

Climate Risk Management in Agriculture

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Outline.....

- **Concept of Risk Management**
- **Climatic events for risk in agriculture**
- **Recent trends of Climatic Variability**
- **Operational aspects of handling of the risks (Observations, forecasting, Advisory Services etc.)**
- **Weather and Crop Insurance**
- **Conclusion**



- In India, over 60% of agricultural land is rainfed, a failed monsoon causes crippling impacts in rural communities.
- Farmers often face a complete loss of crops, threatening livelihoods and food security, and pushing already stressed areas into further poverty.
- Nationally, GDP drops and the government spends massive sums on drought relief for farmers.
- The magnitude of these human and economic costs – particularly as concern grows over the potential for climate change to increase extreme weather patterns.



Rainfall variability: Impact on farming community

- ❖ Rainfall variability tends to be the dominant source of livelihood risk in smallholder rainfed agriculture, particularly in dryer environments.
- ❖ In the face of climatic uncertainty, risk-averse farmers employ conservative strategies, including –
 - avoidance of improved technology,
 - under-use of fertilizers and
 - shifting from productive to non-productive liquid assets.



Recent developments in climate risk management

- 1. Improved crop insurance**
Site specific weather indices
Community crop insurance
- 2. Climate smart villages for sustainable food security in risk prone regions**
- 3. New tools to support developed of national and state level adaptation action plans and resource allocation**
- 4. Climate analogues for farmer to farmer learning of risk management approaches**

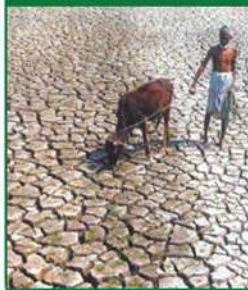


Climate smart villages/farms: Key interventions

CLIMATE SMART VILLAGE / FARM

Weather smart

- Seasonal weather forecasts
- ICT based agro-advisories
- Index based insurance
- Climate analogues



Water smart

- Aquifer recharge
- Rainwater harvesting
- Community management of water
- Laser leveling
- On-farm water management



Carbon smart

- Agroforestry
- Conservation tillage
- Land use systems
- Livestock management



Nitrogen smart

- Site specific nutrient management
- Precision fertilizers
- Catch cropping / legumes



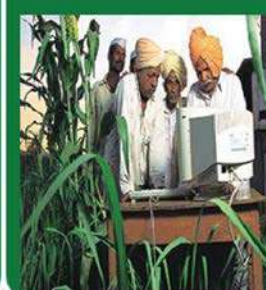
Energy smart

- Biofuels
- Fuel efficient engines
- Residue management
- Minimum tillage



Knowledge smart

- Farmer-farmer learning
- Farmer networks on adaptation technologies
- Seed and fodder banks
- Market info
- Off-farm risk management-kitchen garden



Diagnose Risks in Agriculture Sector

Production Risk

Market Risk

Financial Risk

Weather Risk

Pest Disease Risk

Choosing
sowing
Harvesting
Energy

Commodity
Flow
Transport

Insurance
Input Costs

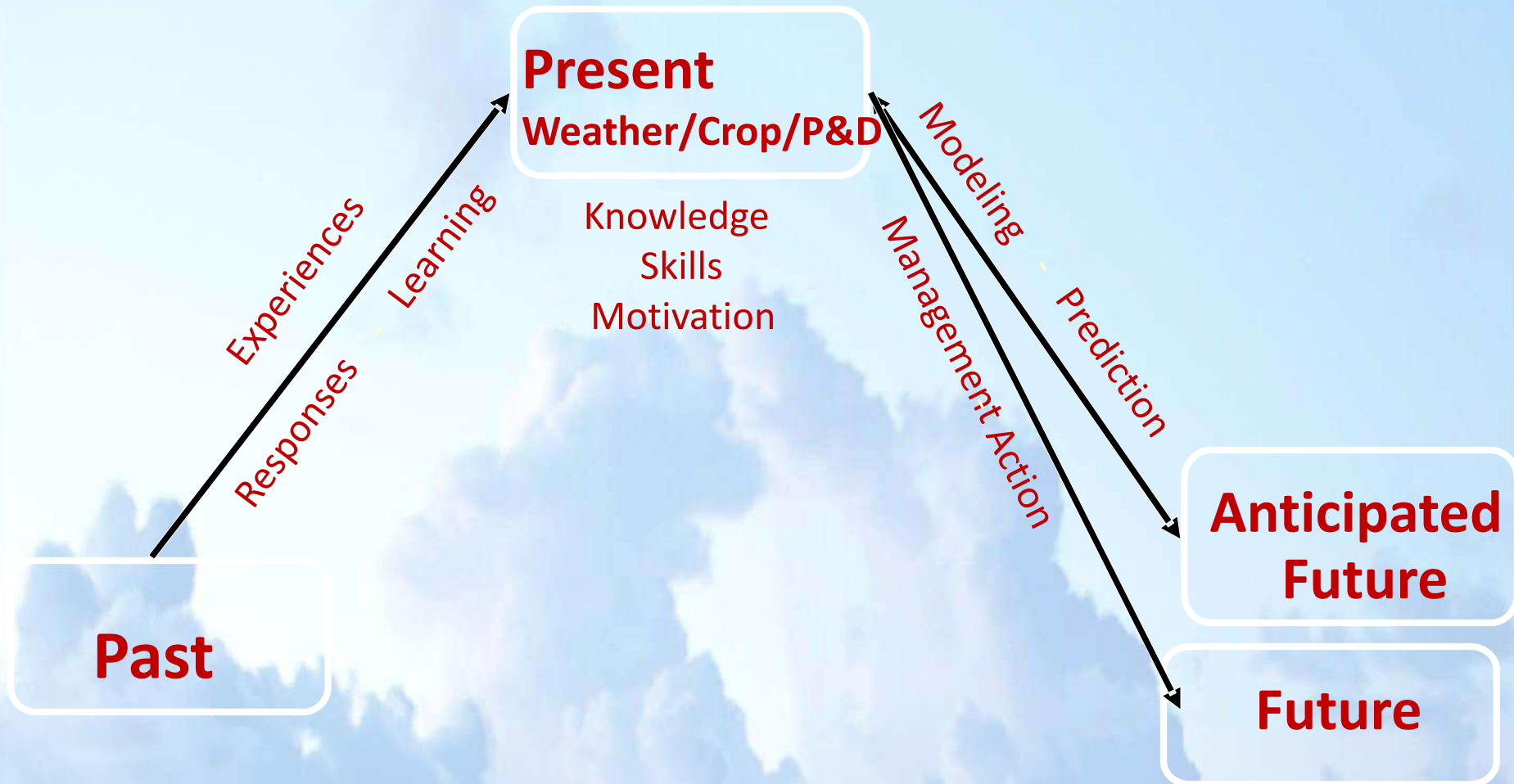
Cold/Heat
wave
Dry spell
Flood

Outbreak
Infestation
Migration

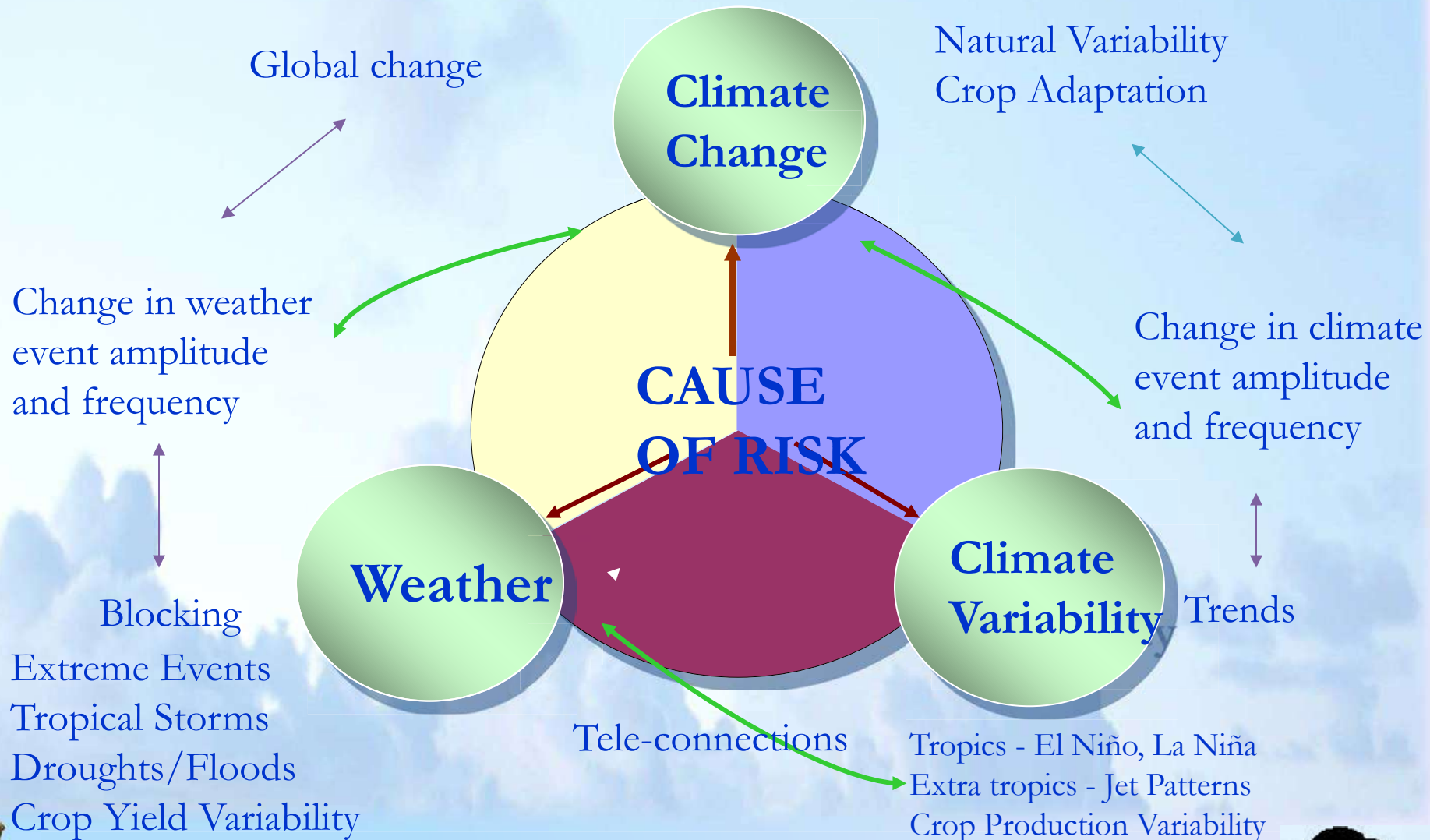
Weather and Climate Dependent



Managing Agricultural Risks



Coping with Climate Risks Agrometeorological Perspective

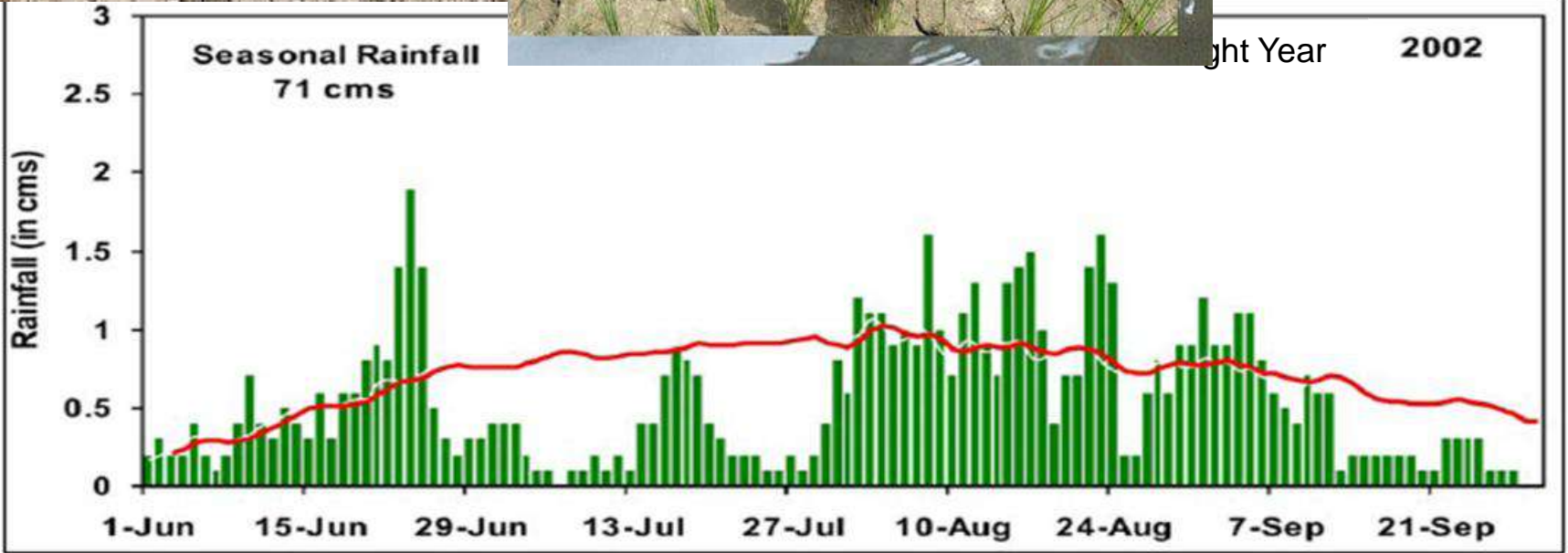


Agrometeorological Risks

- Periods of **extreme temperature** i.e. low temperatures below the threshold value and high temperatures above the maxima are hazardous to plant development and growth.
- Extreme temperature conditions during cold spells cause stress and frost; high temperatures lead to heat stress and both affect agricultural production.
- Extremes of **moisture** conditions namely drought episodes and low moisture conditions as well as very humid atmospheric conditions including wet spells tend to affect agriculture.
- Dry desiccating and **strong winds** reduce agricultural production as a result of very high evapotranspiration rates.
- High **soil moisture** influences the rate of transpiration, leaf area expansion and ultimately plant productivity.
- Drastic changes in **rainfall variability** can have very significant impact, particularly in climatically marginal zones such as arid, semi-arid and sub-humid areas where incidence of widespread drought is frequent.
- It also causes mechanical damage to plants with weak stems by lodging such as the sugarcane and the banana.



Drought

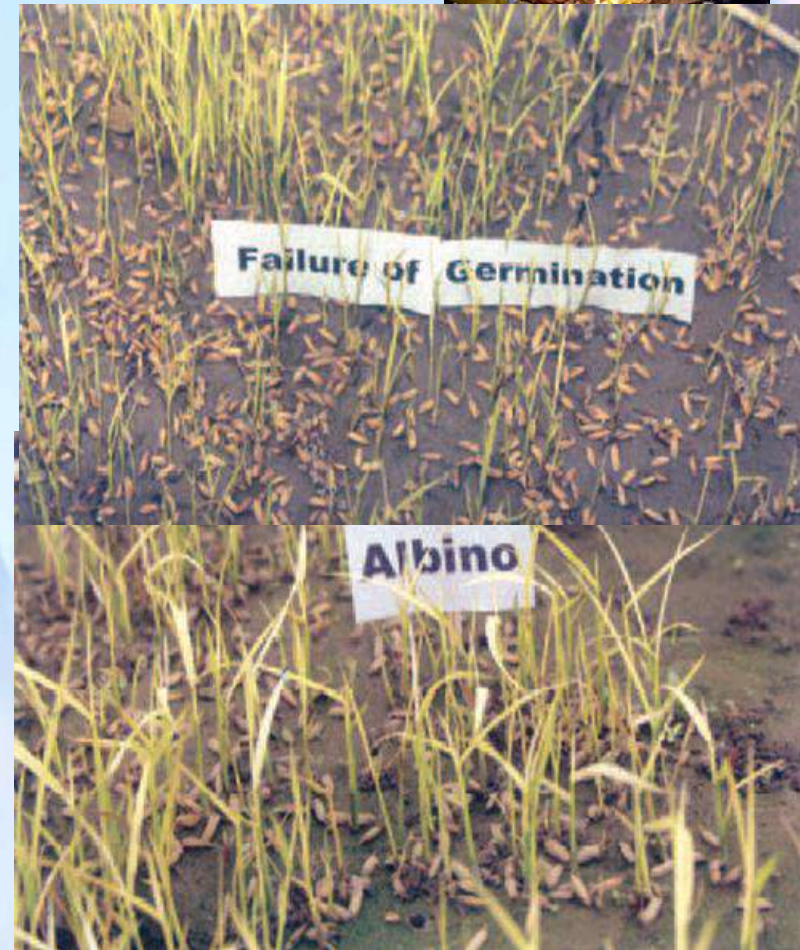


Variation of the daily rainfall over central India during June – September 2002 (drought year)



COLD WAVES

- Cold Waves are incursion of dry cold winds coming from North direction and are associated with passing western disturbances.
- Low temperature decrease the number of sprout lets per tuber and the total sprout length per tuber and ultimately decrease the yield of potato.



Effects of cold injury in *boro* rice nursery bed in Assam in 2003



HEAT WAVE

- Heat waves are defined under two categories. The first category includes places where the normal maximum temperature is more than 40°C. In such regions if the day temperature exceeds by 3 to 4°C above the normal, it is said to be affected by a heat wave.
- Similarly, when the day temperature is 5°C or more than the normal, severe heat wave condition persists. The second category considers the regions where the normal maximum temperature is 40°C or less.



**Heat Wave damage to
Mango Orchard**



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Custard Apple is tolerant to High temperatures



Thunderstorms

- Thunderstorm is a severe weather phenomenon, which develops mainly due to intense convection and is accompanied by heavy rainfall, thunder, lightning, hail, and squall line.
- It is the towering cumulus or the cumulonimbus clouds of the convective origin and high vertical extent that are capable of producing lightning and thunder. Usually, these thunderstorms have the spatial extent of a few kilometres and life span less than an hour. However multi-cell thunderstorms developed due to organized intense convection may have a life span of several hours and may travel over a few hundred of kilometres.



Damage of apples in Himachal Pradesh due to thunderstorms



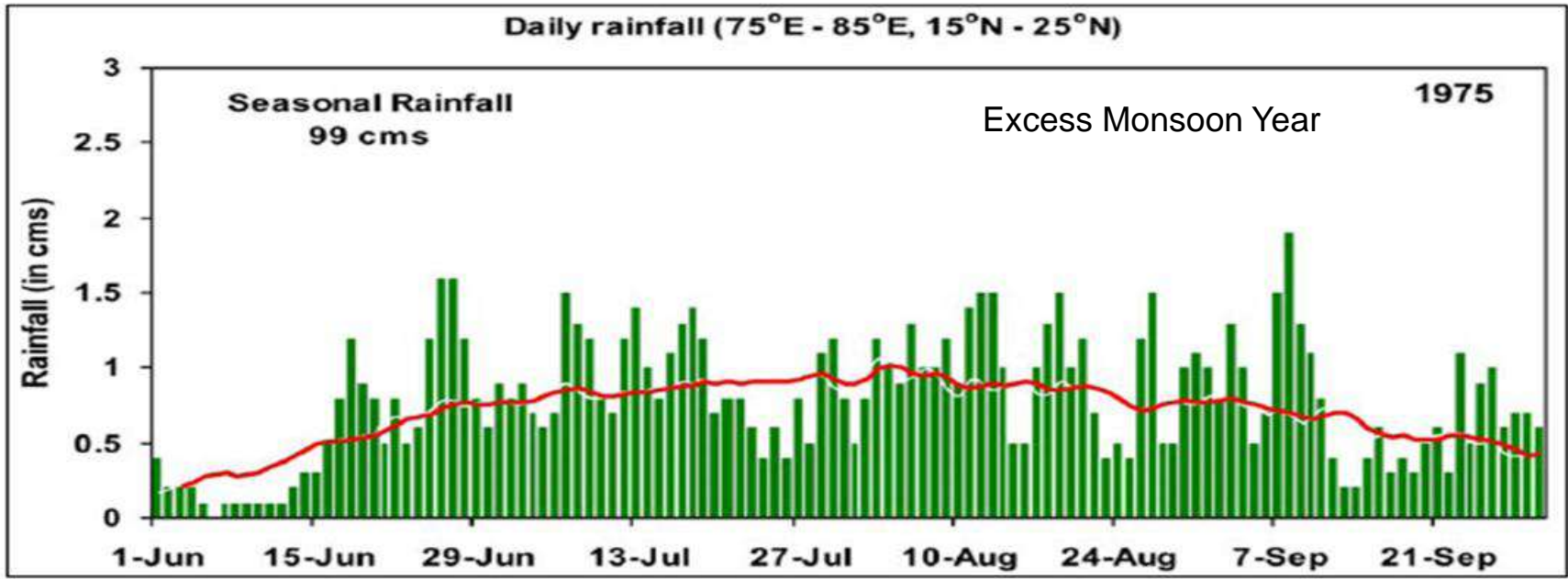


Frost damage to the different crops (Hisar)

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FLOOD



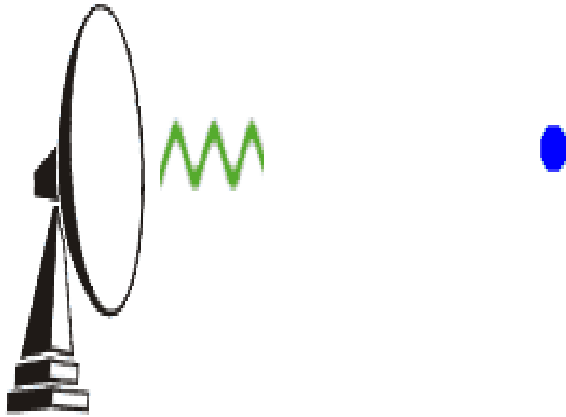
Variation of the daily rainfall over central India during June – September 1975 (excess monsoon year)



Radar



Hailstorm



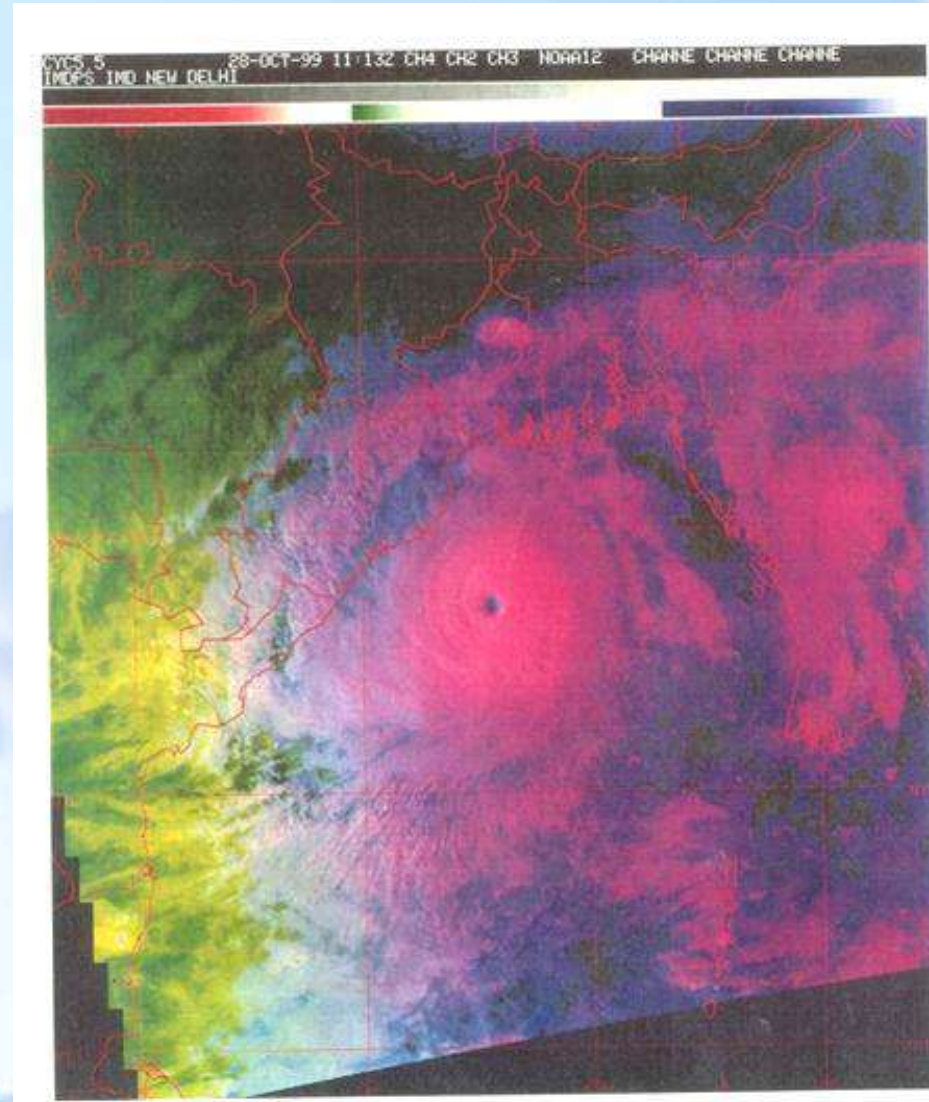
Hailstorm occurs particularly in pre-monsoon season (March – April) -

- It causes substantial damage to the standing crops as well as the horticultural crops within a very short time.
- Hail storm could be predicted from the data generated through Doppler Radar within 3 hours of the incidence.
- Thus an advisory within a very short period may be communicated to the farming community.



Tropical Cyclones

Tropical cyclones are large synoptic scale weather systems which originate over warm oceans, develop into massive vortices comprising of swirling winds, intense clouds and torrential rains by drawing energy from the ocean and move poleward.



