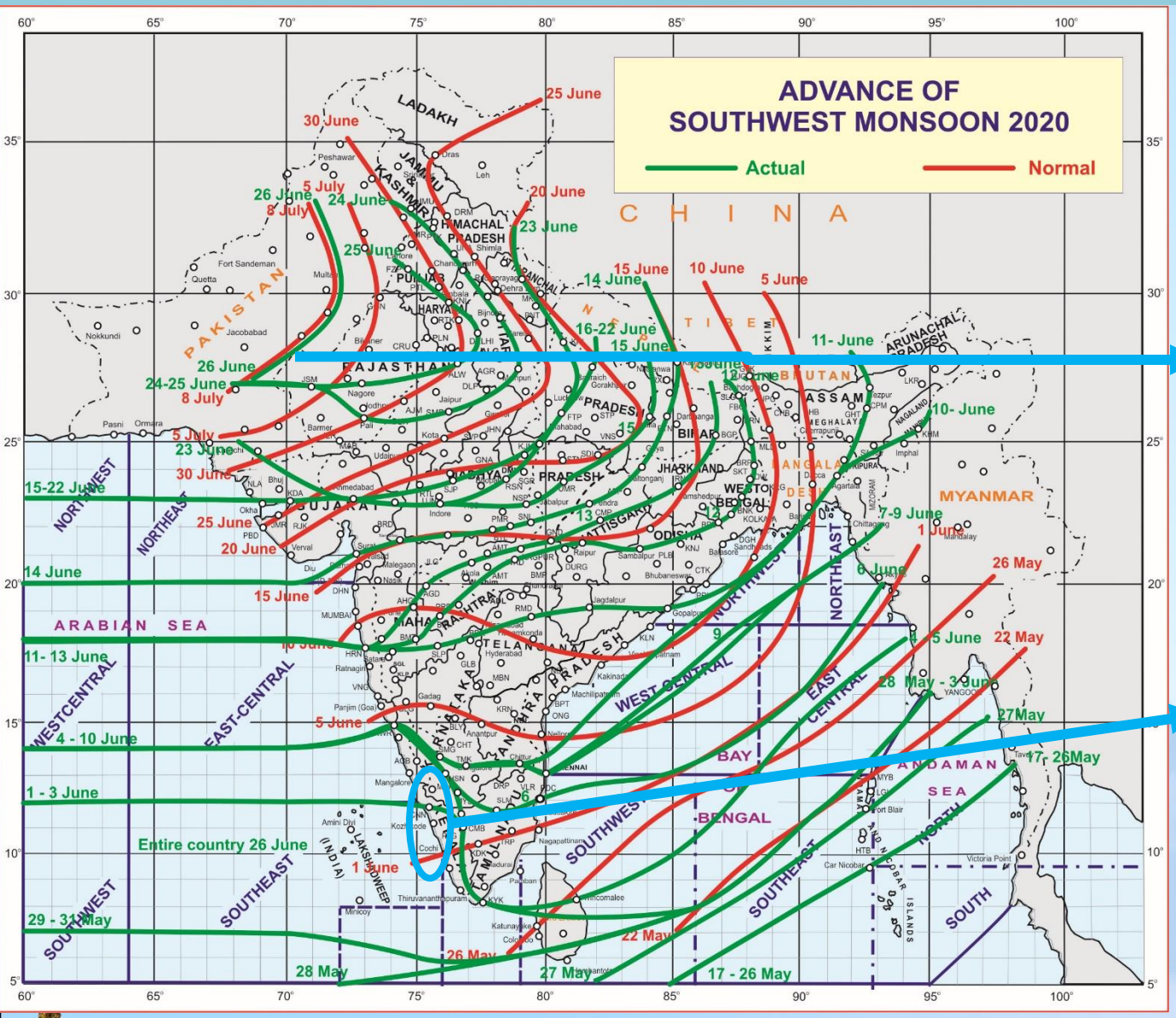
Southwest Monsoon 2020: Current status and forecast

M. Mohapatra

Director General of meteorology

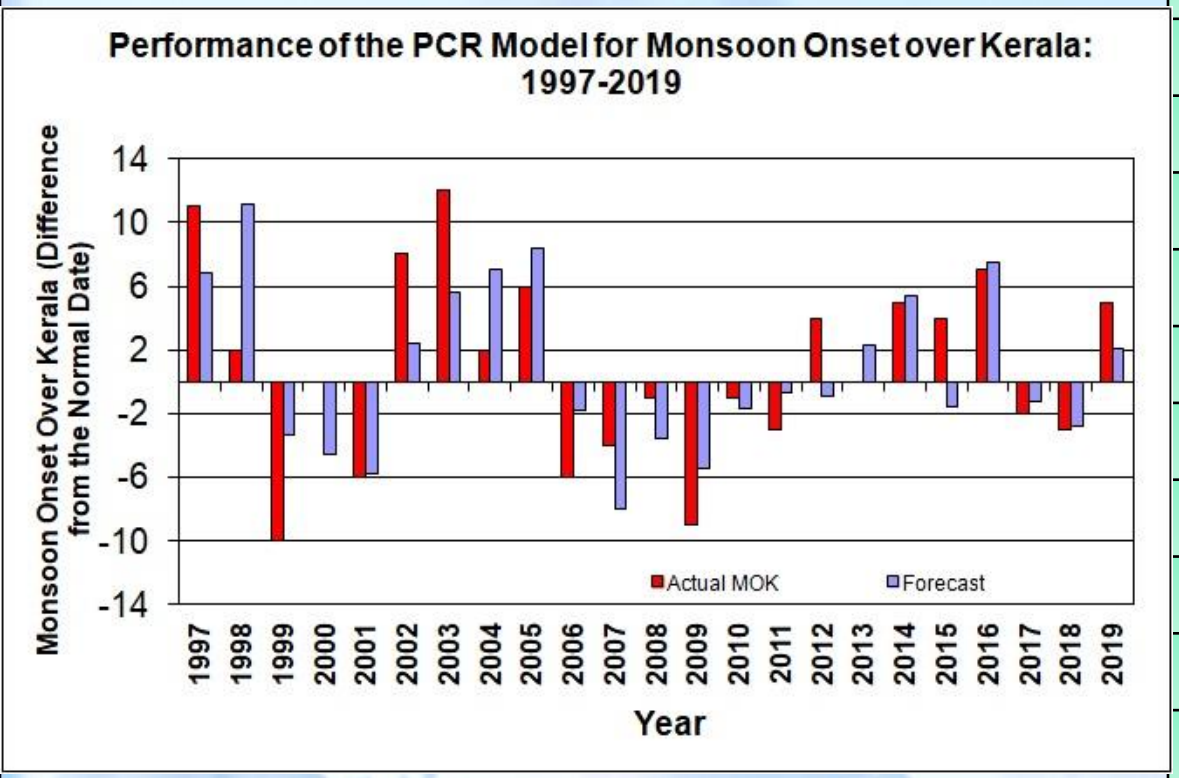
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

Advance of southwest monsoon – 2020 Vs. normal dates



- *Forecast onset date was 5th June, which was updated to 1st June, in the last week of May*
- **Covered entire country on 26th June against normal of 8th July**
- **Set in over Kerala on 1st June- normal date of onset**

Forecast for Monsoon onset over Kerala issued on 15th May 2020)

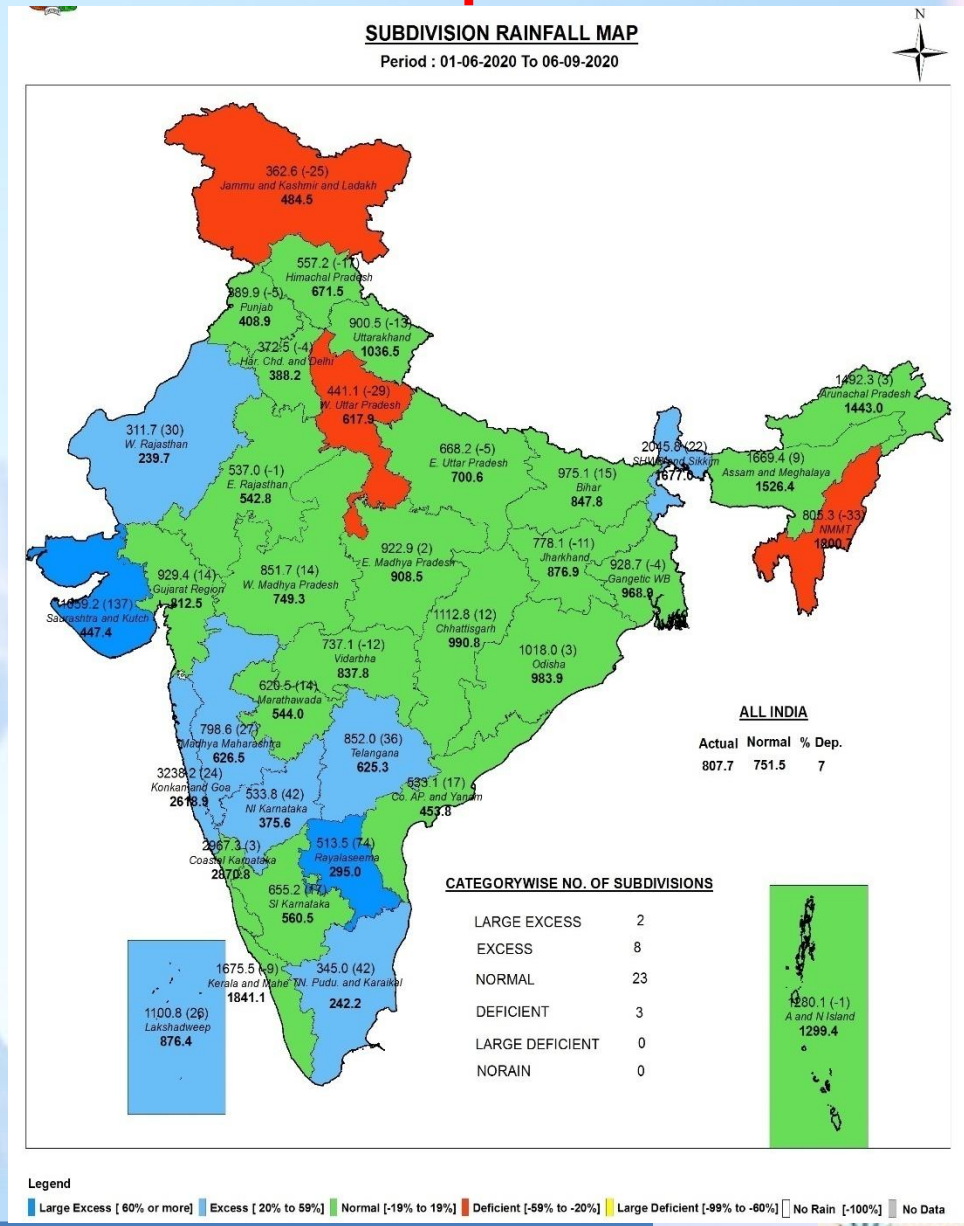


Model error = 4 days

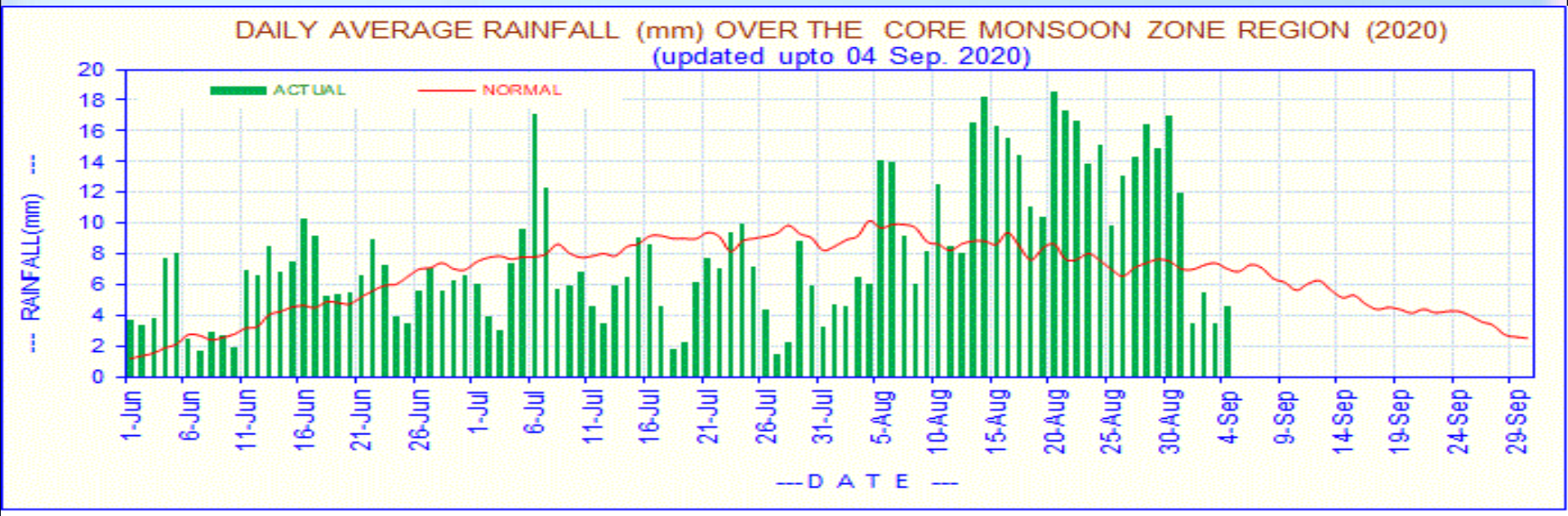
Year	Actual Onset Date	Forecast Onset Date
2005	7th June	10th June
2006	26th May	30th May
2007	28th May	24th May
2008	31st May	29th May
2009	23rd May	26th May
2010	31st May	30th May
2011	29th May	31st May
2012	5th June	1st June
2013	1st June	3rd June
2014	6th June	5th June
2015	31st May	5th June
2016	8th June	7th June
2017	30th May	30th May
2018	29th May	29th May
2019	8th June	6th June
2020	1st June	5th June

