Center for Disaster Management and Risk Reduction Technology

CEDIM Forensic Disaster Analysis Group (FDA)

Excessive Indian Monsoon

Information as of 06 September 2017 – Short Report No. 1

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SUMMARY

Official Disaster Name	Date	Local	Duration
Indian Monsoon	**01-06-present**	**+5:30**	**3+ months**

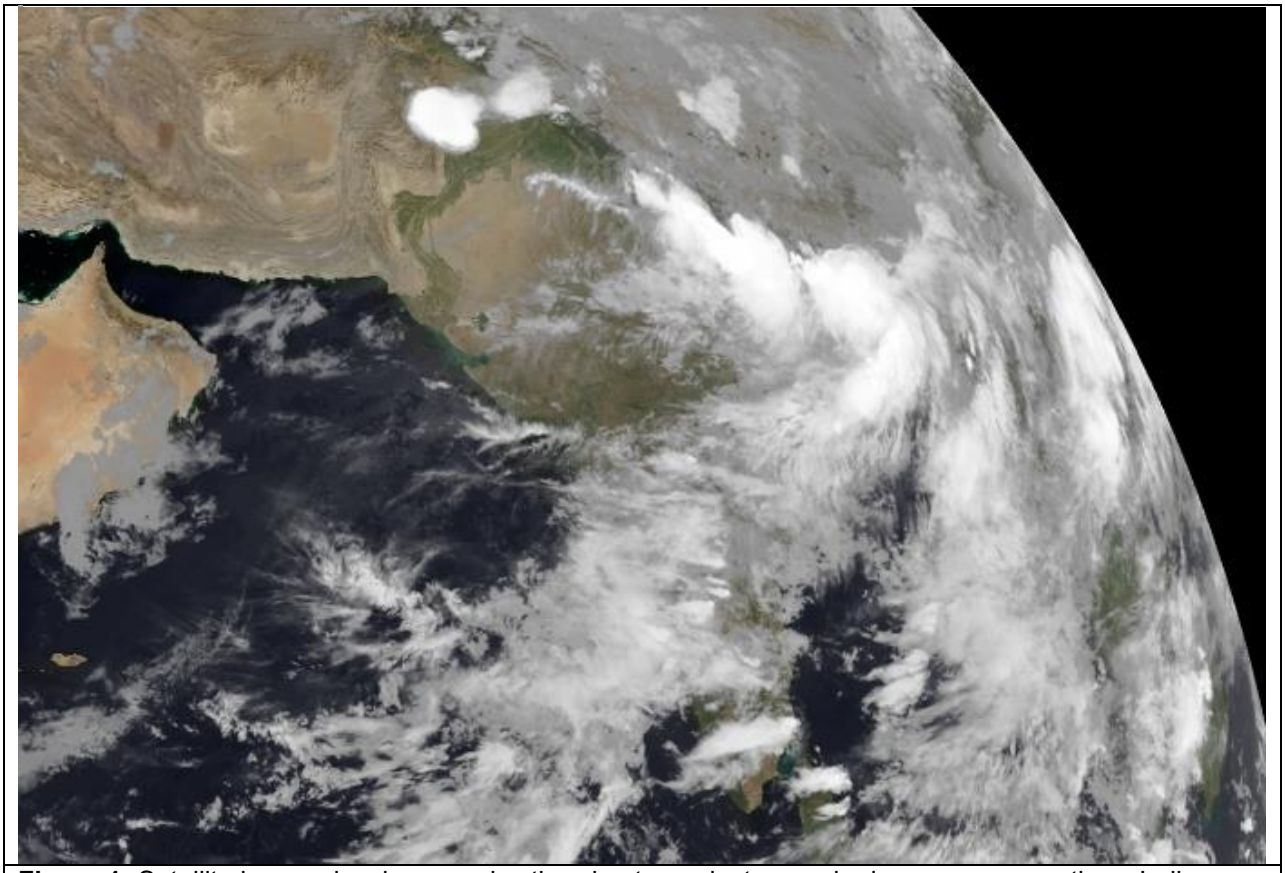

Figure 1: Satellite image showing massive thunderstorm clusters and rain areas over northern India, Nepal and Bangla Desh on 11 August 2017, 12 UTC.
Image Credit: Earth at Large, http://fvalk.com