Climate during the recent past

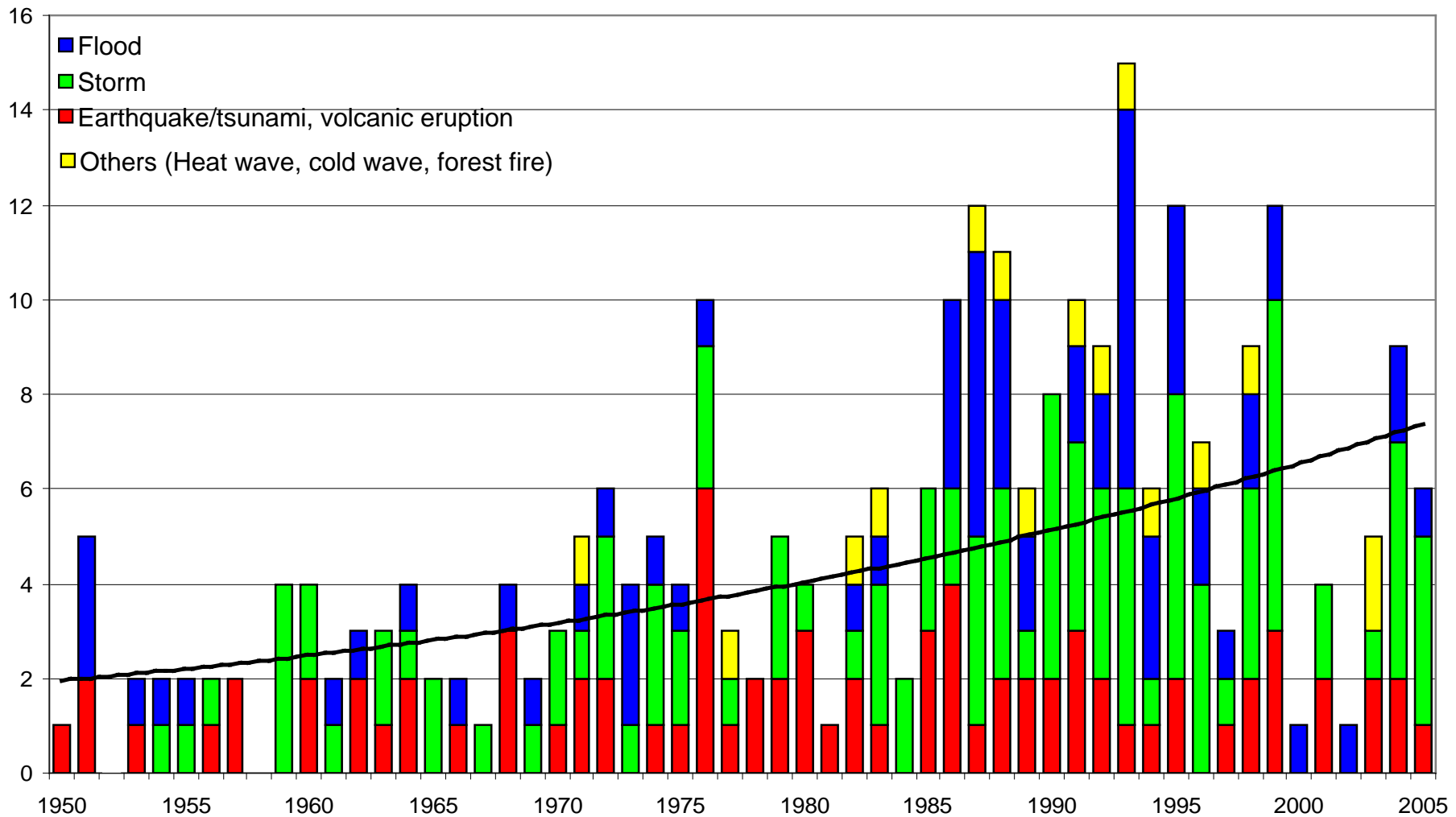
Year	All India SWM Rainfall Departure (%)
2000	-8
2001	-15
2002	-19
2003	+2
2004	-13
2005	-1
2006	-1
2007	+5
2008	-2
2009	-23
2010	+2
2011	+1
2012	-8

Extreme Events

- 2002 drought
- 20 day heat wave during May 2003 in Andhra Pradesh
- Extreme cold winter in the year 2002-03
- Drought like situation in India in July 2004
- Abnormal temperatures during March 2004 and Jan 2005
- Floods in 2005
- Cold wave 2005 - 06
- Floods in arid Rajasthan & AP and drought in NE regions in 2006
- Abnormal temperatures during 3rd week of Jan to 1st week of Feb 2007
- All India Severe drought 2009
- 2010 – One of warmest years
- 2011 – Failure of September rains in AP
- 2012 – early season drought

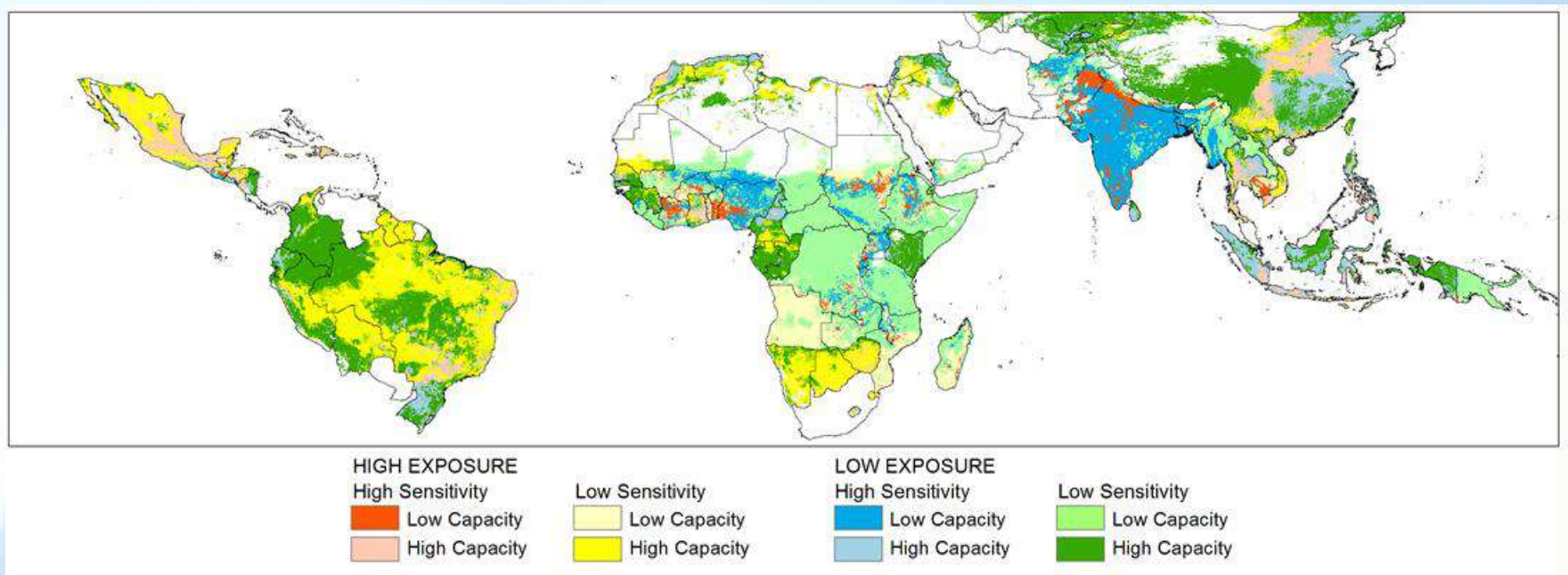


Trends of extreme weather events in India



India faces increasing challenges due to climatic risks

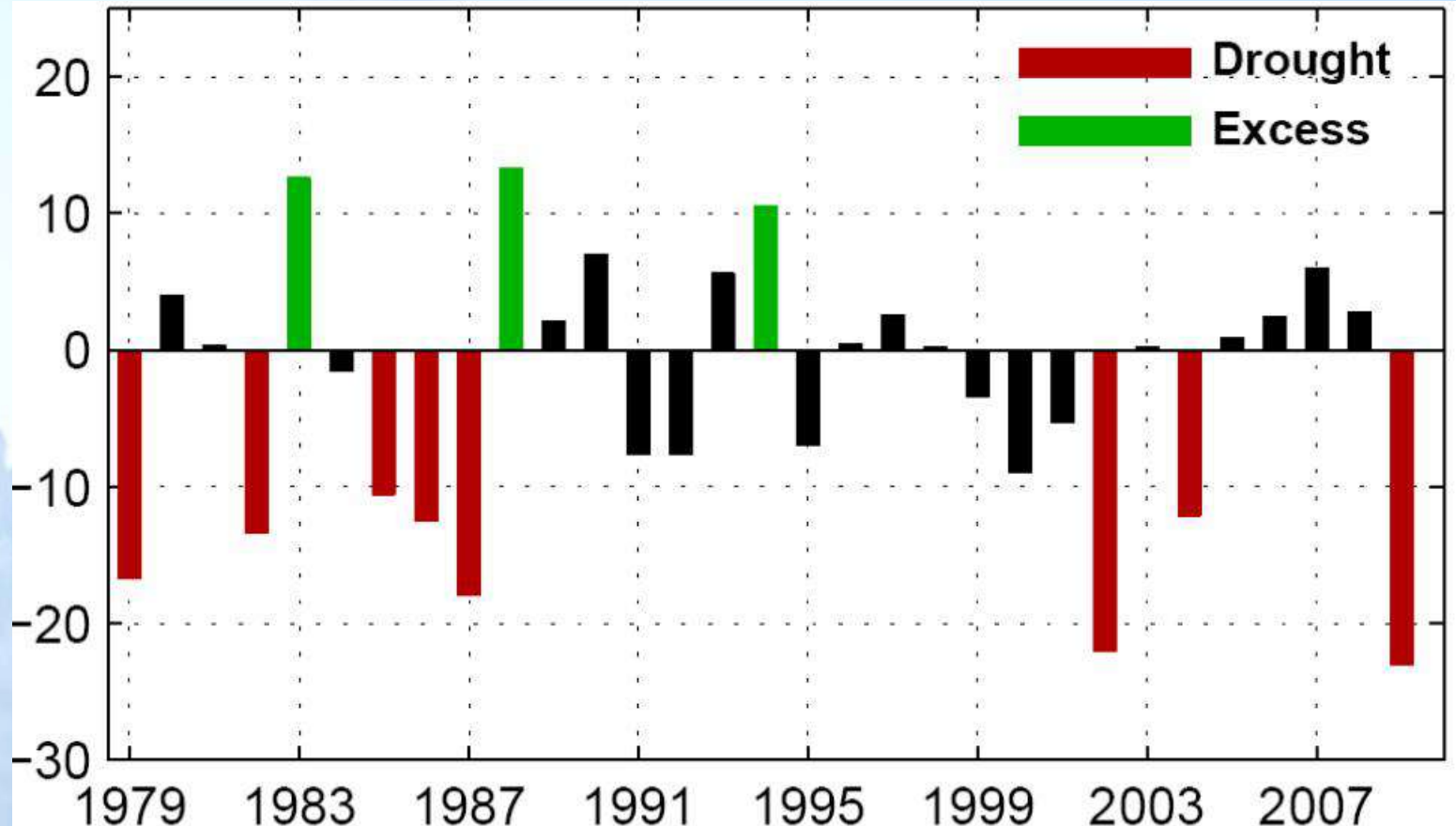
- Frequent episodes of droughts, floods, cyclones, very heavy rainfall, heat waves, and frost in one or the other part of the country
- Climate change will further increase such events

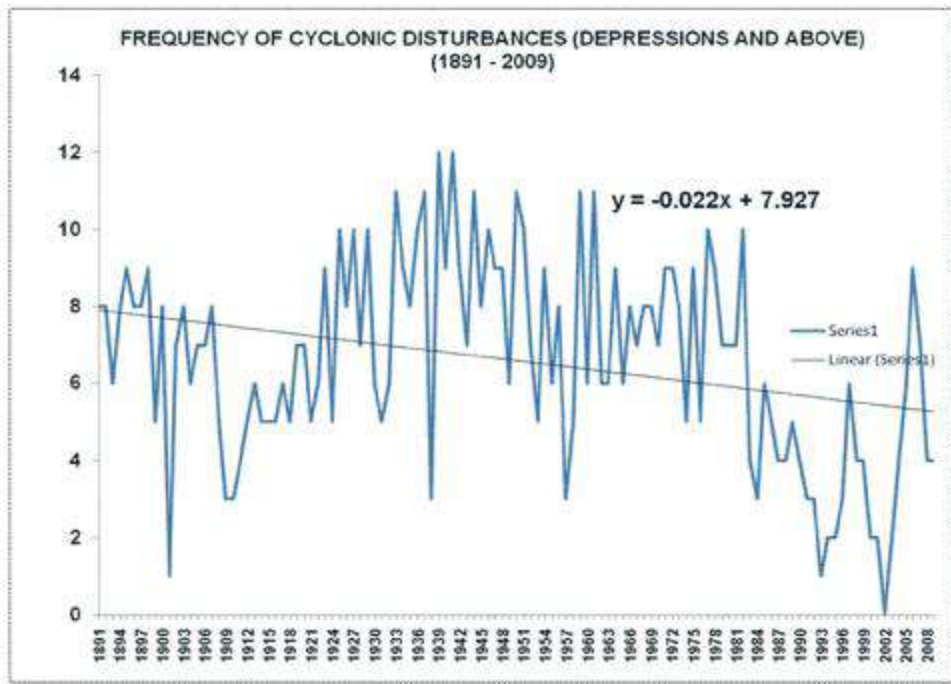


(Source: Erickson et al., 2011)



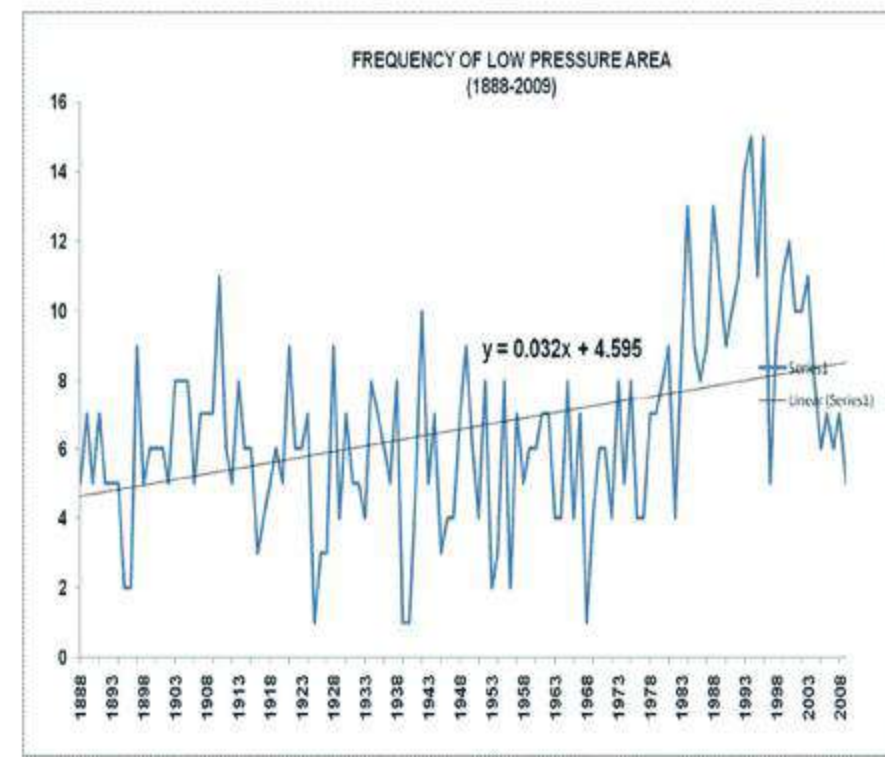
Variation of ISMR anomaly during 1979-2009





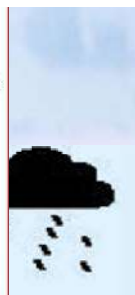
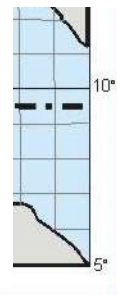
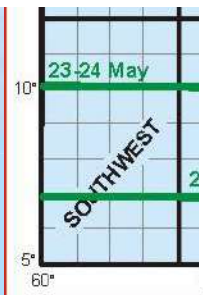
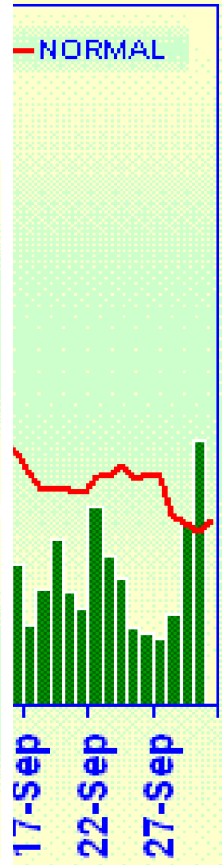
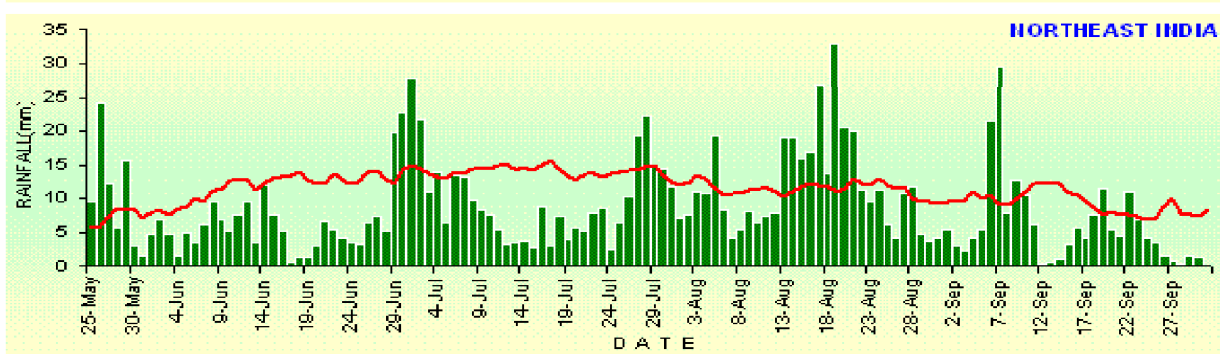
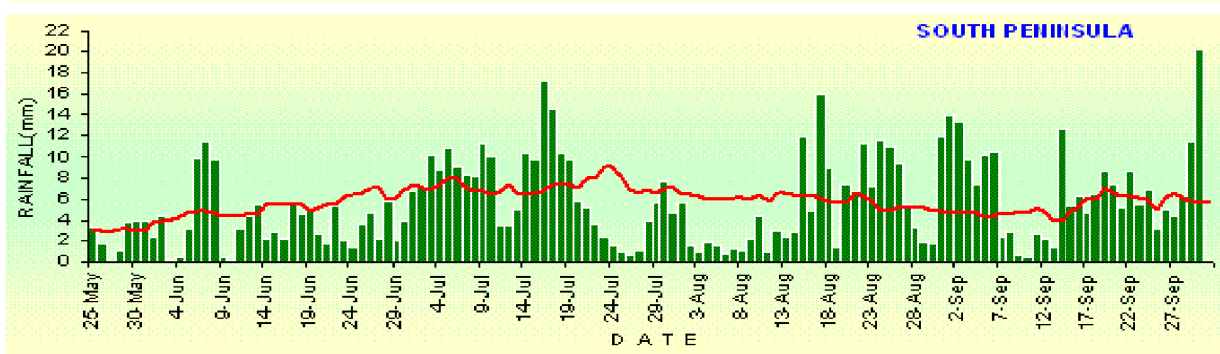
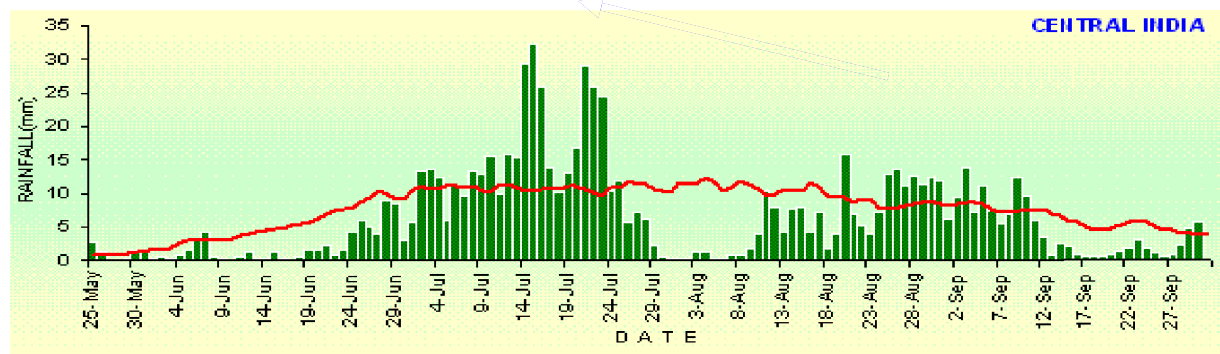
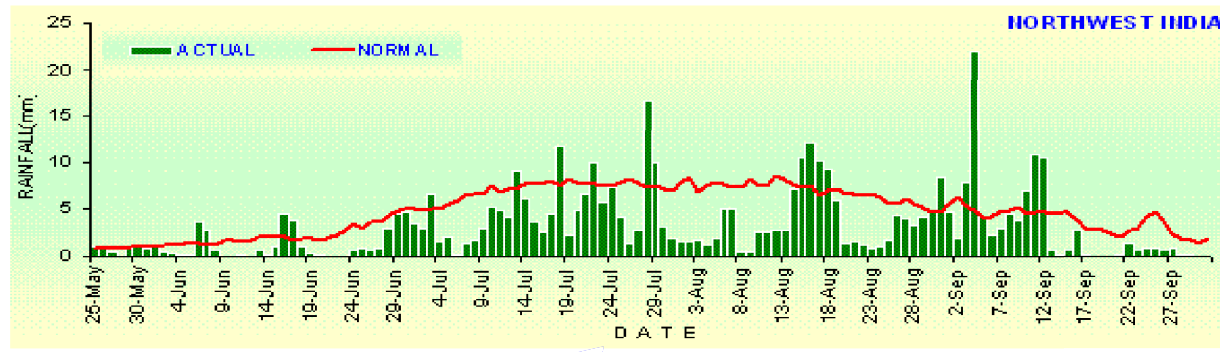
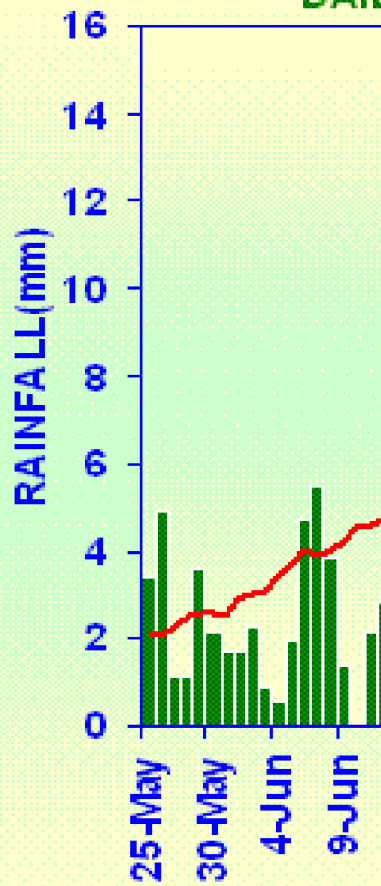
Frequency of cyclones and depressions during 1891-2009

Frequency of low pressure during 1891-2009

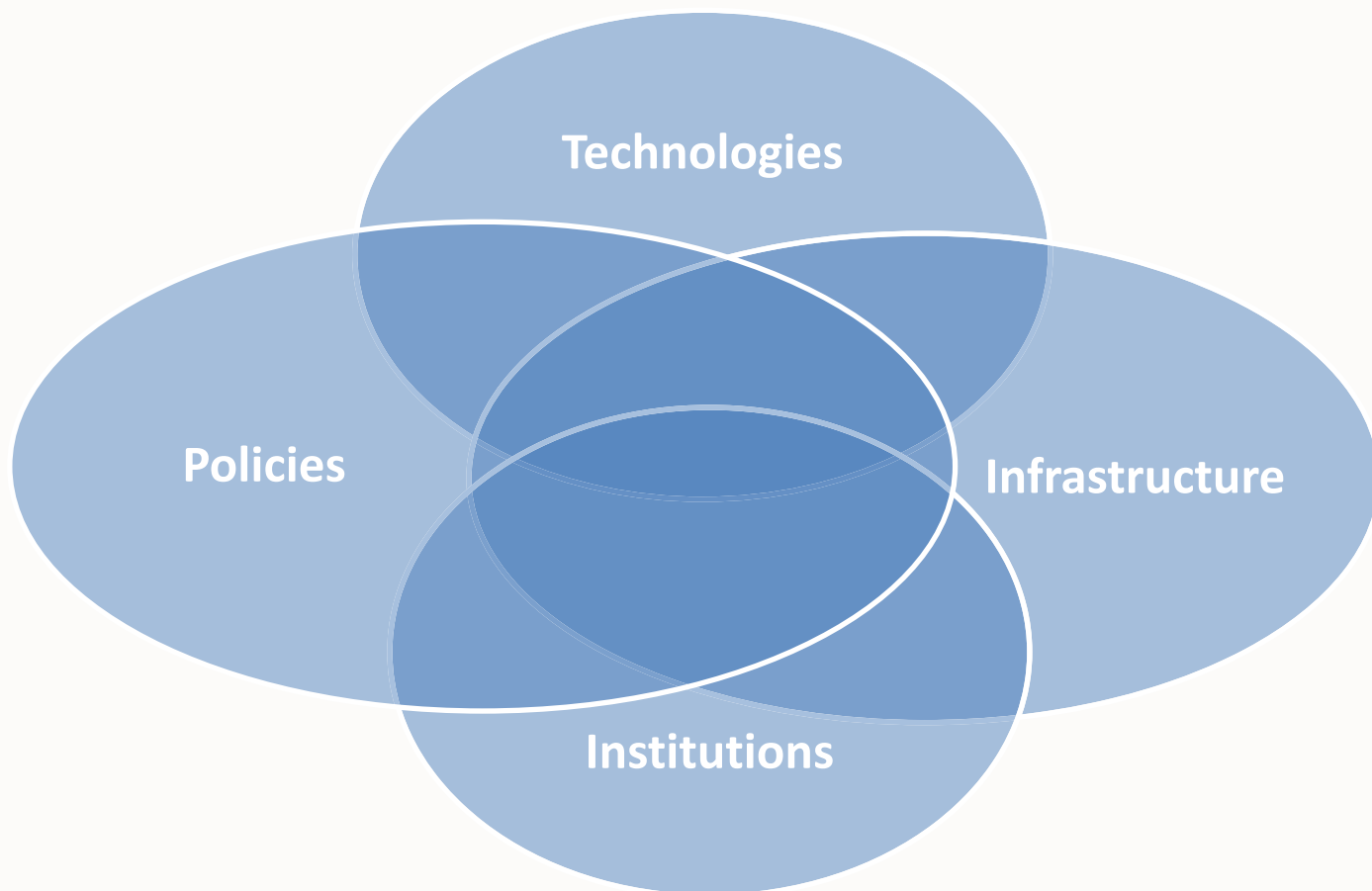


Trend in frequency of low pressure areas during 1888-2009

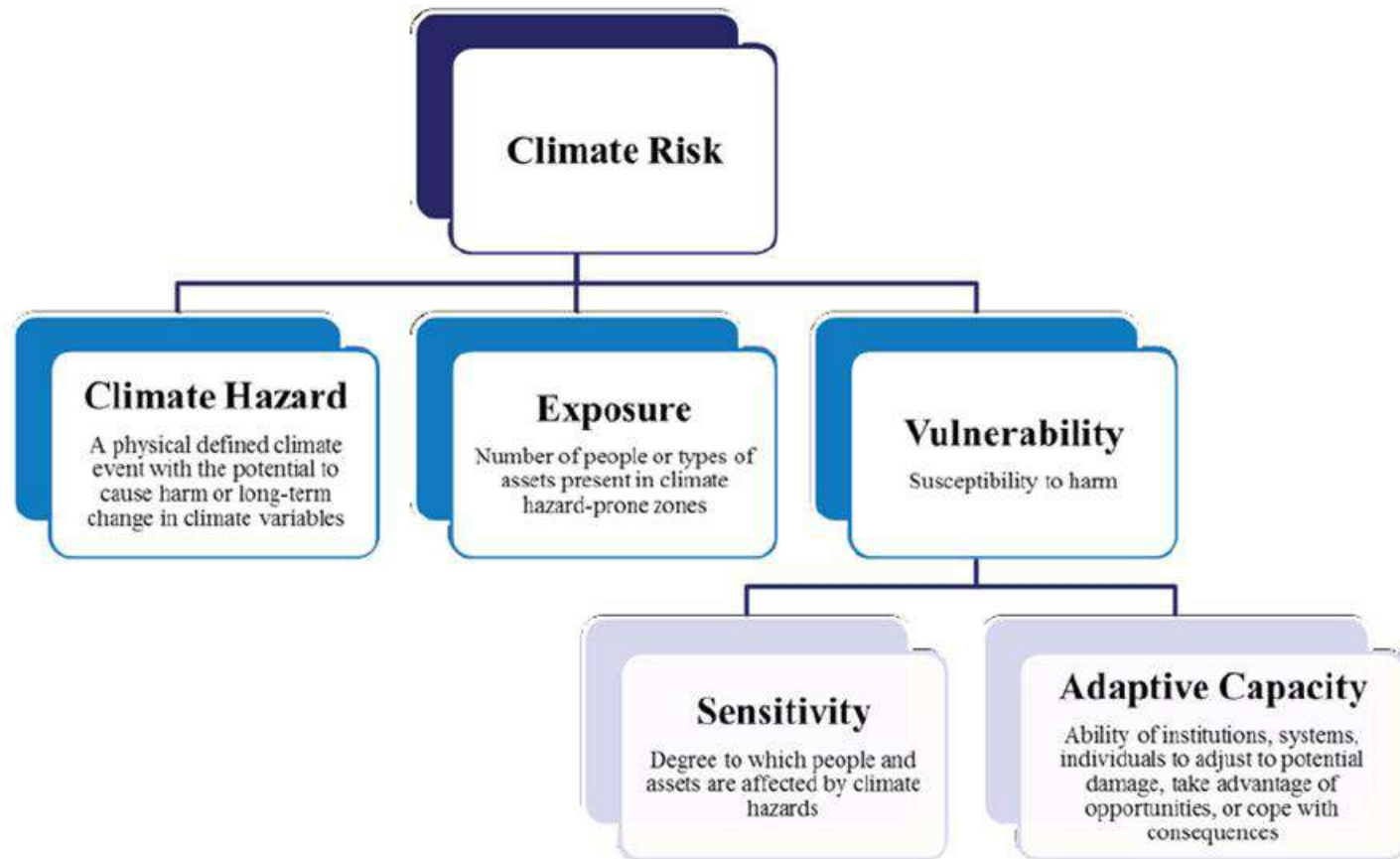




Increasing preparedness of Indian farmers to climatic risks: Regionally differentiated solutions needed



