



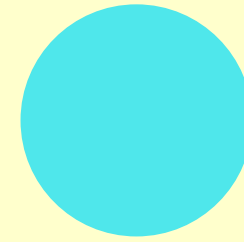
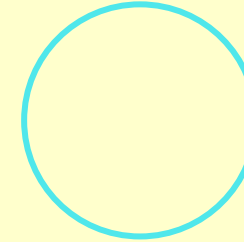
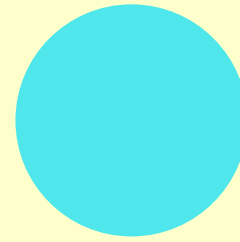
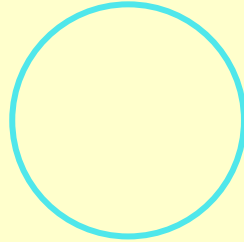
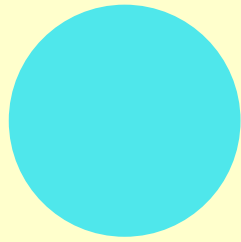
**India Meteorological Department**

**MONSOON ASIAN HYDRO ATMOSPHERIC  
SCIENTIFIC RESEARCH and PREDICTION  
INITIATIVE**

**&**

**ASIAN MONSOON YEAR 2008**

**N.Y.APTE (Director)**



- **The different aspect of my presentation are**
  - **Agencies associated with Hydrological Services in India**
  - **Availability of Meteorological / Hydrological data in India.**
  - **Hydro meteorological concerns related to SW Monsoon.**

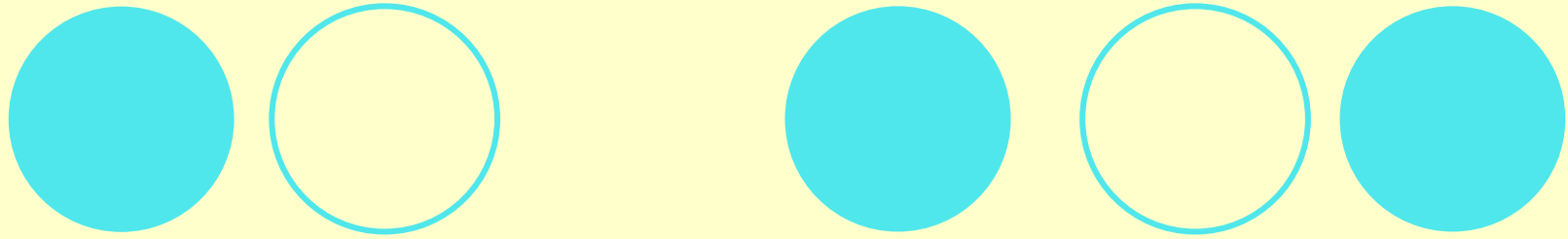
# HYDROLOGICAL SERVICES in INDIA

- The thrust area of the Hydrological services are
  - Data Management, Operational Hydrology,  
and Hydrological Forecasting :

**India meteorological Department (IMD)**

**Central Water Commission (CWC)**

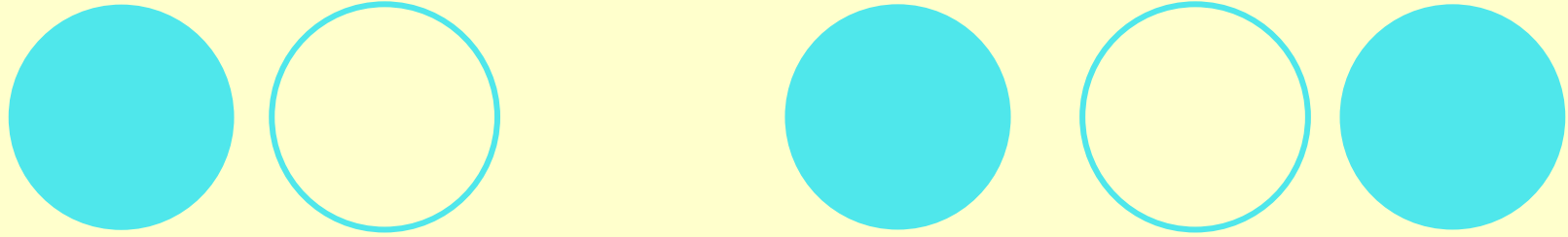
**State Governments**



## Research, Model Development, Training in:

### 1 Meteorology / Hydro Meteorology

- **India meteorological Department**
- **Indian Institute of Tropical Meteorology**
- **National Center for Medium Range Forecasting**
- **Indian institute of sciences**
- **Academic Institutions, Universities etc**



- Research, Model Development, Training in:

