



ORGANIZATION STRUCTURE AND WEATHER FORECASTING

**India Meteorological Department
Ministry of Earth Sciences**

PRESENTATION LAYOUT

- Meteorological Observations
- Organisation Structure
- Forecast & Warnings product and its dissemination
- Warnings skill score
- Future schemes



METEOROLOGICAL OBSERVATIONS

- **Weather Monitoring**
- **Assessment of synoptic condition of the atmosphere for analysing the characteristics of weather systems in terms of their genesis, evolution, intensification, movement, decay and associated adverse weather**
- **Assimilation in various global and regional numerical weather prediction models**
- **Development of climatology**
- **Verification of forecast**

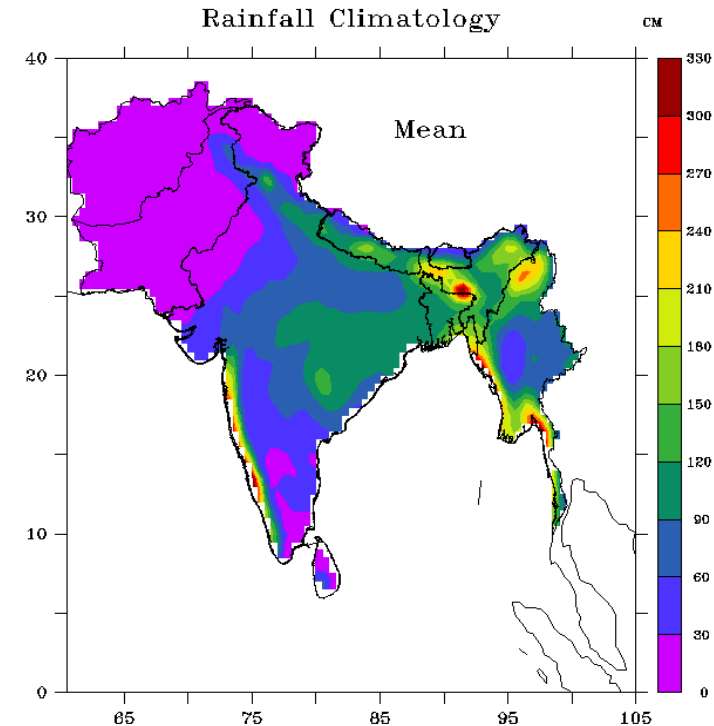


OUR OBSERVATIONAL NETWORK

Type of Observatory	Nos.
Doppler Weather Radars (DWRs)	23
Automatic Weather Systems (AWS)	725
Automatic Rain Gauges (ARG)	1124
Upper Air Radiosonde Observatories	39
Pilot Balloon Observatories	62
Surface Observatories	559
Aviation Current Weather Observatories	71
High Wind Speed Recording Stations	13
INSAT-based Data Collection Platforms	100
Hydrometeorological Observatories	701
Non-Departmental Raingauge Stations:	
- Reporting	3540
- Non-Reporting	5039
Non-Departmental Glaciological Observatories (Non-reporting):	
- Snowgauges	21
- Ordinary Raingauges	10
- Seasonal Snow Poles	6
Agrometeorological Observatories	219
Evaporation Stations	222
Soil Moisture Recording Stations	49
Dew-fall Recording Stations	80
Evapotranspiration Stations	39
Ozone Stations	6
Radiation Stations	45
Air Pollution Observatories:	
- Background Pollution Observatories	10
- Urban Climatological Units	2
- Urban Climatological Observatories	13
Ships of the Indian Voluntary Observing Fleet	203

