

Types of Weather & Climate Forecast and its application for Agriculture

**Agro-Meteorological Information Systems Development Project
Component-C of Bangladesh Weather and Climate Services
Regional Project
Department of Agricultural Extension (DAE), Ministry of
Agriculture, Bangladesh**

- What is forecasting ?
- In general, forecasting is the process of estimation of unknown situations.

* What is weather forecasting?

Weather Forecasting is the application of science and technology to predict the state of the atmosphere for a future time and given location.

Successful Weather Service

A weather service is **successful** when recipients:

- Receive the weather forecast;
- Understand the information presented;
- Believe the information;
- Personalize the information;
- Make correct decisions; and,
- Respond in an adequate manner,
- Feedback, lessons learnt.

Prime Users

- Genral Public
- Agricultural Sector
- Aviation and Navigation Sectors.
- Fisheries Operations
- Construction Business
- Transportation
- Defense Services
- Mountaineering and Tourism.
- Energy Sector etc.

Importance of Weather Forecasting for Farmers in relation to Agriculture

- Weather and climate are some of the biggest risk factors impacting on farming system and agriculture management.
- Extreme weather such as severe droughts, floods, temperature etc., often strongly impede Bangladesh farming system.
- Timely Weather forecasting minimizes the risk of uncertainty of climate hazards.
- Knowing about weather in advance is important for good agriculture management practices.

Agriculture & Weather Forecasting in Bangladesh

- Agriculture is one of those prime sectors that impacted heavily due to weather
- Bangladesh is a country with diverse climate, seasons, crops and farming systems.
- Rainfall, temperature and radiation are having direct impact on agriculture systems and productivity.
- Wet and dry spells as well as extreme events causes enormous impacts on the agriculture sector.
- Majority of Bangladesh farmers are residing in villages and have poor access to the agro-climatic information.
- We need timely weather forecast on agro-climatic factors that should be accessible in a easiest way at rural community.

Farmers' need for weather forecasting

- ❖ Timely forecast on weather-Rainfall, storm, wind, frost etc to farmers
- ❖ Appropriate agricultural technologies for adaptation of changing weather and climate change
- ❖ Mitigation options for farmers in changing environment

In Farm
operations



Tactical Decisions

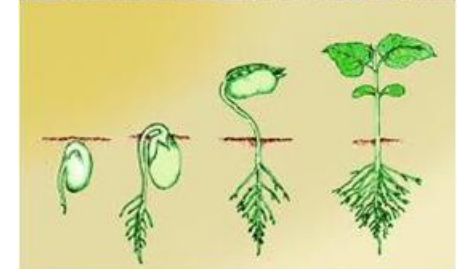
Seed Management,
Irrigation,
Fertilizer Application,
Pesticide spraying,
etc...

Weather forecast Applications

Sowing
Transplanting
Vegetative
Grain formation
Harvesting, etc...

**Strategic Decision: Contingent
Planning**

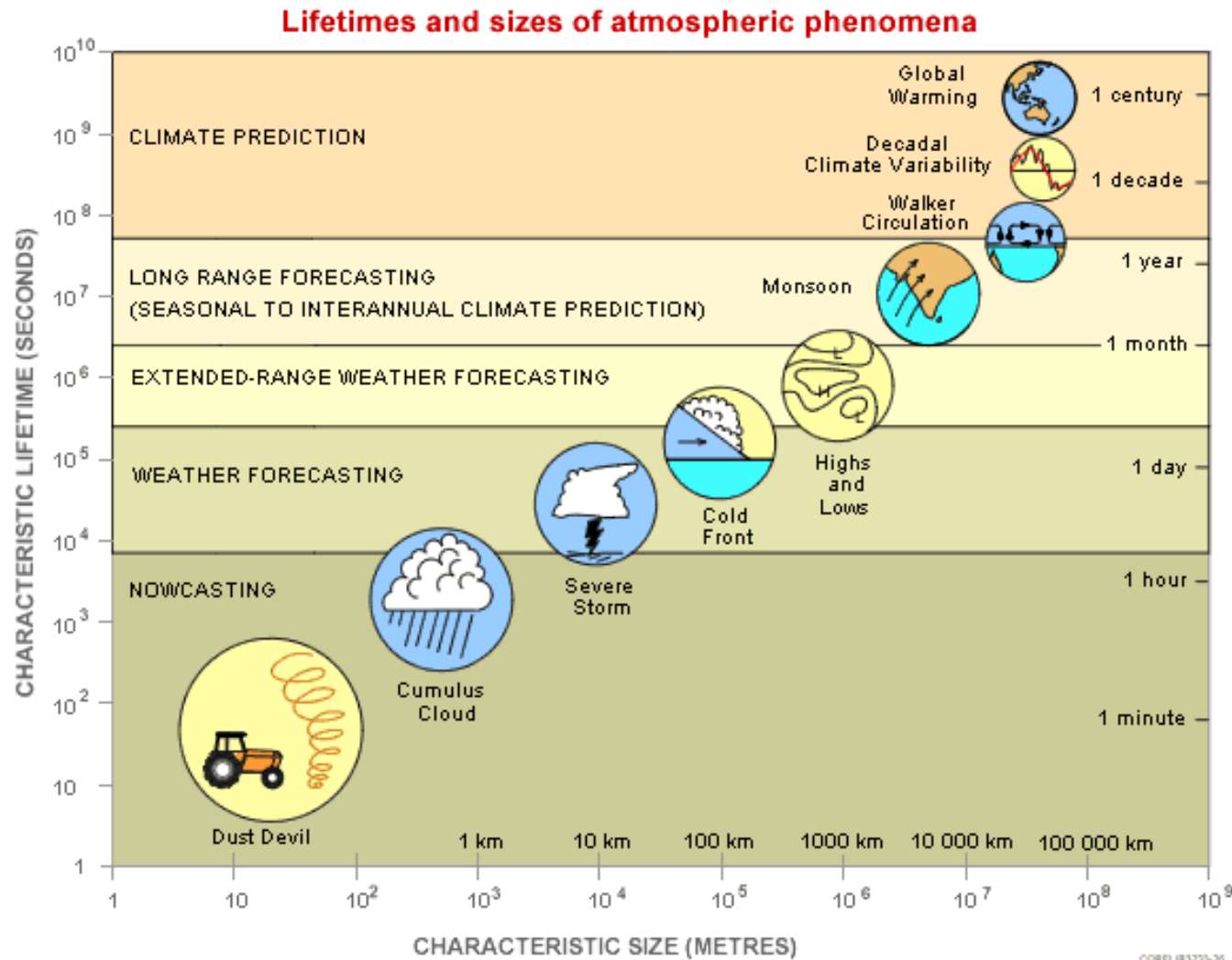
In different
stages of crops



Elements Which are covered under Weather Forecast:

1. Rainfall
2. Temperature
3. Thderstorm,Dust storm
4. Clouds
5. Cyclonic Storms (their courses and stages)
6. Heavy R/F Warnings
7. Frost Warning
8. Squall Warning
9. Heat Waves, cold waves etc.

Space and time scales of different atmospheric systems



There are a variety of phenomena occurring in our atmosphere having different space and time scales

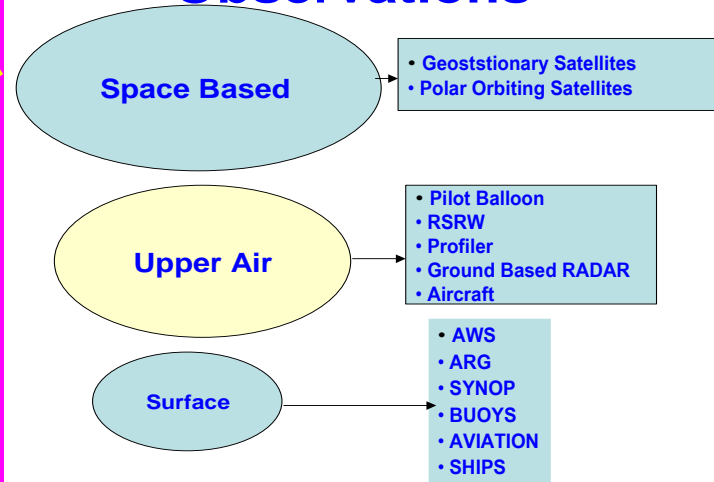
Monitoring and Forecast Process

**Initial conditions
(Observations)**

**Runs of different
Models,
Consecutive runs
from the same
model,
Ensemble runs
("choosing the
best member")**

Weather Monitoring and Forecast Process

Broad Classification of Observations



Action

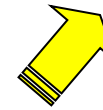
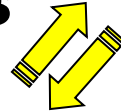
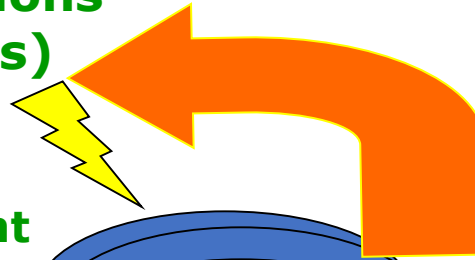
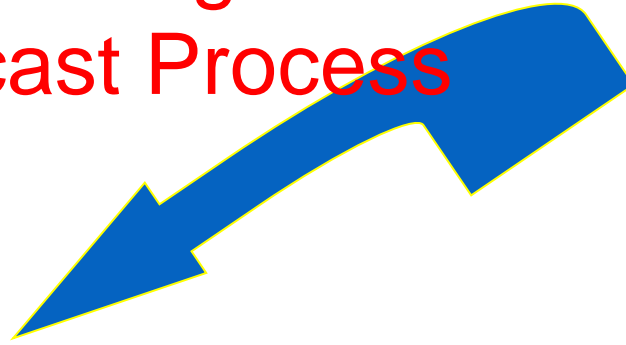
Model runs

Forecaster

**Decision
maker**

**Numerical
forecasts**

**End
forecast**



Tools: Observation, forecast, data & products.

Conventional Observational Network

- Surface Observatories –
- Agrometeorological Observatories-
- Hygrometeorological Observatories –
- Raingauge Stations
- ✓ Extreme Weather reporting – Storm surge,
- Frost, Heat wave, Hail storm etc.