## **2**      HYDROLOGY

**Central water Commission**

**National Institute of Hydrology**

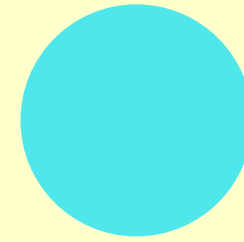
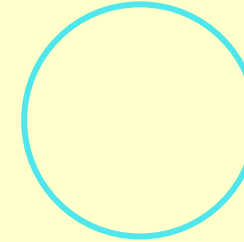
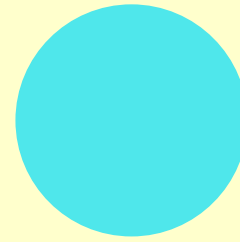
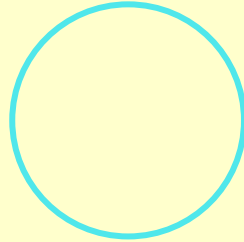
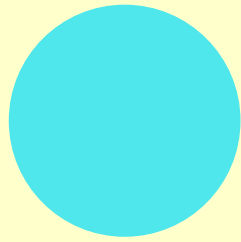
**Indian institute of Technology (s)**

**Academic Institutes, Universities.**

# Meteorological Data Collection Network of India Meteorological Department

## SURFACE OBSERVATORIES NETWORK

- **Surface Observatories** **559**
- **Aviation Current Weather Observatories** **71**
- **High Wind Speed Recording Stations** **4**
- **INSAT-based Data Collection Platforms** **100**
- **Hydro meteorological Observatories**
- **Non-Departmental Raingauge Stations:-**
- **Reporting –** **3540**
- **Non-Reporting** **5039**

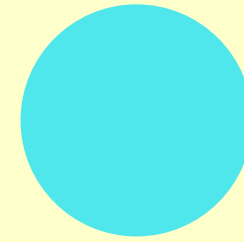
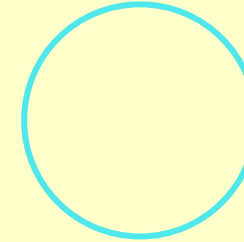
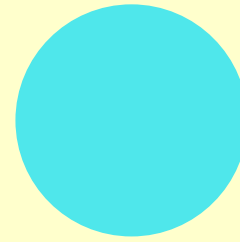
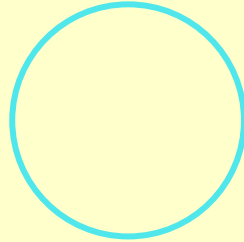
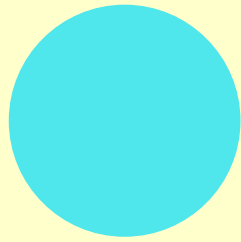


- **Non-Departmental Glaciological Observatories (Non-reporting):-**

- **Snow gauges**  
**21**

- **- Ordinary Rain gauges**  
**10**

**Seasonal Snow Poles**  
**6**



**Agro meteorological Observatories**  
**219**

**Evaporation Stations**  
**222**

**Soil Moisture Recording Stations**  
**49**

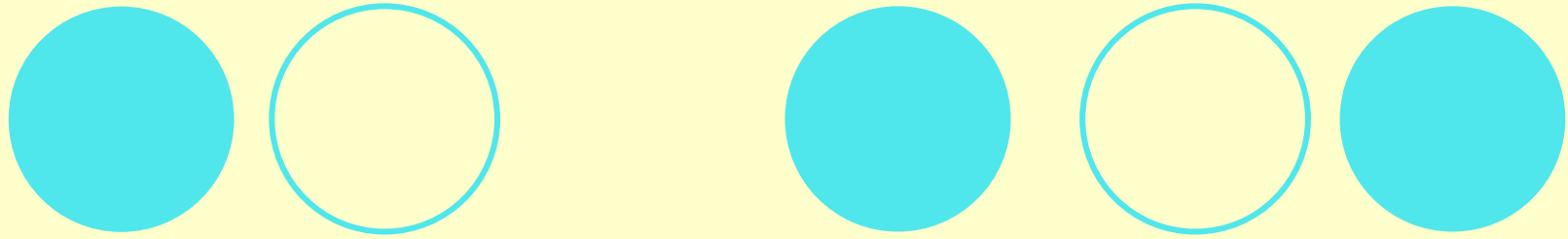
**Dew-fall Recording Stations**  
**80**

