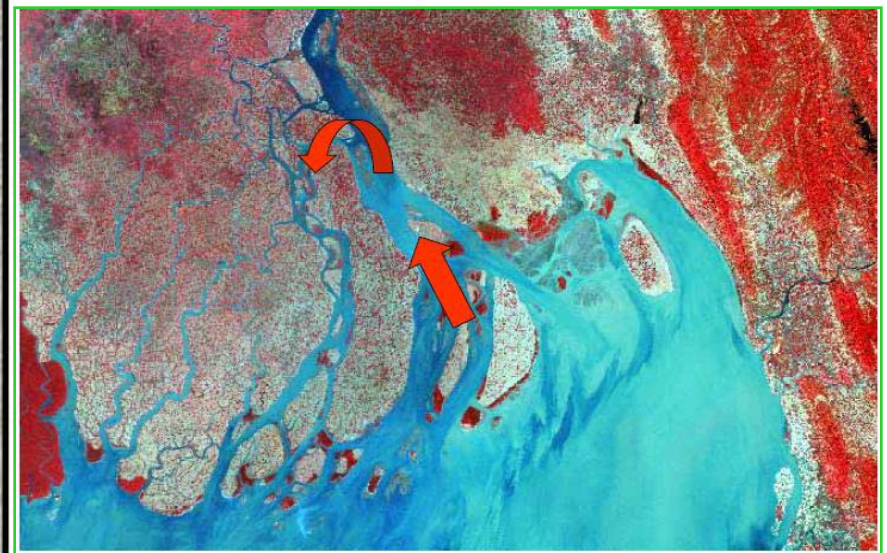
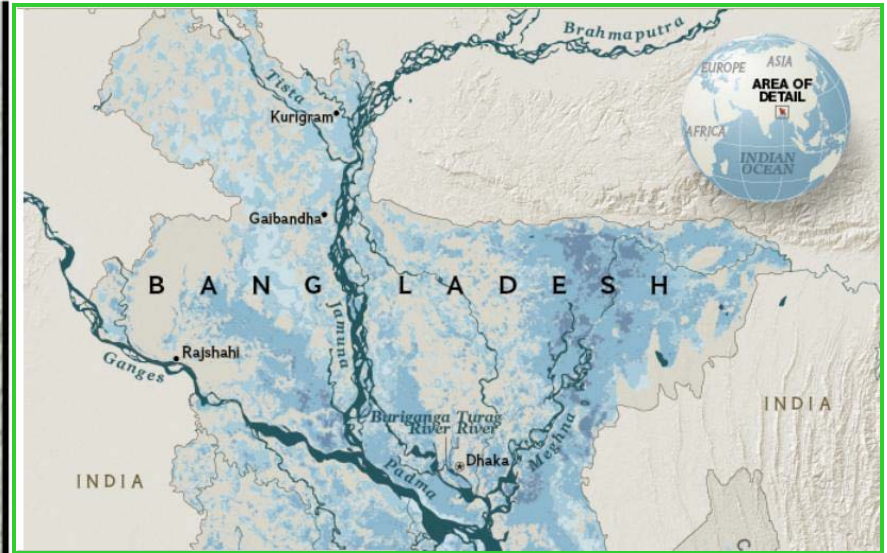
River	<u>Ganges- Padma</u>	<u>Brahmaputra- Jamuna</u>	<u>Meghna</u>
Distributaries	<u>Mahananda, Punarbhaba, Atrai, Karatowa</u>	<u>Brahmaputra</u>	<u>Surma- Kushiyara join Meghna mouth</u>
Origin	<u>Himalayas (India)</u>	<u>Himalayas (China-Tibet)</u>	<u>Asam (India)</u>
Annual discharge	393,000 cusec	678,000 cusec	124,000 cusec
Flood Overflow	2,000,000 cusec		+ 2,600,000 cusec + 300,000 cusec
Total flow to Bay of Bengal = 4,900,000 cusec			

River Basin flow map



Bangladesh flood risk map

Bangladesh Flood Risk Map

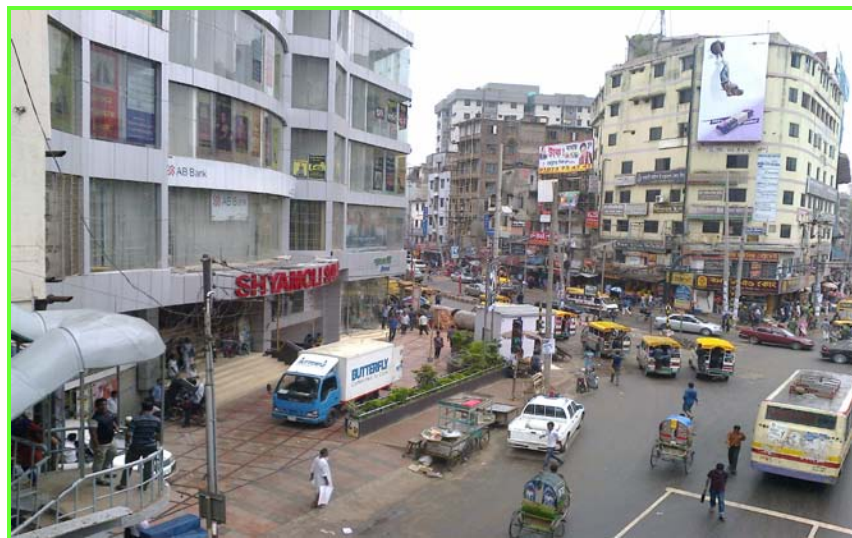


Flood Impact

- **Damages** - people die / missing, floated away, damages agri products, fields, houses
- **Destroy** - communication, road, embankments
- **Displacements** - people become homeless, migrated
- **Crisis** - evacuated, security hazard, drinking water, fresh water (for daily consumptions) water polluted (linked with sewerage line, drains, open place, mixed dirty materials)
- **Losses** - economic activities, trading, transport

(losses aprox 3 billion US\$ for preparedness, and recovery activities, ref: Dr SI Khan, “Utilization and sharing of international rivers: Bangladesh-India perspective”, 18 May, 2014, Dhaka.)

Flood Photographs-2



Causes of Flood-1

- **Heavy rainfall during monsoon, unstable, variation, flood peaks of major rivers, flash water - outside rivers**
- **Sea level rises, subsidence**
- **Uneven sediment accumulations, silting on flood plains**
- **Sediment load 1.6 billion tons/year**
before Farakka barrage - 2.4 billion tons/year,
sediments falls in flood plains 10-15 %,
Sub-marine Canyon 80-85%, 30% in the coast @ 30%,
predicted sea level rise 1 cm/year
- **Climate change (weather variation, unstable, temp rises)**
- **Inadequate river training/dredging**
- **Damming/ barrage of rivers**
(outside the country, sudden open the gate and again closed)
- **Soil erosion, and change of river direction**

Causes of Flood-2

- **Blockage of drainage system, sewerage line, rivers/channels, irregular settlements/ constructions.**
- **Deforestation in upstream region**
- **Population growth (1951- 44 million, 1971- 75 million, 1989 - 110 million, 2009 - 120 million, 2014 - 160 million)**
- **Tectonic activities /movements/ earthquake:**
 - **plate upliftment, land subsidence, sudden water flow**
 - **Bangladesh lies on Indian Lithospheric Plate which pushing against Asian Plate, growth of Himalayas,**
 - **Old Brahmaputra river changed directions due to earthquake in 1857, madhupur tract, barind tract, subsidence-Sylhet hour, chalan bill, 1988 and 1991 flood caused by earthquake.**

Impact on Farakka / Tista barrage:

- **decreases of water flow and water level,**
- **if decrease more 5 meter water level,
saline water goes up to Sylhet district**
- **16 districts both sides of Meghna river
already started desertification
60% land will suffer in desert**

Decreases of river route and passengers

Year	River Route (distance)	Passenger	Transport materials
1971	24,000 km	32 %	40 %
1984	8,400 km	18 %	27 %
2005	6,000 km	04 %	15 %
2012	2,500 km	03 %	10 %
Total decrease (1971 – 2012)	21, 000 km	29 %	30 %

(Source: Dr. SI Khan, Ex UN Environment and Water Expert, Lecture on "Utilization and sharing of international rivers: Bangladesh-India perspective", 18 May, 2014, Hotel Purbani, Dhaka.)

Adaptation Strategies – preparedness-1

- **Govt is alert to face the flood risk**
- **Given priority the flood issue- management**
- **Taken mitigation program:**
 - **evacuation centre, emergency relief, medical facilities**
 - **rehabilitation, special fund for farmers**
 - **safe drinking water / fresh water**
 - **linked with sewerage line, develop drainage systems**
- **Taken awareness programme**
 - **alert vulnerable people**
 - **issue special bulletin, early warning, flood forecast**
 - **Flood Forecast and Warning Centre issue warning message from July 2011 through mobile phone to alert vulnerable people**

Adaptation Strategies – preparedness-2

- **Standing Orders on Disaster Management (SOD 2008, updated 2010)**
perform duties, responsibilities at administrative level
- **National Adaptation Program of Actions (2005)**
- **Bangladesh Climate Change Strategy and Action Plan (2008, updated 2009)**
 - under the recommendations of Bali Plans, Dec 2007, UNFCCC
- **the strategy will be achieved through 6 pillars:**
 - (i) food security, social protections, (ii) disaster management, (iii) infra structure development, (iv) knowledge management, (v) mitigation and low-carbon development, (vi) institutional development.