Climate Risks



Nodal agencies for monitoring and early warning of disasters

- ❖ Forecasts / Warnings relating to major Natural Disasters are being provided by....
 - India Meteorological Department (Cyclones, Floods, Drought, earthquakes)
 - Central Water Commission of the Ministry of Water Resources (Floods)
 - Geological Survey of India (Landslides)
 - Department of Ocean Development (Tsunami)



Generation of Multi-model Forecasts

NCEP

JMA

ECMWF

NCMRWF

UKMO

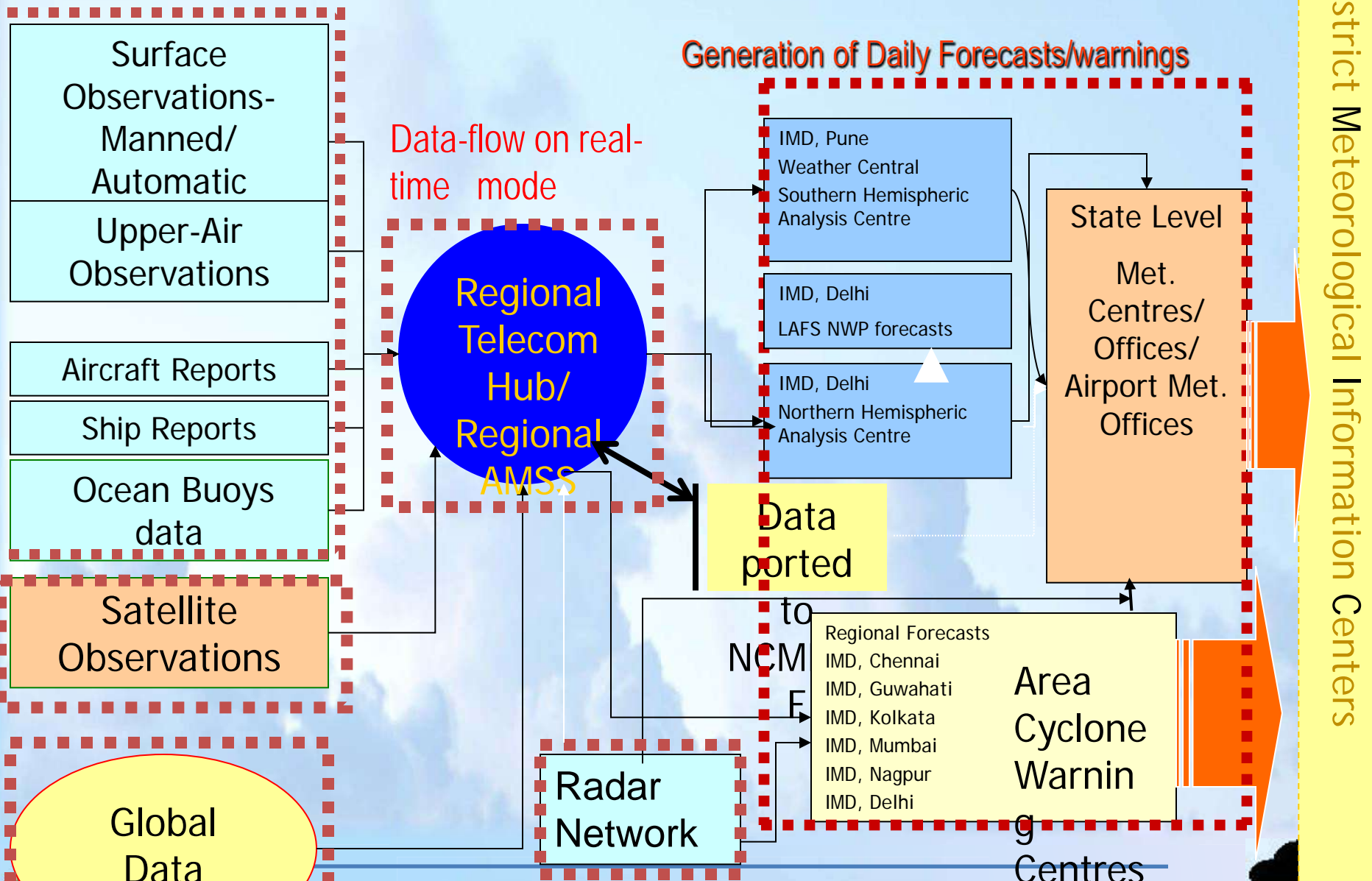
IMD Multi-model Ensemble (MME) based District level
(50 x 50 km) Forecasts

Parameters:

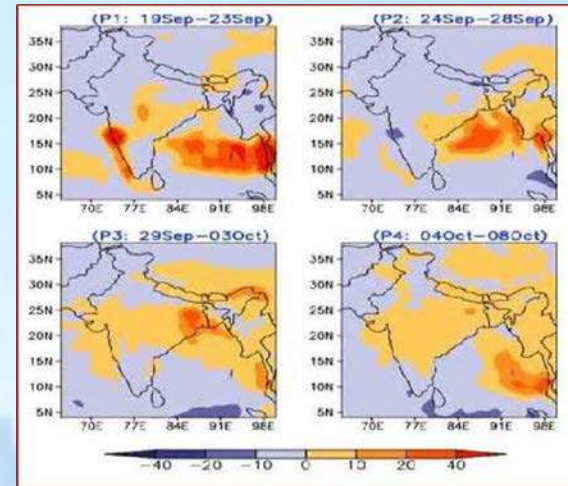
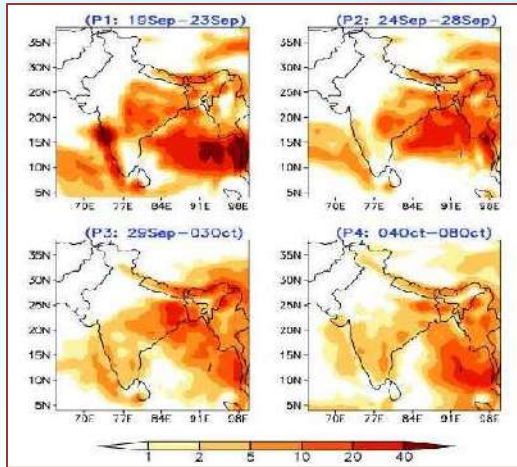
- Rainfall
- Max and Min temperature
- Total cloud cover
- Surface Relative humidity
- Surface Wind



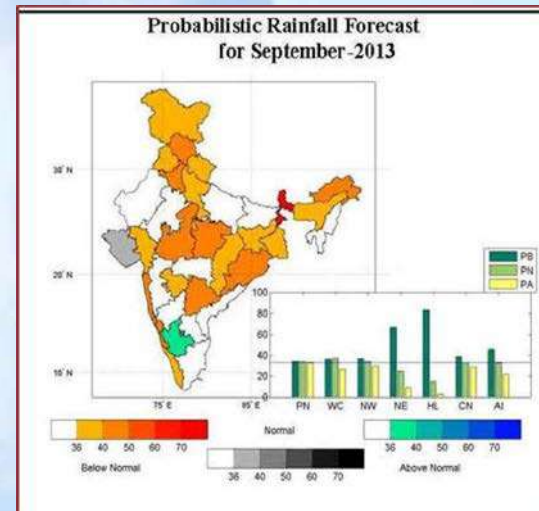
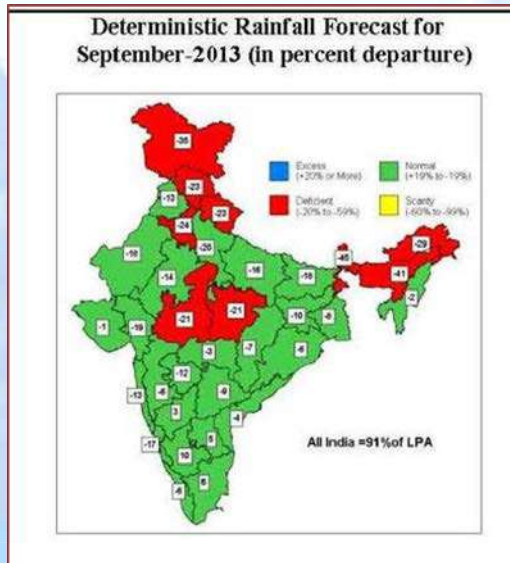
IMD's Observational & Forecasting System

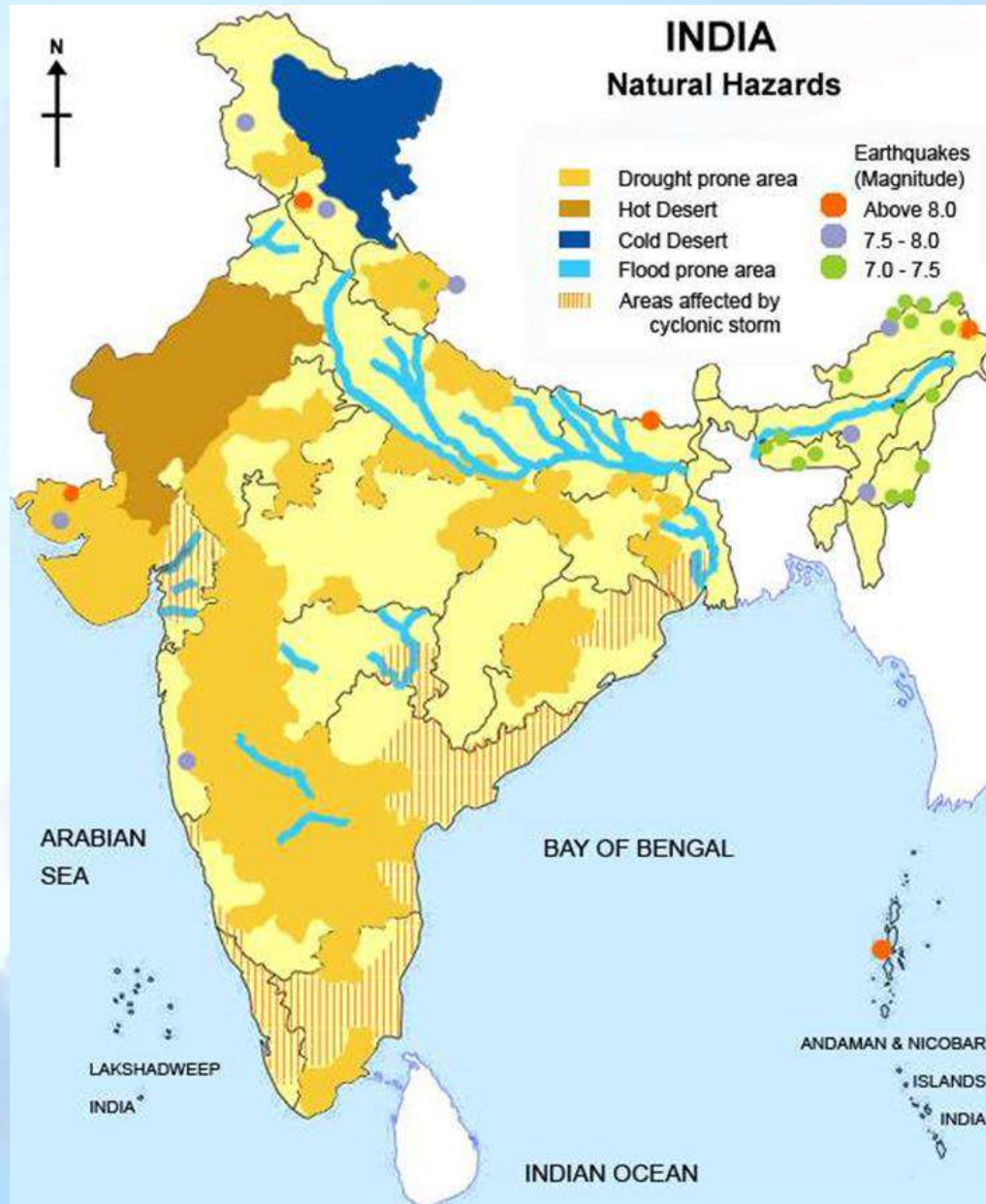


Experimental Extended Range Weather Forecast



Experimental Monthly Forecast Weather Forecast



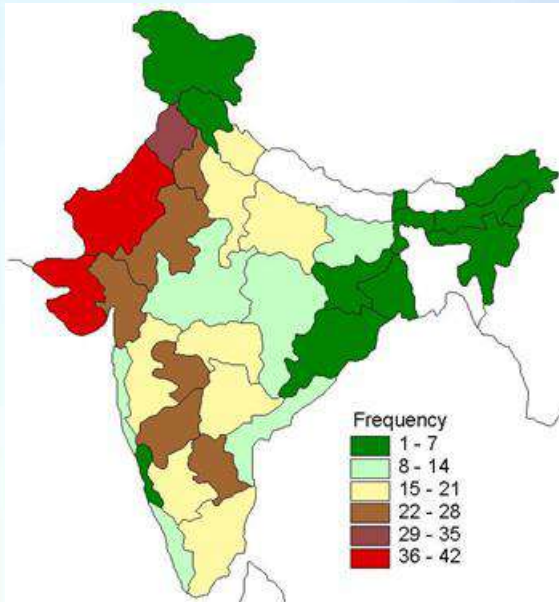


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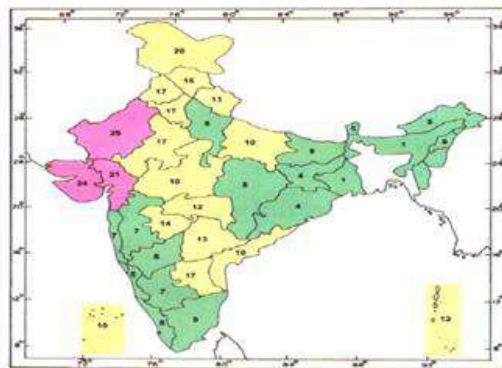


Drought Scenario in India

Frequency of droughts in India- 1871-1999



- 68% of net sown area(142.2 Mha) is drought prone
- 50% of drought prone is severe in nature
- 13% of India experience drought once in 2-3 years
- More than 50% of dry tropical region is affected by drought once in 4 years
- Some part of the country or other is affected every year



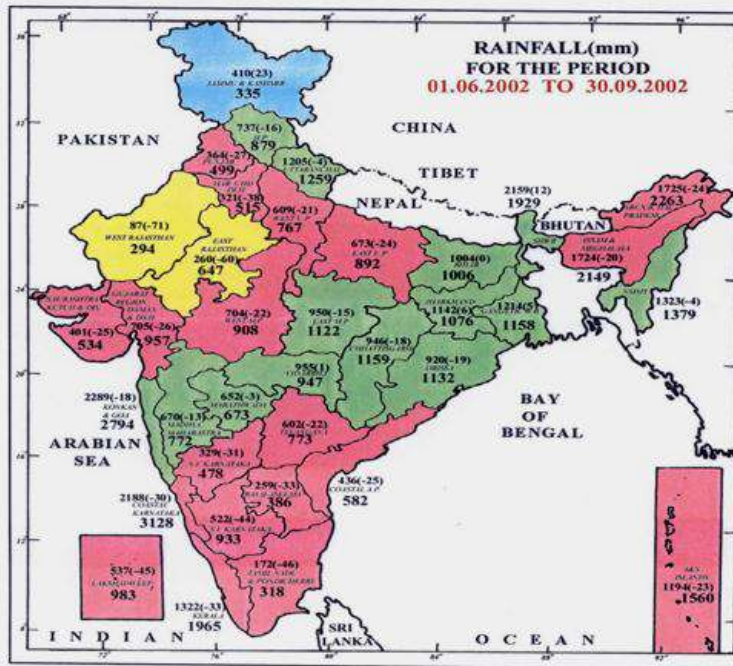
PROBABILITY OF OCCURRENCE OF DROUGHT (%) AND DROUGHT PRONE AREAS 1875 - 2004

- CRONICALLY DROUGHT PRONE ARE A (PROBABILITY OF OCCURRENCE OF DROUGHT MORE THAN 20%)
- FREQUENTLY DROUGHT PRONE AREA (PROBABILITY OF OCCURRENCE OF DROUGHT 10% TO 20%)
- LEAST DROUGHT PRONE AREA (PROBABILITY OF OCCURRENCE OF DROUGHT LESS THAN 10%)



Monsoon 2002

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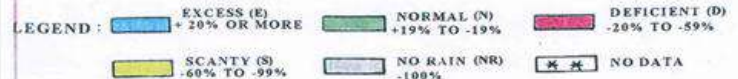
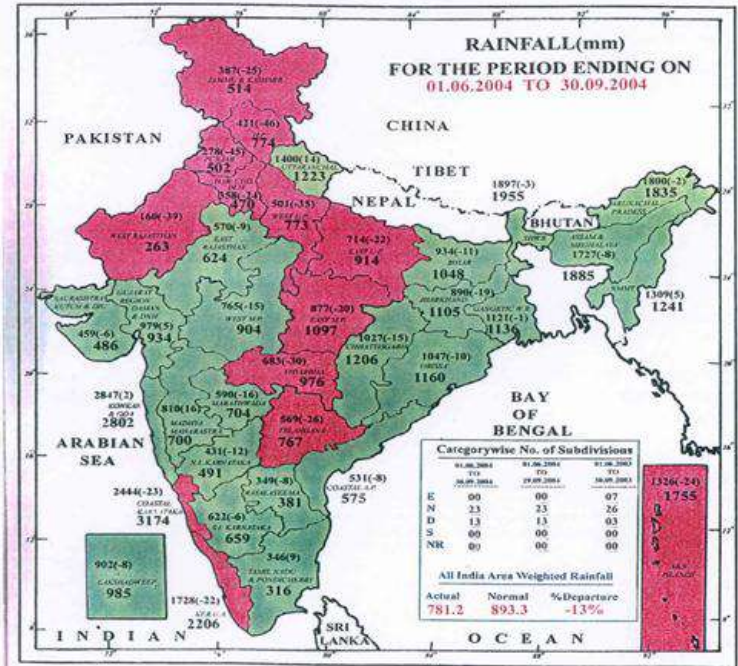


NOTES:

(a) Rainfall figures are based on operational data.
(b) Small figures indicate actual rainfall (mm), while bold figures indicate normal rainfall (mm).
Percentage departures of rainfall are shown in brackets.

Monsoon 2004

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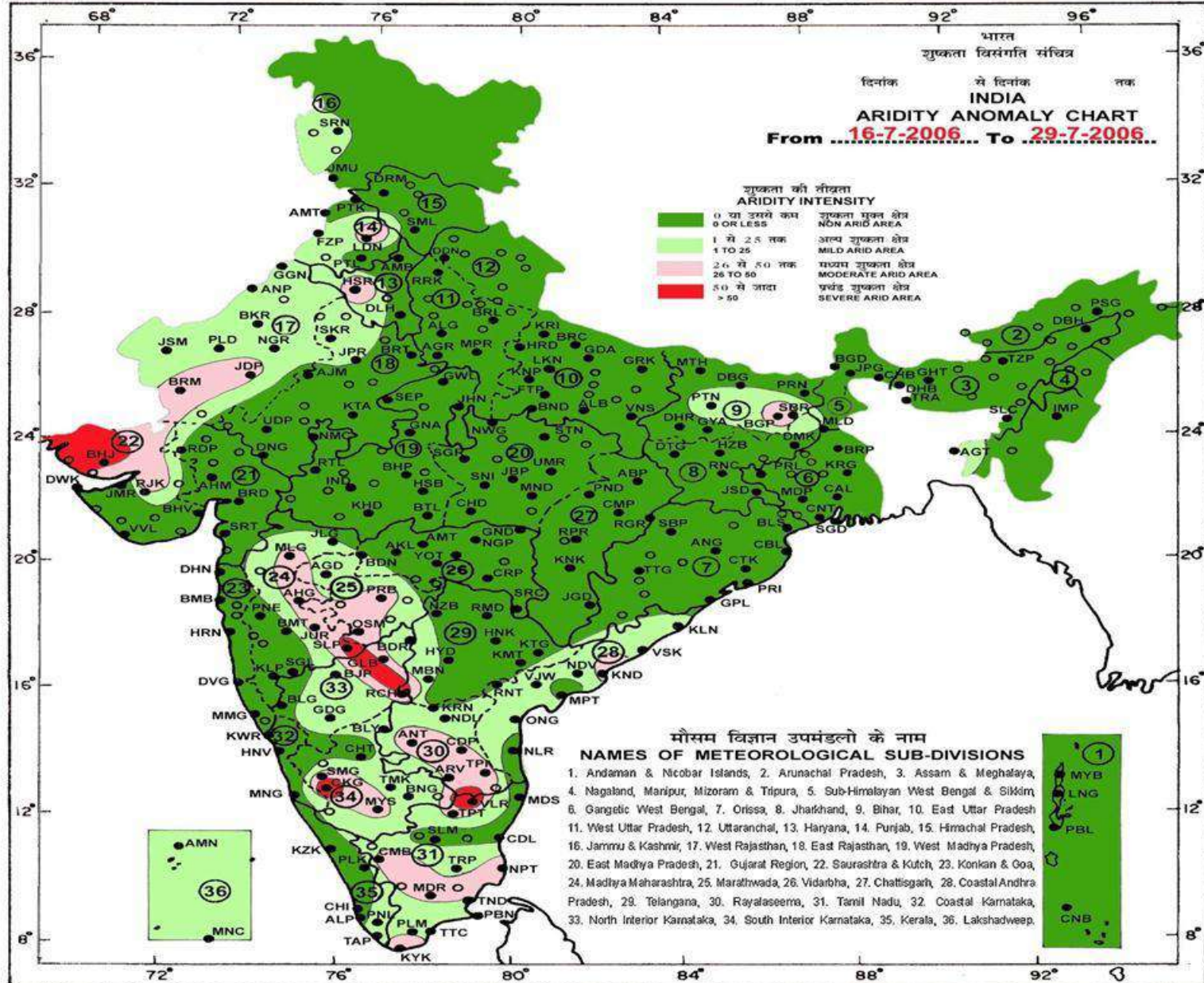
Category	No. of Subdivisions		
	01.06.2004 TO 30.09.2004	01.06.2003 TO 30.09.2003	01.06.2002 TO 30.09.2002
E	00	00	07
N	23	23	26
D	13	15	03
S	00	00	00
NR	00	00	00

All India Area Weighted Rainfall
Actual Normal %Departure
781.2 893.3 -13%

Drought Monitoring

	Jun-Sep 2002	Jun-Sep 2004
No. of Districts under moderate drought	180	133
No. of Districts under severe drought	87	36
Total No. of Districts under drought	267	169
Percentage Area under drought	29	18
Departure of Rainfall from LPA (%)	-19	-13

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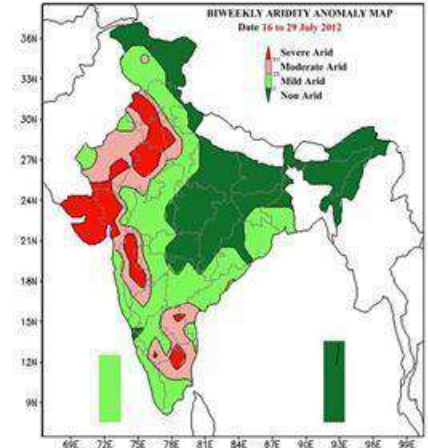
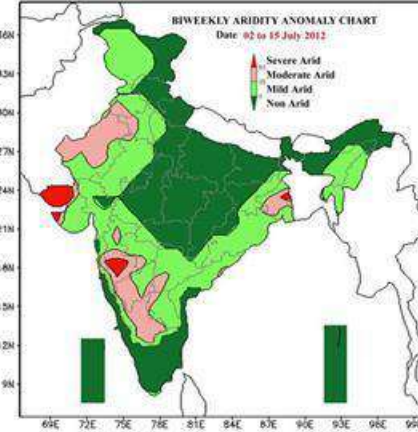
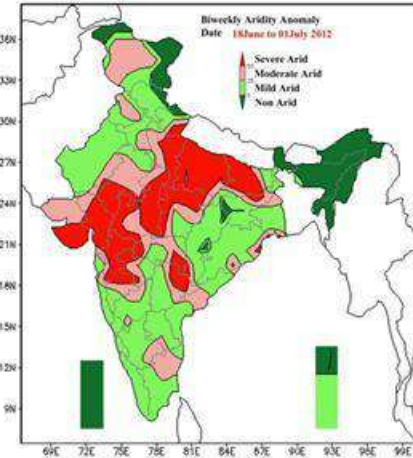
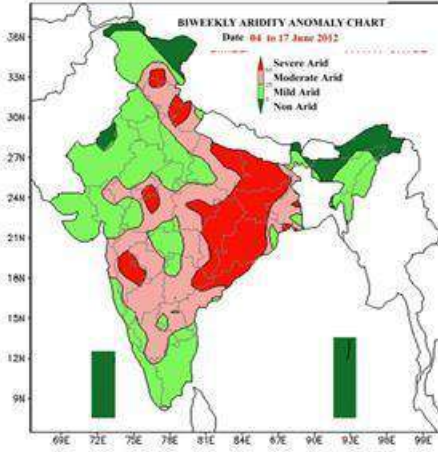
Biweekly Aridity Anomaly Map for 2012