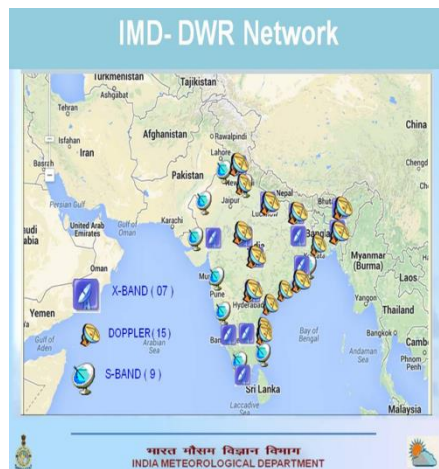
Automatic Weather Stations

Agro-AWS

AWS



Advanced Weather Satellite



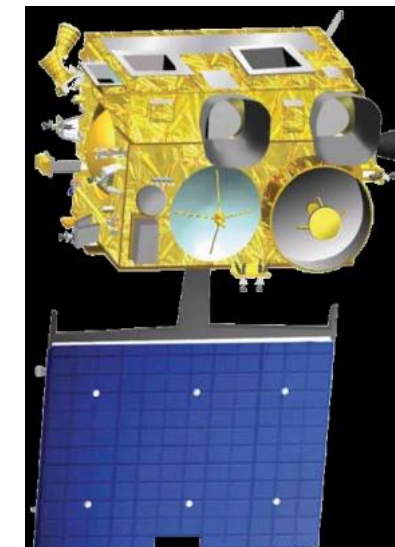
Doppler Weather Radar

16 DWRs are installed

Products are

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

(Res: 0.5x0.5 km)



FORECASTING METHODS

1. **SYNOPTIC TECHNIQUES**-weather charts, experience and skill of forecaster imp.
2. **STATISTICAL METHOD**- correlation and regression, time series etc.
3. **NUMERICAL WEATHER PREDICTION (NWP)**
dynamical technique, numerical model , high power computer

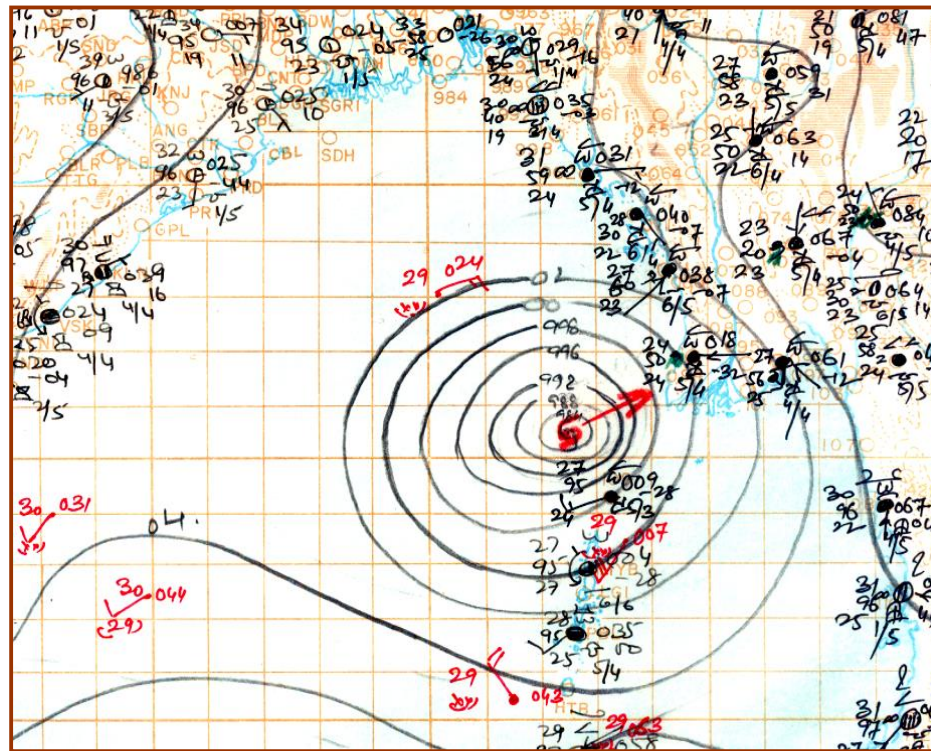
**NOTE: A GOOD SET OF DATA & SUITABLE METHOD
PRIME REQUIREMENTS.**

BMD's Forecast & Warning

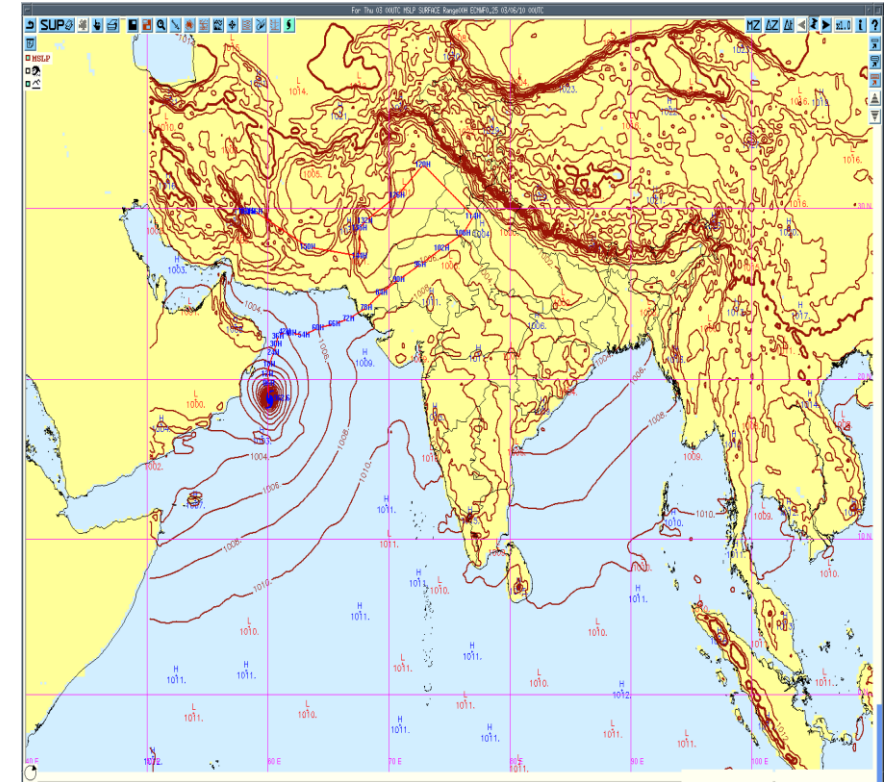
- ✓ Nowcast, short, medium and extended range Forecast
- ✓ Public Weather Local Forecast
- ✓ Long Range Forecast
- ✓ Tropical Cyclone Forecast & Warnings
- ✓ Warnings related to all other Disaster
- ✓ Sea State Forecast
- ✓ Coastal Zone Forecasts
- ✓ Forecasts to Aviation
- ✓ Forecasts for Agriculture
- ✓ Customized Forecasts to different Sectors- Power, Tourism, Defense, Adventure, Road/Railway transports, Public Utility, VIP functions, Strategic operations, Space, event based etc

Objective analysis of weather systems

Isobaric analysis at mean sea level at 12UTC of
28 April 2006



Isobaric analysis at mean sea level during cyclone, Phet
at 00 UTC of 03 June 2010



HPC Resource & Models used for Weather Foprecasting

1st Supercomputer



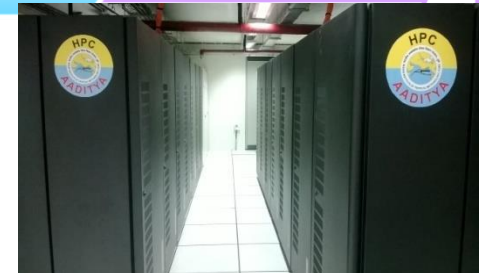
Models: LAM (110 km)/QLM (40 km)

2nd Supercomputer



Models: GFS (23 km), WRF (27/9 km)

3rd Supercomputer



Models: GFS (23 km), WRF (9/3 km), HWRF (9/3 km)

Parameter	Tools / technique
Forecast method	<p>Synoptic, satellite, radar, low resolution NWP models</p> <p>Operational forecast issued Up to 24 hrs synoptic cum models</p> <p>Beyond 24 hrs only models</p> <ul style="list-style-type: none"> · ·
Models	<p>Synoptic, satellite, radar, CLIPER, Limited NWP</p> <p>HWRF: 3KM resolution</p> <p>WRF (27/9 km guidance (Caorser ECMWF, UKMET, NCMRWF (T80), LAM, MM5, QLM).</p> <p>Operational forecast issued upto 24-hr lead time qualitatively in textual form.</p>

Spatial and Temporal domains of Forecast

- ❑ **Nowcast for next few hours**
(Venue/ location specific)
- ❑ **Short Range for 24 to 72 hours** (Location/District/ State/Met Sub-division)
- ❑ **Quantitative Medium Range for 3-10 days**
(City, District, Block)
- ❑ **Extended range for four weeks**
(Met Subdivision/State/ Homogeneous regions)
- ❑ **Long range for month/season rainfall**
(Homogeneous regions/country) + **India (July and August and temperature for season)**

Graduated Response to Disaster Risks



Why do farmers need weather/climate forecast

Ready!

Seasonal

- Select cultivars
- Purchase appropriate seeds
- Choose alternative livelihoods
- Sensitize Community

Farmer Early Actions Across Time Scales

Set !

Mid-range

- Anticipate wet/dry spells variations in temperature
- Manage risk in harvest operations
- Plant/clear fields
- Warn community on hazards

Go!

Short range

- Determine right harvest time
- Decide timing of pesticide/fertilizers application
- Evade crop losses
- Evacuate community

Access to relevant climate information can empower farmers to anticipate and confront climate related risks and opportunities

Short Range Weather Forecasting Short Range for 24 to 72 hours (District)



Govt. of the People's Republic of Bangladesh
Bangladesh Meteorological Department
Storm Warning Center
E-24, Agargaon, Dhaka-1207

Phone: 9135742, 9141437
FAX : 58152019, 9119230
Email: info@bmd.gov.bd
www.bmd.gov.bd
Web site: www.bmd.gov.bd

Date : 13-05-2019

Weather Forecast Valid for 24 Hours Commencing 09 AM Today:

Synoptic Situation: Trough of low lies over West Bengal to North Bay across southwestern part of Bangladesh.

Forecast: Rain/thunder showers, accompanied by temporary gusty/squally wind is likely to occur at a few places over Rangpur, Rajshahi, Mymensingh, Dhaka & Sylhet divisions and at one or two places over Khulna, Barishal & Chattogram divisions with hails at isolated places.

Heat Wave: Mild heat wave is sweeping over Khulna division and the regions of Rajshahi, Pabna, Tangail, M.Court & Rangamati and it may abate from some places.

Temperature: Day temperature may fall by (1-3) °C over Rangpur, Sylhet & Mymensingh divisions and it may remain nearly unchanged elsewhere over the country. Night temperature may fall by (1-2)° C over the country.

Wind direction and speed at Dhaka : South/Southeasterly(08-12) kph. temporary gusting to 30-40 kph.
RH at 06 A.M. of Dhaka : 83%
Today's sunset at Dhaka : 06-33 PM
Tomorrow's sunrise at Dhaka : 05-17 AM
Outlook for next 72 hrs : Rain/thunder showers activity may continue.

Rainfall for last 24 hours (till 06 AM today) and maximum temperature of Yesterday, minimum temperature of today:

Name of Divisions	Name of Stations	Rain fall (mm)	Max. Temp (°C)	Min. Temp (°C)	Name of Divisions	Name of Stations	Rain fall (mm)	Max. Temp (°C)	Min. Temp (°C)
Dhaka	Dhaka	00	35.8	28.8	Rajshahi	Rajshahi	00	37.6	26.3
	Tangail	00	36.4	25.0		Ishurdi	00	36.8	26.3
	Faridpur	00	35.9	27.4		Bogura	00	35.5	23.5
	Madaripur	00	35.5	27.5		Badalgachhi	00	36.0	21.0
	Gopalganj	00	35.5	28.5		Tarash	00	35.8	24.0
	Nikli	00	34.2	22.5	Rangpur	Rangpur	43	32.8	20.5
Mymensingh	Mymensingh	00	34.5	23.4		Dinajpur	00	34.6	21.8
	Netrokona	10	32.4	22.0		Sayedpur	Trace	34.2	20.5
Chattogram	Chattogram	00	34.7	28.4		Tetulia	54	31.0	19.3
	Sandwip	00	34.1	20.5		Dimla	45	32.8	20.0
	Sitakunda	00	34.0	27.9		Rajarhat	33	31.6	19.4
	Rangamati	00	36.5	27.2	Khulna	Khulna	00	37.2	28.4
	Cumilla	00	34.4	27.2		Mongla	00	36.2	27.9
	Chandpur	00	35.7	27.1		Satkhira	00	36.4	28.2
	M.Court	00	36.8	27.5		Jashore	00	37.4	28.4
	Feni	00	35.5	27.4		Chuadanga	00	36.6	28.4
	Hatiya	00	35.0	27.0		Kumarkhali	00	36.0	28.0
Sylhet	Cox's Bazar	00	35.0	28.7	Barishal	Barishal	00	35.3	27.5
	Kutubdia	00	34.5	28.6		Patuakhali	00	35.6	27.6
	Teknaf	00	xx	27.5		Khepupara	00	34.7	27.7
						Bhola	00	35.0	27.7
	Sylhet	10	33.1	21.1					
	Srimangal	03	35.0	22.0					