Adaptation Strategies-structural preparedness-3

- **Construction of embankments,**
 - **flood evacuation centre / shelter (560)**
 - **Dhaka-Narayangonj Dam**
 - **Dhaka boundary embankments**
- **UNDP-GOB flood Control Mega Project**
 - **embankments, drains, link road, deep tubewell**
- **Constructions of reservoirs, sluice gate, roads, river training, dredging, re-excavation of rivers**

Organizational preparedness- *local administration* developing lifelines facilities

- **Depute Civil officers/ special team, in affected areas-MOPA**
 - local administration is responsible for coordinating the risk
 - prompt participation- follow SOD
- **Water Development Board- implementing Flood Action Plans with 26 components**
- **City Corporations (6 divisions) / District Council (64)**
- **Urban Development Authority (RAJUK)**
- **Barind Tract Development Authority**
- **Bangladesh Red-Crescent Society/ Fire Service**
 - volunteers- the front line warning and rescue members
- **Bangladesh Space Research and Remote Sensing Organizations**
- **Bangladesh Meteorological Department.**
- **Flood Forecasting and Warning Centre**

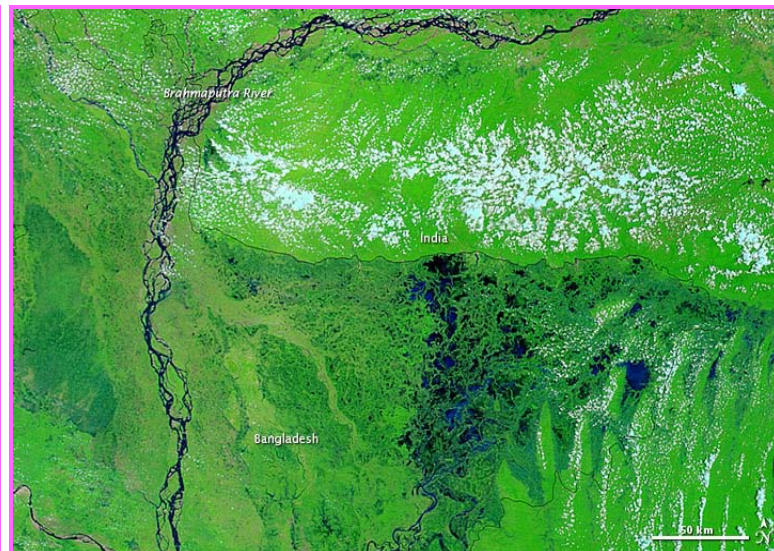
Use of Space-based / Satellite Data

- **After 1988 flood, Bangladesh has given emphasis on space-based data, mostly satellite images, reports.**
- **Bangladesh Space Research and Remote Sensing Organizations**
 - **connects with international space stations**
 - **collect satellite images, weather data, reports, temperature, air mass, cloud, rainfall, and analysis,**
- **water flow detection and forecast -24-48-72 hours**
- **Issue early warning, weather forecast,**
- **Flood Forecasting and Warning Centre**
 - **using satellite data, alert the flood situation, flow movements, by 52 monitoring points, only non-structural measures, flood watch, MIKE II hydrodynamic model + real time forecasting, using GIS**
- **Bangladesh Meteorological Department**
 - **issue weather bulletin/early warning based on satellite data.**
 - **visual interpretation of images for accurate monitoring**

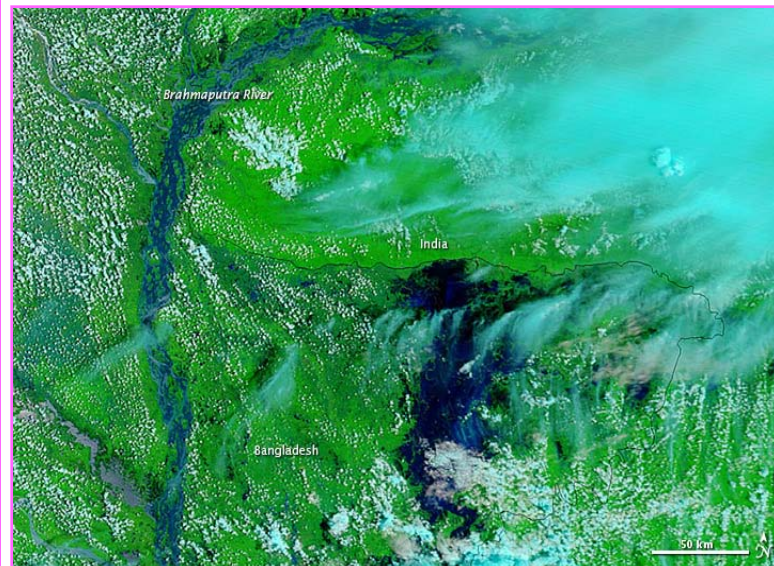
Flood detection using satellite image



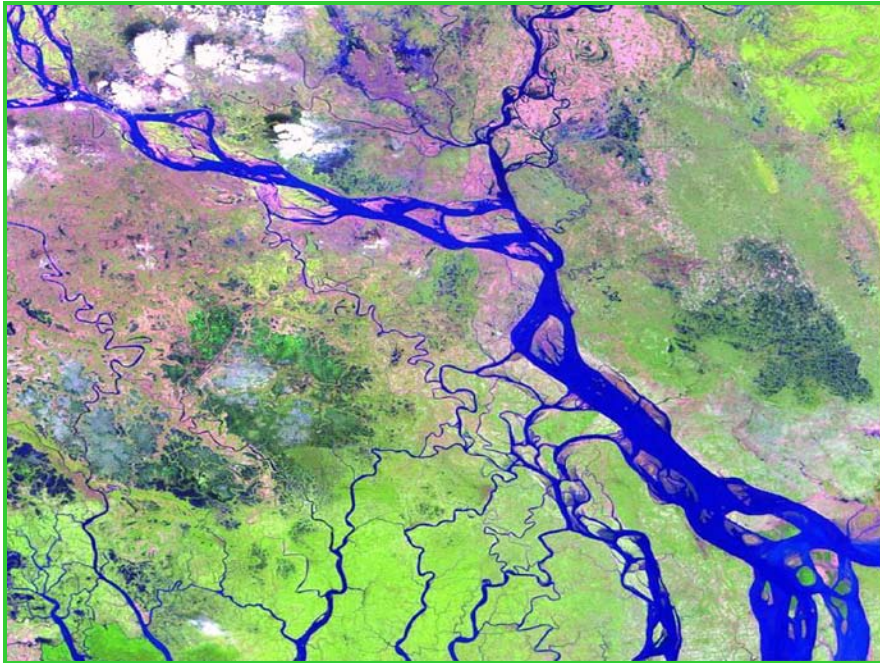
October 12, 2005



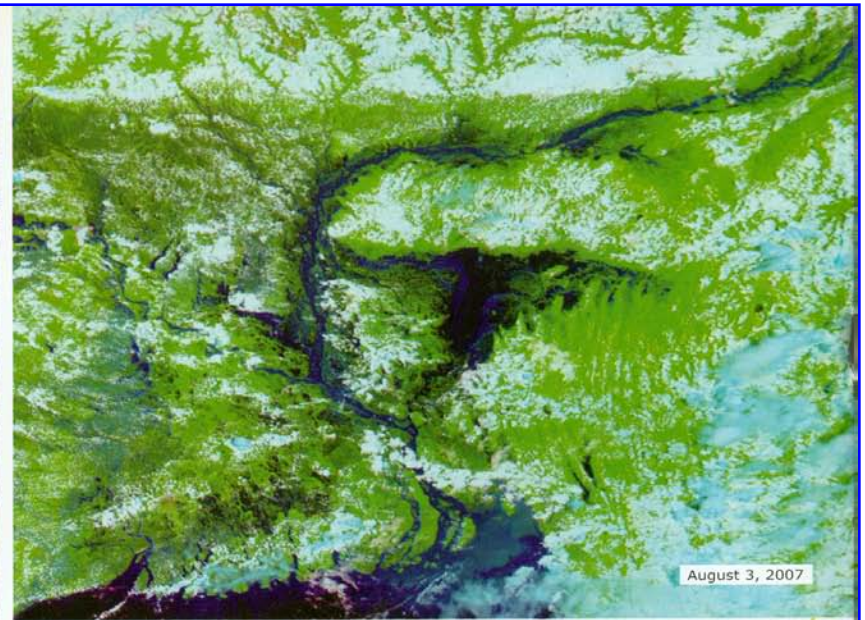
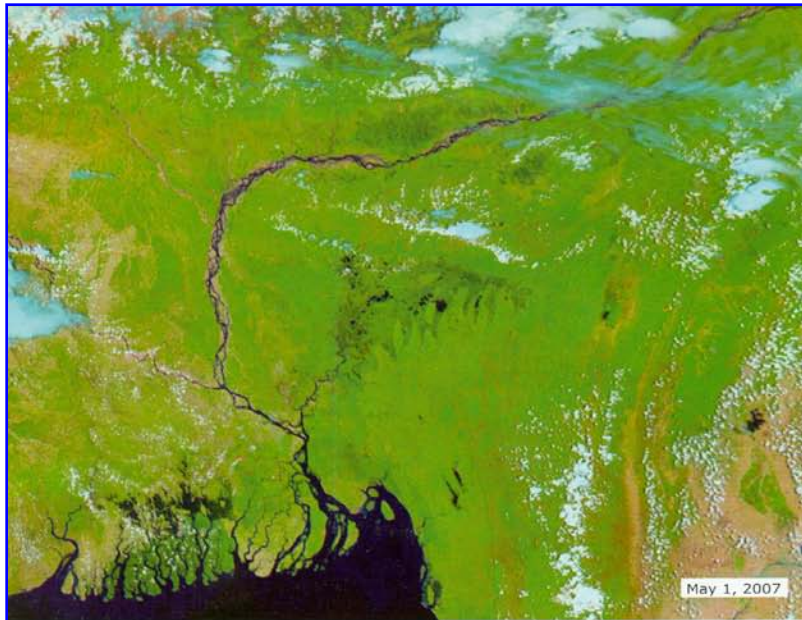
September 19, 2005



Use of satellite images in detection of flood



Use of satellite images in detection of flood



Floods maroon millions in Bangladesh

A large part of Bangladesh is an alluvial delta and therefore is extremely prone to flooding. In 2007, the monsoon in the upstream basin was particularly heavy, leading to a series of floods. Scientists have predicted more severe, extreme and recurring floods for the region which includes Bangladesh in the coming decades. This is alarming for a country already vulnerable due to population density, agriculture dependent livelihoods and human settlements along its coast and mighty rivers.