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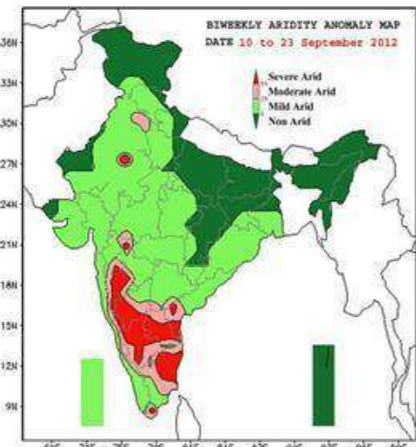
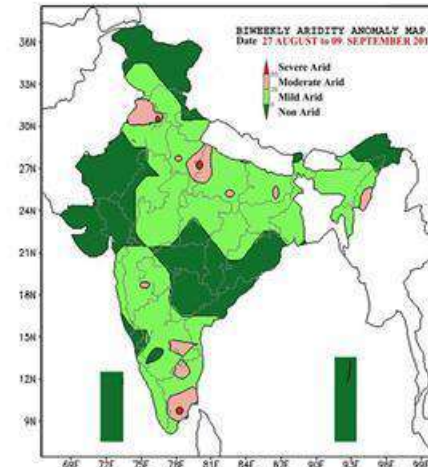
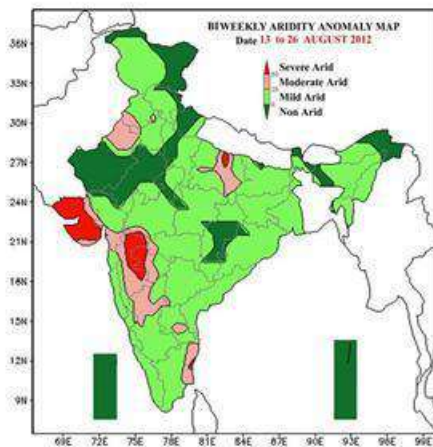
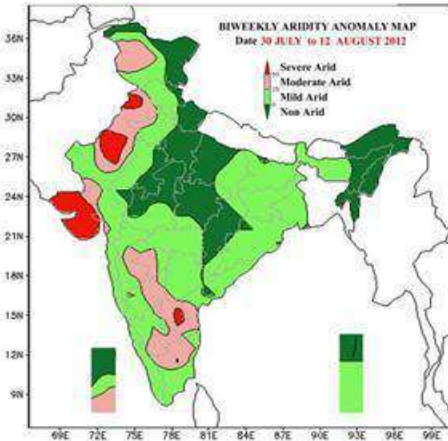


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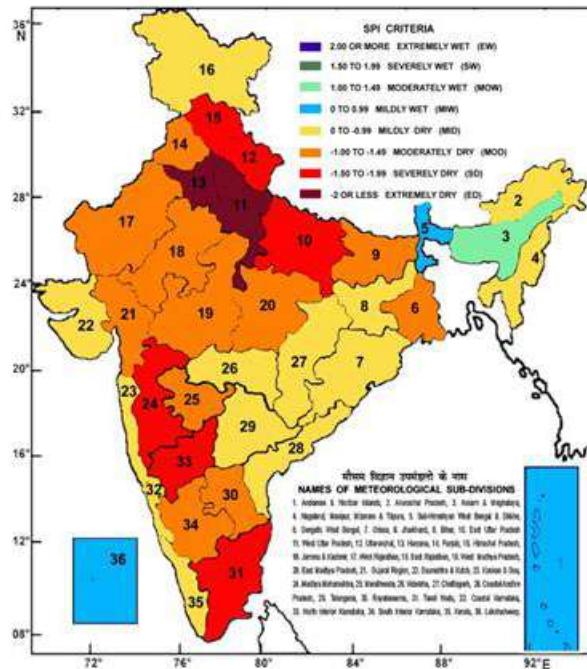
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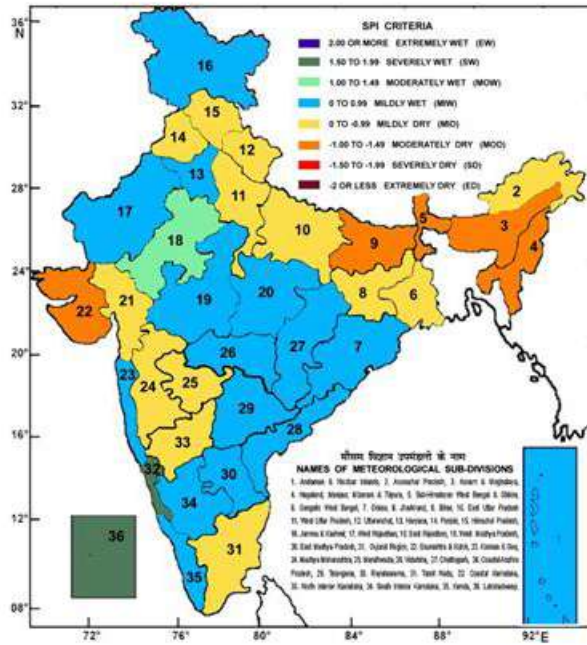
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SPI (STANDARDIZED PRECIPITATION INDEX) MAP
JUNE 2012

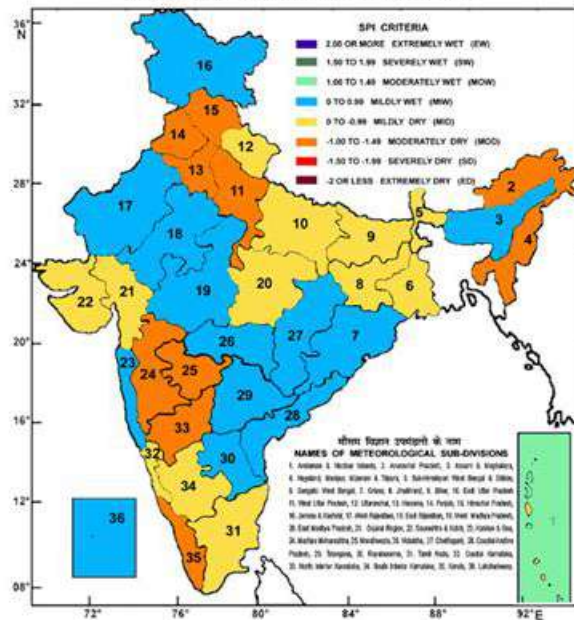


SPI (STANDARDIZED PRECIPITATION INDEX) MAP
AUGUST 2012

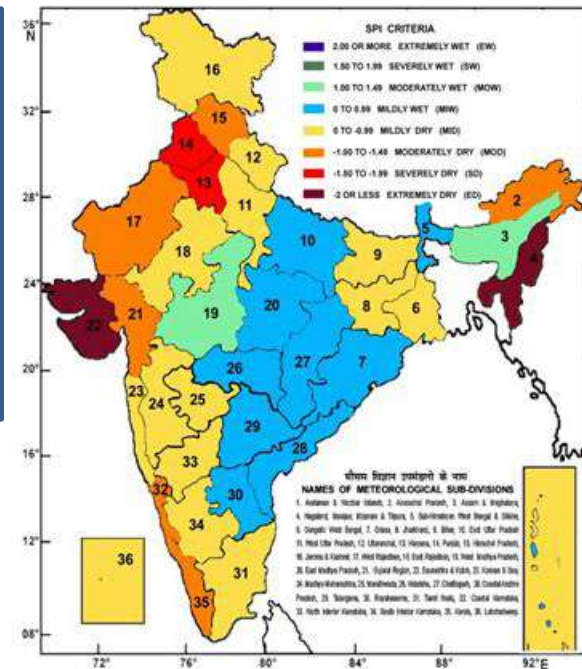


Monthly and cumulative SPI for June to September 2012

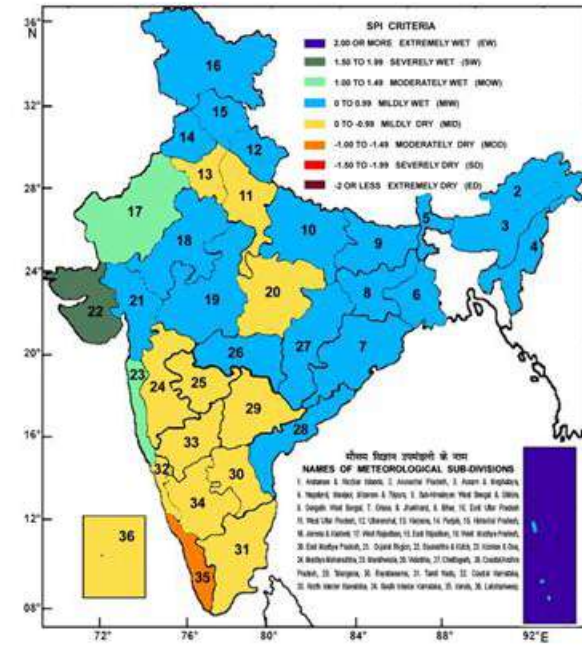
SPI (STANDARDIZED PRECIPITATION INDEX) MAP
June+July+August+September 2012



SPI (STANDARDIZED PRECIPITATION INDEX) MAP
JULY 2012

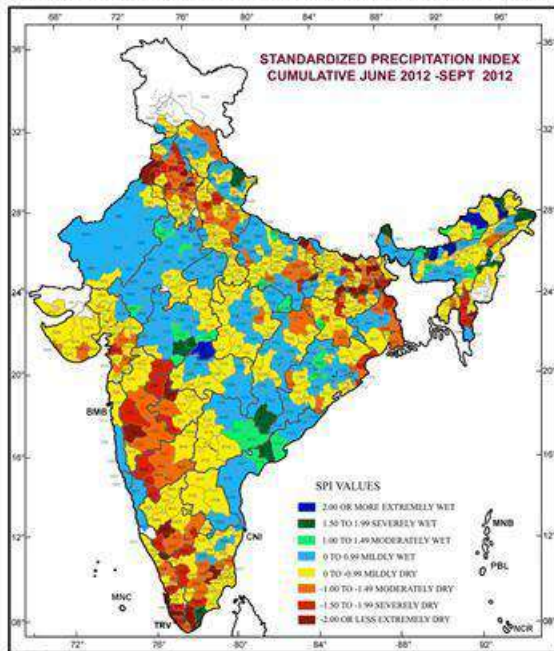


SPI (STANDARDIZED PRECIPITATION INDEX) MAP
SEPTEMBER 2012

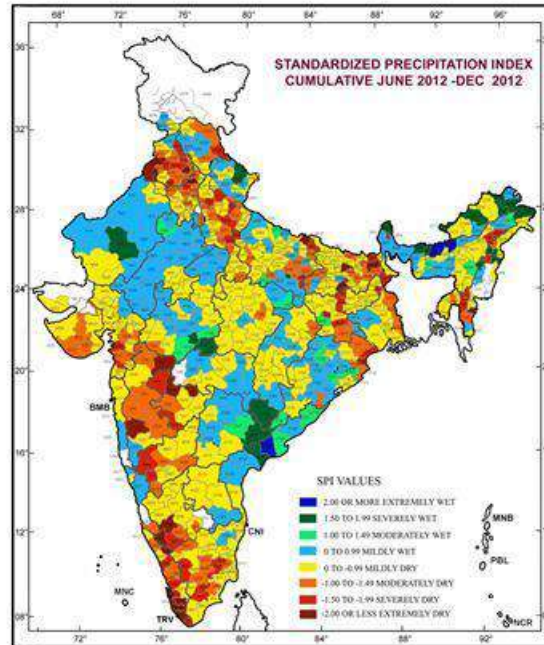


Four months cumulative SPI

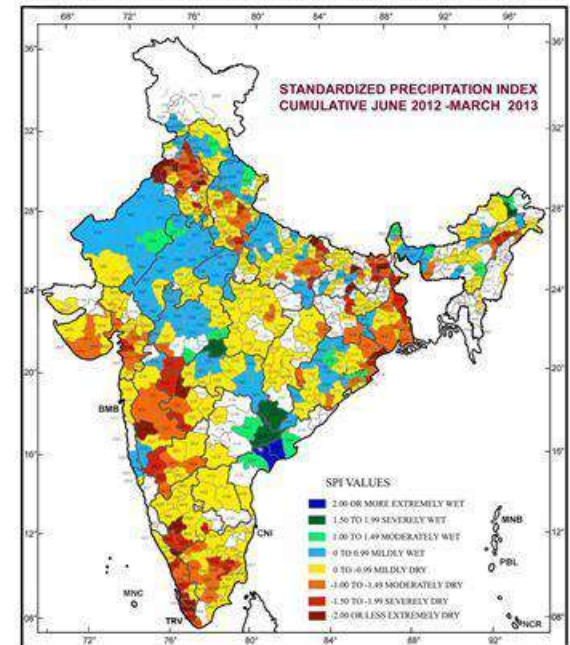
DROUGHT SITUATION IN INDIA SEPTEMBER 2012
FOUR MONTHS CUMULATIVE STANDARDIZED PRECIPITATION INDEX



DROUGHT SITUATION IN INDIA DECEMBER 2012
SEVEN MONTHS CUMULATIVE STANDARDIZED PRECIPITATION INDEX



DROUGHT SITUATION IN INDIA MARCH 2013
TENTH MONTHS CUMULATIVE STANDARDIZED PRECIPITATION INDEX



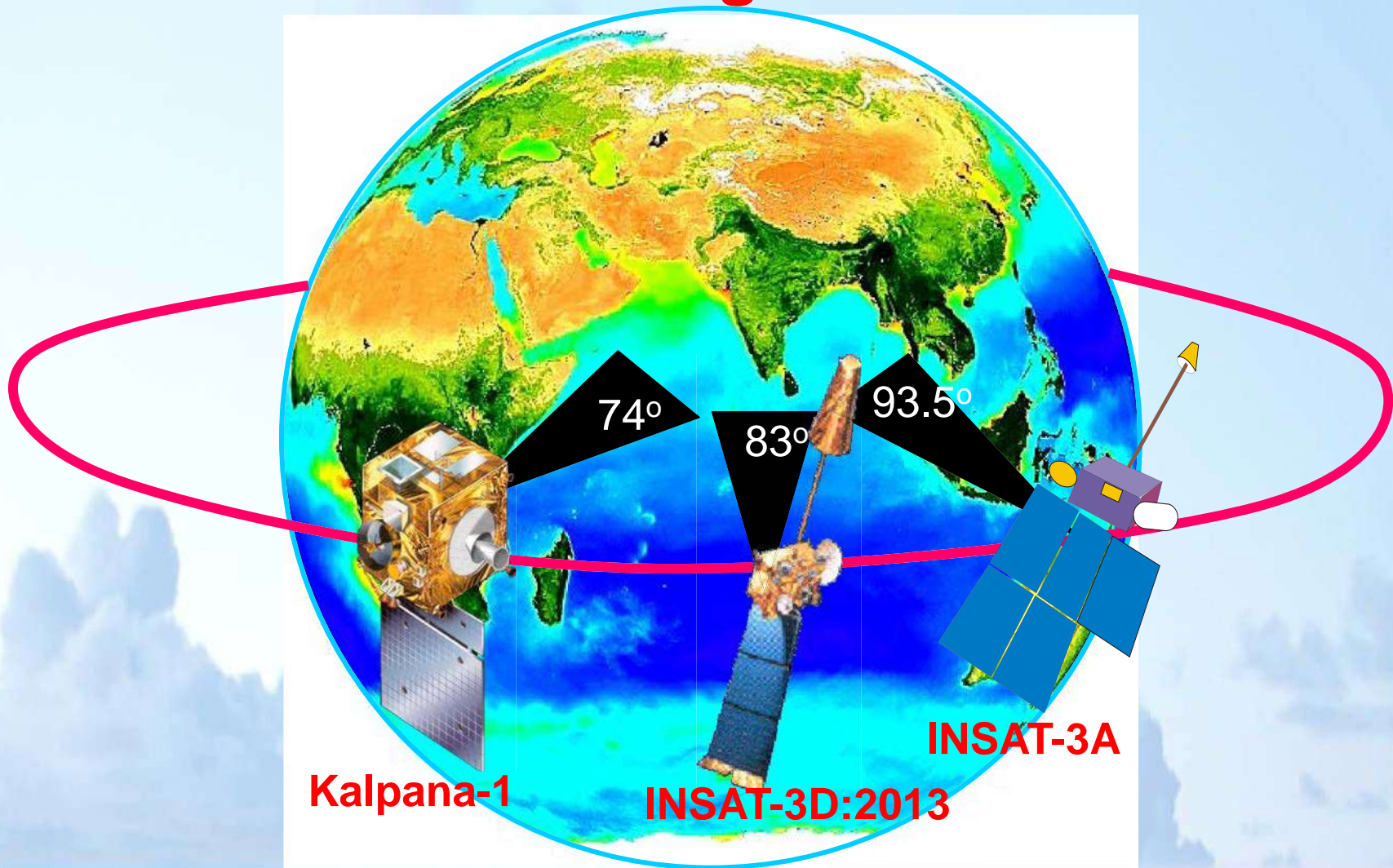
Early Warning System for Floods

Flood Forecasting

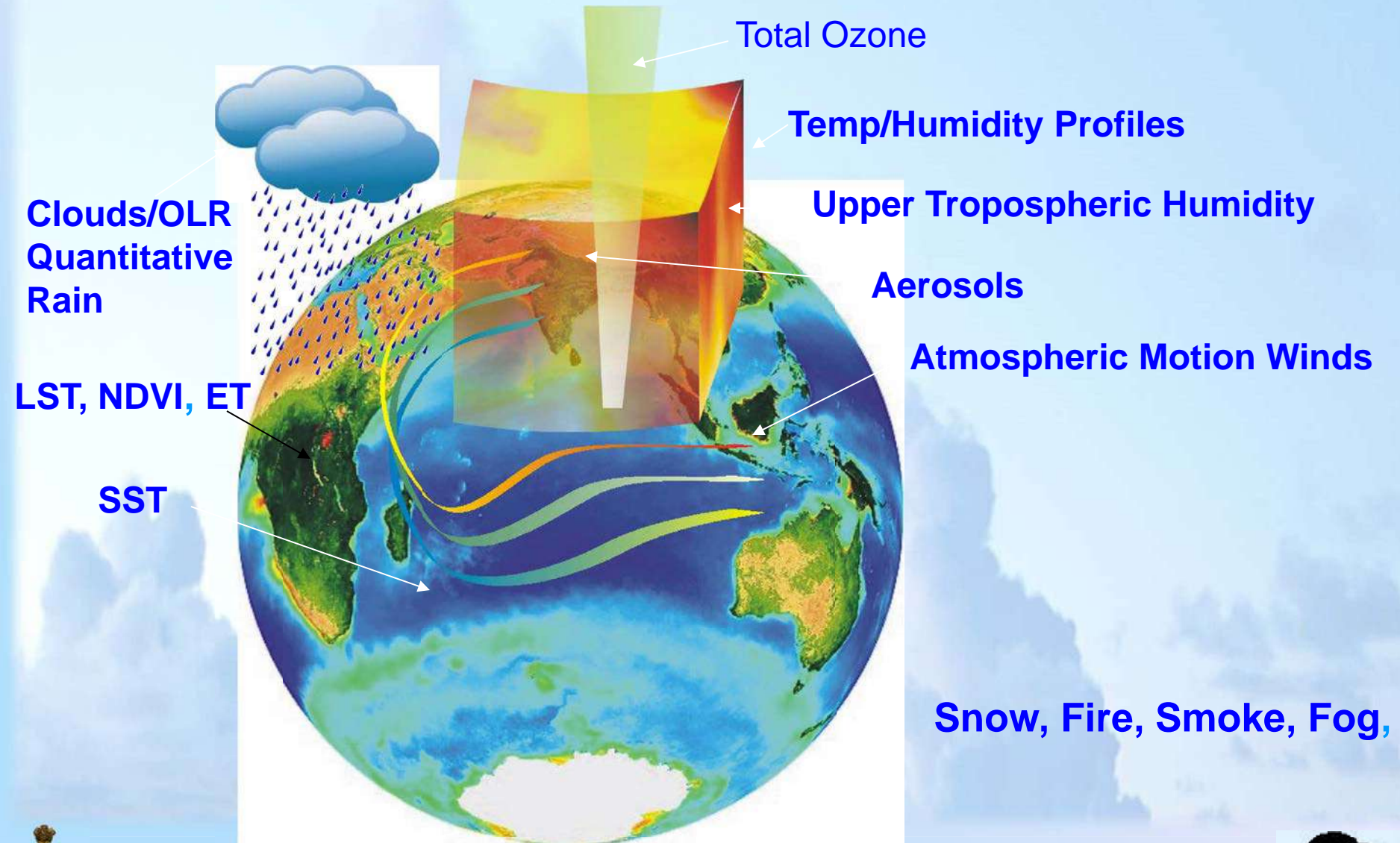
- **Coordination through 10 Flood Meteorological Offices of IMD**
- **166 Flood Forecasting Centres of Central Water Commission --- {134 level forecasting & 32 inflow forecasting}**



Current Indian Geostationary Meteorological Satellites



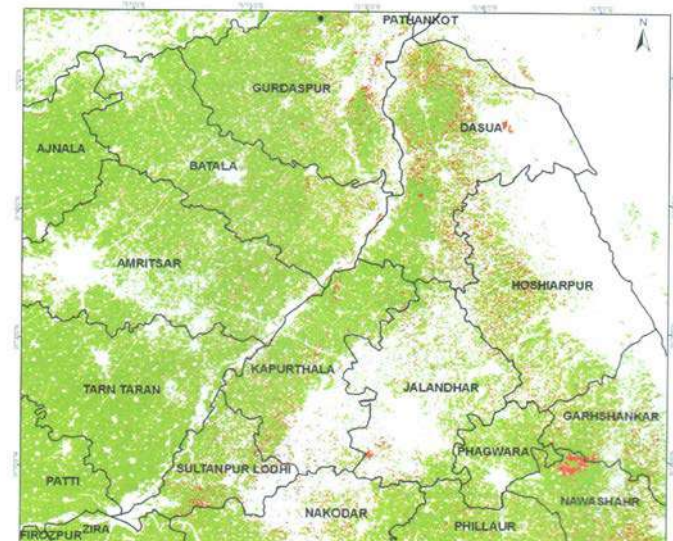
INSAT-3D : Science Products



Disease Tracking: Outbreak, persistence and damage assessment

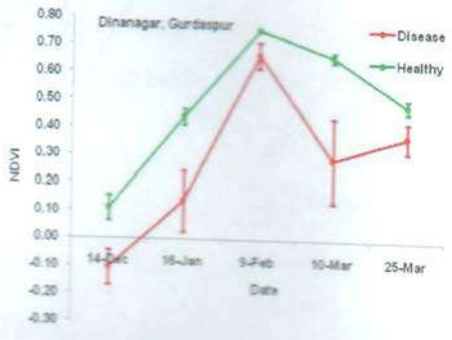


Damage detection (Sclerotinia rot in Mustard) using hyperspectral data

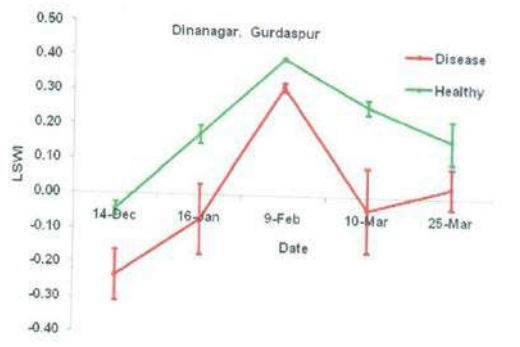


Spatial distribution of affected wheat areas by yellow rust using multi-spectral data of AWIFS over different district of Punjab

Spectral profile of NDVI healthy and disease sites in Gurdaspur taluka in Punjab



Spectral profile of LSWI healthy and disease sites in Gurdaspur taluka in Punjab



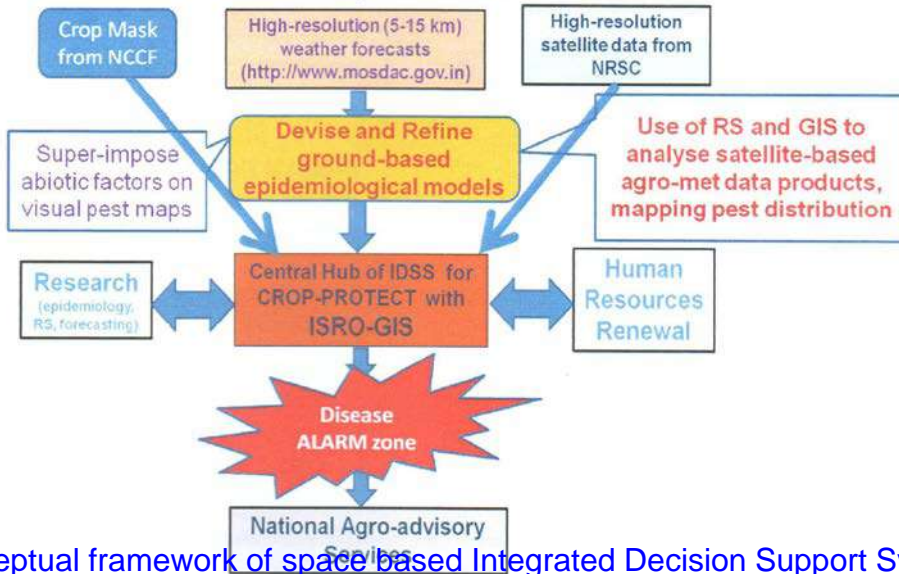
- ✓ Forewarning outbreak is crucial for initiating disease specific spraying
- ✓ Assessment of persistence helps in determining further and advanced control measures or likelihood of crop loss
- ✓ Damage assessment helps in setting crop insurance claim



