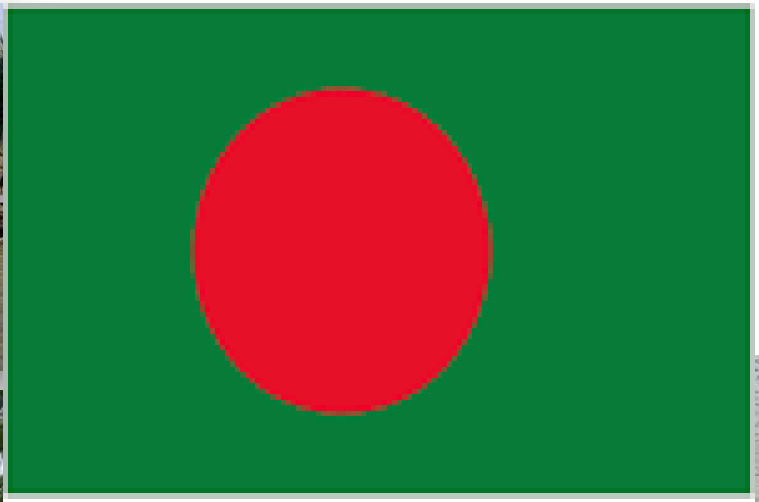
Country Perspective: Bangladesh



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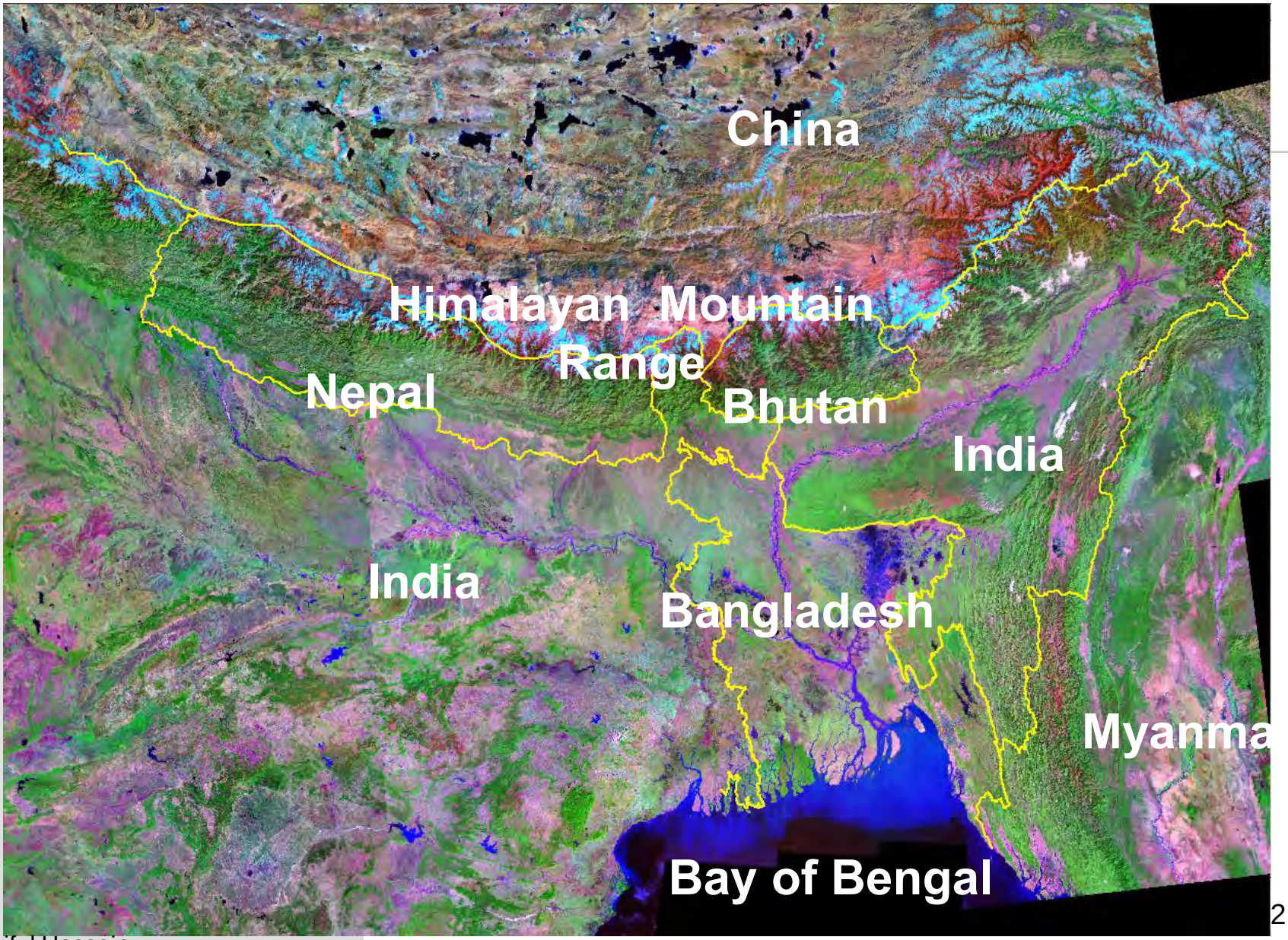
Bangladesh : Physical Surroundings



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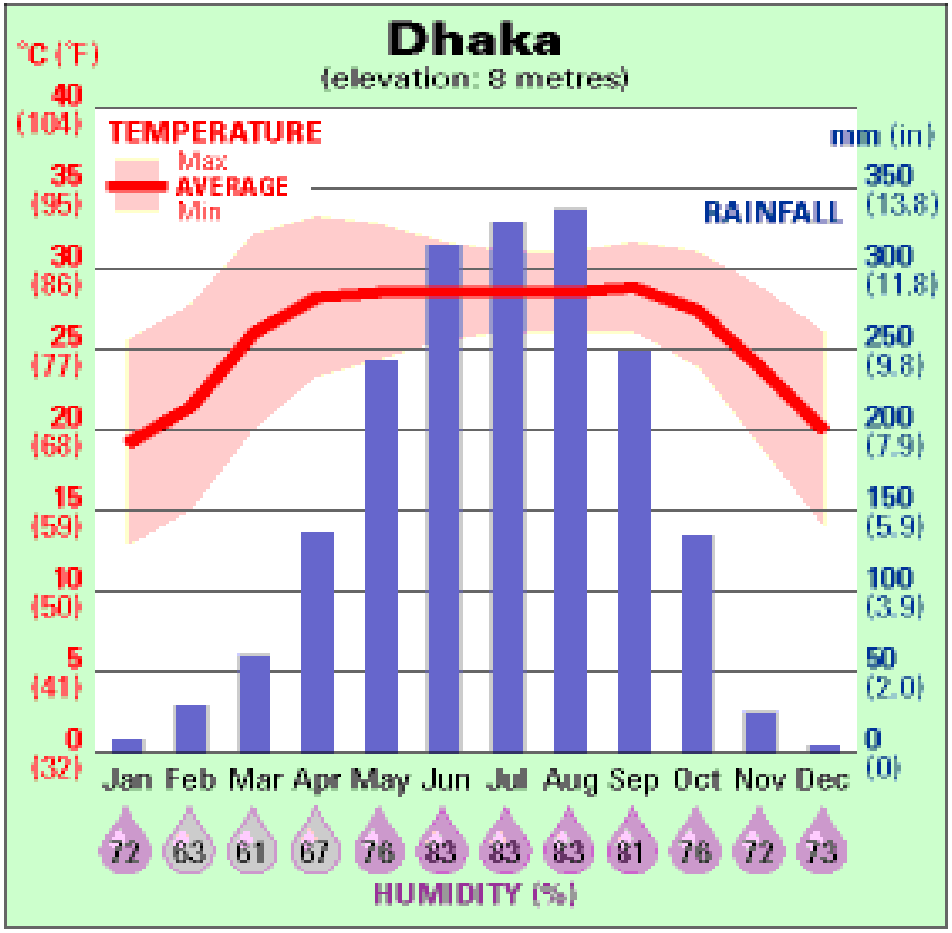
Bangladesh: General Information

- **Area – 14.76 million ha**
- **Population - 160 million**
  - **density > 1000/ km^2**
- **Lowest Per capita land availability**
- **Annual land loss: 8,700 ha.**
- **Agricultural land is reducing by 1% annually**
- **Per capita water availability:≈ 1230 m^3/year**
- **Flood Vulnerable Area:11.7 million ha**

- **Irrigable Land:8.2 million ha**
- **Irrigation Provided:5.9 mha**
- **Land Reclamation:1800 ha**
- **Sanitation coverage: 55%**
- **GDP: 533.7 billion US$**
- **Economic Growth (5 years compound): 6.2%**
- **Foreign Currency Reserve >32 billion US$**
- **Life expectancy :71.8years**
- **Natural Disasters: Flood, Drought, Cyclone, Storm Surge, River Bank erosion.**

