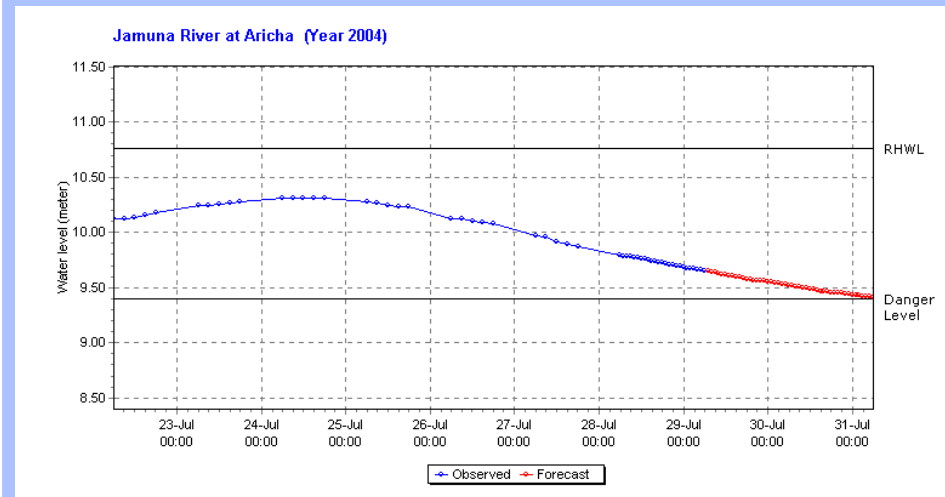


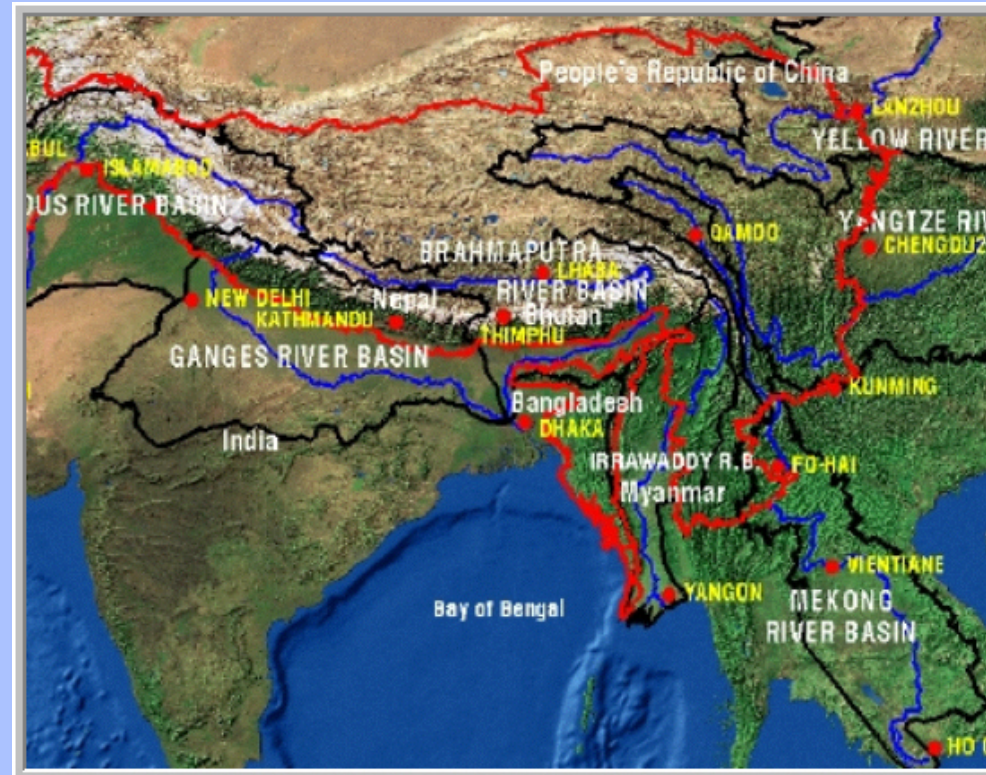
Transboundary Flood issues: (2) Regional Flood Forecasting- dreams slowly becoming reality !



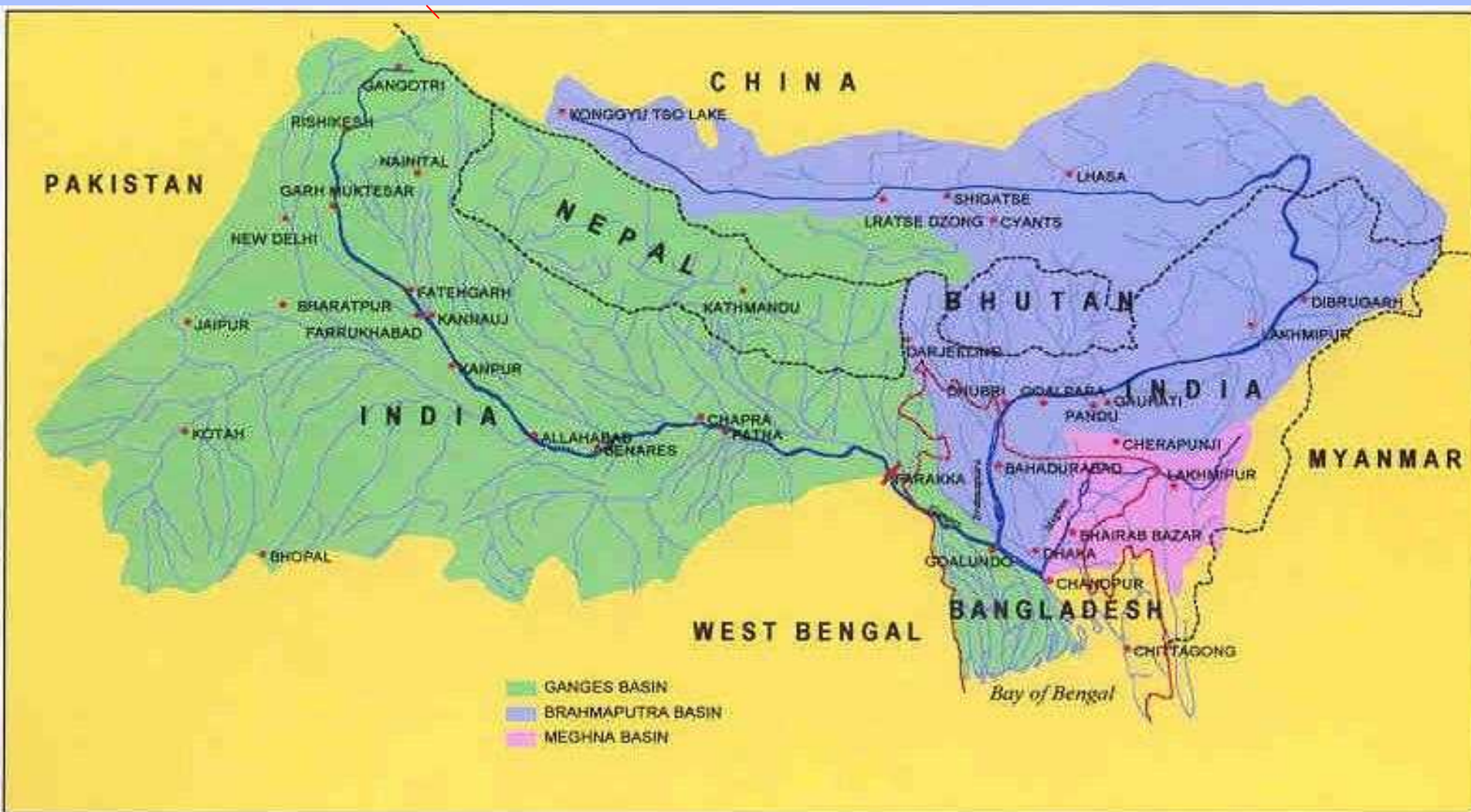
Guna Paudyal gnp@dhi.dk

Two major transboundary river systems

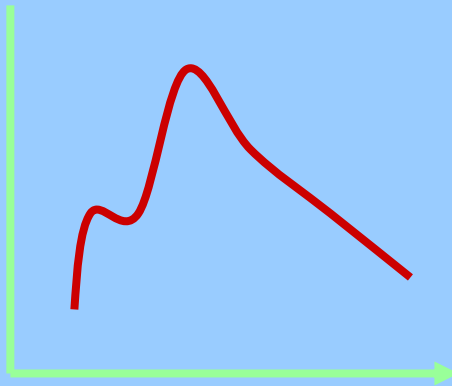
1. Ganges - Bhramputra-Meghna River system:
=> Focus on flood forecasting only
2. Mekong River System
=> Focus on flood management including forecasting



Ganges, Brahmaputra & Meghna basins

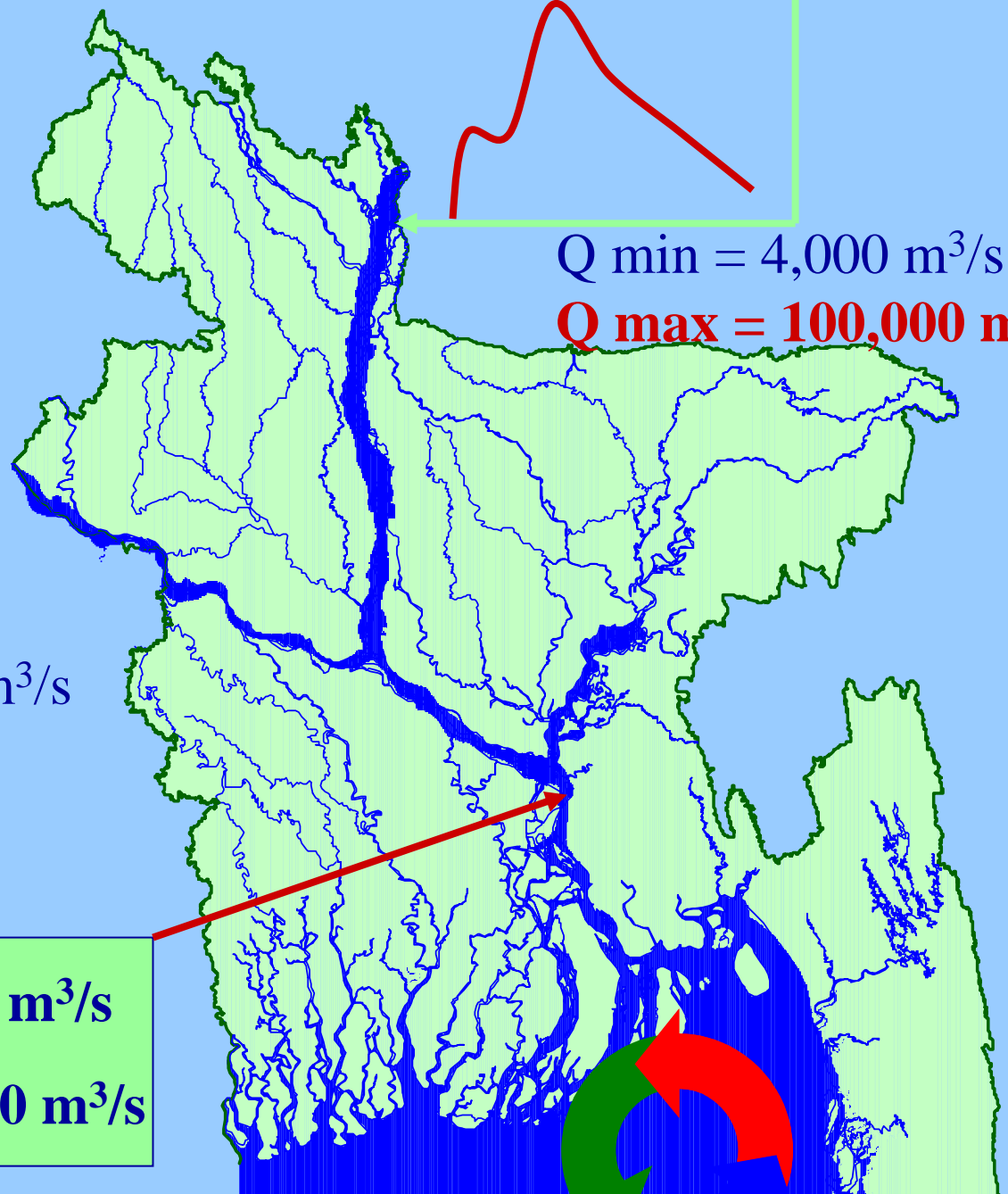


Total basin area is 1.72 million sq. km. Only 7 percent of these three basin area lies within Bangladesh



$Q_{\min} = 200 \text{ m}^3/\text{s}$

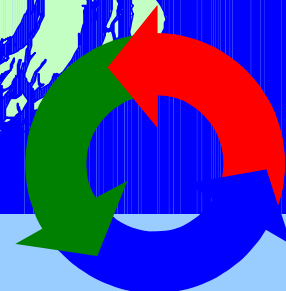
$Q_{\max} = 70,000 \text{ m}^3/\text{s}$