Date : 05-01-2020

Weather Forecast Valid for 24 Hours Commencing 09 AM Today:

- Light rain/drizzle is likely to occur at one or two places over Rangpur, Rajshahi, Dhaka, Mymensingh & Sylhet divisions and the regions of Jashore, Kushtia & Chattogram.
- Weather may remain mainly dry with temporary partly cloudy sky elsewhere over the country.
- Fog: Light to moderate fog may occur at places over the country during midnight to morning.
- Temperature: Night temperature may fall by (1-3)°C and day temperature may remain nearly unchanged over the country.
- Outlook for next 72 hrs : Rainfall activity will decrease and night temperature may fall further.
-

Generation of district level weather forecast (DLWF)

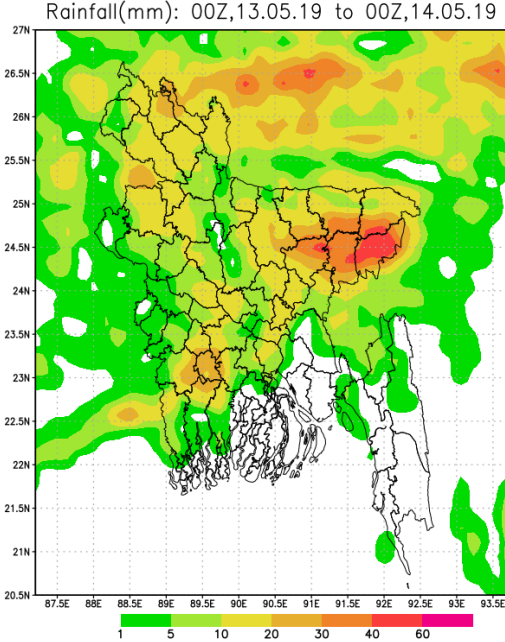
Bangladesh Meteorological Department

Districts in Bangladesh

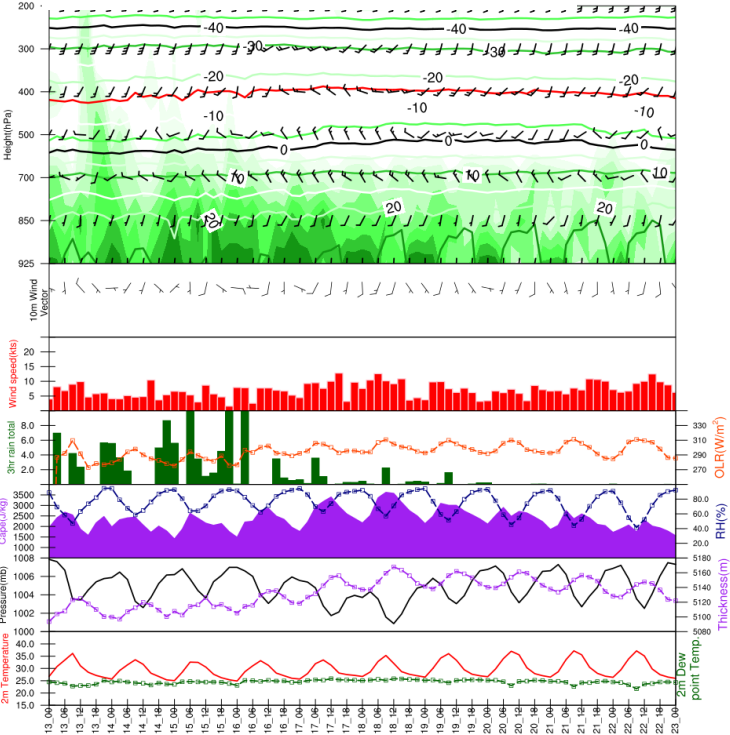
Currently these cover 64 districts of the country

DISTRICT LEVEL FORECAST

Weather Forecast of Aurangabad District (Valid for 04 th to 08 th July, 2018)					
Weather Parameters	04/07	05/07	06/07	07/07	08/07
Rainfall (mm)	15.0	04.0	22.0	13.0	18.0
T _{max} (°C)	33.0	31.0	33.0	33.0	33.0
T _{min} (°C)	21.0	20.0	20.0	20.0	20.0
Cloud Cover	Cloudy	Cloudy	Cloudy	Cloudy	Cloudy
RH-I (%)	76	78	76	76	76
RH-II (%)	48	52	52	52	52
Wind Speed (km/hr)	20	16	13	17	20
Wind Direction	SW	SW	W	W	W



WRF for District S





কৃষি আবহাওয়া পূর্বাভাস

গত তিন দিন

মোট বৃষ্টিপাতের
পরিমাণ (মি.মি.)

১০.১

তাপমাত্রা (°সেন্টিগ্রেড)

২৭.১ থেকে ৩২.০

আর্দ্রতা (শতকরা হার)

৮৫.১ থেকে ৮৮.০

বায়ুপ্রবাহ
গড় গতিবেগ (কি.মি./ঘন্টা)

১১১ থেকে ১১১

দিক: পূর্ব থেকে দক্ষিণ-পূর্ব

আলোকঘণ্টা

১.১ থেকে ১.১

বৃষ্টিপাতের ক্ষেত্রে কোন রঙের কি মানে:

- হালকা বৃষ্টিপাত
- হালকা থেকে মাঝারি বৃষ্টিপাত
- হালকা থেকে ভারি বৃষ্টিপাত
- মাঝারি বৃষ্টিপাত

আগামী তিন দিন

মোট বৃষ্টিপাতের
পরিমাণ (মি.মি.)

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বায়ুপ্রবাহ
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আলোকঘণ্টা

১.১ থেকে ১.১

- মাঝারি থেকে ভারি বৃষ্টিপাত
- ভারি বৃষ্টিপাত
- ভারি থেকে অতি ভারি বৃষ্টিপাত
- অতি ভারি বৃষ্টিপাত

আগামী তিন দিনের আবহাওয়াভিত্তিক কৃষিবার্তা

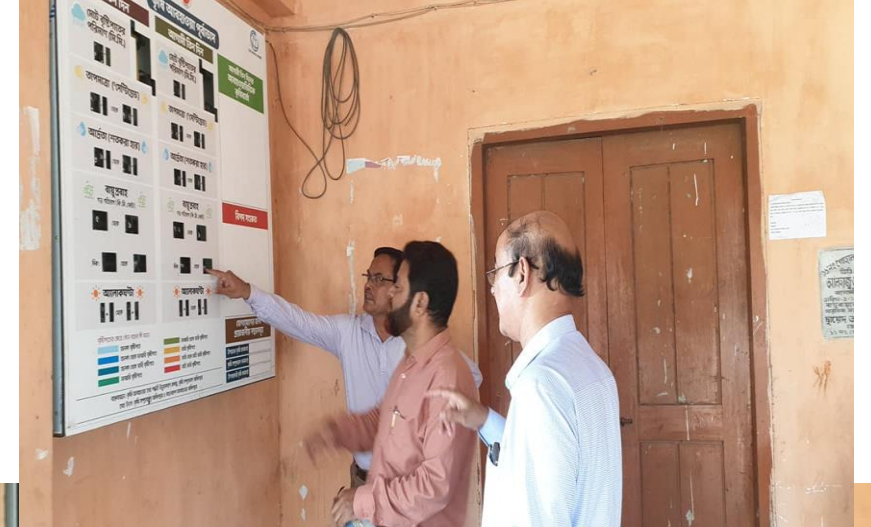
বিপদ সংকেত

যোগাযোগের জন্য প্রয়োজনীয় নম্বরসমূহ

উপজেলা কৃষি কর্মকর্তা	
কৃষি সম্প্রসারণ কর্মকর্তা	
উপসহকারী কৃষি কর্মকর্তা	

Agromet Display Board at Union Level

Weather Information along with Agromet
Advisories under favourable and unfavourable
weather conditions will be displayed shortly



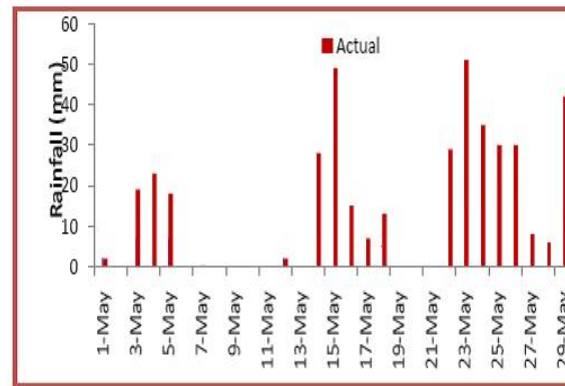
Success story of Medium Range Weather Forecast on damage of crops due to heavy rainfall

Heavy rainfall during May, 2015 affected the maize crop in village Chamua

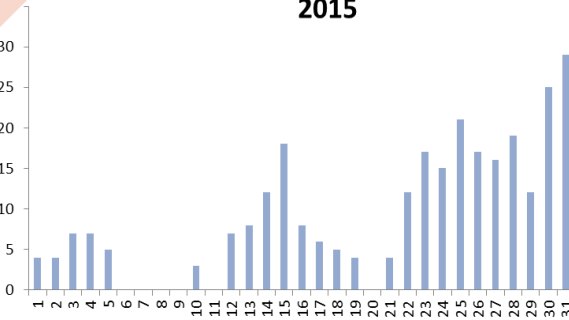
Actual Rainfall

Medium Range Weather Forecast

Both are matching in the month of May 2015 for Lakhimpur, Assam



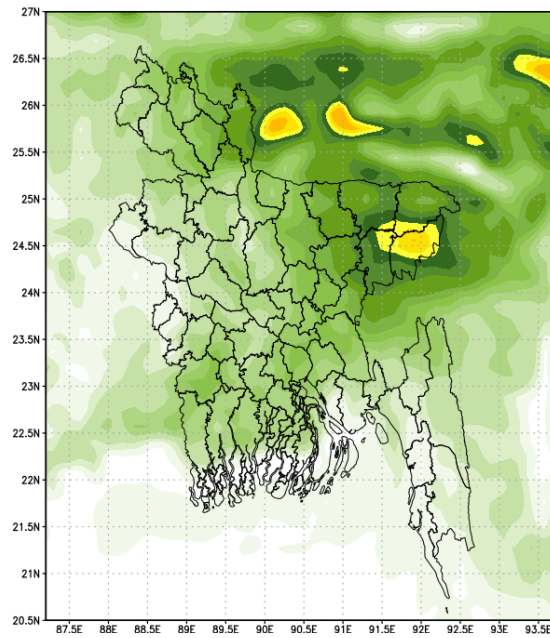
Rainfall in mm for Lakhimpur District for May 2015



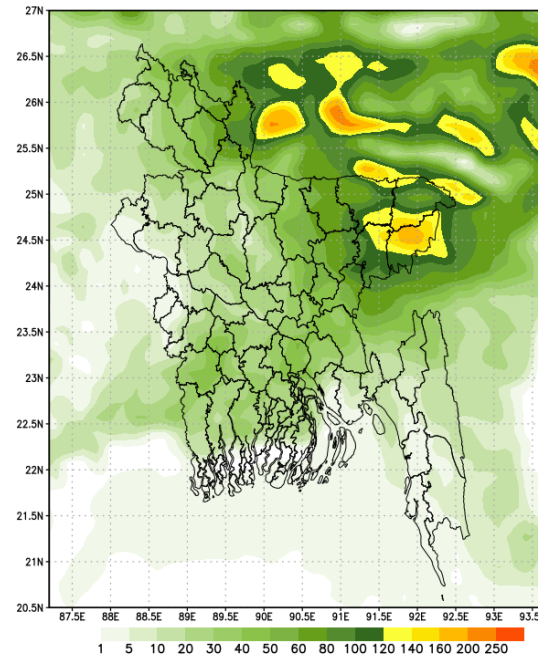
Weather forecast at that time was very much useful in managing the situation arising due to the excess rainfall. Farmers were benefited with different agromet advisories issued and displayed in the village.