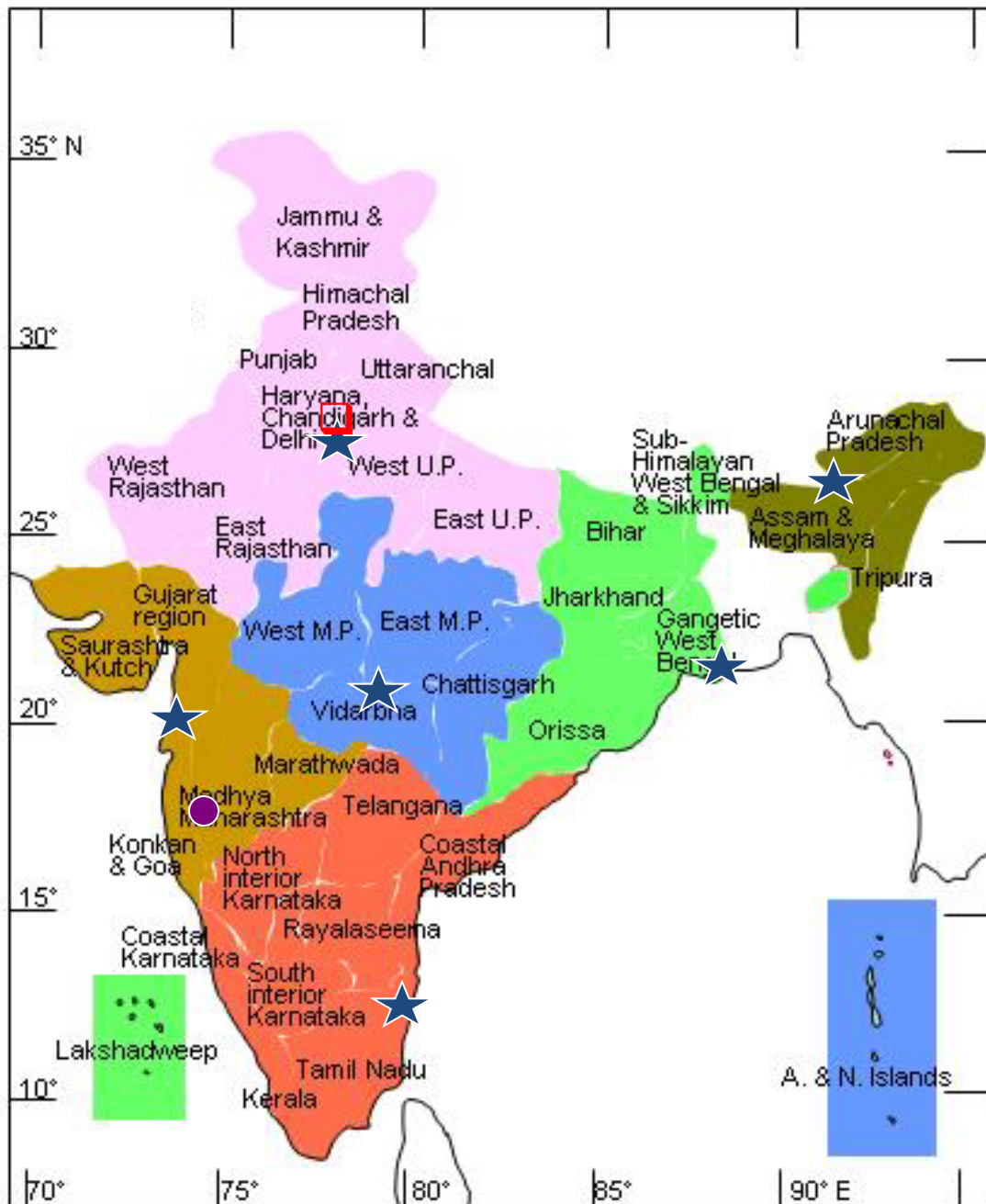
WEATHER RELATED NATURAL HAZARDS OCCUR THROUGHOUT THE YEAR

- WINTER (JAN-FEB)
 - WD
 - COLD WAVE, FOG, HEAVY SNOW, FROST
- PRE-MONSOON (MAR-MAY)
 - CYCLONIC DISTURBANCES
 - HEAT WAVE
 - THUNDER STORMS, SQUALLS
 - HAIL STORM
 - TORNADO
- MONSOON (JUN-SEP)
 - HEAVY RAINFALL,
 - FLOODS/FLASH FLOODS
 - DROUGHTS
- POST-MONSOON (OCT-DEC)
 - CYCLONIC DISTURBANCES
 - NORTHEAST MONSOON (HEAVY RAINFALL)



Near 90 % of loss of life due to natural disasters is caused by Weather, Climate and Water related hazards

6 Meteorological Regions



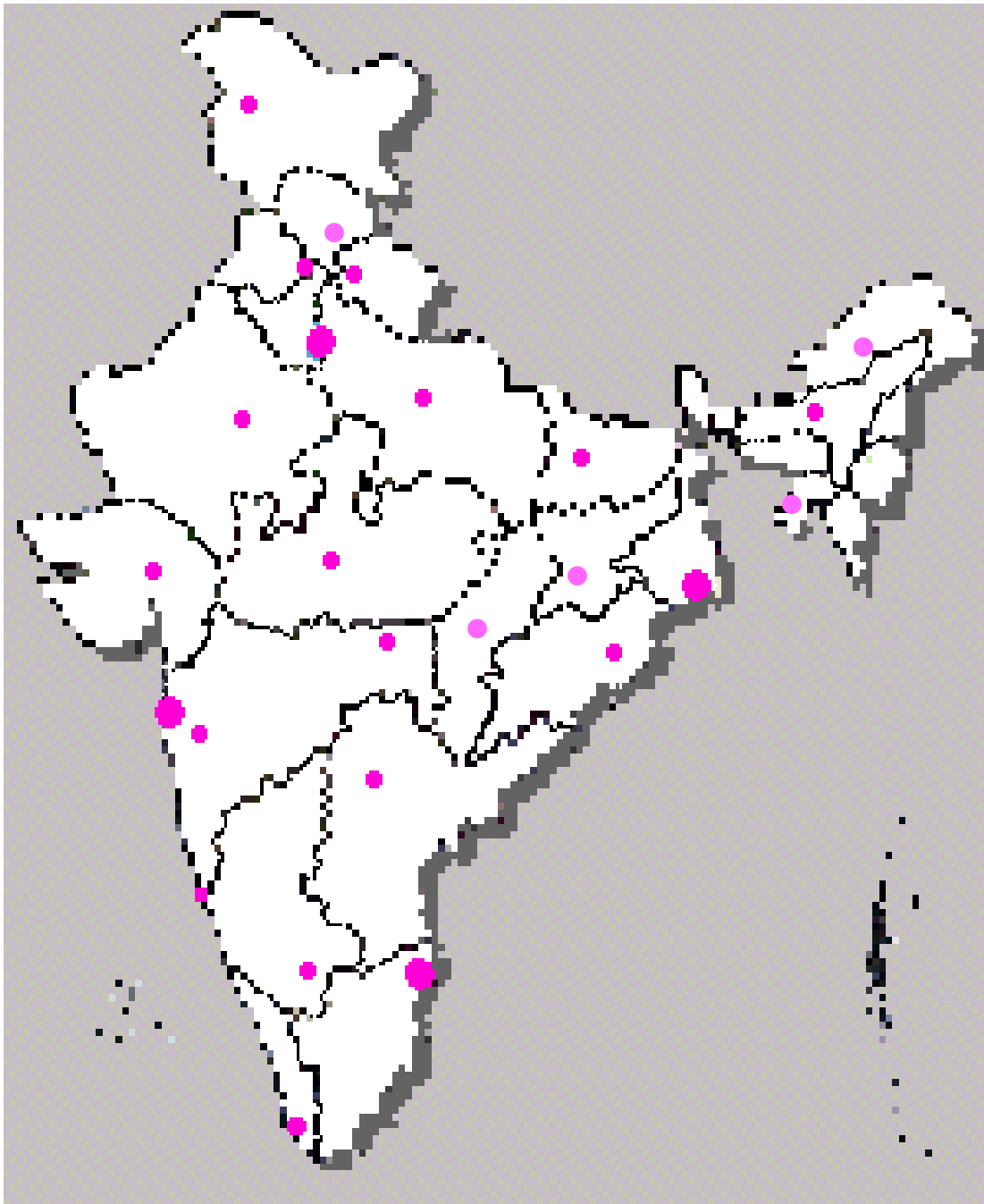
- North Region
- East Region
- North East Region
- Central Region
- West Region
- South Region

□ **NWFC at New Delhi and WF at Pune**

★ **Regional Centres**
Delhi, Kolkata, Guwahati, Nagpur, Mumbai, Chennai

● **Pune Centre for Research /Training, Agromet, and surface instrumentation**





Meteorological Centres

1. Srinagar
2. Chandigarh
3. Shimla
4. Dehra Dun
5. Lucknow
6. Patna
7. Itanagar
8. Jaipur
9. Ranchi
10. Agartatala
11. Ahmedabad
12. Bhopal
13. Raipur
14. Bhubaneshwar
15. Hyderabad
16. Bangalore
17. Thiruvananthapuram
18. Panjim
19. Gangtok



Weather Forecasting System

Observations

Communication

Analyses & Forecasting

Dissemination

Surface Observations
Manned (559) + AWS
(725) + ARG (1124)

Upper-Air Observations
(62 PB stations + 39
RS/RW)

Aircraft Reports

Ship Reports

Ocean Buoys data
(Deployed by Dept. of Ocean
Development)

Satellite Observations
Sat. Met Division, IMD
(Deployed by Department of
Space)

Global
Data

Data-flow at Three Hourly
Intervals on 24x7 Mode

Regional
Telecom
Hub (RTH)