$Q_{\min} = 4,000 \text{ m}^3/\text{s}$

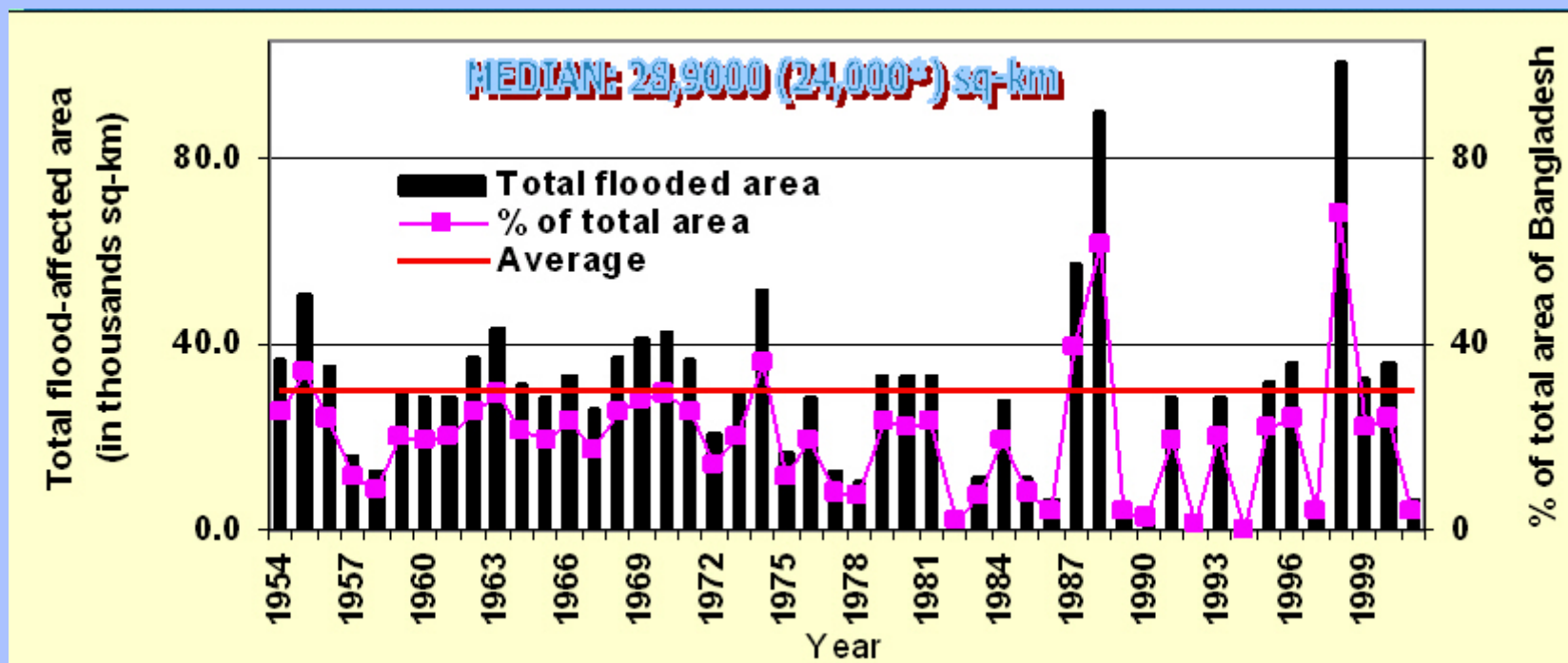
$Q_{\max} = 100,000 \text{ m}^3/\text{s}$

$Q_{\min} = 4,000 \text{ m}^3/\text{s}$
 $Q_{\max} = 180,000 \text{ m}^3/\text{s}$



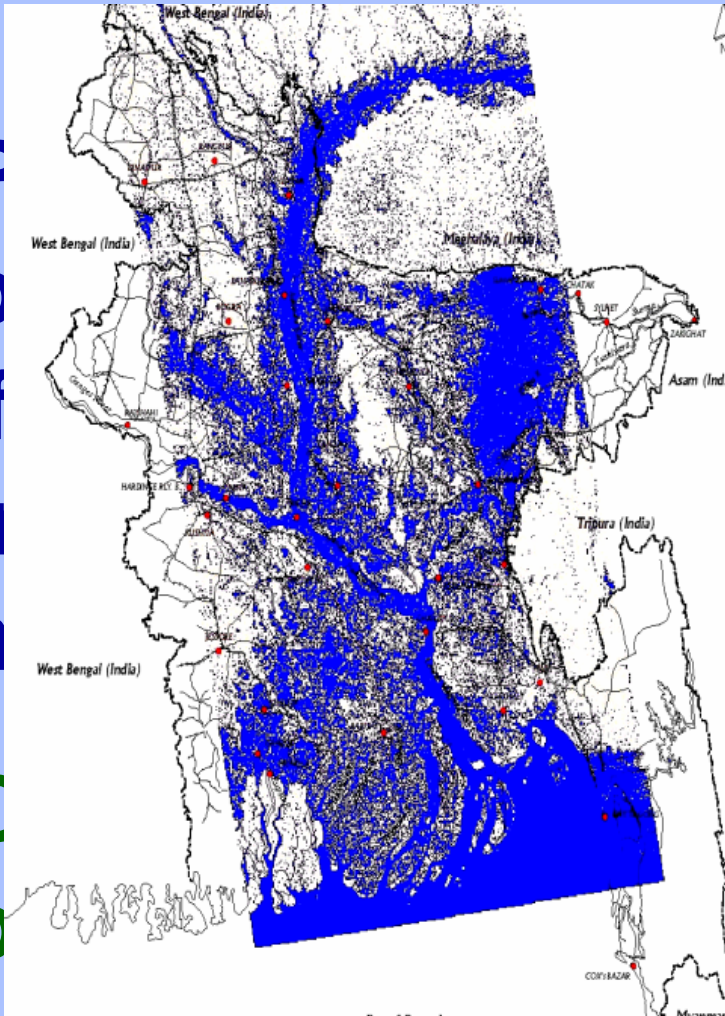
Normal floods are good and required

But many recent past floods have been devastating



The Sever floods of 1998 and 2004

- F
- fo
- af
- or
- m
- D
- fo



Areas inundated in
1998 flood

ness of flood
warning to flood
and a variety of
concerned with flood
relief

• detailed flood

Realised many cross cutting issues related to the provision of flood forecasting and warning services:

- Flood Forecasting and providing early warning is the most cost effective way of flood damage reduction, **no environmental controversy**
- Flood warning messages must reach Communities in time and in easily understandable form, **NGOs and CBO** play important roles
- Pooors are the most affected by floods - hence flood warning programs can help in **poverty alleviation**
- Women and children are worst affected by floods - hence warning systems have gender relevance
- Regional cooperation is a key to a successful flood forecasting in Bangladesh : **Governance**

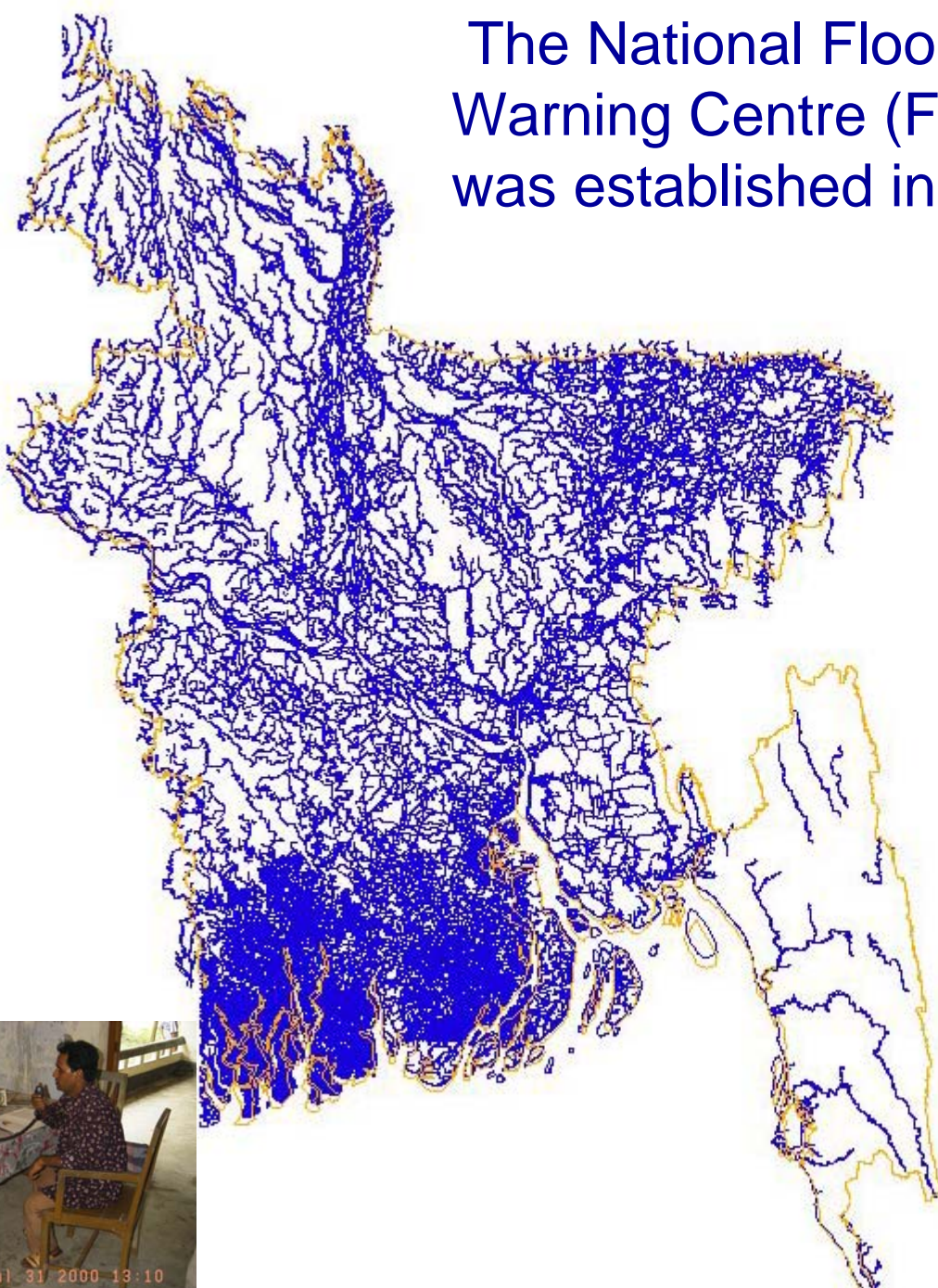
The National Flood Forecasting and Warning Centre (FFWC) in Bangladesh was established in 1972

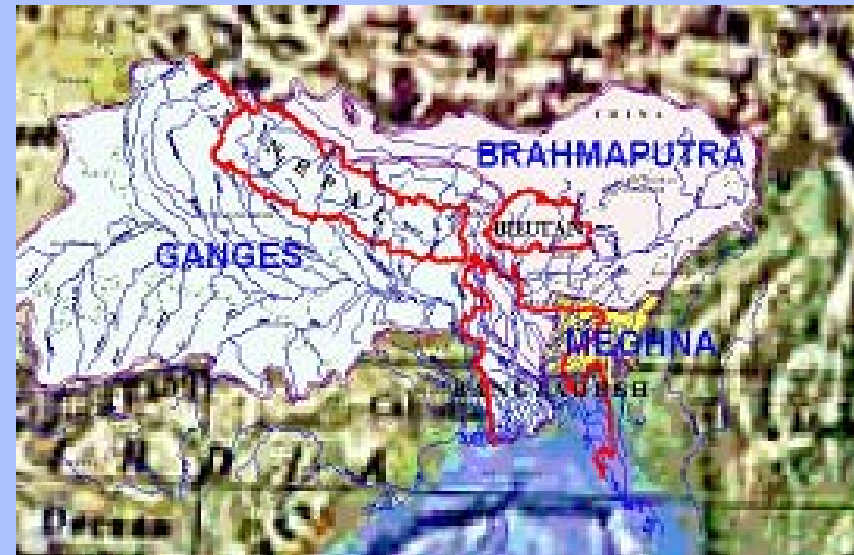
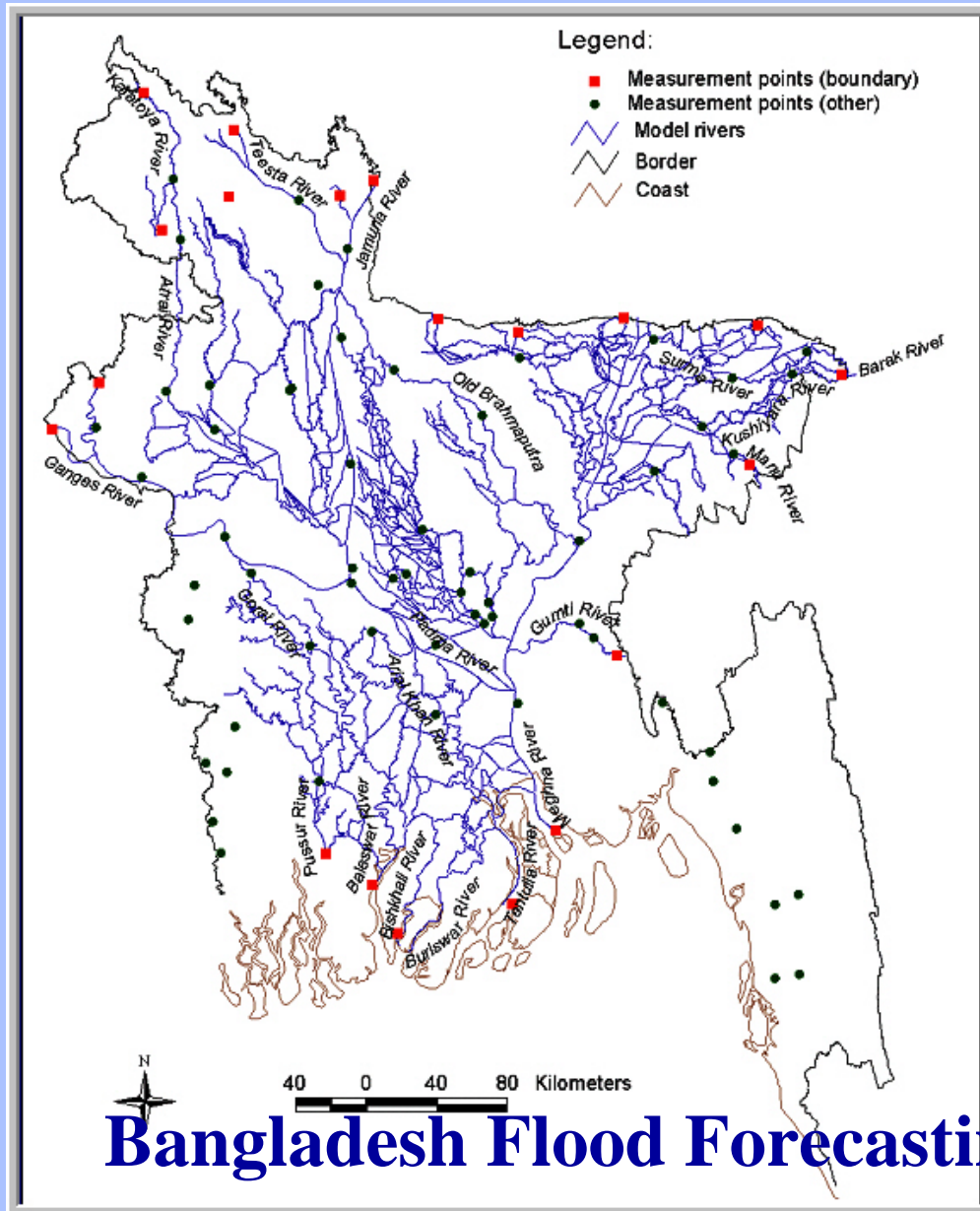
After several decades of struggle and learning

FFWC is now fully Operational

www.ffwc.net

Still dreaming to do regional FF !