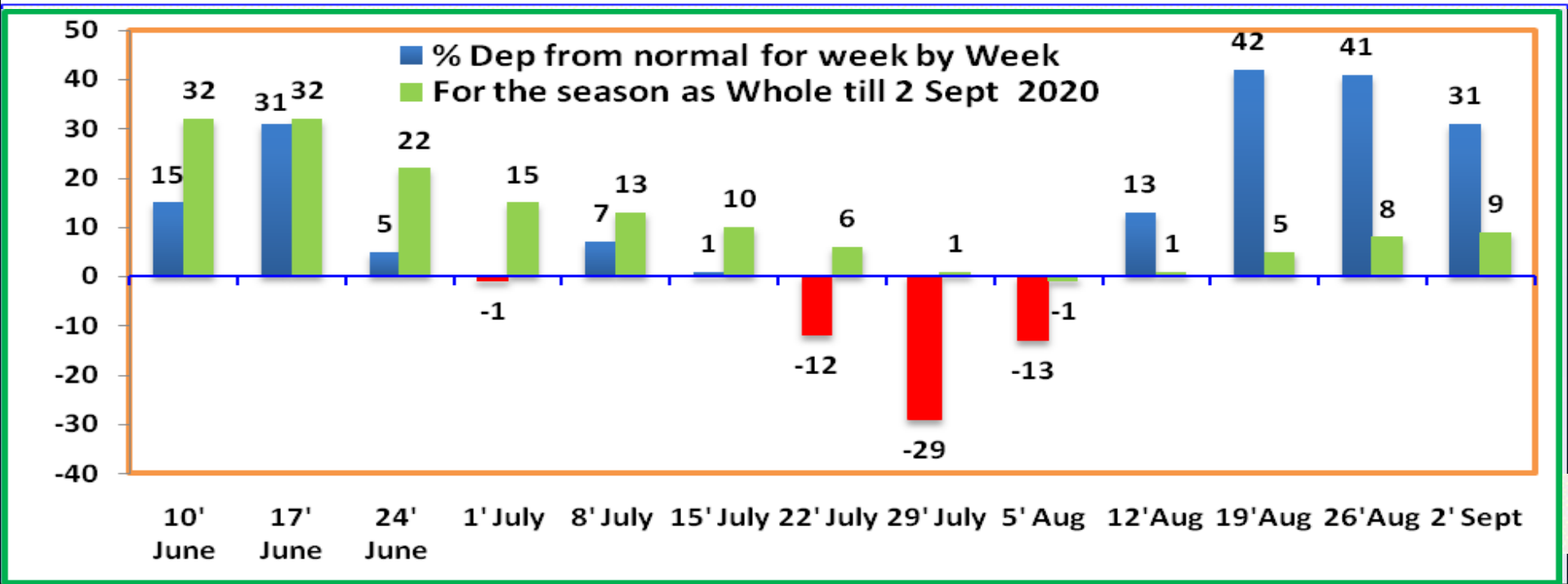
Long Range Forecast issued on 15th April 2020

- Southwest monsoon seasonal (Jun-Sep) rainfall over country as is likely to be normal (96-104%).
- Monsoon seasonal (Jun-Sep) rainfall is likely to be 100% of Long Period Average (LPA) with a model error of ± 5%.
- It was further updated on 31 May to 102% of the LPA with a model error of ±4%.
- LPA of season rainfall over country based on 1961-2010: 88 cm.
- Actual cumulative rainfall (1 June – 6 September 2020): 107% of LPA

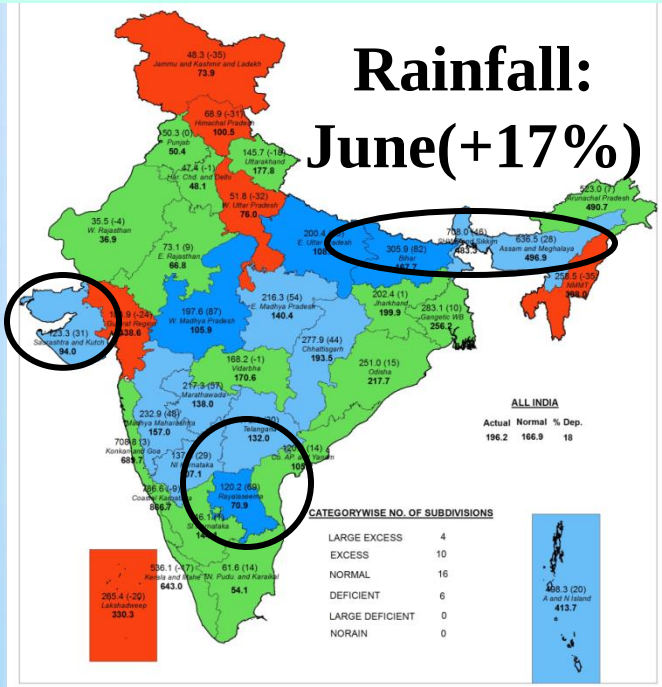


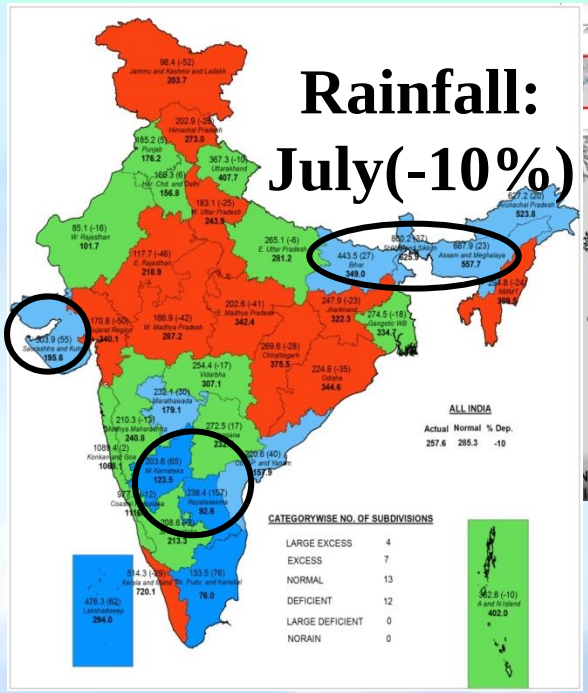
Daily and Weekly performance

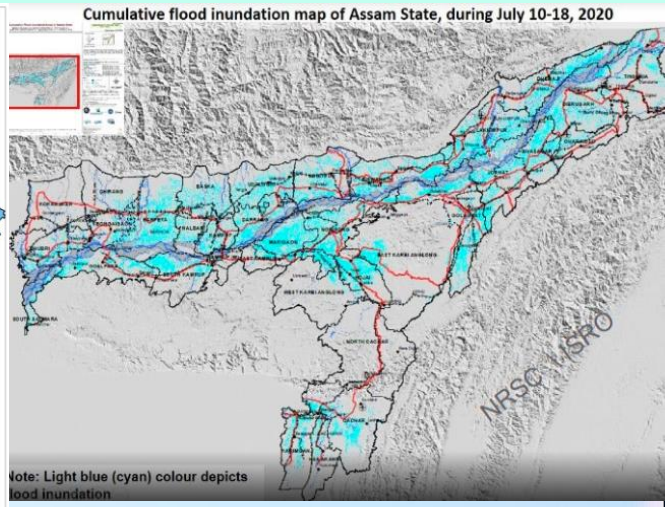




Monsoon-2020: Monthly Rainfall

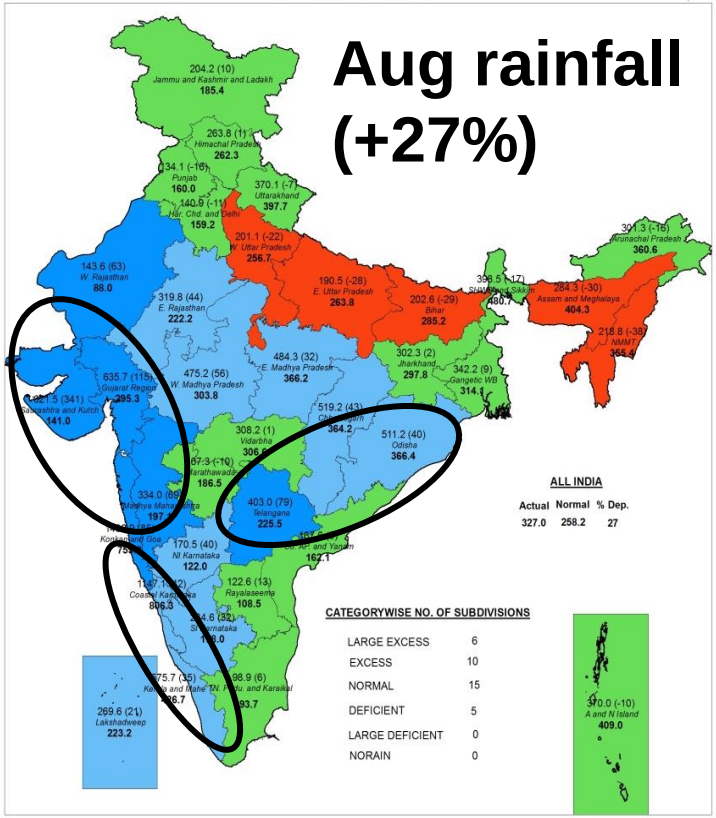






- **June:** Heavy rain led to flooding in Saurashtra and NE states
- **July:** Heavy-extremely heavy rainfall: East UP, Bihar, Sub-Himalayan West Bengal (SHWB), Sikkim, Assam, Meghalaya, Arunachal Pradesh
  - Led to floods in Bihar, Assam, some pockets of east UP and Arunachal Pradesh and land slides over Assam, SHWB, Sikkim,
- Rainfall has been consistently excess during June and July over (i) Assam & Meghalaya, (ii) Sub-Himalayan west Bengal and Sikkim (iii) Bihar (iv) Saurashtra & Kutch and (v) Rayalaseema.

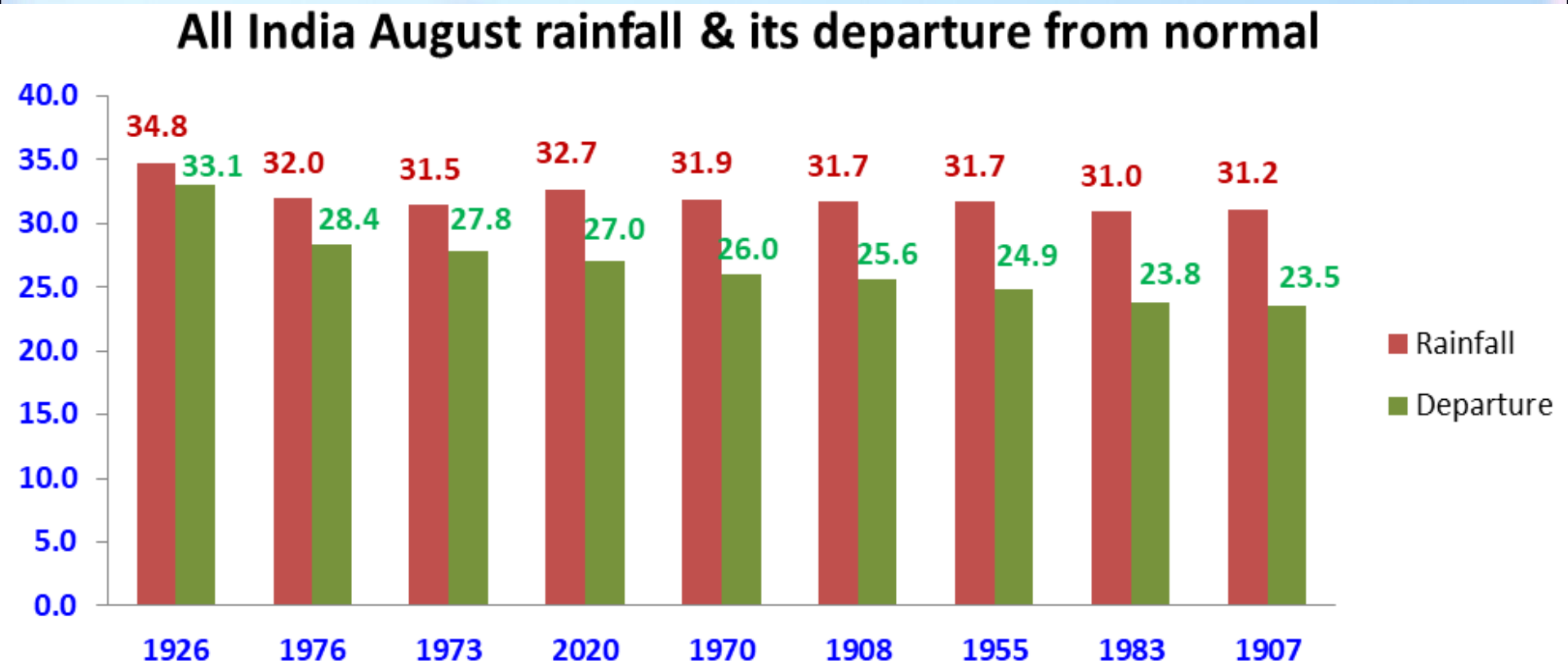
Monsoon-2020: August and Seasonal rainfall