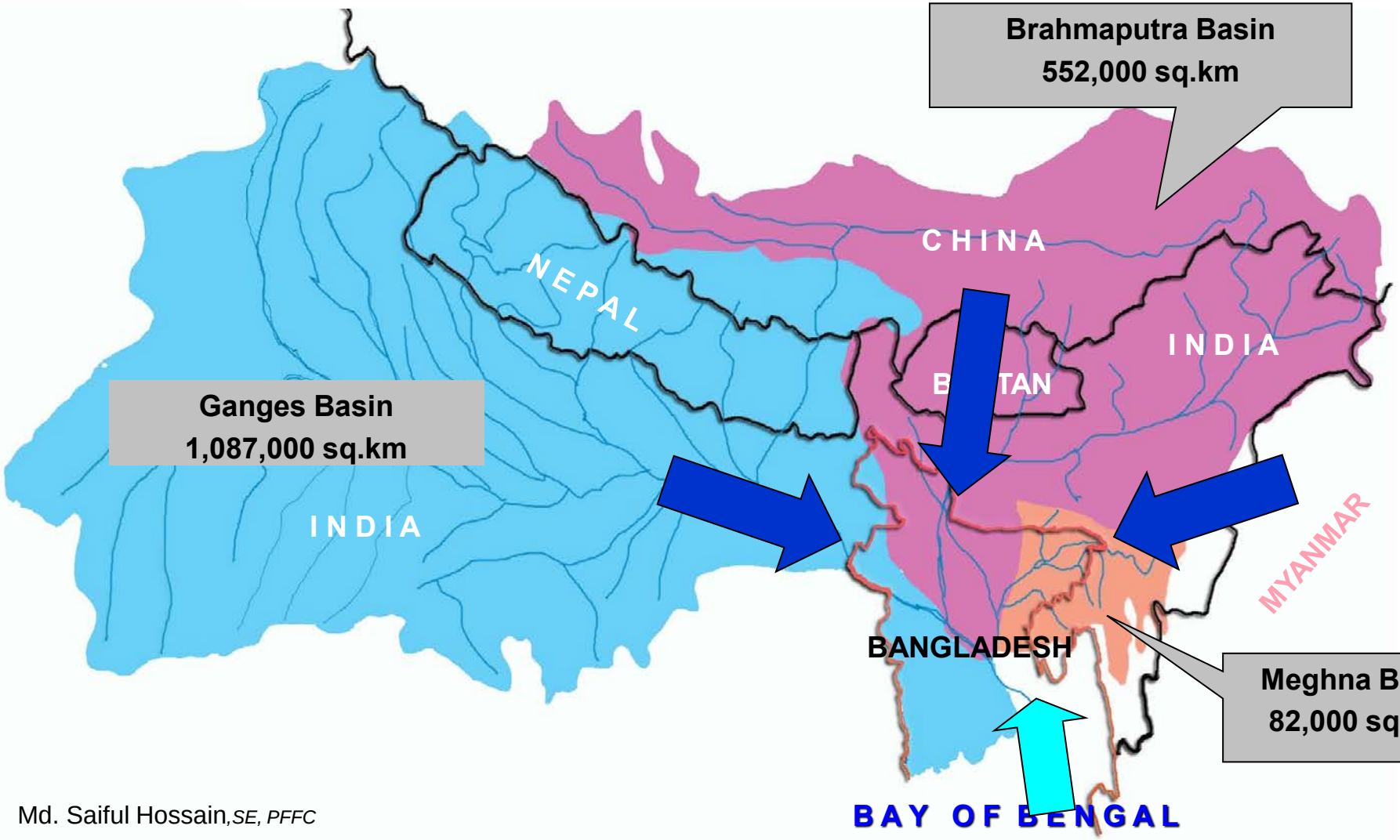
Climate

- Subtropical monsoon, characterized by wide seasonal variations in rainfall
- Moderately warm temperatures, and high humidity
- Three seasons are recognized: a hot, humid summer (March-June); rainy (flood) monsoon season (June-Oct.); and a cool, dry winter (Nov.-March).



Hydrology and Water Resources

Bangladesh rivers receive runoff from a catchment of 1.72 million sq. km, around 12 times its land area



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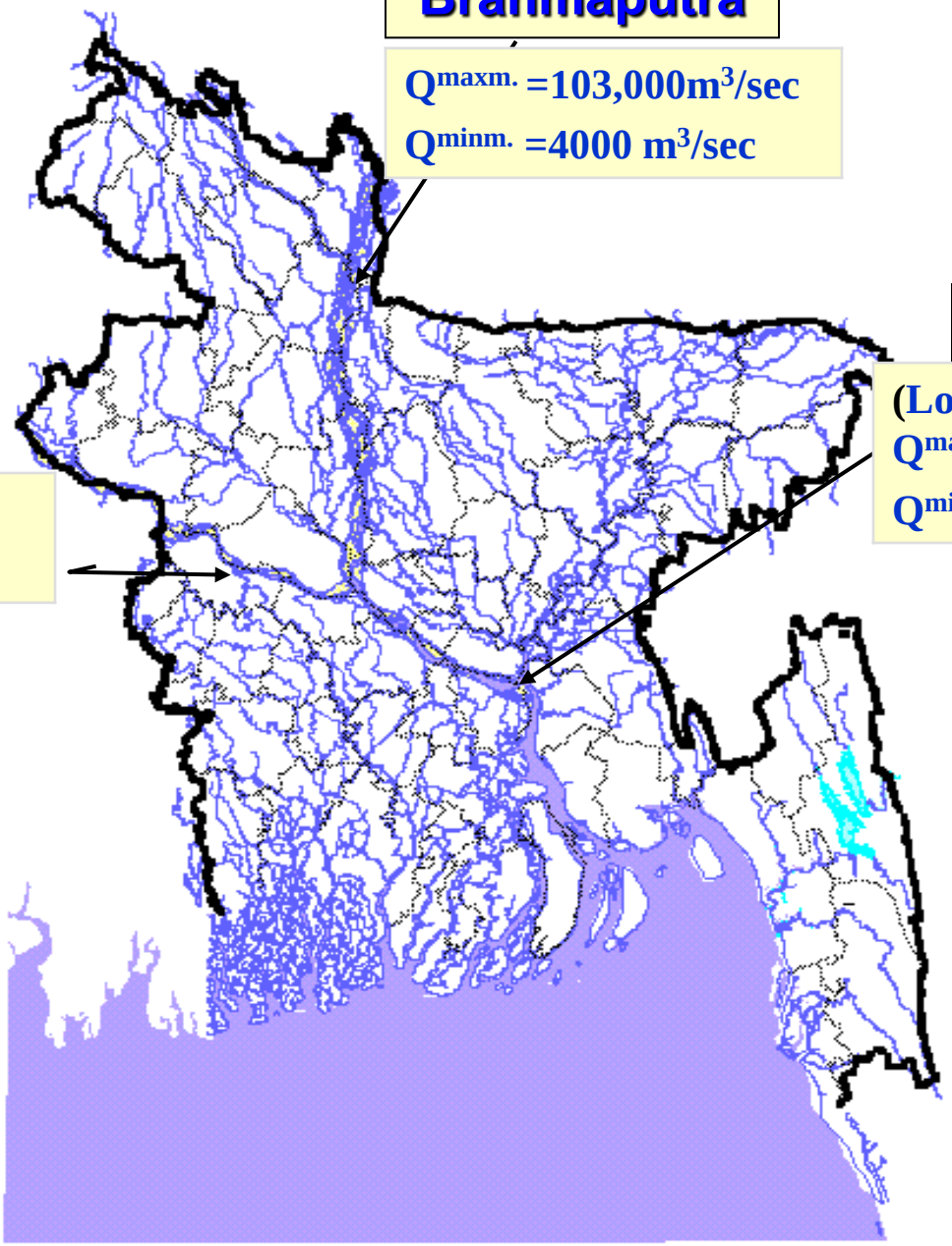
RIVER SYSTEMS OF BANGLADESH

Riverine Country with 405 rivers



Brahmaputra

$Q^{maxm.}$ =103,000m^3/sec

$Q^{minm.}$ =4000 m^3/sec

Meghna

(Lower Meghna)

$Q^{maxm.}$ =180,000 m^3/sec

$Q^{minm.}$ = 4,000 m^3/sec

Ganges

$Q^{maxm.}$ =78,000 m^3/sec

$Q^{minm.}$ = 700 m^3/sec

Trans-boundary Flow:

57 Rivers (54 with India, 3 with Myanmar)

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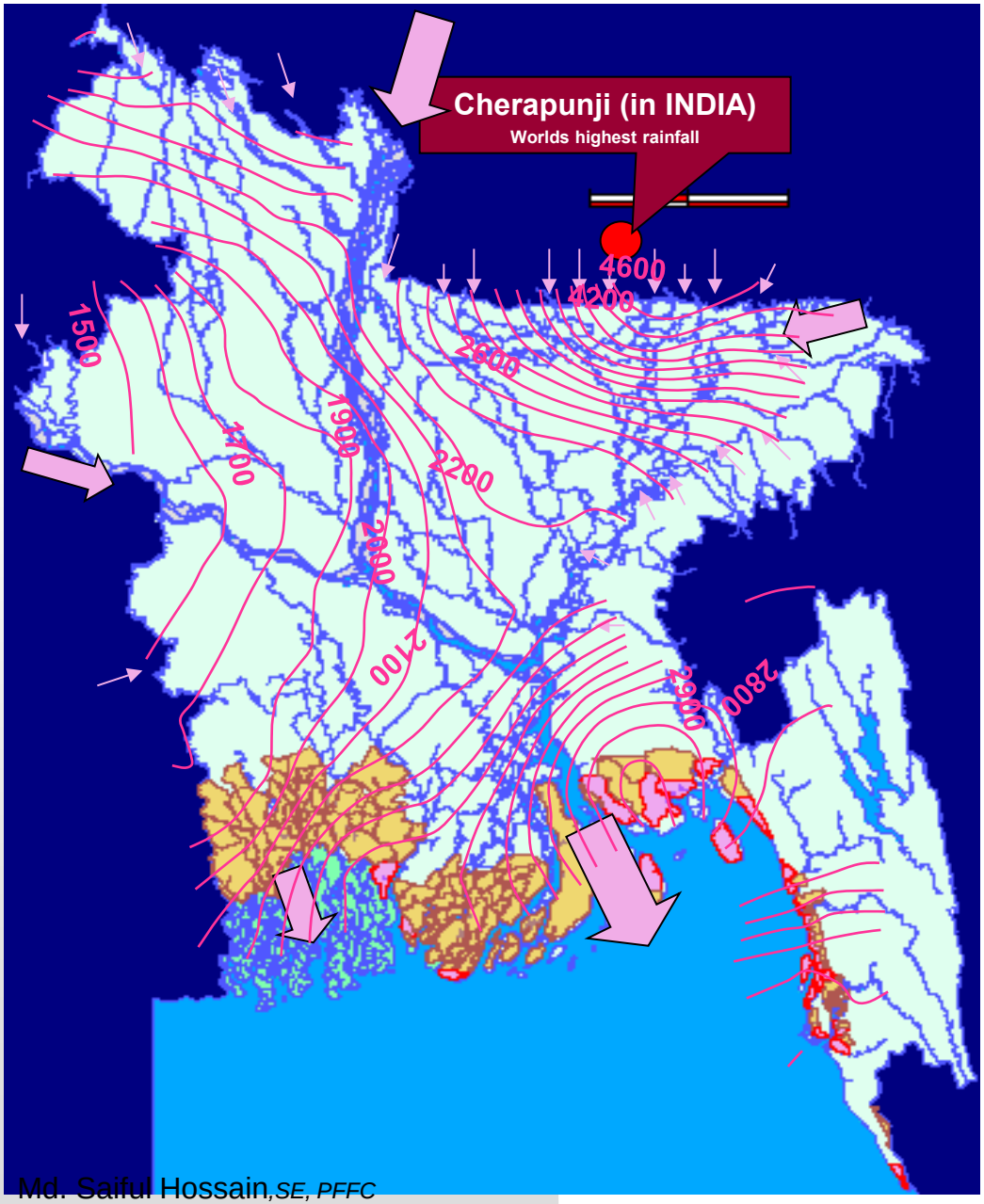
Hydrology and Water Resources



Rainfall

Annual Rainfall 2200 -2500 mm

Highly skewed

80% fall in June-September

1200 mm in NW, 5500 mm in NE

STATE OF WATER RESOURCES

- Too much water during monsoon & too little in dry season
- No control over 57 transboundary rivers
- High rainfall in four months
- Flat Topography
- Salinity Intrusion
- Flooding, Erosion & Siltration are major problems