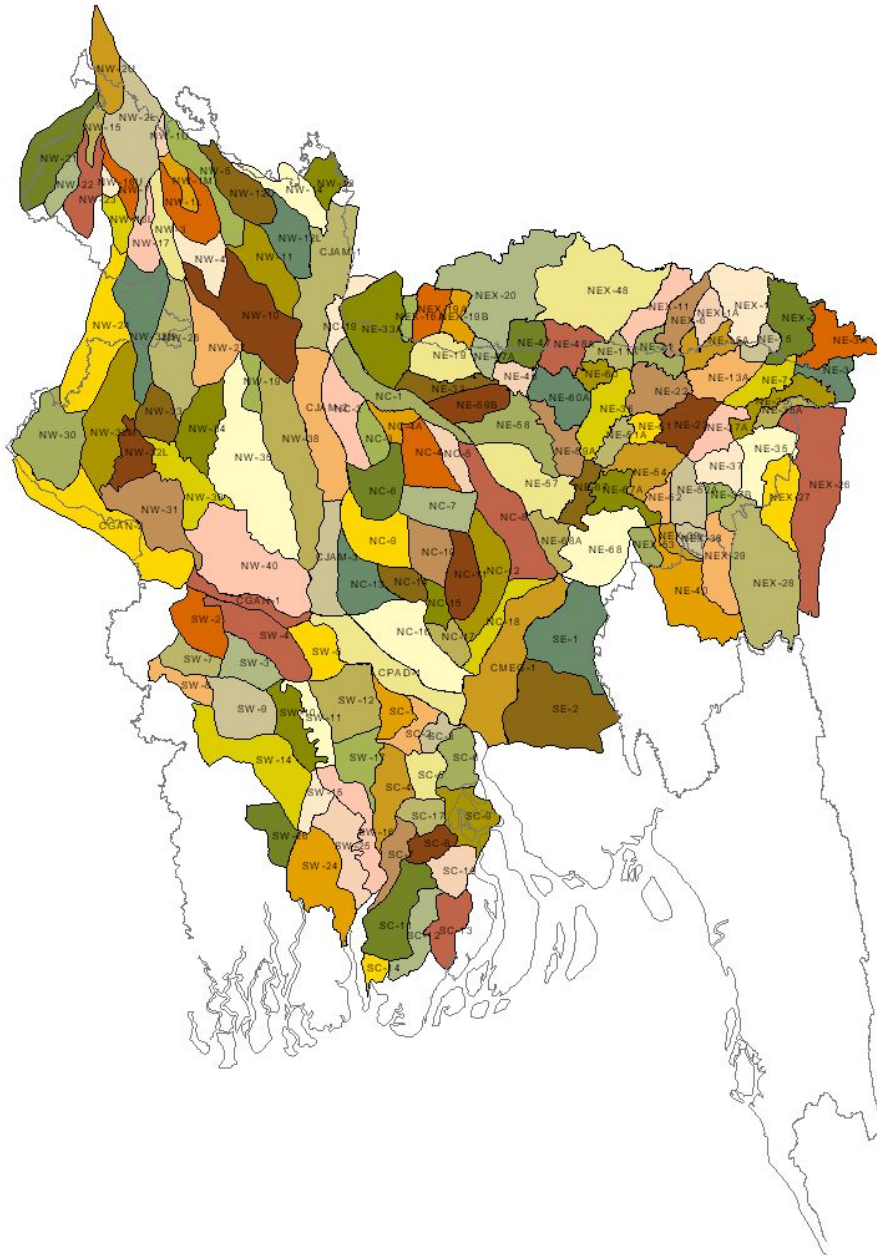
Bangladesh Flood Forecasting Model

(Super Model-2004) Based on MIKE11

Water Level and Rainfall St

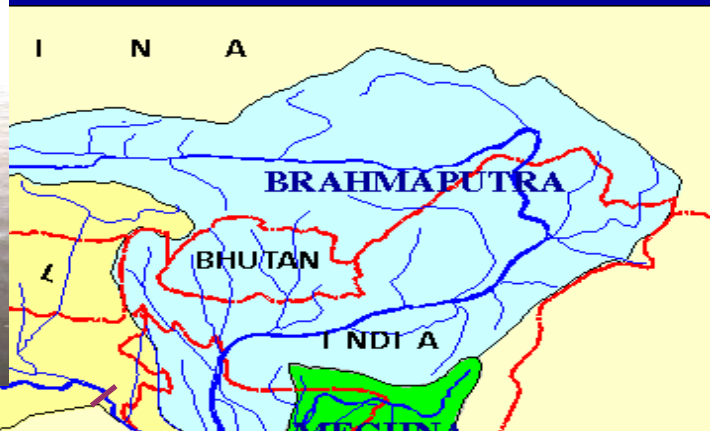
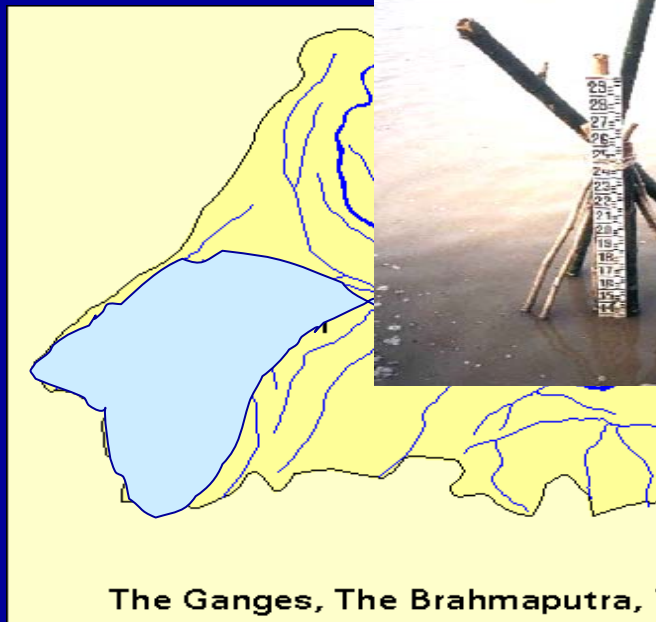


B A Y O F B E N G A L



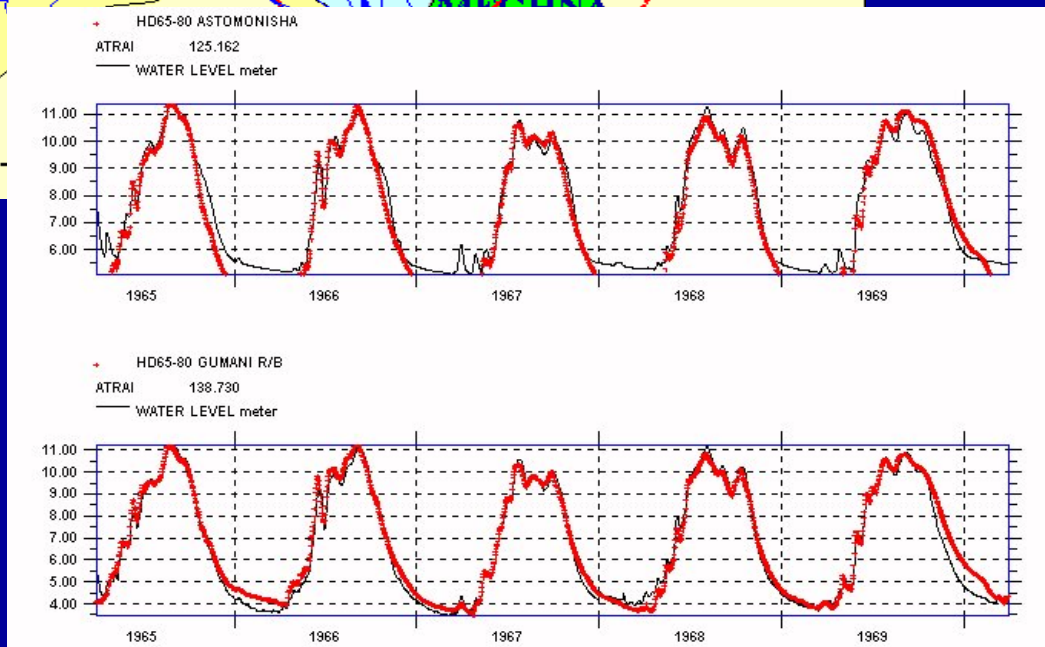
Sub-catchments of the Flood Forecast Supermodel of Bangladesh

135 rainfall runoff
models integrated
with the Quasi 2-d
river-flood plain
simulation model