Data/Flow

Delhi
National Weather
Forecasting Centre

Pune
Weather Central

IMD, Delhi
NWP forecasts

State Level
Met.
Centres

Airport
Met. Offices

Data ported to
NCMRWF for
medium range
weather forecasts

Regional Centres - 6

Met. Centres - 19

Cyclone Centres - 6

16 DWR
Networks

There are total 2664 (Scientists, AM, SA) trained manpower. In all the centres, trained forecasters are working on 24X7 basis

Central / State Govt / Media / Public

VIDEO- CONFERENCING

- Daily between NWFC, DDGM (WF), RWFCs
- To improve accuracy of Weather Forecast and Warnings
- To remove contradictions in Weather Forecast and warnings



THREE TIER FORECASTING STRUCTURE

Level	Responsibility
National	
NWFC	Met Subdivision <u>Forecasting/Warning</u>, Guidelines Developmental work
PUNE	Documentation , Reports
Regional	
RMCs	District-wise Forecasting/warning, other Forecasts
Local	
MCs	District-wise Forecasting/warning, other Forecasts

SPATIAL AND TEMPORAL DOMAINS OF FORECAST

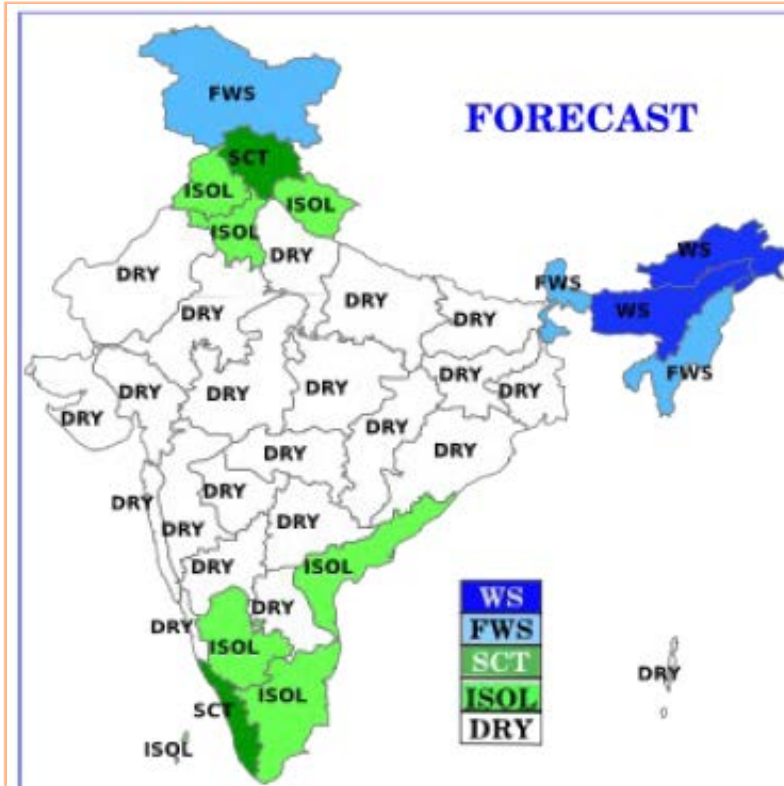
- ❑ **Nowcasting for next few hours**
(Venue/ location specific)
- ❑ **Short Range for next 120 hour**
(Location/District/ State/Met Sub-division)
- ❑ **Medium Range for next 3-10 days**
(District/Block)
- ❑ **Extended range for 10-30 days**
(Met Subdivision/State/ Homogeneous regions)
- ❑ **Long range for month/season**
(Homogeneous regions/country)

Customized Forecasts- Power, Defense, Adventure, Road/Railway transports, Highway, Expedition, pilgrimage, Public Utility, VIP functions, Strategic operations, City, Tourism, Space, event based etc 

OUR SERVICE STANDARDS

No.	Our Services and Transactions	How we measure our performance in this area	Service Standard
1	Weather Forecasts and Warnings	Timely release of 5 day Weather Forecast and Warnings	6 Hours
2	Agro-meteorological advisories and Forecast at district level	Issue of 5 day Agro-meteorological advisories and Forecast at district Level (625)	Bi-Weekly
3	Meteorological support for Civil Aviation purpose	Meteorological support for Civil Aviation purpose	60 Minutes
4	Rainfall monitoring	Rainfall Monitoring (District/subdivision wise)	1 Day
5	City Forecast	5 day Forecast for 324 locations	6 hourly
6	Tourism Forecast	5 day Forecast for 106 Locations	6 hourly
7	Nowcast	3 hourly warnings from for 156 Locations	3 Hourly

SUB-DIVISION WISE FORECAST & WARNINGS



21 April(Day 1) :

- ◆ Heat wave conditions at many places with severe heat wave at a few places over Jharkhand; heat wave at a few places with isolated severe heat wave over Odisha.
- ◆ Heat wave conditions at a few places over Bihar and East Uttar Pradesh; at isolated places over East Madhya Pradesh, Vidarbha, Chhattisgarh, Gangetic West Bengal, Telangana and Rayalaseema.
- ◆ Warm night conditions likely at isolated places over Punjab, Haryana, Chandigarh & Delhi.
- ◆ Heavy rain at isolated places over Sub-Himalayan West Bengal & Sikkim, Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura.
- ◆ Thunderstorm accompanied with squall/hail likely at isolated places over Assam & Meghalaya.
- ◆ Dust/thunderstorm likely at isolated places over Punjab, Haryana, Chandigarh & Delhi, north Rajasthan and West Uttar Pradesh.