1 Overview

Localized excessive rain amounts related to 2017 Indian summer monsoon led to devastating flooding in some parts of northern and north eastern India as well as in parts of Nepal and Bangla Desh. The death toll rose to more than 2000 people. Torrential rain made buildings collapsing and left part of cities underwater. Furthermore, vast areas of land were flooded in the state of Uttar Pradesh, thousands of villages were submerged and flooding affected millions of people.
However, overall averaged rain amounts for India didn't show unusual values. Also the timing of the onset of the monsoon was pretty much what has to expected on average.

2 Meteorological Information

2.1 The Indian Monsoon

The Indian Monsoon is a large seasonal wind system affecting not only India but most of south east Asia. From around spring the monsoon carries moisture laden air from the sea inland with increasing intensity towards summer months. In nearly all countries of south east Asia the summer monsoon is responsible for the vast majority of the yearly precipitation.

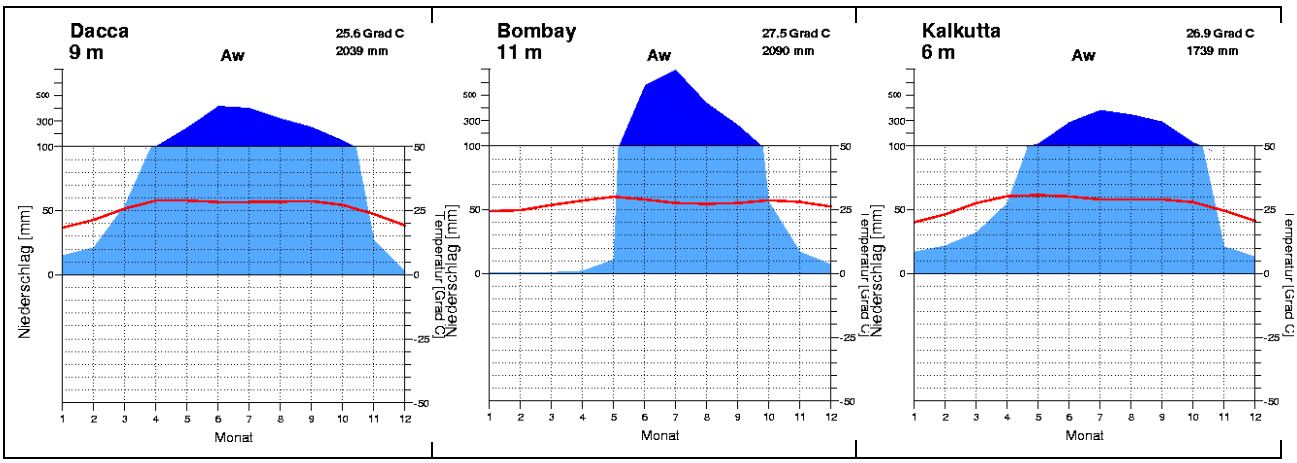

Figure 1: Climate normals of temperature and precipitation (1961-1990) of Dacca (Bangla Desh), Mumbai (Bombay) and Calcutta (India). Data source: NCDC. Image source: www.klimadiagramme.de

Accumulated summer monsoon precipitation in India usually is in the order of 1000-2000 mm, but can be significantly higher. For example, in north eastern India Cherrapunji rain activity is orographically enhanced and as much as 11.777 mm on average every year, in July the average rain amount is 3272 mm making this place one of the wettest on earth.