India's Brahmaputra river was already flooded in early August (top right image), but those floods turned out to be small compared to the floods that hit the river in early September (bottom image). The river flooded for the third time in 2007 when monsoon rain pounded northeastern India, Bhutan, and Bangladesh in early September. As these images illustrate, the September floods were the worst of the year, forcing 500,000 people to be evacuated in Bangladesh. The floods damaged crops that had been replanted after the August floods.

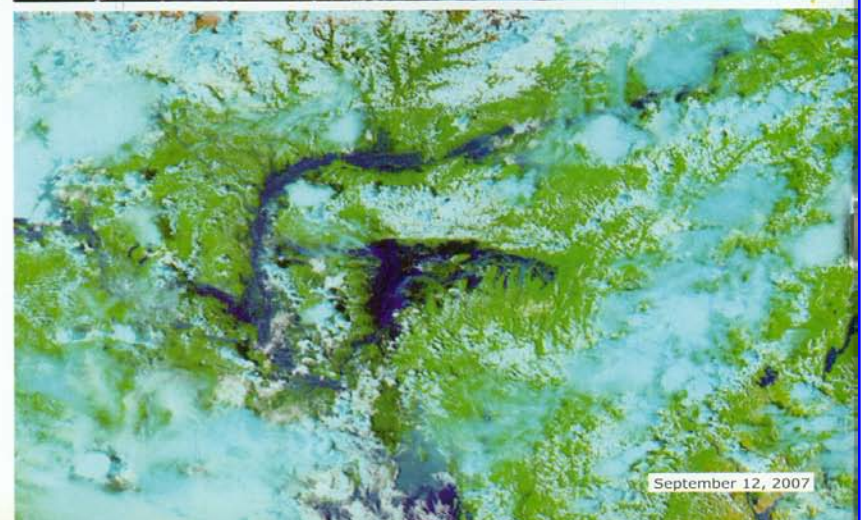
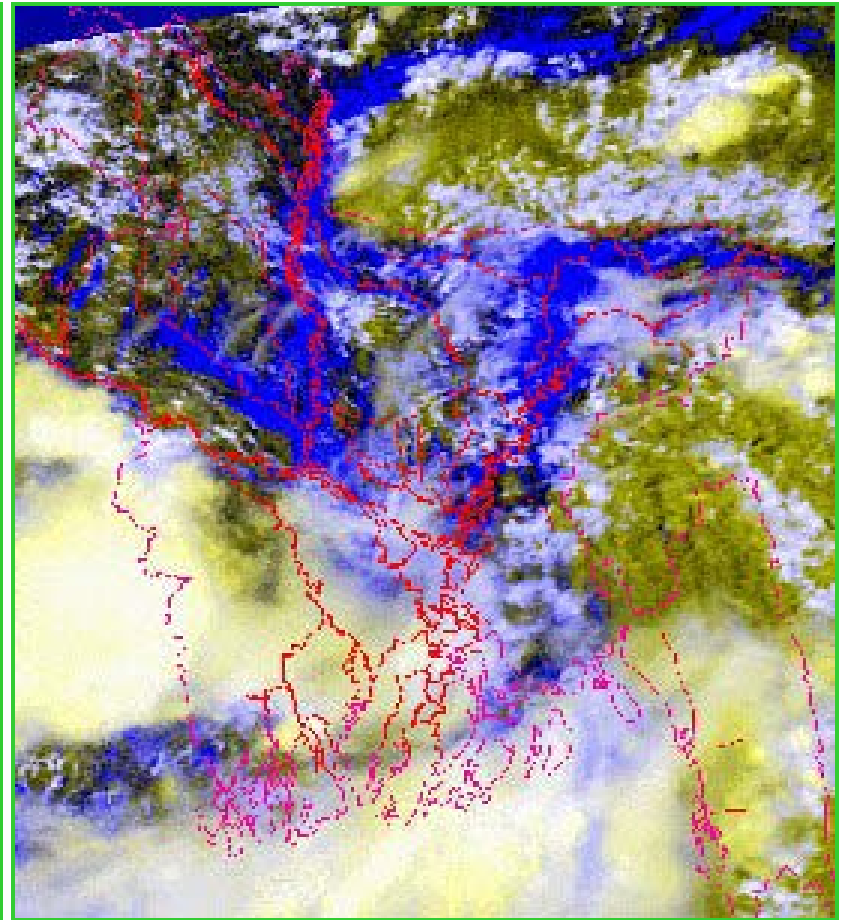
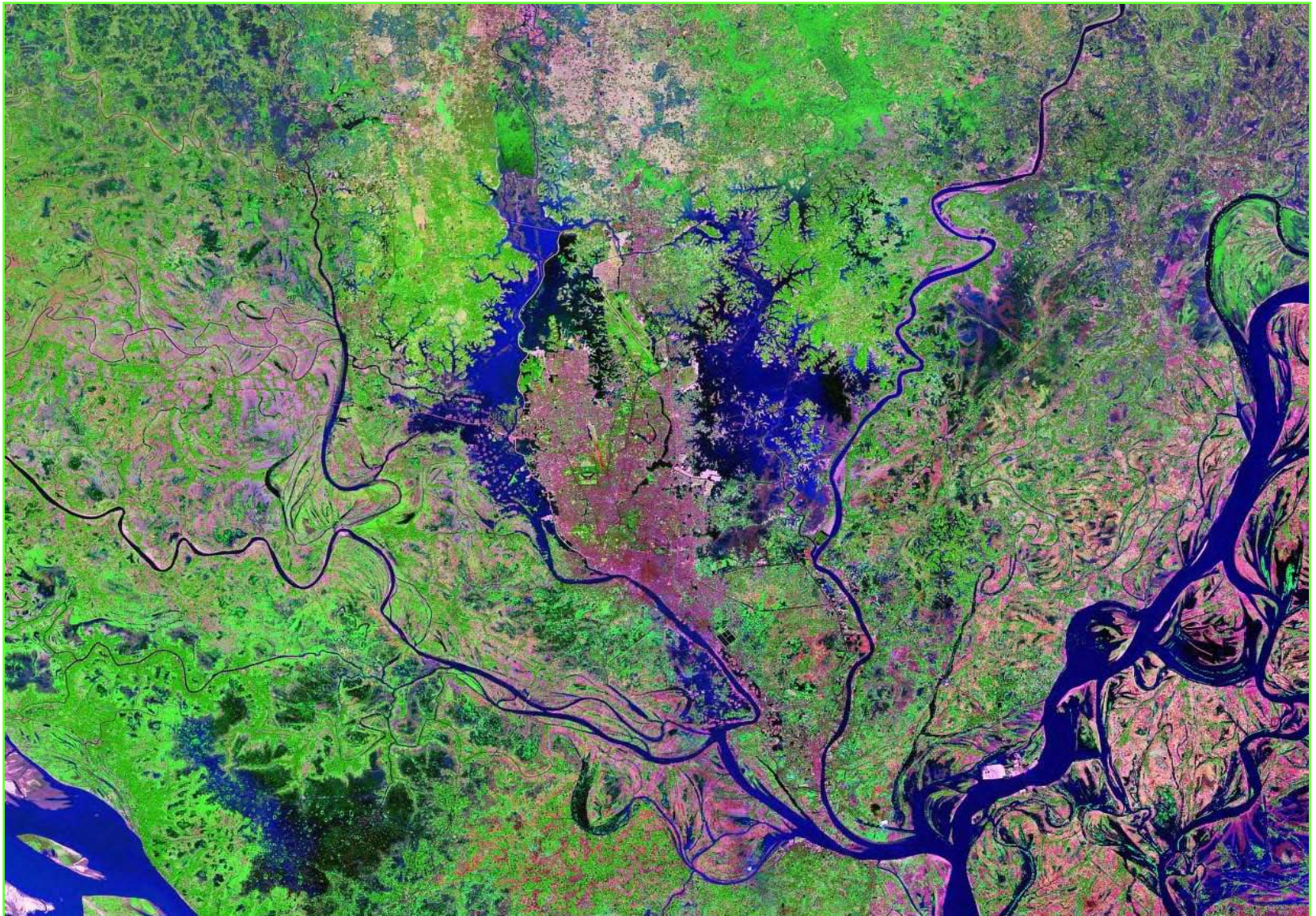


