



The South Asian Summer Monsoon – A Personal Perspective

Arathy Menon

NCAS-Climate, Department of Meteorology, University of Reading

RMetS Meeting on Understanding the Weather of 2018



**University of
Reading**



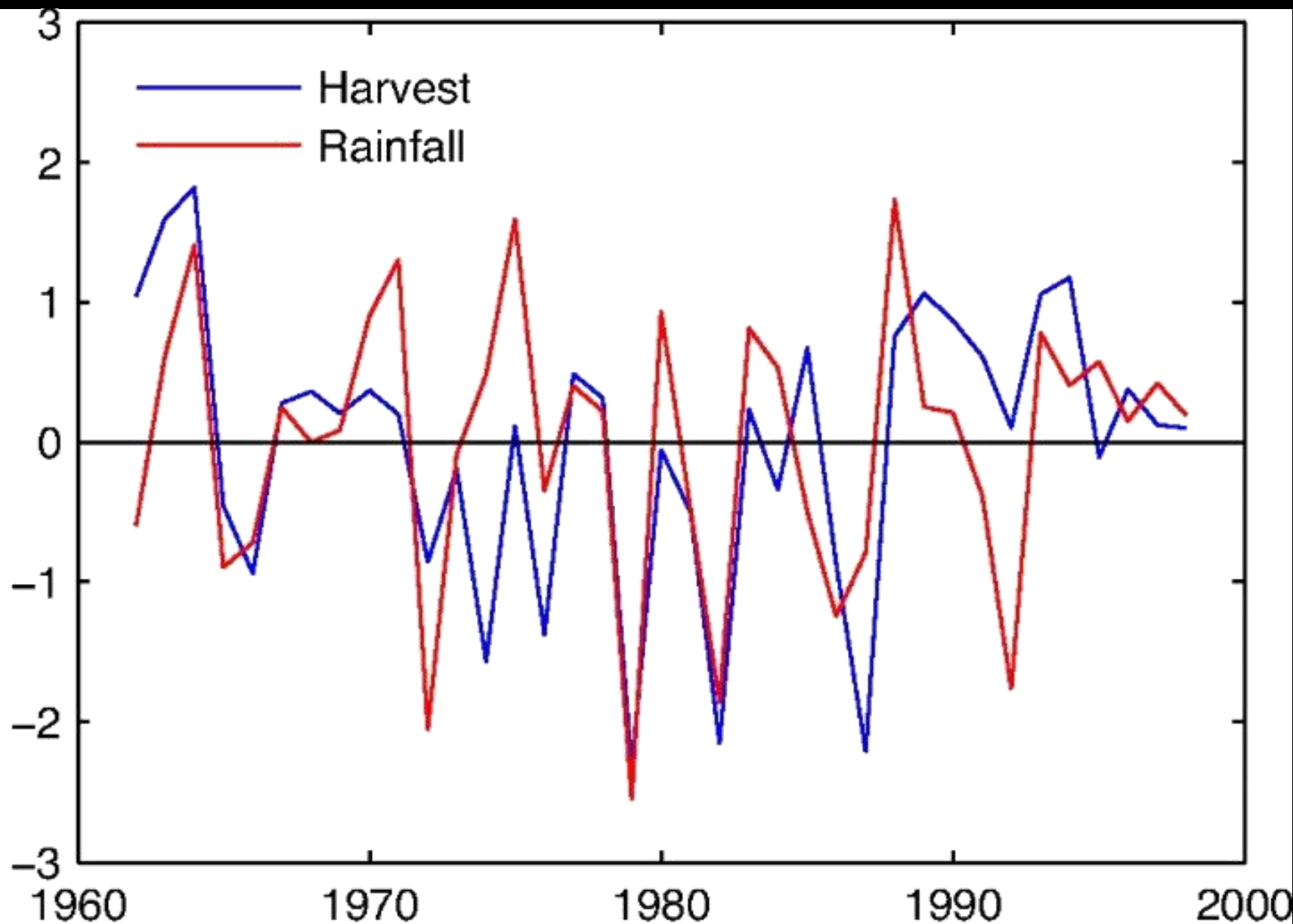
**National Centre for
Atmospheric Science**

NATURAL ENVIRONMENT RESEARCH COUNCIL

- 80 % of the annual rainfall
- Affects 2 billion people
- Rain-fed agriculture contributes to 18% of India's GDP

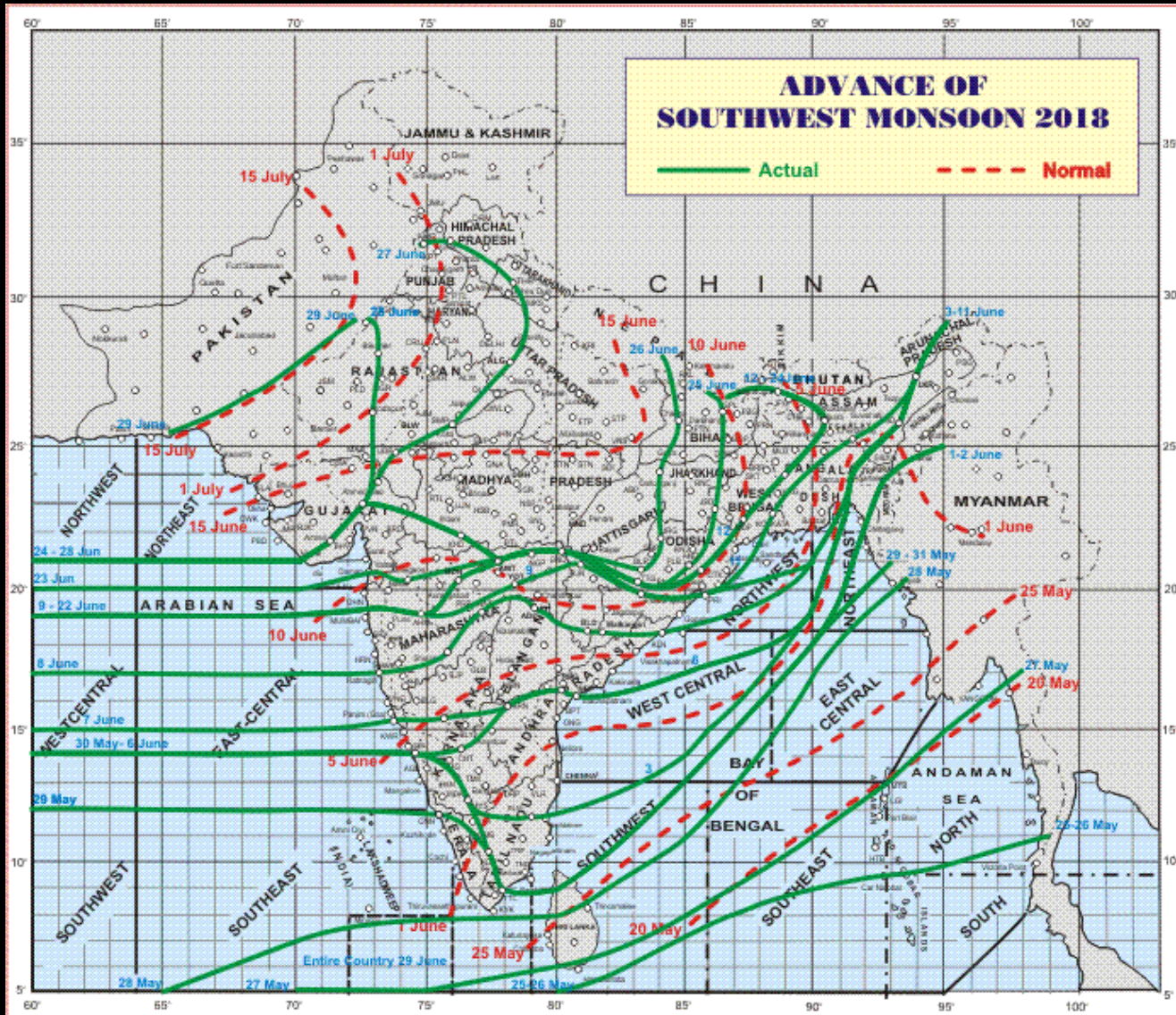


Anomalies



- Large year-to-year variability
- Hence predicting it in advance is vital.