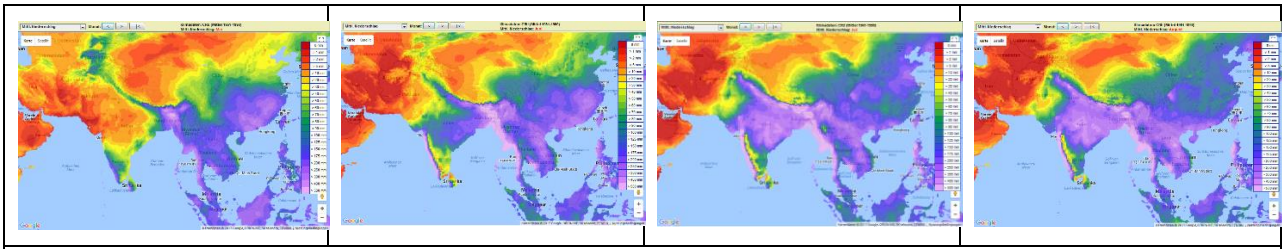

Figure 2: Average rain amount for the months of May (left), June, July and August. Period: 1961-1990. Data source: CRU. Image Credit: Wettergefahren-Frühwarnung

There is a great variability in both the onset respectively the withdrawal of the monsoon and in its intensity. In some years monsoon rain is less pronounced resulting in serious droughts across large areas.

Monsoon rain doesn't mean that there is a daily steady rain across the affected countries; ususally some consecutive days with strong rain are interrupted by short dry spells. Rain areas with an extension of a few hundred kilometres are associated with slowly travelling and shallow low pressure systems or troughs.