Water Use, Demand, Availability

Use

- Domestic and Municipal
- Agriculture and Forestry
- Fisheries
- Navigation
- Environment

Demand

- **Dry season demand 147 BCM (estimated)**
- **Shortfall by about 40%**

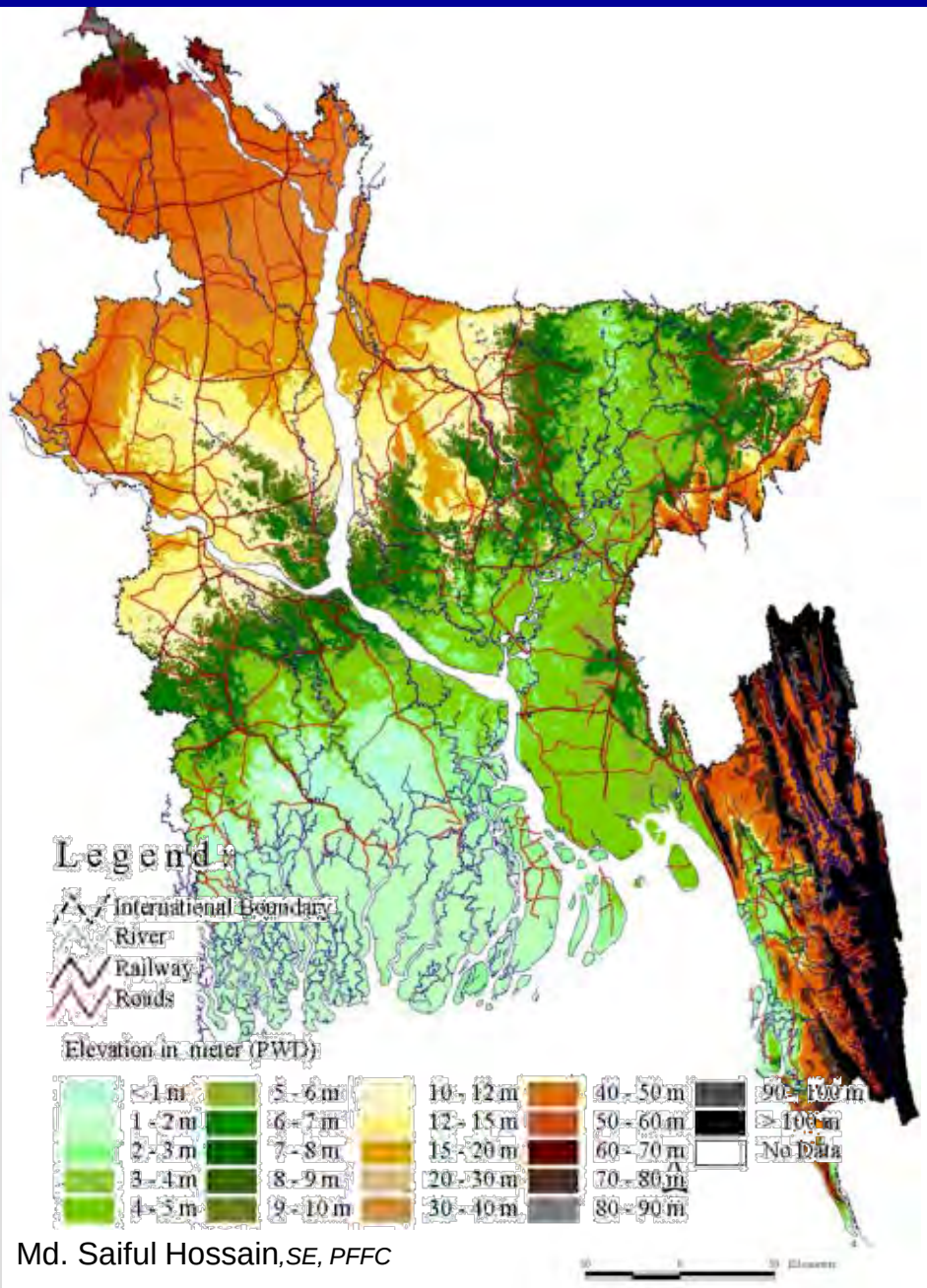
Availability

- **Annual quantum available – 1,223 BCM**
  - **Cross border flows inflows – 1,053 BCM**
  - **Local Rainfall – 149 BCM**
  - **Available from Groundwater – 21 BCM**
- **Temporal Distribution**
  - **During Monsoon 1,000 BCM**
  - **During Dry Season - 90 BCM**
- **Groundwater is important component of water supply, especially for domestic purpose**

Demands exceeds Availability

Some area experience drought condition even in Monsoon

Bangladesh : Topography



- **Mostly flat**
  - **flood plains - 80%.**
  - **hilly areas -12%**
  - **terrace areas -8%**
- **About 16% of the area Lies below 1.50 m of MSL**
- **About 50% of the country is within 6-7 m of MSL**
- **About 68% of the country is vulnerable to flood**
- **25-30% of the area is inundated during normal monsoon**

Coastal Zone of Bangladesh

32% of the land area,
28% of the population,

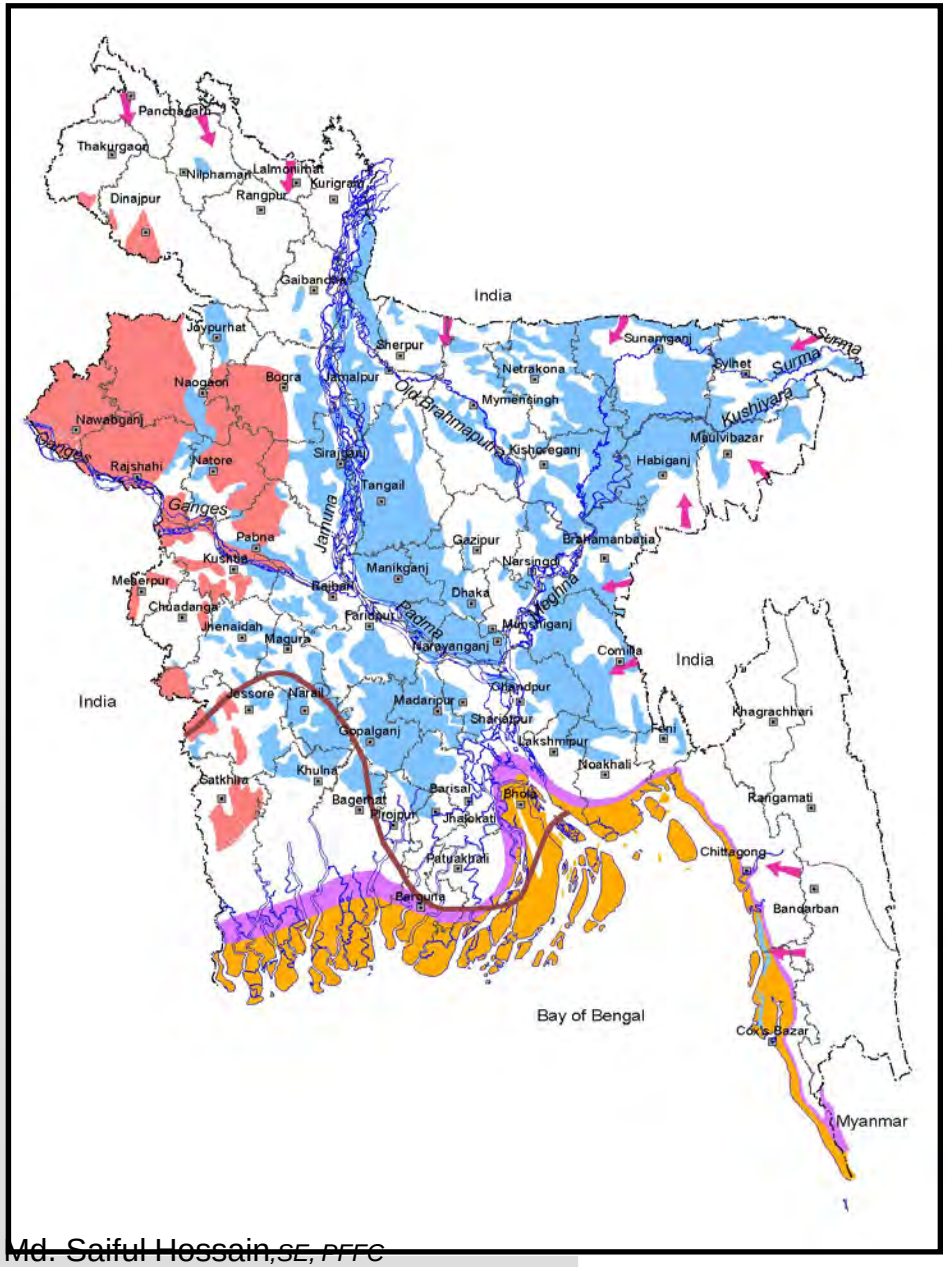
Opportunities

- Sedimentation and Land Accretion
- Land development & settlement
- Agricultural & fishery Development
- Livelihood
- Tourism

Vulnerabilities

- Erosion
- Drainage congestion
- Salinity Intrusion
- Cyclone & Storm surge
- Climate Change Impact

Water Induced Hazards and Disasters



Floods

Cyclone/storm surge

Riverbank Erosion

Sedimentation

Drought

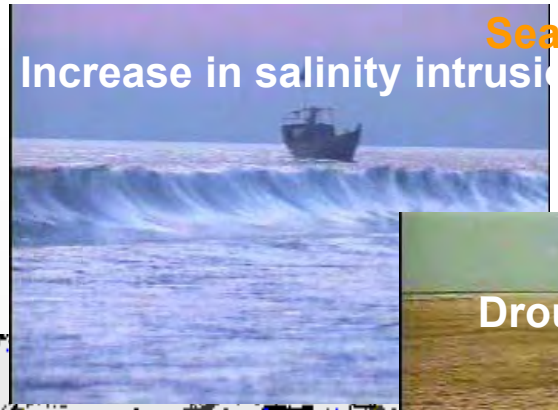
Water Quality Deterioration

Salinity Intrusion

Climate Change provoke all Disasters

- Normal Flood
- Flash Flood
- Severe drought prone area
- Surge Height above 1 meter
- Surge Height less then 1 meter
- 1 ppt salinity Isoline