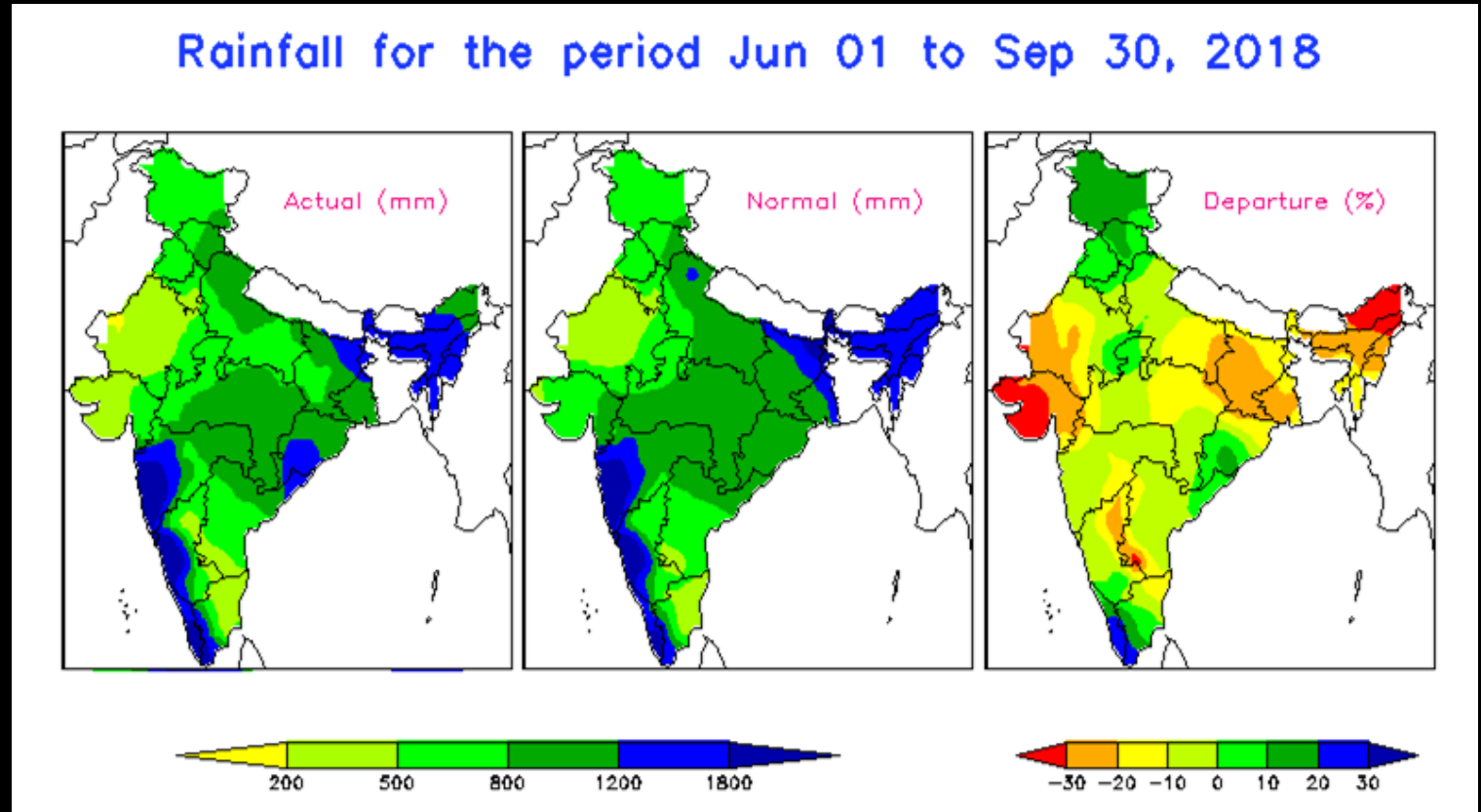
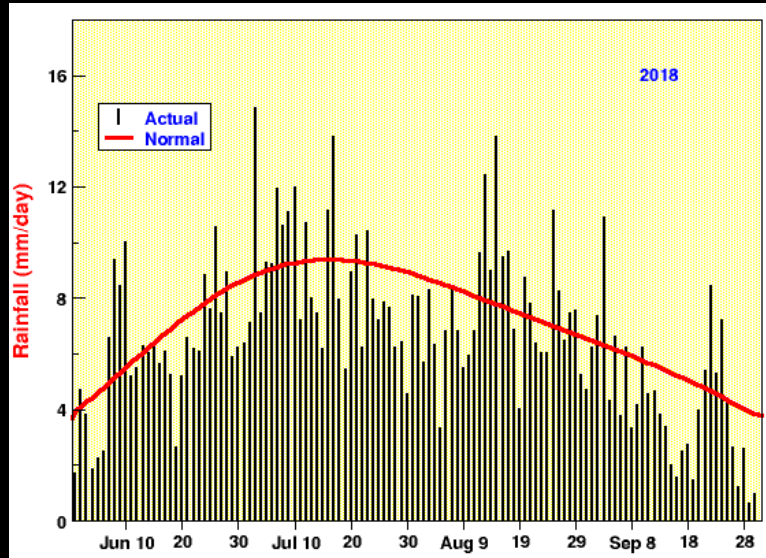
South Asian monsoon 2018



Date of Monsoon Onset: **29 May 2018**

Date of Monsoon covering the entire country: **29 June 2018**

South Asian monsoon 2018



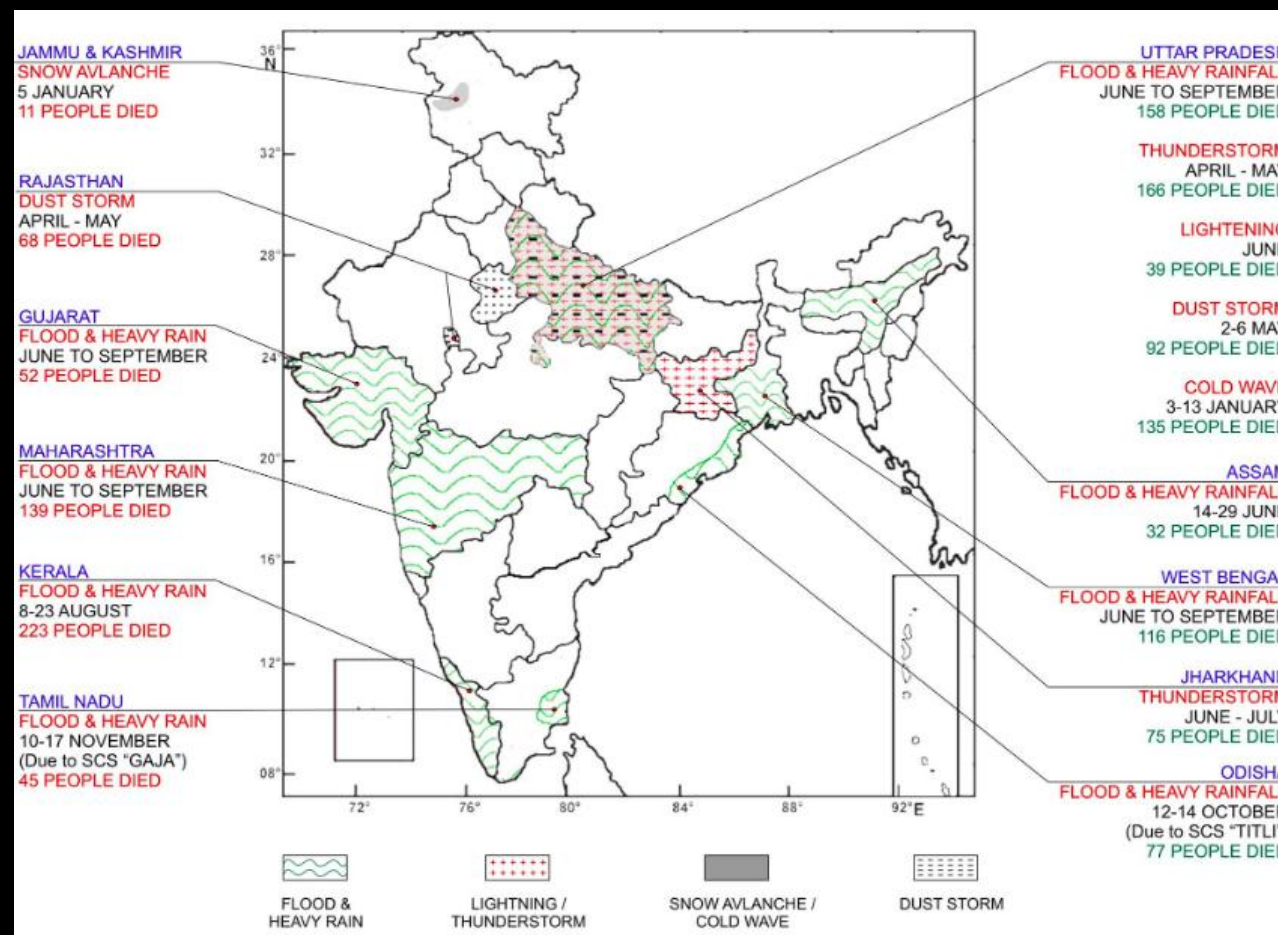
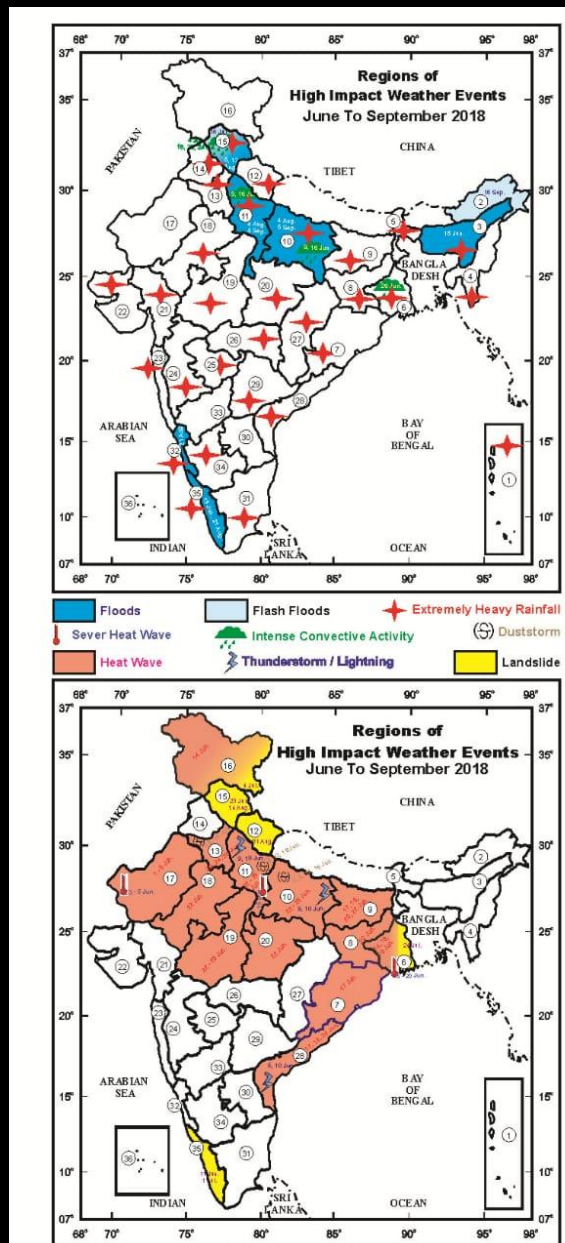
Actual Rainfall: 804.0 mm