Accumulated Rainfall

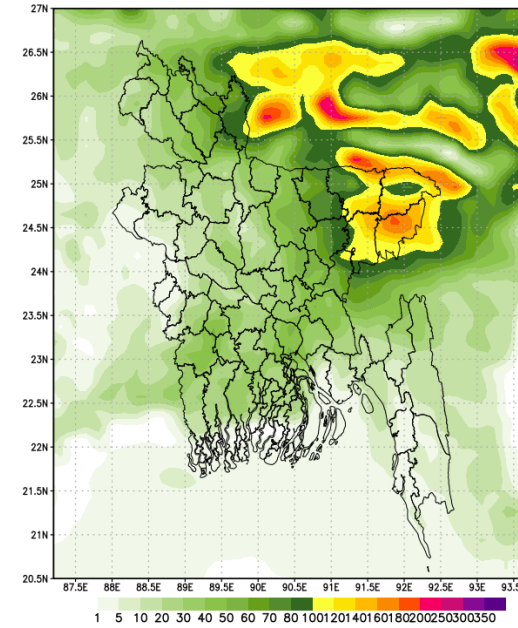
4 Day Accumulated Rainfall(mm): 00Z,13.05.19 to 00Z,17.05.19



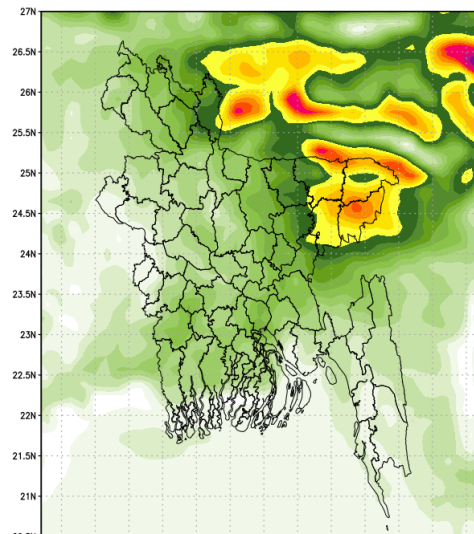
5 Day Accumulated Rainfall(mm): 00Z,13.05.19 to 00Z,18.05.19



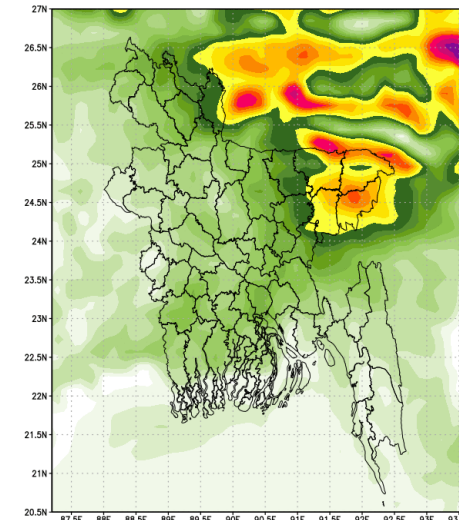
6 Day Accumulated Rainfall(mm): 00Z,13.05.19 to 00Z,19.05.19

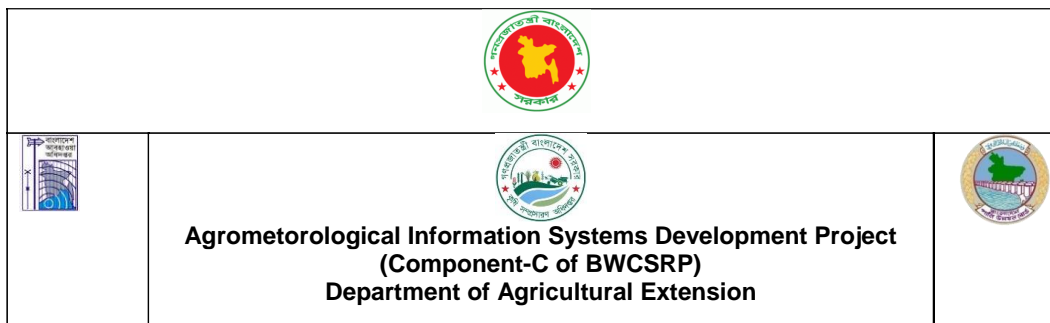


7 Day Accumulated Rainfall(mm): 00Z,13.05.19 to 00Z,20.05.19



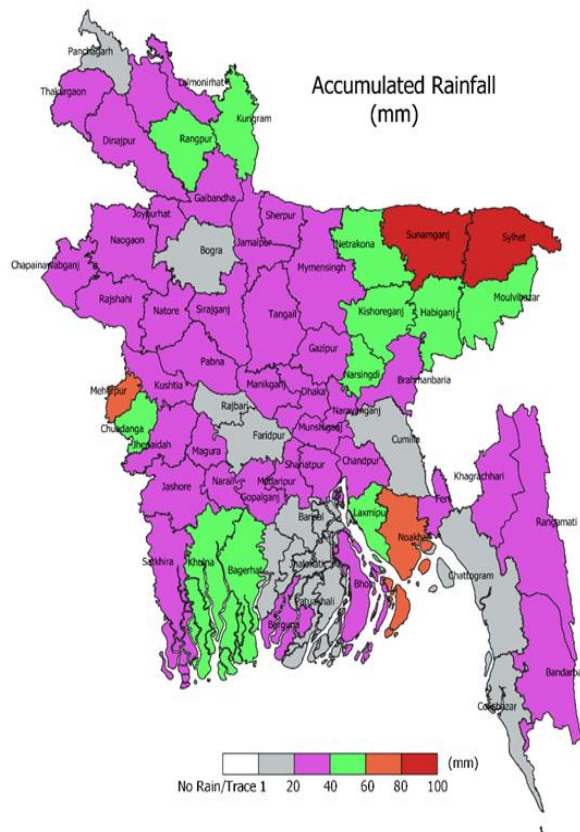
10 Day Accumulated Rainfall(mm): 00Z,13.05.19 to 00Z,23.05.19





Alert Message as on 30th April 2019

Communicated through the Control Room of Department of Agricultural Extension (DAE) to all the agricultural officers in the State



Special Agromet Advisories for the districts of Sylhet, Sunamganj, Meherpur, Noakhali

There is chance of comparatively very good amount of rainfall (6.0-10.0 cm) along with strong wind during 3-6 May 2019. In view of that, following urgent Agromet advisories are issued to save the standing crops;

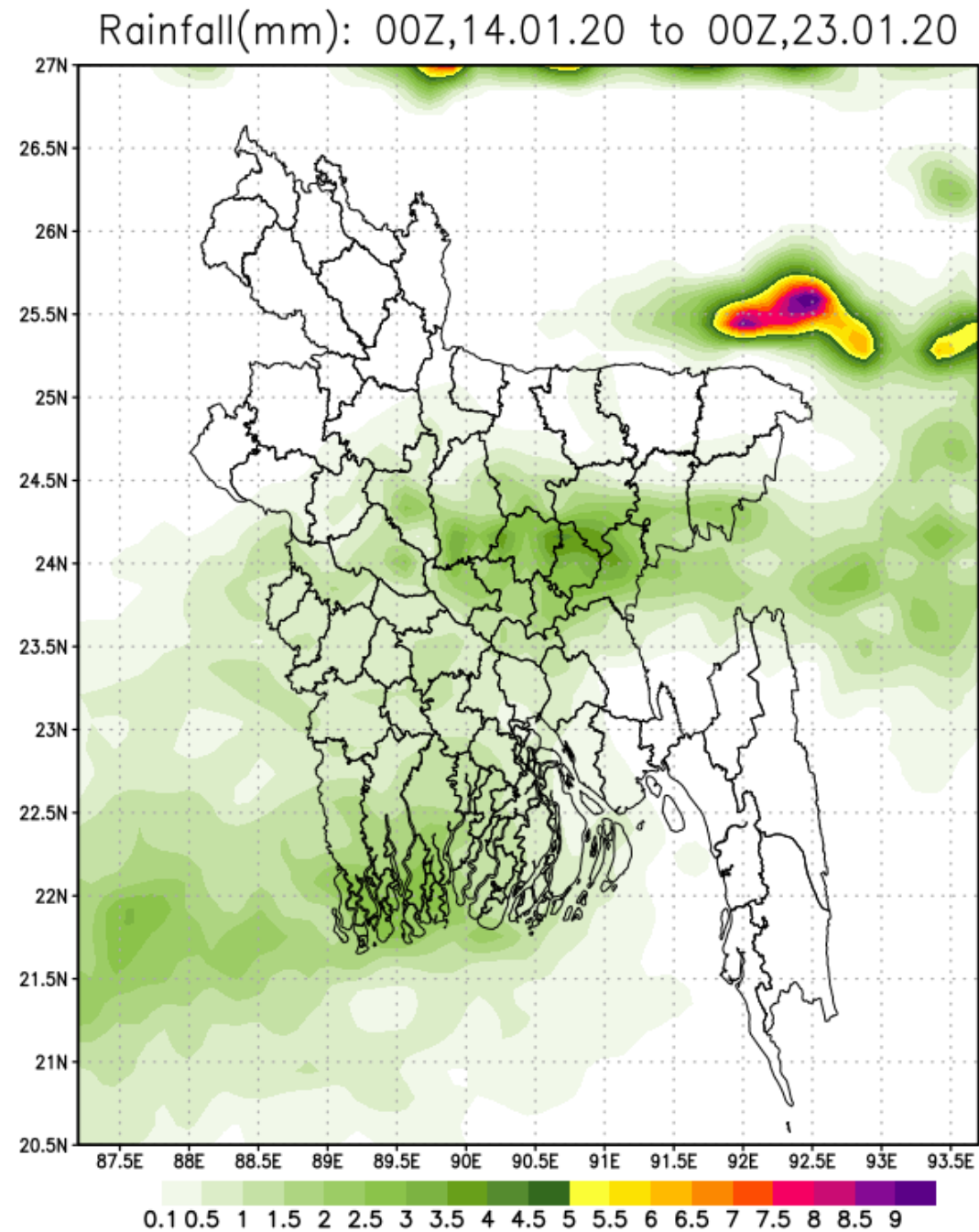
1. Where boro paddy found 80% maturity, harvest immediately otherwise due to cyclone shattering loss will take place.
2. Immediately harvest matured groundnut, rabi maize, horticultural crops, vegetables
3. Clean the irrigation channel so that there should not be any standing water in the paddy field
4. Arrange for elevated bunding around and inside the paddy field so that water current may not affect the standing crops.
5. Avoid sowing of new plants/ crops
6. Provide mechanical support to the standing crops
7. Uplift the plants which were lodged due to heavy rainfall and high wind immediately.
8. Avoid application of fertilizer, pesticides, irrigation.