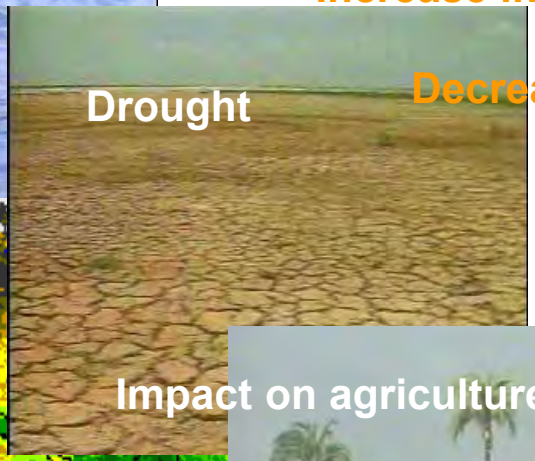
Water Resources Management Vulnerabilities



Sea level rise

Increase in evaporation

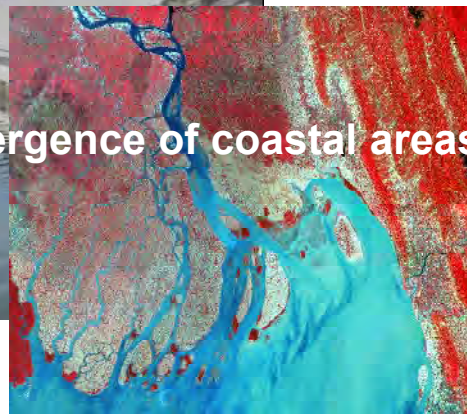
Increase in snow melt in the Himalayas



Decrease in precipitation in dry season

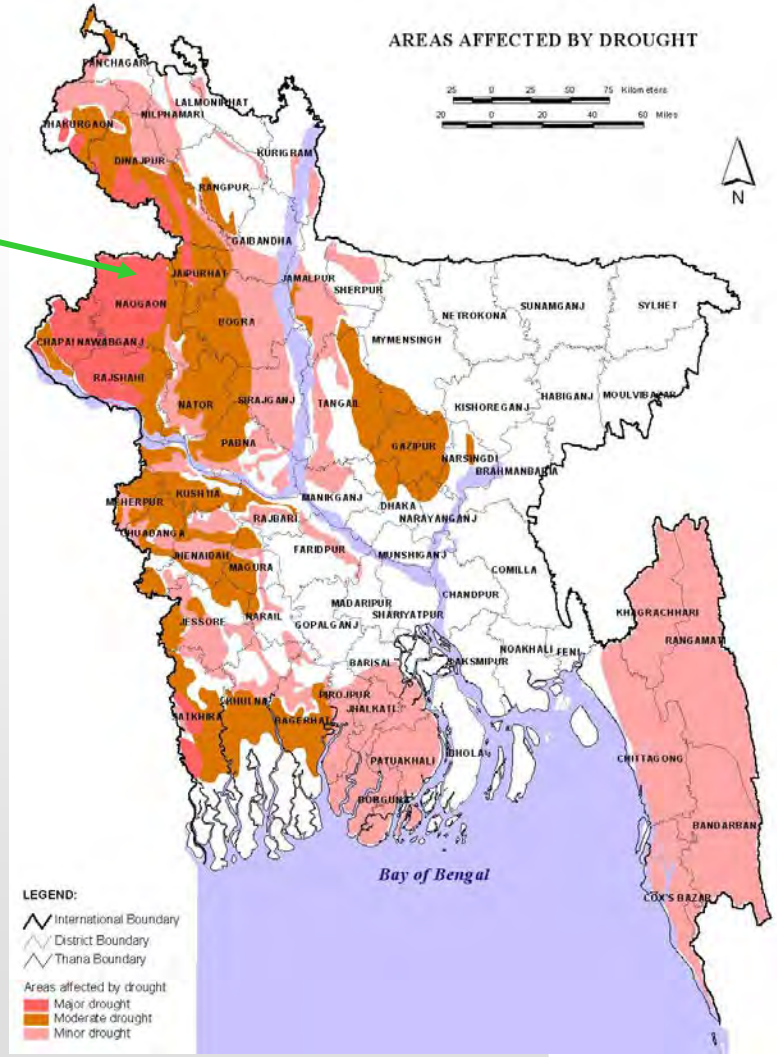
Increase in precipitation in monsoon

Prolonged monsoon



Water Resources Management Vulnerabilities: Flood

Water Resources Management Vulnerabilities: Drought



About 25% of the country suffer water stress in dry season

Flood

- Flood occurs in Bangladesh regularly
- Being low-lying country, average 22% area is flooded every year
- In case of severe flood, 66% area inundated
- 1954,'55,'74,'87, '88,'98, 2004,2007 & 2017 floods were catastrophic

Causes of Floods

- Unique Geographical Location
- Excessive run-off from upstream
- Low topography
- River siltation
- Sea swell during monsoon
- Hydraulic Characteristics
  - low gradients of major rivers
    - Ganges: 4 cm/km, B.Putra: 8 cm/km, Meghna: 3 cm/km

Flood Management

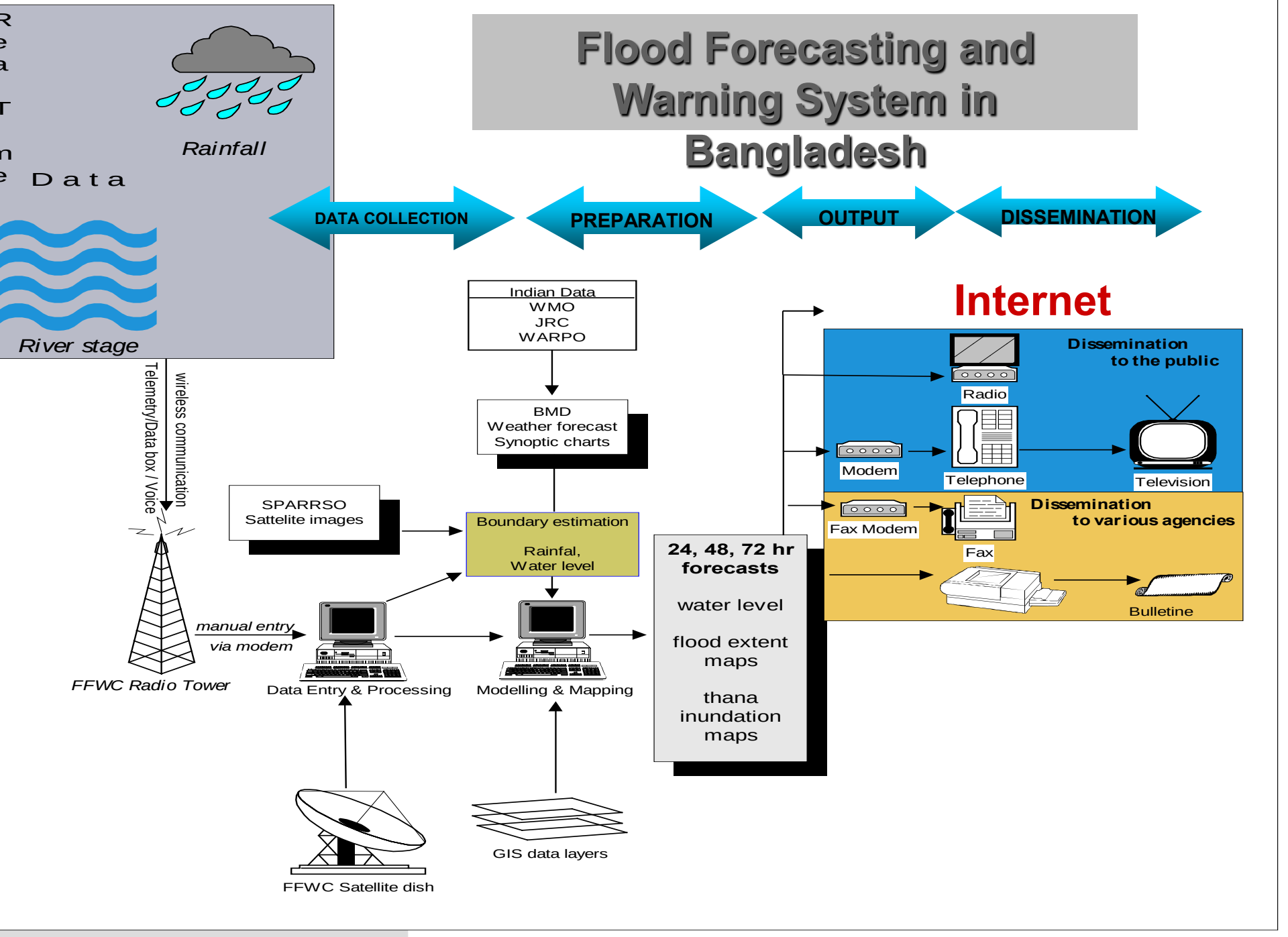
Structural measures

- Embankments
- Hydraulic structures, etc.

