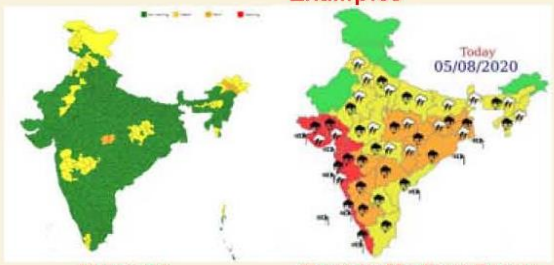
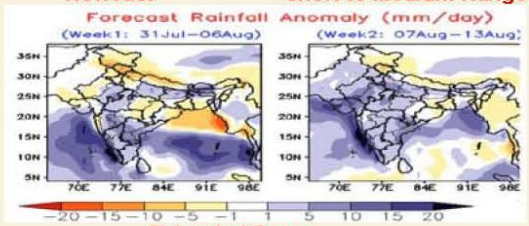
Warning Bulletin and Products for Heavy Rainfall:-

- Nowcast (lead time/ validity up to 03 hours): at station and district level.
- Short to Medium range forecast (lead time/ validity of 1 to 5 days): at station, block, district and meteorological sub-division level.
- Extended range forecast (lead time/ validity up to 4 weeks): probability of heavy rainfall at meteorological sub-division level during week 1 and week 2.

Examples

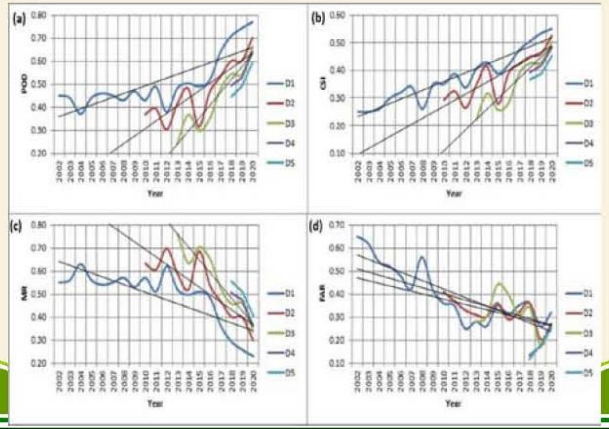


Nowcast | Short to Medium Range

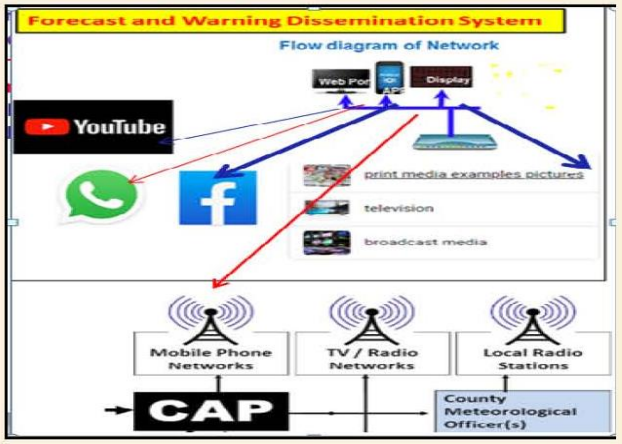


Extended Range

Heavy Rain Warning Skill:-

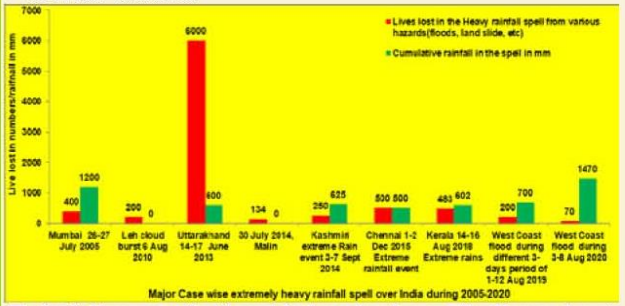


Warning Dissemination Methods:-



Warning Disseminated To:-

- National Disaster Management Authority
- National Disaster Response Force
- State Disaster Management Authority
- Aviation, Railways, Road Transport Authority
- District authorities
- Other Central and State government authorities
- All types of print and electronics Media and Public
- Other users



Rainfall cumulative highest vis-a-vis lives lost during various Major extremely heavy rainfall events of 2005-2020

Heavy Rain Warning Services

India Meteorological Department

Ministry of Earth Sciences

Government of India

Mission

- To generate and disseminate Impact based Forecast for Heavy Rainfall events.
- Analysis of Heavy Rainfall hazard proneness of the country.
- Research on Heavy Rainfall monitoring and prediction.
- Development of tools & technologies and their application in Heavy Rainfall Monitoring, Forecasting and Early Warning System.