- **August: Excess rainfall over Rajasthan, Gujarat, Maharashtra. Karnataka, Kerala, Telangana, Chhattisgarh and Odisha**
- **Mainly due to five low pressure systems over north Bay of Bengal which moved westwards upto Gujarat/Rajasthan (4-10, 9-11, 13-18, 19-26, 24-31 August.**

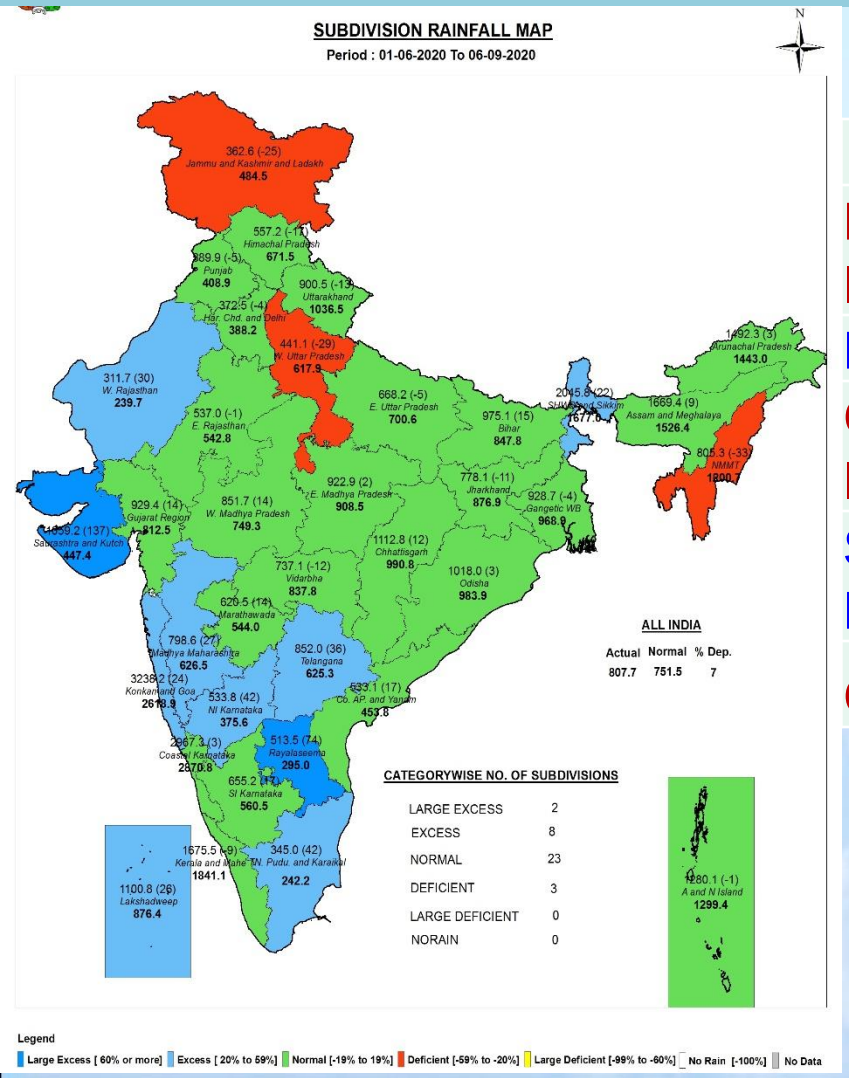
- **Led to frequent floods/inundation of low lying areas and urban flooding over different parts of above states**
- **Landslides occurred over Ghat sections of Karnataka & Kerala**
- **Extremely heavy rainfall warnings, expected impact & suggested actions were issued 3-4 days ahead.**

10 highest August rainfall during (1901-2020)



Regions	Actual	Normal	% Dep
Country as a whole	780.3	710.4	10
Northwest India	446.7	490.2	-9
Central India	966.8	799.3	21
South Peninsula	680.1	566.1	20
East & NE India	1153.2	1125.1	2

1 Jun-6 Sep dep (+7%)



	ACTUAL	NORMAL	% DEP.
EAST & NE INDIA	1191.9	1186.5	0%
NW INDIA	469.7	520.2	-10%
CENTRAL INDIA	987.8	847.8	17%
SOUTH PENINSULA	716.1	595.9	20%
COUNTRY	807.7	751.5	7%

Long Range Forecast for Aug–Sep. 2020(issued on 31 July 2020)

Rainfall Forecast

- **Rainfall over country in Aug.-Sep. 2020:Normal(94%-106% of LPA).**
- **Rainfall over country during Aug.-Sep. 2020: 104% of LPA (44.7 cm) with a model error of ±8%.**
- **Seasonal (June-Sep.) rainfall over country : Normal (96% -104% of LPA) as issued on 1st June and quantitatively 102% ± 4% of LPA (88 cm)**

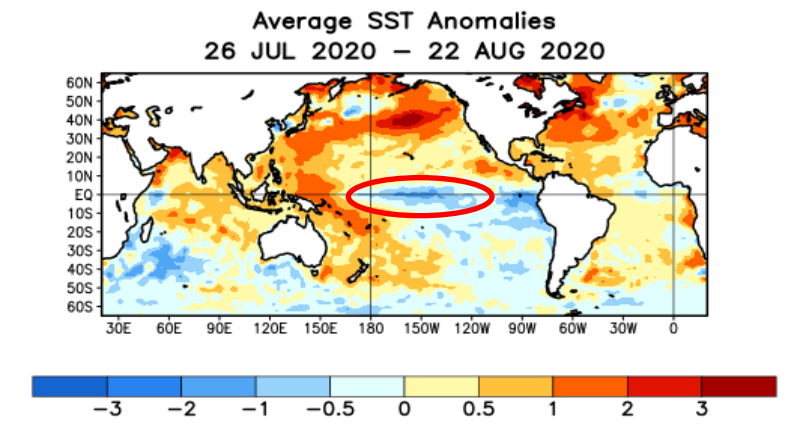
ENSO Forecast:

- **Currently, sea surface temperatures(SSTs) and atmospheric conditions over equatorial Pacific Ocean indicate cool ENSO neutral conditions.**
- **MMCFS and other global models indicate SSTs over the region to cool further. However, ENSO neutral conditions to continue during remaining part of monsoon season.**

Indian Ocean Dipole(IOD) Forecast:

Neutral IOD conditions are prevailing over equatorial Indian Ocean. MMCFS forecast indicates development of negative IOD conditions during coming months.

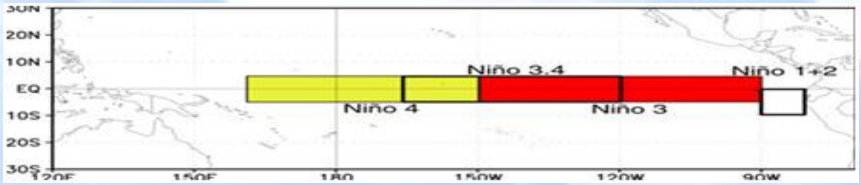
Latest Global SST Departures (ºC) and ENSO Conditions over Pacific



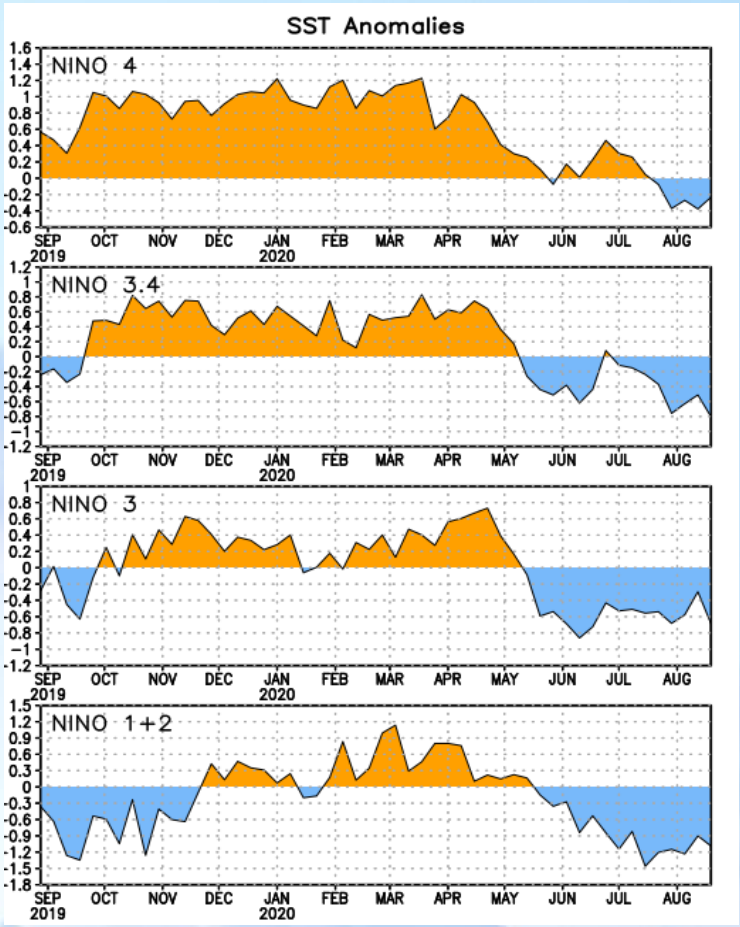
Data source
CPC, USA

The latest weekly SST departures are:

Niño 4	-0.2ºC
Niño 3.4	-0.8ºC
Niño 3	-0.7C
Niño 1+2	-1.1ºC



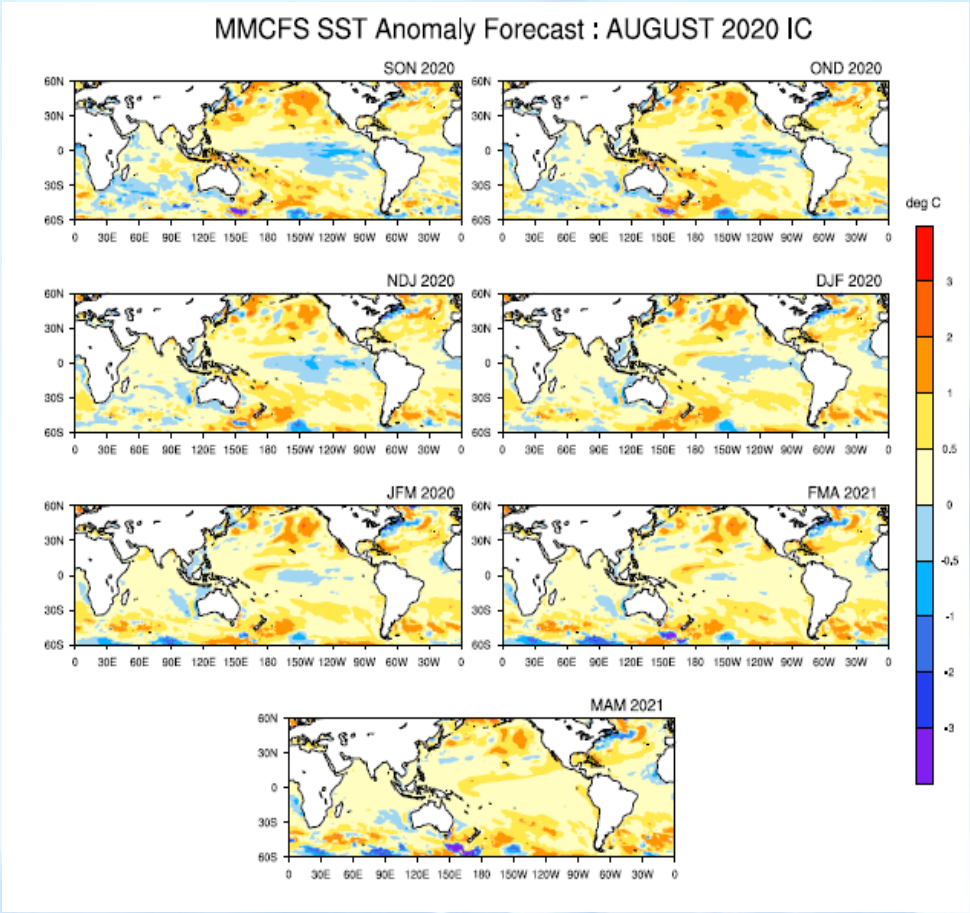
Recent evolution of NINO SSTs



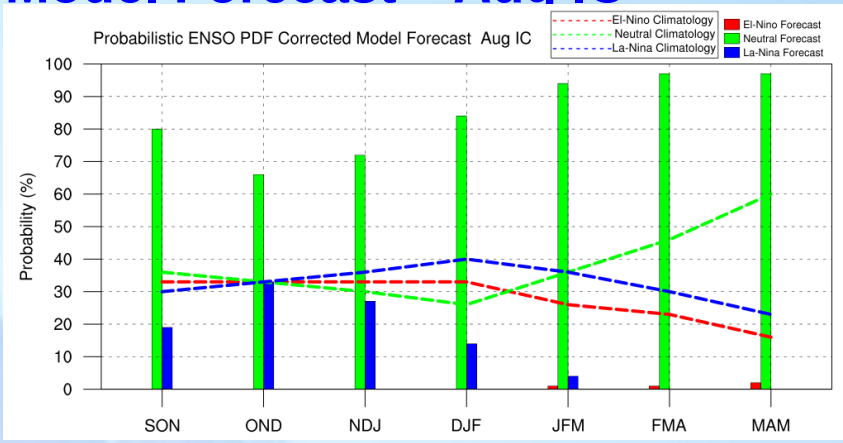
Data source
CPC, USA

Equatorial SSTs were near-to-below average across the central and eastern Pacific Ocean, and above average in the western Pacific