Image Source: NASA, 2007, courtesy the MODIS Rapid Response Team, NASA GSFC

Use of satellite images in detection of flood

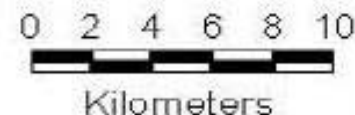
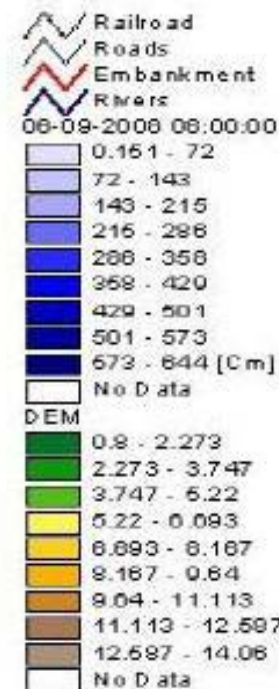
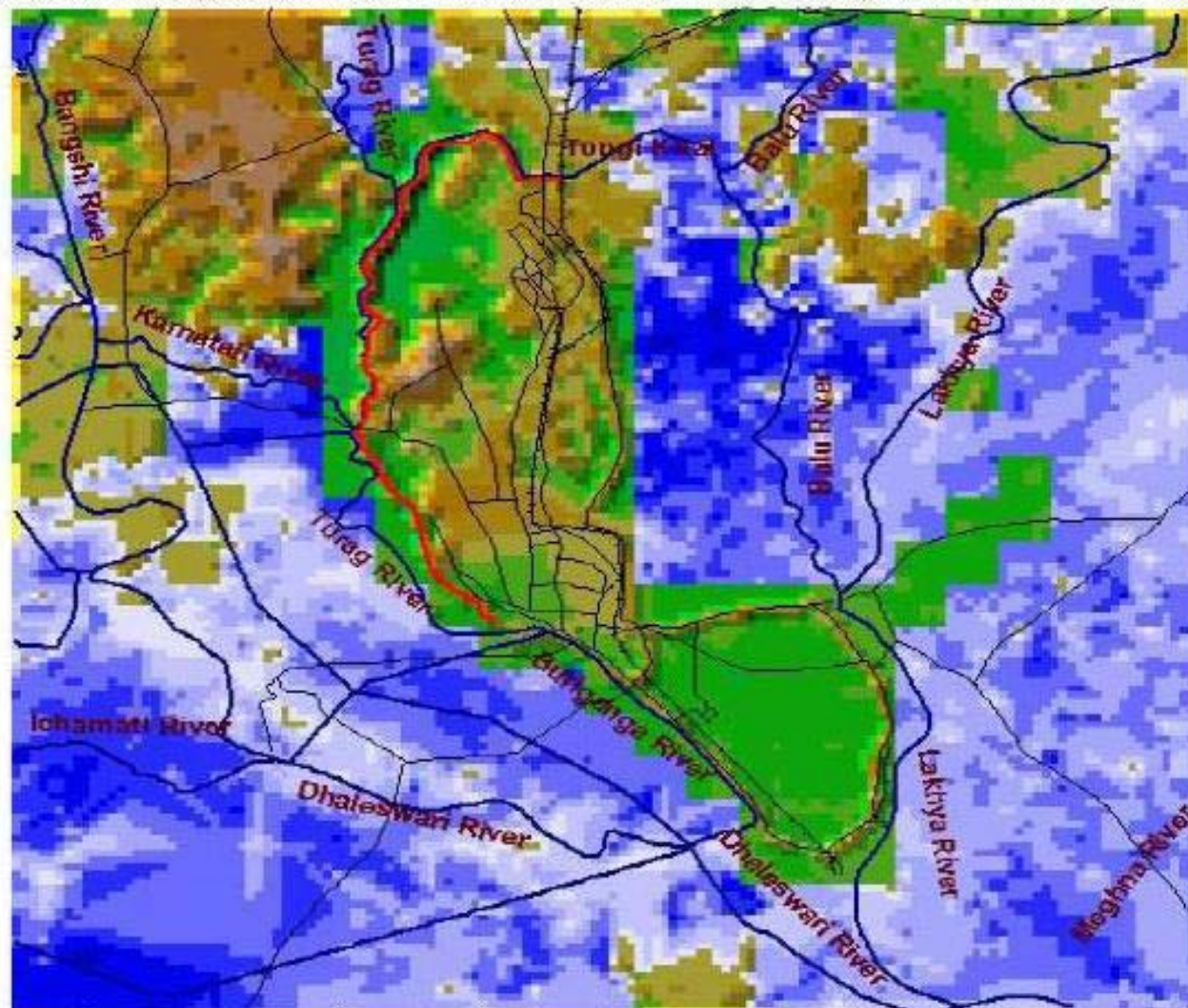


Flood detection using satellite image-Dhaka city



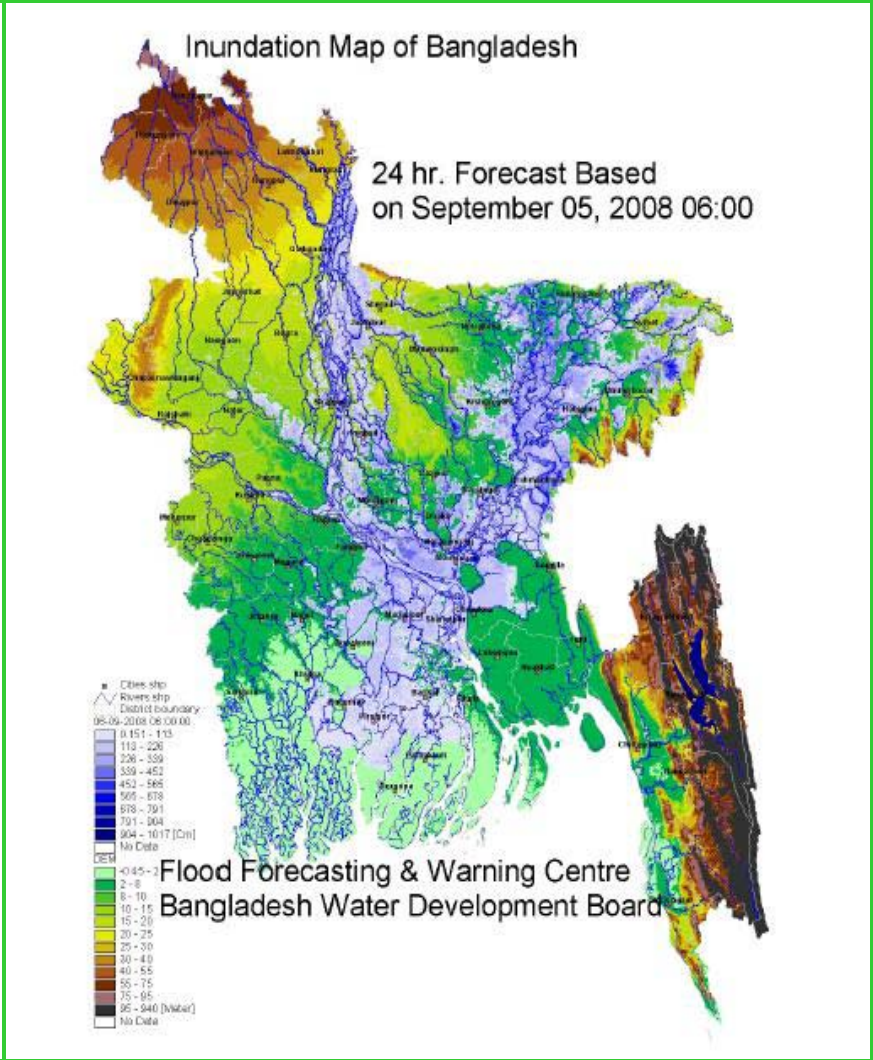
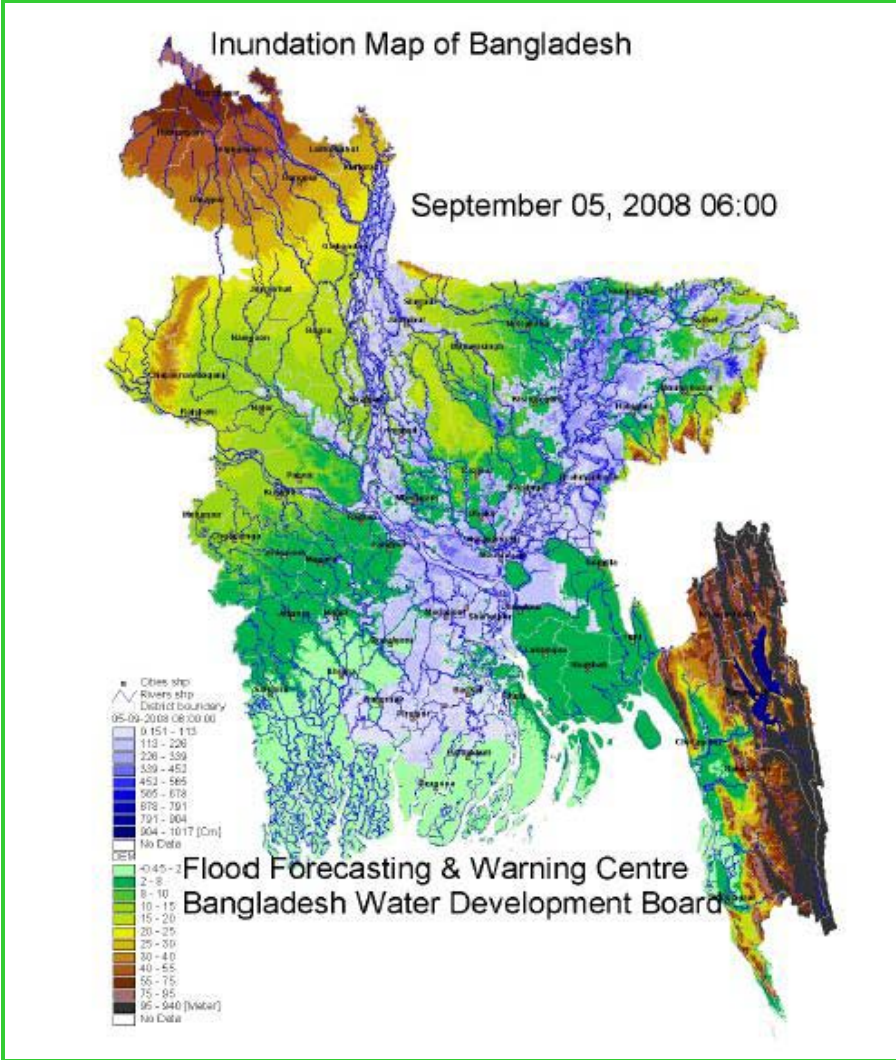
Flood forecast map-Dhaka-2008

Inundation Map of Dhaka 24 hr. Forecast Based on September 05, 2008 06:00



Flood Forecasting & Warning Centre, Bangladesh Water Development Board

Flood forecast map



Flood damage report- *recent success*

Damage report	Year of Flood								
	1955	1974	1988	1991	1998	2004	2007	2010	2012
Affected district (64)	38	52	52	54	54	54	46	42	42
Affected areas(sq.km)	50,500	52,000	89,900	28,000	1,00,250	55,000	51,000	48,000	46,000
Affected Popln (mln)	20	35	55	51	51	33	36	34	32
Flood stay (days)	30	35	68	40	84	22	28	35	32
People Died	12,000	16,000	2300	2100	1085	745	58	26	18
Economic loss (mln \$)	5000	10000	2000	3500	2060	500	350	180	130
Took shelter	-	-	2,00,500	300000	2,50,000	350,000	53,000	22,000	12,000
Food deficit (mln mt)	-	15.0	5.0	6.0	3.0	2.5	1.5	1.4	1.2
Homeless (mln)	-	-	22	38	36	32	21	15	11