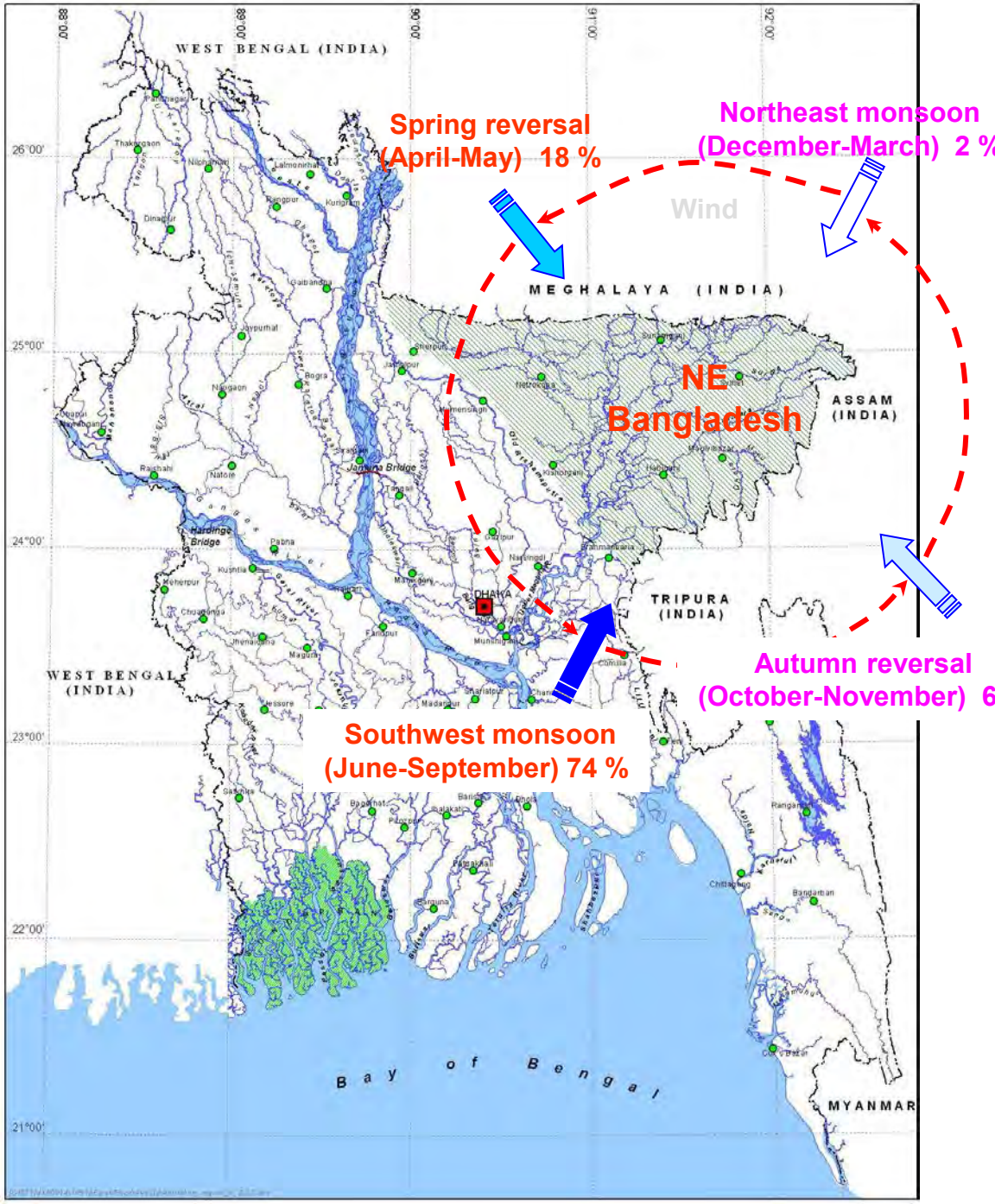
Non-structural measures

- **Flood forecasting and warning**
- **Flood preparedness,**
- **Erosion prediction**
- **Environmental Monitoring**
- **Watershed Management**

Flood Forecasting and Warning System in Bangladesh



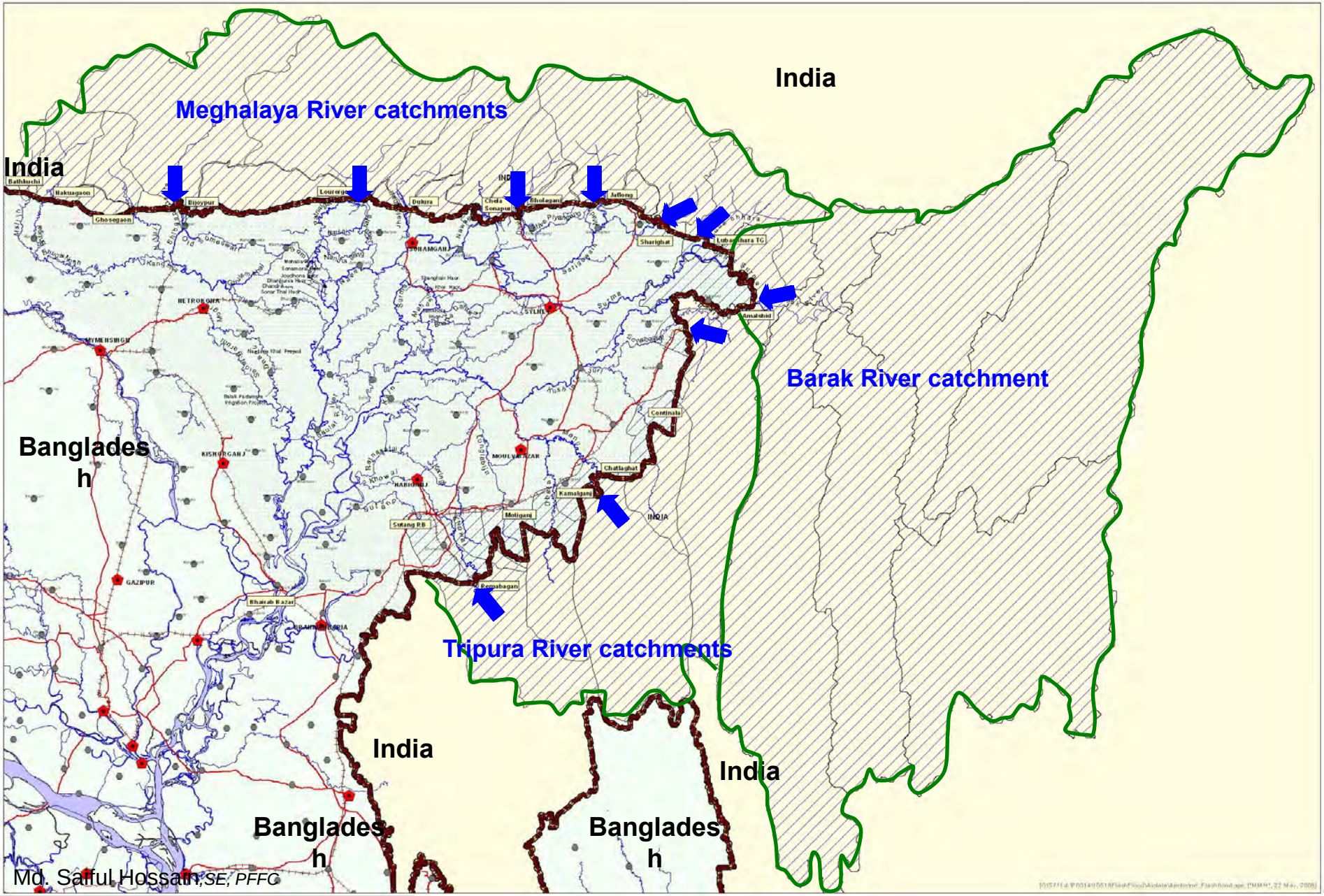
Flash Flood 2017



Flash Flood in Sunamganj (April 02 2017): Erratic rainfall In the face of Climate change

Md. Saiful Hossain,*SE, PFFC*

Catchments that contribute flash flood



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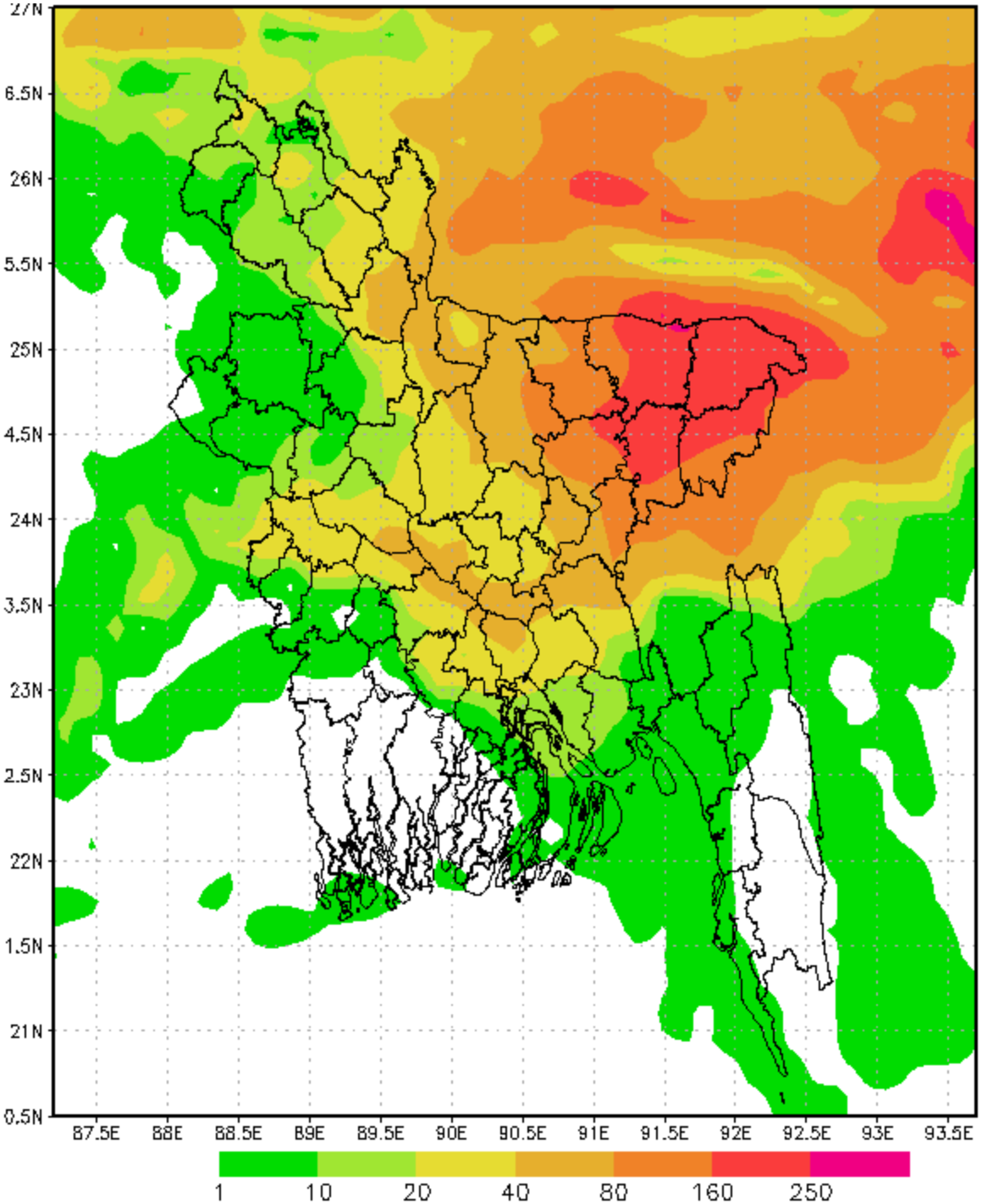
Accumulated Rainfall: 1/4/17 to 5/4/17 (Ref: RIMES)