Vision

- No Heavy Rainfall hazard to go undetected and unpredicted.
- Accurate warning against Heavy Rainfall with reasonable lead time triggering response from disaster managers and public to save life and property.

Classification of Rainfall:-

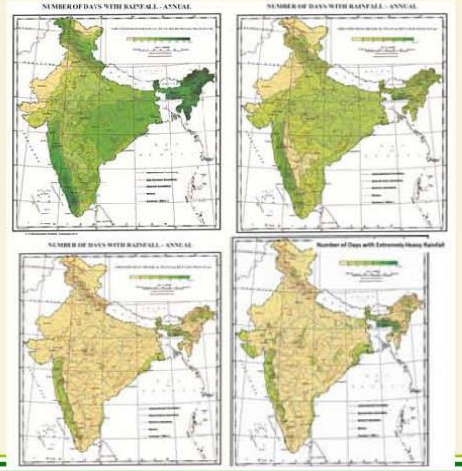
Category	24 hour rainfall over a station ending at 0830 hours IST
Very Light Rain	Trace - 2.4 mm
Light Rain	2.5 – 15.5 mm
Moderate Rain	15.6 – 64.4 mm
Heavy rain	64.5-115.5 mm
Very heavy rain	115.6-204.4 mm
Extremely heavy rain	≥ 204.5 mm

Category of Rain Spell:-

Category	Range of daily Rainfall of a station
Light spell	1 cm/hour
Moderate spell	1-2 cm/hour
Intense spell	2-3 cm/hour
Very Intense spell	3-5 cm/hour
Extremely Intense spell	5-10 cm/hour
Cloud Burst(CB)	> 10 cm/hour

Climatology of Heavy Rainfall: -

Climatology of Annual number of Rainy days, Heavy Rainfall, Very Heavy Rainfall and Extremely Heavy Rainfall days:



Major Factors affecting Heavy Rainfall:-

1. Monsoonal Weather System:
   - Monsoon Trough, Cyclonic Circulation, Low Pressure Area, Depression, Cyclone etc.
   - West coast Off Shore Trough.
2. Interaction of Mid latitude systems with Monsoon Circulation.
3. Other Weather System:
   - Western Disturbance
   - Pre Monsoon Thunderstorm in association with Easterly/Westerly trough, wind discontinuity, cyclonic circulations.
4. Northeast Monsoonal System: Easterly Wave, Trough, Low Pressure Area, Depression, Cyclone.
5. Orographic uplifting of moist air.

Steps for Monitoring and Prediction of Heavy Rainfall: -

i. Analysis of causative weather system (genesis, evolution, characteristics & dissemination).
ii. Analysis of current weather system based on surface, RADAR and Satellite observations.
iii. Comparison of this analysis with model analysis.
iv. Comparison of model diagnosis & prognosis and hence prediction of heavy rainfall for next five days.
v. Development of objective consensus based NWP models using decision support system about occurrence and intensity of rainfall.
vi. Development of subjective consensus among forecasters through video conferencing system through knowledge, experience and expertise.
vii. Final consensus forecast on occurrence and intensity of heavy rainfall by modulating objective consensus with subjective consensus.
viii. Warning bulletin, product generation, presentation and dissemination.

Techniques for Heavy Rainfall Forecast: -

i. Climatology
ii. Persistence
iii. Statistical
iv. Synoptic
v. NWP Models

Impact based Forecast for Heavy Rain: -

Stage -1: Heavy Rainfall Advisory/Watch: 3-4 days' lead time with 12 hourly update

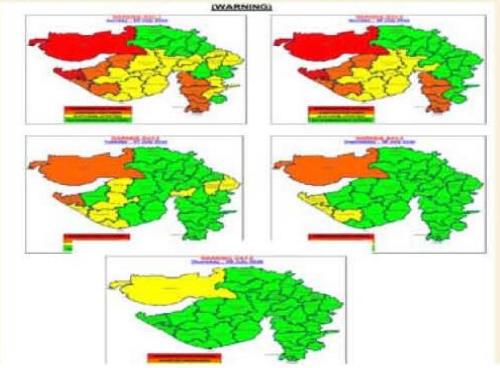
Stage-2: Heavy Rainfall Alert: 48 hours prior to the occurrence of the event with 12 hourly update

Stage-3: Heavy Rainfall Warning: 24 hours prior to the occurrence of the event with 06/12 hourly update

Stage-4: 12-Hours prior to occurrences of maximum Rainfall spell

Example of Impact based Forecast for Heavy Rainfall: -

i. District level IBF over Saurashtra & Kutch



IMPACT BASED FORECAST

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

ii. Mumbai and Chennai Flooding system