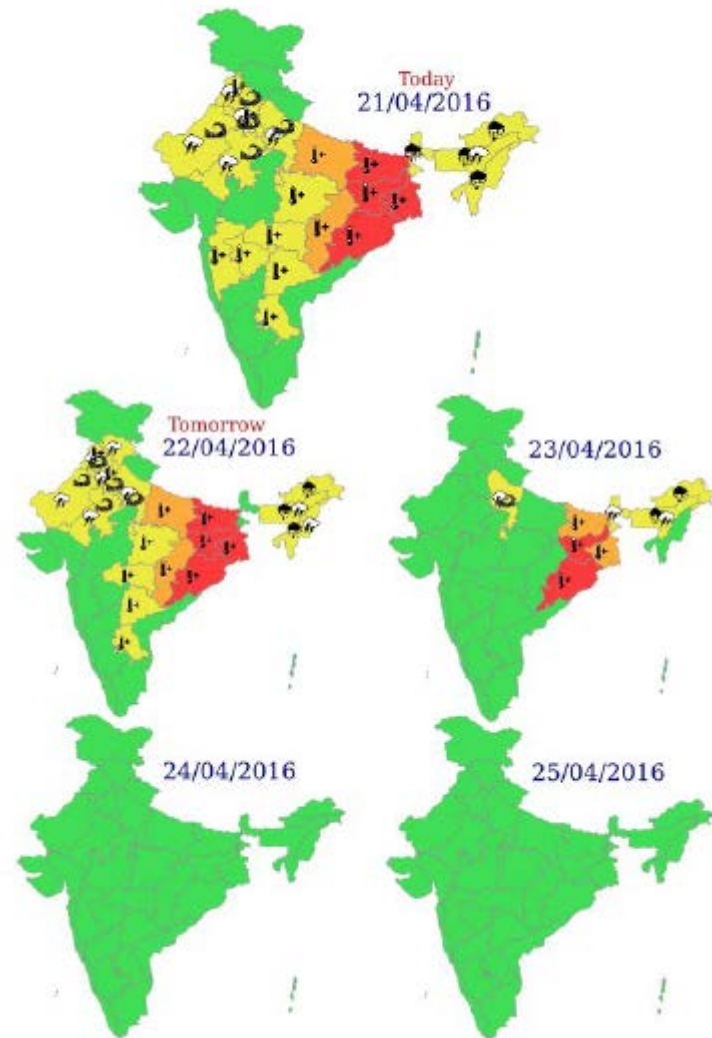
ALL INDIA SEVERE WEATHER WARNINGS

East India
Date: 21 APRIL, 2016
(EVENING)

Met-Sub Division	Today 21 APRIL, 2016	Tomorrow 22 APRIL, 2016	23 APRIL, 2016	24 APRIL, 2016	25 APRIL, 2016
Andaman & Nicobar Islands	NIL	NIL	NIL	NIL	NIL
Bihar	Heat wave conditions very likely at a few places	Heat wave conditions very likely at a few places	Heat wave conditions very likely at isolated places	NIL	NIL
Jharkhand	Heat wave conditions very likely at a many places with severe at few places	Heat wave conditions very likely at a many places with severe at isolated places	Heat wave conditions very likely at many places	NIL	NIL
Odisha	Heat wave conditions very likely at a few places with severe at isolated places	Heat wave conditions very likely at a few places with severe at isolated places	Heat wave conditions very likely at a few places with severe at isolated places	NIL	NIL
Gangetic West Bengal	Heat wave conditions very likely at isolated places	Heat wave conditions very likely at isolated places	Heat wave conditions very likely at isolated places	NIL	NIL
SHWB & Sikkim	Heavy rain at isolated places	NIL	Thunderstorm accompanied with squall/hail and heavy rain likely at isolated places	NIL	NIL

* The Warning for any day is valid from 0830 hours IST of the day till 0830 hours IST of Next day

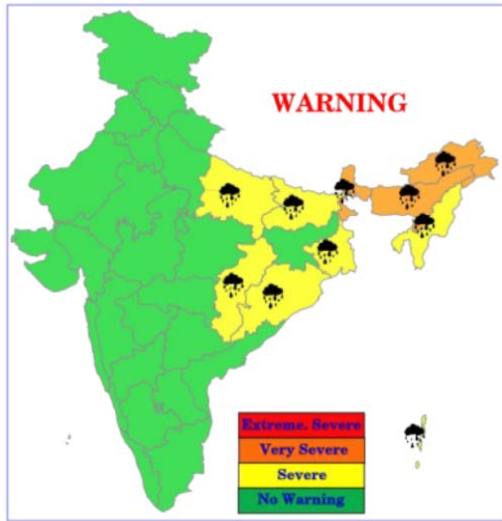
Date: 21 APRIL, 2016
(EVENING)



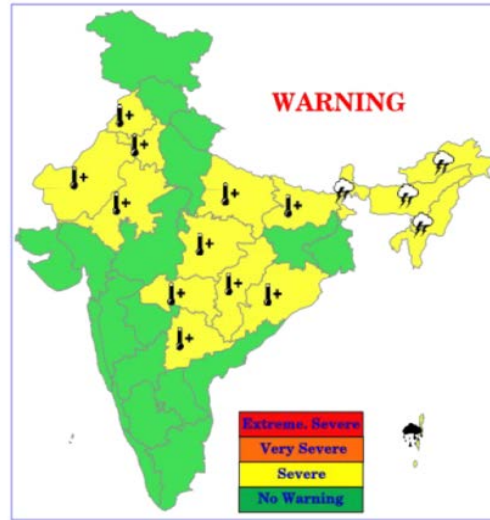
WARNING (TAKE ACTION)
ALERT (BE PREPARED)
WATCH (BE UPDATED)
NO WARNING (NO ACTION)

Terms	Probability of Occurrence (%)
Unlikely	< 25
Likely	25 - 50
Very Likely	50 - 75
Most Likely	> 75