Special Advisories for Rangpur, Kurigram, Kishoreganj, Chuadanga, Narsingdi, Lalmonirhat, Moulvibazar, Netrokona

There is chance of good amount of rainfall (4.0—5.9 cm) during 3-6 May 2019. In view of that, following urgent Agromet advisories are issued to save the standing

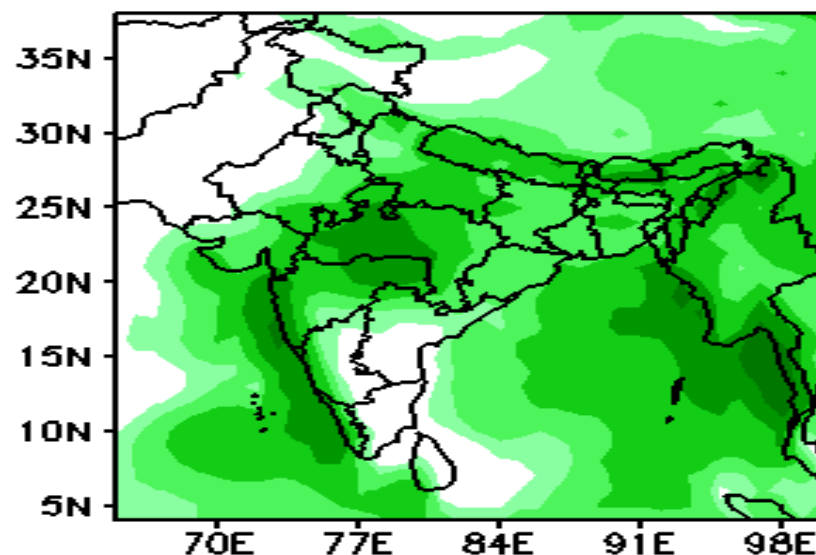
1. Where boro paddy found 80% maturity, harvest immediately otherwise due to cyclone shattering loss will take place.
2. Immediately harvest matured groundnut, rabi maize, vegetables etc.
3. Avoid application of fertilizer, pesticides, irrigation.

WRF Week 2

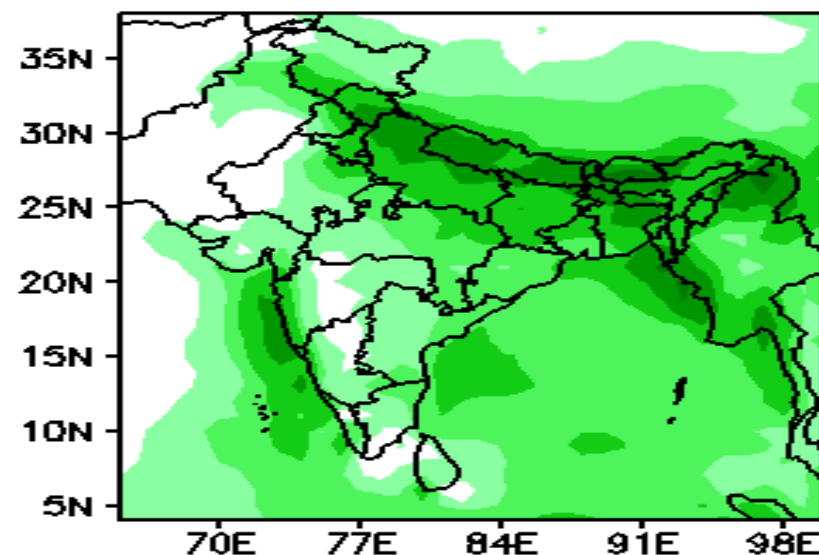


MME Actual Rainfall (mm/day)

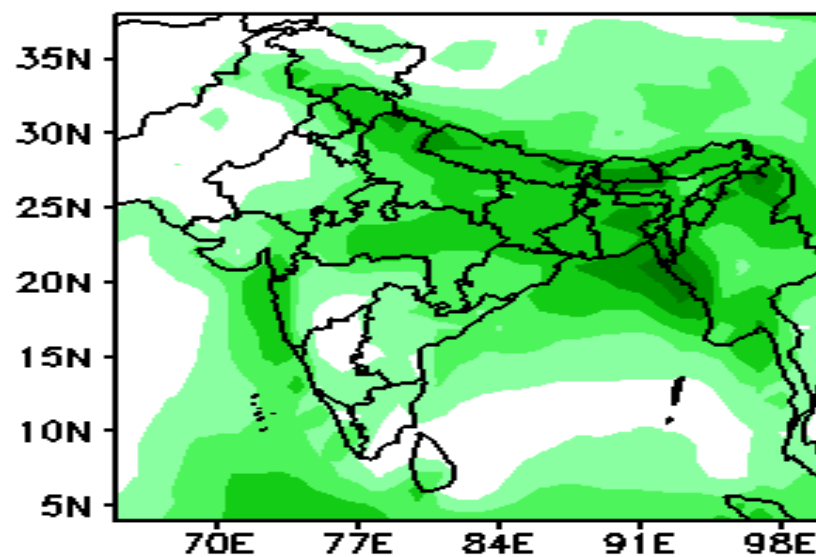
(Week1: 08Jul-14Jul)



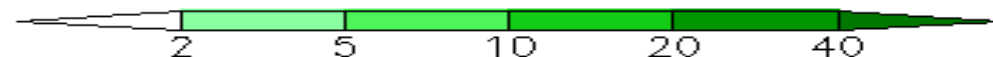
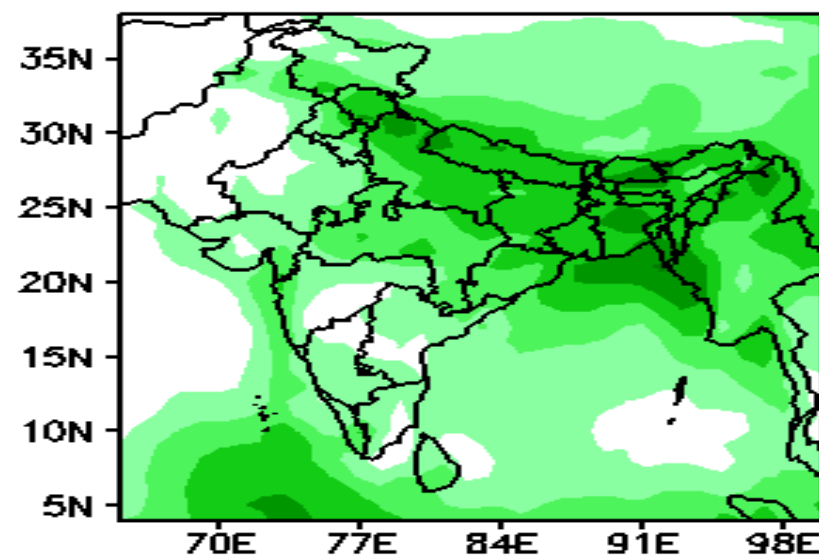
(Week2: 15Jul-21Jul)



(Week3: 22Jul-28Jul)

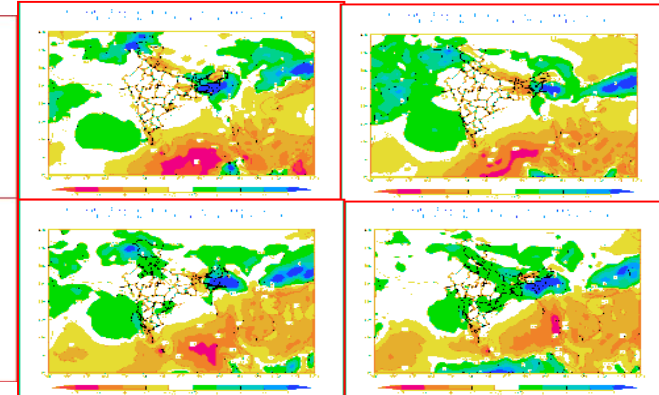
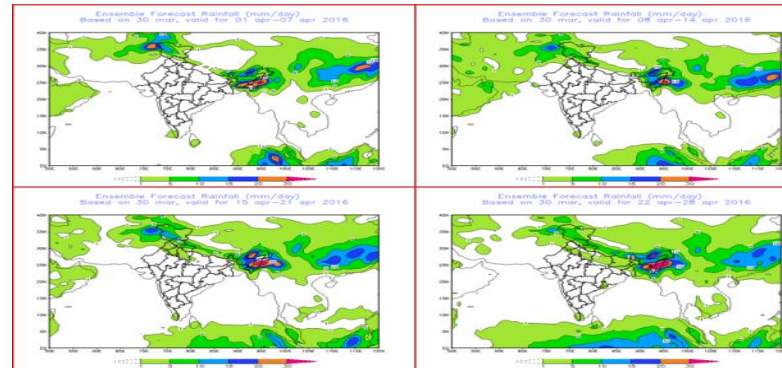


(Week4: 29Jul-04Aug)

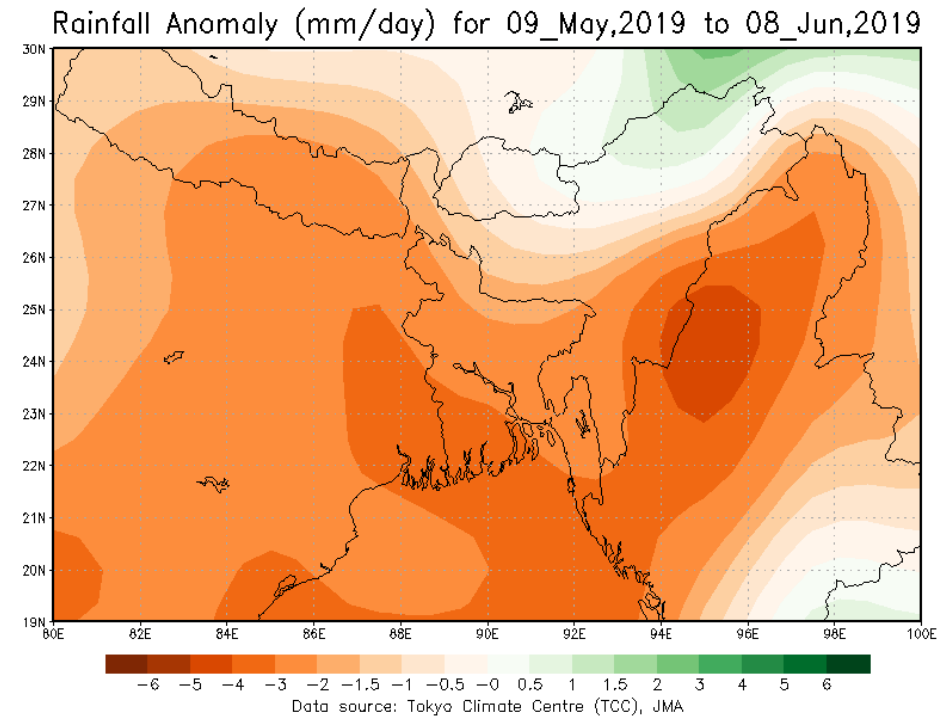
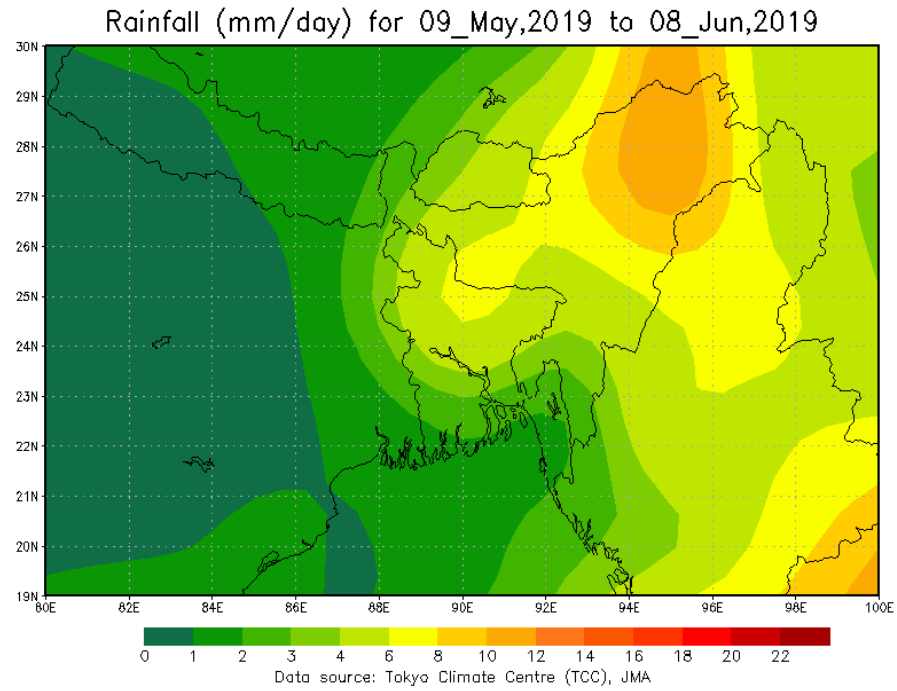