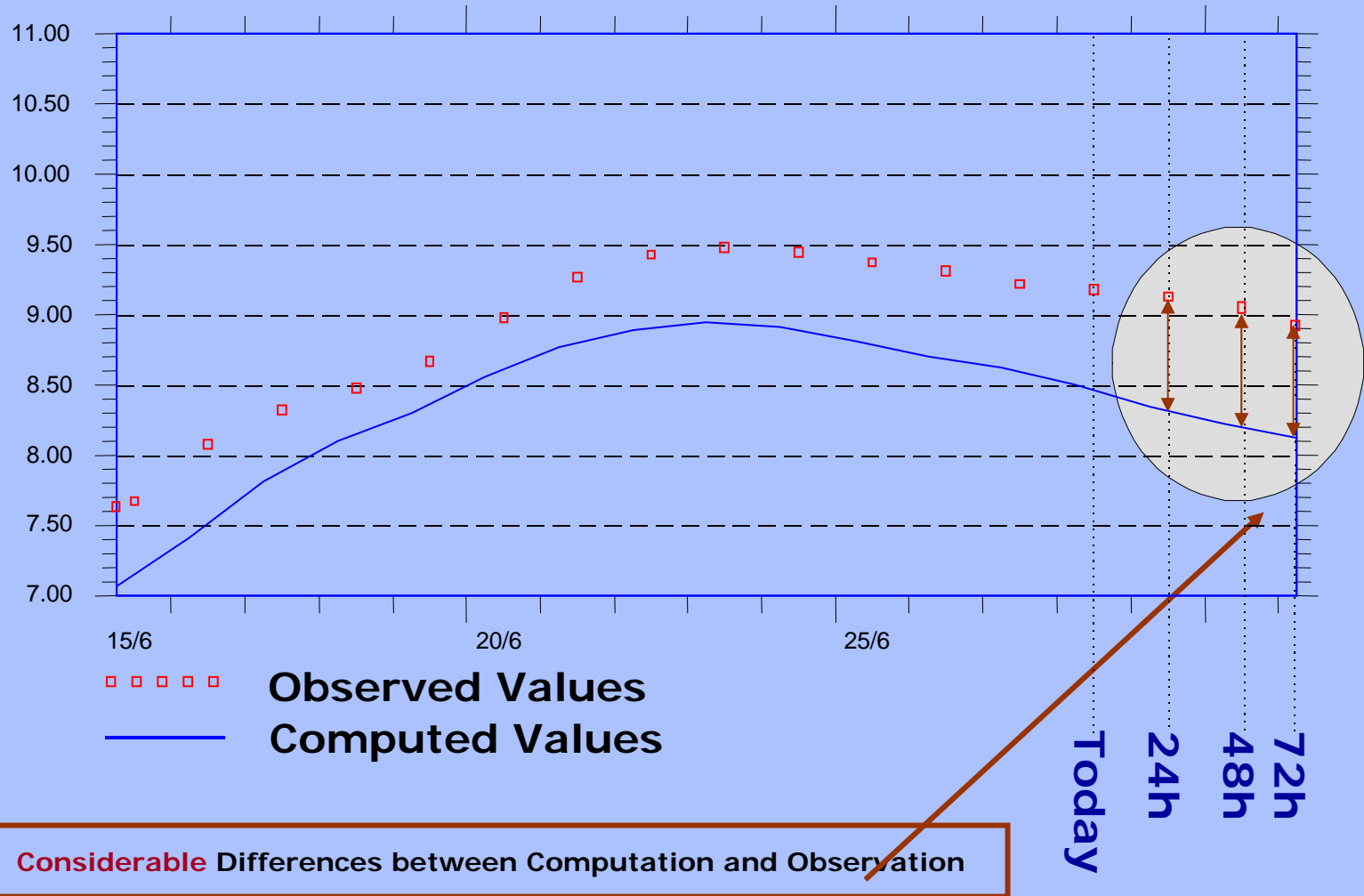


The Ganges, The Brahmaputra,

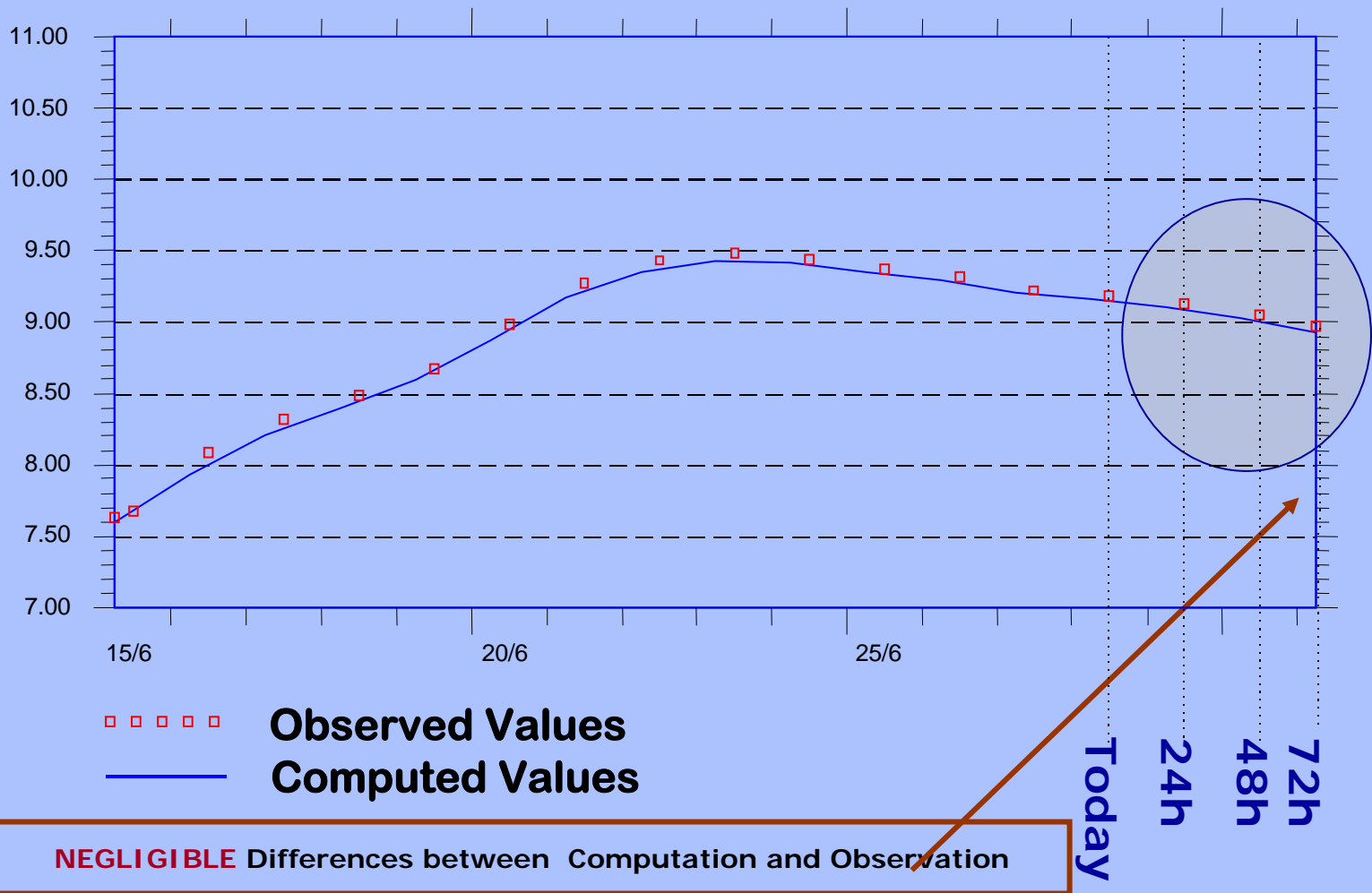
Calibration



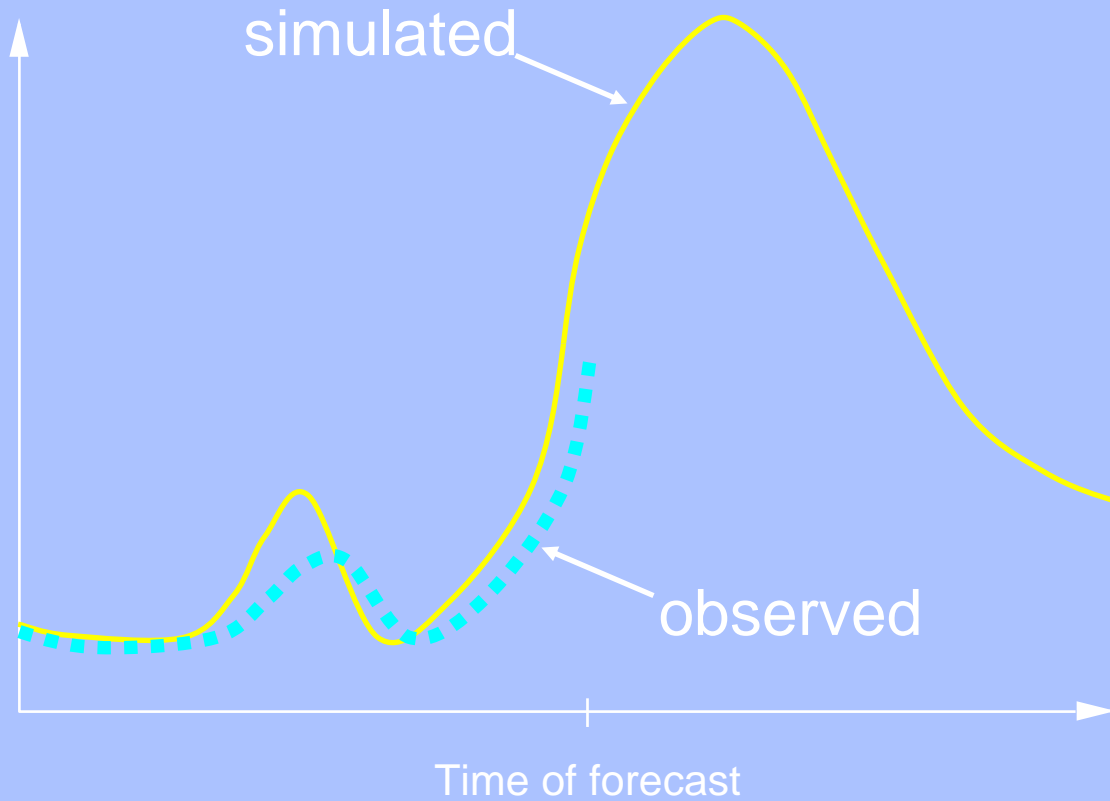
Forecasting Without Updating



Forecasting WITH Updating

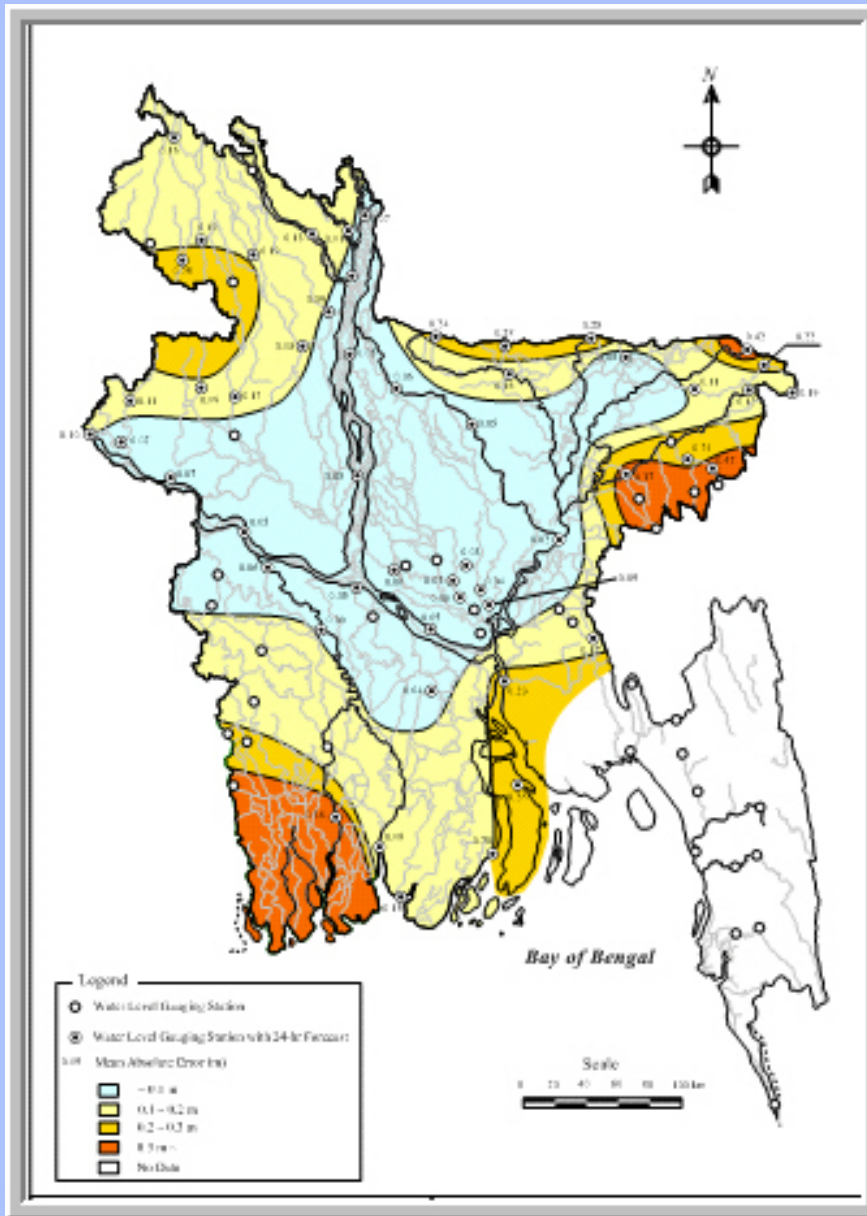


Updating



Imperfect present – Uncertain future

Forecast performance is satisfactory, but there is a need to increase the lead time to more than 3 days.



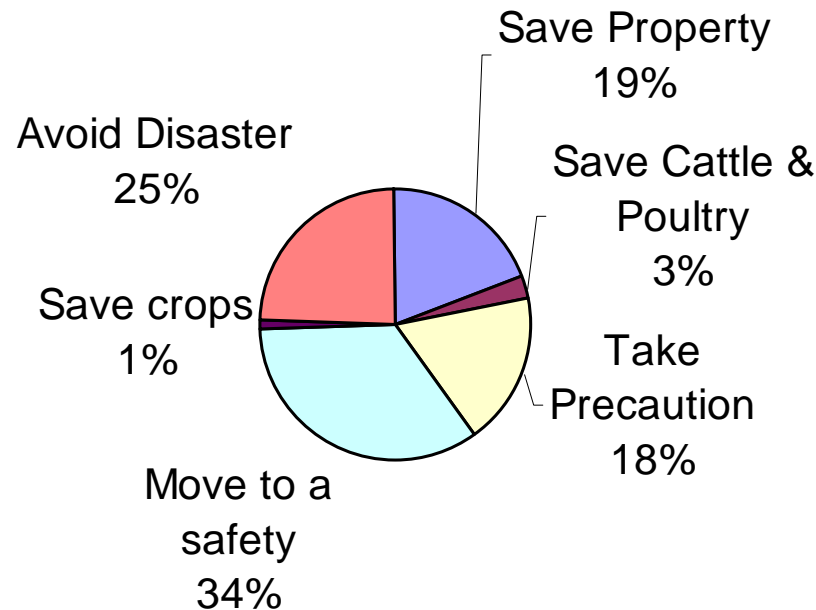
Mean error of 24 hr forecast

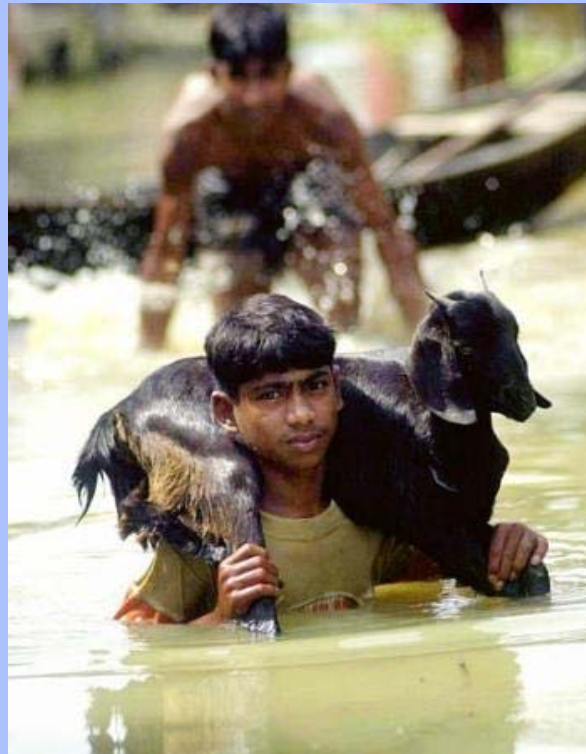
Summary example of water level forecast accuracy (mean absolute error, cm) 24, 48, 72 hours