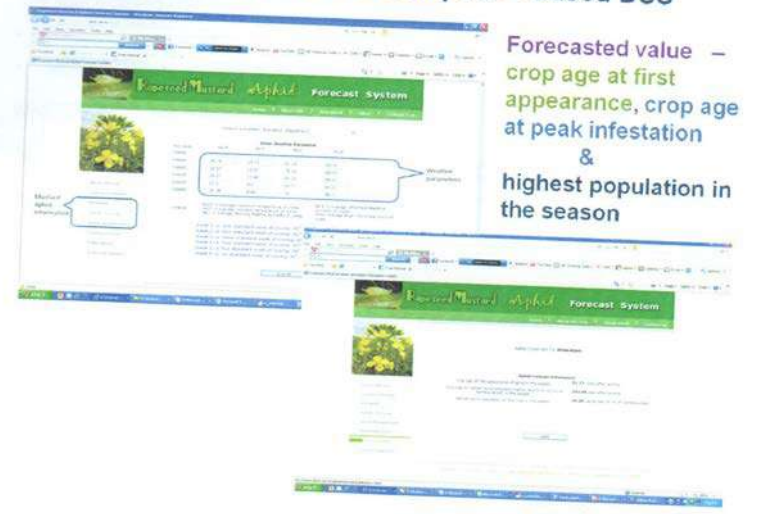
Pest forewarning and space based Decision Support System (IDSS)

Integrated Decision Support System (IDSS) for

Crop Protection Services



Weather-based Models & Computer - based DSS

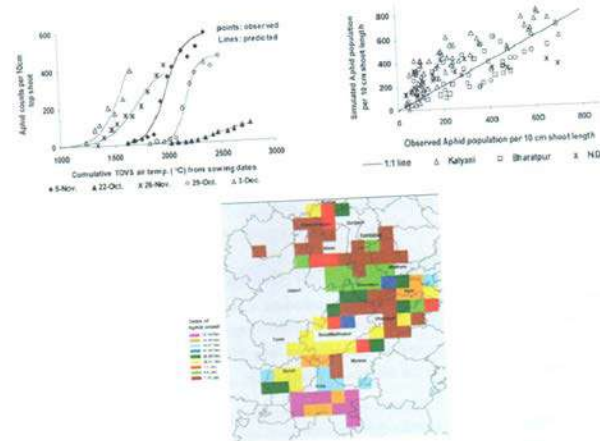


Operational mustard aphid forecast system for Bharatpur region, Rajasthan based surface weather measurements

Conceptual framework of space based Integrated Decision Support System

Scientific report

SAC/EPSA/ABHG/CAD/SR/02/2013

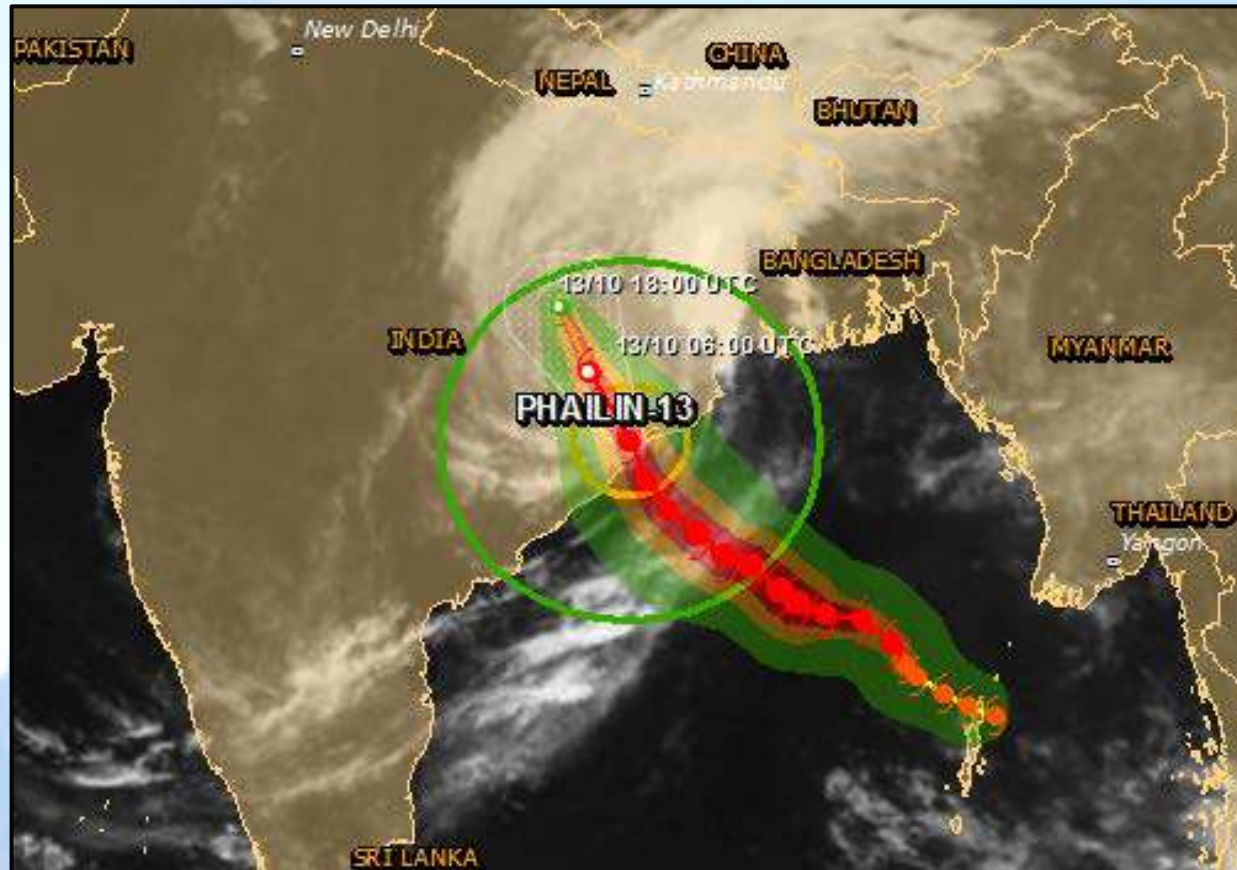


- The space based DSS can delineate alarm zones to alert farmers on spraying operations.
- High resolution weather forecast and observations along with established weather based pest forewarning models and satellite based broad crop phenometrics may be spatially extrapolated through the development of IDSS

Mustard aphid model using sounder data and regional extrapolation



Tropical Cyclone alert for PHAILIN-13 in India from 09/10/2013 18:00 UTC to 12/10/2013 18:00 UTC



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INDIA METEOROLOGICAL DEPARTMENT



Effects of Cyclone Phailin as it approaches the coast on 11th and 12th October



Waves smashing into a breakwater at a fishing harbour in Jalaripeta in the Visakhapatnam district in Andhra Pradesh October 11, 2013

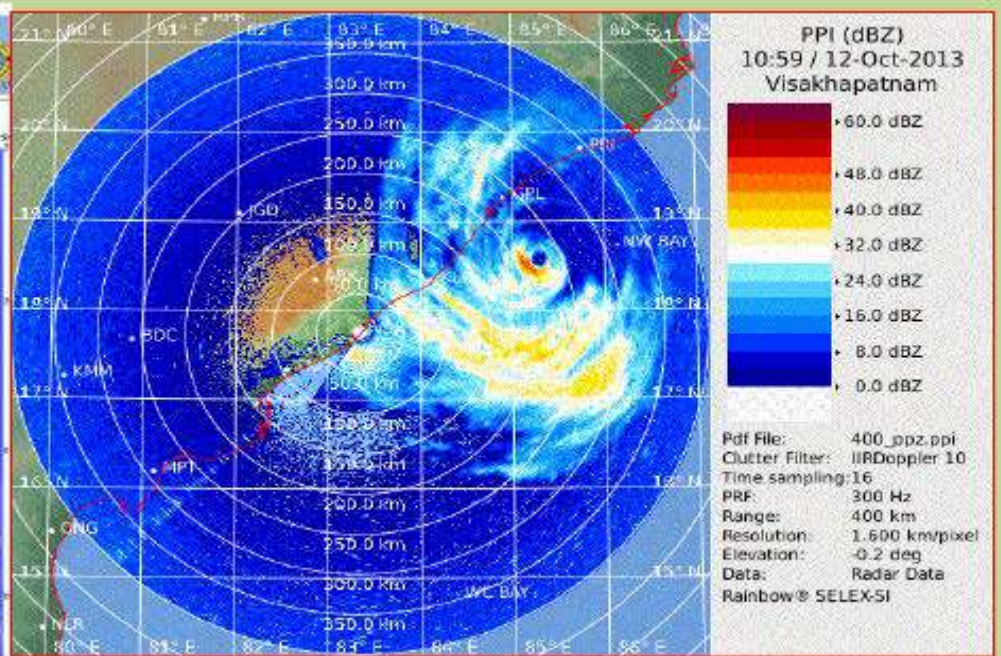
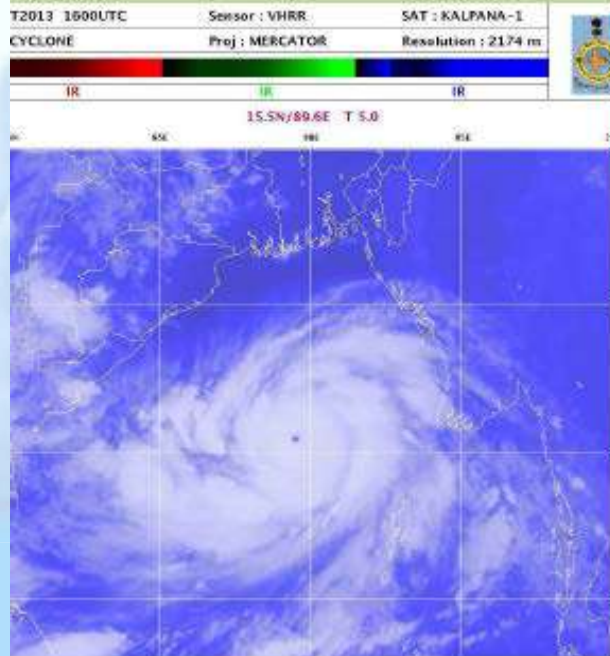
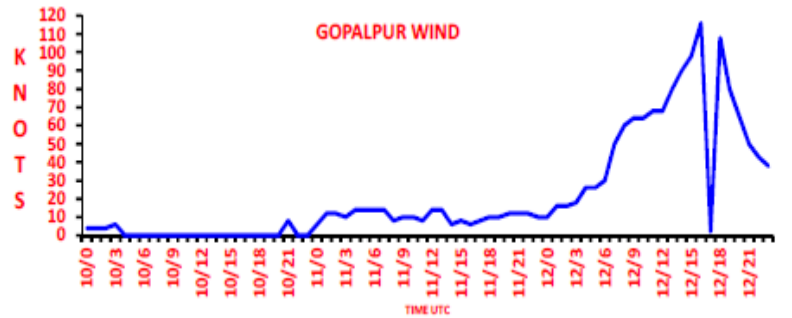
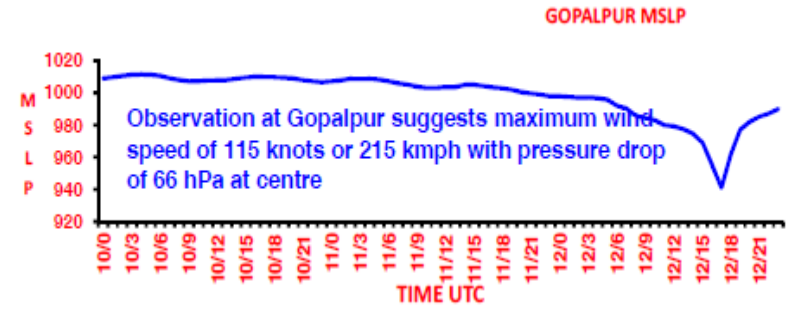
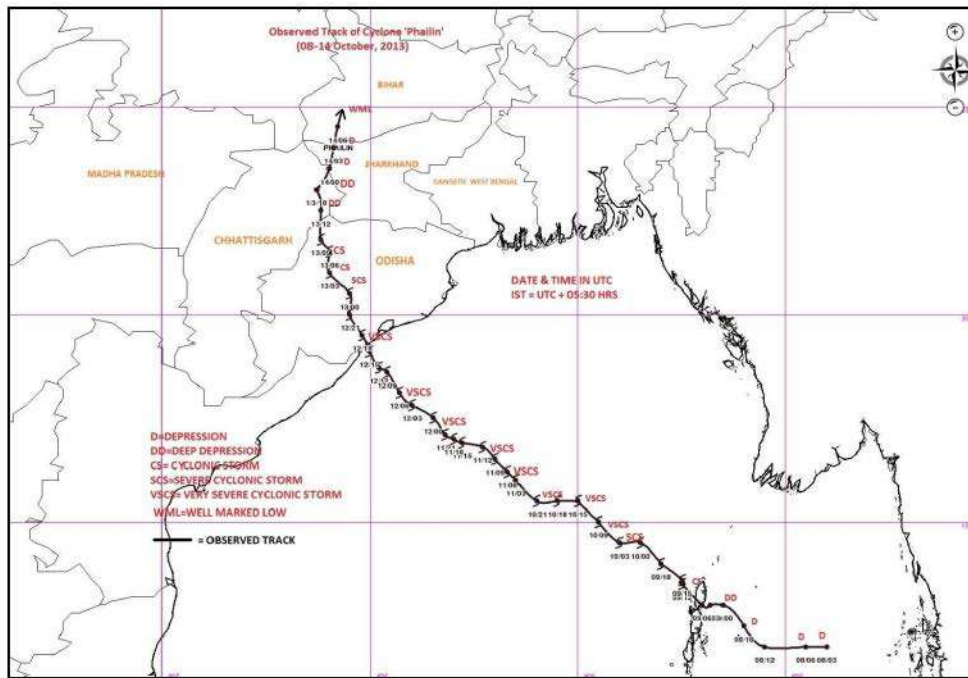


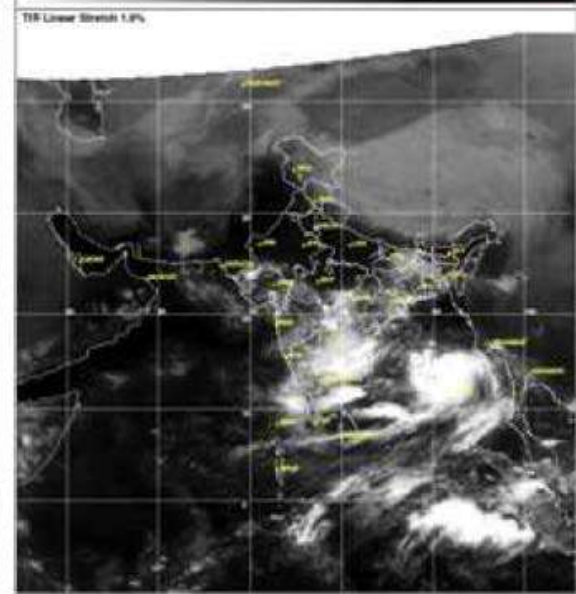
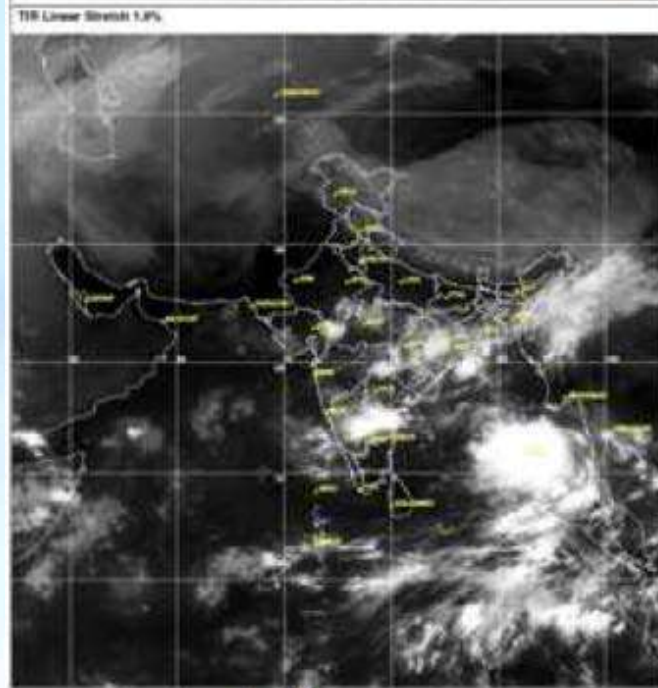
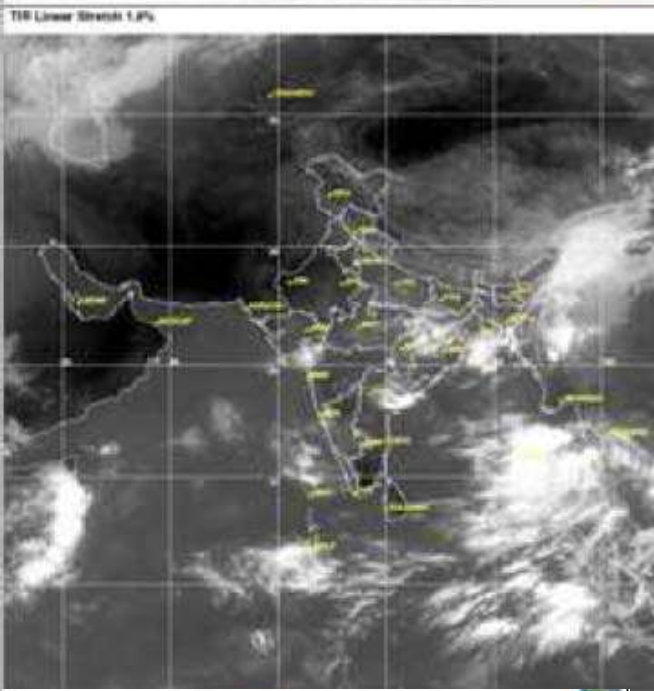
Heavy rain brought by Cyclone Phailin in Ichapuram town in Srikakulam district in Andhra Pradesh October 12, 2013.



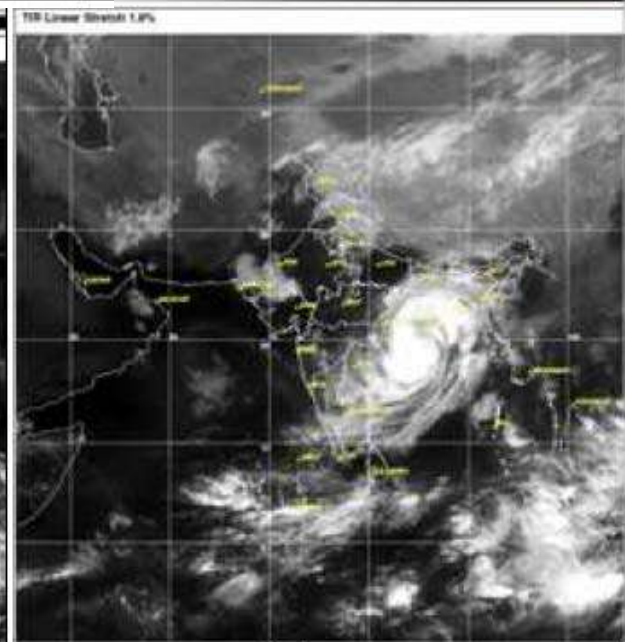
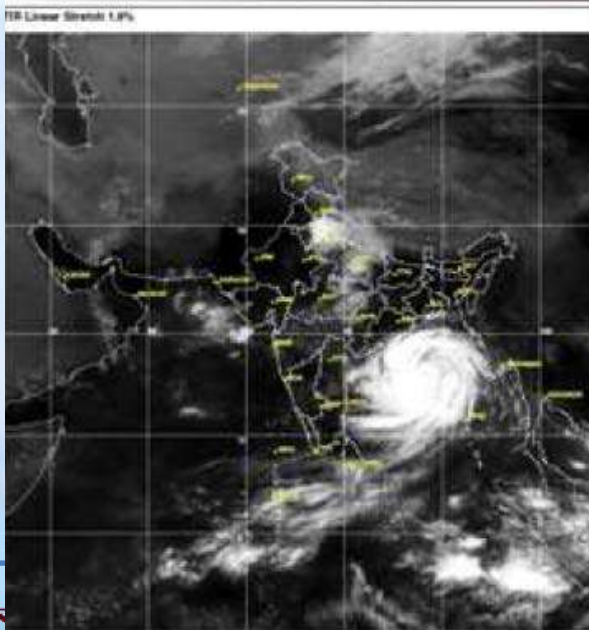
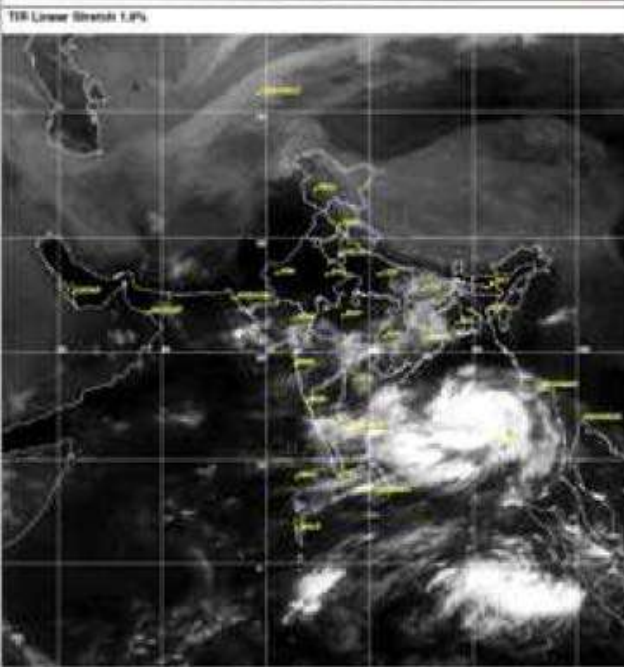
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INDIA METEOROLOGICAL DEPARTMENT





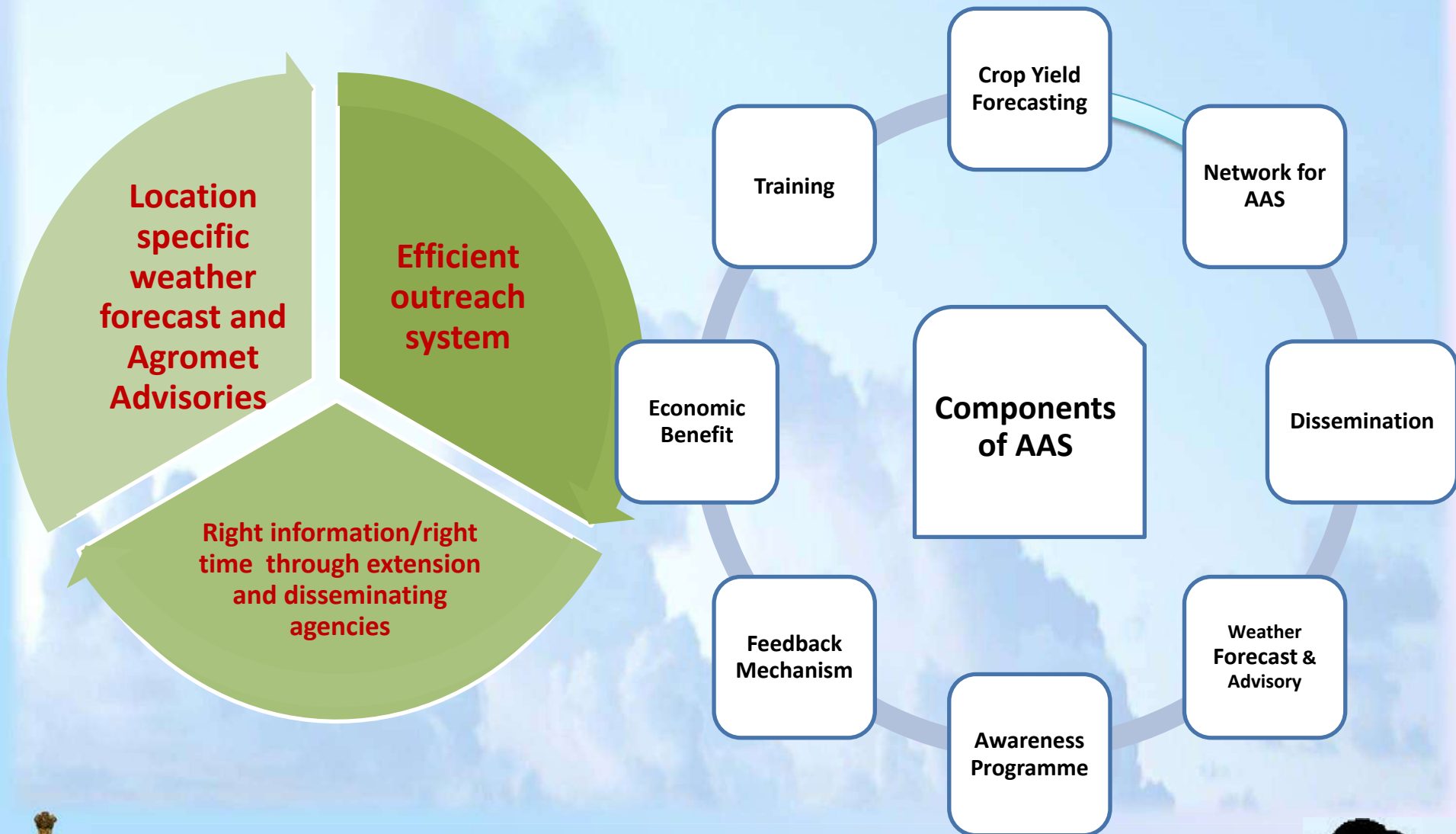


TIR Imagery



IR Imagery

Objectives & Components of Agromet Service



Collaborating Agencies

Multi-Disciplinary & Multi-Institutional

Indian Council For Agricultural Research

Department Of Agriculture & Cooperation

State Departments Of Agriculture

State Agricultural Universities And Other Universities

Department Of Space

Ministry of Information Technology

Ministry Of Earth Sciences

India Meteorological Department

National Centre For Medium Range Weather Forecasting

Indian Institute of Tropical Meteorology

Multi-Disciplinary & Multi-Institutional

National Informatics Centre

Ministry of Science & Technology

Ministry of Information & Broadcasting (AIR & TV)

Print Media

Min. of Rural Development

MSSR Foundation & Other NGOs & PP



Operational Agrometeorology

The Agromet services provide a very special kind of inputs to the farmer as advisories that can make a tremendous difference to the agriculture production by taking in time actions against extreme weather events.

This has a potential to change the face of India in terms of food security and poverty alleviation.