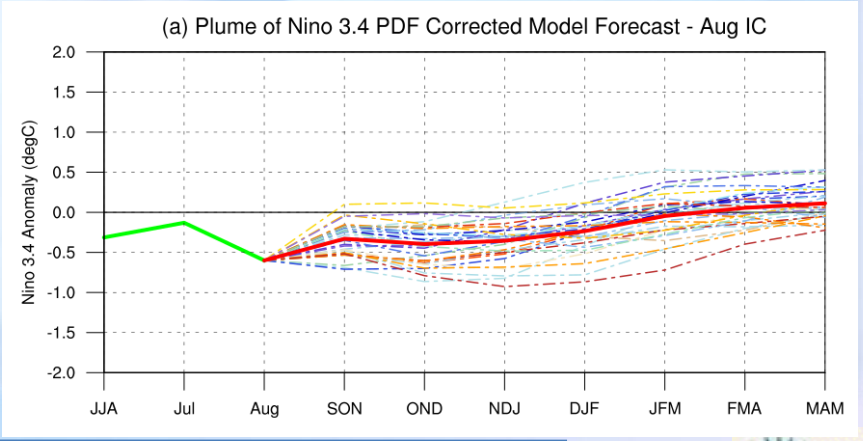
ENSO Forecast - MMCFS: Aug IC (34 Ens)



Probability of Nino 3.4 PDF Correct Model Forecast – Aug IC

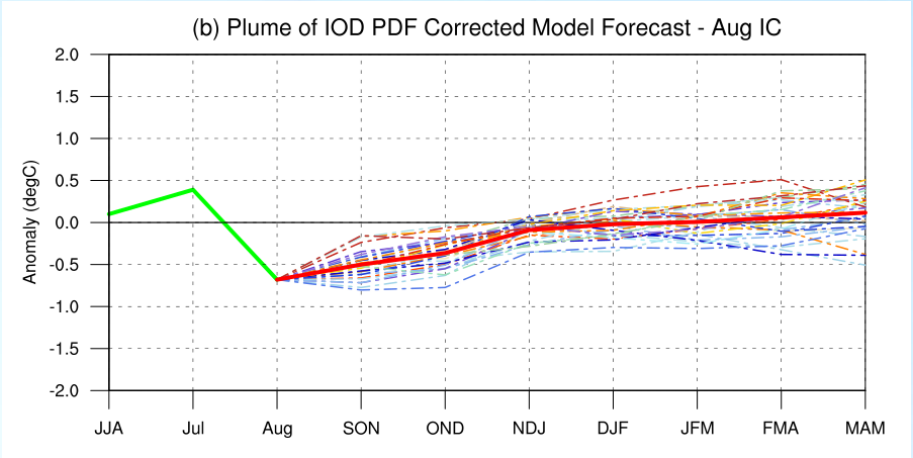


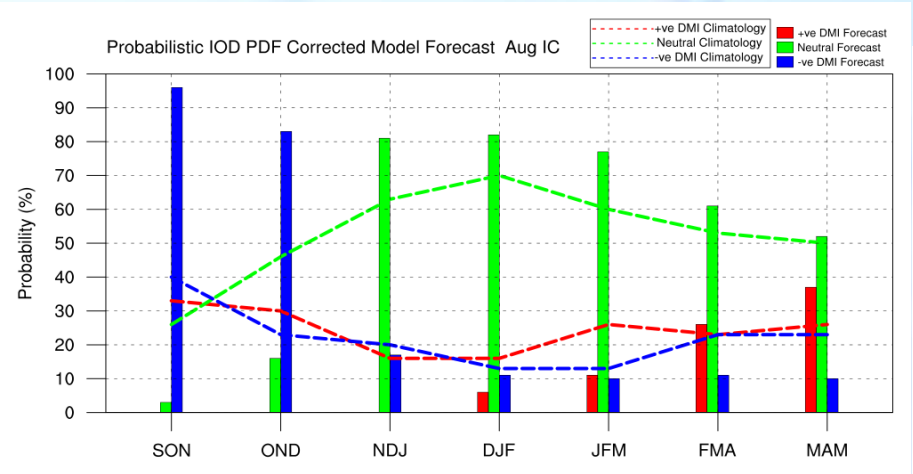
Plume of Nino 3.4 PDF Corrected Model Forecast – Aug IC

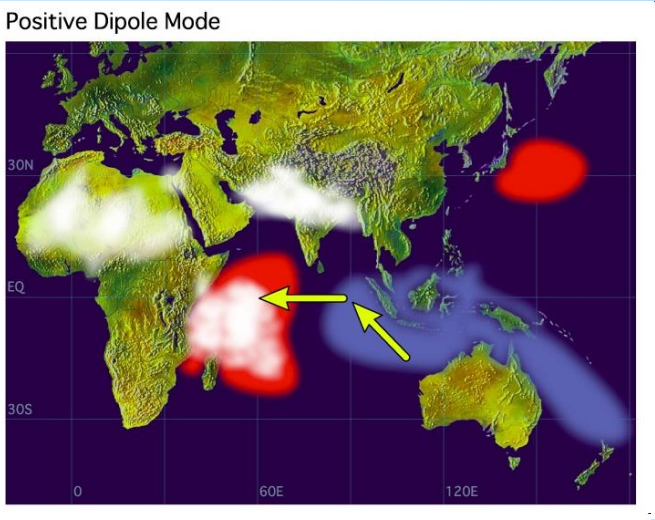


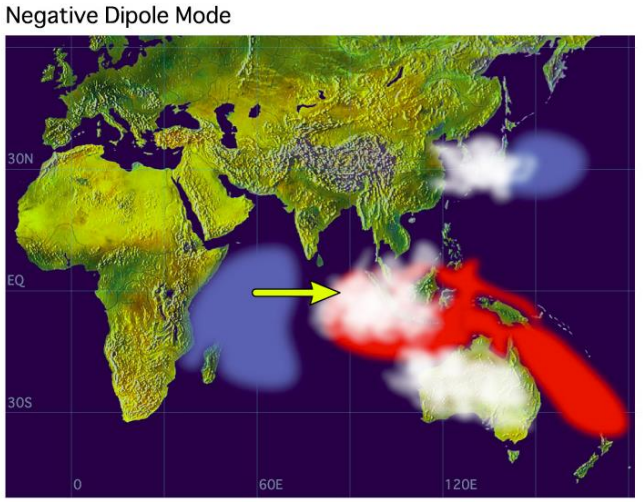
MMCFS forecast indicates neutral ENSO conditions during monsoon season.

Indian Ocean Dipole (IOD): MMCFS Aug IC



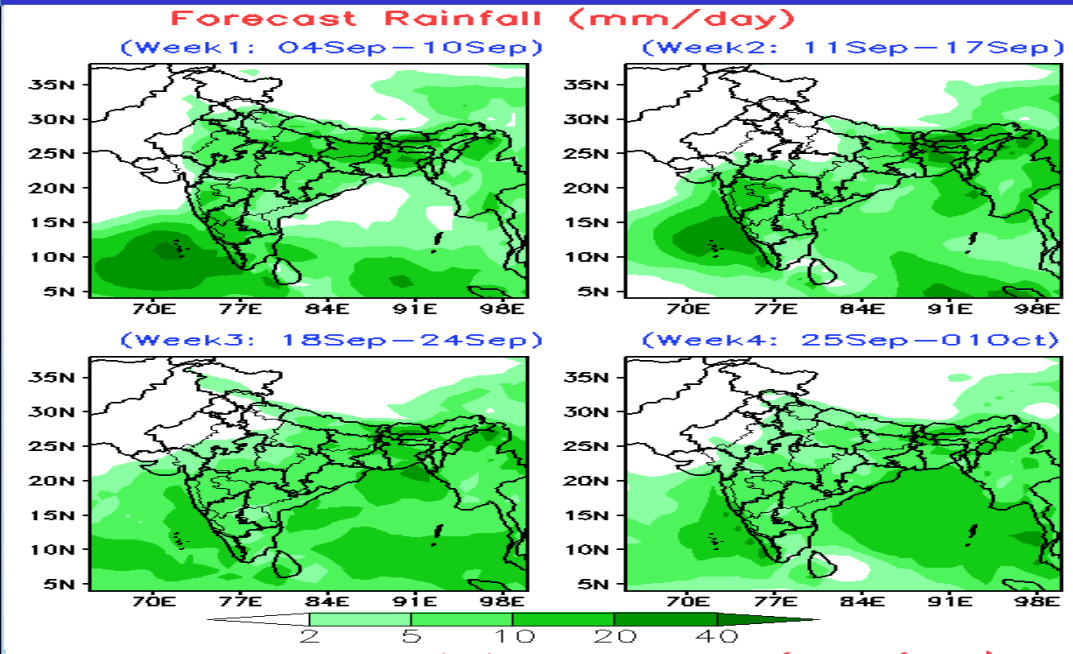


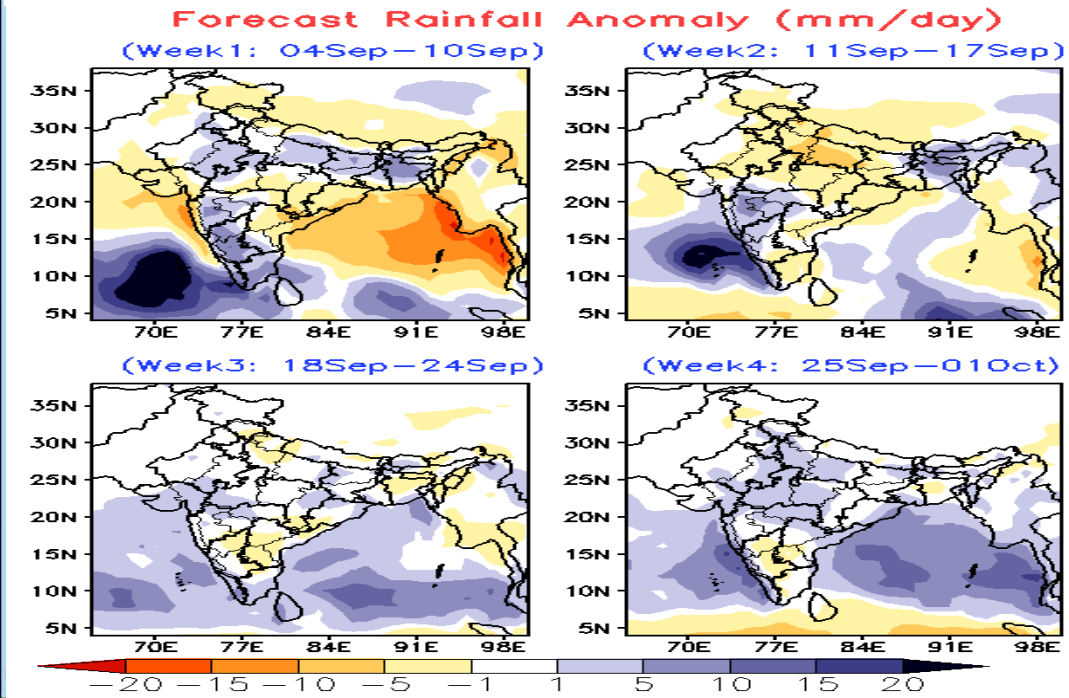




- **Negative IOD conditions are observed over Indian Ocean**
- **Latest MMCFS forecast indicates Negative IOD condition will continue during rest of the season.**

Rainfall Forecast for next four weeks Valid for 4-Sep.-1 Oct., 2020





Week 1 : Overall for the country as a whole decrease in rainfall compared to previous week.