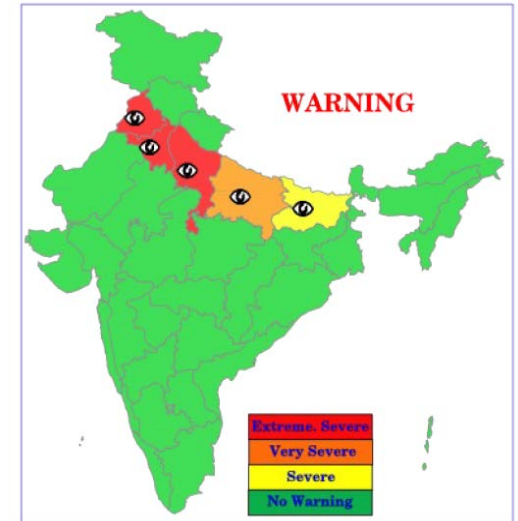
Heavy Rainfall



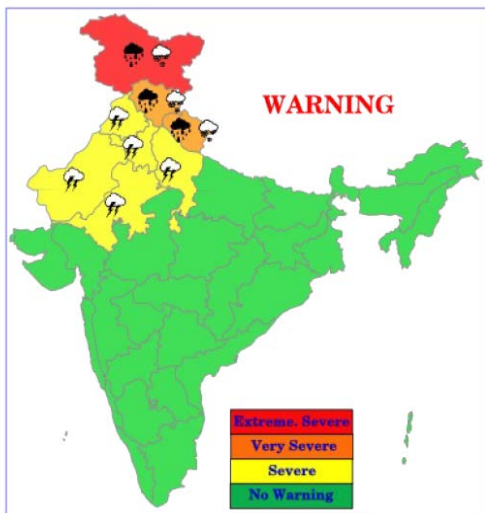
Heat Wave & Thundersquall



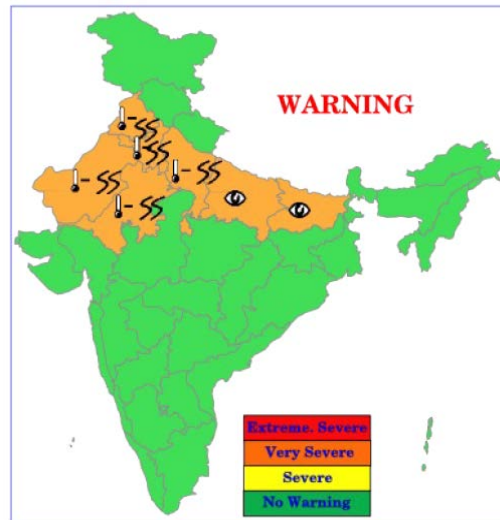
Fog/Visibility



Heavy Snow



Cold wave/ visibility & frost



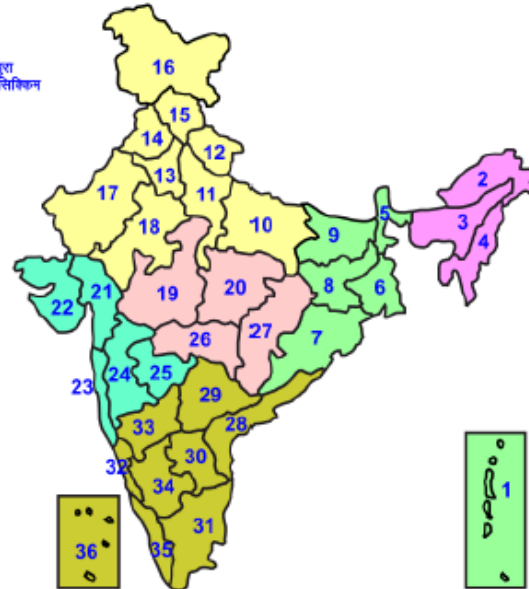
Heat Wave



36 Meteorological Sub-Divisions

LEGENDS

- 1 अंडमान और निकोबार द्वीप समूह
- 2 अरुणाचल प्रदेश
- 3 असम और मेघालय
- 4 नागालैंड मणिपुर मीजोरम और त्रिपुरा
- 5 उप हिमालय पश्चिम बंगाल एंग्म सिक्किम
- 6 पश्चिम बंगाल
- 7 ओडिशा
- 8 झारखंड
- 9 बिहार
- 10 पूर्वी उत्तर प्रदेश
- 11 पश्चिम उत्तर प्रदेश
- 12 उत्तराखंड
- 13 हरियाणा, चंडीदाह और दिल्ली
- 14 पंजाब
- 15 हिमाचल प्रदेश
- 16 जम्मू और कश्मीर
- 17 पश्चिम राजस्थान
- 18 उत्तराखण्ड
- 19 पश्चिम मध्य प्रदेश
- 20 पूर्वी मध्य प्रदेश
- 21 गुजरात
- 22 सौराष्ट्र
- 23 कर्नाटक
- 24 मध्य प्रदेश
- 25 मध्य प्रदेश
- 26 बिहार
- 27 उत्तराखण्ड
- 28 उत्तर प्रदेश
- 29 उत्तर प्रदेश
- 30 उत्तर प्रदेश
- 31 उत्तर प्रदेश
- 32 उत्तर प्रदेश
- 33 उत्तर प्रदेश
- 34 उत्तर प्रदेश
- 35 उत्तर प्रदेश
- 36 लक्षद्वीप



1. Andaman & Nicobar Islands
2. Arunachal Pradesh
3. Assam & Meghalaya
4. Nagaland, Manipur, Mizoram & Tripura
5. Sub-Himalayan West Bengal & Sikkim
6. Gangetic West Bengal
7. Orissa
8. Jharkhand
9. Bihar
10. East Uttar Pradesh
11. West Uttar Pradesh
12. Uttarakhand
13. Haryana, Chd & Delhi
14. Punjab
15. Himachal Pradesh
16. Jammu & Kashmir
17. West Rajasthan
18. East Rajasthan
19. West Madhya Pradesh
20. East Madhya Pradesh
21. Gujarat
22. Saurashtra
23. Konkan & Goa
24. Madhya Maharashtra
25. Marathwada
26. Vidharbha
27. Chhattisgarh
28. Coastal Andhra Pradesh
29. Telangana
30. Rayalaseema
31. Tamilnadu & Pondi
32. Coastal Karnataka
33. North Interior Karnataka
34. South Interior Karnataka
35. Kerala
36. Lakshadweep

SPATIAL DISTRIBUTION (% of Stations reporting)

% Stations	Category	% Stations	Category
76-100	Widespread (WS/ Most Places)	26-50	Scattered (SCT/ A Few Places)
51-75	Fairly Widespread (FWS/ Many Places)	1-25	Isolated (ISOL)
Dry (No station reported Rainfall)			

WARNING

WARNING (TAKE ACTION)
ALERT (BE PREPARED)
WATCH (BE UPDATED)
NO WARNING (NO ACTION)

Probabilistic Forecast

Terms	Probability of Occurrence (%)
Unlikely	< 25
Likely	25 - 50
Very Likely	50 - 75
Most Likely	> 75



Heavy Rain



Heavy Snow



Thunderstorm



Dust Storm



Strong Winds



Visibility



Cyclone



Squall/ Hail



Frost



Cold Wave



Heat Wave



Sea State

Hailstorm Advisory for Maharashtra

Date of Issue : 12 March 2014

DISTRICT WARNINGS

Sub Div	Districts	Today	Tomorrow
Konkan & Goa	Thane	NIL	NIL
	Mumbai	NIL	NIL
	Raigad	NIL	NIL
	Ratnagiri	NIL	NIL
	Sindhudurg	NIL	NIL
	Goa	NIL	NIL
Madhya Maharashtra	Mandurbar	NIL	NIL
	Dhule	NIL	NIL
	Jaigaon	P1	P1
	Nasik	P2	P1
	Ahmednagar	P2	P2
	Pune	NIL	P1
	Sholapur	NIL	NIL
	Satara	NIL	NIL
	Sangli	NIL	NIL
	Kolhapur	NIL	NIL
Marathawada	Aurangabad	P1	P1
	Jalna	P1	P1
	Beed	P1	P1
	Parbhani	NIL	NIL
	Latur	NIL	NIL
	Omanabad	NIL	NIL
	Nanded	NIL	NIL
	Hingoli	NIL	NIL
Vidarbha	Buldana	P1	P1
	Akola	P1	P1
	Washim	NIL	P1
	Amravati	NIL	P1
	Yavatmal	NIL	P1
	Wardha	NIL	P1
	Nagpur	NIL	P1
	Bhandara	NIL	NIL
	Chandrapur	NIL	NIL
	Gondia	NIL	NIL
	Gadchiroli	NIL	NIL

LEGEND:


NIL:	No Warning
P1:	1 - 25 % probability
P2:	26 - 50 % probability
P3:	51 - 75 % probability
P4:	76 - 100 % probability

5 day City Forecast (for 324 cities)

CLIMATOLOGICAL TABLE (PERIOD: 1971-2000)