● **Evapo transpiration Stations**  
**39**

● **Ozone Stations**  
**6**

● **Radiation Stations**  
**45**





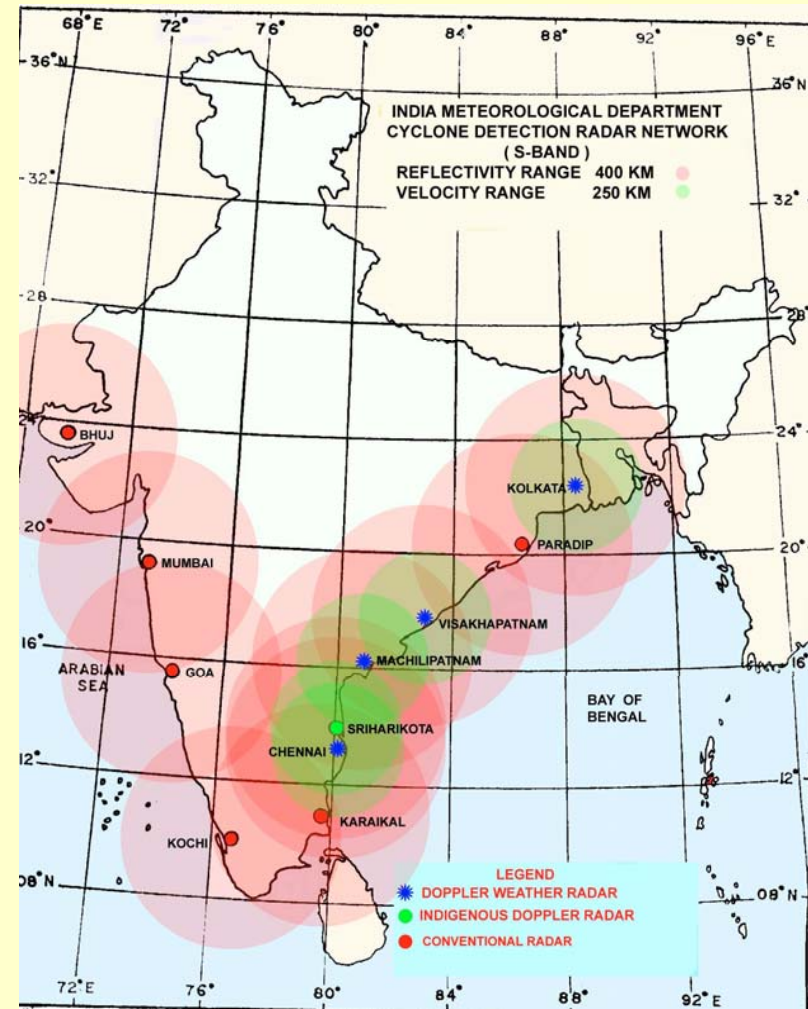
**IMD is exchanging surface met  
data of 83 stations and**