Increase in rainfall over foothills and adjoining northern plains, south Peninsula

Deficient rainfall over eastcentral and northeast Peninsula

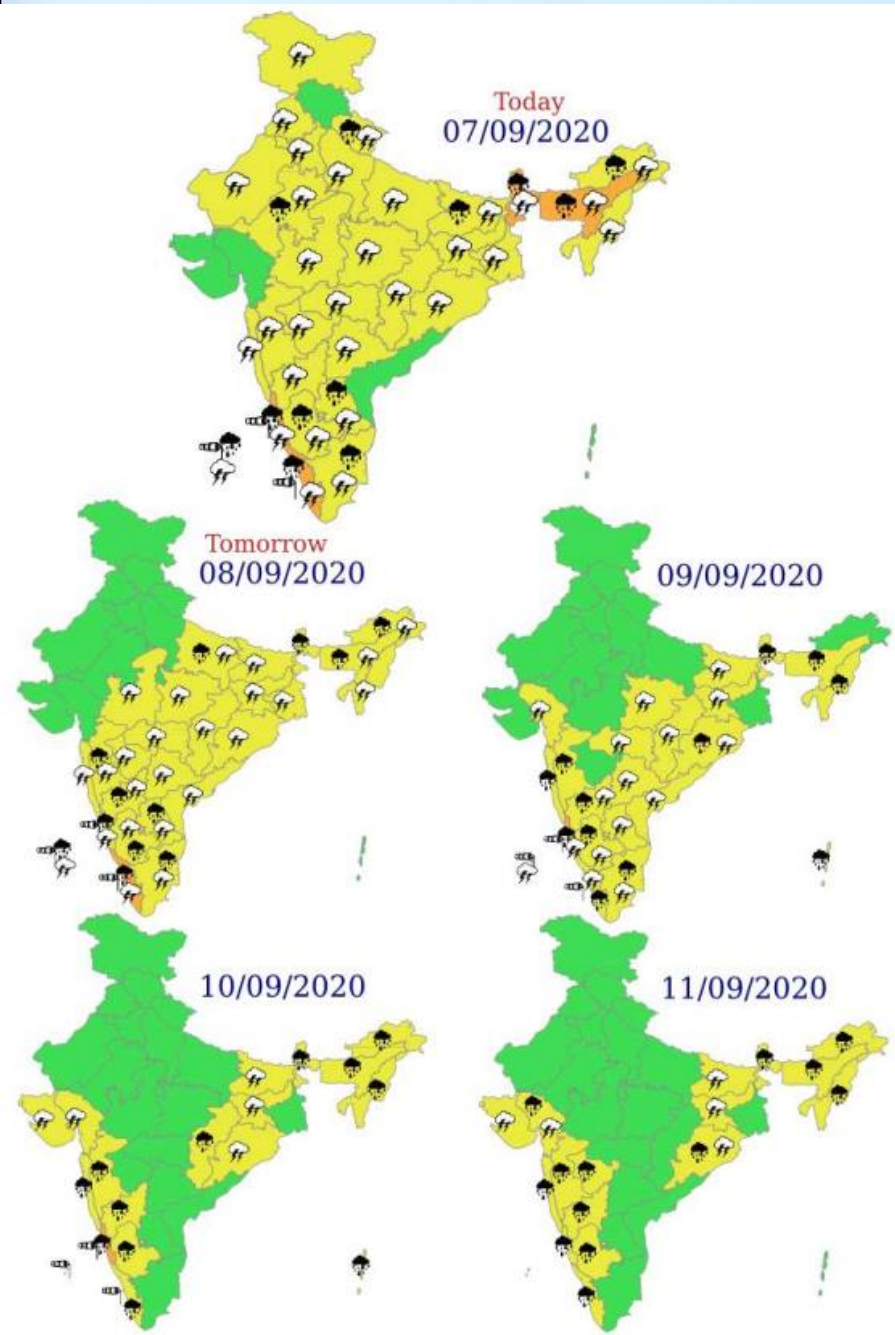
- **Week 2:** Further decrease in rainfall over the country
- Excess rainfall over NE states and southwest Peninsula
- Deficient rainfall over central and NW India
- *Conditions to become favourable for withdrawal of monsoon from extreme NW India*

Week 3 : Increase in rainfall activity over country

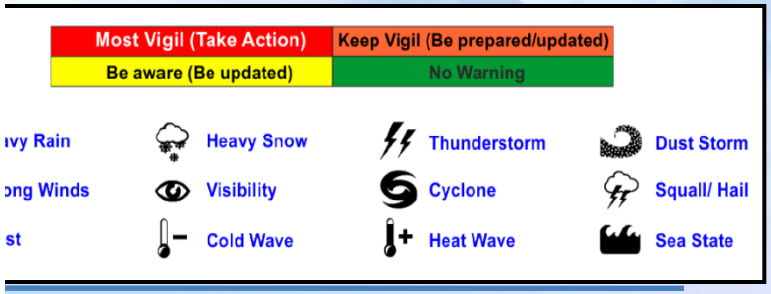
Week 4: Mostly normal to slightly above rainfall during this period.

DEPARTMENT

Forecast and Warnings for next 5 days (7-11 Sept. 2020)

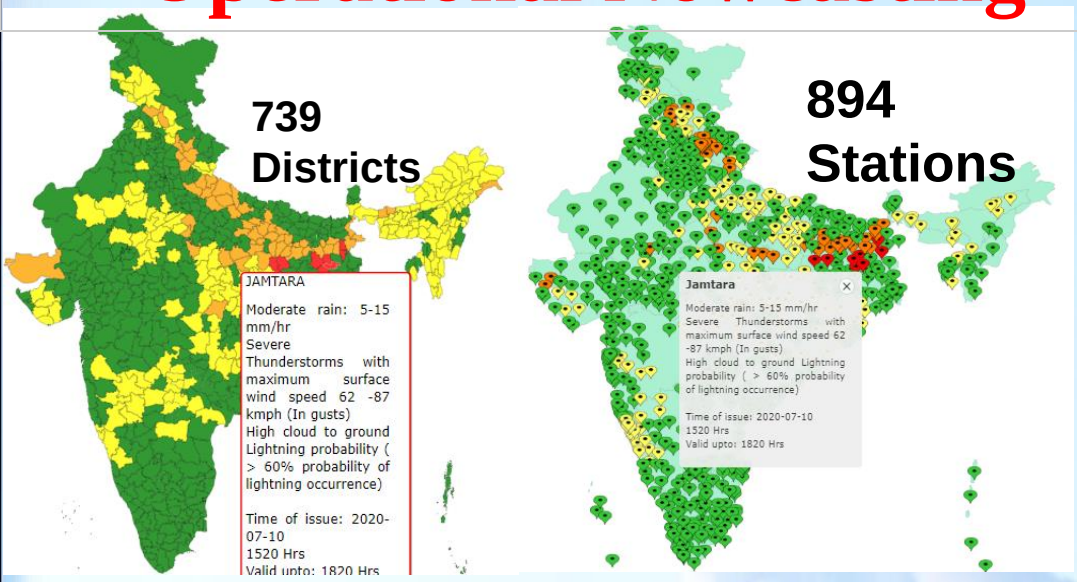


- A low pressure area lies over Eastcentral Arabian Sea. To move northward and become less marked tomorrow
- Monsoon trough lies to north of its normal position
- Increased rainfall activity over NE states, foot hills, west coast
- Subdued rainfall over central India
- No red colour warning in country

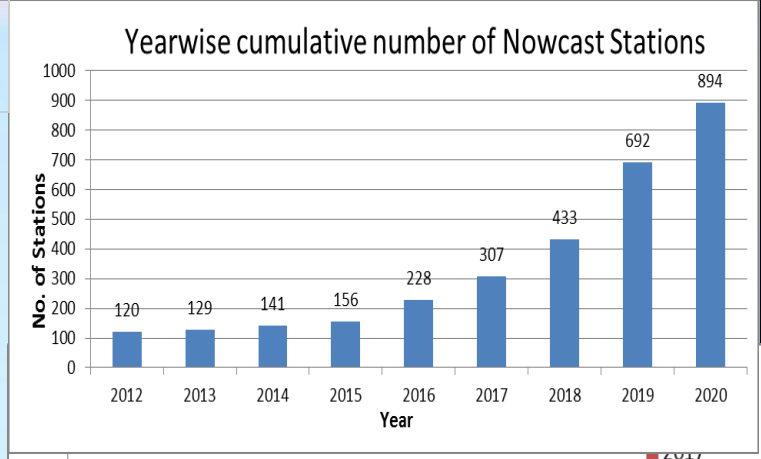


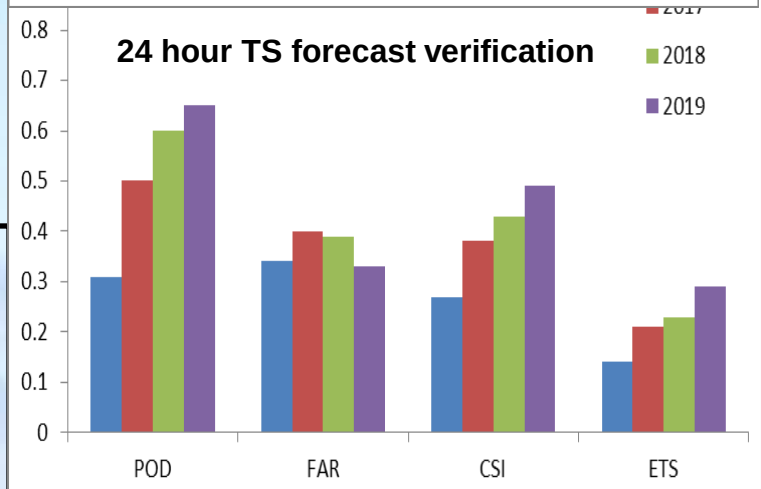
विज्ञान विभाग
OGICAL DEPARTMENT

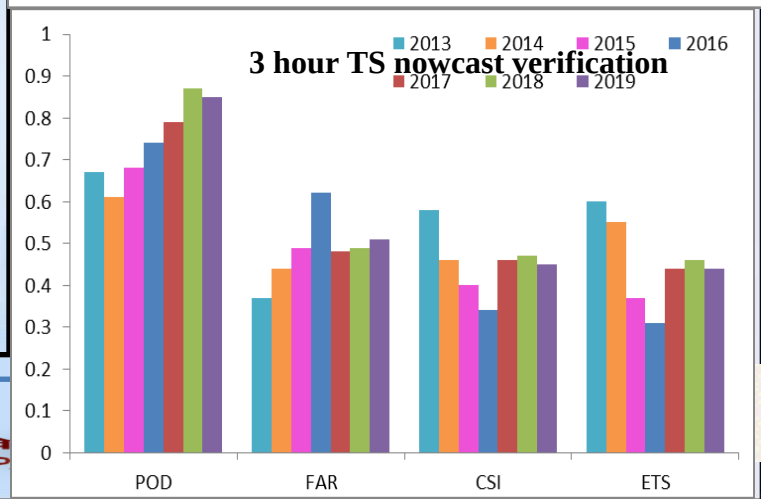
Operational Nowcasting



- 3 hourly nowcasting for 894 stations in country
- 3 hourly nowcasting for 739 districts
- District level Nowcast bulletins by SMS /whatsapp /e-mail for severe weather with impact assessment
- Ground based lightning networks of IITM/IAF
- SWIRLS and SCOPE-Nowcast.
- NWP model products for TS, Squall, Lightning



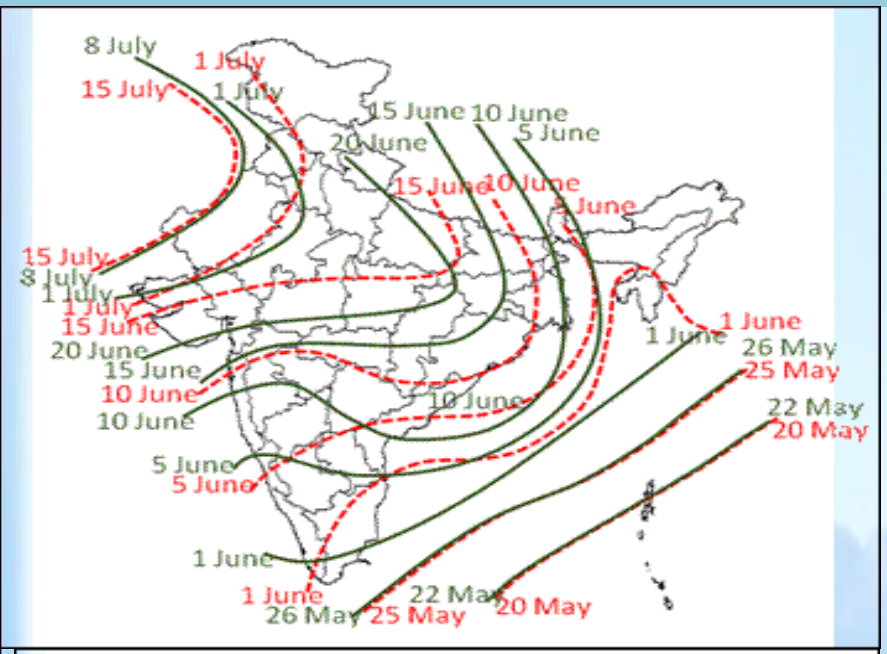


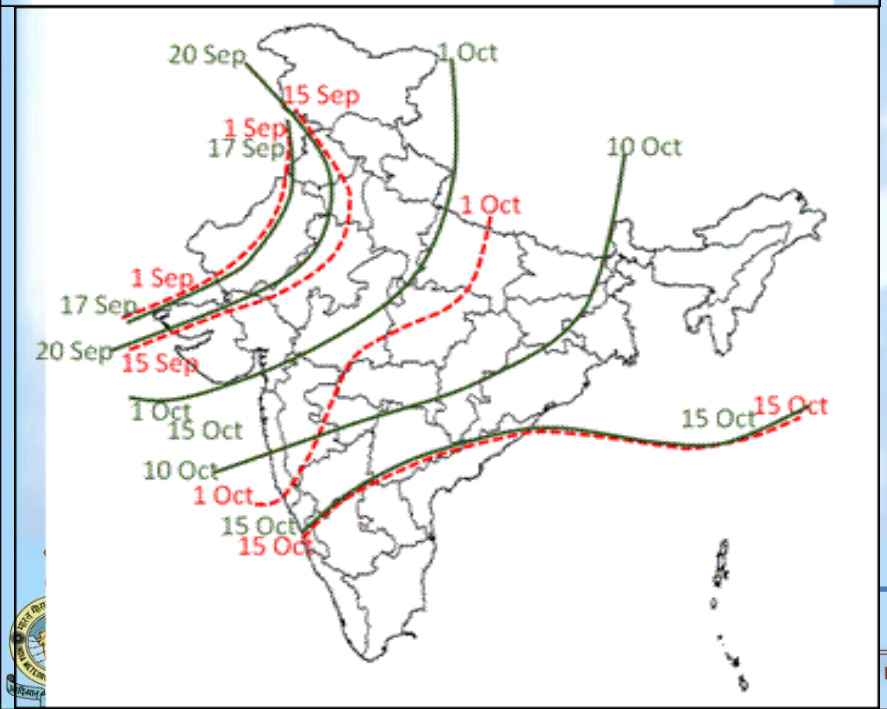


Achievements and New Initiatives durimng Monsoon 2020

- Introduction of new Normal Dates of Monsoon Onset and Withdrawal
- Successful early warning of two cyclones, viz., Amphan and Nisarga
- Impact based forecast and warning at city and district level
- South Asia Flash Flood Guidance
- Urban flood warning system for Mumbai and Chennai
- Specific quantitative probabilistic forecast for river catchments
- Augmented warning dissemination system
- Regular and frequent update through Social Media, press and electronic media