Network of AAS units in the



TIER 1

Apex Policy Planning Body, Delhi

TIER 2

**National Agromet Service HQ
Execution, Pune**

TIER 3

**State Agromet Centres (28)
Coordination/Monitoring**

TIER 4

**Agromet Field Units
Agroclimatic Zone Level (130)**

TIER 5

**District Level Extension and Training
Input Management as advisory~612**

**Network of 130
Agromet Field
Units**

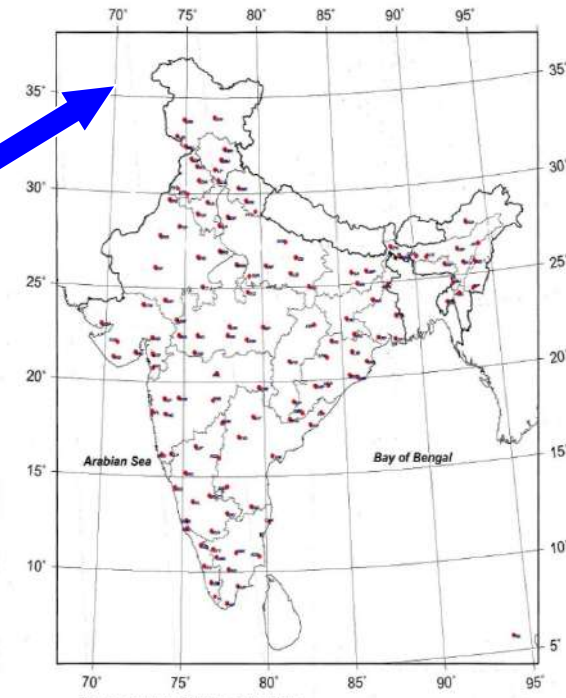
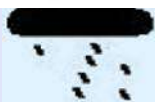


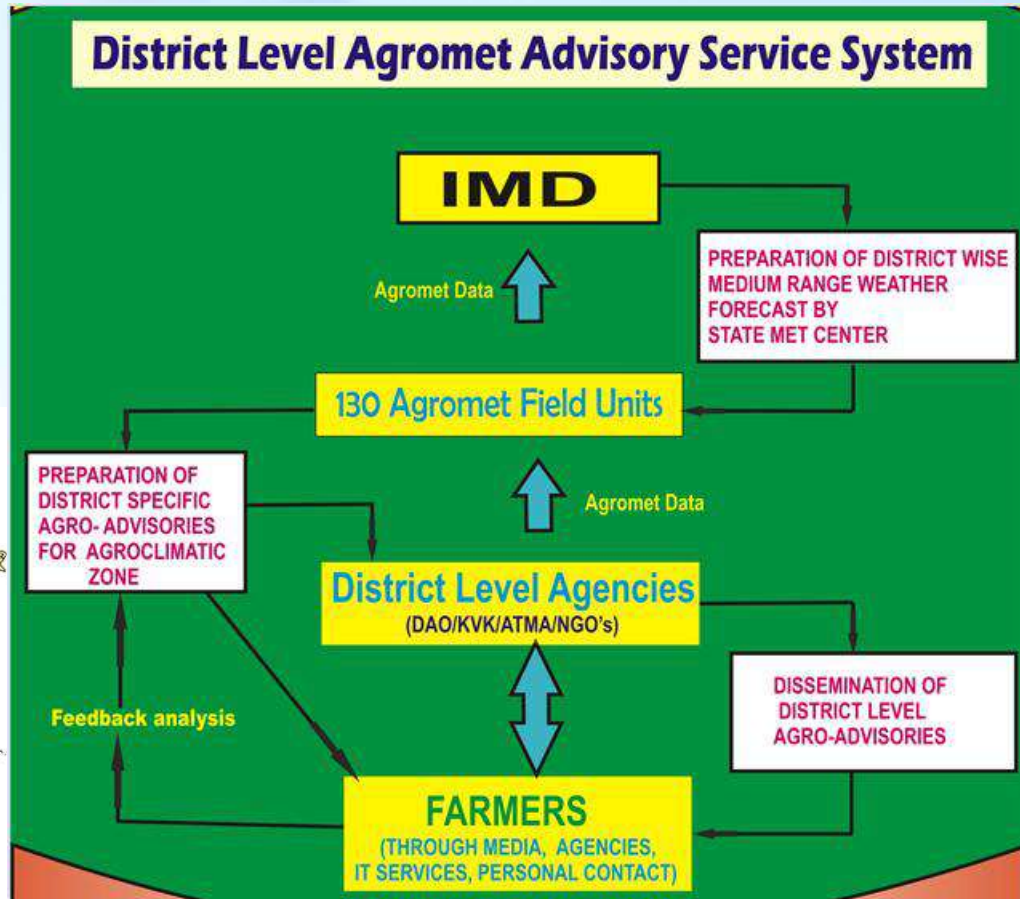
Fig 1. Map showing location of 130 selected stations



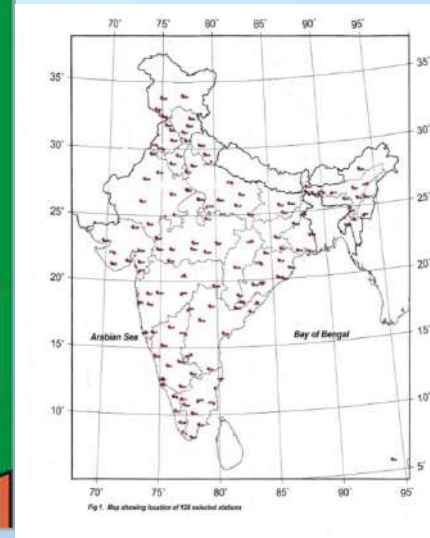
Network of Agromet Advisory Services

Two Ways of Communication System

Network of AAS units in the country



Network of 130 Agromet Field Units



District Level Five days **Weather** Forecast



Parameters:

- Rainfall
- Max and Min temperature
- Total cloud cover
- Surface Relative humidity
- Surface Wind

<http://www.imd.gov.in>

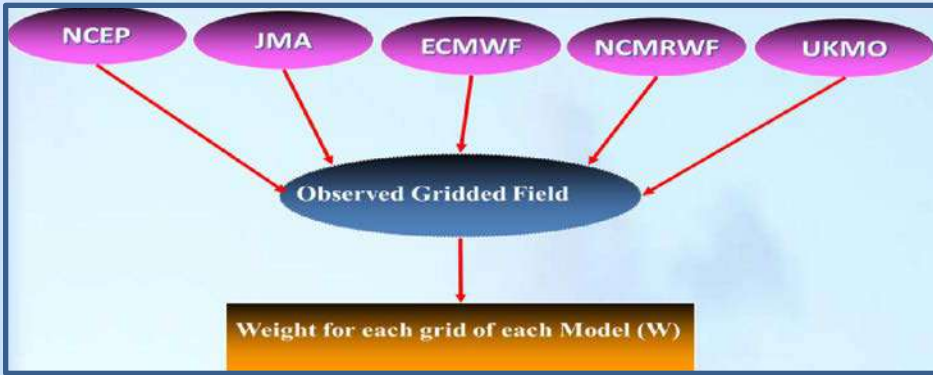
Implemented from 1 June 2008
Rainfall: MME based
Members: ECMWF, UKMO,
JMA, NCEP and IMD GFS T584



Risk-based Approach for AAS

- Obtain short/medium range forecast and seasonal weather predictions
- Link medium range Wx forecast with seasonal Wx forecasts to identify maximum risk during the entire crop season
- Increased emphasis on proactive approaches to manage adverse consequences.
- Suggest diverse management options through decision-making guidance (DSS Tools)
- Elucidate direct functional link between Wx conditions/hazards and selecting best management options.





Generation of district level weather forecast (DLWF)



DISTRICT LEVEL FORECAST

Currently these cover **640** districts of the country

INDIA METEOROLOGICAL DEPARTMENT
 MULTIMODEL ENSEMBLE BASED DISTRICT LEVEL WEATHER FORECAST
 ISSUED ON: 13-11-2009
 VALID TILL 08:30 IST OF THE NEXT 5 DAYS

DISTRICT : PUNE

STATE : MAHARASHTRA

PARAMETERS	ENSEMBLE FCST				
	DAY-1 14/11	DAY-2 15/11	DAY-3 16/11	DAY-4 17/11	DAY-5 18/11
Rainfall (mm)	0	8	15	15	6
Max Temperature (deg C)	29	26	26	26	27
Min Temperature (deg C)	19	20	20	21	21
Total cloud cover (octa)	7	8	8	7	8
Max Relative Humidity (%)	98	99	98	99	99
Min Relative Humidity (%)	93	92	92	87	82
Wind speed (kmph)	004	006	006	004	002
Wind direction (deg)	90	80	110	120	90

NOTE: -99.0 NO DATA



National Level Bulletin

National Agromet Advisory Bulletin
 Thursday 11. October 2012
 (for the Period 11th to 15th October 2012)

Issued by
National Agrometeorological Advisory Service Centre,
 Agricultural Meteorology division,
 India Meteorological Department, Pune.



State Level Bulletin

Agro-meteorological Advisory Bulletin for the State of Punjab
 for the period 12th to 15th October 2012

Issued on
Friday, 12th October, 2012

Issued by
Meteorological Centre Chandigarh
 In collaboration with
Punjab Agricultural University Ludhiana & Department of Agriculture, Punjab



District Level Bulletin for Chennai

தமிழ்நாடு மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
 (20.10.2012 முதல் 24.10.2012 வரை)

மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு

அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு (A.A.D.)

மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
 அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு

அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு

பகுதி	அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10
அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10
அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10
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அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10
அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10
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அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10
அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10
அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு	10	10	10	10	10

மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு

1. மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
2. மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
3. மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
4. மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு
5. மாநில அகரூப உயிரின வளர்ச்சித் துறை அமைச்சு



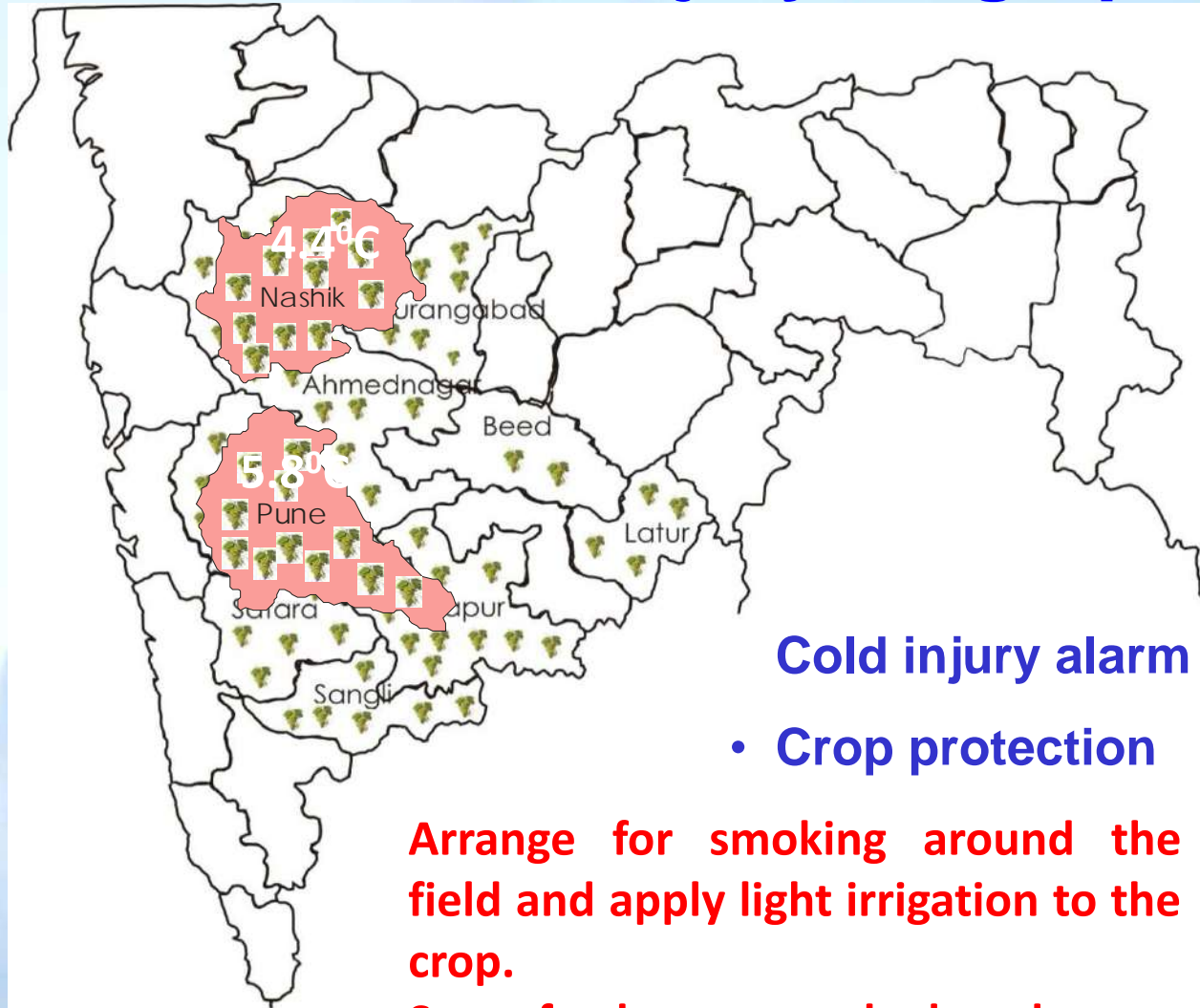
Weather Derivatives/Products



भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT



Cold injury on grapes



Cold injury alarm

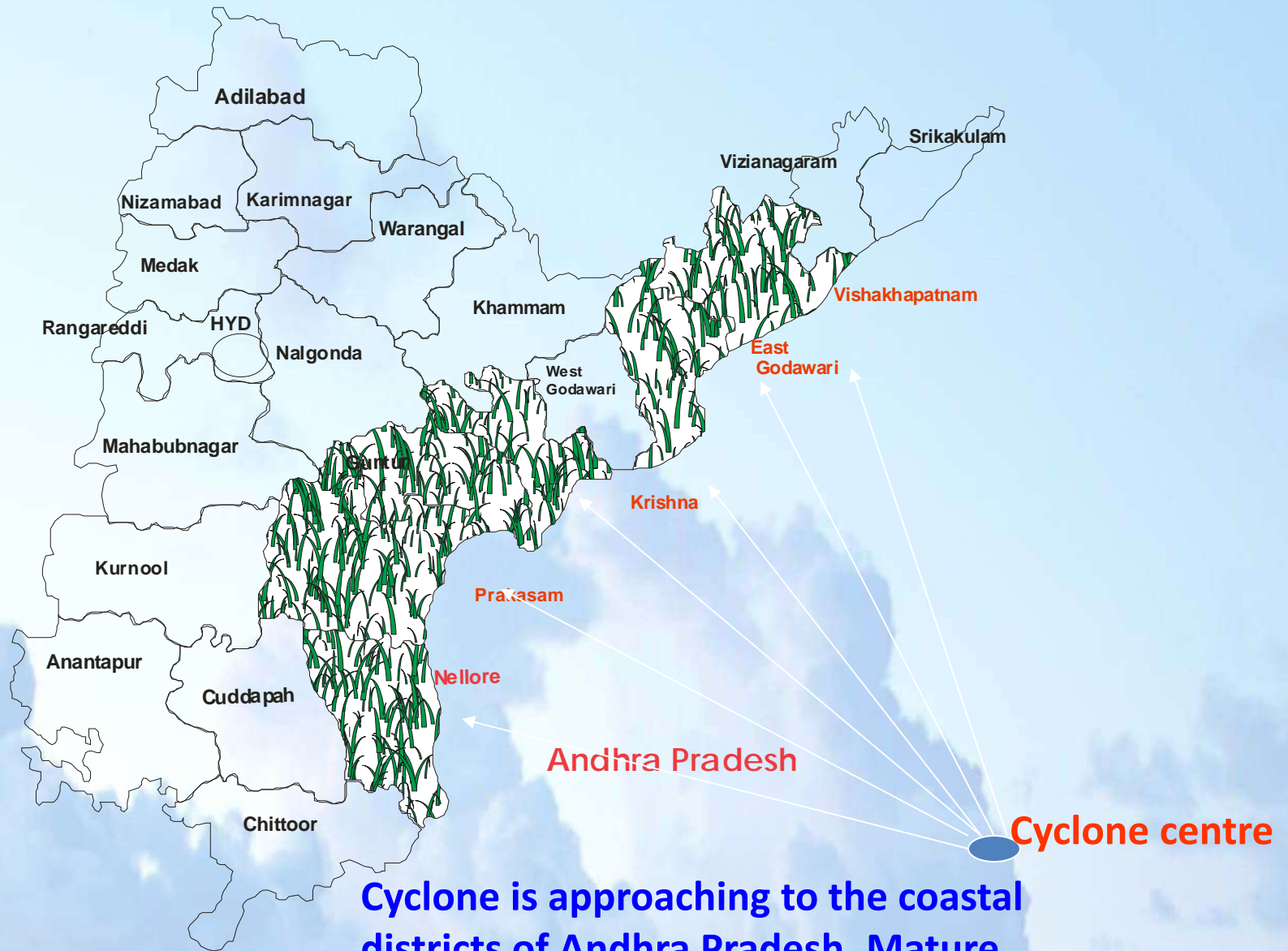
- Crop protection

Arrange for smoking around the field and apply light irrigation to the crop.

Spray fresh water to the bunches.

Grapes could suffer cracks due to the extreme cold conditions in the traditional belt of the crop in **Nasik** region where mercury dropped to 4.4°C, the lowest in the state, in Pune recording minimum temperature of 5.8°C and also next to Nasik where an average minimum temperature of 5 to 6°C was recorded.





Cyclone is approaching to the coastal districts of Andhra Pradesh. Mature crops may be harvested immediately.



Crop Weather Calendar

Crop weather Calendar depicts information of state and stage of the crop, Normal weather condition and warning. The components of crop weather calendars include :

- i) weather warning for the crops at various crop phenophases and
- ii) normal weather (standard week-wise) along with weather favorable for pests and diseases development.

Crop weather calendars for the states viz. Tamilnadu, Andhra Pradesh, Kerala, Himachal Pradesh, Assam, Gujarat, Orissa, Karnataka, West Bengal, Maharashtra and Rajasthan have already been published.

CROP WEATHER CALENDAR																		3										
STATE :		MADHYA PRADESH			CROP :		WHEAT			VARIETY :			WH-147, LOK-1, C-306, HDM-1553, N-4			SOIL :			SANDY LOAM, CLAY LOAM, BLACK COTTON, ALLUVIAL									
DISTRICTS :		GWALIOR, DATIA, SHIVPURI, GUNA			IRRIGATED/NON-IRRIGATED :		DURATION :			110-145 DAYS																		
Weather warnings	Rain	> 50 MM/DAY			> 100 MM/DAY			> 100 MM/DAY			> 100 MM/DAY																	
	Duration of wet spell	> 30 MM FOR 3-4 DAYS			> 75 MM FOR 3-4 DAYS			> 75 MM FOR 3-4 DAYS			> 75 MM FOR 3-4 DAYS																	
	Cloudy weather				CLOUDY WEATHER			CLOUDY WEATHER			CLOUDY WEATHER																	
	Drought	20 DAYS			20 DAYS			20 DAYS			20 DAYS																	
	High winds	> 50 KM/HR			> 50 KM/HR			> 50 KM/HR			> 50 KM/HR																	
	Temperature	MAX. TEMP. > 30°C, MIN. TEMP. < 15°C			MAX. TEMP. > 30°C, MIN. TEMP. < 15°C			MAX. TEMP. > 30°C, MIN. TEMP. < 15°C			MAX. TEMP. > 30°C, MIN. TEMP. < 15°C																	
Weather conditions favourable for incidence of pests and diseases	Hail Storm				HAIL STORM			HAIL STORM			HAIL STORM																	
	Pests	STEM BORER, APHIDS, TERMITES, ARMY WORMS/CUT WORMS			STEM BORER, APHIDS, TERMITES, ARMY WORMS/CUT WORMS			STEM BORER, APHIDS, TERMITES, ARMY WORMS/CUT WORMS			STEM BORER, APHIDS, TERMITES, ARMY WORMS/CUT WORMS																	
	Weather	CLOUDY WEATHER			CLOUDY WEATHER			CLOUDY WEATHER			CLOUDY WEATHER																	
Weather	Diseases	RUST, LEAF SPOTS, LEAF BLIGHT			RUST, LEAF SPOTS, LEAF BLIGHT			RUST, LEAF SPOTS, LEAF BLIGHT			RUST, LEAF SPOTS, LEAF BLIGHT																	
	Weather	HIGH HUMIDITY, CLOUDINESS			HIGH HUMIDITY, CLOUDINESS			HIGH HUMIDITY, CLOUDINESS			HIGH HUMIDITY, CLOUDINESS																	
Normal phase wise water requirement(mm)		47			128			77			137			39			TOTAL = 428											
Weekly normal weather	Rainfall(mm) total	1.5	3.2	4.2	8.5	12	1.8	2.0	1.3	3.4	3.7	2.1	12	4.7	4.7	3.9	3.0	1.3	0.7	1.3	0.4	1.1						
	Max. temp. °C	28.4	28.9	28.4	28.8	28.5	26.9	23.8	23.3	23.2	23.0	24.9	24.5	25.3	26.8	27.6	29.4	31.4	32.7	33.8	35.0	35.3						
	Min. temp. °C	12.2	11.3	9.8	8.2	7.9	7.9	7.1	6.7	7.4	7.3	7.9	8.1	8.2	10.2	10.9	12.2	13.7	15.1	14.3	17.9	19.0						
Sunshine hours	9.5	9.4	9.1	8.6	8.9	8.8	8.2	8.3	8.7	8.4	8.5	8.1	9.8	9.8	9.8	9.4	9.1	8.8	8.4	8.2	9.7	10.0						
Life history and mean dates of important epochs of crop growth																												
Standard weeks		44	45	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Months		NOVEMBER					DECEMBER					JANUARY					FEBRUARY			MARCH			APRIL					

D.D.G.M.(AGRIMET),L.M.D;PUNE 2005



Pest Weather Calendar

Temperature (both the maximum and the minimum), relative humidity, rainfall, cloudiness, soil moisture, wind, light, have influence on occurrence of pests and diseases and hence, are useful in developing forewarning models.

Pest weather calendars are also prepared by using these parameters, which can act as reference tool.

PEST WEATHER CALENDAR

STATE:KERALA
STATION:PATTAMBI

CROP:RICE
PEST:GALL MIDGE

SEASON : KHARIF

Weather warnings	Max. temp. 0C	>33.3 ^o C(36 wk)								
	Min. temp. 0C									
	Morning RH (%)									
	Afternoon RH (%)	>71.0%(36 wk)								
	Sunshine hours	>7.4hour(36 wk)								
	Total Rainfall (mm)									
Weekly normal weather	Rainfall(mm) total	37.9	33.8	41.5	65.7	47.2	55.2	78.1	61.7	53
	Max. temp. ^o C	30.1	30.5	30.6	30.5	30.8	31.2	31.5	31.4	31.9
	Min. temp. ^o C	22.8	22.9	22.9	22.9	22.9	22.9	22.9	22.8	22.7
	Sunshine hours	6.3	6.8	6.3	6.3	6.0	6.3	5.7	6.2	6.7
	Morning RH (%)	94	94	94	94	95	95	95	94	94
	Afternoon RH (%)	70	67	70	67	69	68	68	67	64
Mean dates of important epochs of crop growth and pest development										
Standard weeks	36	37	38	39	40	41	42	43	44	
Months	SEPTEMBER				OCTOBER					



Special advisories for extreme weather events



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INDIA METEOROLOGICAL DEPARTMENT



Agro meteorological Advisory Services Chennai
(Issued jointly by Tamil Nadu Veterinary and Animal Sciences University,
& India Meteorological Department)
Severe cyclonic storm THANE and Heavy Rainfall Warning

Advisories for extreme events

This is issued to Chennai, Thiruvallur, Kancheepuram, Villupuram and Cuddalore Districts

The very severe cyclonic storm THANE and heavy rainfall has been predicted for next 24 hours

Extensive damage may be expected to weak **animal houses**, thatched roof and huts. Minor damage to power and communication line due to uprooting of large avenue trees and flooding of escape routes also expected.

Farmers are advised to safe guard their **animals** from severe rain and wind blow.

Young animals to be protected from chillness by way of providing side curtains in the animal houses.

In case of broiler house, the side has to be protected to avoid feed wastage due to wind blow and birds can be protected from chillness.

In case of **horticulture crops** may be protected by providing support to avoid being uprooted.

Fishermen's are advised not to venture in to the sea because of cyclonic storm and heavy wave tides.

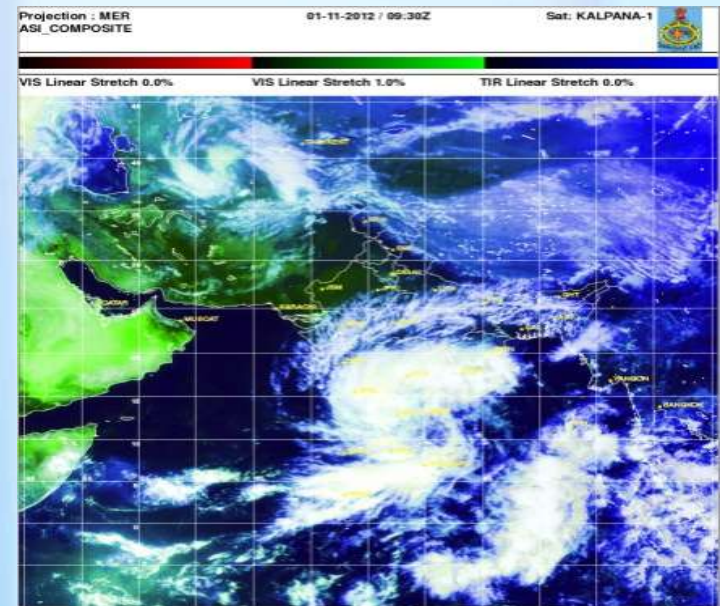


Advisories during Nilam

High wind speed (nearly 75 kmph at Chennai) and rainfall occurred on 30 and 31 October, 2012 due to cyclone 'NILAM'

Livestock Advisory

Due to heavy rain along with high wind-speed, farmers in the North Eastern Zone of Tamil Nadu are advised to house animals in well constructed sheds, protect the young animals from chillness and rain, avoid stagnation of water nearby animal shed and clean the bushes to avoid multiplication of flies so that vector born diseases like anaplasmosis, theilerosis, babesiosis and trypanosomiasis can be prevented.