**Upper Air Observations of 35  
stations through GTS.**

# RS /RW Observatories 35No.

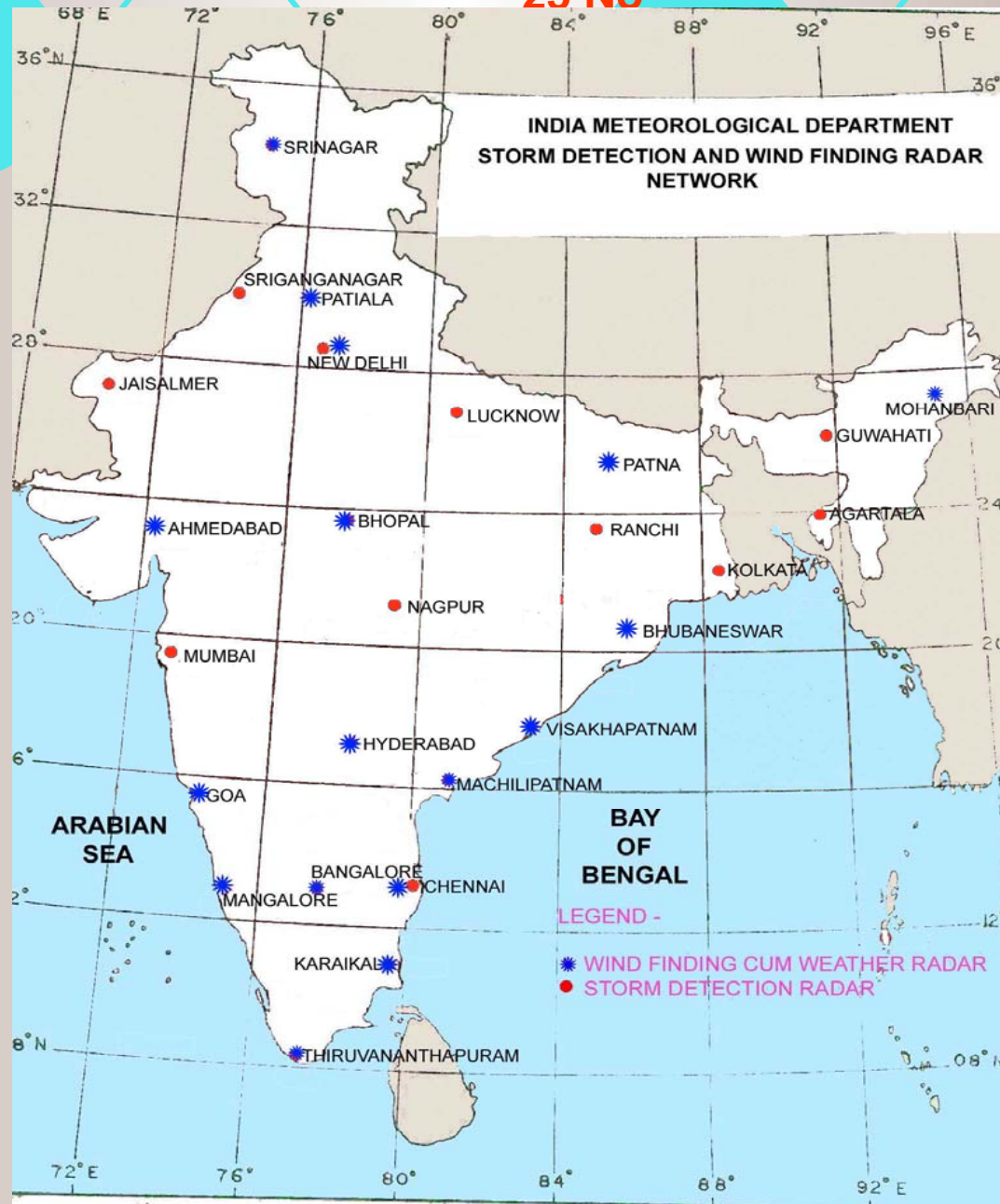


# S-Band Cyclone Detection Radars -11



# X-Band Weather Radar Network

25 No





- **IMD has proposed to upgrade**
    - 3500 ordinary rain gauges to Satellite linked ARGs**
    - 1000 surface observatories to Satellite linked AWS**
- and install** **5 GPS**  
**8 Doppler Weather Radars**  
**5 Wind Profilers**  
**in coming 5 years.**

**However data from same may not be available for**  
**AMY 08**

# Meteorological Information Available on IMD'S Web Site ( [www.imd.gov.in](http://www.imd.gov.in) )

All India Daily Weather Report

Current Weather Observations

Main features of Today's Weather

All India Weekly weather Report

Weather Charts

Cyclone page

Climate Normal

# INSAT IMAGES AVAILABLE on IMD'S WEB SITE

- **Satellite images Animation**
- **FULL DISC/ SECTOR /NORTH WEST SECTOR**  
**Visible Channel , Infra red channel,**  
**Color Composite. Water vapor Channel**

# INSAT Products (cont.)

- **Cloud Motion Vectors (CMV)**

**Low Level, Medium Level, High level**

**Outgoing Long wave Radiation (OLR)**

**Quantitative Precipitation estimation**

**Sea Surface Temperature**



# **DOPPLER RADAR PRODUCT from**

**CHENNAI, / KOLKATA, / MACHILIPATNAM, /  
VISAKHAPATNAM**

**MAX (Z) product**

**Plan Position Indicator (Z)**

**Volume Velocity Processing (2)**

**Plan Position Indicator (V)**

**Surface Rainfall Intensity**

**Precipitation Accumulation**

**(PAC) 24 hrs at 0300UTC**

# HYDROLOGICAL DATA Central Water Commission

- - Gauge only 246
- Gauge, discharge 282
- Gauge, discharge and silt 41
- Gauge, discharge and water quality and silt 261
- Gauge, discharge and water quality 115

Out of these 945 sites data of 286 sites is available to general public/ research institutes.

web site

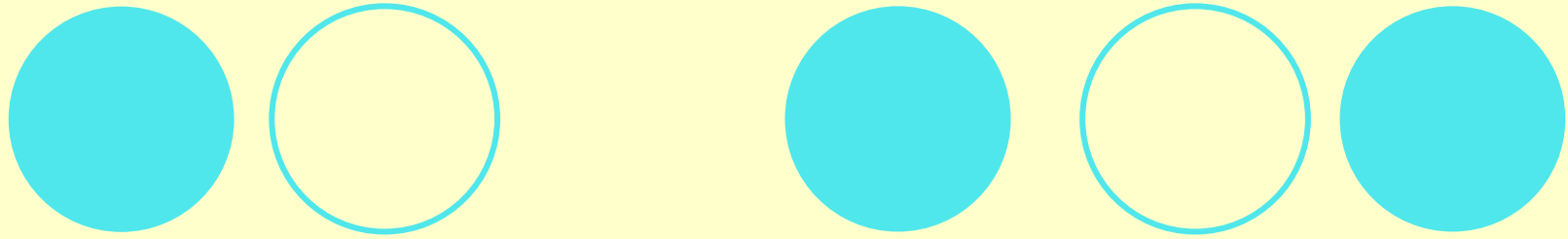
[www.cwc.nic.in](http://www.cwc.nic.in)

## HYDRO-MET CONCERNS RELATED with SW MONSOON

- The Indian economy is mainly **Agro based**. Hence **SW Monsoon** is mainly identified with **rainfall quantum**.
- The **seasonal rainfall** shows **wide variation** from year to year. As a result, there are two main disasters related with SW Monsoon rainfall.