Normal Rainfall: 887.5 mm

Departure from Normal: -9.4 %

Courtesy: IMD

High impact weather of 2018



2018 witnessed a very large number of high impact weather events from **heatwaves** to **floods**

the new paper

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WORLD

More bodies found in flooded Kerala as toll climbs

With 725,000 people crammed into relief camps, threat of disease looms

Aug 20, 2018 06:00 am

THRISUR, INDIA Rescuers searched submerged villages in India's southern state of Kerala yesterday in a desperate hunt for survivors after floods killed at least 370 people and drove more than 700,000 from their homes.

Entire villages in Kerala have been swept away in the state's worst floods for a century. Rescuers fear the death toll will rise as they reach areas almost entirely underwater.

Thousands remain trapped - often without food or safe water - in towns and villages cut off by the floods. But the rain has begun to ease in some areas, and a heavy rain forecast remains in place only for a few spots.

Nearly 725,000 people have taken shelter in relief camps, state government spokesman Subhash T.V. said yesterday.

As the water begins to recede, the authorities fear an outbreak of disease among the people crammed into the relief camps.




A flood victim is rescued up to a rescue helicopter as floodwaters near Kochi, in the Indian state of Kerala, on Saturday. PHOTO: AFP


Piano Fair YAMAHA

Kerala Flood 2018: Once-in-century flood

WHY 2018 IS THE WORST



- The state has received **37.5% excess rainfall** from June till date
- This year, most parts of Kerala has received heavy rainfall from June till date
- North Kerala receives heavy rainfall during south west monsoon (Jun to Sep)
- South Kerala gets rainfall during north east monsoon (Oct to Dec)
- 58 dams managed by KSEB and 22 managed by water resources dept in full capacity
- Gates of all these dams have been opened to discharge excess water



➤ Idukki dam, which is Asia's largest arch dam, has been releasing water at the rate of 10-15 lakh litres per second for the last three days

➤ While Kerala received excess rainfall in 2013, too, life was not hit because dams were not full at this time of the year

➤ While in 2013, excess rainfall was 37% for entire four-month monsoon period, this year it has crossed that mark in just two and a half months

Relief measures

- PM Modi speaks to CM Pinarayi Vijayan on Thursday on the crisis
- State govt cancels Onam week festivities

₹30 cr earmarked for festivities diverted for disaster relief

12 more NDRF teams - six each from Delhi and Gandhinagar - sent; 18 teams already engaged in flood relief

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LIVE: Increase funds for Kerala, Rs 500 crore not enough, Rahul tells PM

Kerala floods photos: State braces for more rains, 11 districts still on...

Oppn targets Sidhu for

PM Modi's decision to walk at Vajpayee's funeral surprised all

Kerala woman refuses to leave flooded house without her 25 dogs

Bodies found floating, roads cut off, food scarce: Kerala tragedy unfolds

India vs England 3rd Test Day 1 LIVE: Kohli & Rahane looking good

Walmart completes deal to buy 77% stake in




കരുതൽപ്പടി

അതിജീവനം

കുഞ്ഞിനെ പാത്രത്തിലിരുത്തി ജലക്കുതിപ്പിൽ തോൽക്കുന്നവരെ കണ്ടെത്തുക...

പറമ്പുതറന്നു, പതറാതെ!

കുരിശിനെ കയ്യിൽക്കൊണ്ട് കുഞ്ഞിനെ പാത്രത്തിലിരുത്തി ജലക്കുതിപ്പിൽ തോൽക്കുന്നവരെ കണ്ടെത്തുക...