Success story of extended range for sowing of crops

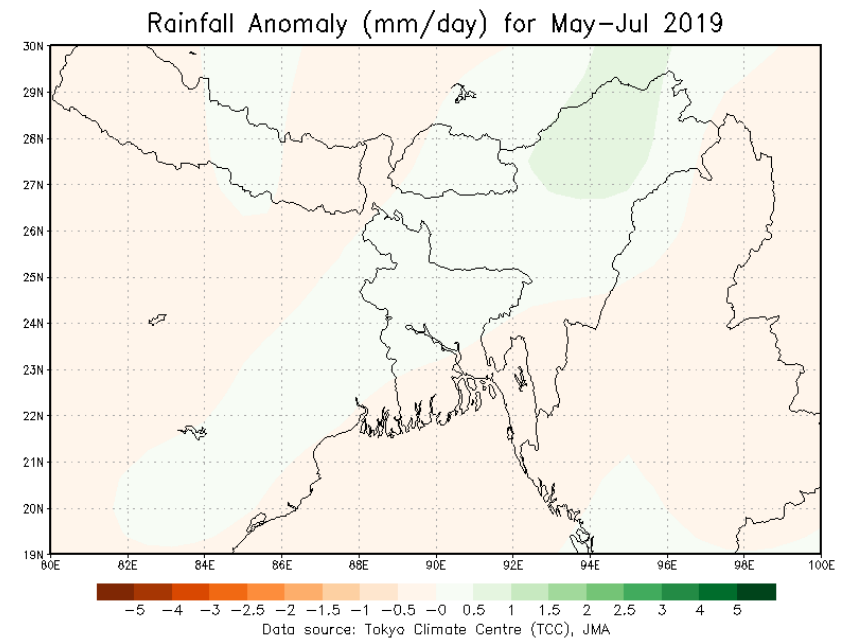
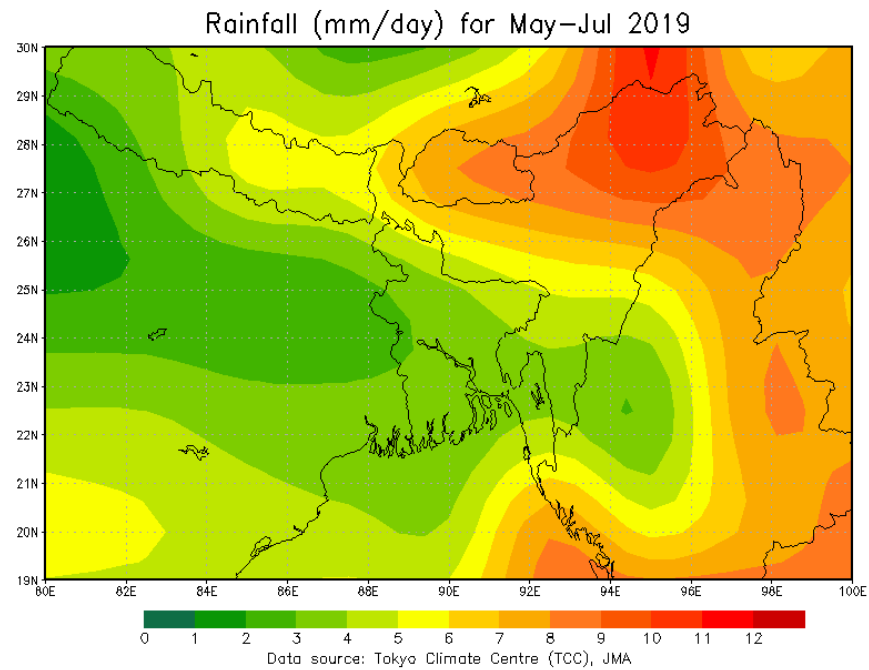
Up to 30th March, 2016, farmers of the village did not start sowing of *baor* varieties. Based on the forecast of continuous rainfall during April, 2016 received from IMD, farmers were advised to complete the sowing as early as possible (within first/second week of April). Though, the situation of the village was worse than the previous year, due to more rainfall during April and May farmers were able to complete the sowing. Thus the advisory given based on extended weather forecast was proved to very useful for the farmers of the village.



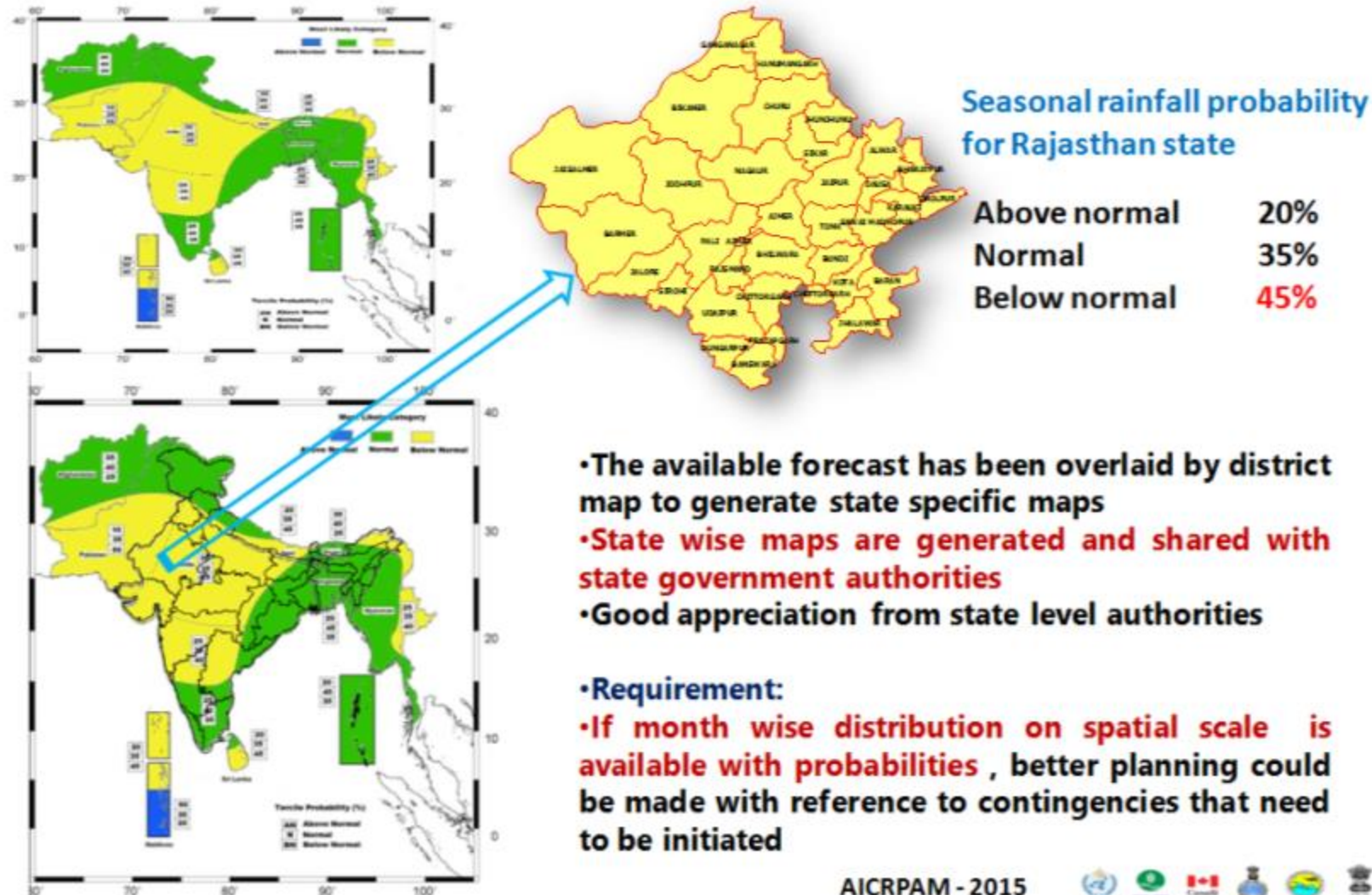
One Month Products Rainfall Forecast



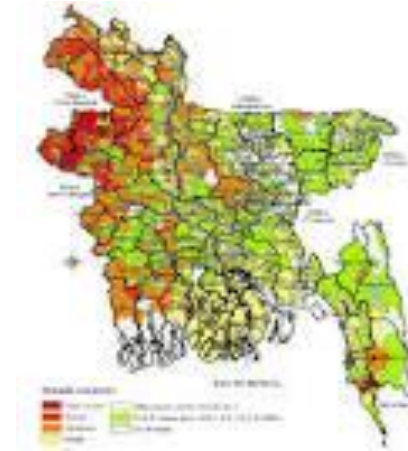
Three months



Southwest Monsoon Rainfall over South Asia Consensus outlook for 2015 and Rajasthan state



Extreme Events in Bangladesh



✓ Cyclone

✓ Flood

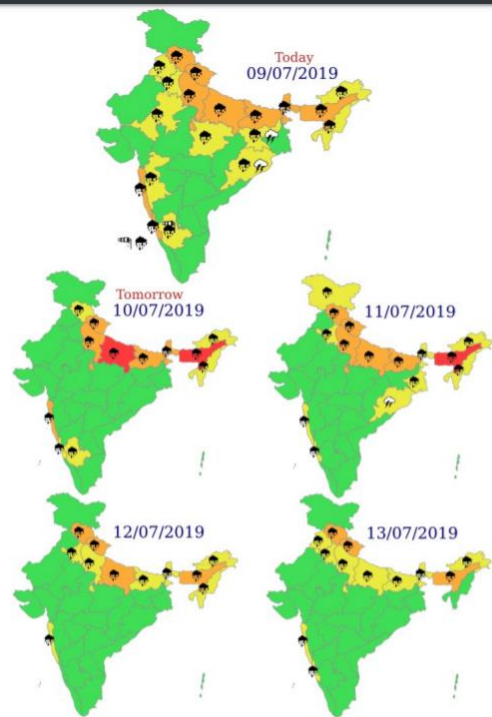
✓ Drought

?Lightning/
Thunderstorm

Warnings Parameters

- ✓ Cyclone
 - ✓ Heavy rainfall/snowfall
 - ✓ Thunderstorm/Squall/Hailstorm
 - ✓ Heat/Cold Wave
 - ✓ Frost
 - ✓ Fog
 - ✓ Strong winds
 - ✓ Storm surge and coastal inundation
-
- Warning criterion defined for each parameter
 - Linkages with Media, Disaster authorities well defined

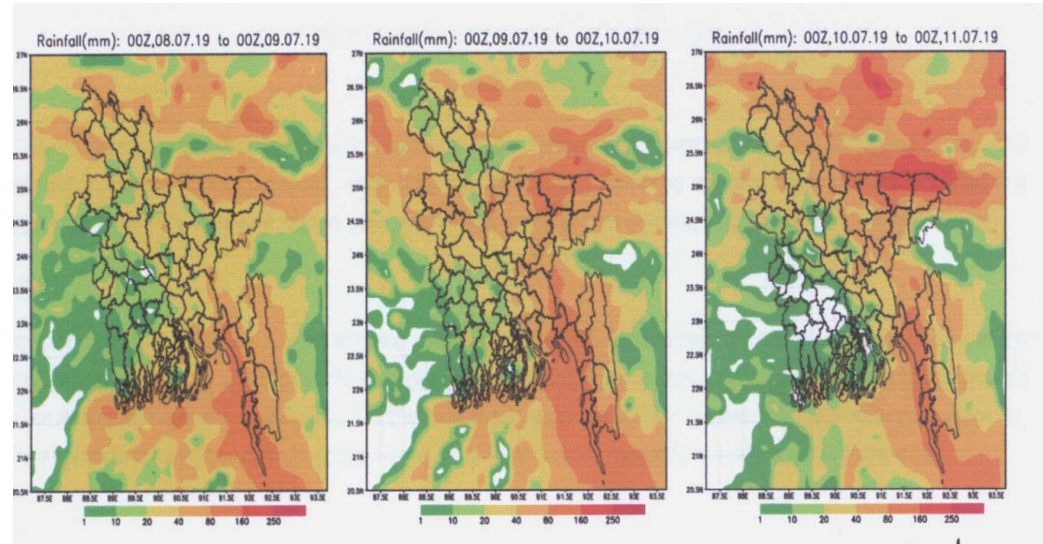
Pre-Flood Agromet Advisories on 9th July 2019



* Red color warning does not mean "Red Alert" Red color warning means "Take Action".
Forecast and Warning for any day is valid from 0630 hours IST of day 18 0630 hours IST of next day
For more details kindly visit www.imd.gov.in or contact : +91 11 24621913, 24643985, 24629798



Heavy rainfall forecast over Assam & Meghalaya by IMD



Heavy rainfall forecast over Assam & Meghalaya by BMD

From 8th July onwards there is a chance in increase in water level in Brahmaputra river. During 11 to 13 the July, the level of water in Yamuna river at Jamalpur-Bahadarabad point may cross danger level. And next the water level may cross danger level in Sariakundi in Bogura and also Sirajganj. As a result, there is chance of low to medium duration flood in Gaibandha, Jamalpur, Bogura, Sirajganj, Tangail and Manikganj.