Source: Annual Report, FFWC, BWDB, 2000-2013

Recommendations

- **Needed regional understanding and cooperation between India, Bhutan, Nepal, China and Bangladesh.**
- **Needed more emphasis on space-based data / satellite data, and transfer of space technology from developed countries.**
- **To be undertaken program on river training, dredging, construction of water storage, dam, reservoir, embankments, ponds, evacuation centre and link canal for irrigation purpose.**
- **To be developed a better drainage - sewerage system.**
- **To be developed a pre-flood warning system.**
- **Needed more people's participation for reducing risk.**
- **To be developed awareness program, volunteers involvements and gender issues.**

Conclusions

- **Recent flood damages proofs that the use of space-based data reduces the flood risks.**
- **Regional cooperation is very much needed for flood risk mitigation.**
- **Space-based data create**
 - **new hope**
 - **new initiatives**
 - **new inspirations.**

Flood and river erosion



Flood Photographs-3



Flood Photographs-4



Flood Photographs-5



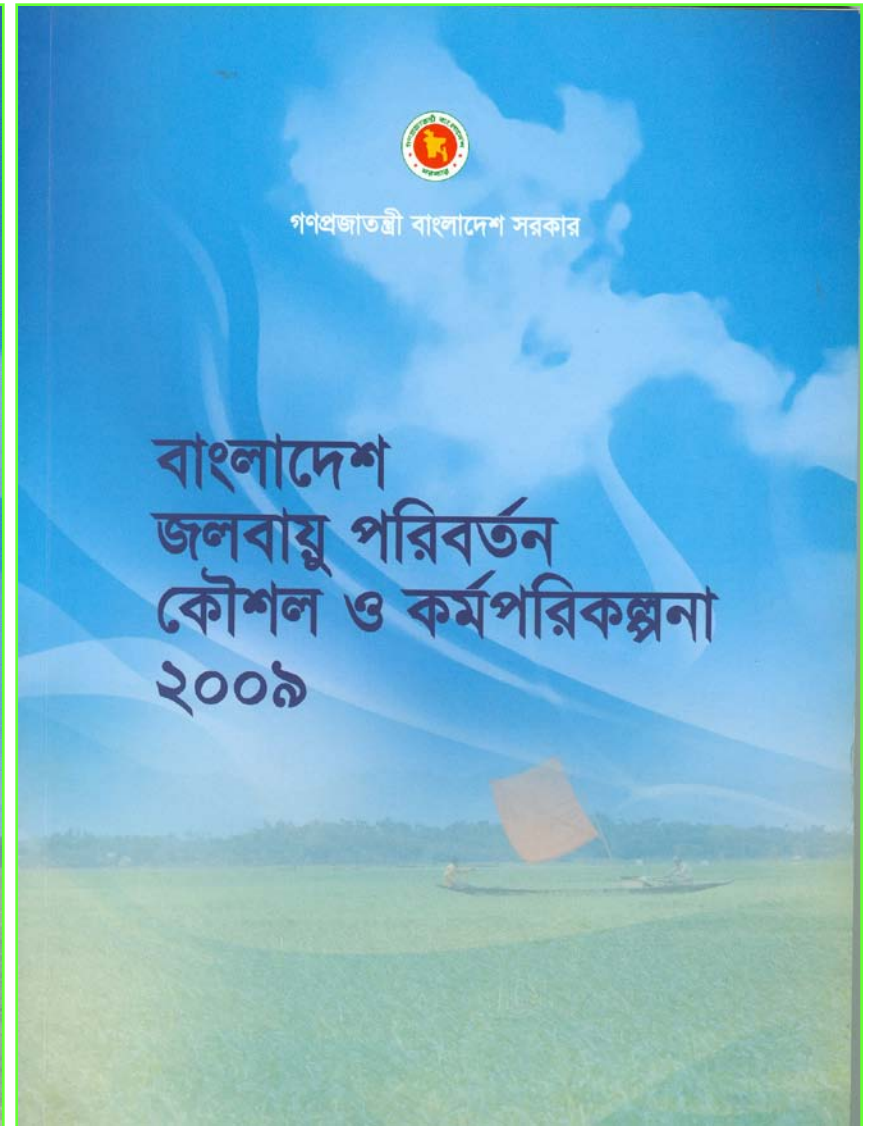
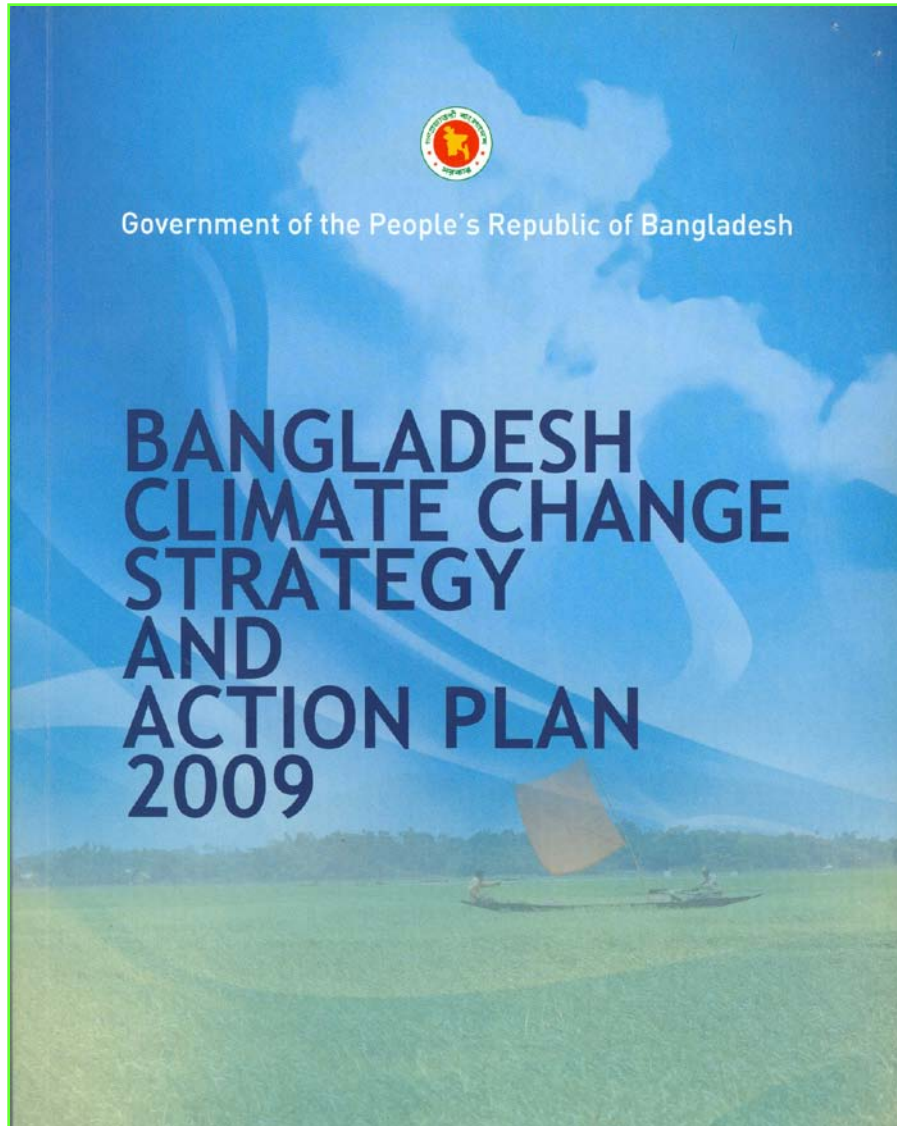
Last hope and new initiatives