കുരവയിട്ടു, പേരിയാമ്പുക്കൾ

ഭൂരിതരമൊഴിയാതെ നാടും നഗരവും

ജന കമലയ്ക്കു നമസ്, ഹൃദയംഗമം ഹൃദയംഗമം

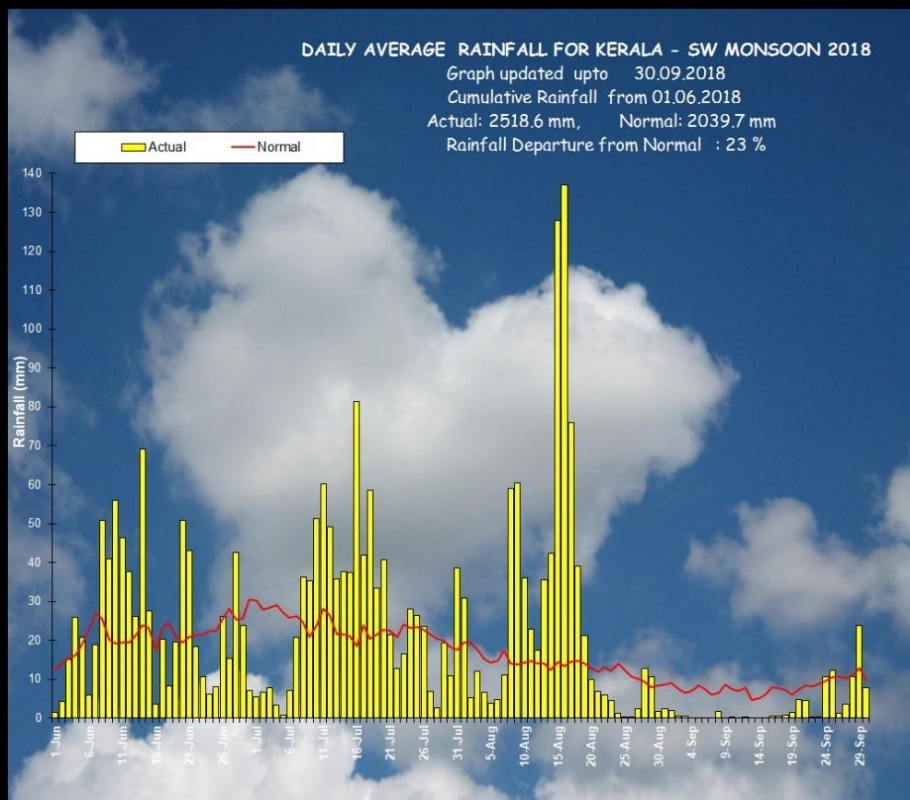




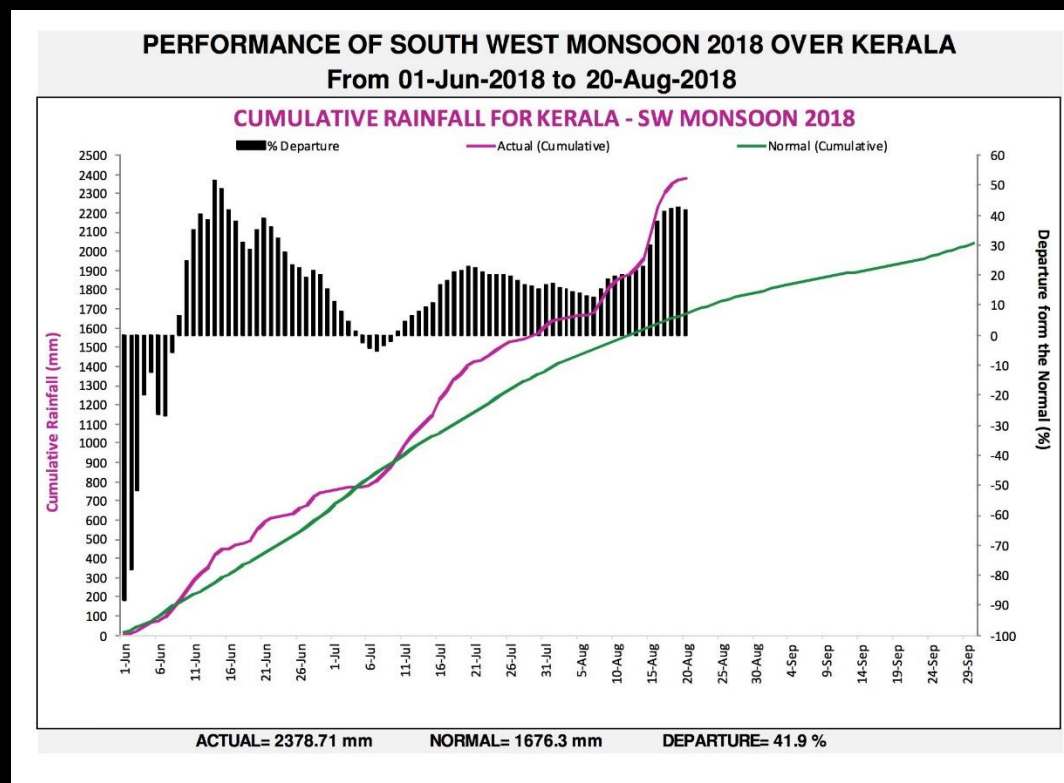

- ❖ 8th to 18th August 2018
- ❖ Heavy rainfall, landslides, flood
- ❖ 483 dead
- ❖ 1.4 million evacuated
- ❖ 3000 relief camps
- ❖ Heavy rain warnings from IMD a week in advance
- ❖ No flood forecast



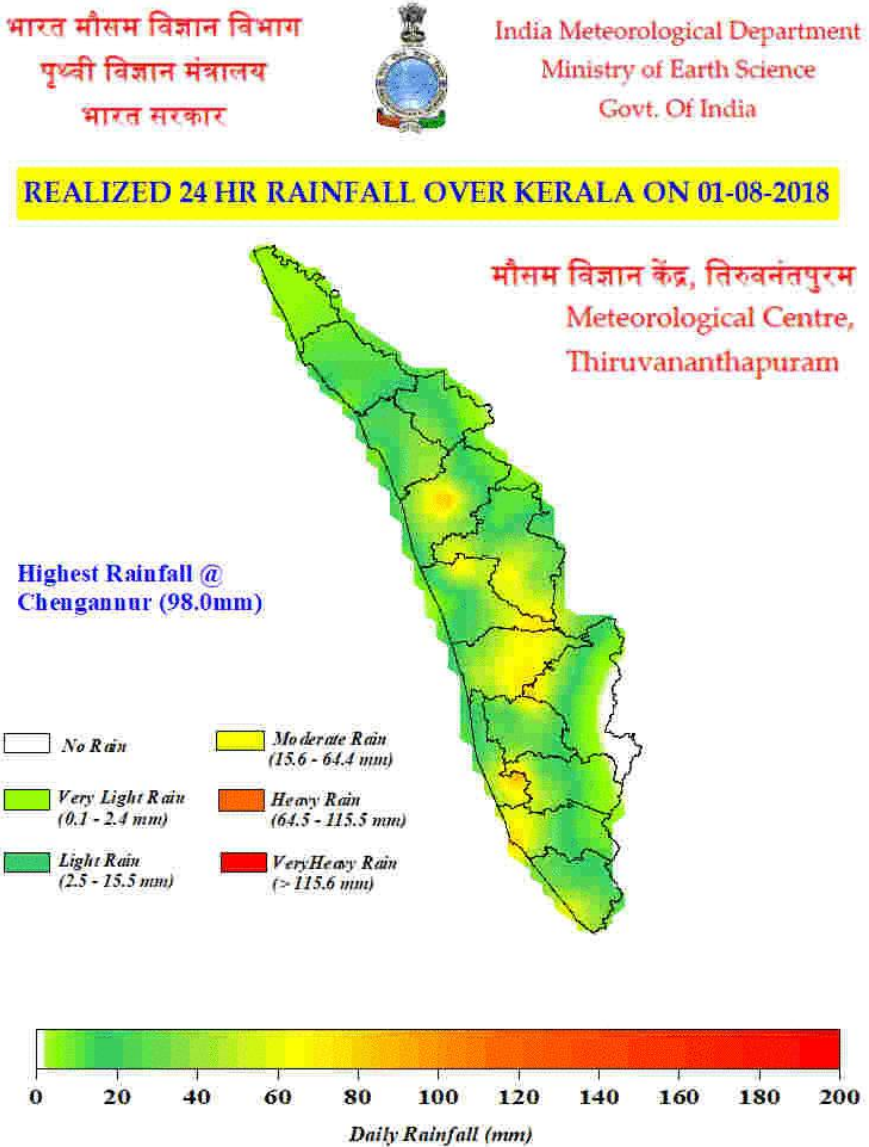
Kerala Rainfall June-September 2018



Actual: **2518.6 mm**
Normal: **2039.7 mm**
Departure from Normal: **+23 %**



Kerala Rainfall 2018



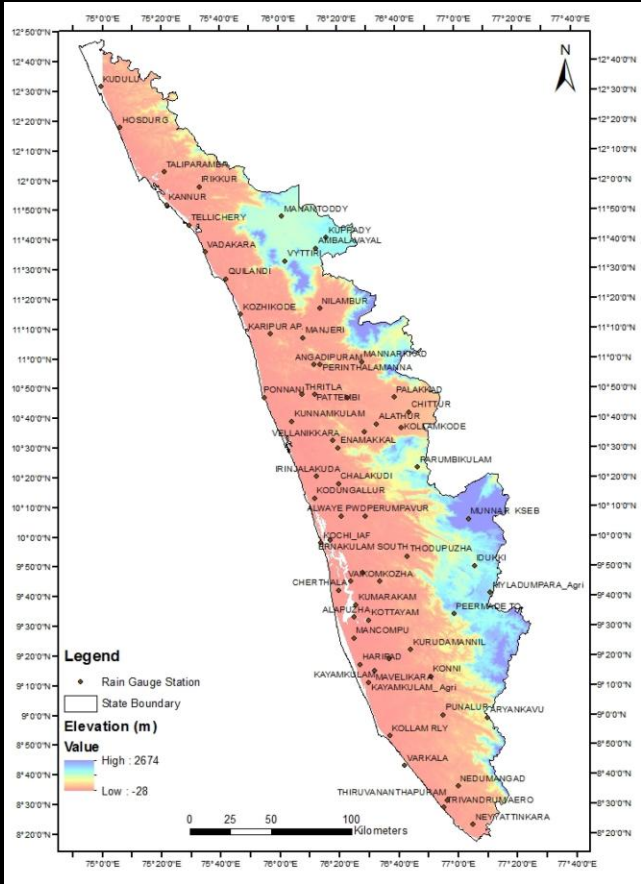
1-20 Aug rainfall

Two episodes:

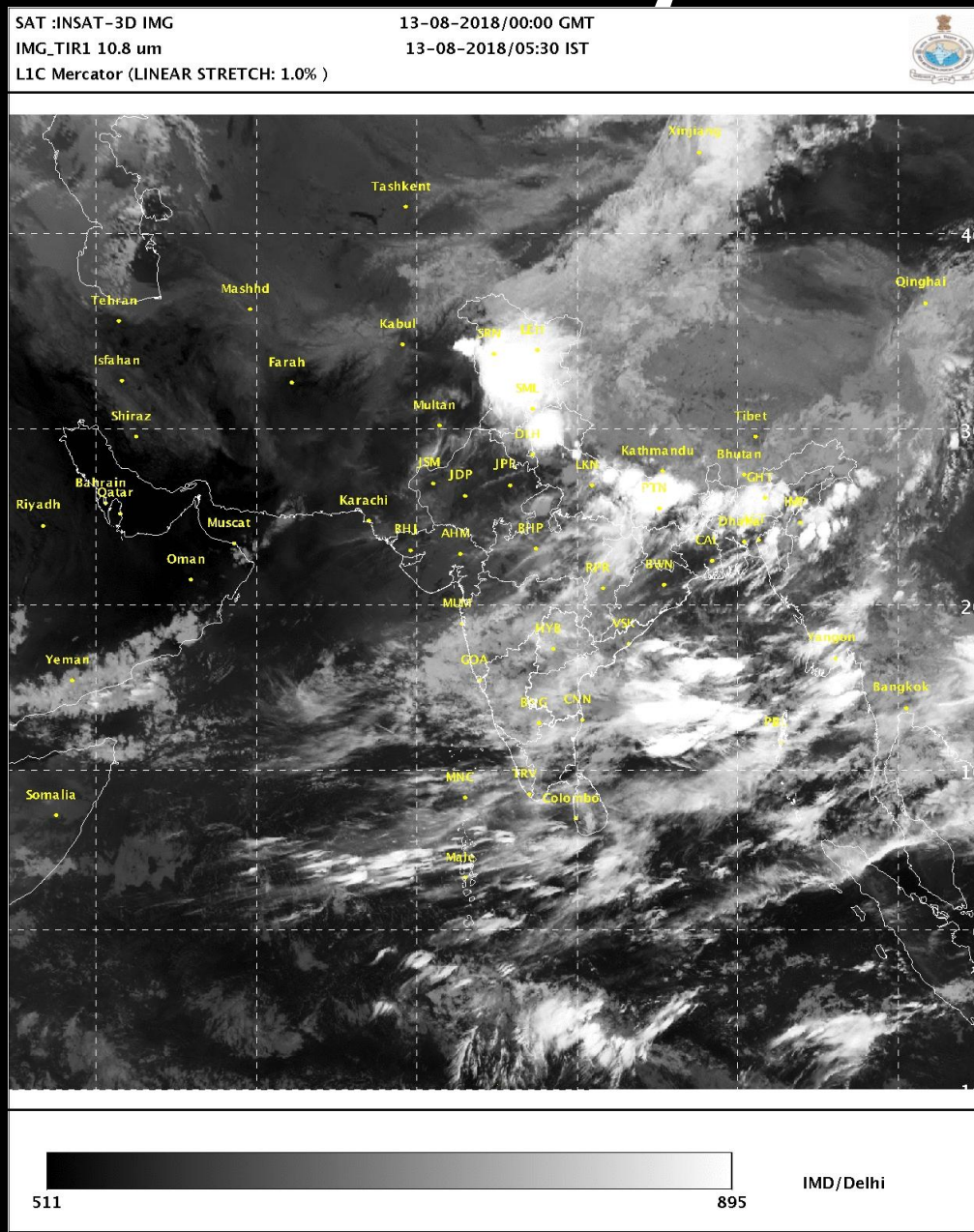
❖ 8-9 August

❖ 14-18 August

Topography

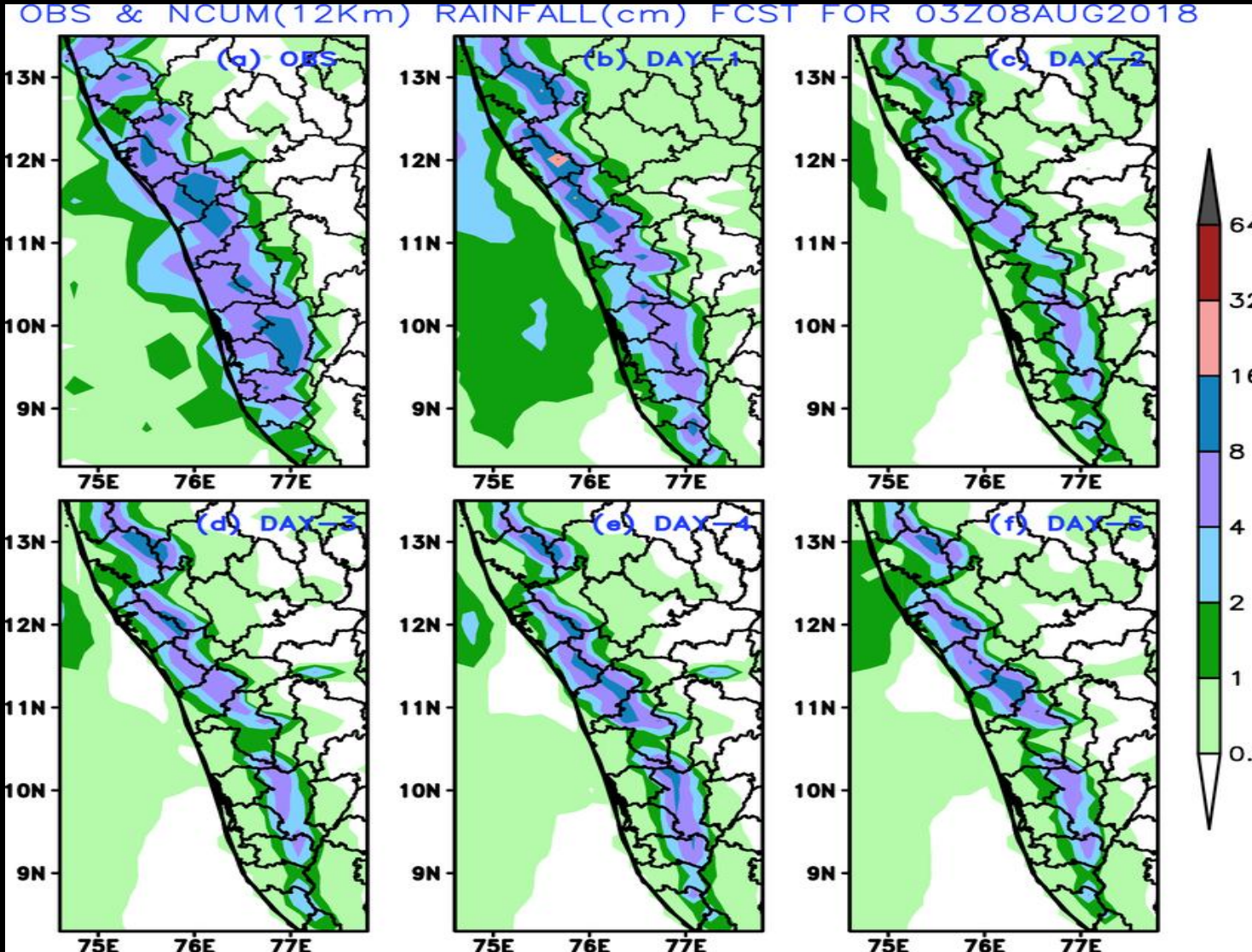


What caused these heavy rains?



Low pressure system
called 'monsoon
depression' stationary for
few days;
taking an unusual path