Location	Station River	24- hrs	48 - hrs	72- hrs
Near border/ boundaries	Chilmari Brahmaputra	12	17	24
Central Region	Dhaka Buriganga	5	8	10
Areas away from main rivers	Tongi Tongi Khal	4	7	10
Flashy rivers(hilly catchment)	Kanaighat Surma	25	42	55

Example of community surveys in Bangladesh

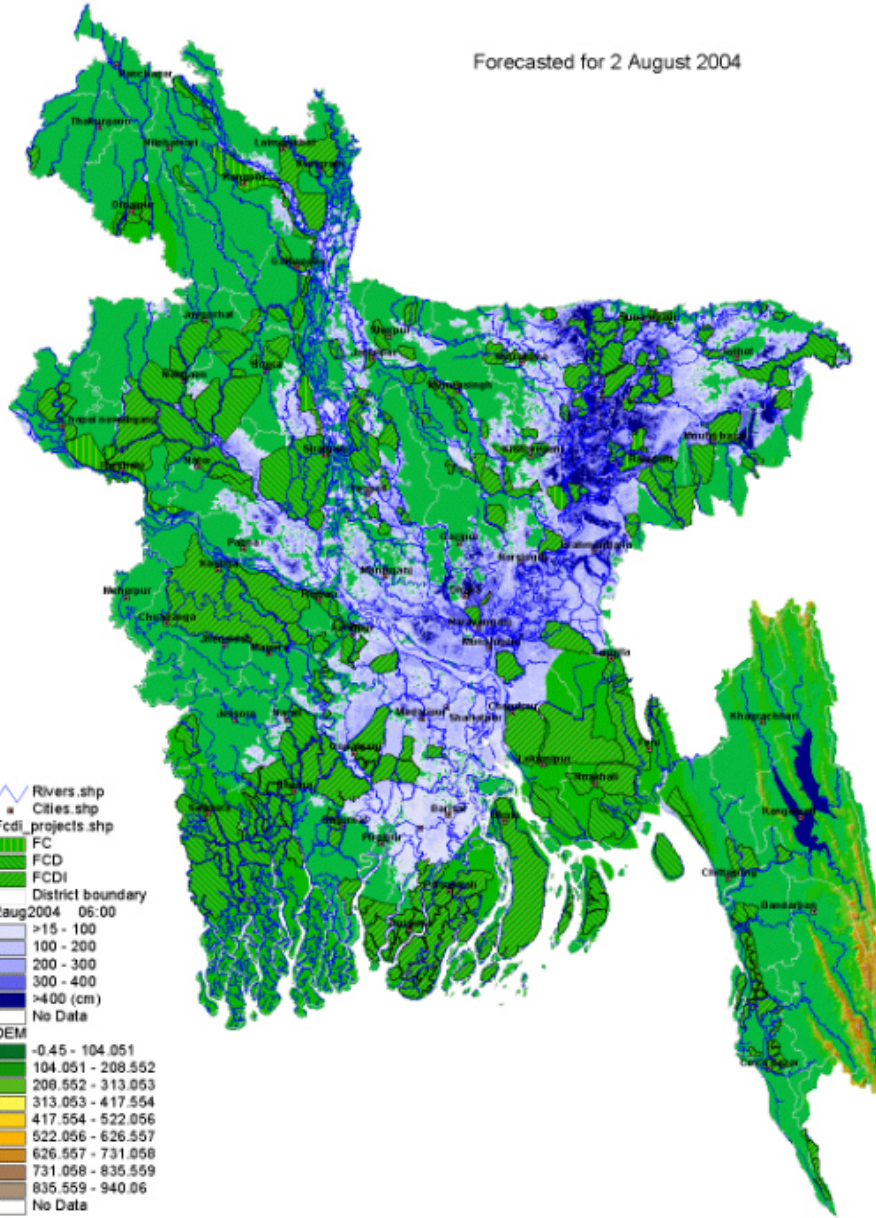
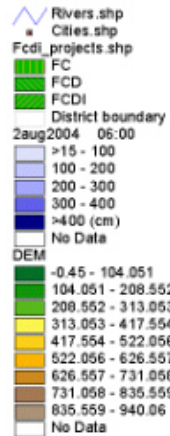
Local people believe that an effective flood forecast and warning will be useful in flood disaster preparedness.





Forecasted for 2 August 2004

National level
Flood Map
generated by
model based on a
course digital
topo map



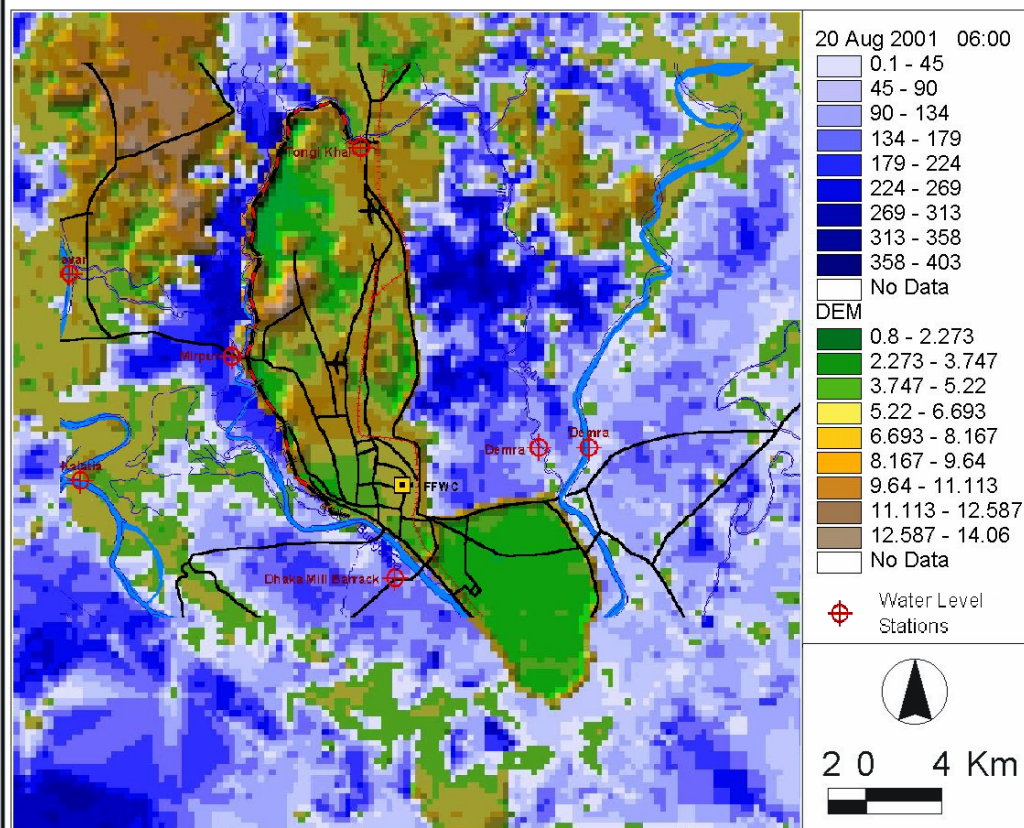
Dhaka City Special Flood bulletin

Sl. No.	River Name	Station Name	RHWL (m)	D.L. (m)	Water Level		+ Rise - Fall (cm)	Above D.L. (cm)
					19/08/2001 (m)	20/08/2001 (m)		
1	Buriganga	Dhaka Mill Barrack	7.58	6.00	4.48	4.55	7	-
2	Balu	Demra	7.09	5.03	-	-	-	-
3	Turag	Mirpur	8.35	5.94	4.78	4.78	0	-
4	Turag	Tongi Khal	7.84	6.08	-	-	-	-

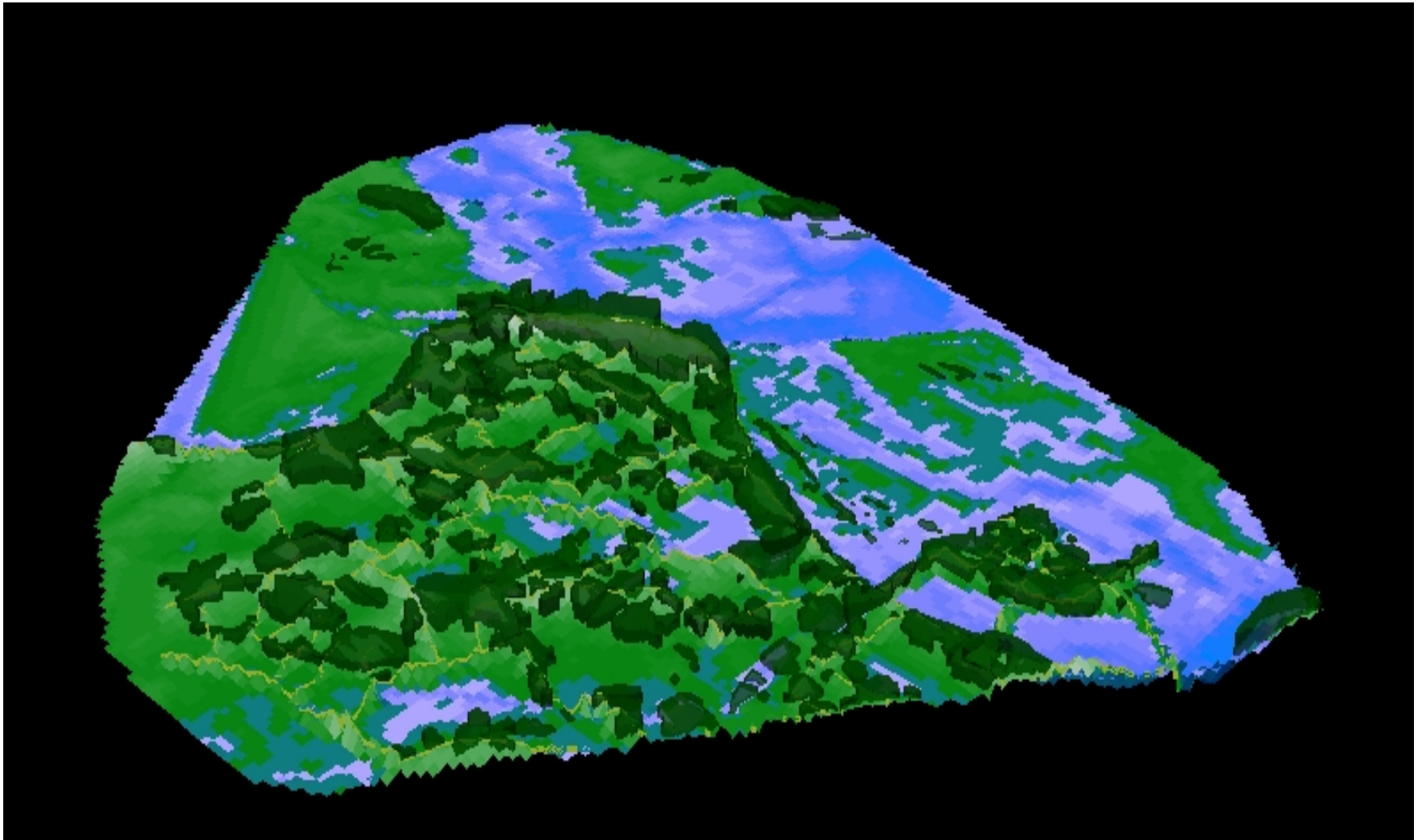
Note: River situation an on 20 August 2001 at 6:00 hrs.

RHWL = River Highest Water Level DL = Danger Level

Inundation mapping for forecast

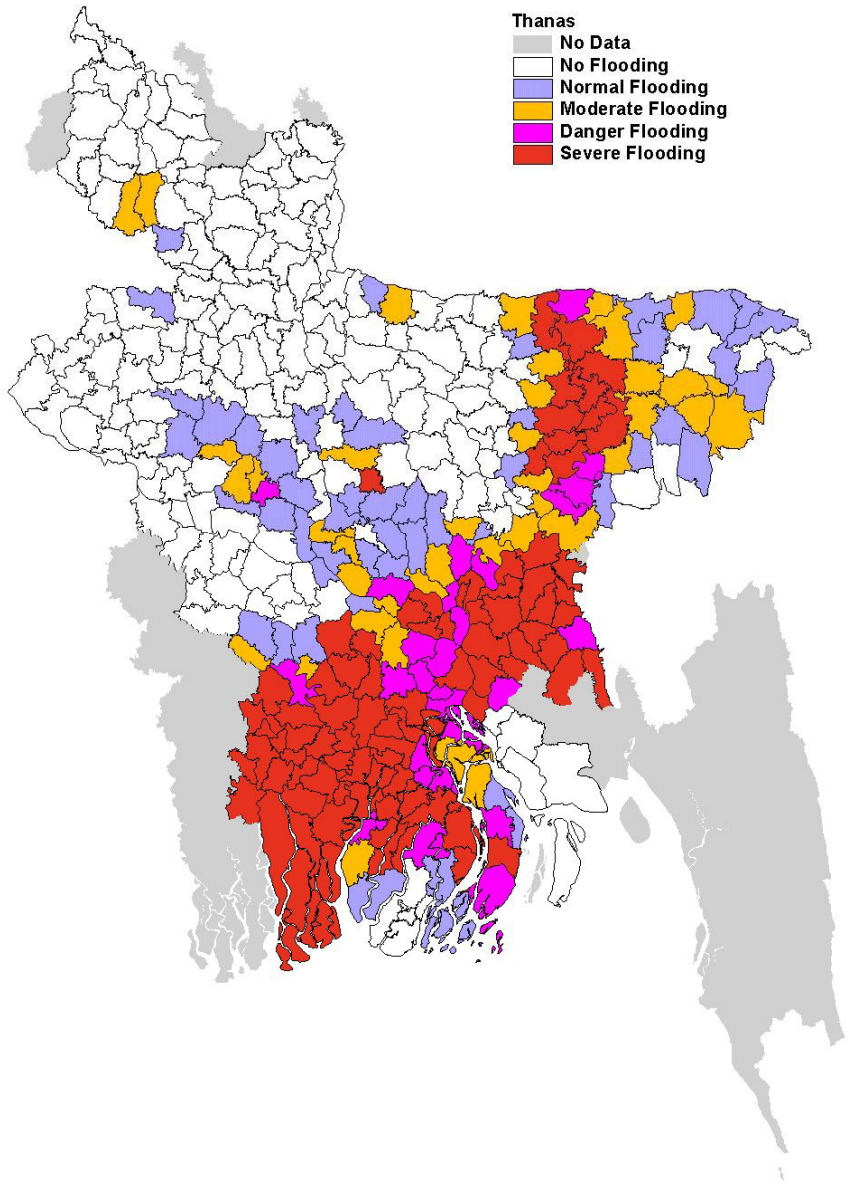


Flood Forecasting and Warning Center
Bangladesh Water Development Board (BWDB)