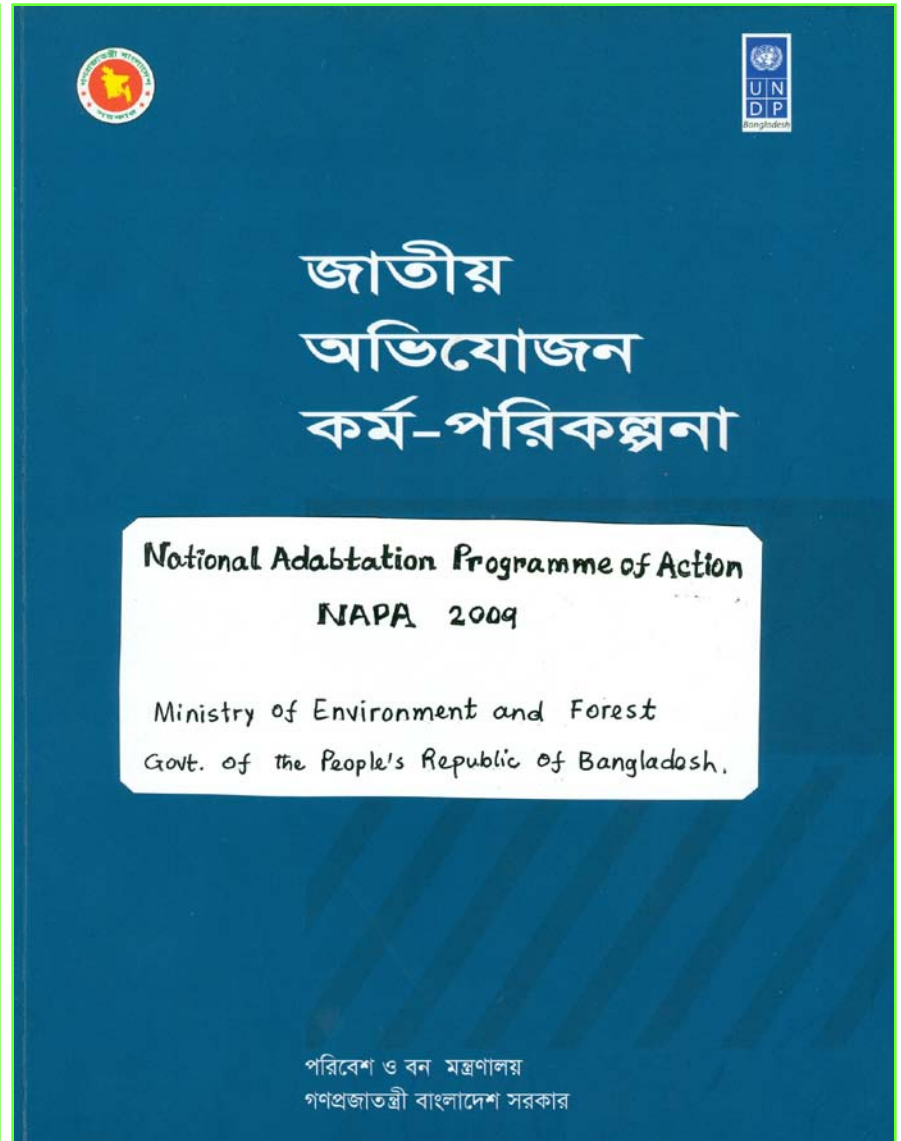
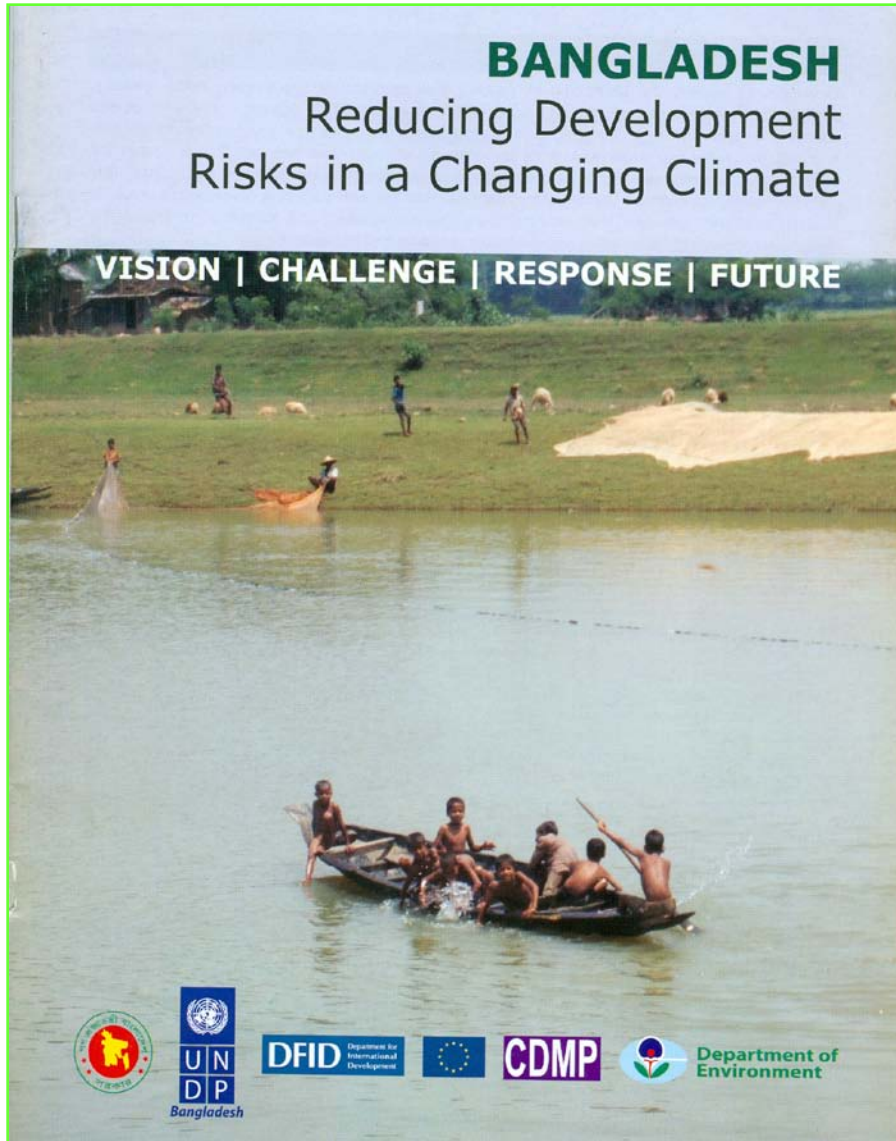
Thank you