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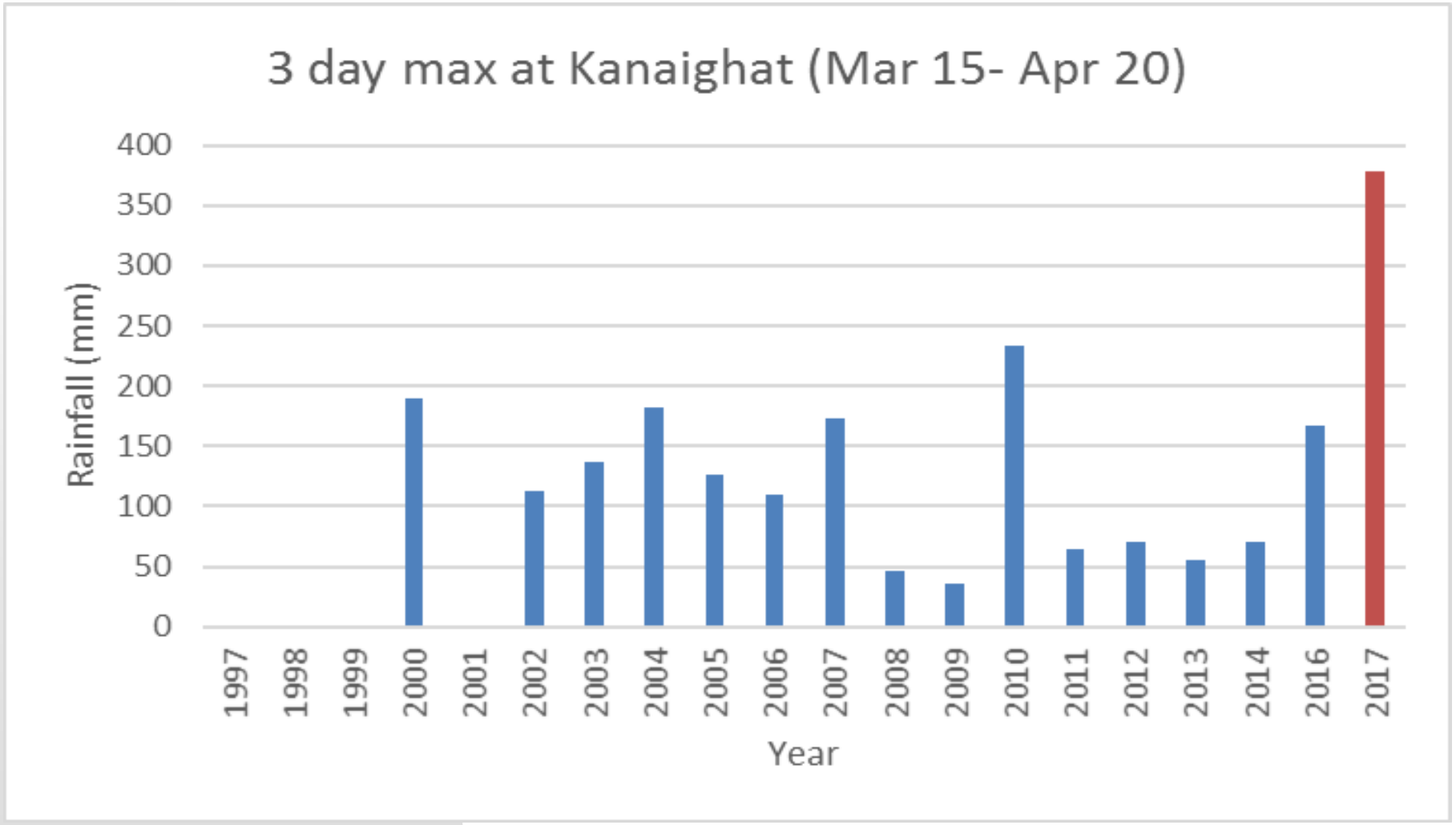
Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Karaighat



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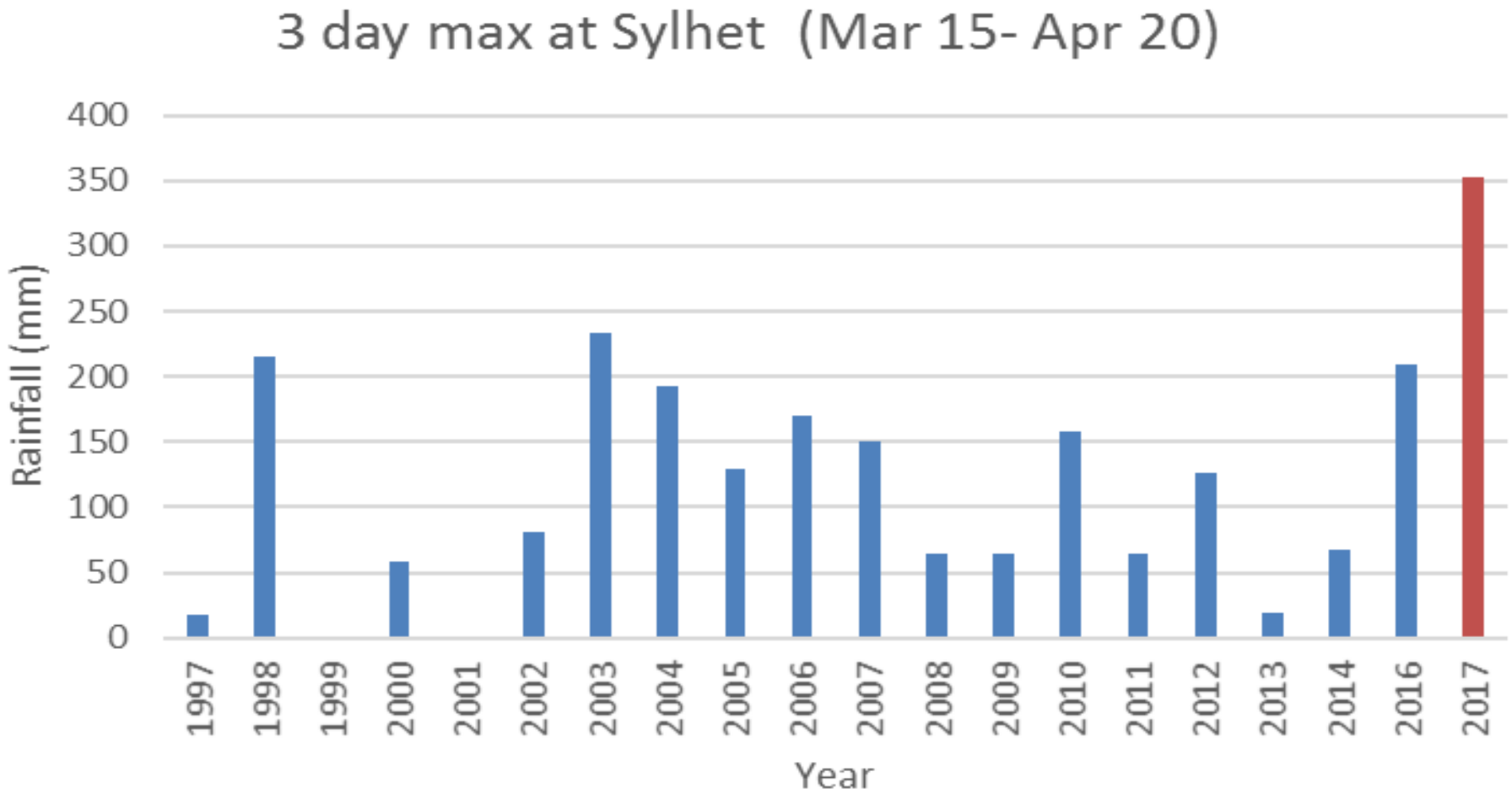
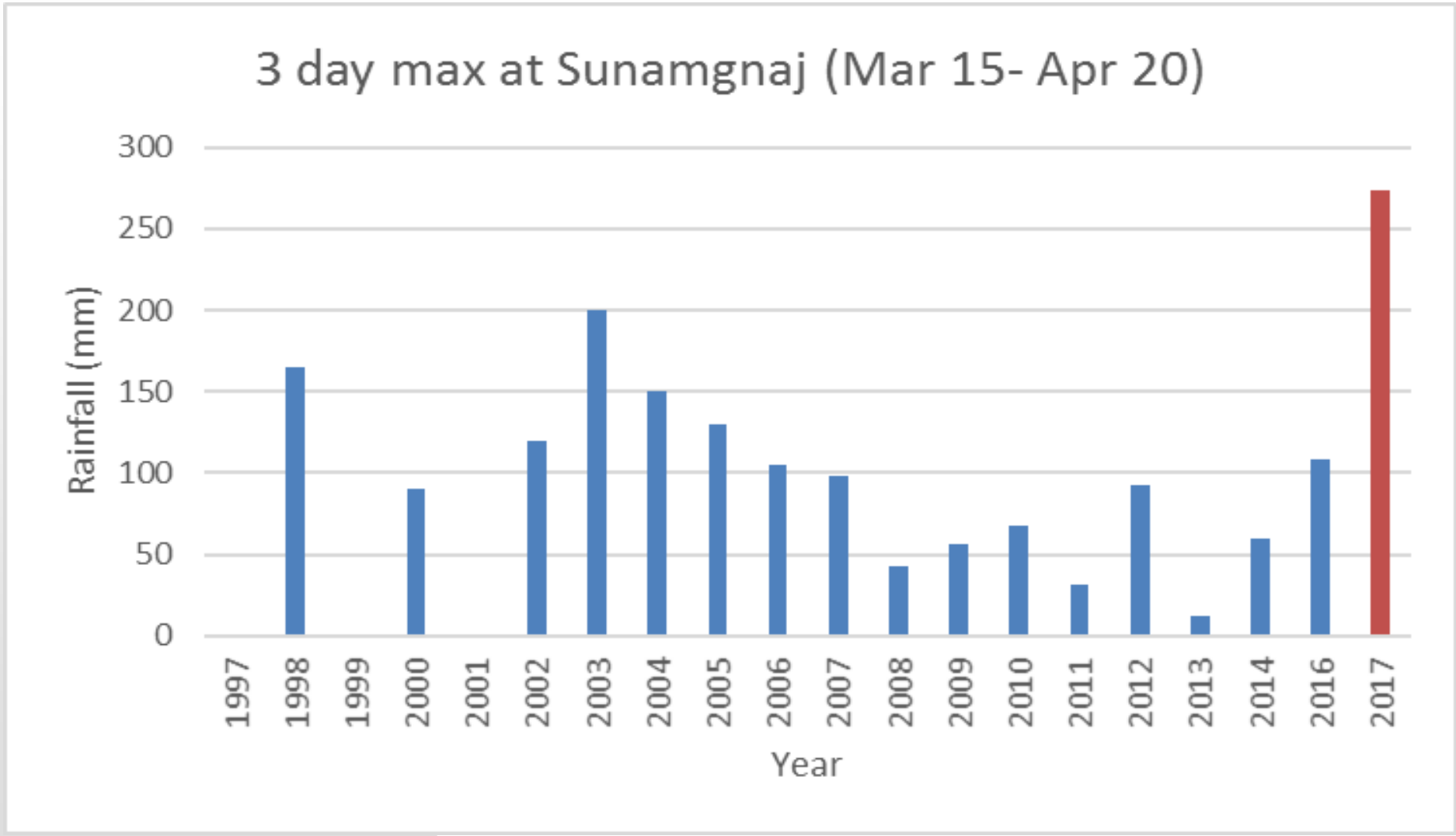
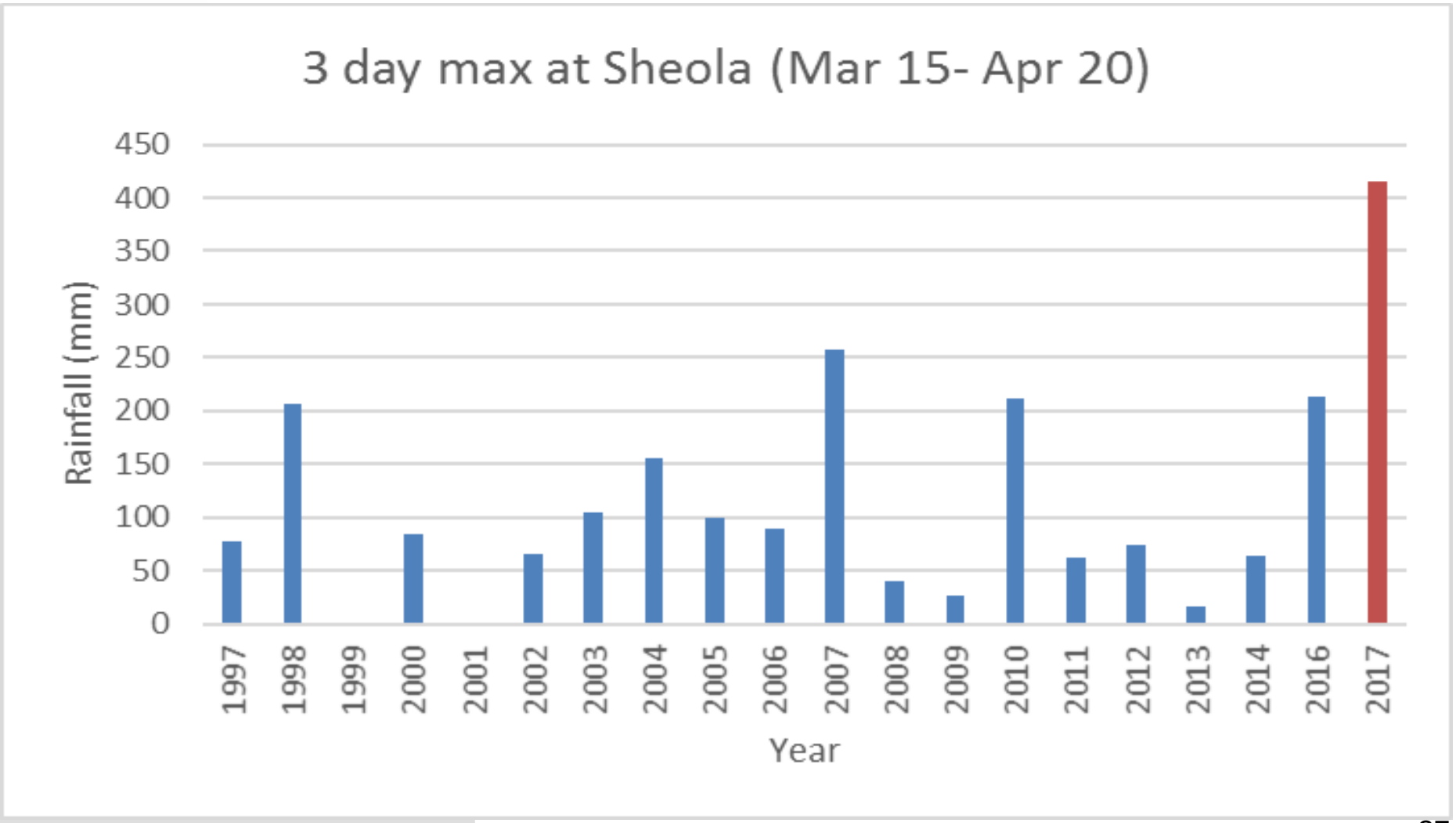
Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Sylhet