**3-dimensional flood maps clearly show
affected villages, land and infrastructure**

MIKE 11 GIS FLOOD MANAGEMENT
Thana Flood Status Map based on percentage area inundation
Status as on 13th Sept, 2001



Flood watch :
Thana level
indicative flood
status

Flood Forecasting and warning via the Internet

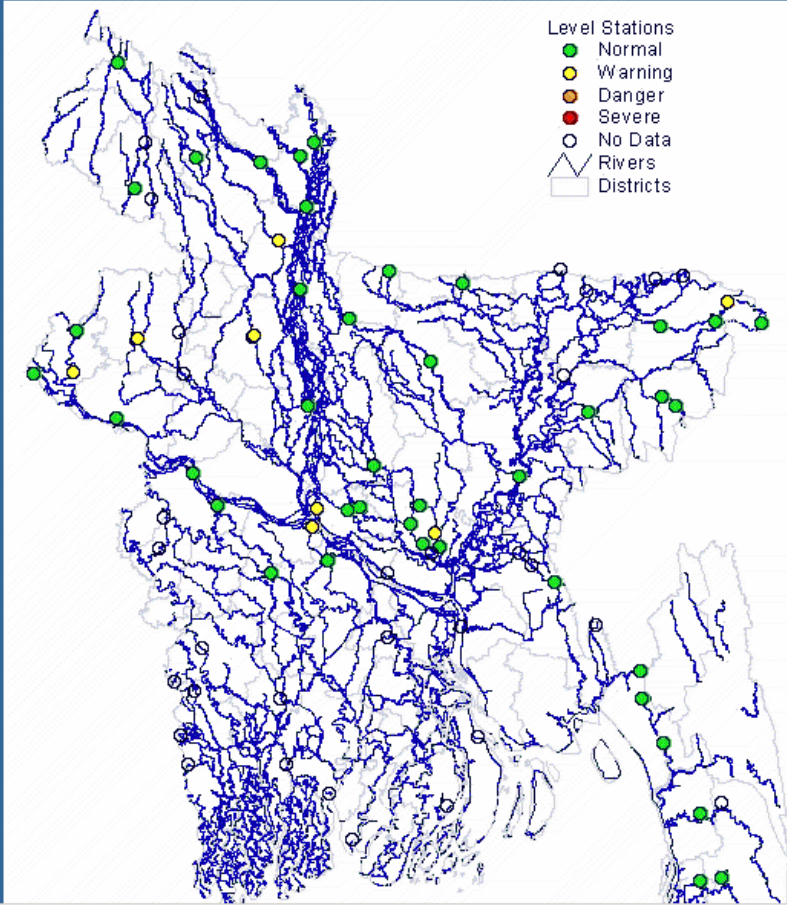
FFWC - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address <http://www.ffwc.net/>

Flood Forecasting and Warning Centre, Bangladesh

Updated on 20 Oct 2002



Level Stations

- Normal
- Warning
- Danger
- Severe
- No Data
- △ Rivers
- Districts

Contents

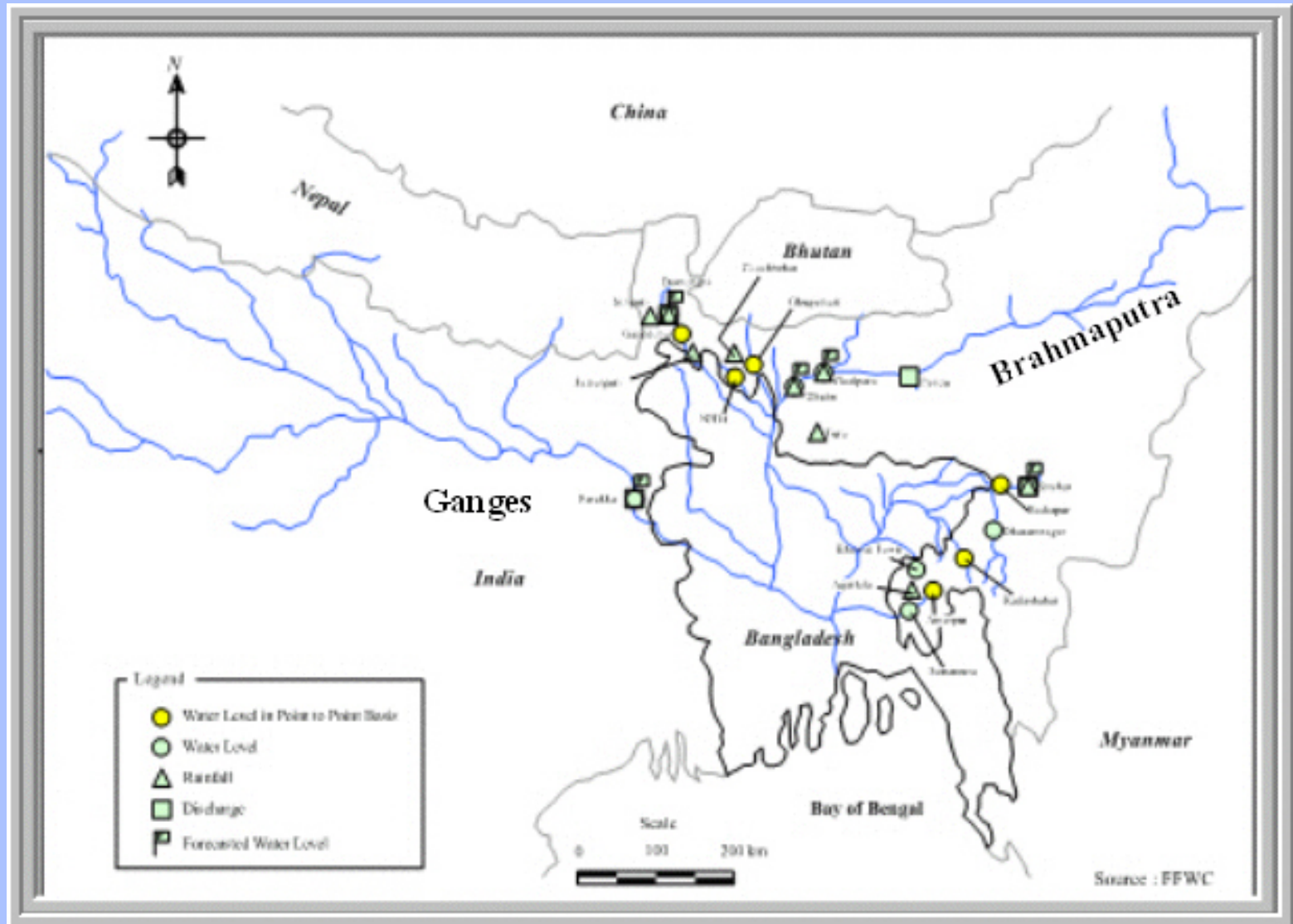
- About us
- Bulletin
- Rainfall
- Water Level
- Inundation Map
- Flood Info.
 - Definitions
 - Statistics
 - Reports
 - Important Links
- Feedback

Amalshid	Habiganj	Naravanganj
Ariaha	Hardinge	Nayrhat
Atrai	Bridge	Noonkhawa
Badadargani	Hariharpara	Panchagarh
Bahadurabad	Hatboalia	Panchpukuria
Baider Bazar	Jagir	Pankha
Bandarban	Jamalpur	Pashuram
Bhagyakul	Jarialaniail	Patherghata
Bhairab	Jhikargachha	Phulbari
Bazar	Jibanpur	Porabari
Bhusirbandar	Kalagachia	Rajshahi
Bogra	Kalaroa	Ramgarh
Chakrahimpur	Kaliganj-Js	Ravenda
Chandpur	Kamakhalai	Rohanpur
Chapai	Kanaighat	Sarihat
Nawabganj	Kangsanagar	Sengram
Chilmari	Kaunia	Serajani
Chiringa	Kazipur	Shakra
Chuadanga	Khulna	Sheola
Comilla	Kurigram	Sherpur
Dalia	Lakhpur	Singra
Dasmunia	Lama	Sunamganj
Daulatkhani	Louergeroh	Sylhet
Demra	Madaripur	Talbaria
Dhaka	Manu Rly Br.	Taraghat
Dinajpur	Mawa	Toke
Dohazari	Mathurapara	Tongi
Durgapur	Meghna Br.	
Faridpur	Mirpur	
Gaibandha	Mohadevpur	
Gibar(Sarsa)	Mohendrapur	
Goalondo	Mongla	
Gorai Rly	Moulvi Bazar	
Bridge	Mymensingh	
	Nakuagaon	
	Naogaon	
	Naravan Hat	