Besides, there is chance in increase in water level of Surma, Kushiya & Kangsha river in the regions of Sylhet, Sunamganj & Netrakona. Due to rainfall in Tripura, there is chance in increase in water level in Manu, Khoai, Gomoti river and as a result low to medium duration flood may occur in Habiganj, Moulvibazar.

Water level in major rivers like Karnafuli, Halda, Matamuhari, Sang in Barishal and Chattogram division also may increase and as a result, low to medium duration flood may occur in some places in Chattogram, Rangamati, Banderban & Cox's bazar.

Special Agromet Advisories

Drain out excess water from the nursery as well as crop field. To prevent water stagnation in the nursery bed, construct channels around the seed bed for drainage. Clean the irrigation channel for draining out extra water from the field.

Raise the bund around the crop field. Hold on all agricultural operations like transplanting, application of irrigation, fertilisers, pesticides etc.

Immediately harvest the matured vegetables.

Immediately harvest the matured kharif maize.

Provide mechanical support to banana & standing vegetables.

Arrange for popping of sugarcane.

Arrange boats for migration of essential food items and others from low to high land.

Arrange for migration of livestock and poultry birds to high land.

Maintain a good height of embankment around the pond. If possible provide net or bamboo chatai around the pond to protect from flowing out with flash flood.

Flood forecast issued by Bangladesh Water Development Board (BWDB)

Criteria for Forecast Area and Rainfall Intensity (mm/day):

Forecast Area:

At one or two places (দু'এক জায়গায়)	= (1-25)% area
At a few places (কিছু কিছু জায়গায়)	= (26-50) % area
At many places (অনেক জায়গায়)	= (51-75)% area
At most places (অধিকাংশ জায়গায়)	= (76-100)% area

Criteria for Rainfall Intensity (mm/day)

Light rain (হালকা বৃষ্টি)	<10 mm
Moderate rain(মঝারী ধরণের বৃষ্টি)	11-22 mm
Moderately Heavy rain(মঝারী ধরণের ভারী বর্ষণ)	23-43 mm
Heavy rain(ভারী বর্ষণ)	44-88 mm
Very Heavy rain(অতি ভারী বর্ষণ)	>89 mm

Are categorized as:

Cold wave (শৈত্য ধবাহ)	Minimum Temperature Range
Mild Cold Wave (মৃদু শৈত্য ধবাহ)-	08-10°C
Moderate cold wave (মাঝারী ধরনের শৈত্য ধবাহ)-	06-08°C
Severe cold wave (তীব্র শৈত্য ধবাহ)-	04-06°C
Very Severe cold wave (খুব তীব্র শৈত্য ধবাহ)-	<04°C

Heat waves are categorized as:

Heat wave (তাপ ধবাহ)	Maximum Temperature Range
Mild Heat Wave (মৃদু তাপ ধবাহ)	36-38°C
Moderate Heat wave (মাঝারী ধরনের তাপ ধবাহ)	38-40°C
Severe Heat wave (তীব্র তাপ ধবাহ)	40-42°C
Very Severe Heat wave (অতি তীব্র তাপধবাহ)	>42°C

Fog Warning (কুয়াশার সতর্ক বার্তা):

In case of moderate/ thick fog and surface visibility reducing to 3000 m or less, BMD issues fog warnings for river basins and its adjoining land areas and also for airports for smooth running of transports and air craft's.

Classification of tropical disturbances that form in the Bay of Bengal and the Arabian Sea.

Disturbance	Corresponding Wind Speed
1. Low Pressure Area (লঘুচাপ)	Less than 17 knots (31 km/h)
2. Well Marked Low (সুস্পষ্ট লঘু চাপ)	17-21 knots (31-40 km/h)
3. Depression (নিম্নচাপ)	22-27 knots (41-51 km/h)
4. Deep Depression (গভীর নিম্নচাপ)	28-33 knots (52-61 km/h)
5. Cyclonic Storm (ঘূর্ণিঝড়)	34-47 knots (62-88 km/h)
6. Severe Cyclonic Storm (প্রবল ঘূর্ণিঝড়)	48-63 knots (89-117 km/h)
7. Severe Cyclonic Storm with a Core of Hurricane wind (হ্যারিকেন এর তীব্রতা সম্পন্ন প্রবল ঘূর্ণিঝড়)	64-119 knots (118-219 km/h)
8. Super Cyclone (সুপার সাইক্লোন)	120 knots (220 km/h) or above.

Dissemination and Communication

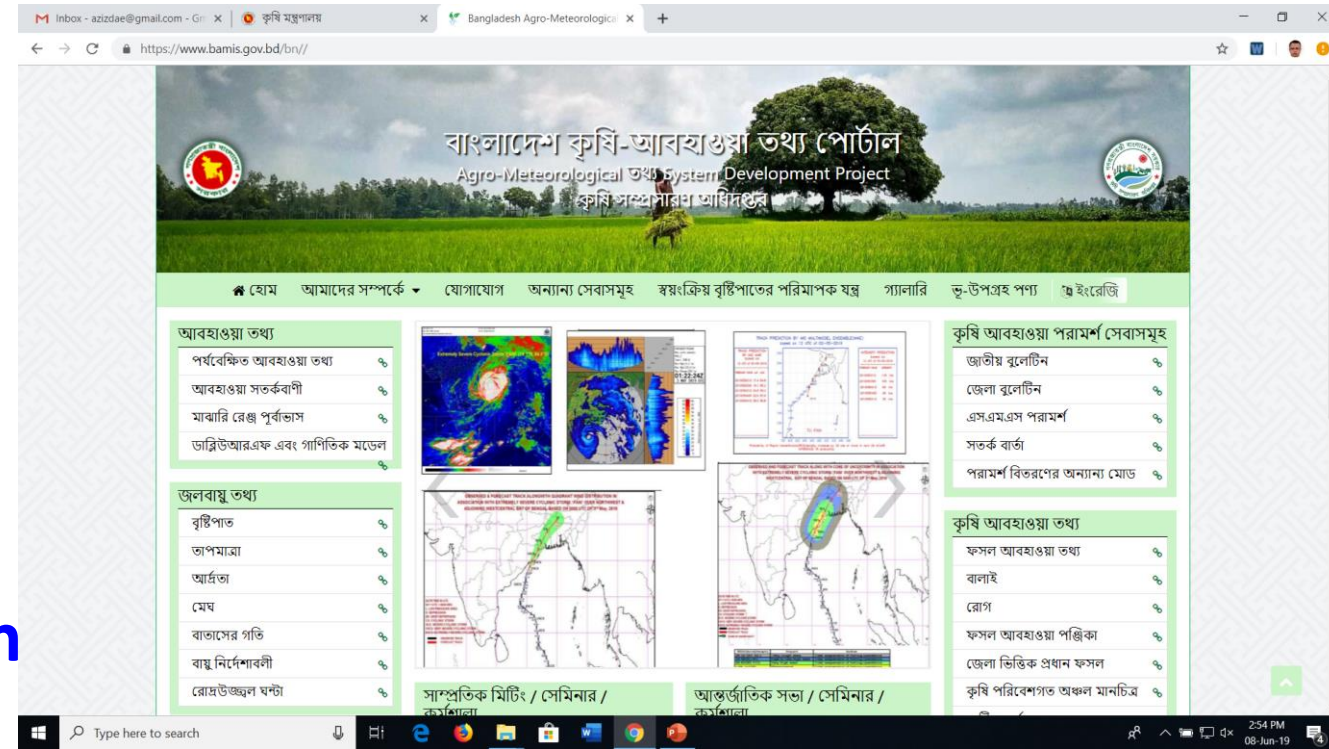
Key Components of Warning System

- Effective dissemination:
 - Need to cover as large an audience as possible:
 - Backups and redundancies
 - Must reach Hazards Community
- Media: indispensable partner in warning process; multiple channels:
 - Traditional (TV, Radio, Sirens, Public Address systems etc.)
 - mobile and Social networking (Email, SMS, Web, face book)
- Public education: to avoid reinterpretation (FAQs, Do's and Don't are published by IMD along with leaflets on specific hazards)

Warning Dissemination service

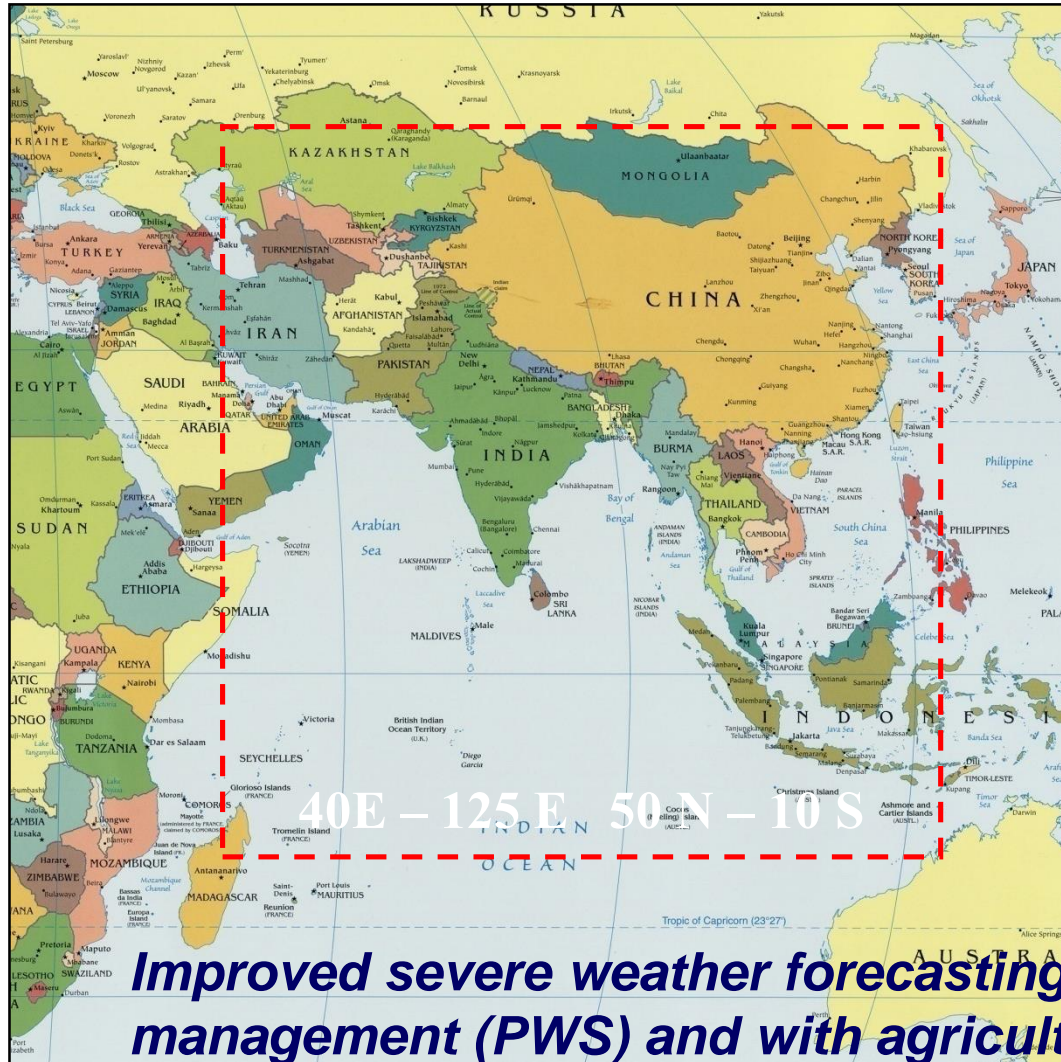
Dissemination mode

- Websites with
- Internet (e-mail),
- Telephone,
- Mobile Phones(SMS),
- Satellite based warn dissemination System,
- Global telecommunication system,
- Radio(AM, FM, Community Radio,
- TV (Govt and Private TV),
- Social Media (Mobile apps, Facebook and Tweeter)