Local Weather Report and Forecast For: Agartala Dated :Apr 24, 2016

Tripura



Past 24 Hours Weather Data

Maximum Temp(°C) (Recorded on 23/04/16)	34.9
Departure from Normal(°C)	2
Minimum Temp (°C) (Recorded. on 24/04/16)	28.4
Departure from Normal(°C)	6
24 Hours Rainfall (mm) (Recorded from 0830 hrs IST of yesterday to 0830 hrs IST of today)	NIL
Today's Sunset (IST)	17:51
Tommmorows Sunrise (IST)	04:55
Moonset (IST)	08:19
Moonrise (IST)	19:40

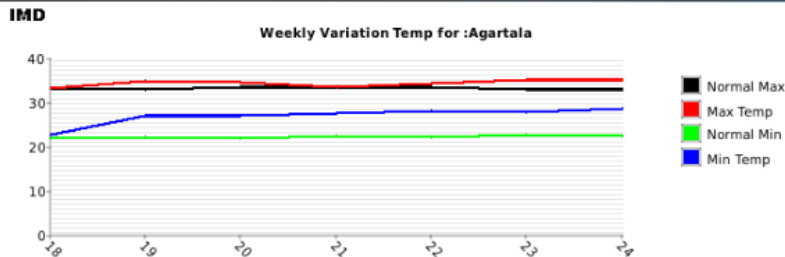
7 Day's Forecast

Date	Min Temp	Max Temp	Weather
24-Apr	27.0	34.0	Partly cloudy sky with one or two spells of rain or thundershowers
25-Apr	27.0	34.0	Partly cloudy sky with one or two spells of rain or thundershowers
26-Apr	27.0	35.0	Partly cloudy sky
27-Apr	27.0	35.0	Partly cloudy sky
28-Apr	27.0	35.0	Partly cloudy sky
29-Apr	27.0	34.0	Partly cloudy sky
30-Apr	27.0	34.0	Partly cloudy sky

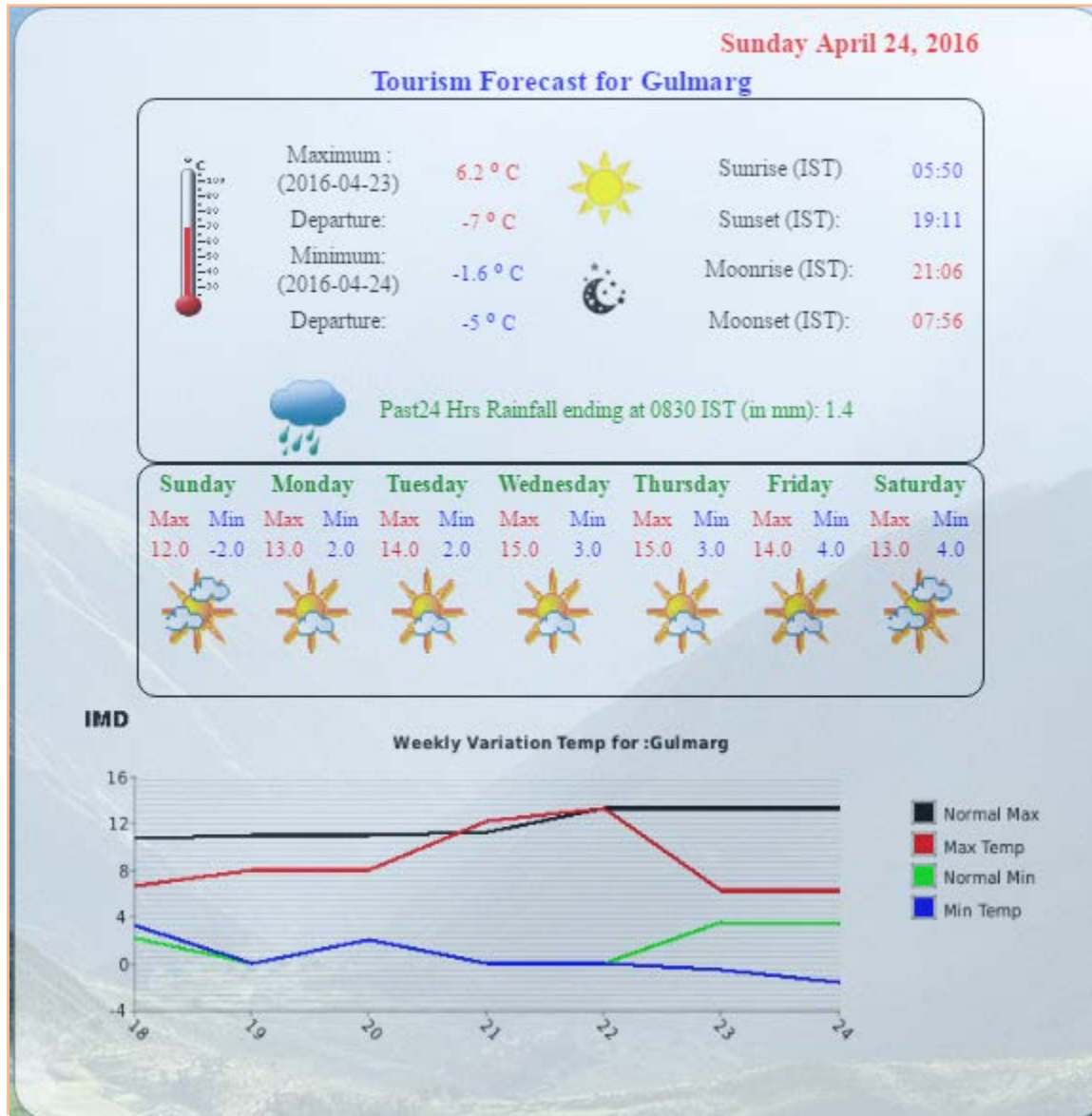
Year	Temperature(°C)		Rainfall (mm)	
	Highest Maximum(Date)	Lowest Minimum(Date)	24 Hours Highest (Date)	Monthly Total
2011	35.9(13)	18.7 (07)	25.5 (20)	55.4
2010	35.5(08)	20.7 (18)	62.8(30)	155.7
2009	39.1 (26)	18.7 (01)	17.6 (03)	53.0
2008	37.6(23)	18.2 (04)	20.3 (04)	29.5
2007	37.0(30)	15.5(13)	198.0 (11)	458.6
2006	37.1(29)	18.8 (04)	68.7 (04)	136.5
2005	35.8(21)	19.2 (04)	29.9 (29)	109.5
2004	34.0(30)	17.4(13)	82.9 (19)	384.3
2003	35.0 (27)	18.2 (23)	48.8 (02)	217.4
2002	34.4(20)	14.2 (03)	34.2 (11)⚡	184.4
ALL TIME RECORD	41.5⚡ (30, 1960)	14.2 (03, 2002)	198.0 (11, 2007)	537.3 (1977)