Those are **Drought** and **Floods**.

Every year one or other part of the country is affected by either drought or floods



- Even in worst **Drought Year of 2002** about **7% area** of the country was under **Excess rain** while during **1988** which was the **Good Monsoon Year**, about **8%** area of the country was reeling under **Drought**.

# DROUGHT PRONE AREAS OF INDIA

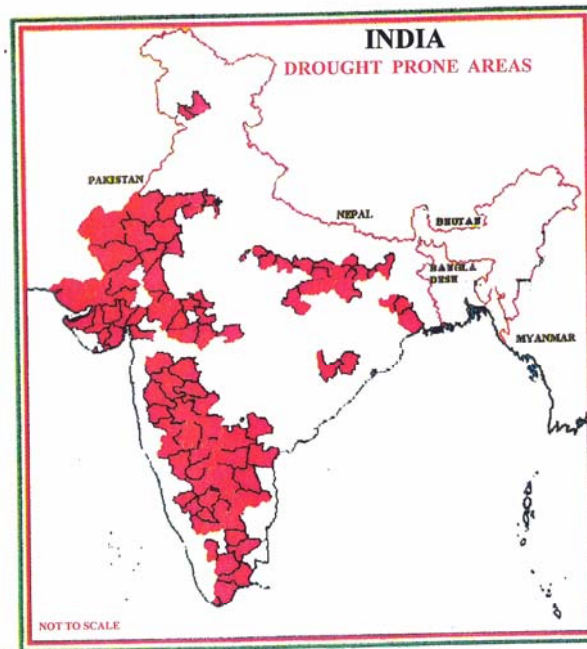


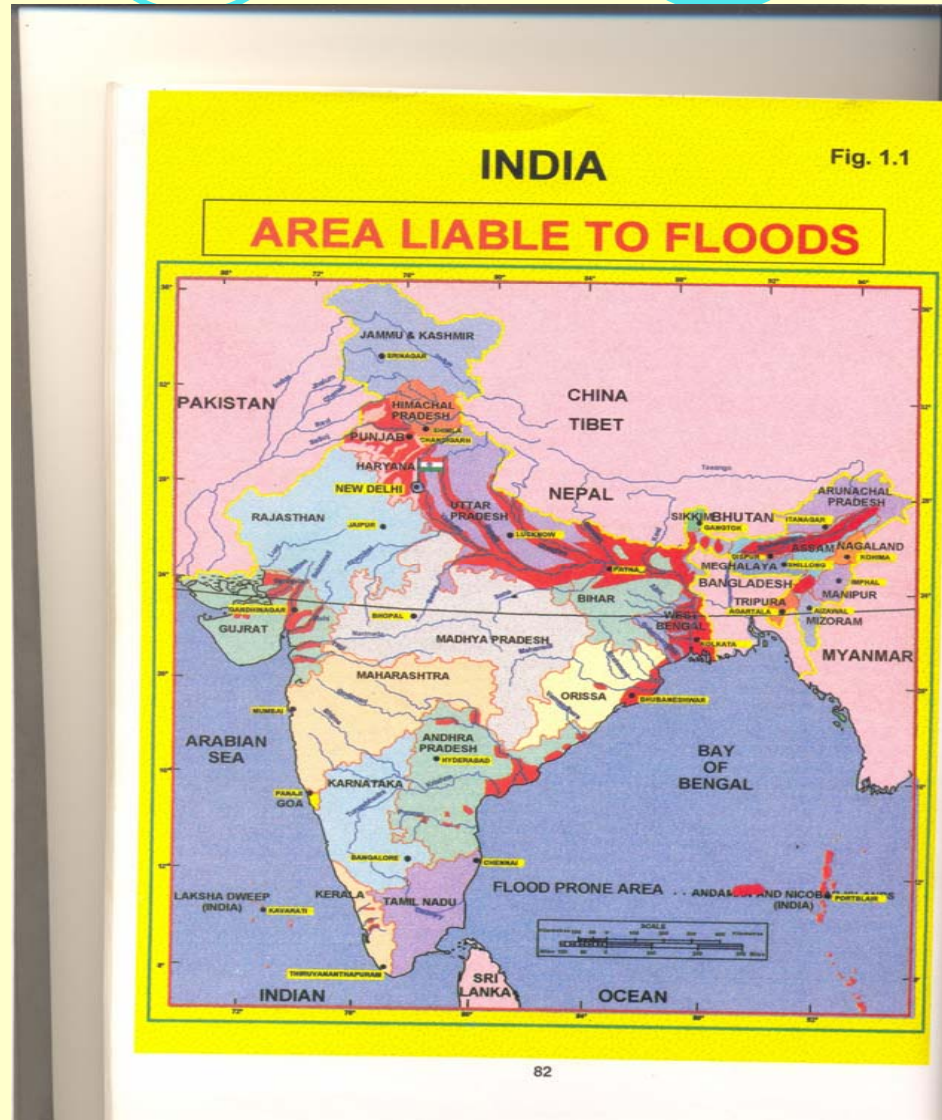
FIG. - 1



# Drought Prediction

- **The droughts are generally realized after their occurrence and as such the commencement and conclusion of drought is not predicted / forecasted effectively and hence a challenge.**
- **Suitable indicators for anticipation of drought over a small region / area at the early stage need to be established.**