Adaptation Programme in Bangladesh



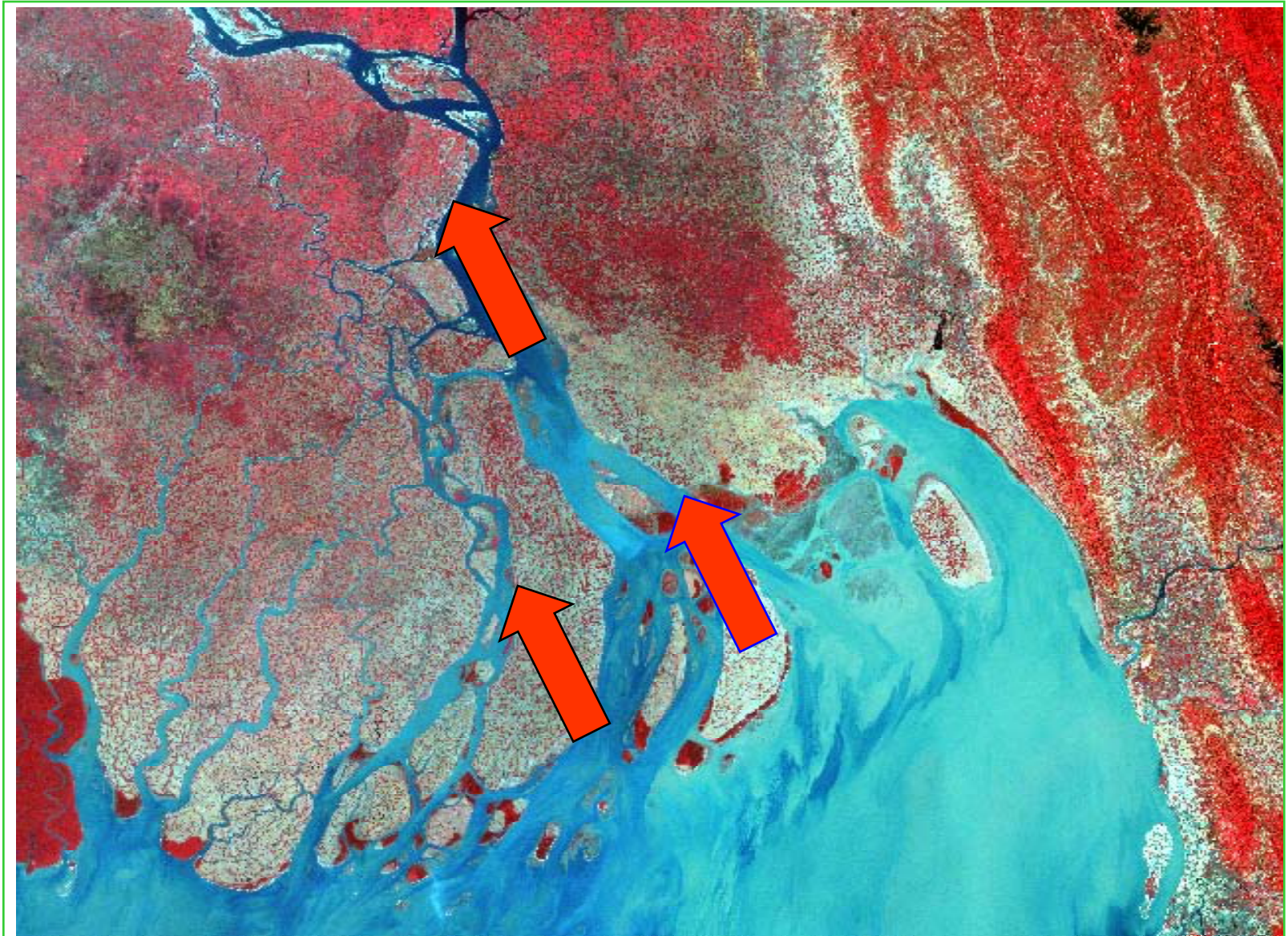
Adaptation Programme in Bangladesh-2



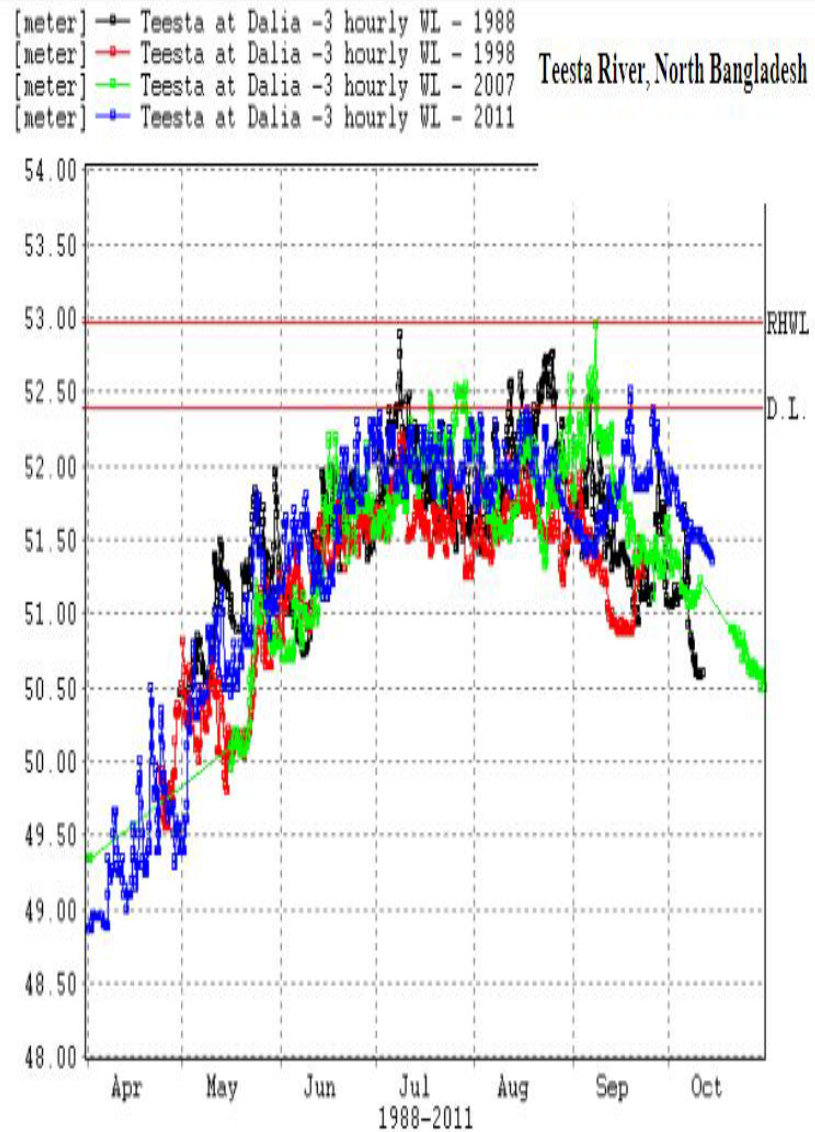
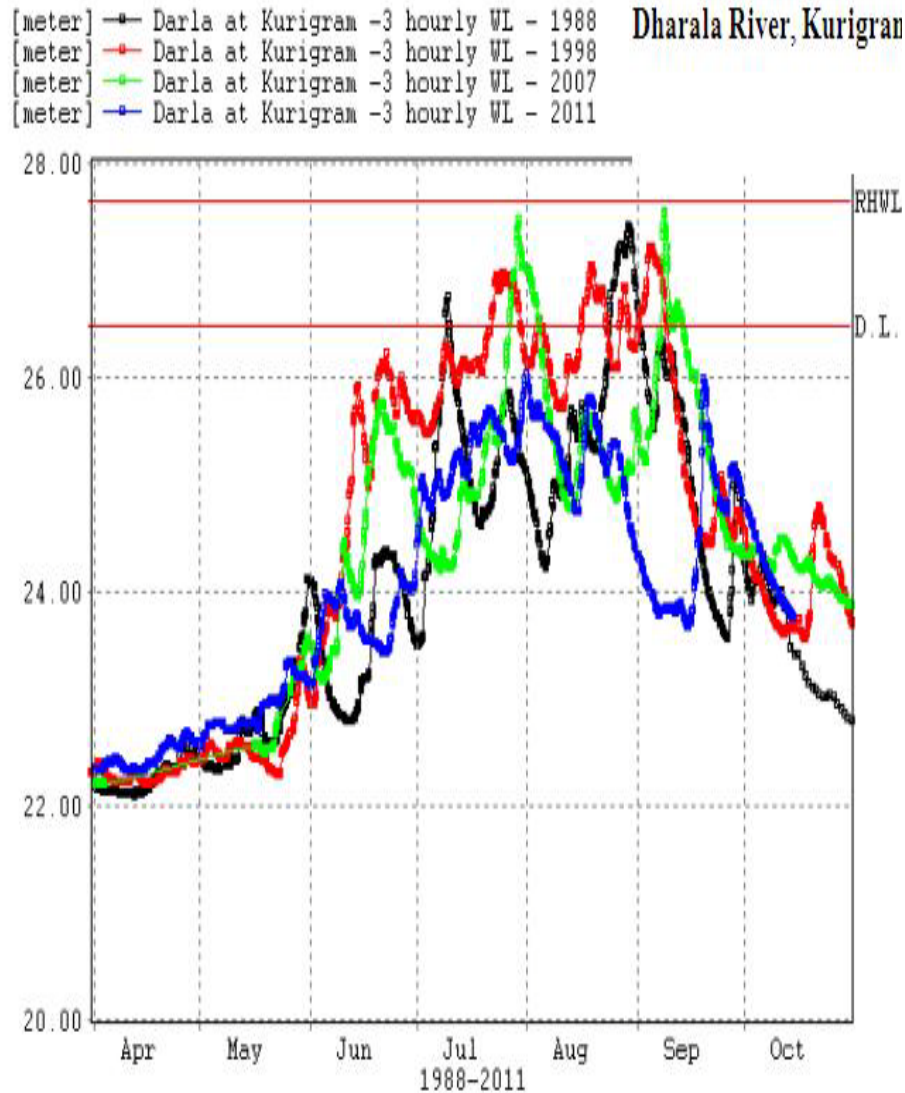
Flood and evacuation centre



Intrusion of saline water



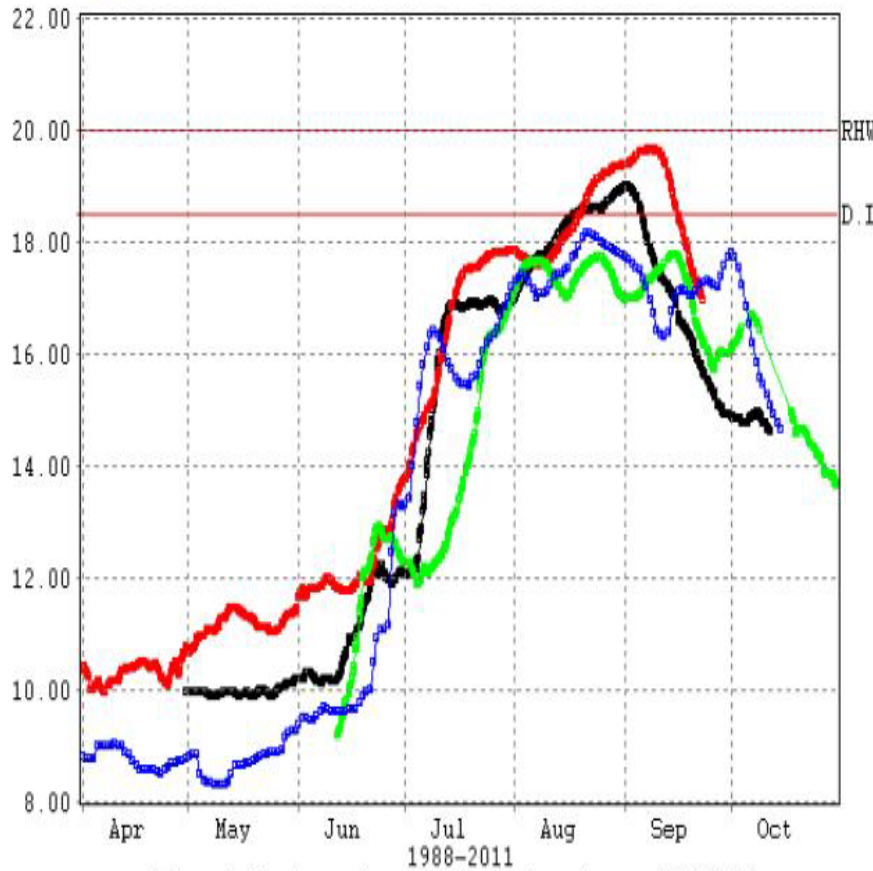
River water flow- Dharala-Tista



River water flow- Padma-Jamuna

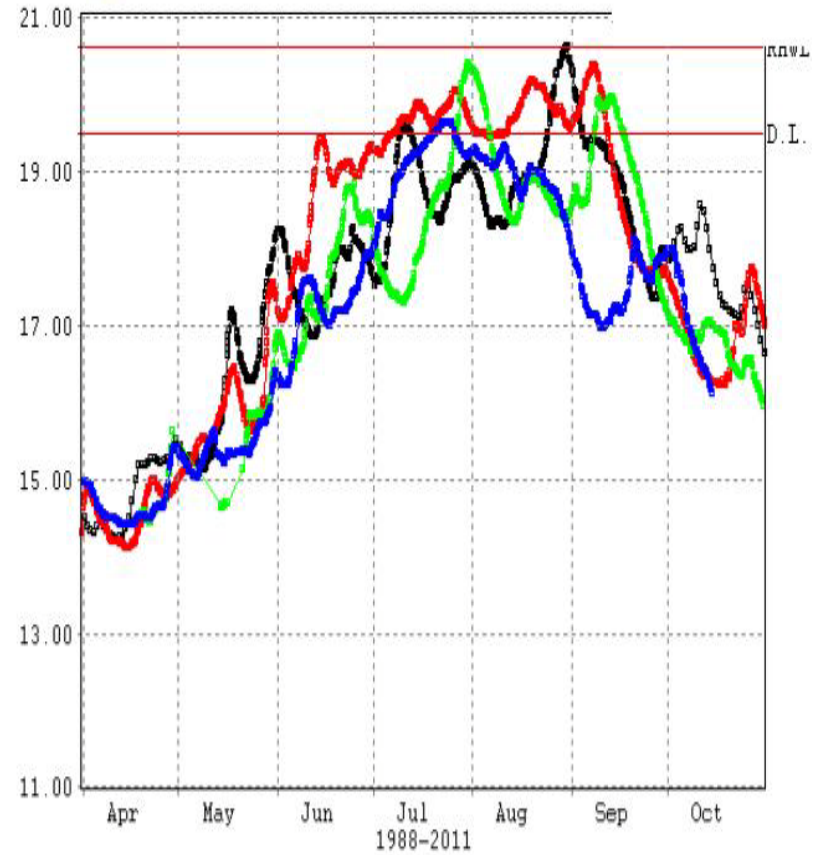
[m] — Ganges at Rajshahi -3 hourly WL - 1988
 [m] — Ganges at Rajshahi -3 hourly WL - 1998
 [m] — Ganges at Rajshahi -3 hourly WL - 2007
 [m] — Ganges at Rajshahi -3 hourly WL - 2011

