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Hydrometeorological drivers of 2017 Flood in Bangladesh and associated forecasting skill

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1. Introduction

Flood is the most common natural hazard in Bangladesh and causes huge economic losses every year. Usually, 20-25 % inundation of the country is considered as normal flood for Bangladesh. In 2017, Bangladesh experienced severe monsoon flood.

The Brahmaputra Basin (Figure1) experienced two flood peaks in July and August, with water level in several rivers exceeding their previous historical record. This 2017 flood was a severe flood in terms of both duration and magnitude.

This study looks at the hydrological and meteorological drivers along with extended range GLOFAS flood forecast for the 2017 flood event in Bangladesh

2. Study Area

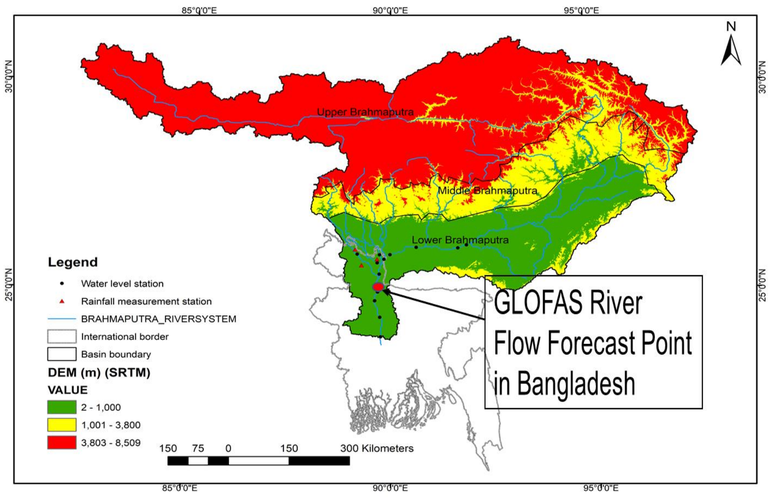

Figure 1: Brahmaputra river basin

The Brahmaputra is a transboundary river basin, and it is shared by Bangladesh, Bhutan, China and India. Total area of the basin is about 552,000 sq. km, and only 7% of its area is inside Bangladesh. The basin can be divided into three sub-basins based on elevation.

1. Upper Brahmaputra
2. Middle Brahmaputra
3. Lower Brahmaputra

The lower part of the Brahmaputra is mostly vulnerable for monsoon flood.

3. Hydrological Driver

Wavelet analysis is performed to study annual flood peak flow behavior of the Brahmaputra river. Daily water level data has been used for the period of year 31 years, from 1987 to 2017.