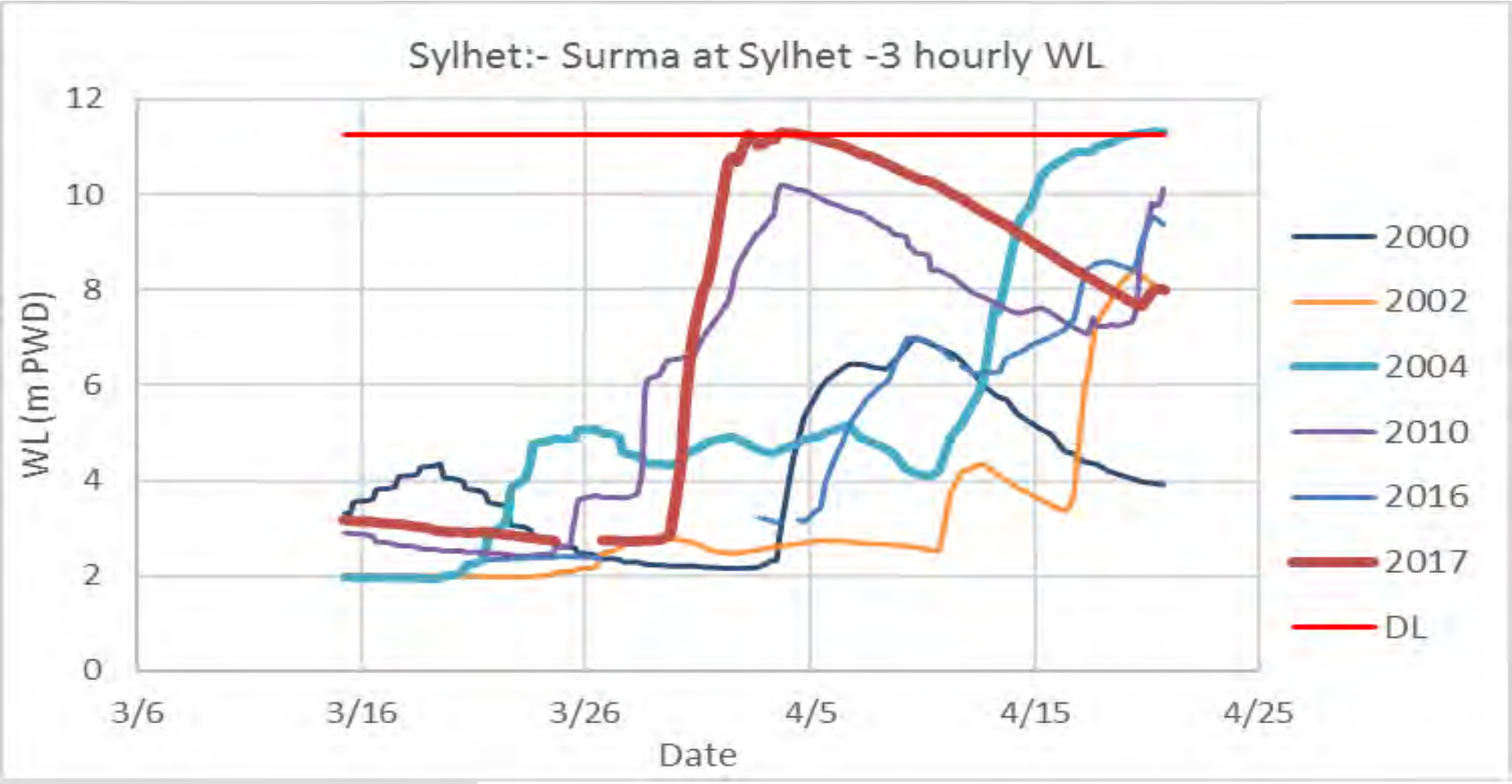
Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Sunamganj



Comparison of 3 days cumulative rainfall (Mid March-April 20) 1997-2017 at Sheola



Comparison of Water level (Mid March-April 20) 2017 with Historical Flash flood year; Surma at Sylhet



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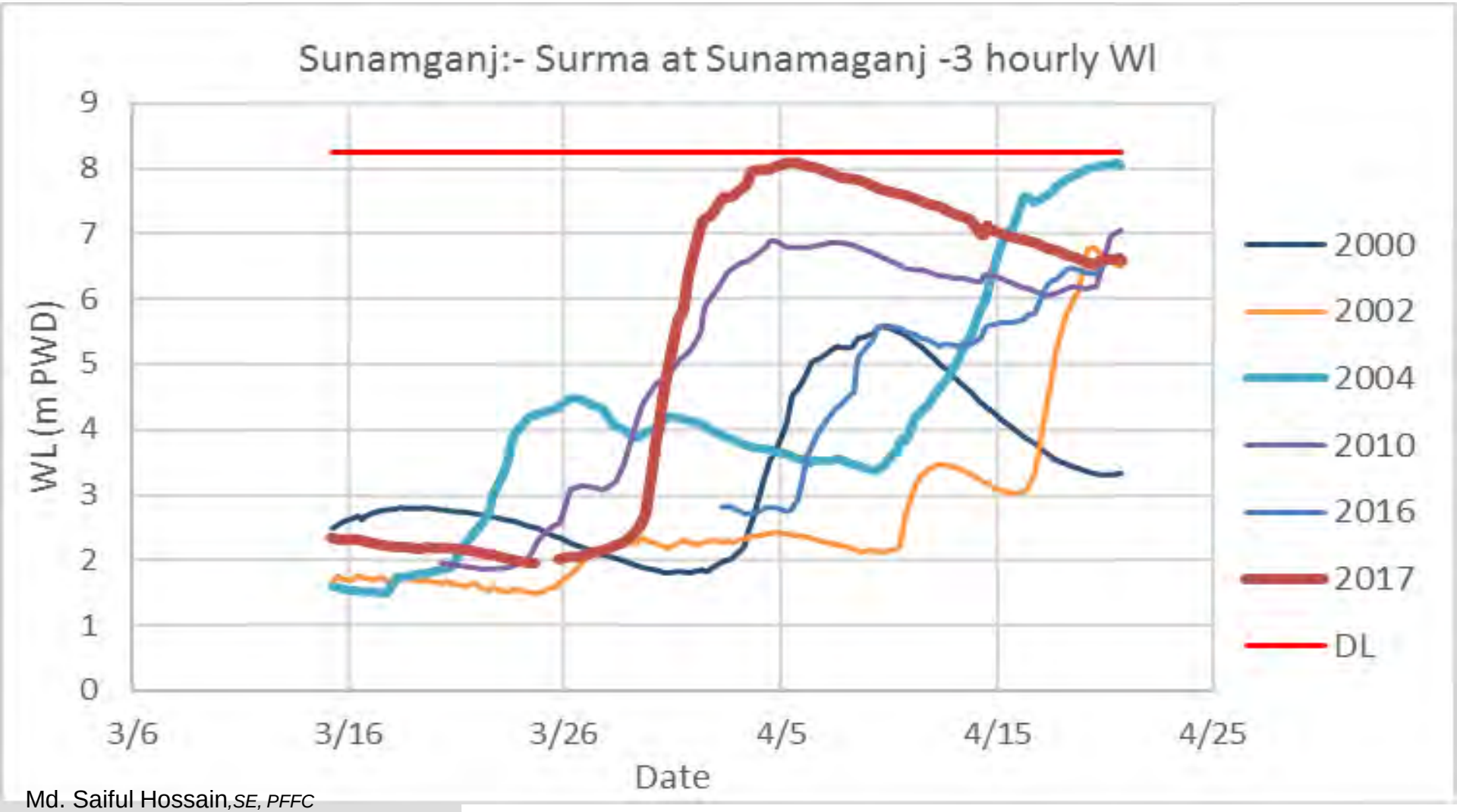
Comparison of Water level (Mid March-April 20) 2017 with Historical Flash flood year; Surma at Sunamganj