EXTREME WEATHER EVENTS IN THE MONTH OF APRIL

Month	Mean Temperature(°C)		Mean Total Rainfall (mm)	Mean Number of Rainy Days	Mean Number of days with			
	Daily Minimum	Daily Maximum			HAIL	Thunder	FOG	SQUALL
Jan	10.0	25.5	5.6	0.5	0.1	0.5	7.1	0.1
Feb	13.1	27.9	24.9	2.5	0.0	1.8	2.0	0.0
Mar	18.6	32.2	72.0	3.5	0.1	4.3	1.1	1.0
Apr	22.2	33.1	206.8	8.9	0.0	11.0	0.4	2.2
May	23.3	32.4	352.6	13.7	0.0	13.0	0.1	2.8
Jun	24.8	32.0	359.3	15.2	0.0	8.9	0.1	0.4
Jul	24.9	31.4	369.4	16.1	0.0	6.7	0.0	0.2
Aug	25.0	31.9	257.9	15.2	0.0	8.7	0.1	0.2
Sep	24.4	31.8	227.6	11.9	0.0	9.4	0.6	0.2
Oct	22.2	31.2	157.0	6.8	0.0	4.5	1.3	0.1
Nov	17.1	29.5	39.5	1.8	0.0	0.6	3.0	0.0
Dec	11.4	26.4	14.8	0.7	0.0	0.1	6.3	0.0
Annual	19.8	30.5	2087.5	96.9	0.3	69.5	22.1	7.2



5 day Tourism Forecast (106 places)



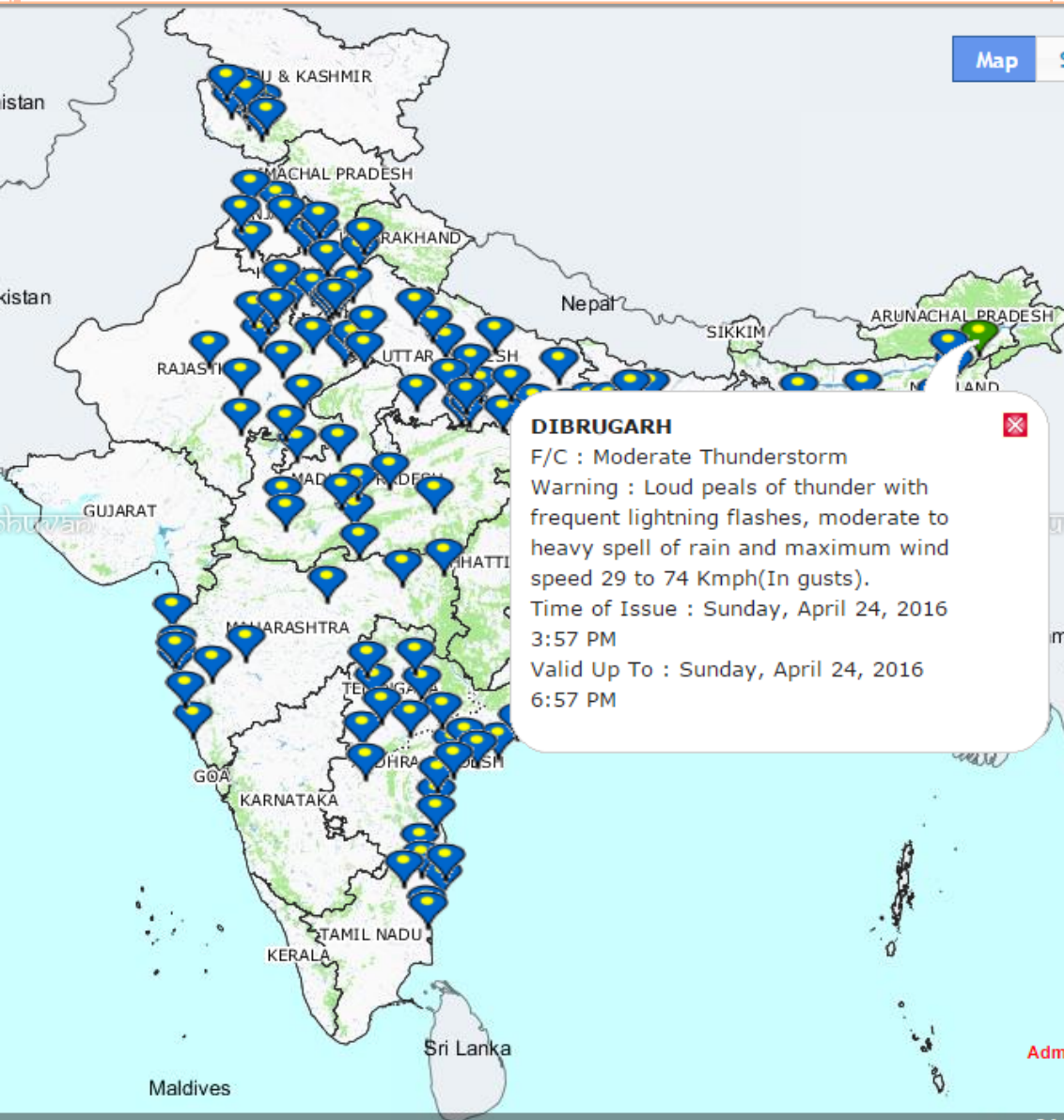
District Forecast (All Districts)

INDIA METEOROLOGICAL DEPARTMENT
 NWP MODELS BASED DISTRICT LEVEL WEATHER PREDICTION
 ISSUED ON: 24-04-2016
 VALID TILL 08:30 IST OF THE NEXT 5 DAYS

STATE : GOA

PARAMETERS	ENSEMBLE FCST				
	DAY-1 25/04	DAY-2 26/04	DAY-3 27/04	DAY-4 28/04	DAY-5 29/04
DISTRICT : NORTH-GOA					
Rainfall (mm)	0	0	0	0	0
Max Temperature (deg C)	35	34	36	36	35
Min Temperature (deg C)	21	21	21	22	24
Total cloud cover (octa)	1	2	1	1	0
Max Relative Humidity (%)	91	91	87	88	92
Min Relative Humidity (%)	34	39	32	37	45
Wind speed (kmph)	006	007	004	004	006
Wind direction (deg)	346	196	5	141	168
DISTRICT : SOUTH-GOA					
Rainfall (mm)	0	0	0	0	0
Max Temperature (deg C)	31	31	32	32	32
Min Temperature (deg C)	23	23	23	23	25
Total cloud cover (octa)	1	2	1	1	0
Max Relative Humidity (%)	85	85	85	87	87
Min Relative Humidity (%)	49	54	49	55	61
Wind speed (kmph)	010	011	006	006	006
Wind direction (deg)	342	313	45	148	178

All India Thunderstorm Nowcast (156 stations)