New Onset and Withdrawal Dates



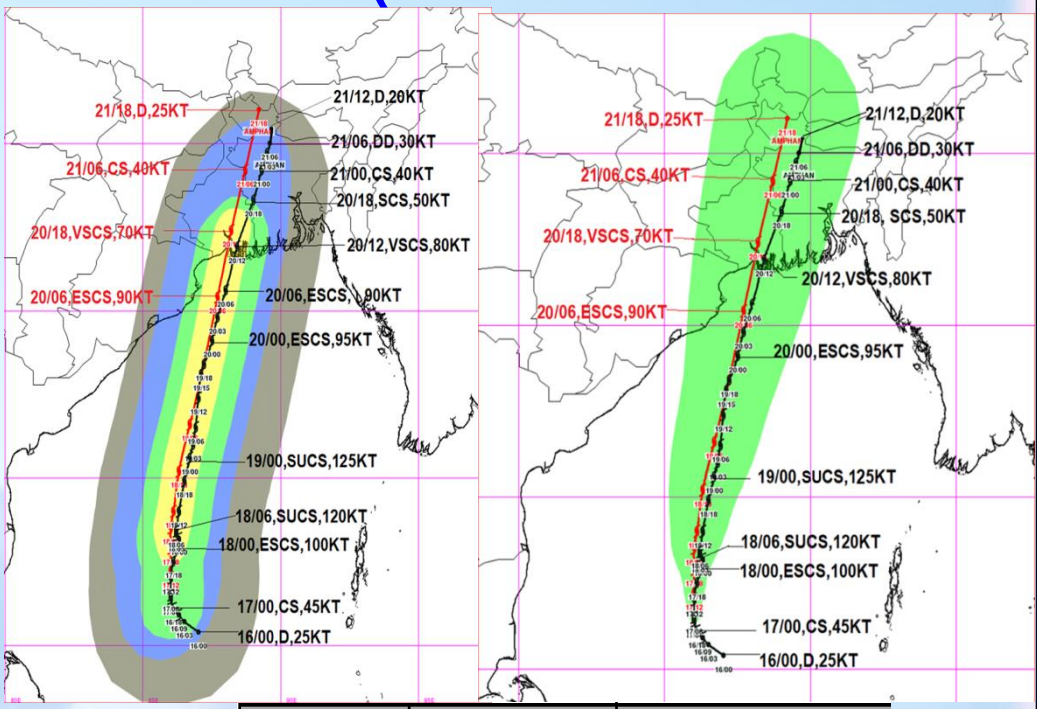


- New normal onset (dotted red line) based on (1961-2019)
- Earlier dates (solid green lines) based on 1901-1940.
- Monsoon onset over Kerala remains same as 1 June.
- Advance over central India, Bihar & parts of UP are delayed by 3-7 days.
- Country is covered by 8th July compared to earlier 15th July
- New normal withdrawal (dotted red line) dates based on (1971-2019)
- Earlier dates(solid green lines) based on 1901-1940.
- Appreciable changes in withdrawal dates over NW and Central India.
- No change in date of final withdrawal from country

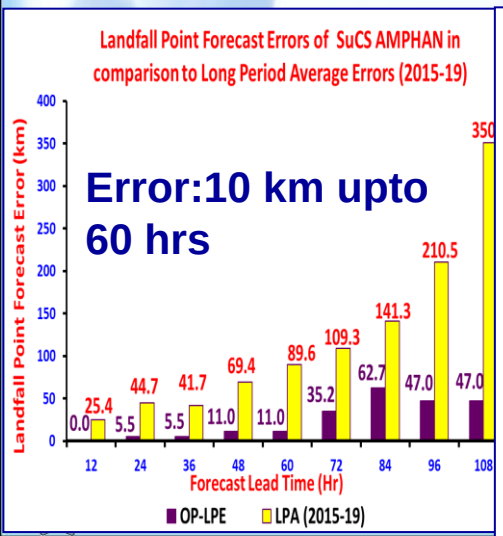
Super Cyclonic Storm AMPHAN (16-21 MAY 2020)

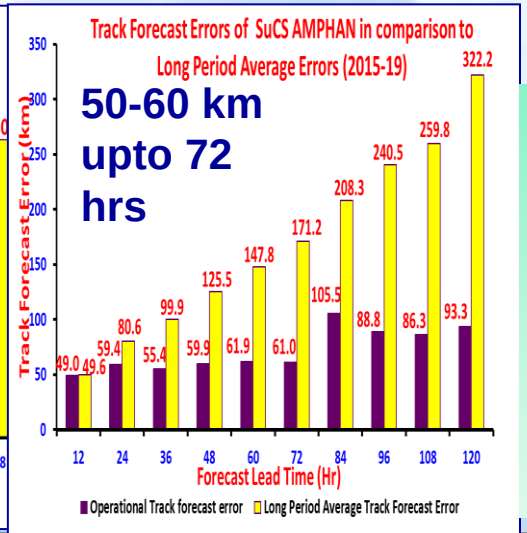
- SuCS crossed West Bengal coast over Sundarbans during 1530-1730 IST of 20th May with wind speed of 155-165 kmph gusting to 185 kmph.
- Accolades from WMO, Govt. of West Bengal & Odisha, media, general public for accurate prediction.
- Loss of Lives: 76

Observed & forecast track (based on 17TH/1130 IST



28-33 /(52–61)	Very rough seas.	Total suspension of fishing operations
34-40/(62-74)	High to very high seas	Total suspension of fishing operations
41-63/(75-117)	Very High seas	Total suspension of fishing operations
≥ 64 (≥118)	Phenomenal	Total suspension of fishing operations





D: DEPRESSION, DD: DEEP DEPRESSION, CS: CYCLONIC STORM, SCS: SEVERE CS, VSCS: VERY SEVERE CS, ESCS: EXTREMELY SEVERE CS, SUCS: SUPER CS

OBSERVED TRACK

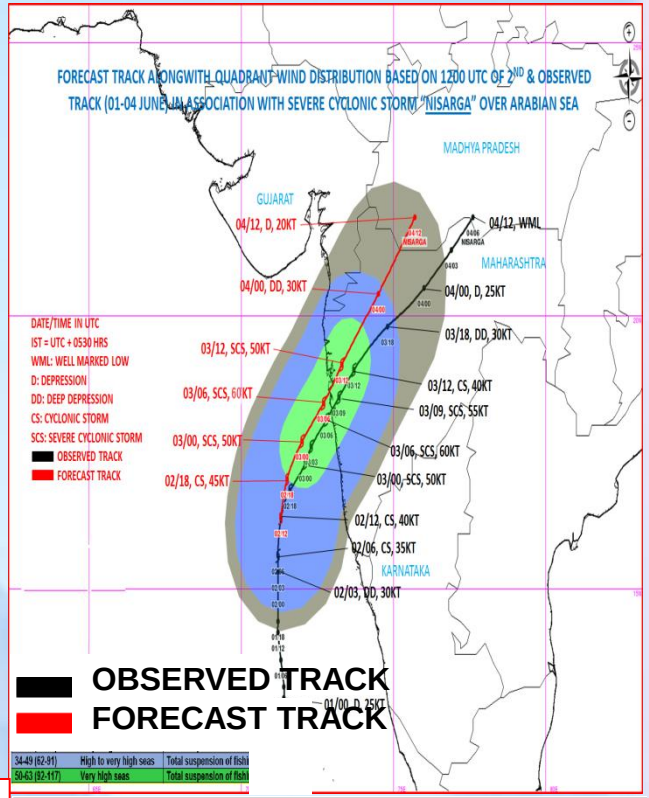
FORECAST TRACK

CONE OF UNCERTAINTY

Severe Cyclonic Storm Nisarga (01-04 June, 2020)

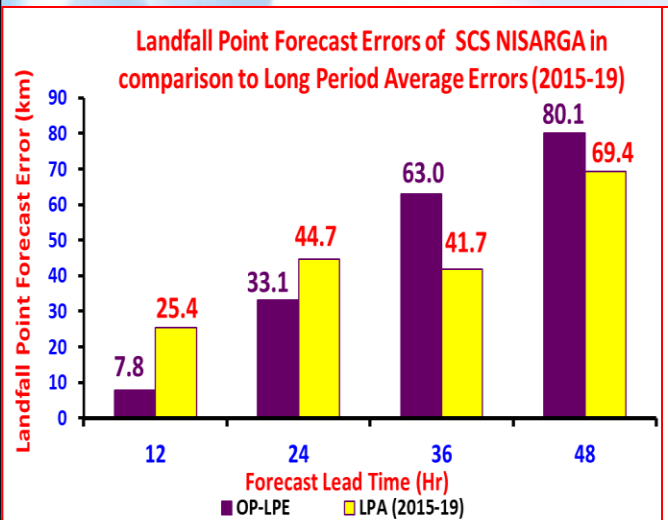
- As predicted, it crossed Maharashtra coast near Alibagh during 1230-1430 IST of 3 June with wind speed of 100-110 gusting to 120 kmph
- Due to short life period, for first time Pre cyclone watch was issued in low pressure stage at 1400 IST of 31 May (80 hours prior to landfall).
- Govt. of Maharashtra, media and general public appreciated IMD for accurate monitoring & prediction.
- Loss of Lives: 4

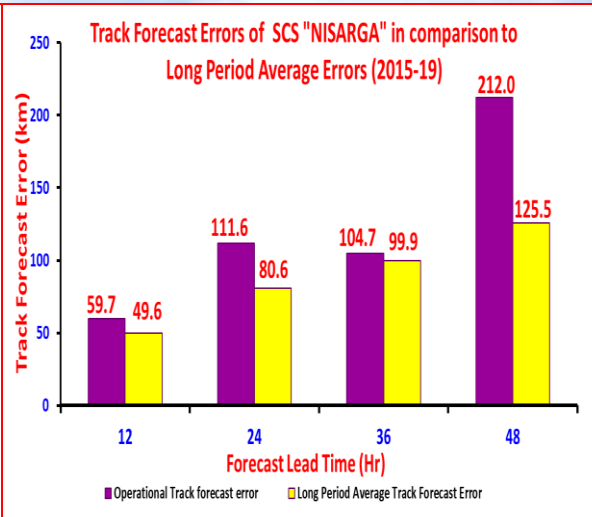
FORECAST TRACK and wind2nd/1730 IST



MSW(knot)/kmph)	Impact	Action
28-33 /(52–61)	Very rough seas.	Total suspension of fishing operations
34-40/(62-74)	High to very high seas	Total suspension of fishing operations
41-63/(75-117)	Very High seas	Total suspension of fishing operations
≥ 64 (≥118)	Phenomenal	Total suspension of fishing operations

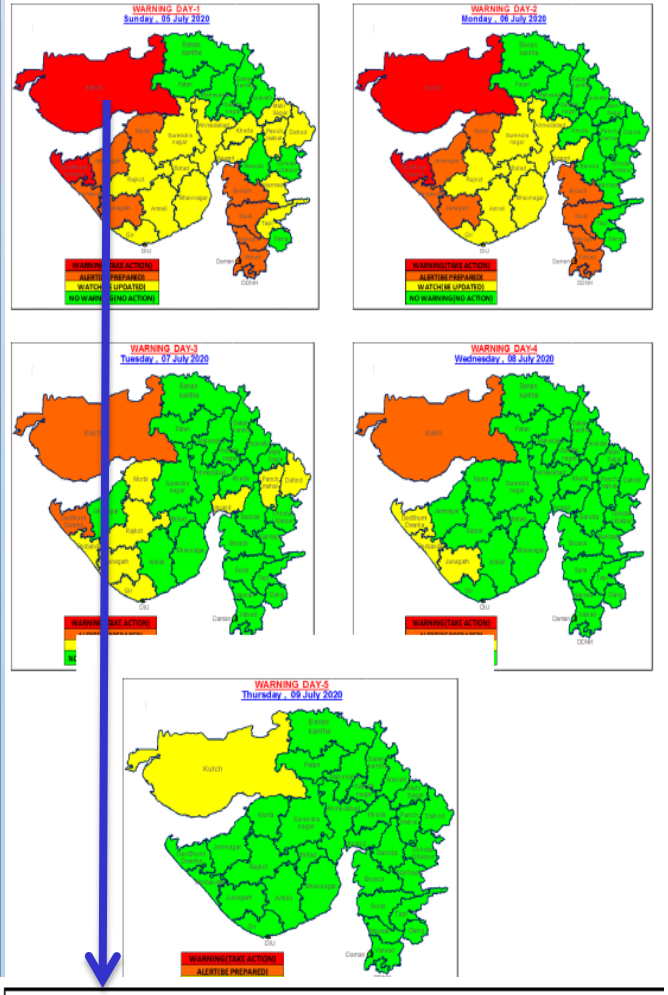
D: DEPRESSION, DD: DEEP DEPRESSION, CS: CYCLONIC STORM, SCS: SEVERE CS





Impact Based Forecast(IBF) and warnings

(WARNING)