Weather forecasts gave a hint

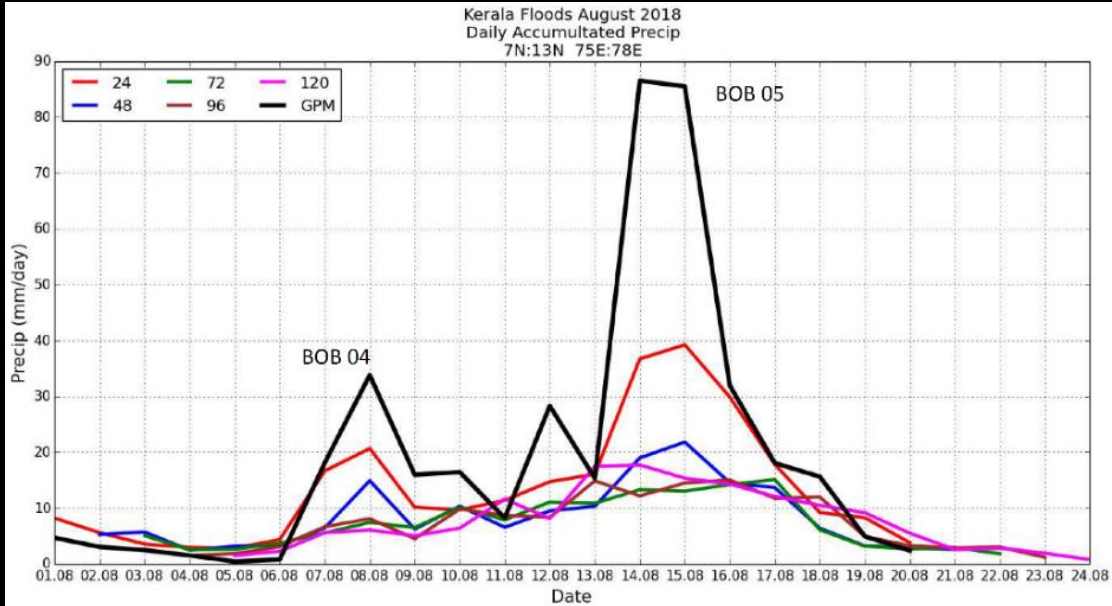


Indian forecast model
(NCUM) forecast

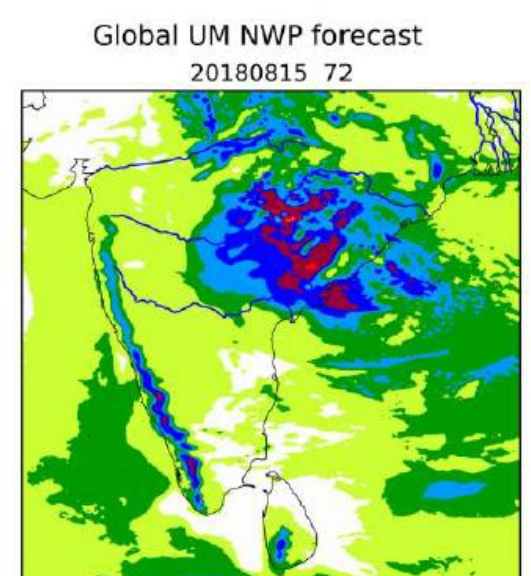
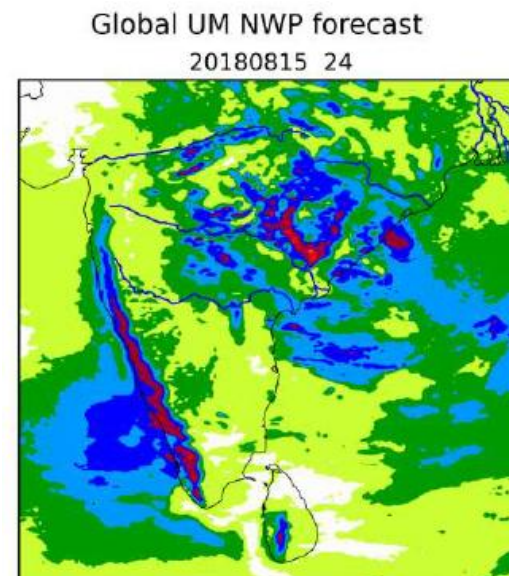
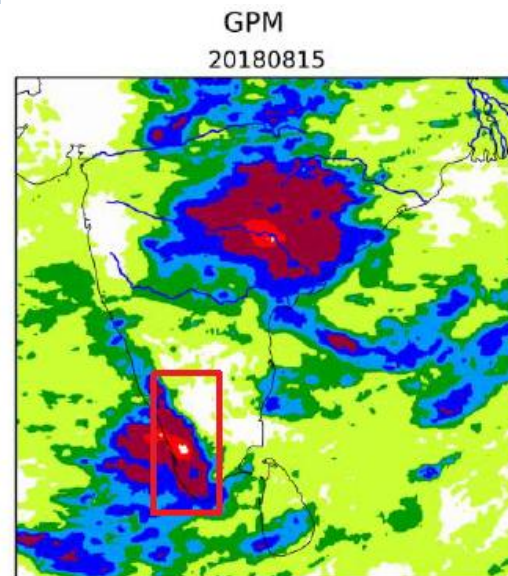
Heavy rainfall was forecasted
a week ahead.

Courtesy: A. Jayakumar
NCMRWF

Met Office forecast

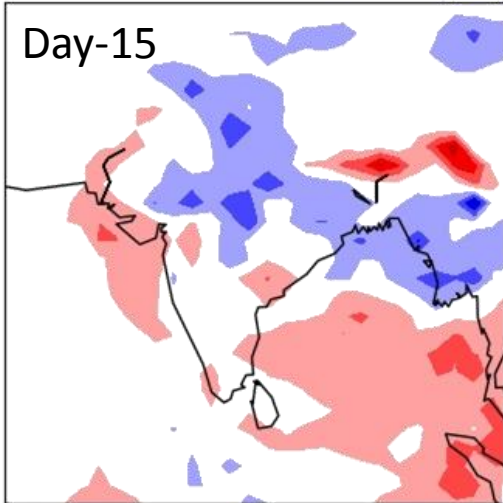


Courtesy: Sean Milton, Charline Marzin; Met Office

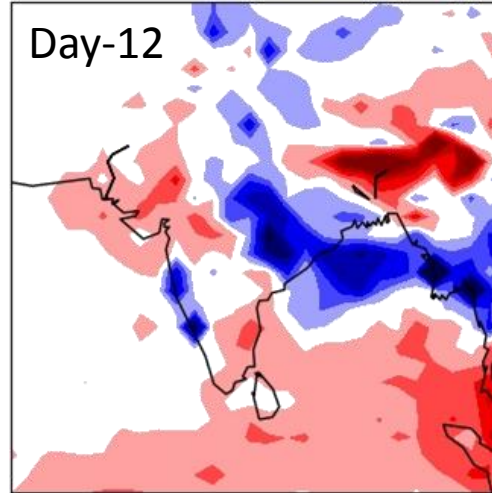


ECMWF forecast

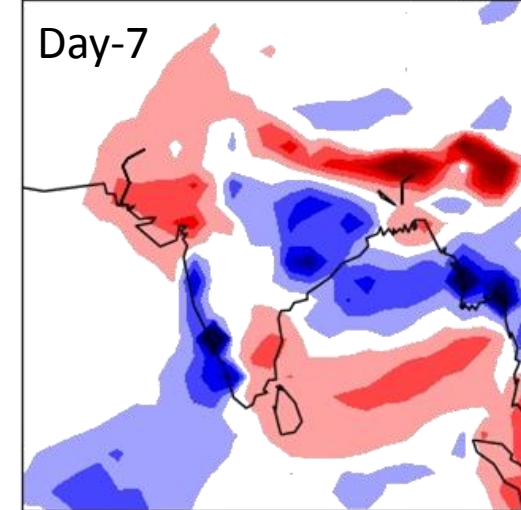
Daily mean rainfall forecast for 15-17 Aug from 07-30



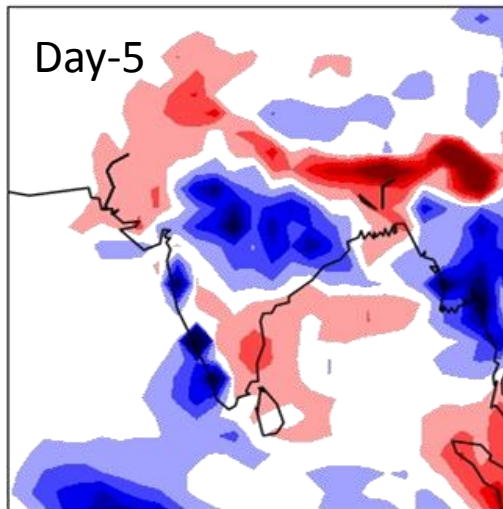
Daily mean rainfall forecast for 15-17 Aug from 08-02



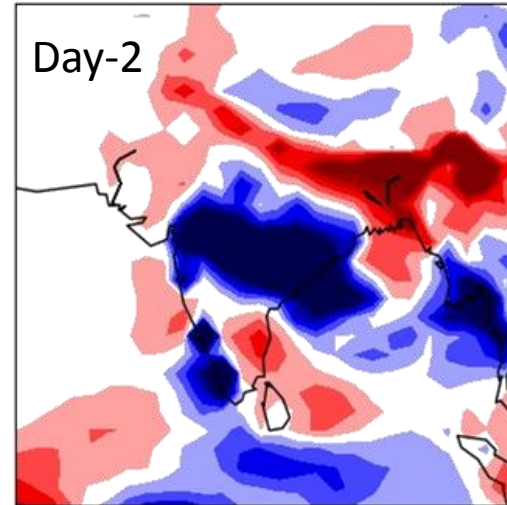
Daily mean rainfall forecast for 15-17 Aug from 08-06