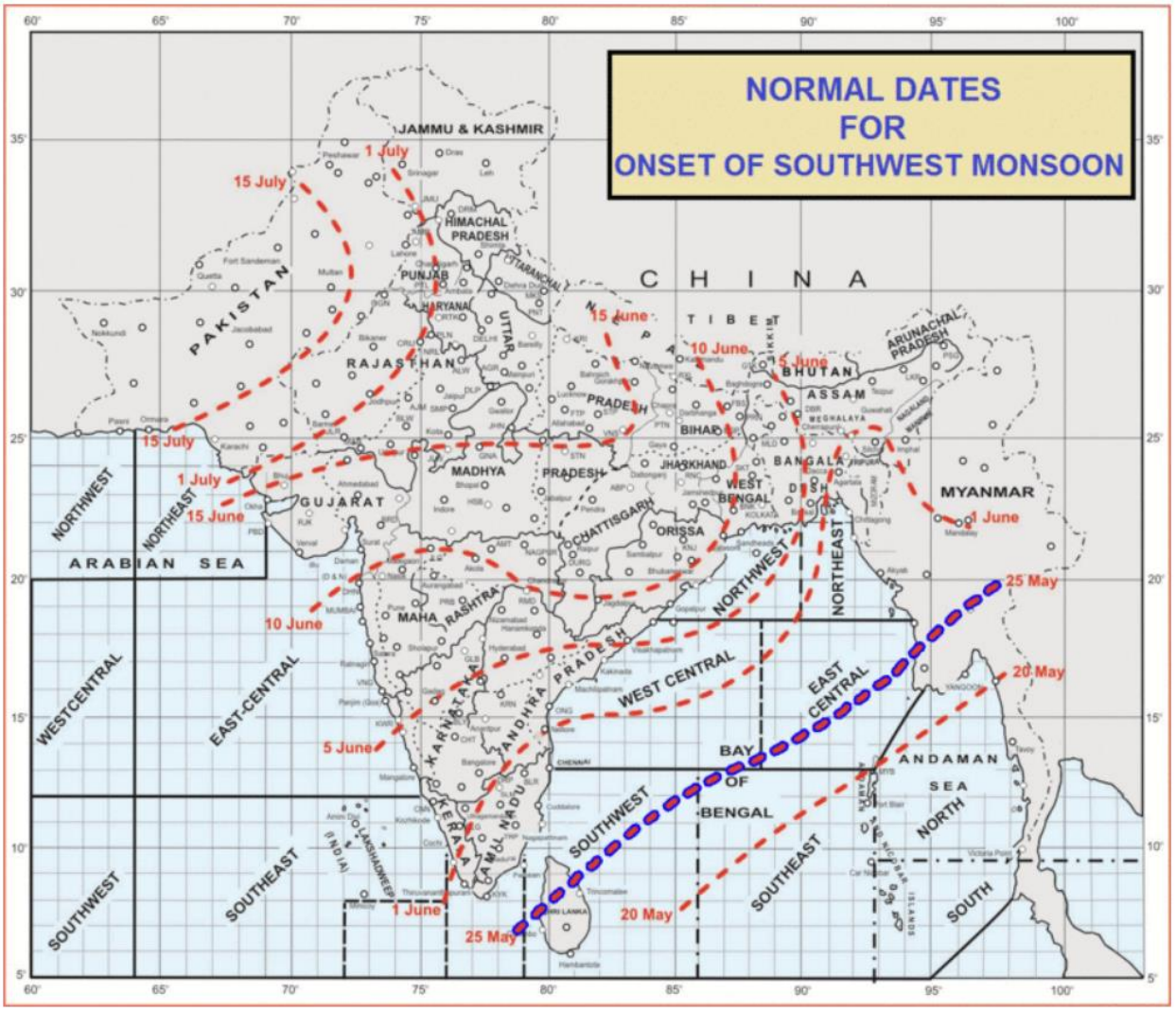

Figure 3: Average arrival dates and propagation of summer monsoon across the Indian subcontinent. Image credit: India Meteorological Department, http://www.imd.gov.in

Over the Indian subcontinent the summer or southwest monsoon usually arrives around 1 June in the very south east of India (Tamil Nadu), and the eastern parts of Bangla Desh. During the next two weeks until 15 June the monsoon propagates to the northwest and affects most of India apart from the northwest, and in rains in most of Nepal. Finally, by mid of July Pakistan benefits from monsoon rain.

2.2 The 2017 Monsoon

The premonsoon, related to the period between 01 March and 31 May 2017, was associated with rain amounts well above normal. The cumulative rainfall for the area of east and north east India was calculated to 400 mm which is a surplus of 30 mm compared to the long term average of 370 mm. By end of April and beginning of May an exceptionally wet episode caused an excess of 39%.