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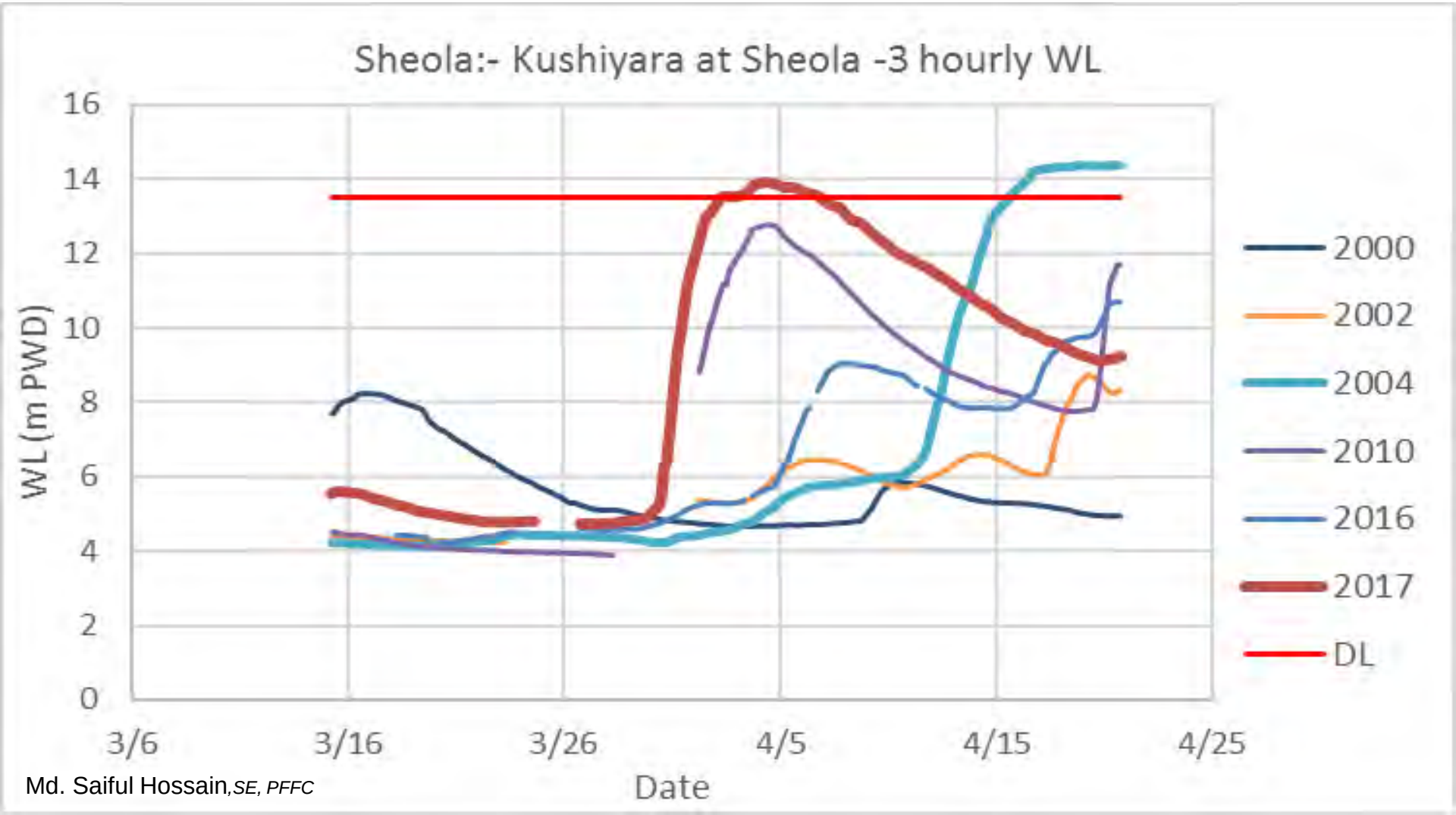
Comparison of Water level (Mid March-April 20) 2017 with Historical Flash flood year; Kushiyara at Sheola



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Findings

- **Flash Flood 2017 in the North-Eastern part of the country was unprecedented in terms of:**

  -Accumulated Rainfall

  -Water Level

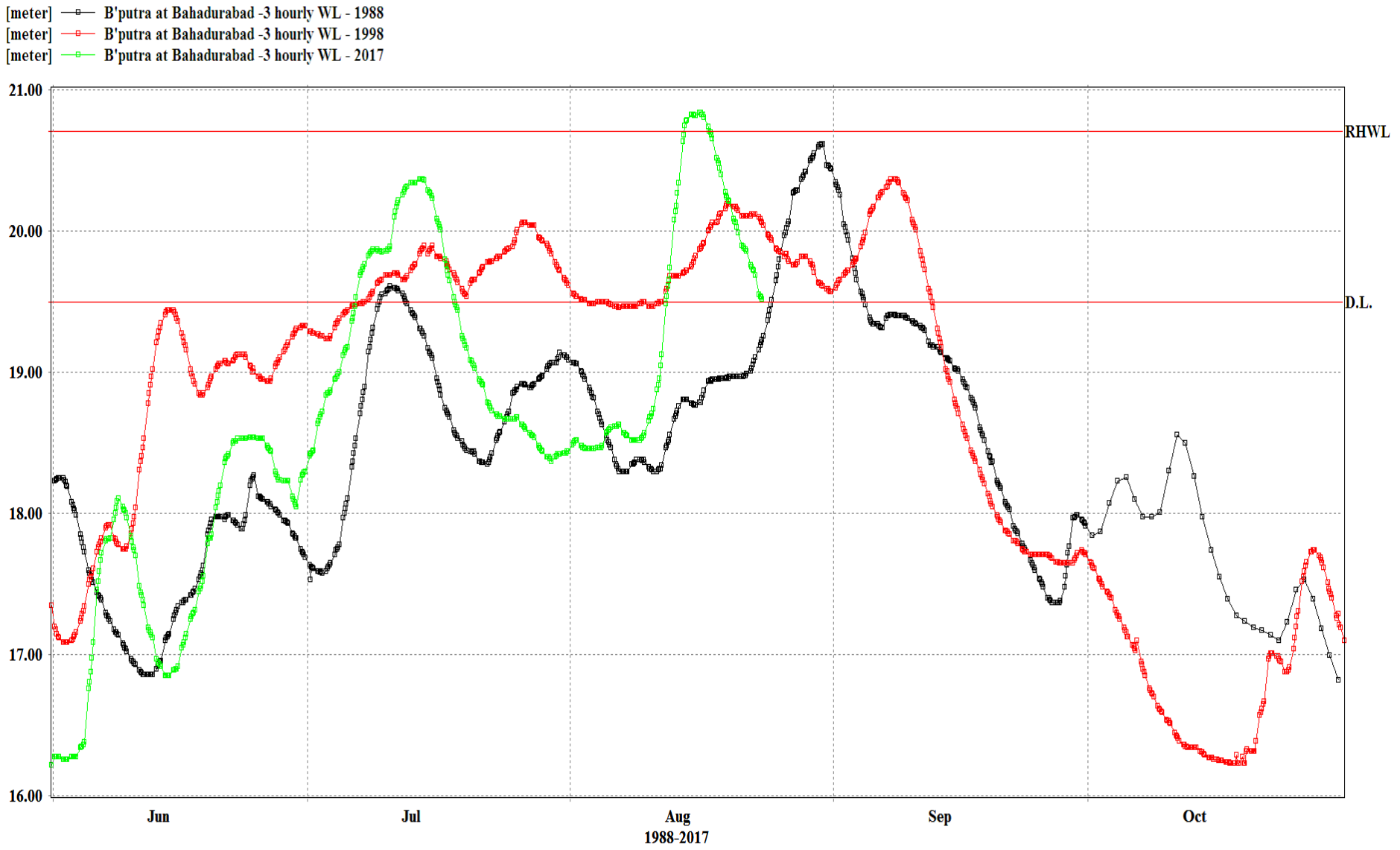
  -Timing of flash flood &

  - Duration

- **Climate Change/Variability/Erratic rainfall could the possible reason.**

Monsoon Flood 2017

Hydrograph comparison of Brahmaputra River at Bahadurabad Station



Loss and Damages

Damage Types	Quantity
Affected Districts	32
Affected Population	319702 (partly) 8011165 (Fully)
Affected Houses	80537 (Partly) 676426 (Fully)
Crop Damage Agricultural land (Hector)	102864 (Partly) 504287(Fully)
Number of Death(People)	144
Affected Road	885 Km (partly) 10211 km(Fully)
Damage Bridge /Culvert (number)	843

Bangladesh's Catastrophic Flood of 1998

People and animals sharing the same room as well as same fate.
Photo - Salahuddin Azizee
Source : Grameen Bank

100,000 sq. km, approx 70% of country's land mass was inundated for 2 months

30 million people affected, $ 45 Billion in damages.

¾ million hectares of agri lands submerged ruining most of the autumn rice crop

1.2 million of Grameen's 2.3 million customer affected.

Member Barun Nesa's house. Photo - Nurjahan Chaklader
Source : Grameen Bank

Benefits from the Flood Forecasting System

- Crop cutting/harvesting/ seedling/plantation
- Save/shift movable property
- Save cattle/Poultry
- Take precaution
- Move to safe place
- Avoid disaster
- Relief & rescue operation
- Maintenance of Embankments/structures
- Assist policy makers & Disaster managers.

Concluding Remarks

Specific Needs/Products to increase prediction/forecast lead-time to minimize/limit loss and damages due to Flood & Drought.

- **Establish GBM (Ganges, Brahmaputra & Meghna) basin flood forecast and drought prediction system.**
- **GBM basin outlook (Hydrological & Meteorological) with reasonable precision.**
- **Data sharing within GBM basin**
- **Down-scaled Satellite products (SRE, QPF, Soil moister).**
- **Addressing the Challenges needs to be inclusive, global and participatory.**
- **WMO can play vital role to increase resilience of flood and drought affected millions poor people of Bangladesh.**

"If you fail to plan, then you plan to fail"

Thanks for Patience Hearing