Ganges River, N-BD



[meter] — B'putra at Bahadurabad -3 hourly WL - 1988
 [meter] — B'putra at Bahadurabad -3 hourly WL - 1998
 [meter] — B'putra at Bahadurabad -3 hourly WL - 2007
 [meter] — B'putra at Bahadurabad -3 hourly WL - 2011

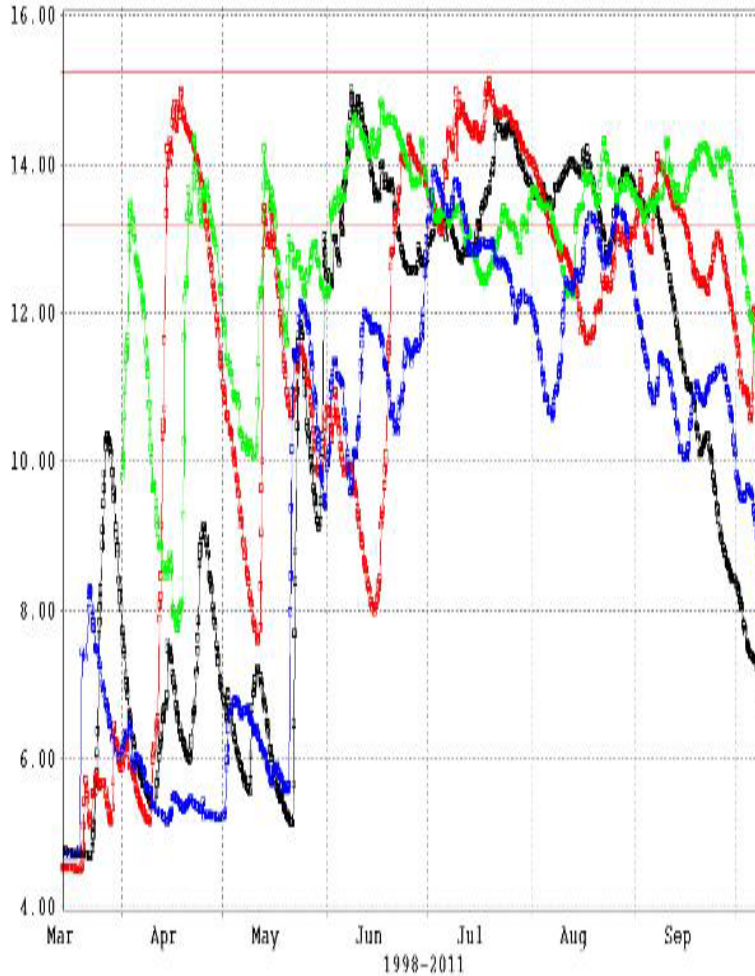
Brahmaputra River



River water flow- Surma-Kushiyara

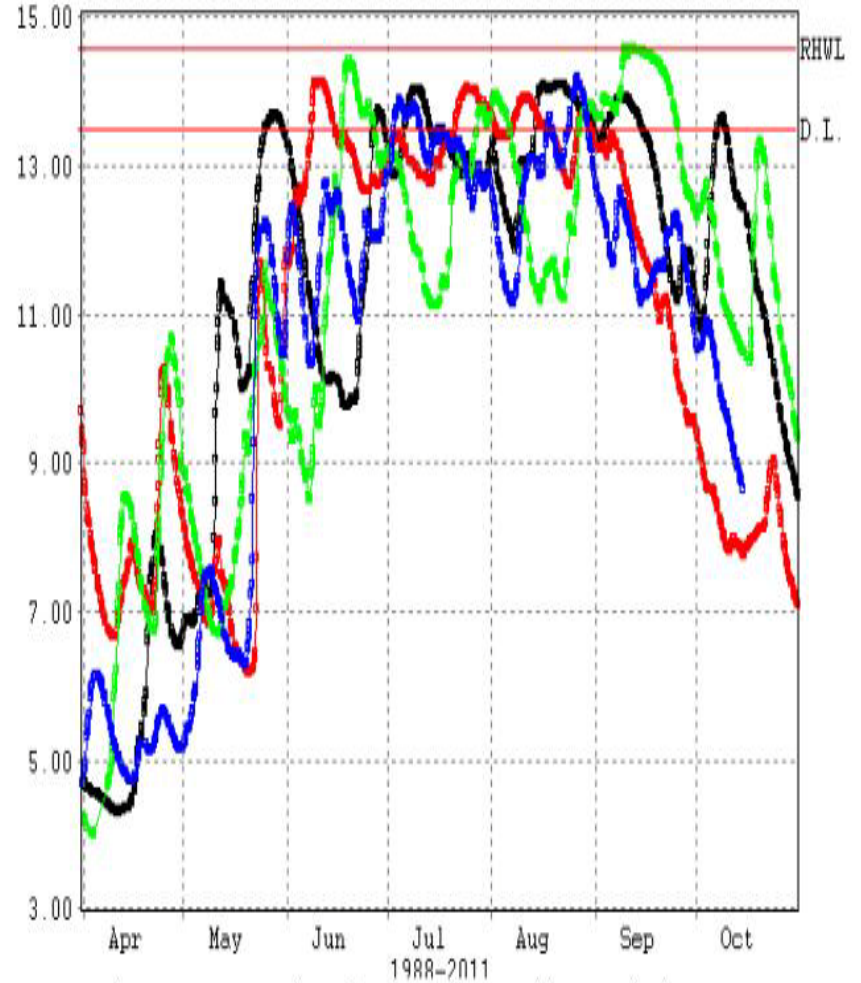
- [m] — Surma at Kanaighat -3 hourly WL - 1998
- [m] — Surma at Kanaighat -3 hourly WL - 2004
- [m] — Surma at Kanaighat -3 hourly WL - 2010
- [m] — Surma at Kanaighat -3 hourly WL - 2011

Surma River, NE -BD



- [meter] — Kushiyara at Sheola -3 hourly WL - 1988
- [meter] — Kushiyara at Sheola -3 hourly WL - 1998
- [meter] — Kushiyara at Sheola -3 hourly WL - 2007
- [meter] — Kushiyara at Sheola -3 hourly WL - 2011

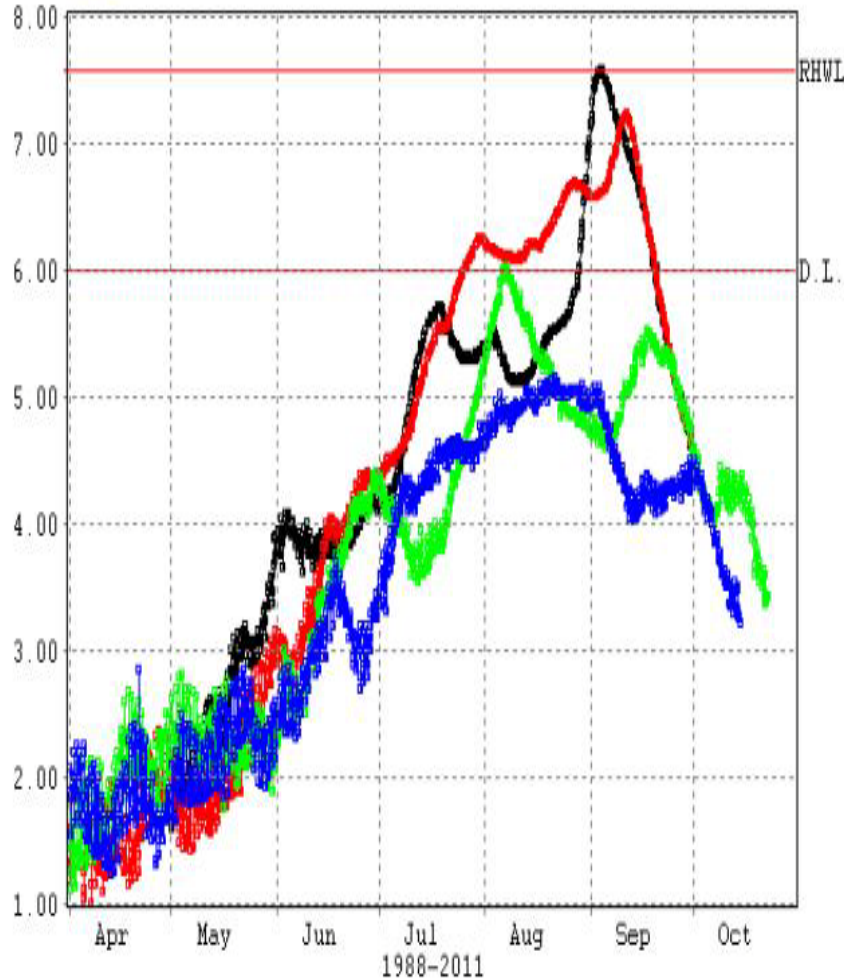
Kushiyara River-2, NE -BD



River water flow- Dhaka-Buriganga-Turag

[meter] — Buriganga at Dhaka -3 hourly WL - 1988
 [meter] — Buriganga at Dhaka -3 hourly WL - 1998
 [meter] — Buriganga at Dhaka -3 hourly WL - 2007
 [meter] — Buriganga at Dhaka -3 hourly WL - 2011

Buriganga River, Dhaka



[m] — Turag at Tongi -3 hourly WL - 1988
 [m] — Turag at Tongi -3 hourly WL - 1998
 [m] — Turag at Tongi -3 hourly WL - 2007
 [m] — Turag at Tongi -3 hourly WL - 2011

Turag River, North Dhaka