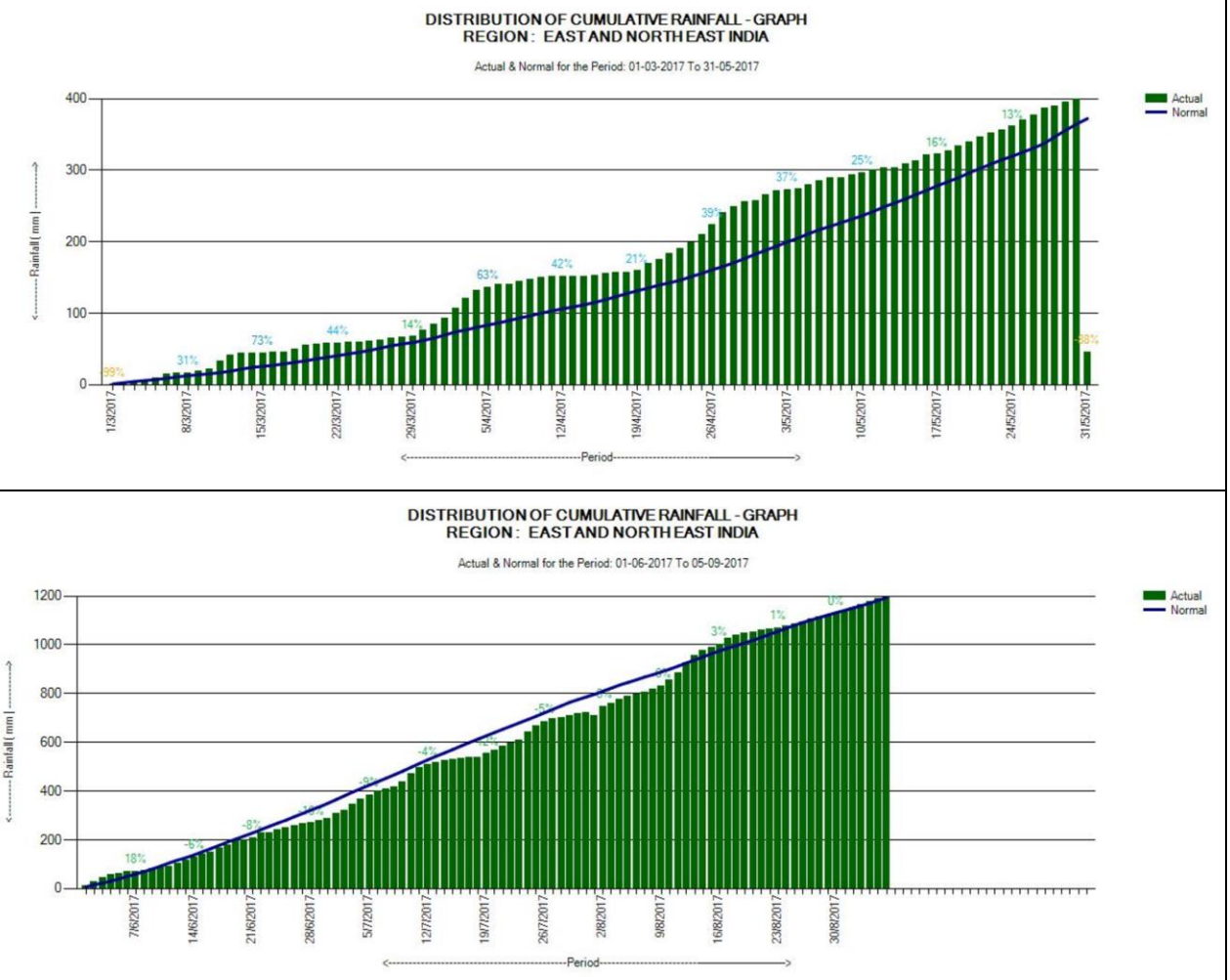

Figure 4: Distribution of cumulative rainfall across eastern and north eastern India. Above: Premonsoon period (1 March to 31 May). Below: Monsoon period beginning 1 June 2017. Image credit: India Meteorological Department (CRIS, http://hydro.imd.gov.in)

Since 1 June 2016 the daily rain distribution charts are characterized by alternating rainy episodes and dry intervals with each of them lasting about a week. Above normal rain amounts can be identified around 4 June, 12 July, 26 July, and 18 August. At 5 September 2017, on average there was no rain surplus at all. For the entire country of India even a deficit of 4% has been calculated by 5 September (see Figure 4).

Only 7 of 36 states of India received more rain than usual, Gujarat, Dadar and Nagar Haveli in the very west of India, additionally the south eastern parts of the country (states of Tamil Nadu, Pondicherry, and Andhra Pradesh) and Tripuna and Mizoram in India's eastern tip. But only Mizoram was very wet with nearly twice as much of rain as normal.

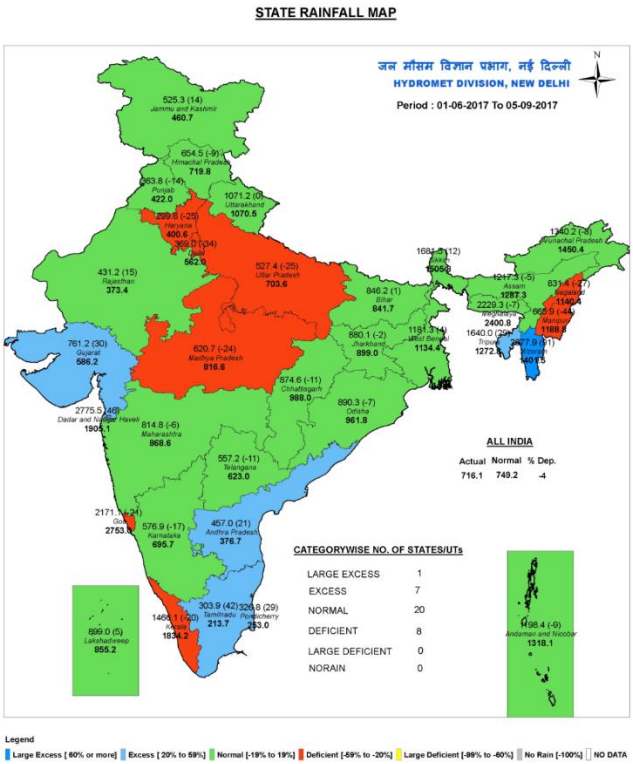

Figure 5: Statewise rain amount and departure from normal. 1 June to 05 September 2017. Images credit: Indian Meteorological Department