# FLOOD PRONE AREAS in INDIA





# FLOODS in INDIA

Flood is an **ANNUAL FEATURE** of major rivers like **GANGA , BRAHAMPUTRA , MAHANADI , NARMADA , TAPTI , GODAVARI & KRISHNA** . Maximum floods Occur in **S-W MONSOON** season.

It is estimated that about **400000 SQ. KM** of area is **FLOOD PRONE** . Out of this about **25% is now FLOOD PROTECTED**.

On an average **75000 SQ. KMS** of area & **33million population** faces **FLOOD WRATH** every year.

In past 50 years India had lost assets of more than **RS 650000 million (@ US\$ 14800 million)** and loss of more than **75000 human lives** due to floods alone



# FLOOD FORECASTING in INDIA

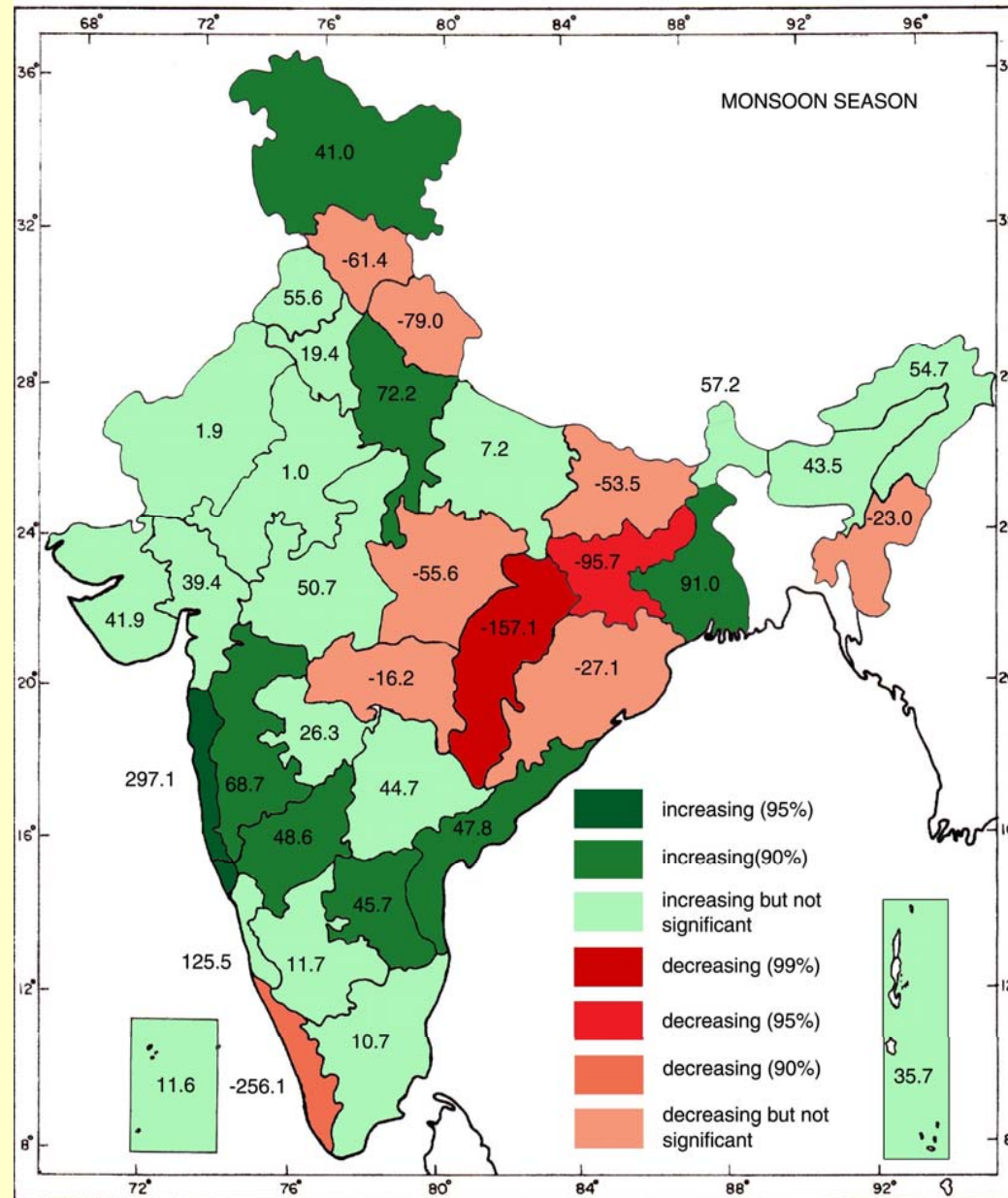
- In India flood warning activity is entrusted to India meteorological Department and Central Water Commission.