प्रादेशिकमौसमकेंद्र, कोलाबा , मुंबई
Regional Meteorological Centre, Mumbai

Dated: 03 Aug 2020 Time of issue: 1300 hrs IST

IMPACT BASED FORECAST FOR HEAVY RAINFALL OVER MUMBAI

Date	03 Aug 2020	04 Aug 2020
Forecast& Warning	Heavy to very heavy rainfall at isolated places	Heavy to very heavy rainfall at a few places with extremely heavy rainfall at isolated places
Impact Expected	• Water logging/ flooding in many parts of low lying area and river banks • Localized and short term disruption to municipal services (water, electricity, etc.) • Major disruption of traffic flow. Major roads/local trains affected. • Possibility of danger to very old buildings and unmaintained structures, falling of trees etc • Closure of roads crossing low water bridges	• Widespread water logging/ flooding in most parts of low lying area and also on river banks. • Major disruption of traffic flow. Major roads/local trains and travel routes • Localized and short term disruption to municipal services (water, electricity, • Possibility of danger to very old and unmaintained structures, falling of trees etc. • Possibility of landslides in elevated hilly areas • Closure of roads crossing low water bridges
Action Suggested	• Traffic may be regulated effectively • People in the affected area may restrict their movement	• Traffic may be regulated effectively • People in the affected area may restrict their movement

COLOR CODES	
Very Low	No action
Low	Be updated
Medium	Be prepared
High	Take Action

IBF & Warning Stages

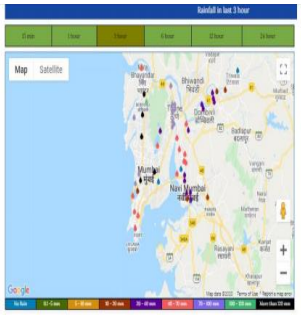
- **Stage-1:Heavy rainfall Watch-(3-4 days lead time daily update)**
- **Stage-2:Heavy rainfall Alert: (48 hours prior to the occurrence and 12 hourly updates)**
- **Stage-3:Heavy rainfall Warning (24 hours prior to occurrence & 06/12-hourly updates)**
- **Stage-4:12-Hours prior to occurrence– 3-hourly updates.**

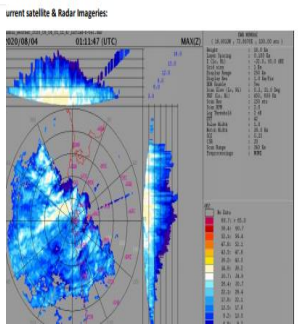
IMPACT BASED FORECAST

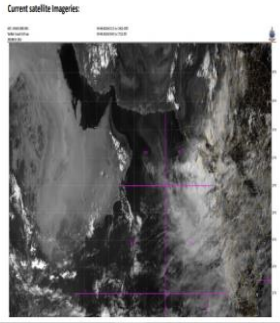
Expected Impact with respect to red colour warning issued for the Districts namely Devbhoomi Dwarka, Porbanda

Jamnagar, Kutch:

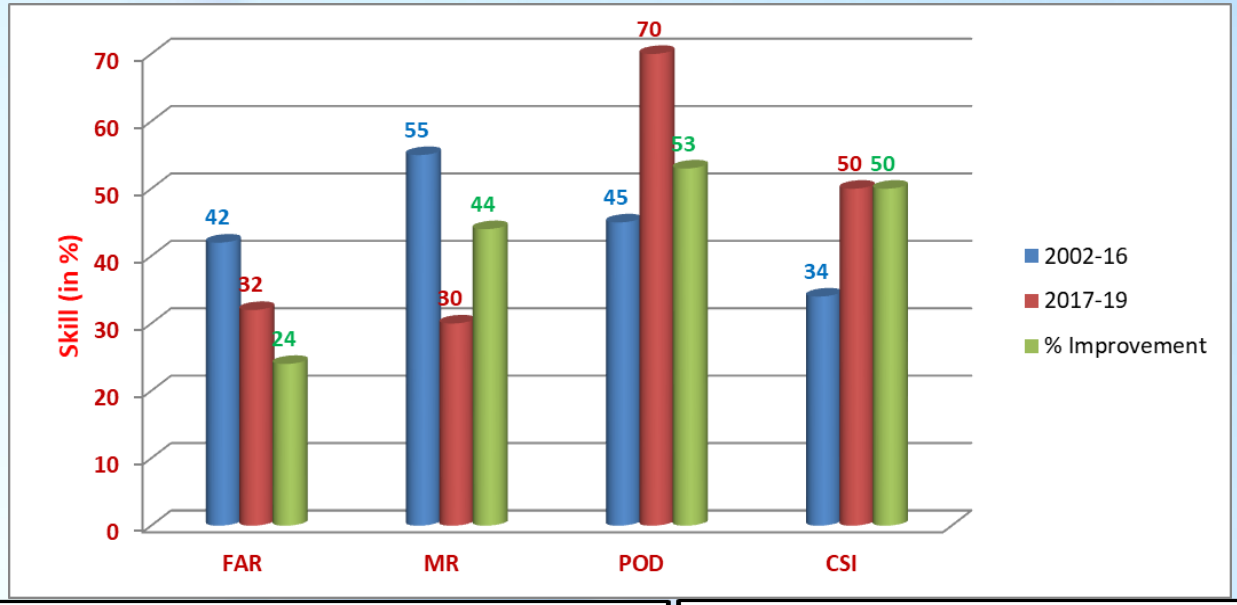
- ✓ Major damage to kuchcha roads due to inundation.
- ✓ Major disruption in traffic in city areas.
- ✓ Inundation of low lying areas leading to damage to kuchcha houses.
- ✓ Water logging in underpass in city areas.
- ✓ Sudden reduction in visibility during heavy downpour leading to road accidents.

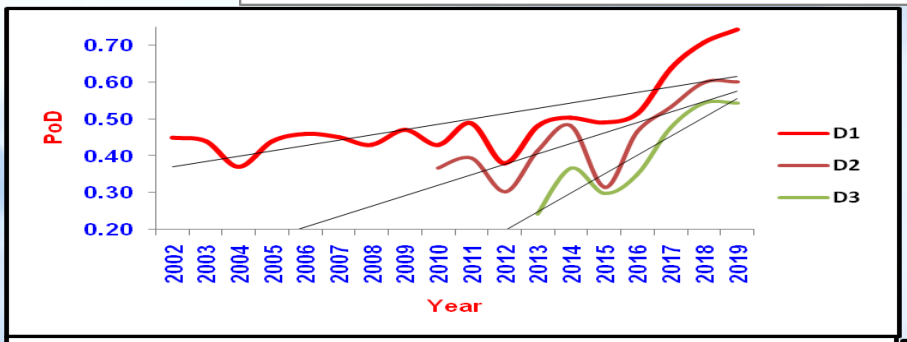


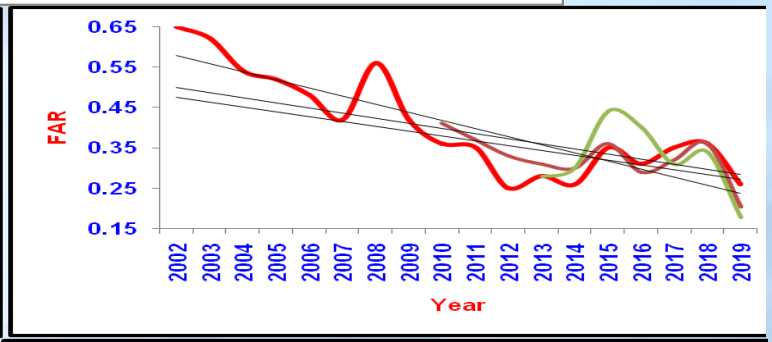


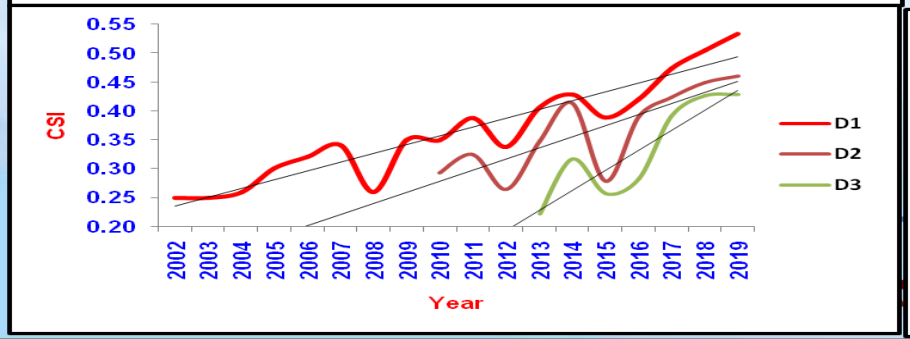


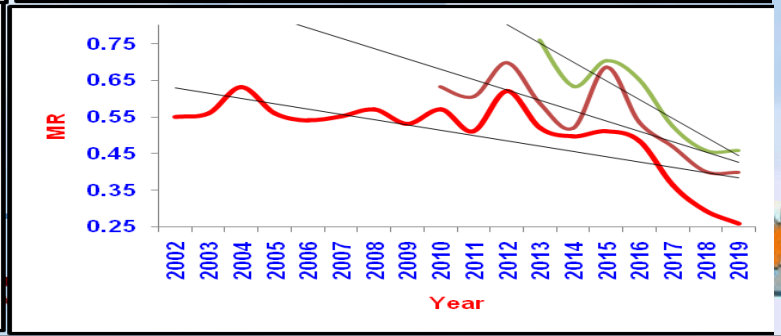
Southwest Monsoon heavy rainfall Warning Skill







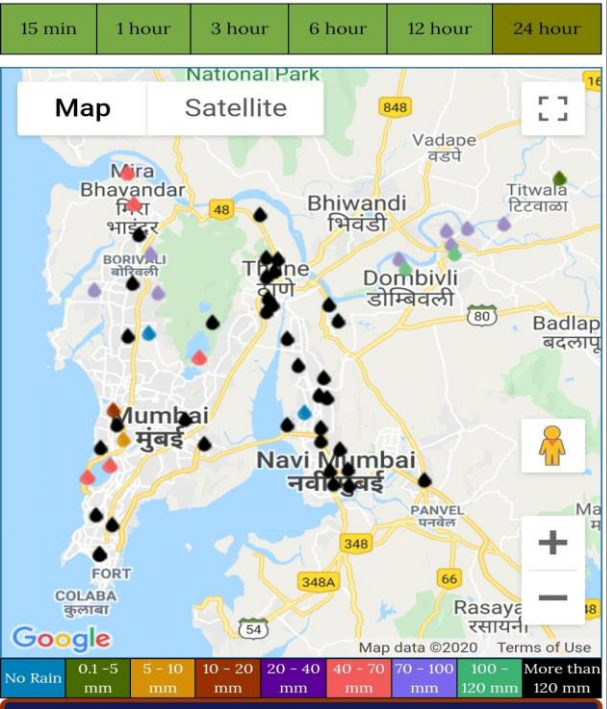


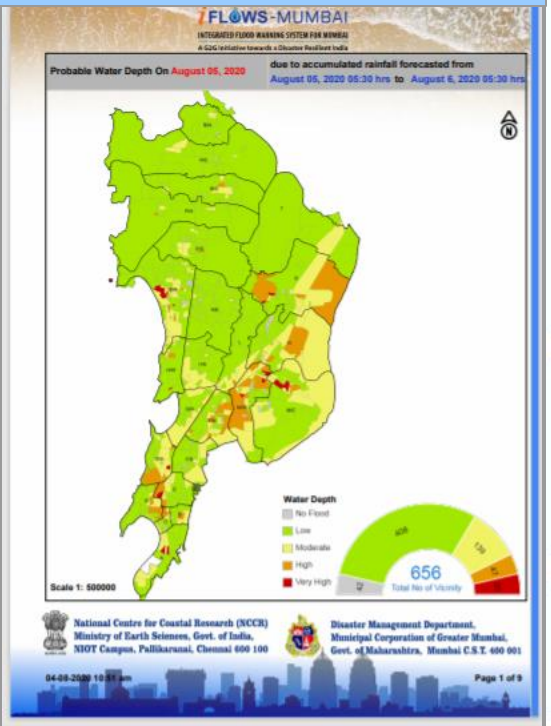


Impact based Extremely Heavy Rainfall Warning for Mumbai during 3rd- 6th Aug.