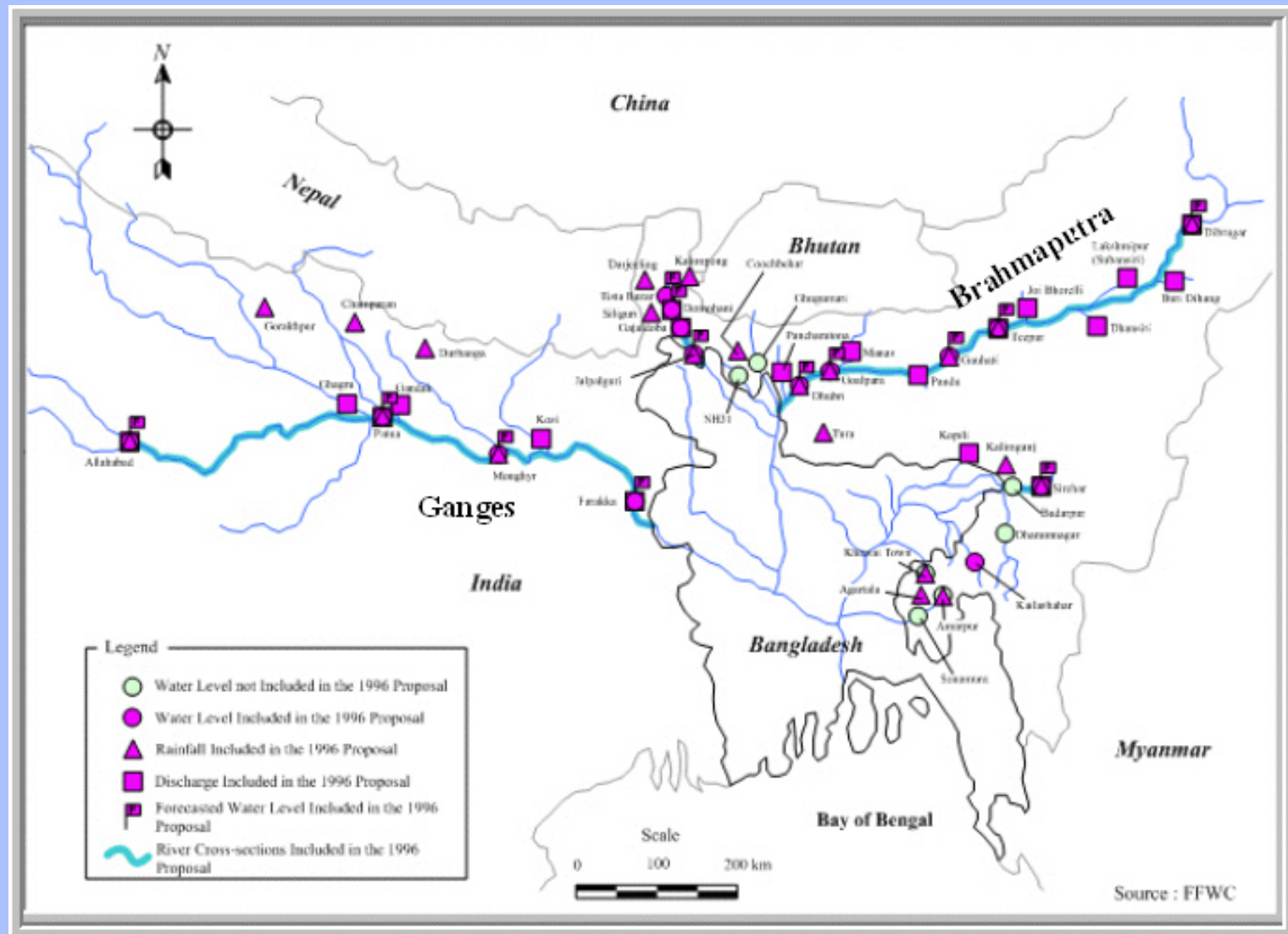
Done Internet

www.ffwc.net

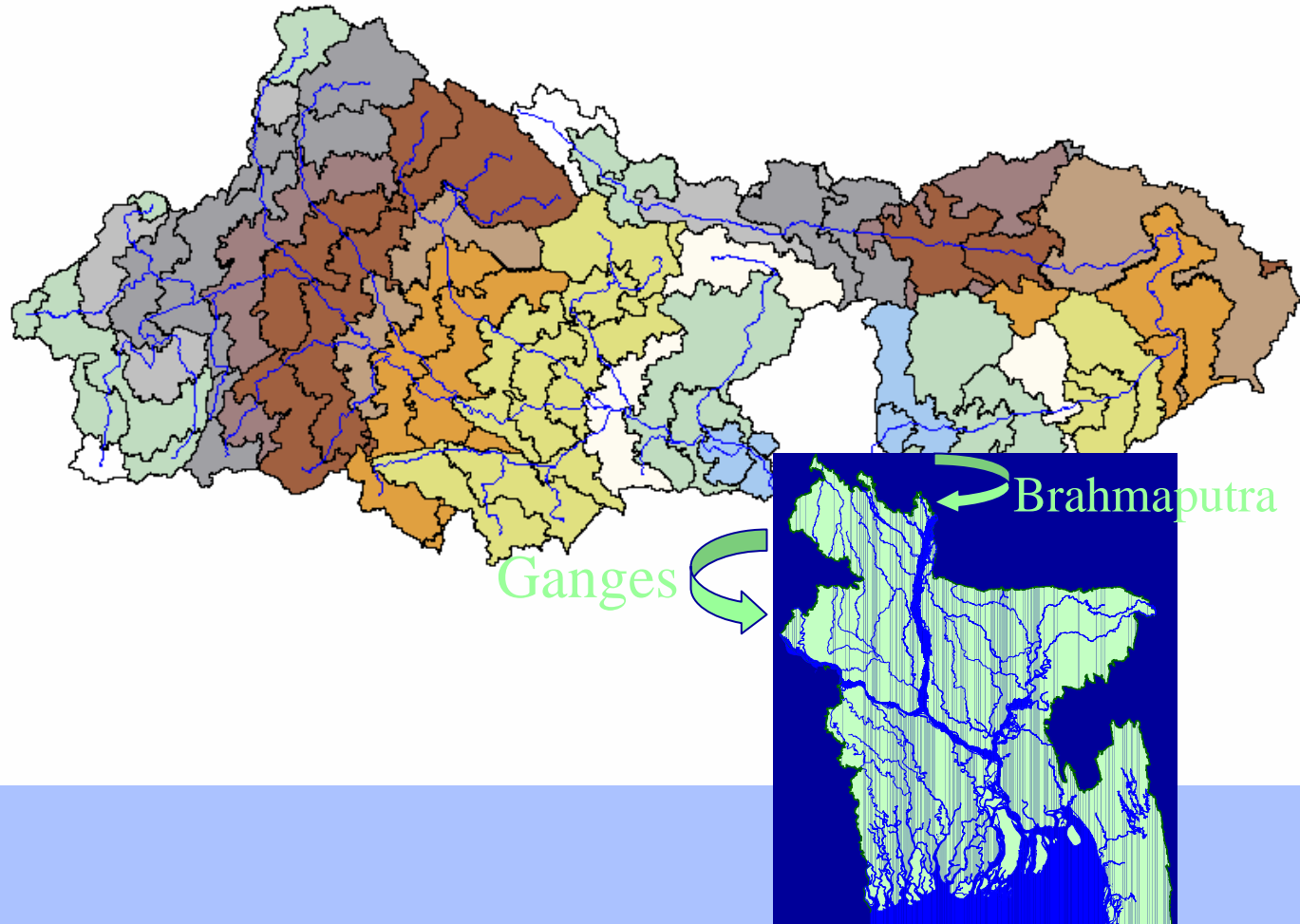
Data from India as per the existing Agreement



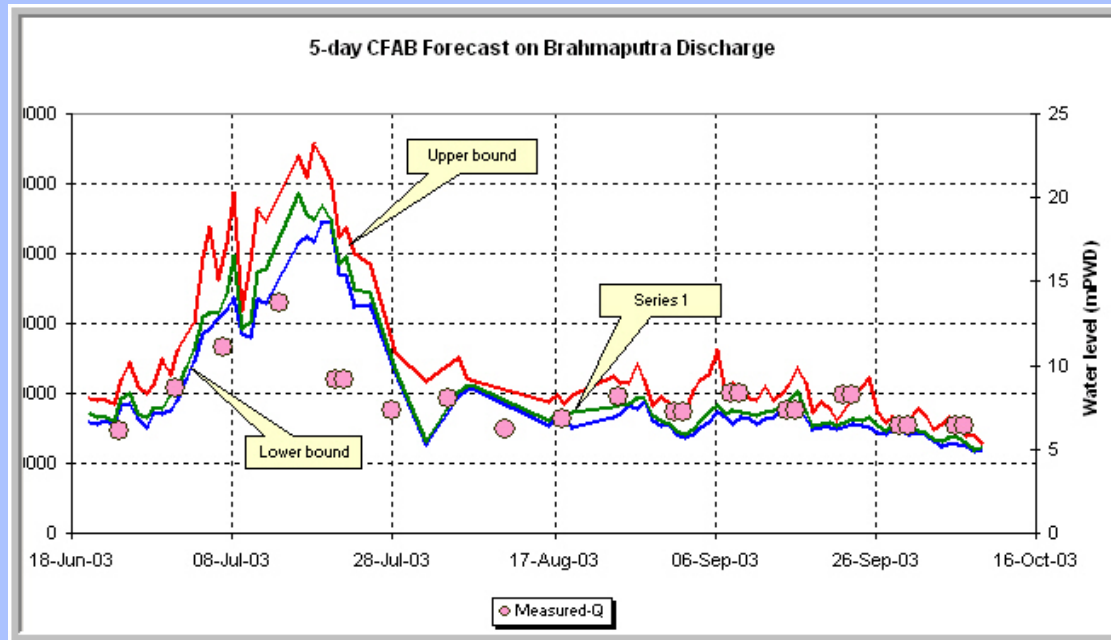
Desired (by Bangladesh) data from India



Catchment Response Time Lag (1-21days)

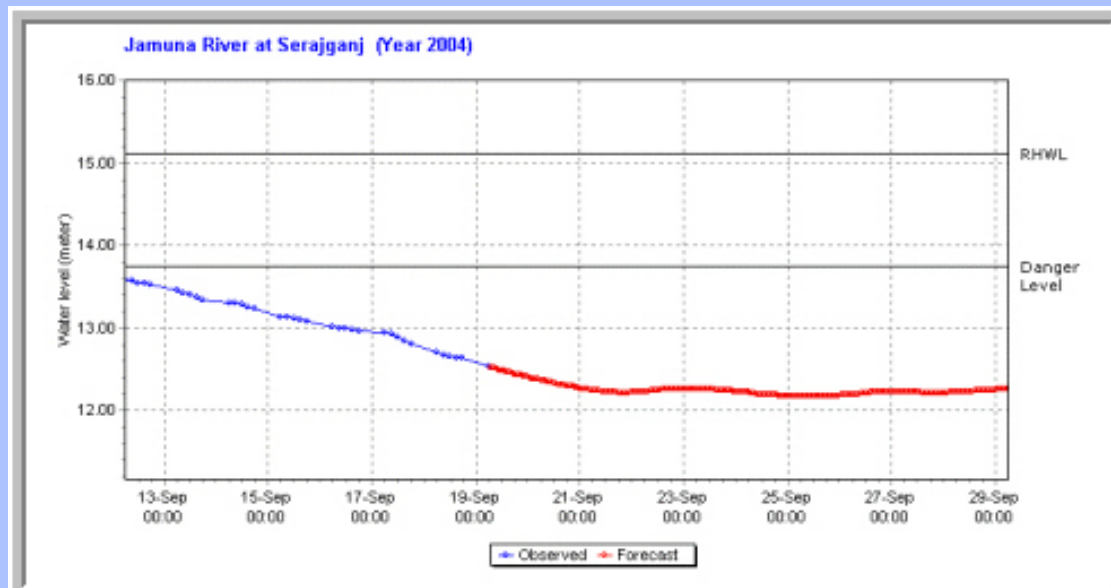


Climate forecast applications (long term)



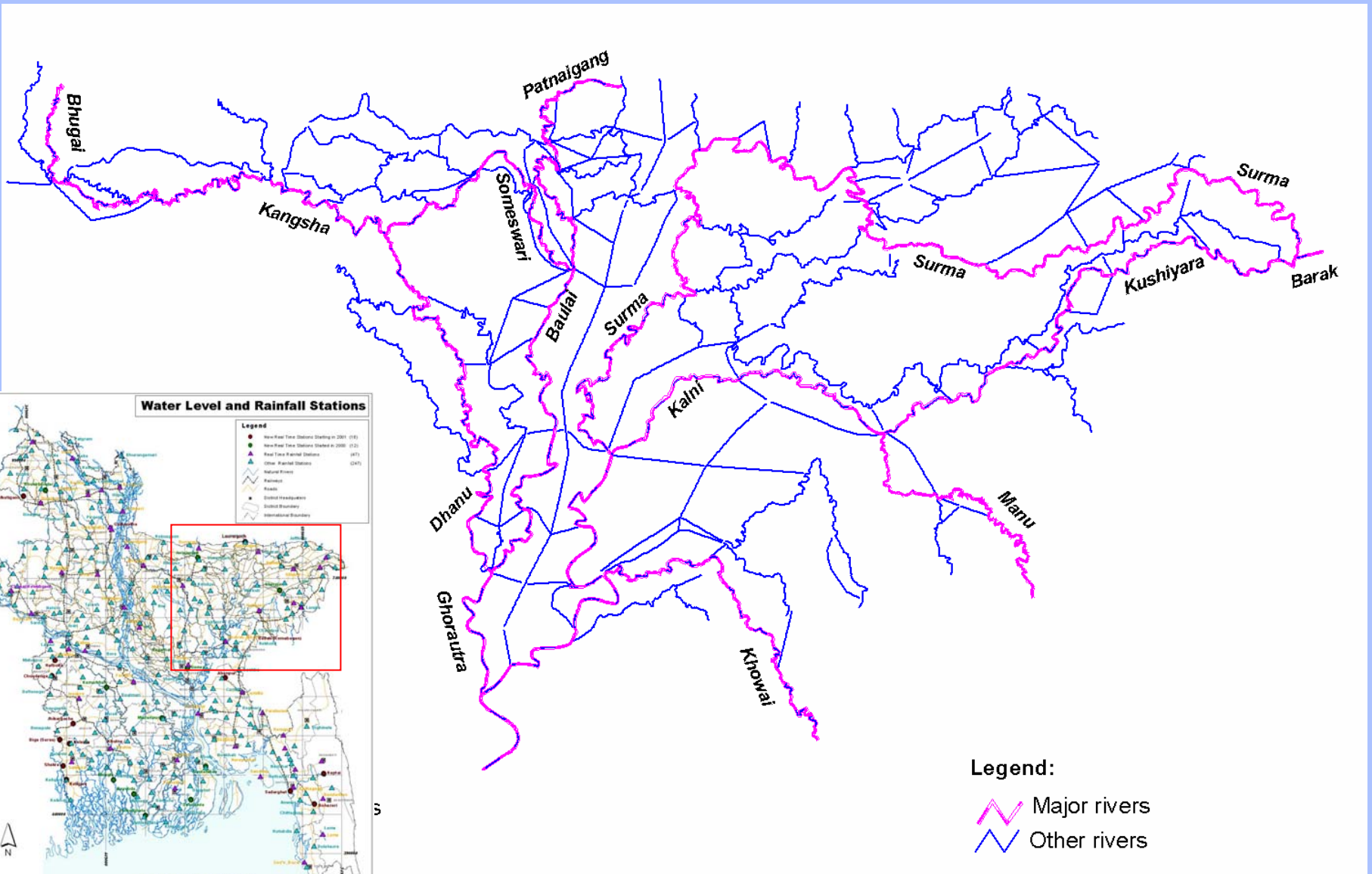
Examples;