Special Advisories Issued AMFU Bhubaneswar



Integrated Agromet Advisory Services
Orissa University of Agriculture and Technology
Bhubaneswar -751 003



Advisories for cyclonic storm "PHAILIN" on standing crops

Intervention in Kharif Crops

- Drain out the excess water from the rice fields .
- Completely drain out non-paddy crops
- Spray 2% salt solution to standing crop at maturity.
- Harvest non-harvested Matured crops and keep on aerated safe place
- Strait up the lodged crops
- Apply 2nd top dressing of nitrogen or foliar spray of urea to long duration rice after flowering
- Control pests such as leaf eating caterpillar
- Harvest groundnut and hang in bunches at aerated safe place.
- Pop the sugarcane crops again

Intervention in Rabi crops

- Priority of reservoirs for irrigation
- Bring all the LI points into functioning on war footing
- Ensure power supply to LI points
- Ensure fuel supply for irrigation pumps
- Thrust on rainfed rabi pulses like greengram, blackgram and oilseeds like groundnut, mustard, sesame, sunflower. Seed is critical
- Thrust on growing rabi maize in coastal areas
- Trust on potato as much areas possible
- Encourage (by subsidy, etc) to use complex and compound fertilizers as these boost up the yields.
- Encourage gypsum application as much as possible in pulses and oilseeds.
- Facilitate Zn, Cu, B application giving subsidy
- Monitor pest control by extending the e-surveillance to Rabi season

Special Advisories Issued AMFU Anakapalle

Acharya N.G. Ranga Agricultural University
Regional Agricultural Research Station, Anakapalle
Integrated Agro-Meteorological Advisory Services Scheme

Advisories for cyclonic storm “PHAILIN” on standing crops



- **Paddy** : Draining out the excess water from the field as early as possible. Lifting and Staking of lodged hills. Apply booster dose of urea 25 kg and 10-15 kg of potash per acre or spray multiK (13-0-45) @ 10 gm /lt of water. Apply 15-20 kg of potash or spray multi-K (13-0-45) @ 10 gm /lt of water to the crop and spray strepto cycline @ 0.1 gm /lt where BLB noticed (varieties: BPT-5204, MTU-1001, MTU-1075).
- **Maize**: Lifting of the crop and earthing up where ever possible
- **Cotton** : Spray with COC 3g+ Strepto cycline 0.1 gm /lt and spray 19:19:19 2 10 gm /lt water 4 days after fungicide spray
- **Sugarcane**: Drain out the water ,lifting of cane and propping application of booster dose fertilizers



Contingency Plan for the Year 2009

Bihar

- Mid July is a peak time for rice transplanting .
- In delayed rain situation protect rice seedling and transplanting can be done after providing irrigation. Prefer early /mid duration rice variety for transplanting.
- In deficit rain situation adopt SRI method of rice cultivation.
- If the sowing of medium & long duration rice varieties have not been done for any reason, this may be done immediately considering that late maturity wheat can be sown after harvesting of rice.

Jharkhand

- Undertake sowing of high yielding in variety of maize like swan composite, Birsa maize, Kanchan & hybrid GS-2.
- Undertake sowing of arhar variety Upas & Laxmi.
- Undertake sowing and transplanting of ragi variety like A-404, Birsa Ragi-1. If the seedling is about 8 – 10 days foliar spray of 1 % urea be provided. The seedling may be transplanted in 15 to 20 cm row to row.



Contingency Plan for the Year 2012

Karnataka: Contingency plan has been issued in two stages-

- First stage contingency plan has been issued on second week of July 2012.
 - Sowing of finger millet, maize, sunflower, tobacco, cowpea, sorghum, maize, cotton, red gram (medium duration varieties like BRG-1, 2), sunflower (SB-275) was advised.
- Second stage contingency plan was issued during middle of August 2012.
 - Direct sowing of ragi was suggested till 18th August and after that transplanting of ragi and sowing of minor millets till 1st fortnight of September and transplanting of tobacco and chilli, sowing of sunflower, desi Cotton and planting of onion as well as intercrops like cotton + onion, cotton + chilli etc. were suggested.



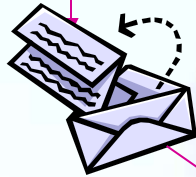
Operational communication linkage between Agromet Advisory Service Unit and end-users (farmers) for effective communication



Forecast from IMD, New Delhi

State Met Centres

**Agromet Advisory Bulletin
by AMFUs**



**SMS on
mobile**



**Personal
Contact**



State Agril. Dept.



KVK

Farmer



Television



Radio



News Papers

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Mobile Call Flow – Agro Advisory Bulletin

Agro Advisory Icon



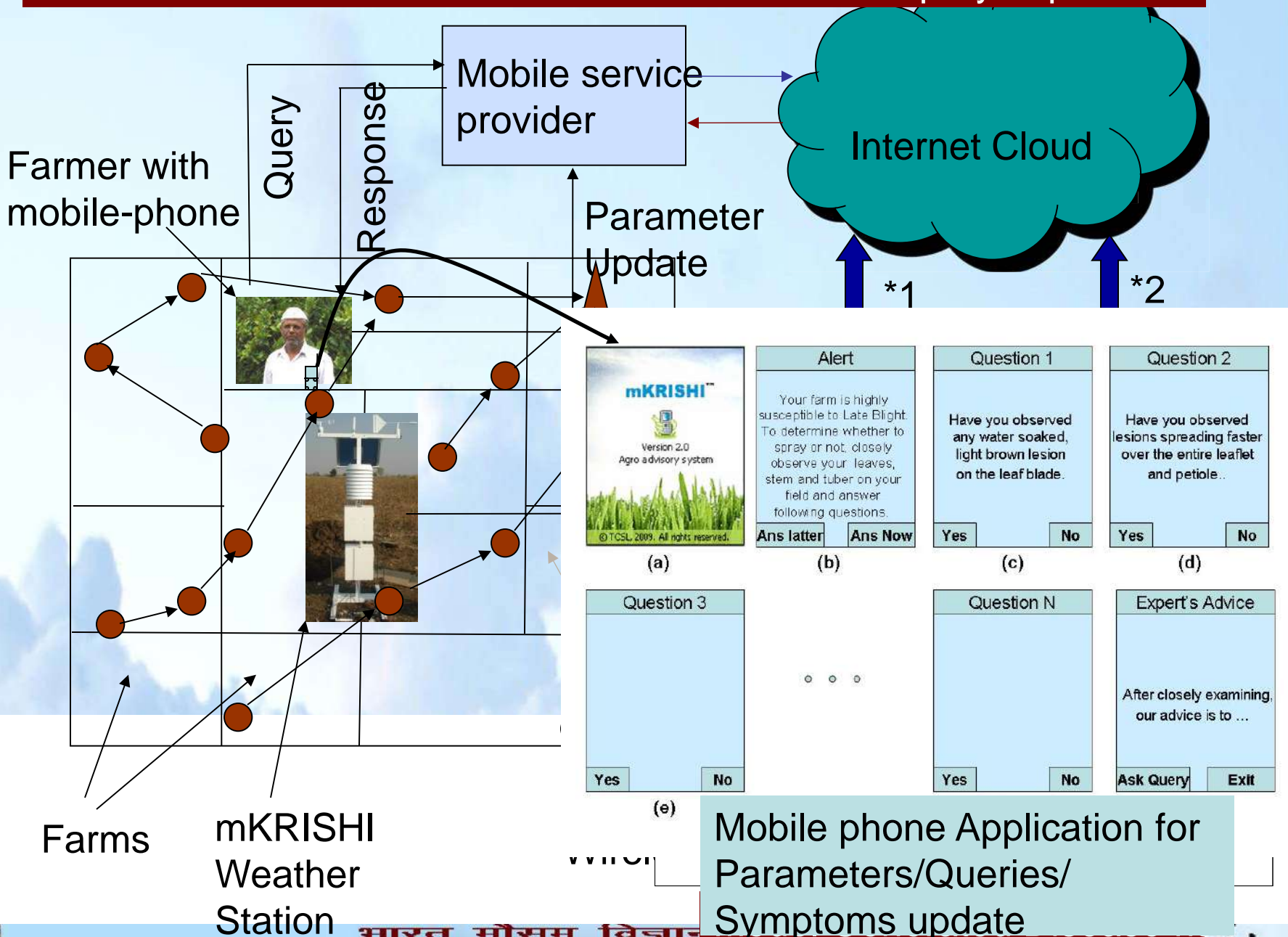
Map showing the coverage of SMS service in India through PPP mode



Reuters Market Light



Accurate Plant Disease forecast and minimize the spray of pesticides



Dissemination of agromet advisory through SMS



Name of the agency	Status of SMS
Reuter Market Light	387989
Handygo	221000
IKSL	1412357
Nokia Tools	974038
State Department	325409
Total	3320793

Disseminated Agromet Advisory to 3.4 million farmers through PPP mode (Reuter Market Light, Handygo,, IFFCO Kisan Sanchar Limited (IKSL), Nokia and State Govt. of Maharashtra

Current dissemination projects

Proposed dissemination projects

Proposed projects of dissemination of agromet advisory



Impacts of SMS

Ways in which farmers have saved money as a result of AAS include the following:

- communicated that he was about to sow carrot seeds, but upon receiving an SMS that heavy rains were coming, he postponed the sowing. Had he not received the message and gone ahead with sowing, he would have lost 25,000 rupees and his efforts would have gone to waste

Vikas, a farmer in Nizampur village near Delhi

In Palla village, near Delhi, farmer Surendra

- had decided to irrigate his paddy crop, but on receiving an SMS that it would rain in the next couple of days, he postponed irrigating, saving on costs, including electricity

- was planning to spray fertilizer during September. An SMS text that there would be rains within the next two days convinced him the time was not right. If he had ignored the message, rain would have washed away all the fertilizer

A farmer in Nekpur village in Bulandshah in the state of Uttar Pradesh





Trainings

Agromet Core Course

Basic Agromet Course

Meteorologists
Grade II

Foreign Training

Summer Placement
Course

Refresher Course

Agromet Observers'
Course

Training course on
'Agrometeorology
towards better
advisories for serving
end users requirement'



Two weeks foreign training for personnel from Africa, Asia including North Korea would be organized from 28th January to 9th February 2013



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INDIA METEOROLOGICAL DEPARTMENT**



Popularization Mechanism

Done Field visit at Sakurde, Boregaon and Baramati in Maharashtra

By the end of January 2012 Farmer Awareness Programme at 79 AMFUs



State level Consortium on AAS at 3 States involving KVK, ATMA, NGO and other Stake holders



Brochures in 14 different languages prepared



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INDIAN METEOROLOGICAL DEPARTMENT

Farmer Awareness Programme



By getting involved in the observation of weather data, farmers can help to produce location-specific agromet advisories

Farmers are provided with rain gauges by the programme



மா.சா. சுவாமிநாதன் ஆராய்ச்சி நிறுவனம்

கிராமவள மையம், திருவையாறு.

தனியொரு குடும்பத்தின் தேவை மற்றும் விபரங்கள் கணக்கெடுப்பு

- படிவ எண் : கணக்கெடுப்பு நாள் : கணக்கெடுப்பு செய்தவர் :
- கிராமம் : மாவட்டம் : குடும்பத்தலைவர் பெயர் :
- கதவு எண் தெரு :
- பாலினம் : ஆண் பெண்
 - வயது [கடைசி பிறந்தநாள்] வருடம்
 - தகுதிகள் : திருமணமாகாதவர் திருமணமானவர் விதவை
 - மதம் : இந்து கிறிஸ்தியன் முஸ்லீம் பிறமதத்தவர் [குறிப்பிடுக]
வகுப்பு :
 - கல்வித்தகுதி :
 - குடும்ப உறுப்பினர் விவரம் : ஆண்கள் பெண்கள்
குழந்தைகள் மொத்த எண்ணிக்கை
 - குடும்ப உறுப்பினர்கள் கல்விநிலை
பள்ளி சென்றவர்கள் தொடக்கப்பள்ளி
உயர்நிலைப்பள்ளி கல்லூரி
முதியோர்கல்வி பயின்றவர்
13 லிருந்து 17 வயது பள்ளிக்கு சென்றவர்கள்
பள்ளிக்கு செல்லாதவர்கள்
 - விடலைப் பருவத்தவர் பற்றிய விபரம் [13 லிருந்து 15 வயது]
1. பள்ளிக்கு சென்றவர்கள் :
2. செல்லாதவர்கள் :
3. அவர்கள் கலந்து கொண்ட பயிற்சிகள் :
4. அவர்களின் தேவை :
5. பெண் குழந்தைகள் இரும்பு சத்து
மாத்திரை சாப்பிடுகிறார்களா? :
 - குடும்பத்தின் ஆண்டு வருமானம்

தொழில் வருமானம்

	தொழில்	வருமானம்
1. குடும்பத்தின் ஆதார வருமானம்	:	ரூ.
2. குடும்பத்தின் இதர வருமானம்	:	ரூ.
3. குடும்பத்தின் மொத்தஆண்டு வருமானம்	:	ரூ.
4. ஒரு ஆண்டில் எத்தனை மாதங்களுக்கு வேலை கிடைக்கும் :		

Need Assessment Survey



விவகார

INDIA METEOROLOGICAL DEPARTMENT



Gramin Krishi Mausam Sewa under XIIth FYP



Establishment of DAMU

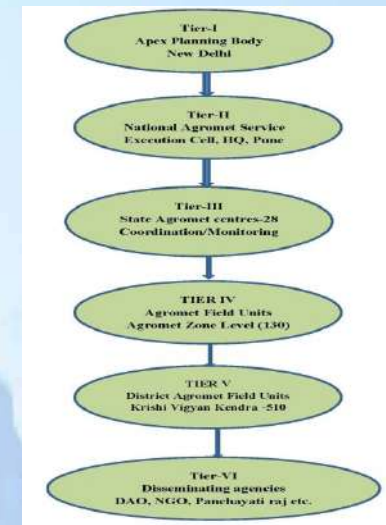
- ❖ Under the existing IAAS in the country AMFUs have already been established in different agroclimatic zones in collaboration with State Agricultural Universities (SAUs), Indian Council of Agricultural Research (ICAR) and Indian Institute of Technologies (IITs). As it will not be possible for these centres alone to address the objectives of the project at block level, there is a need to set up District Agromet Units (DAMUs) in the country in KVK.

AAS Units

AMFU

DAMUs under KVK

Six tier



Pre-Pilot 1: Watershed Organization Trust

- IMD has started providing local specific medium range weather predictions for Sangamner and Akole clusters (WOTR's operational area) of Ahmednagar district from April 2012.
- The weather predictions are used by WOTR to prepare agro advisories. WOTR's agriculture team prepares agro advisory according to the conditions of the major crops standing in the field. The advisory is in the form of wall paper. WOTR's field agronomists share it with the farming community at 5-6 locations in village.

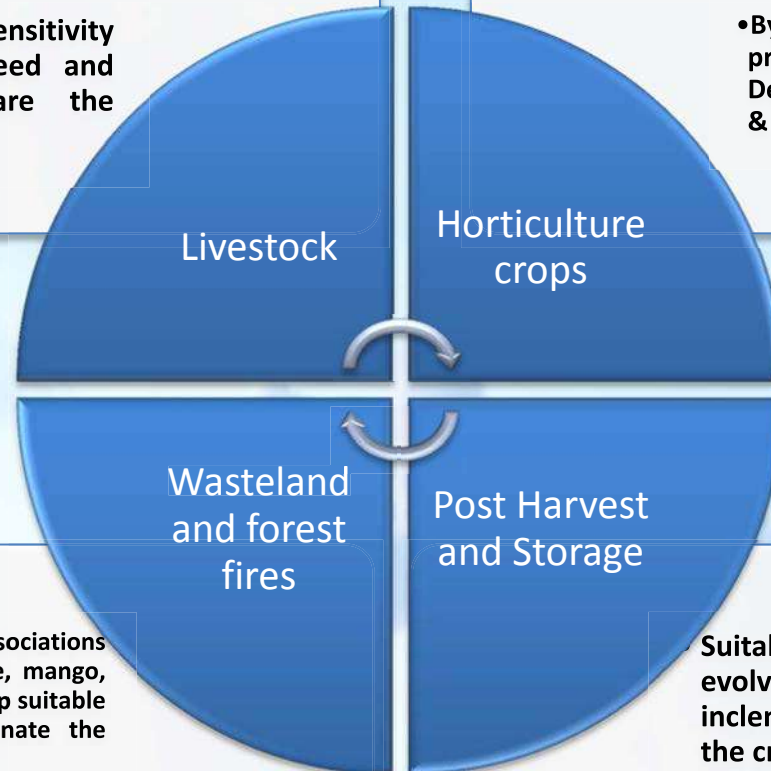
Station N	DAY1			DAY2			DAY3		
	R/F	Max.	Min.	R/F	Max.	Min.	R/F	Max.	Min.
Akole	0.3	37.6	22.3	0.6	37.7	21.3	0.0	37.7	19.3
Sangamner	0.1	38.2	21.9	0.5	38.6	21.6	0.0	38.8	20.2



Advisories for new sectors

- Understanding the weather sensitivity of animal shelter, health, feed and productivity and to prepare the advisory.

- By linking the programme with the existing projects of the Ministry of Rural Development and Ministry of Environment & Forest advisory will be prepared.

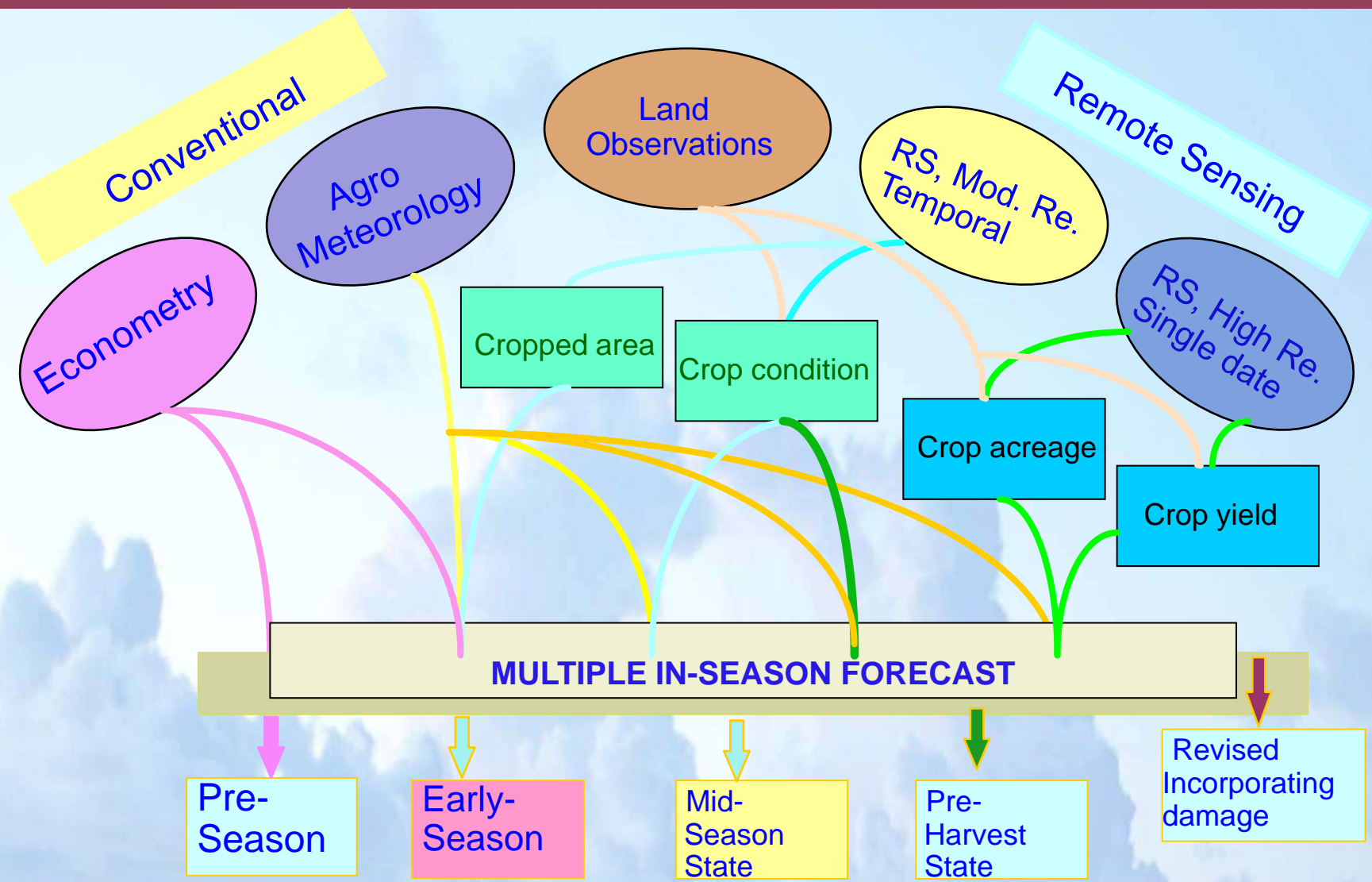


- To involve a number of crop grower associations dealing in crops like tea, coffee, apple, mango, sugarcane, cotton, grapes etc. to develop suitable products and mechanism to disseminate the information to the targeted grow

- Suitable agro-met advisory may be evolved to protect the crop from the inclement weather after the harvest of the crops.



Forecasting Agricultural out put using Space, Agrometeorology and Land based observations (FASAL)



Cardinal parameters for weather based crop insurance

Temperature

Rainfall

Humidity

Wind etc.



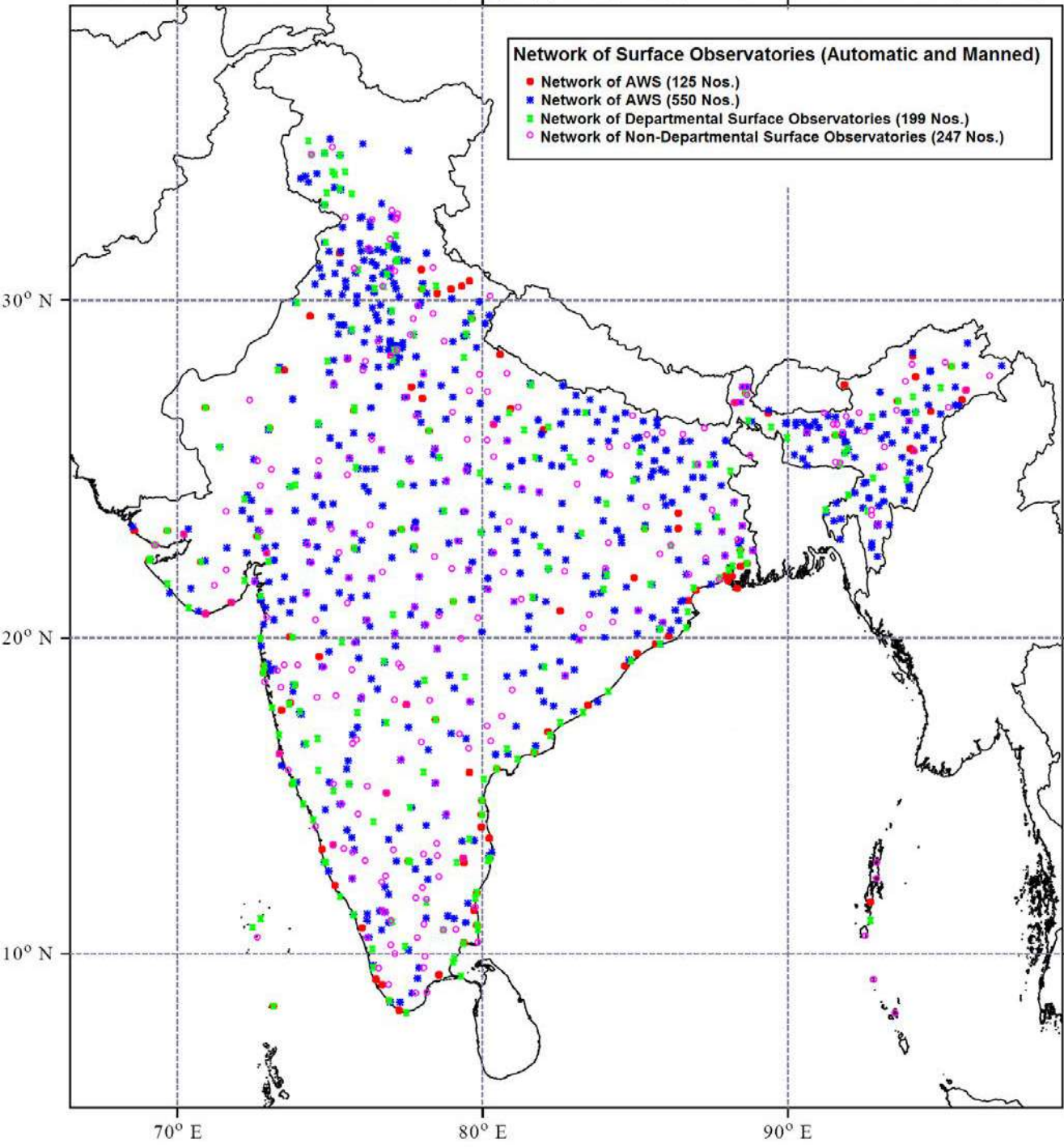
Conventional Observational Network

- Surface Observatories – Class I and Class II (559)
- Pilot Balloon (71)
- Agrometeorological Observatories (219)
- Hyrometeorological Observatories (701)
- Non-Departmental Raingauge Stations
 - Reporting (3540)
 - Non-reporting (5039)
- Extreme Weather reporting – Storm surge, Frost, Heat wave, Hail storm etc.



Network of Surface Observatories (Automatic and Manned)

- Network of AWS (125 Nos.)
- Network of AWS (550 Nos.)
- Network of Departmental Surface Observatories (199 Nos.)
- Network of Non-Departmental Surface Observatories (247 Nos.)