The flood warning is provided for 157 flood prone cities.

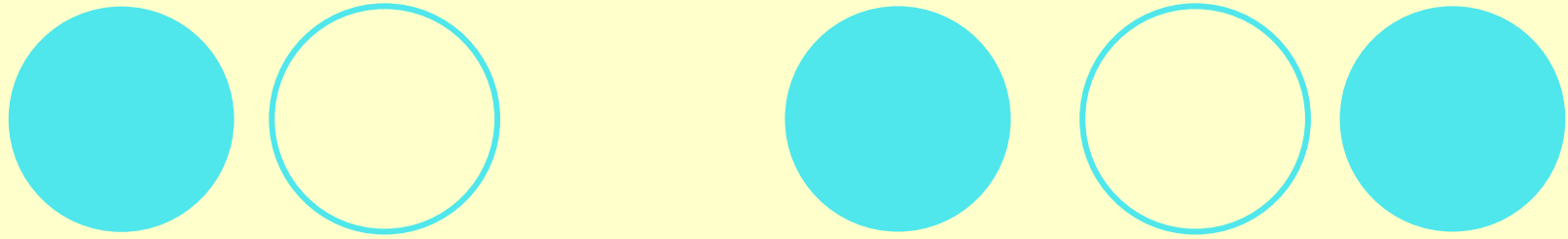
State Governments are taking administrative actions required for evacuation and flood relief.

# TRENDS in MONSOON RAINFALL

- - The INDIAN MONSOON rainfall as a whole does not show any significant change.
- However different parts of the country show changing trends.



**Increase/Decrease in mm in 100 year in each of 36 subdivisions for the south-west monsoon season. Different level of significance is shaded with colors.**



**About 7% area of the country show significant decreasing trends.**

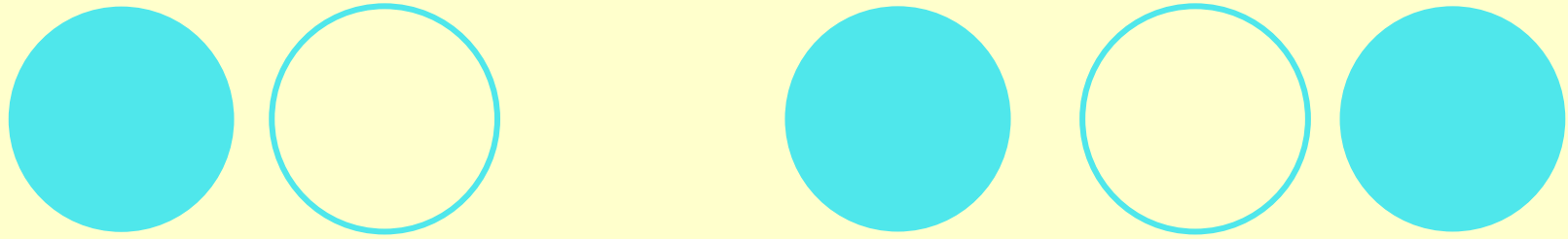
**About 24% area of the country show significant increasing trends.**

**These trends will increase the occasions of droughts and floods in future and affect water resources development.**

# TRENDS in EXTREME RAINFALL

- The following indices were considered for rainfall data of **100 stations** having more than **90 years data**