Daily mean rainfall forecast for 15-17 Aug from 08-09

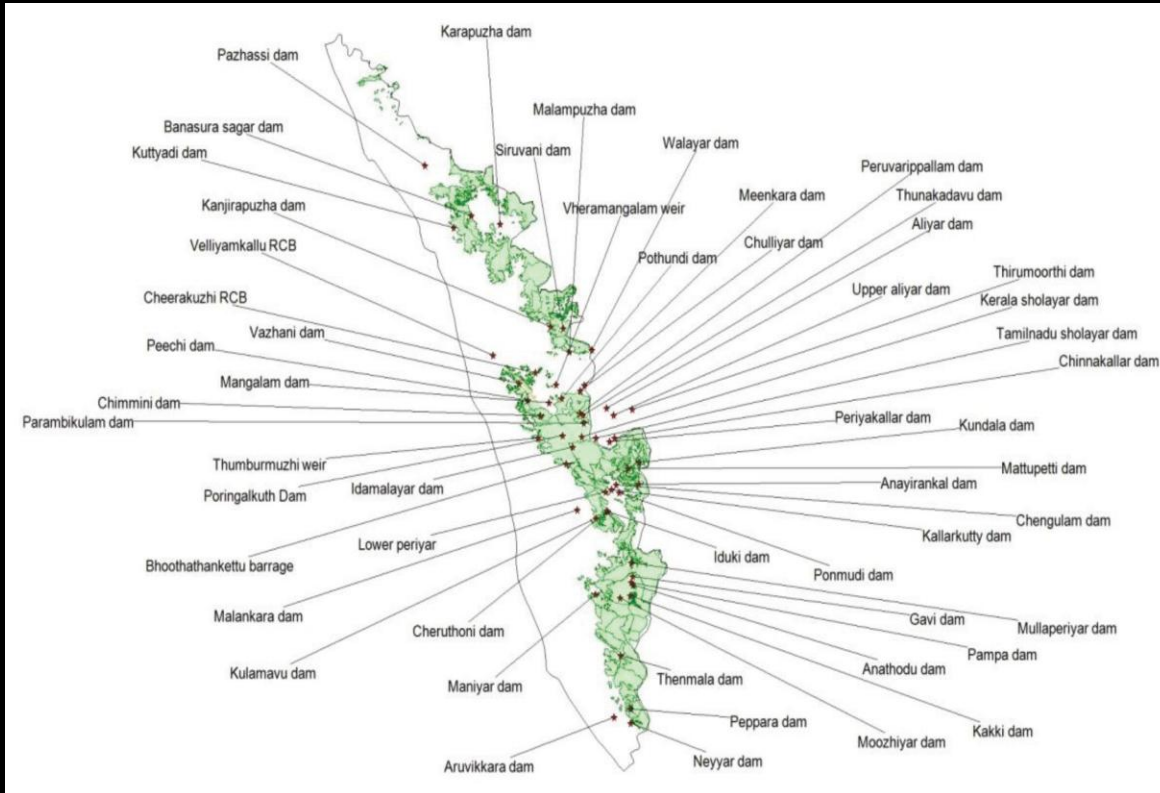


Daily mean rainfall forecast for 15-17 Aug from 08-13



Courtesy: Steve Woolnough

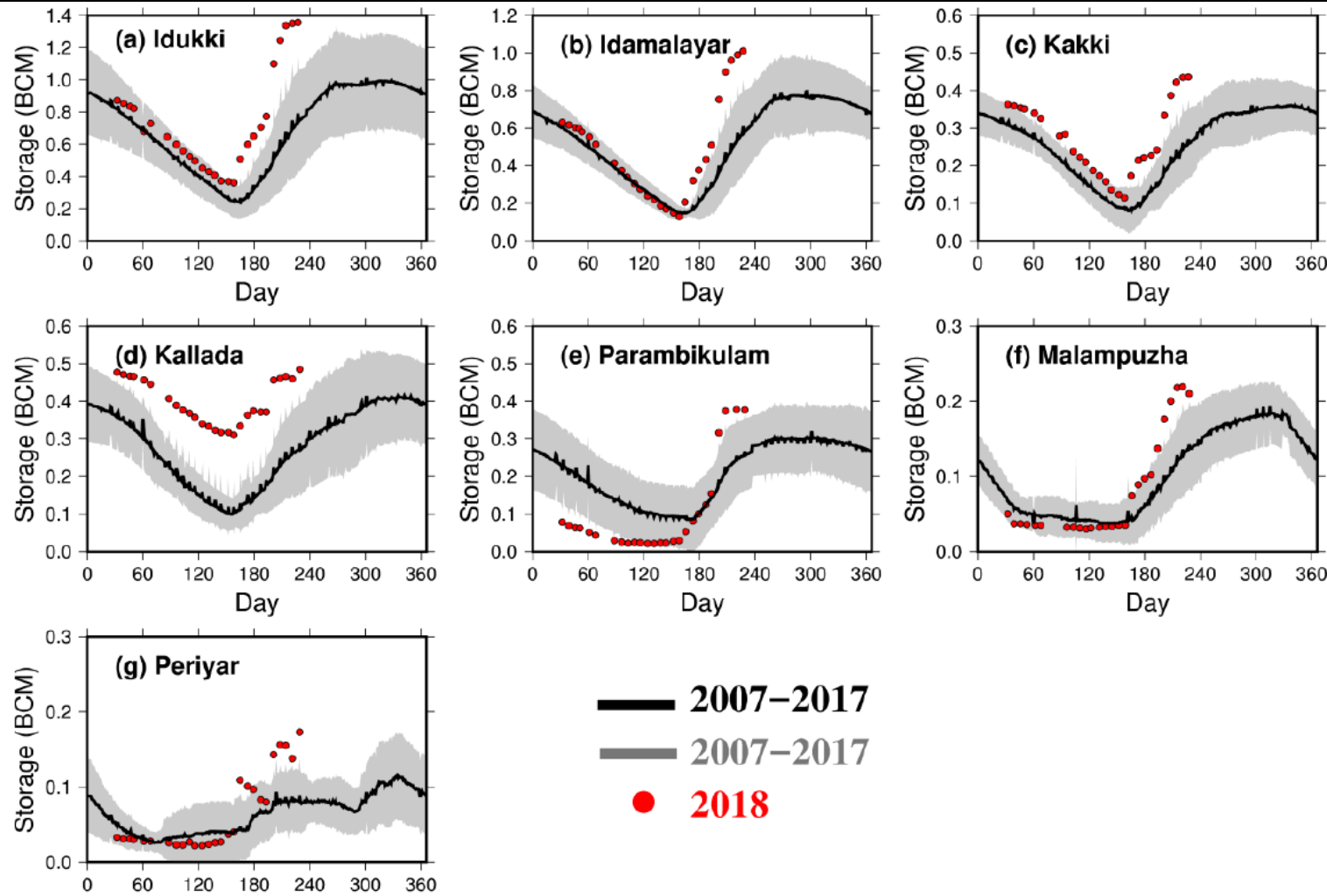
Opening of Dams



- 39 major dams
- 44 Rivers

35 out of the 39 dams were opened

Reservoir storage in 2018



Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2018-480>
Manuscript under review for journal Hydrol. Earth Syst. Sci.
Discussion started: 14 September 2018
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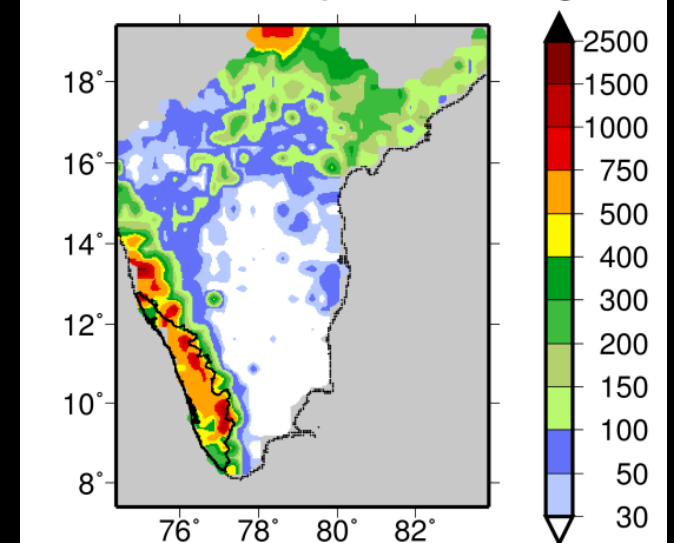
The Kerala flood of 2018: combined impact of extreme rainfall and reservoir storage

Vimal Mishra^{1*}, Saran Aadhar¹, Harsh Shah¹, Rahul Kumar¹, Dushmanta Ranjan Pattanaik², Amar Deep Tiwari¹