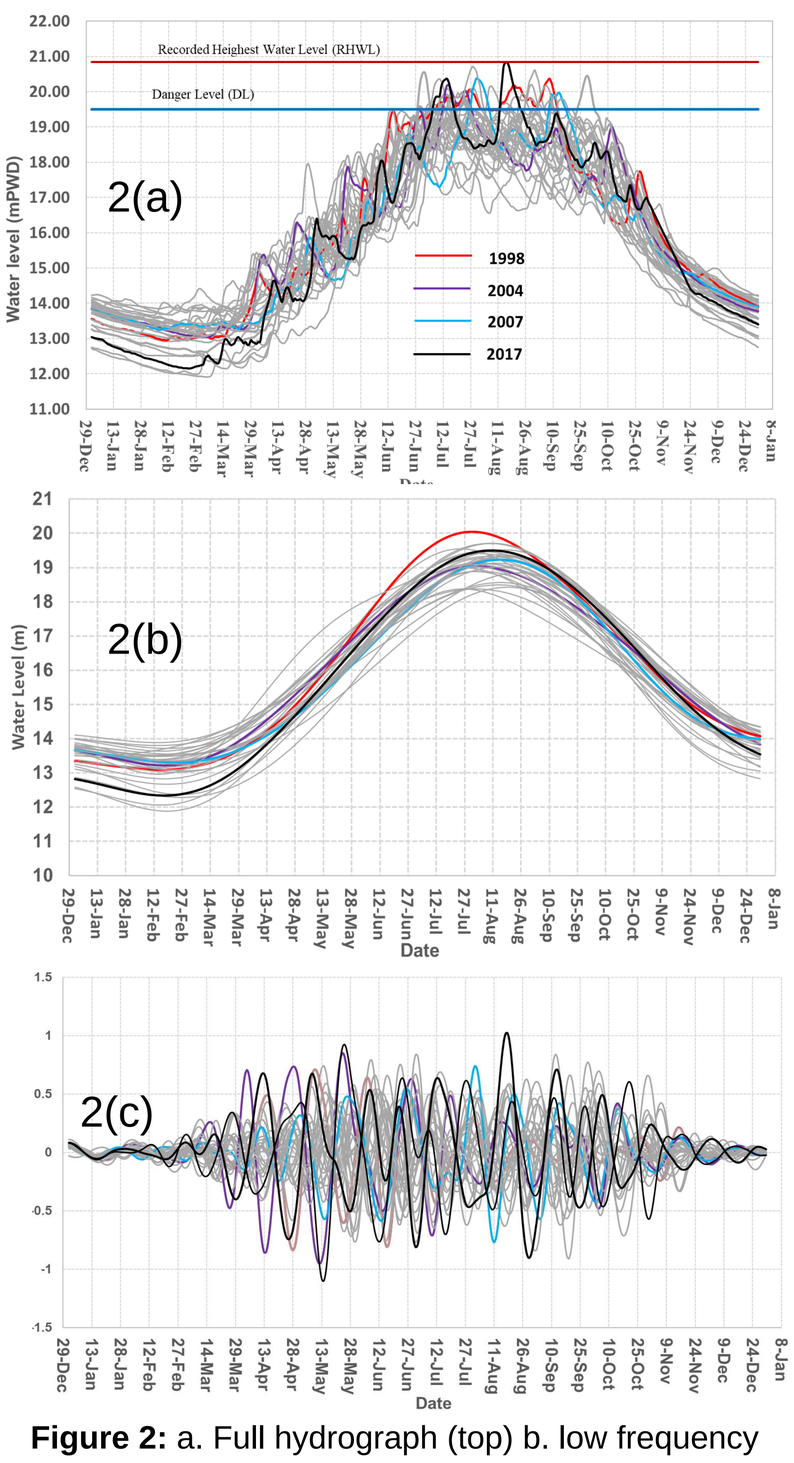

Figure 2: a. Full hydrograph (top) b. low frequency component (middle), c. high frequency component (bottom)

Figure 2a. shows that flood peak usually reach between July to August. During this period the river receives several flood wave.
The general trend component of wavelet analysis (Figure 2b) shows Brahmaputra receive peak flow in August.

High frequency component is caused by the rainfall events in the catchment and presents rapid rise of flood water (Figure 2c).
In 2017, the Brahamputra river received two distinct flood peaks in July and August which caused flood and flood water level exceeded previous recorded water level.

4. Meteorological Driver

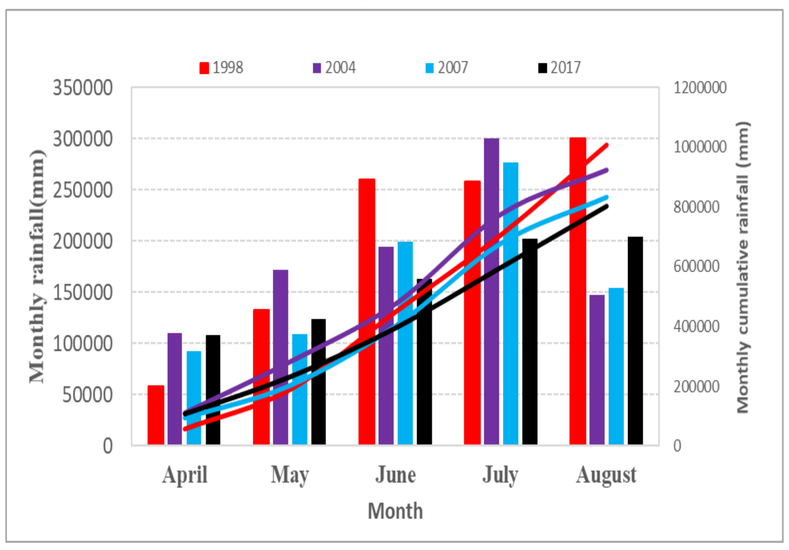

Figure 3: Basin-wide monthly rainfall from April to August (Based on TRMM 3B42 daily)