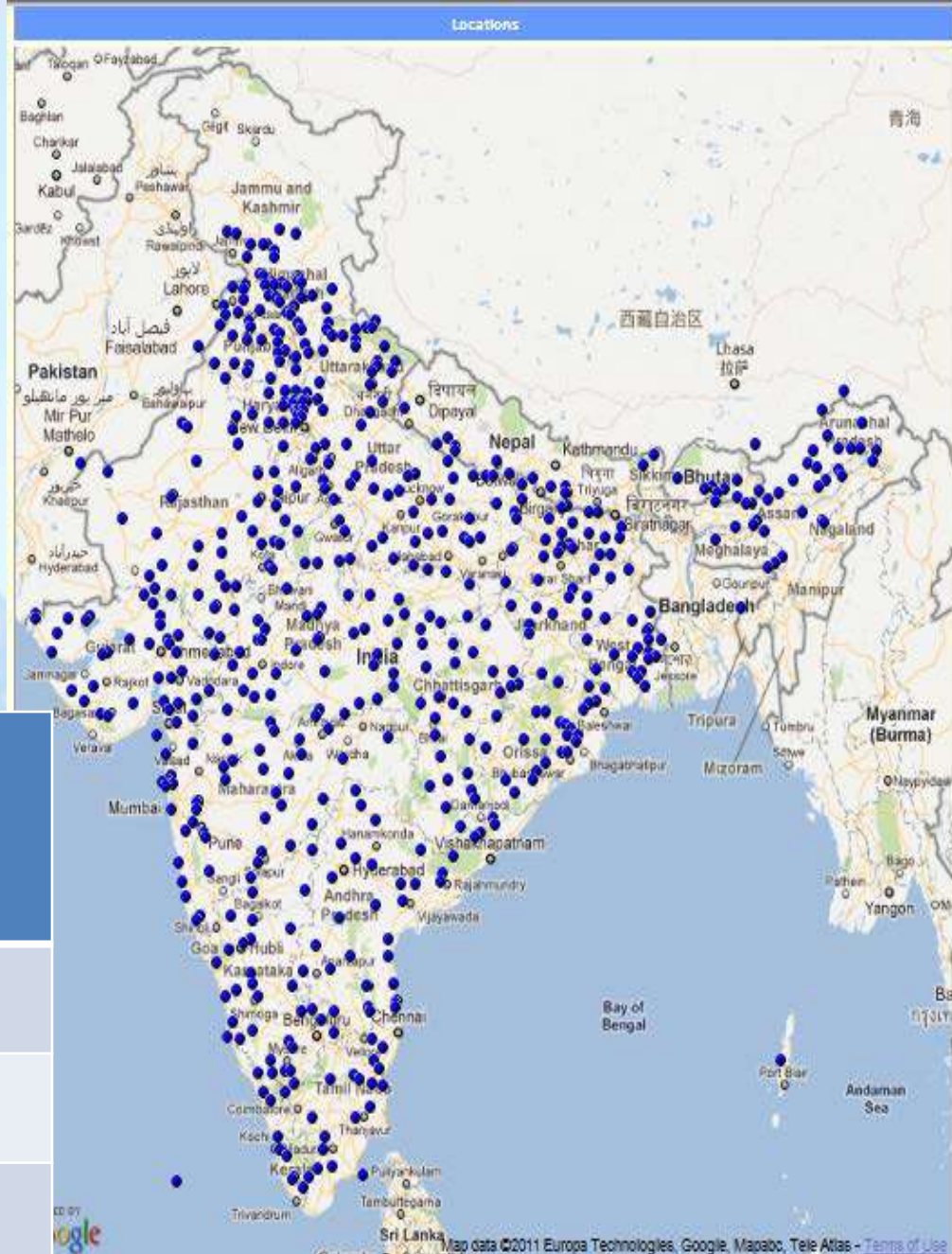
Network of surface observatories



675 Automatic Weather Stations

127 Agro-AWS

548 AWS



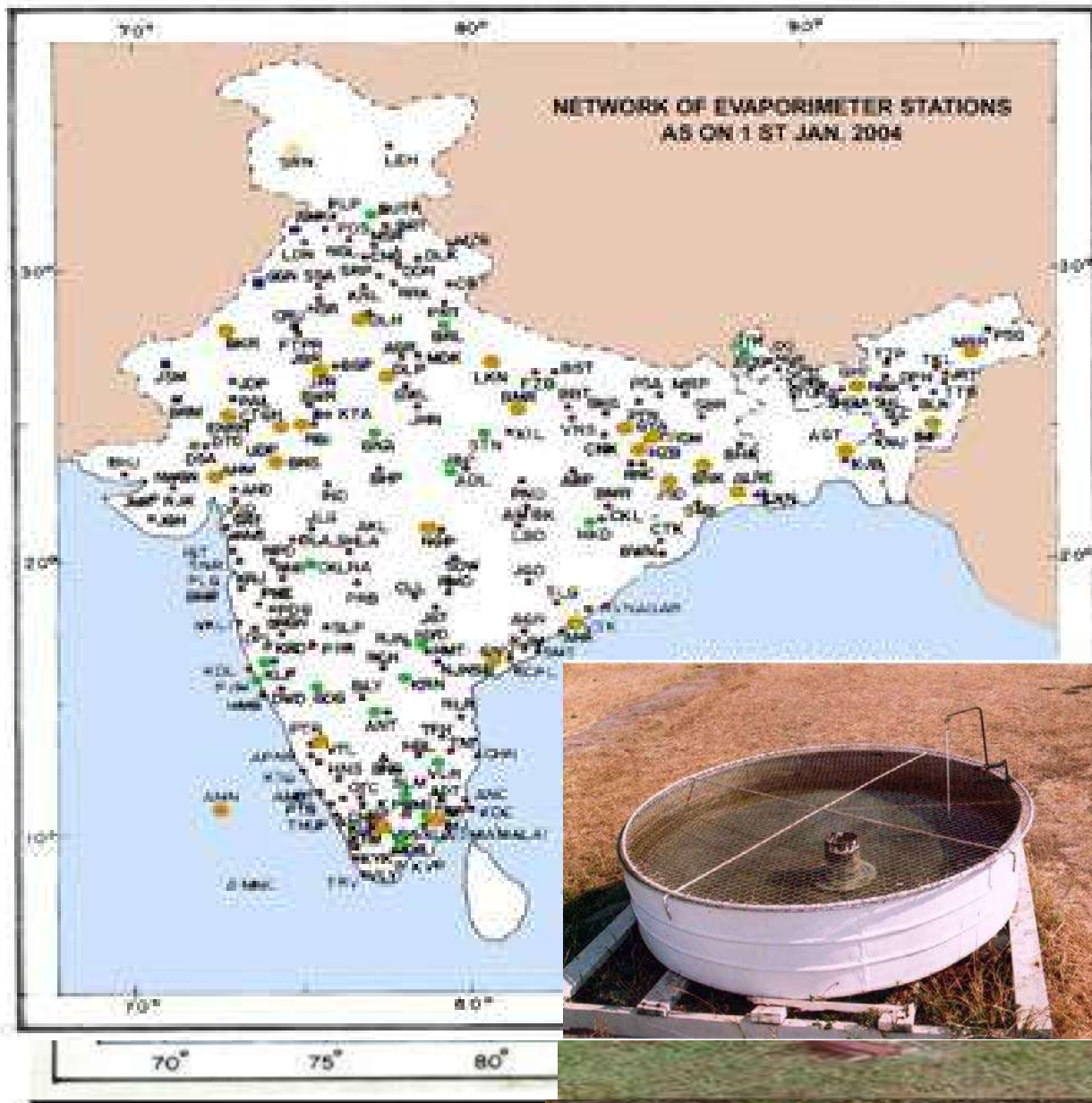
Type of Observatory	Installed	Proposed
AWS	675	400
ARG	1350	2000
DWR	16	42



Agromet Observatories

The Division of Agricultural Meteorology provides technical assistance to States where data are generated. Agromet Observatories record daily and monthly rainfall, temperature, humidity, wind speed, and relative humidity. Agromet Observatories are located in major irrigation Research Stations and

Agromet Observatories provide data from various sources. These data are used for crop simulation, and for the design and operation of irrigation systems and



TY



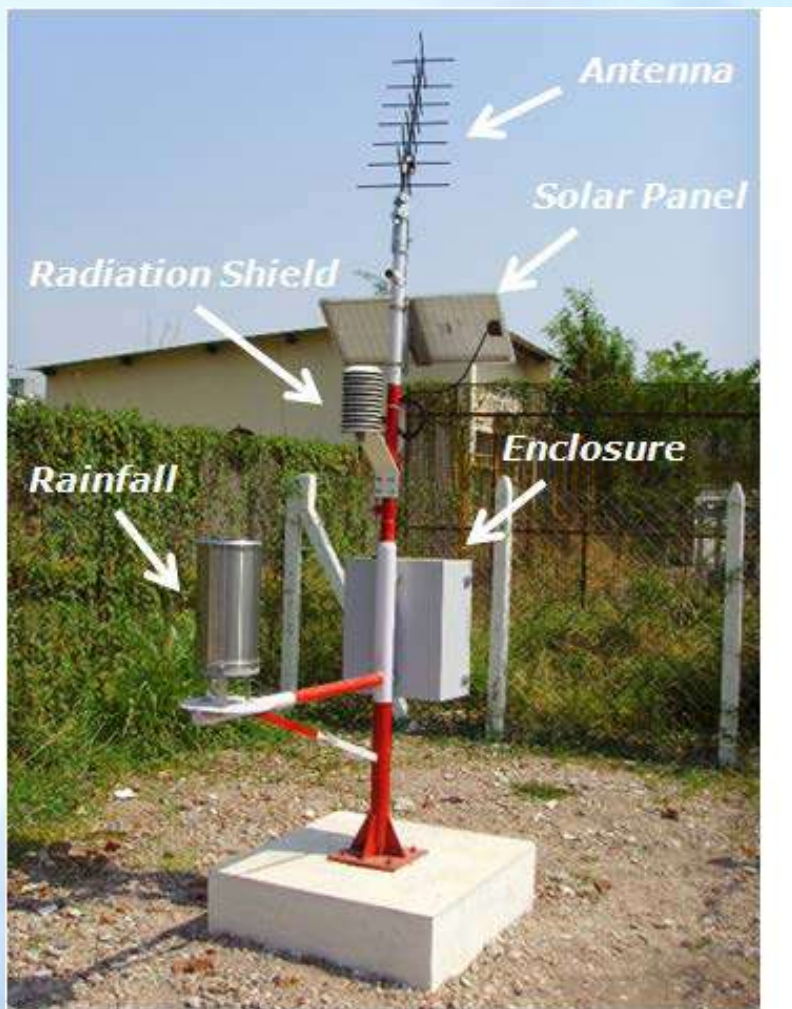
Chamba AWS



INDIA METEOROLOGICAL DEPARTMENT
CHAMBA WEATHER STATION



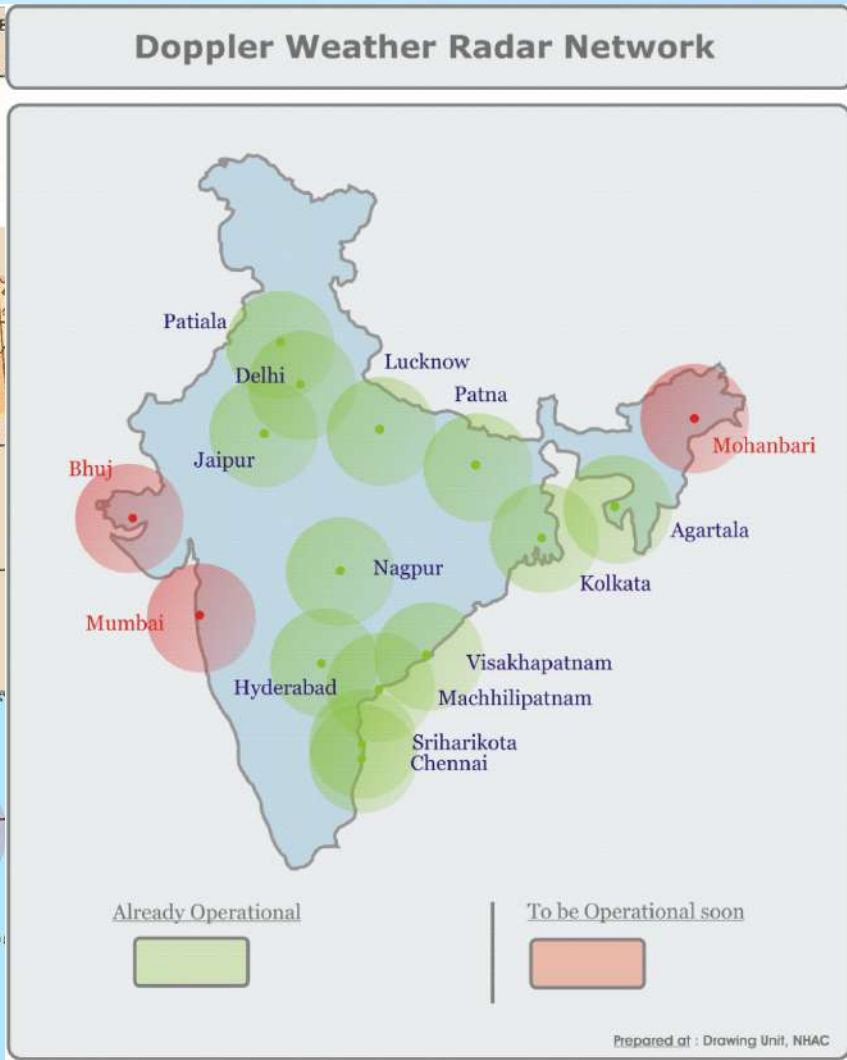
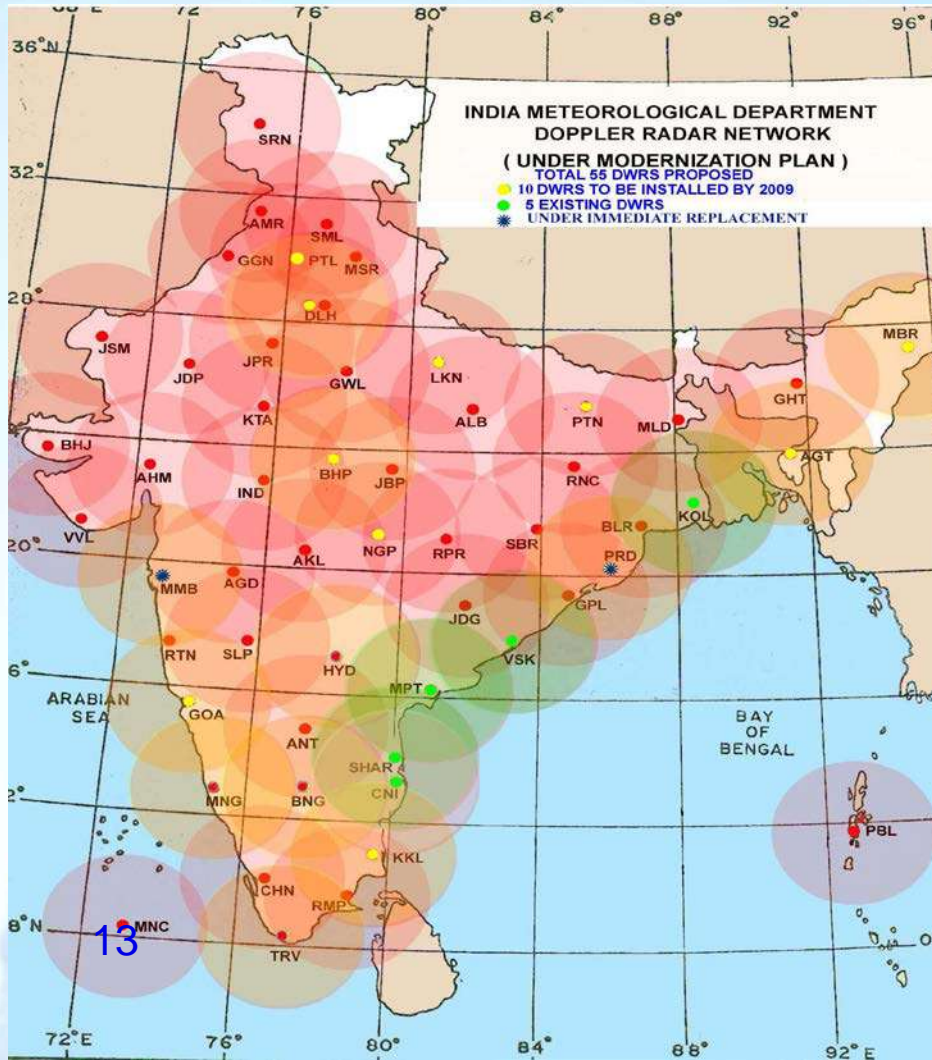
Network of 1350 ARG Stations



- 856 Stations have been installed with AT/RH Sensors.
- ARG stations are being installed in flood prone river basins such as Brahmaputra, Ganga, Mahanadi, Tapi, Narmada, Godavari and Krishna.

Two ARG stations in each district.





To bring entire country under Doppler Weather Radar coverage optimum 55 Nos. of DWRs required.



Non Conventional Observational Network

Doppler Weather Radar

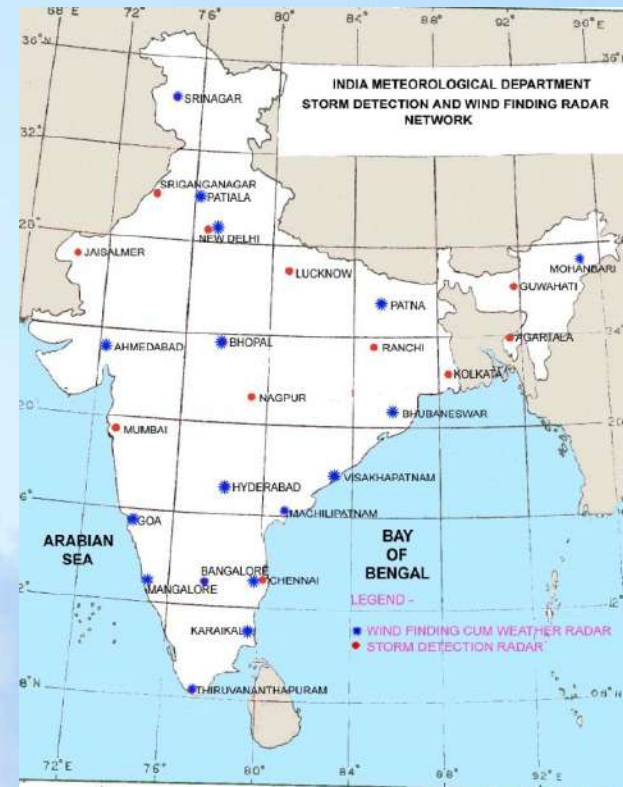
16 DWRs are installed

Products are

- * Rain intensity
- * Cumulative rain
- * Cloud motion winds
- * Vertical profiles of Temperature, humidity etc.

(Res: 0.5x0.5 km)

Assimilation of DWR data with AWS observations. (Res: 9x9km)



Modernization Projects

550 Automatic Weather Stations

127 Agro-AWS



423 AWS

Network of 1350 ARG Stations

- 856 Stations have been installed with AT/RH Sensors.
- ARG stations are being installed in flood prone river basins such as Brahmaputra, Ganga, Mahanadi, Tapi, Narmada, Godavari and Krishna.
- Two ARG stations in each district.

Future plan of installation of state of art weather stations

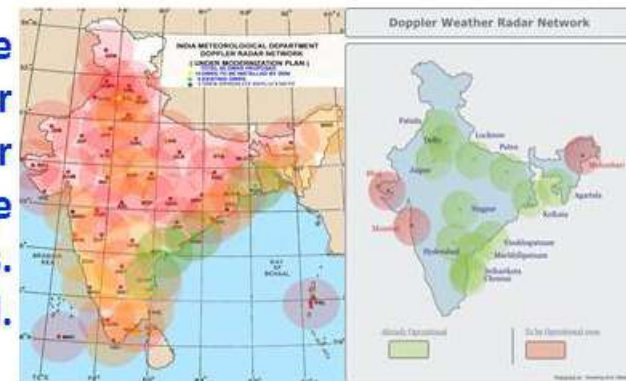
Establishment of network of 400 Synoptic AWS (GSM/GPRS telemetry)

Establishment of network of 50 Ship-based AWS.

Establishment of network of 2000 Automatic Rain Gauge Stations (Satellite telemetry)

Establishment of network of Lightning Detection Network

To bring entire country under Doppler Weather Radar coverage optimum 55 Nos. of DWRs required.



Conducted Brainstorming Session on

Standardisation and Integration of Automatic Weather Stations Under National Umbrella

- ❖ Meeting was done to establish a denser network of automatic weather stations across the country under the joint venture of concerned organisations involved in installation, maintenance of AWS and those desire to use the data from AWS for different services in the country.
- ❖ The objective of the meeting was to develop a national consortium by all the concerned organizations to integrate the existing AWS network and install new ones with the required sensors, maintenance, reception of quality controlled and uninterrupted data, data sharing mechanism etc.



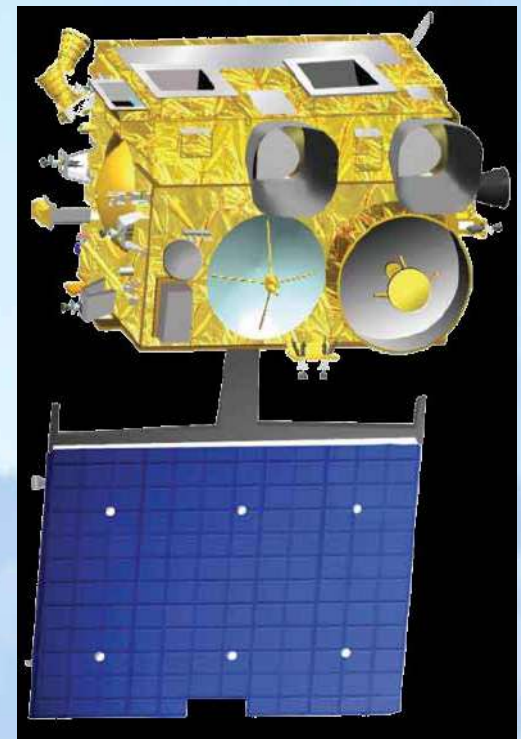
INSAT-3D

INDIA's Advanced Weather Satellite

India's advanced weather satellite INSAT-3D launched in the early hours of July 26, 2013 from Kourou, French Guiana, and has successfully been placed in Geosynchronous orbit.

It carries four payloads

- Imager (Six Channels)
- Sounder (Nineteen Channels)
- Data Relay Transponder(DRT)
- Satellite Aided Search and Rescue (SAS & R)



INSAT-3D

Imager: The Imager will generate images of the earth disk from geostationary altitude of 36,000 km every 26 minutes and provide information on various parameters, namely, outgoing long-wave radiation, **quantitative precipitation estimation, sea surface temperature, snow cover, cloud motion winds, etc**

Atmospheric Sounder: It will provide information on the **vertical profiles of temperature, humidity and integrated ozone**. These profiles will be available for a selected region over Indian landmass every one hr and for the entire Indian Ocean Region every six hrs.

Data Relay Transponder: It will be used for receiving meteorological, hydrological and oceanographic **data from remote, uninhabited locations over the coverage area from Data Collection Platforms (DCPs) like Automatic Weather Station (AWS), Automatic Rain Gauge (ARG) and Agro Met Stations (AMS)**.

Satellite Aided Search and Rescue Transponder :

The major users of Satellite Aided Search and Rescue service in India are the Indian Coast Guard, Airports Authority of India (AAI), Directorate General of Shipping, Defence Services and fishermen.



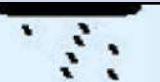
IMPROVEMENTS IN INSAT -3D OVER KALPANA-1 AND INSAT-3A

- Imaging in Middle Infrared band to provide night time images of low clouds and fog.
- Imaging in two Thermal Infrared bands for estimation of Sea Surface Temperature (SST) with better accuracy.
- Higher Spatial Resolution in the Visible and Thermal Infrared band.
- Sounder derived profiles include temperature at 40 vertical pressure levels from surface to about 70 km and water vapor in 21 levels from surface to around 15 km above along with following derived Products.



Geophysical Parameters from INSAT -3D satellite

No.	Parameters	No.	Parameters
1.	Outgoing Long wave Radiation (OLR)	9.	Water Vapor Wind (WVW)
2.	Quantitative Precipitation Estimation (QPE)	10.	Upper Tropospheric Humidity (UTH)
3.	Sea Surface Temperature (SST)	11.	Temperature, Humidity profile & Total ozone
4.	Snow Cover	12.	Stability indices from sounder data
5.	Fire	13.	Normalized Difference snow Index
6.	Smoke	14.	Flash Flood Analyzer
7.	Aerosol	15.	FOG (day and night)
8.	Cloud Motion Vector (CMV)	16.	Tropical Cyclone-intensity /position



Climate data products

- National Data Centre (NDC) at Pune generates, many climate data products for smaller spatial and temporal scales for the user community.

These data products include followings:

- **Daily gridded ($1^\circ \times 1^\circ$) rainfall and temperature data**
- **Daily gridded ($0.5^\circ \times 0.5^\circ$ and $0.25^\circ \times 0.25^\circ$ [long series]) rainfall data**
- District wise normal for various surface parameters, marine climate summaries for Indian Ocean region etc



Challenges for weather based Crop Insurance

- Network design
- Accuracy / Standardisation of Sensors
- Siting of weather station (i) Exposure condition (ii) Watch & ward
- Data communication/Transmission
- Data archival, retrieval and quality control
- Data Supply (a) Mode of supply (b) Financial cost
- Certification of AWS station, inspection, accreditation and data quality control
- System protocol for AWS installation, observation maintenance , utilization etc.
- Spare equipments and storage/processing facilities
- A separate unit and man power required to manage the task



Opportunities

- A. Integration of various existing AWS network
- B. Expansion of rainfall monitoring system (ARG) at Panchayat level
- C. Remote Sensing observations
- D. Development of Secondary Products- Virtual weather grids

Generation of secondary product for rainfall and temperature by merging with radar and satellite at higher resolution (assimilation with high accuracy)



WEATHER INSURENCE

- ❑ An insurance product based on a weather index.
- ❑ The basic idea of weather insurance is to estimate the percentage deviation in crop output due to adverse weather conditions. Unlike regular insurance, which would only cover physical damage, weather insurance protects against additional expenses or loss of profit from specific bad weather events.
- ❑ An analysis of Indian Crop Insurance Program between 1985 and 2003 reveals that rainfall accounted for nearly 95 percent claims – **85 percent because of deficit rainfall** and 10 percent because of excess rainfall.
- ❑ Financial protection based on the performance of specified index in relation to a specified trigger.
- ❑ Detailed correlation analysis is carried out to ascertain the way weather impacts yields of the crops to arrive at compensation levels.
- ❑ Weather indices could be deficit/excess rainfall, extreme fluctuations of temperature, relative humidity and/or a combination of above.



Crop Insurance: Key Challenges

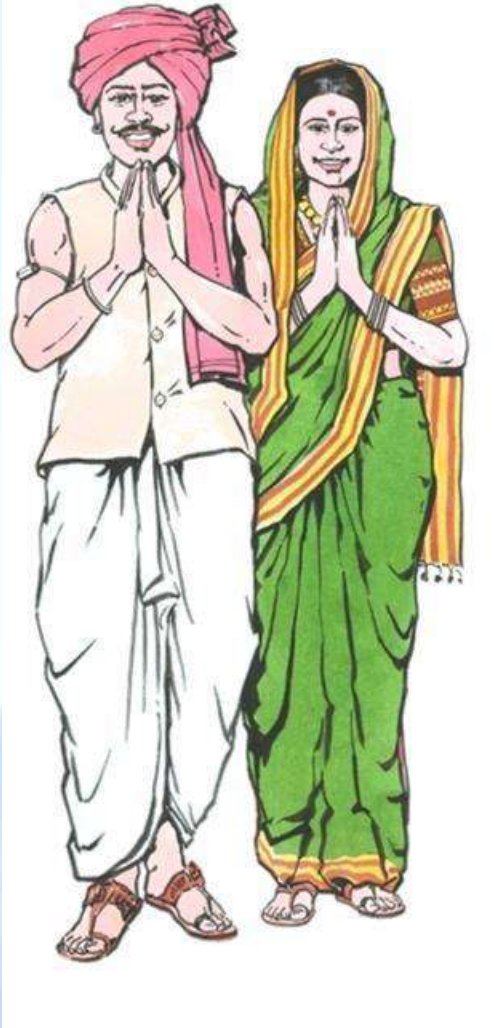
- ❑ Only a fraction of non-loanee farmers avail crop insurance
- ❑ Insurance knowledge limited with most stakeholders
- ❑ Index insurance carries some 'basis risk', but most farmers believe the correlation between their losses and the crop insurance payments is not adequate
- ❑ Delay in settlement of claims (delay in receiving harvest data of crops, funding issues)



Conclusion

- ❖ While climate change is unlikely to exceed current variability in the next two decades, the gradual increase in temperature will eventually may have severe consequences.
- ❖ Climate risk management strategies in agriculture must address current climate variability while preparing the sector for the eventual impacts of warming.
- ❖ These include more efficient water management and irrigation; improved access to markets and finance; livelihood diversification; revival of ancestral agricultural practices, for example in frost protection; climate-proofing local infrastructure; and better management of climate and risk data.
- ❖ To enable these measures, key climate risk management policies and agencies must be better coordinated





THANK YOU



भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