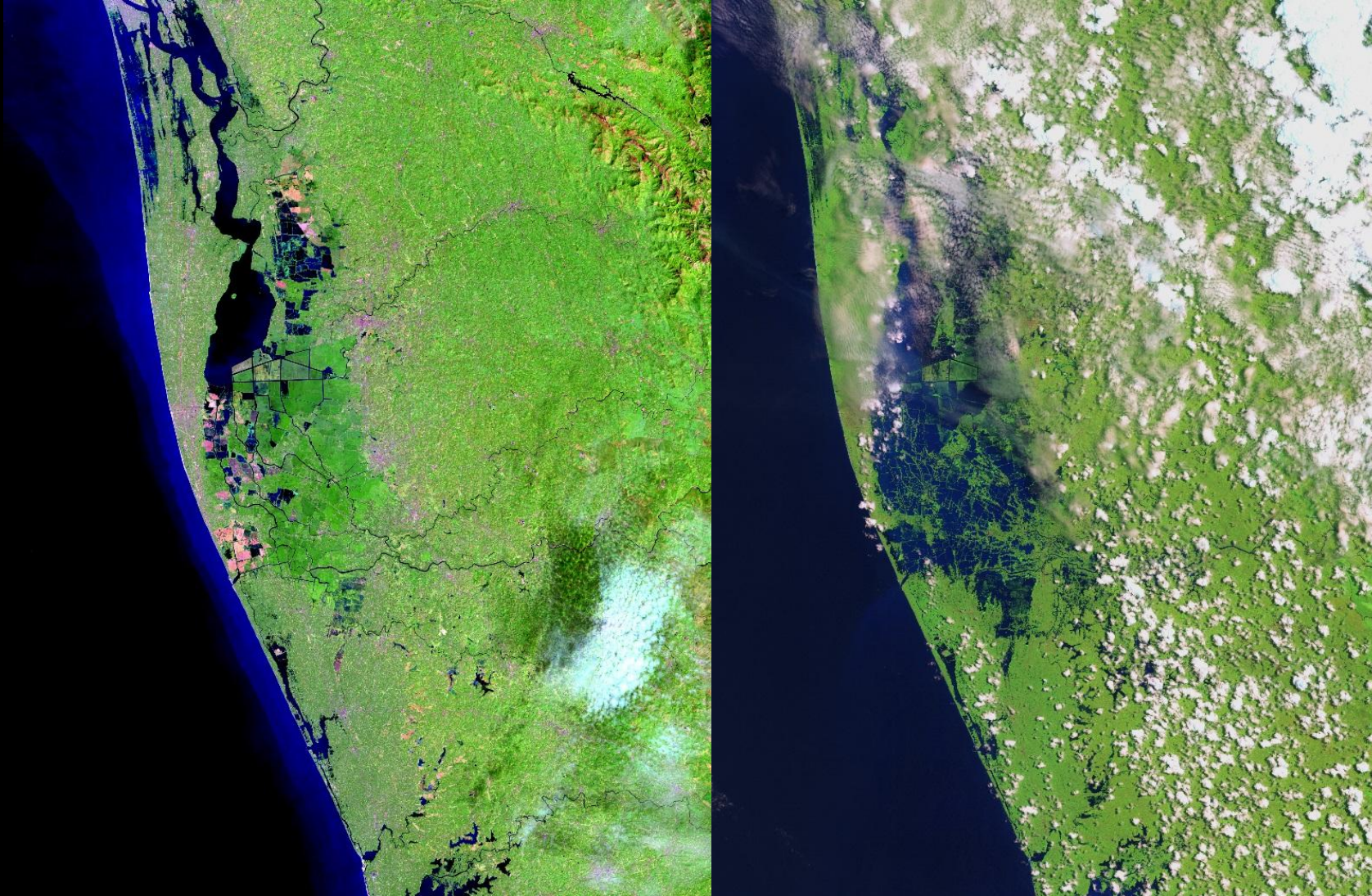
¹Civil Engineering, Indian Institute of Technology Gandhinagar, Gandhinagar, 382355, India

²India Meteorological Department, New Delhi, 110003, India

Cumulative Rainfall (8–17 August)



Kerala: before and after flood



<https://earthobservatory.nasa.gov/images/92669/before-and-after-the-kerala-floods>

Impact of the flood



Rescue Operations



Flood Relief





Summary

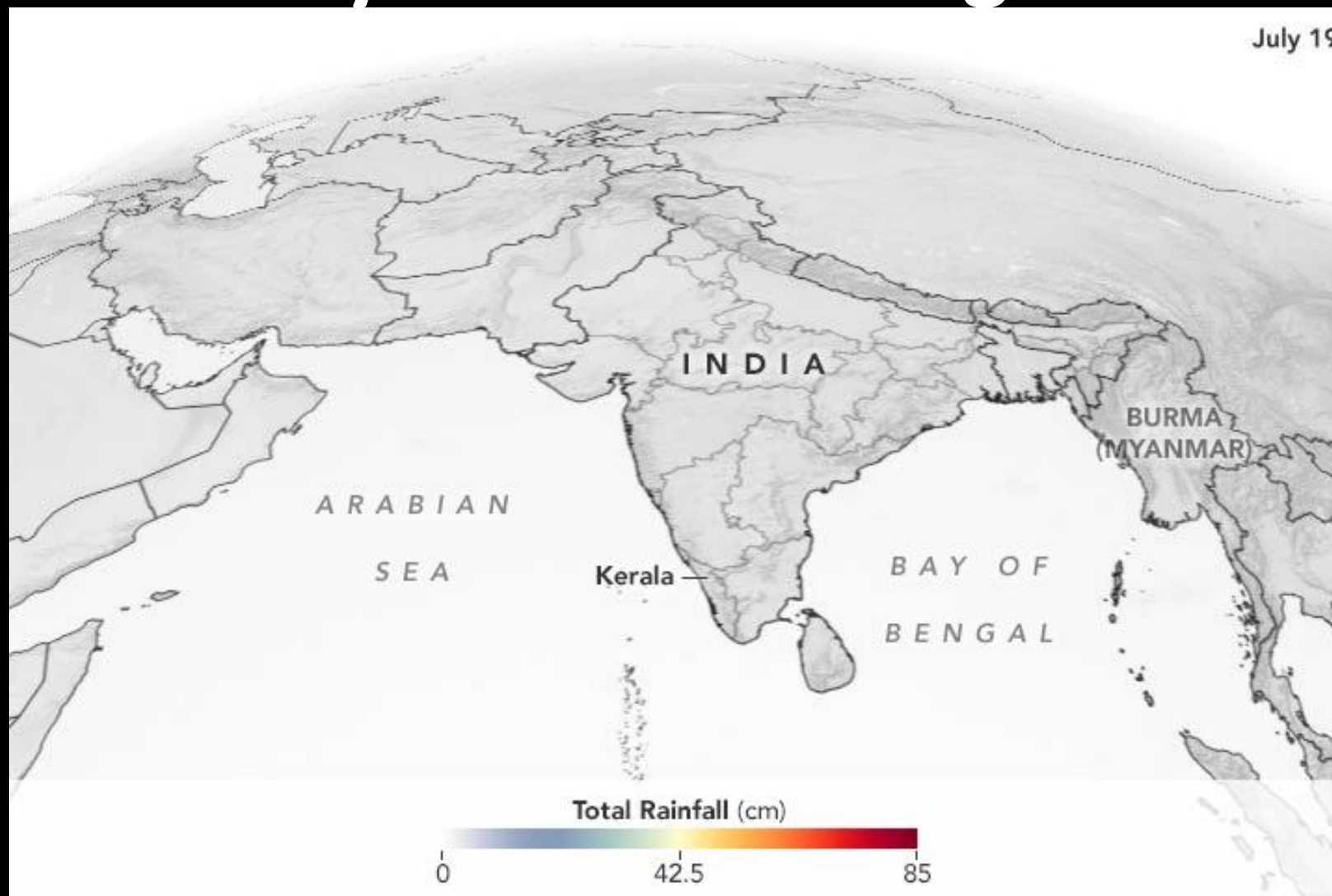
- South Asia witnessed several high impact weather events in 2018
- Kerala flood: once-in-century flood
- 25 trillion litres of water fell in 11-days over 38,000 sq. km
- 483 dead, 1.4 million displaced
- Damages worth US\$ 2.7 billion
- Needs better flood forecasts and disaster management plans in future

Contact: arathy.menon@reading.ac.uk

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**The
Guardian**

Rainfall 19 July 2018 to 18 August 2018



NASA Earth Observatory
images by Joshua
Stevens, using IMERG
data from the Global
Precipitation Mission
(GPM) at NASA/GSFC.