- **Orange** colour warning issued on 30th July for disaster preparedness
- It was upgraded to **RED** from 2nd August for action to be taken by disaster managers

Integrated Flood Warning System for Mumbai





Date	4th Aug	5th Aug
Forecast & Warning	Heavy to very heavy rainfall at a few places with isolated extremely heavy rainfall at isolated places	Heavy to very heavy rainfall at a few places with isolated extremely heavy rainfall at isolated places
Impact Expected	• Widespread water logging/ flooding in most parts of low lying area and also on river banks. • Major disruption of traffic flow. Major roads/local trains and travel routes severely affected. • Localized and short term disruption to municipal services (water, electricity, etc.) • Possibility of danger to incredibly old and unmaintained structures, falling of trees etc • Possibility of local landslides in elevated hilly areas . • Closure of roads crossing low water bridges.	• Widespread water logging/ flooding in most parts of low lying area and also on river banks. • Major disruption of traffic flow. Major roads/local trains and travel routes severely affected. • Localized and short term disruption to municipal services (water, electricity, etc.) • Possibility of danger to incredibly old and unmaintained structures, falling of trees etc • Possibility of local landslides in elevated hilly areas . • Closure of roads crossing low water bridges.
Action Suggested	• Traffic may be regulated effectively • People in the affected area may restrict their movement	• Traffic may be regulated effectively • People in the affected area may restrict their movement

COLOR CODES	
Very Low	No action
Low	Be updated
Medium	Be prepared
High	Take Action

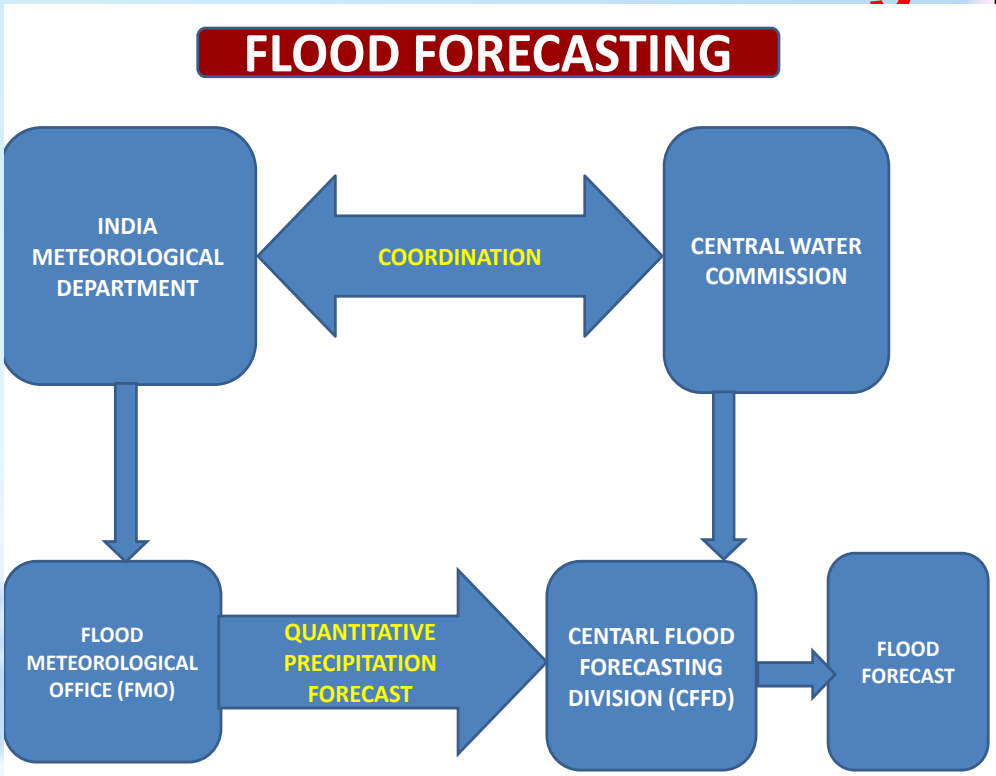
IMD Support to CWC for Flood Forecasting

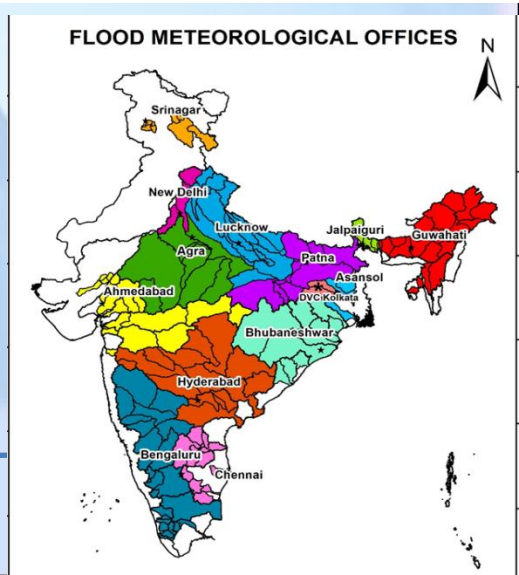
- IMD provides Quantitative Precipitation Forecast(QPF) for 153 river sub basins
- Categorical QPF and Probabilistic QPF in categories, 0, 0.1-10 mm, 11-25 mm, 26-50 mm, 51-100 mm, >100 mm for next three days and outlook for further four days.

❑ Dynamical model support:

- GFS : Day-1 to Day-7
- WRF : Day-1 to Day-3
- MME : Day-1 to Day-5

- Sub-basin wise areal rainfall occurred during past 24-hrs
- Station-wise significant rainfall (5cm & above) during past 24-hours
- Heavy rainfall warning for the next 72-hours





Rainfall Forecast for floods in Bihar, Assam, Maharashtra, Kerala, Odisha and Gujarat during 2020

- **Daily QPF, PQPF and Heavy rainfall warning were sent to CWC 3 day in advance for flood forecasting of Assam & Bihar during July and Maharastra, Gujarat, Odisha & Kerala during August.**
- **Under situation of Heavy rainfall, special e-mail were sent 4-5 days in advance to CWC for informing reservoir authorities**
- **Whatsapp group and social media was used for quick exchange of information. Joint IMD-CWC whatsapp group created by IMD.**
- **Regular interaction and webinar were organised with CWC and MoWR Authorities**
- **Special FFG bulletin sent to CWC on daily basis which was used by CWC in their reports, twitter/facebook and whatsapp group**
- **Additional raingauge established in NE states to improve rainfall monitoring. No. of rain gauges in Districtwise rainfall monitoring scheme increased to 4500**

IMD Support For Management of Riverine Floods

- IMD provides quantitative precipitation forecast (QPF) to Central Water Commission for flood forecasting over 153 river catchments
- During 2020, for 10 river basins, IMD is providing special forecast as follows:

➢ Monthly average rainfall forecast for each month (June to November).

➢ 15 days rainfall forecast every week.

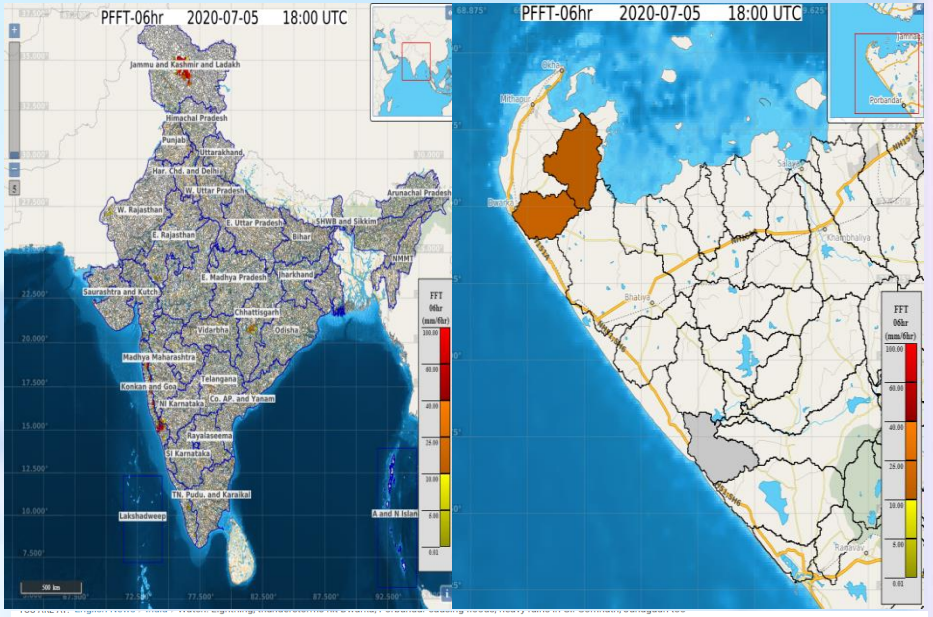
➢ QPF 3 days in advance with 4 days outlook as per current practice.

- Based on above, CWC will decide release of water from reservoirs and regulate its operation.

South Asia Flash Flood Guidance System (SAsiaFFGS)

- **FFGS is a robust system to provide support for flash floodswarnings.**
- **Uses precipitation data from radar & satellite and hydrological models.**
- **IMD supports Bangladesh, Bhutan, India, Nepal & Sri Lanka.**
- **Provides flash flood guidance for about 30000 watersheds delineated with 30m DEM & other terrain parameters.**
- **System is currently pre-operational**
- **IMD issuing bulletins 4 times a day i.e., 0530, 1130, 1730 and 2330 IST to Central Water Commission.**

27 cm rainfall resulting in flash floods in Dwarka on 05 July 20



Watch: Lightning, thunderstorms hit Dwarka, Porbandar causing floods; heavy rains in Gir Somnath, Junagadh too

Heavy rainfall, lightning, thunderstorms lashed parts of Gujarat causing flood situation in Dwarka, Porbandar. One of the regions which witnessed lightning thunderstorms was the site near Dwarkadhish Temple. Rains caused water-logging, flooding in parts of Dwarka and Porbandar. Heavy rains, lightning, thunderstorms have lashed several districts in Gujarat causing flood situations at various places including Dwarka city on Sunday. The district was hit by heavy downpour, lightning and thunderstorm.

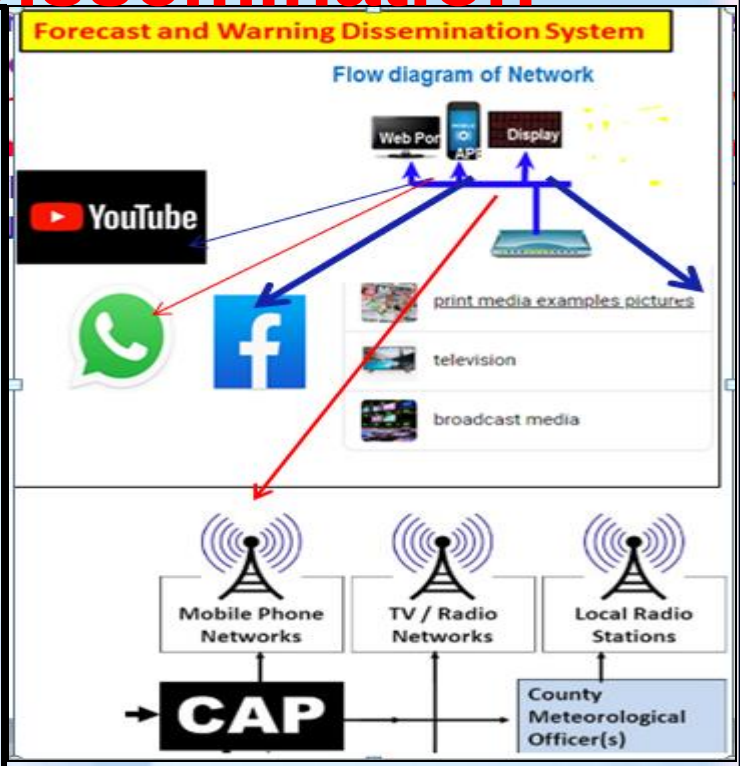
India TV News Desk
New Delhi
Updated on: July 06, 2020 9:24 IST

Screenshot from a video posted on Twitter by news agency ANI.

Watch: Cars sink, JCB stuck as parts of Gujarat's Dwarka gets flooded

Forecast and Warning Dissemination

- Weekly video in YouTube and social media
- Press release National, regional & State levels
- WhatsApp Group: National/Regional/ State/district/city level for quick outreach
- Briefing/ Interaction via phone/VC with disaster managers at national, state & district levels
- Warning to sectoral users: CWC, NHAI, Aviation, Indian Railways, municipal corporation, Agriculture Officials, Farmers, Fishermen
- Public Website (mausam.imd.gov.in)
- IMD Apps like Mausam/ DAMIN/RAIN ALARM
- Social Media: Facebook, Twitter, Instagram, BLOG
- Common Alert Protocol, Global Multi-hazard Alert System (GMAS)



IMD Website and Social Media

- Public Website (mausam.imd.gov.in)
- IMD Apps: Mausam/ Meghdoot/DAMIN/RAIN ALARM
- Social Media: Facebook, Twitter, Instagram, BLOG
- Twitter: https://twitter.com/Indiametdept
- Facebook:https://www.facebook.com/India.Meteorological.Department/
- Blog: https://imdweather1875.wordpress.com/
- Instagram: https://www.instagram.com/mausam_nwfc
- Youtube:https://www.youtube.com/channel/UC_qxTReoq07UVARm87CuyQw

THANK YOU