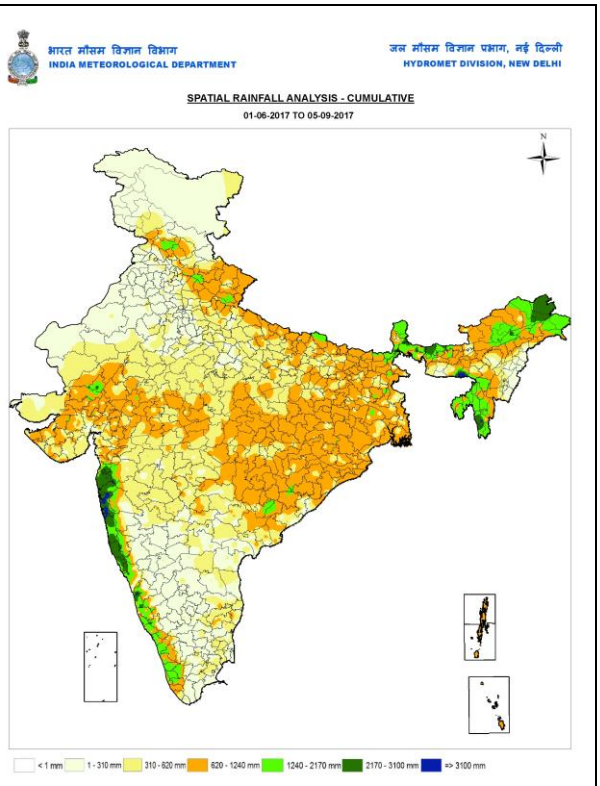

Figure 6: Spatial Rainfall Analysis, accumulated rain. 01 June to 05 September 2017. Image credit: Indian Meteorological Department

The wettest regions within India between 1 June 2017 and 5 September 2017 with rain amounts exceeding 2100 mm were a strip between the Westghats and the Indian Ocean (including Mumbai) and some parts in the very north east of the country (Figure 6).

Every year the southwest monsoon affects vast areas between New Guinea, India and Japan. In 2017, the 90 days accumulated rain until 03 September 2017 most often was near normal, central parts of India so far are below 100%. Western Myanmar received more than 4 times the average rain amount, also parts of Bangla Desh. Furthermore, according to CPC analyses exceptionally wet were few regions in north eastern India and in the very western part of India close to the border of Pakistan and in Nepal.

Large scale floodings are caused by torrential rain falls, when rain intensities are in the order of 100 mm or more within a day and repeatedly affect the same river catchments. In spite of that the average state wide rain amount is not necessarily unusually high and might even be below normal.

In 2017 India doesn't show exeptional rain conditions related to summer monsoon so far as nation wide rain amount is 100%. A closer look to the Indian states results in a more granular rain distribution, however, exceptional wet states are not obvious.

The disastrous flooding in smaller parts of northern and north eastern India might also be a consequence of an unsual wet spring 2017. Particularly in Assam, during premonsoon station recordings in March and April were much above normal. For example, Silchar observed a two-month rain sum of 950 mm; in comparison, long term average is only 529 mm. Kalkutta's 139 mm of rain in March were four times higher than the monthly mean of 35 mm.