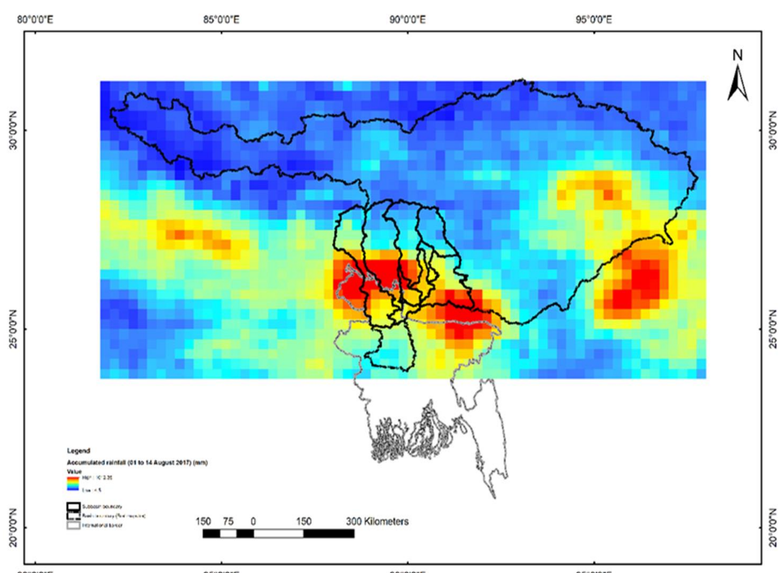

Figure 4: Distribution of total rainfall between 1 August to 14 August 2017 (Based on TRMM 3B42 daily)

The study uses TRMM 3B42 daily rainfall data to calculate the total basin-wide rainfall in different flooding year and rainfall event during august 2017 in the Brahmaputra basin. Figure 3 shows that rainfall in 2017 for April and May was significant and for subsequent months it was not unusual. However, the basin received more rainfall during August than 2004 and 2007.
Figure 4 shows that heavy precipitation was concentrated in some lower sub-basins of the Brahmaputra in August 2017, and this heavy rainfall in the lower sub-basins caused sharp rise of flood water level.

5. GLOFAS Forecast

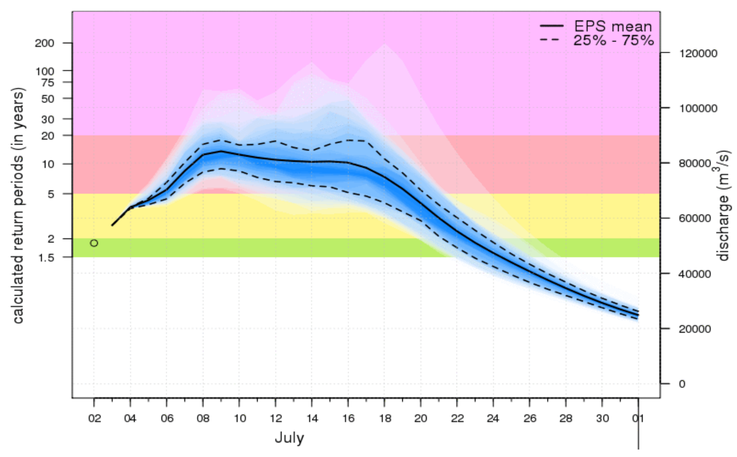

Figure 5: GLOFAS extended forecast hydrograph (Forecast date: 01 July 2017, source: http://www.globalfloods.eu)

GLOFAS one month flood forecast is available for the Brahmaputra river in Bangladesh.

Figure 5 shows GLOFAS forecast hydrograph for July flood event.

Figure 6 shows comparative hydrograph of observed and forecasted data for the August flood event in 2017.

During the August flood event, forecast was issued 17 days ahead of flood water reached to peak which was very important in flood preparedness point of view.

Both the flood events were successfully detected by GLOFAS.

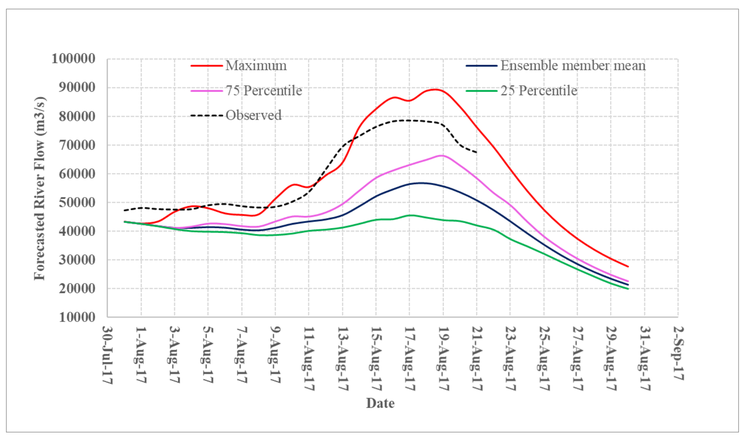

Figure 6: GLOFAS extended forecast hydrograph (Forecast date: 31 July 2017)

6. Summary

- Heavy rainfall in short period of time during August was responsible for sharp rise in river water level.
- Heavy rainfall occurred in the lower sub-basin.
- Flood duration was longer compare to some severe past flood events (e.g. 2004 and 2007)
- GLOFAS extended range forecast was very consistent with respect to time and magnitude in forecasting flood events for the Brahamputra basin in Bangladesh.

Acknowledgement

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