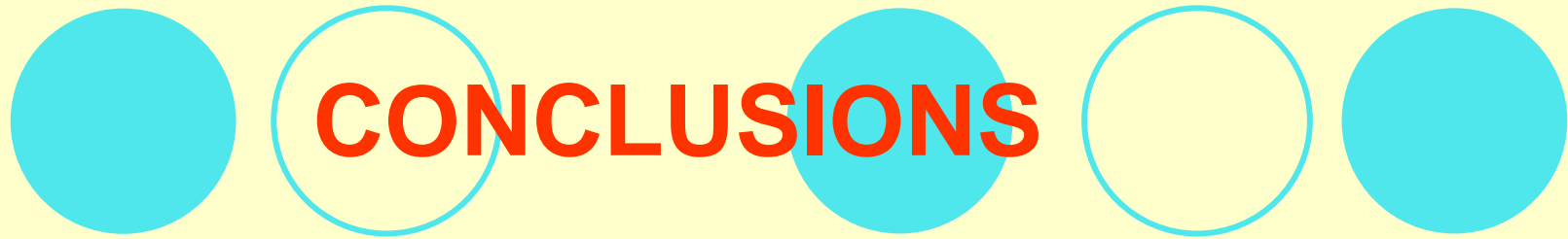
% No. of stations having significant Trend	( + )	( - )
Heavy Precipitation ( $\geq 7.5$ cm) Days	17	2
Very Heavy Precipitation ( $\geq 12.5$ cm) days	8	1
Highest 1 Day Precipitation	15	1
Highest 5 Day Precipitation	9	3



- **The rising trends in extreme rainfall will alter the design parameters like Probable Maximum Precipitation / flood etc. warranting review of hydrological safety of existing structure.**
- **The urban areas are now more vulnerable to flooding due to land use pressure , encroachment etc. The rising trends in extreme rainfall will enhance the threat as happened in Mumbai during 26<sup>th</sup> July 2005.**

# Scarcity of Water in near future

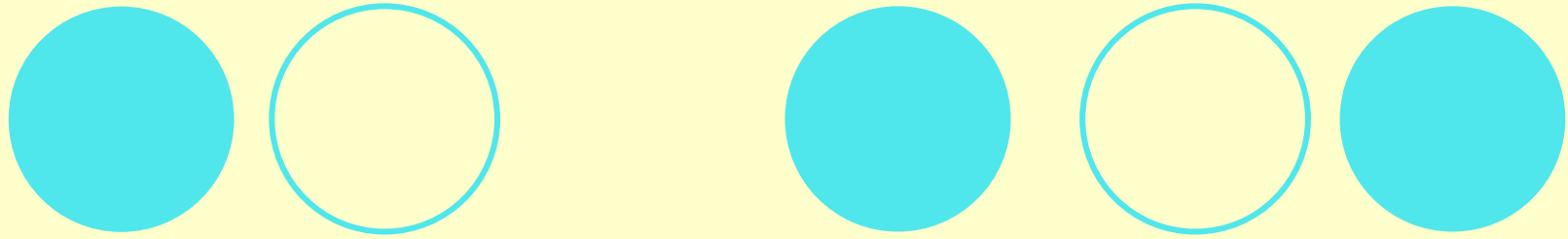
- It is estimated that **maximum utilizable water** (both surface and ground water) is about **1080 cu km**.
- While by **2050 AD** water demand of various users will rise to **1180 cu. km**.
- Thus major portion of India will be under **permanent threat of water scarcity**.



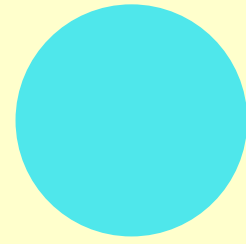
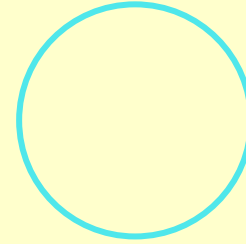
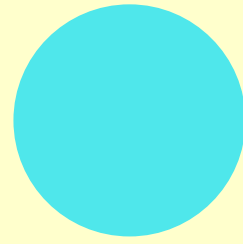
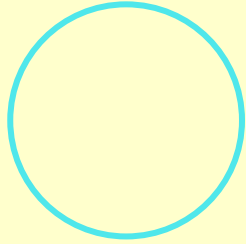
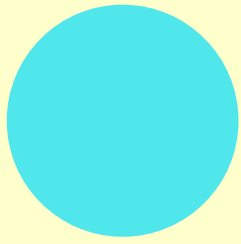
# CONCLUSIONS

- The hydro meteorological disasters like drought and floods require extensive downsizing at local level (catchment / sub basin) for effective forecast / warning system.
- The inferences of **climate models** are to be considered while planning and designing of Water Resources Development Projects.





- The options from **increasing storage capacity, River Linking water conservation , recycling** techniques need to be judiciously adopted to minimize the gap between water demand and availability.
- All these aspects demand **development and sharing of forecasting models and technology.**



THANK YOU