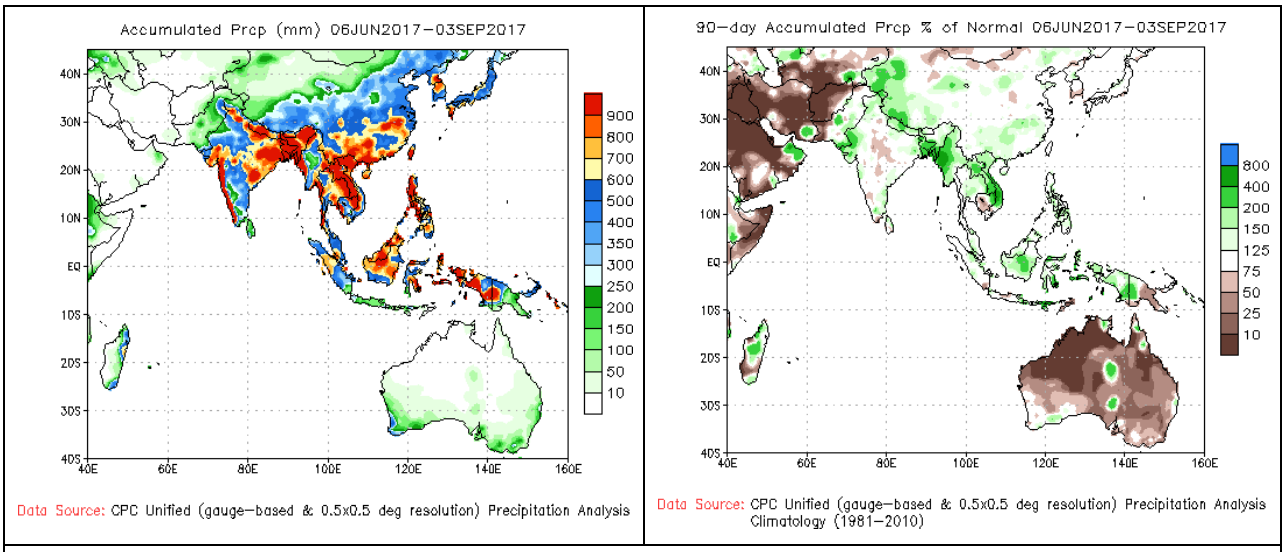

Figure 7: Accumulated precipitation (6 June to 03 September 2017) over south east Asia and Australia (left) and deviation from normal 1981-2010 (right). Image credit: Climate Prediction Center

Also in Bangla Desh the premonsoon during March and April 2017 brought too wet conditions (Table 1). Both Chittagong and Dhaka recorded well above normal rain amounts. Monsoonal precipitation in July 2017 also was much heavier than usual, 1008 mm of rain fell in Chittagong instead of 642 mm which is the long term average.