5-day Q
forecast



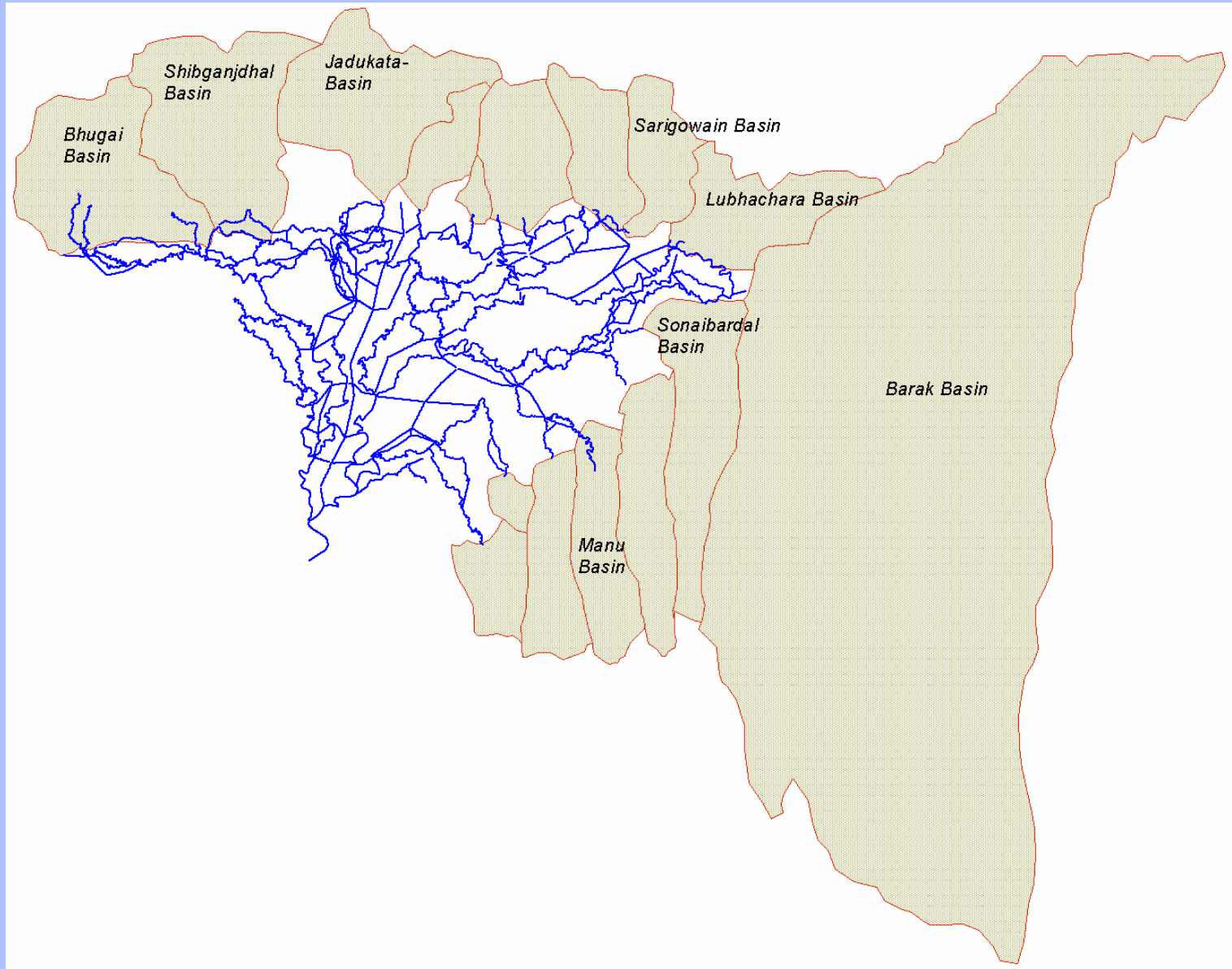
10-day WL
forecast

NE Flood Forecasting: Model Rivers

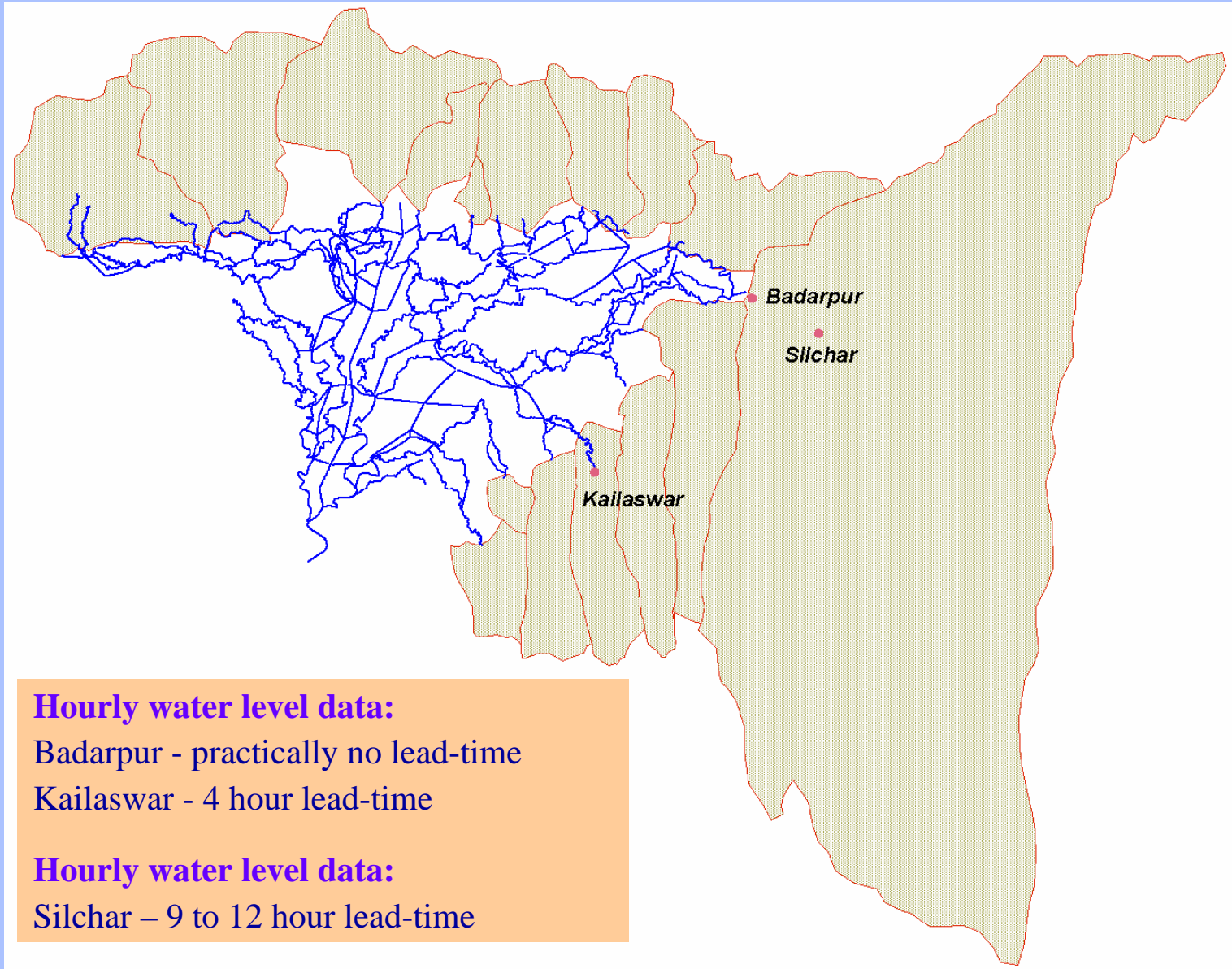


- Legend:**
-  Major rivers
 -  Other rivers

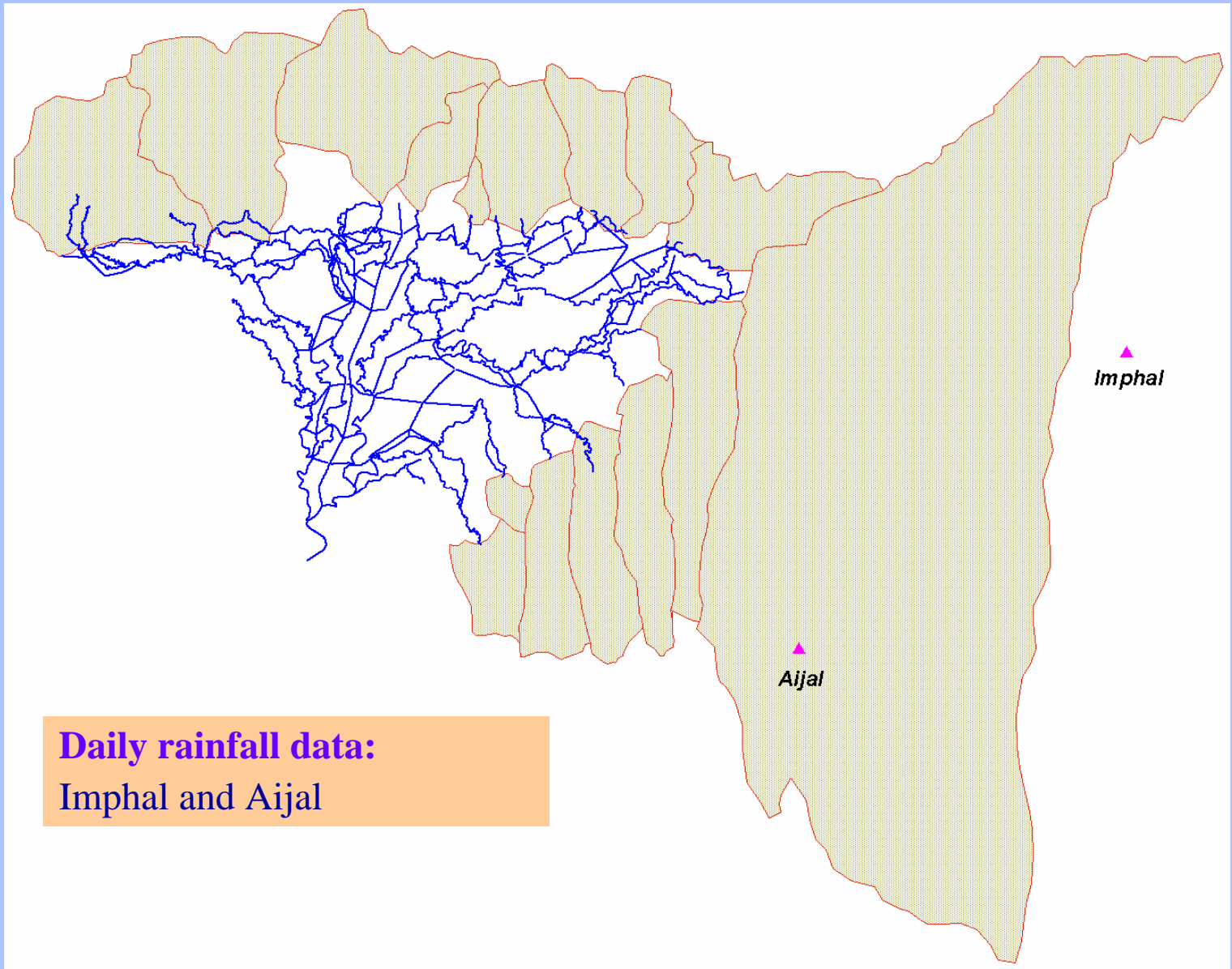
NE Flood Forecasting Model: Trans-border catchments



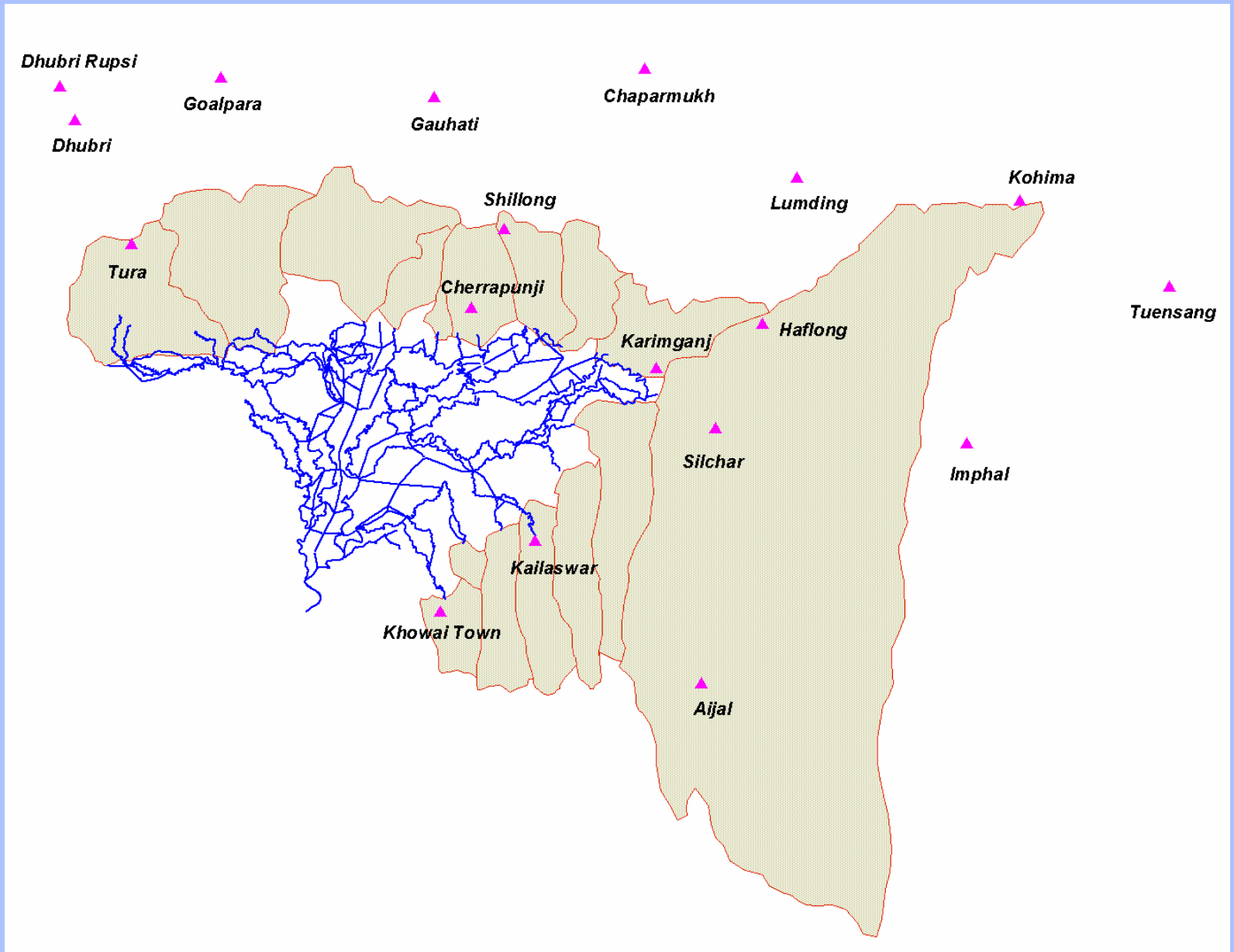
Currently available upstream Water level data



Currently available upstream Rainfall data



Rain gauges in Indian Territory





Thank you