In Bangladesh condition weather forecasting should be delivered through mobile phone system with voice mail, most of the farmer are carrying a mobile phone and for the illiterate farmer, s/he can listen voice easily. The FM radio can also be used for this purpose since it covers more than 80% of the total population.

SWFDP – Bay of Bengal



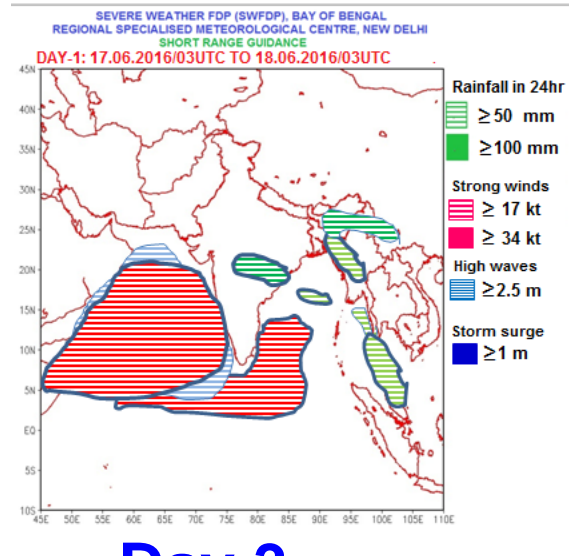
- Bangladesh
- India
- Maldives
- Myanmar
- Sri Lanka
- Thailand
- Bhutan (later)
- Nepal (later)
- Afghanistan (later)
- Pakistan (later)

Heavy precipitation, Strong winds
Large waves / swell, Storm Surge

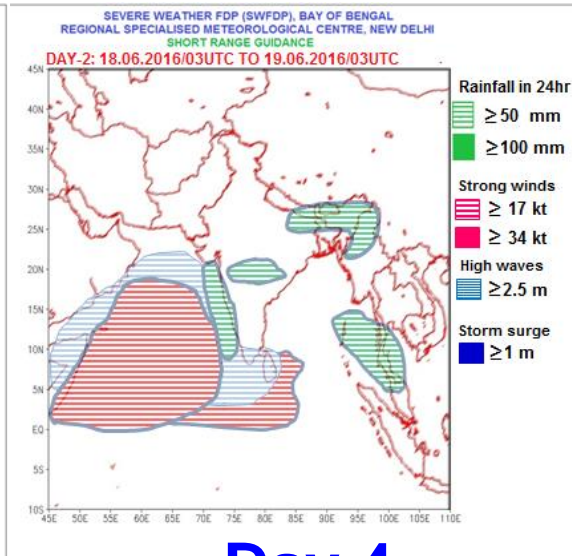
Improved severe weather forecasting , warning services to disaster management (PWS) and with agriculture

Severe Weather Forecast Demonstration Project

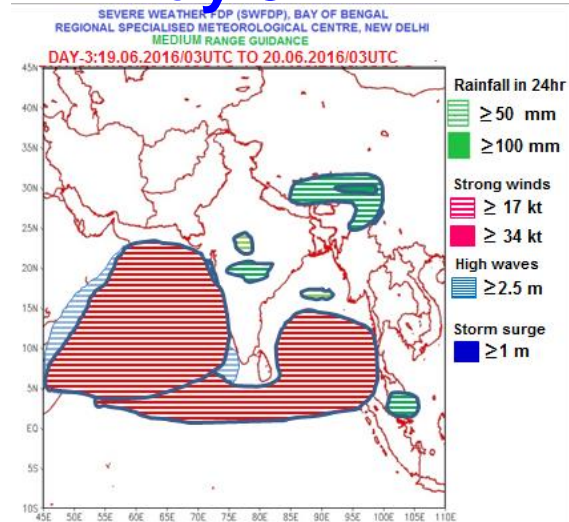
Day 1



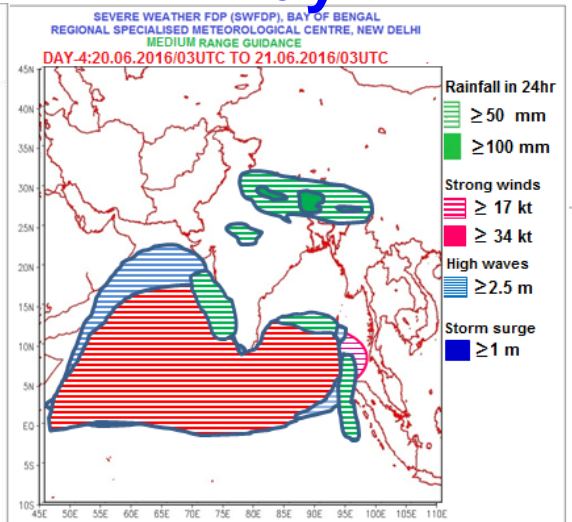
Day 2



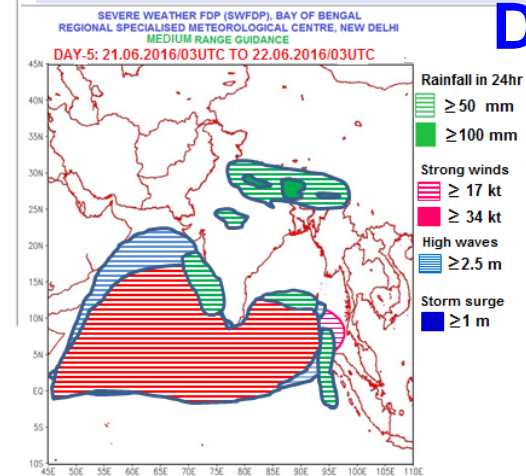
Day 3



Day 4



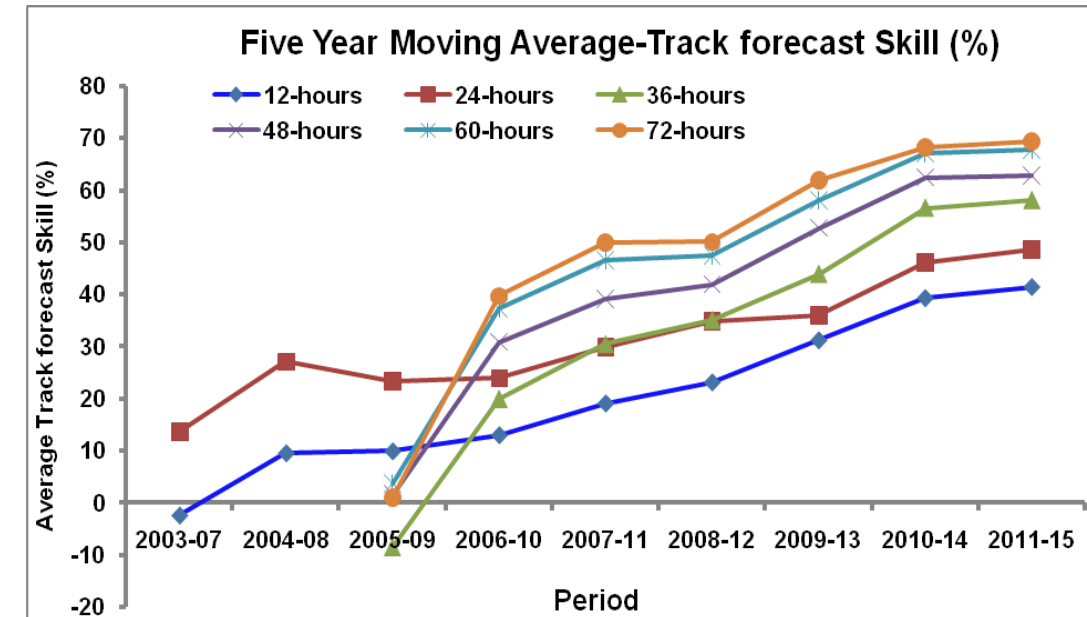
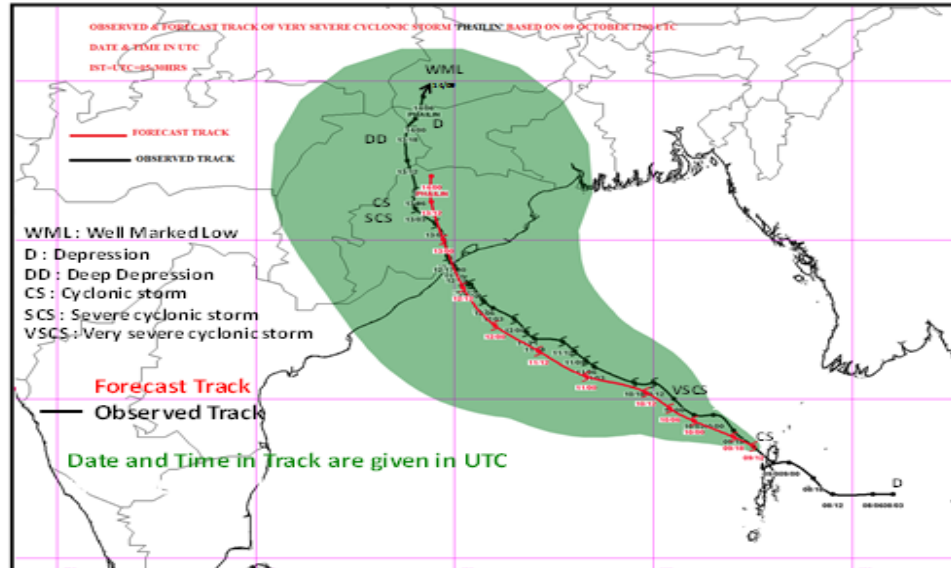
Day 5



- Three tier cascading system (global, regional and national partners)
- Project will commence in pilot mode in 2 May 2016 for cyclone, heavy rain, wind and wave with RSMC, New Delhi as Regional Centre
- Global model products from NCEP, ECMWF, UKMO, JMA will be available for this domain

Cyclone Warning Services

Observed and Forecast Track based on 1200 UTC of
09 October 2013



- Remarkable improvement in the prediction of cyclone, e.g. Phailin and Hudhud
- At par or better than other leading centres

**Temperature
Departure**

Heat Index

Cold waves

Heat waves

Thanks for kind attention!