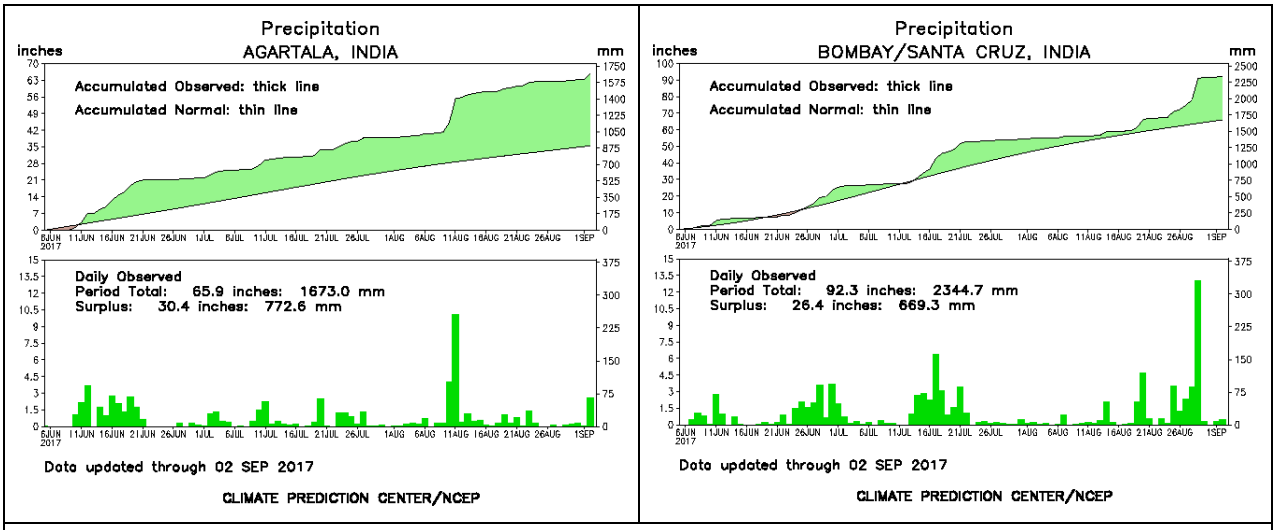

Figure 8: Daily observed rain amount, accumulated rain during, and departure from normal the period 6 June to 3 September 2017 at Agartala (NE-India) and Mumbai (Bombay, W-India). Image credit: Climate Prediction Center

By end of August torrential rain pounded Mumbai (Bombay) leaving hardly any thing dry and knee-high flood waters were present on many streets. In the densely populated area of Bhendi Bazaar a 6-storey building collapsed amid floods as over 300 mm of precipitation have been recorded on 29 August 2017 (Figure 8).

Table 1: Monthly rain amounts in 2017 at various stations in India and Bangla Desh and their deviation from normal. Data source: ogimet.com and National Climatic Data Center

	Silchar, Assam			Mumbai, Maharashtra			Kalkutta, West Bengal		
	2017	1981-2010		2017	1981-2010		2017	1981-2010	
	mm	mm	%	mm	mm	%	mm	mm	%
March	369	153	242	0	0	0	139	35	397
April	581	202	287	0	4	0	5	59	8
May	299	401	74	0	70	0	42	137	31
June	828	515	161	559	848	66	240	304	79
July	482	489	99	525	904	58	621	409	152
August	592	439	135	652	578	113	386	336	115
Mar-Aug	**3151**	**2199**	**143**	**1736**	**2404**	**72**	**1433**	**1280**	**112**

	Chittagong, Bangla Desh			Dhaka, Bangla Desh		
	2017	1961-1990		2017	1981-2010	
	mm	mm	%	mm	mm	%
March	102	58	176	100	54	185
April	297	116	256	228	108	211
May	275	285	96	187	253	74
June	699	507	138	414	420	99
July	1008	642	157	584	405	144
Mar-Aug	**2381**	**1608**	**148**	**1513**	**1240**	**122**

3 Stormwater management

In some reports, the poor management of stormwater has been held as a cause for devastating flooding in India during Monsoons. Critics point out that the current urban plannings disregard the stormwater management.

Green areas alter into impervious ones by rapid urban developement, which increases the surface run-off, leading to more intensive floods. Reckless development of the cities into flood prone areas puts more people and properties at risk, expanding flood damages.

The demand on the government is not to increase the capacity of drainage systems, but to care for efficient usage of the existing drainage systems. Critics call attention to the unregulated construction on natural drains and riverbeds, and also dumping waste into stormwater drains, which reduces the drainage capacity.

Although, the municipal cooperations during the 2017 Monsoon showed improvements with respect to flood management, compared to the past floods (2005 in Mumbai, 2015 in Chennai, 2013 and 2016 in Uttarakhand), the insufficient management of stormwater remains an issue. However, it is to mention that after 2015 floods, the National Disaster Management Authority (NDMA) is seeking a long term plan, to de-clog the existing drainage systems, to adopt better practices of waste management, and to regulate the constructions in low lying areas.

Sources:

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http://indianexpress.com/article/opinion/mumbai-floods-swamp-excessive-rains-drainage-system-july-2005-august-2017-4823348/

http://www.financialexpress.com/india-news/monsoon-in-india-with-this-agenda-narendra-modi-government-plans-to-tackle-urban-rain-woes/836297/

http://www.waterandmegacities.org/the-monsoon-and-water-logging-in-indian-cities/

4 Further Reading

Further detailed meteorological information to previous monsoon events:

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