MINISTRY OF EARTH SCIENCES
 INDIA METEOROLOGICAL DEPARTMENT
 REGIONAL METEOROLOGICAL CENTRE, NEW DELHI

SHRI MATA VAISHNO DEVI YATRA VALUE ADDED NOWCAST KATRA

Date of issue : 24-04-2016
 Time of issue : 18:00 IST

PARAMETERS	Nowcast for 1830-2130 IST 24-04-2016
WEATHER	MAINLY CLEAR SKY
TEMP (°C)	25-28
HUMIDITY (%)	30-40
WIND SPEED (KMPH)	02-03
WIND DIRECTION	SOUTHWESTERLY
RAINFALL (mm)	0.0
WARNING	NIL



MINISTRY OF EARTH SCIENCES
 INDIA METEOROLOGICAL DEPARTMENT
 REGIONAL METEOROLOGICAL CENTRE, NEW DELHI

NOWCAST BASED ON DOPPLER WEATHER RADAR FOR NATIONAL CAPITAL REGION DELHI

Date of issue : 22.04.2016
 Time of issue : 1915 IST

NOWCAST

Valid for: 1915 - 2115 IST IST 22.04.2016
ने दो घंटे में दक्षिणी दिल्ली व आस पास के क्षेत्रों में आंधी आएगी Dust storm would occur over and adjoining areas of South Delhi.





HIGHWAY FORECAST

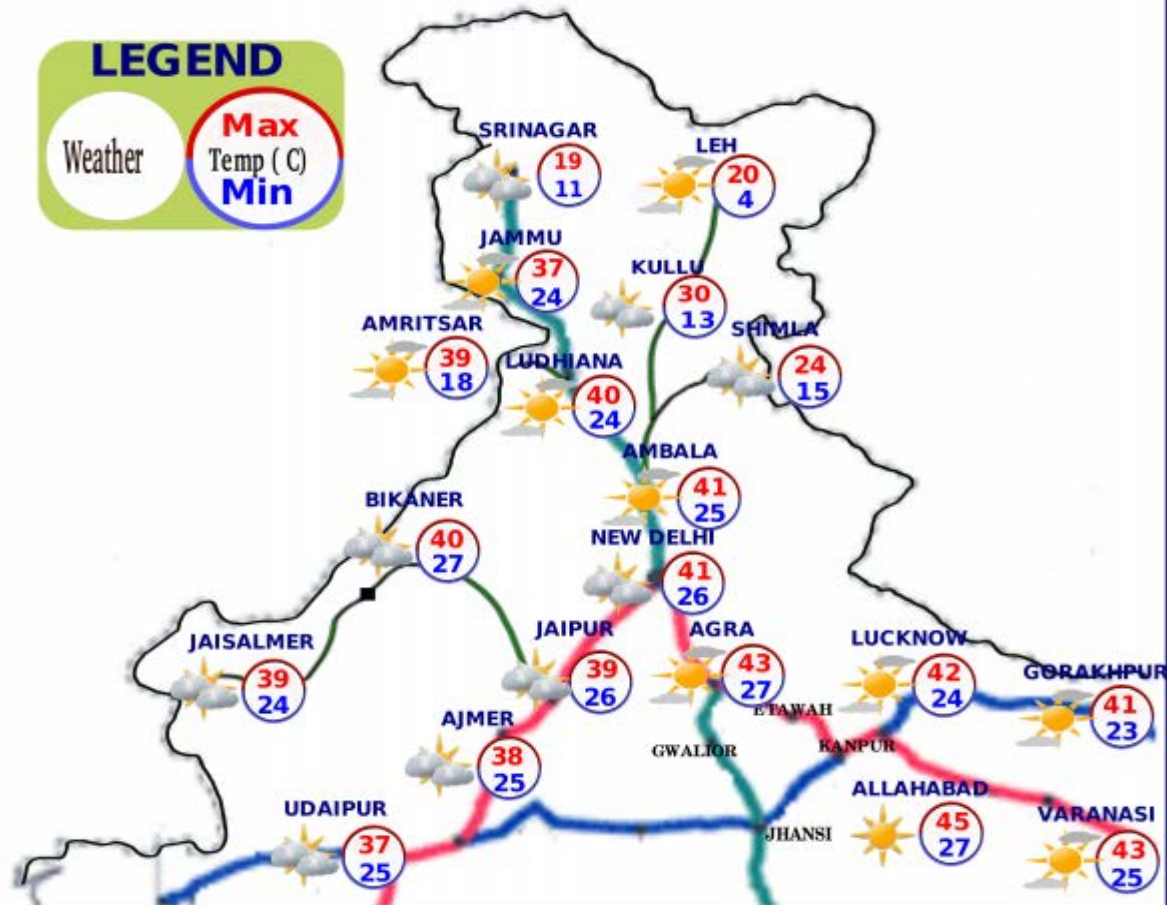
Valid for : 20 Apr 2016



LEGEND

Weather

Max
Temp (C)
Min



FORECAST VALID FOR : 20 Apr 2016

RAIN/SNOW VERY LIKELY AT A FEW PLACES OVER ROADS/HIGHWAYS OF JAMMU & KASHMIR AND AT ONE OR TWO PLACES OVER H. P. WEATHER IS VERY LIKELY TO BE DRY OVER REMAINING ROADS/HIGHWAYS OF NW-INDIA.





पर्वत मौसम बुलेटिन

MOUNTAIN METEOROLOGY DIVISION

0830 hours IST OBSERVATIONS OF 20.04.2016
MID DAY WEATHER BULLETIN

Synoptic features (Based on 0830 hours IST Observation)

- The western disturbance as a trough in mid-tropospheric westerlies now runs roughly along Longitude 64° E and north of Latitude 35° N.
- The other western disturbance as an upper air cyclonic circulation over western parts of Iran & neighbourhood now lies over northern parts of central Iran & adjoining Caspian Sea and extends upto mid-tropospheric level with a trough aloft runs roughly along Longitude 53° E and north of Latitude 30° N.
- The induced upper air cyclonic circulation over Punjab & neighbourhood has become less marked.

WEATHER DURING PAST 24 HOURS (BETWEEN 0630 HRS. OF YESTERDAY AND 0630 HRS OF TODAY)

MET DIVISIONS	KASHMIR (Division)	LEH (Division)	JAMMU (Division)	HIMACHAL PRADESH (High Hills region)	HIMACHAL PRADESH (Lower Hills region)	UTTARAKHAND (Garhwal Region)	UTTARAKHAND (Kumaun Region)
Realised Weather	WS	FWS	WS	FWS	ISOL	DRY	DRY

WEATHER FORECAST

Days	D1	D2	D3	D4	D5	D6	D7
Dates	20.04.2016	21.04.2016	22.04.2016	23.04.2016	24.04.2016	25.04.2016	26.04.2016
KASHMIR (Division)	ISOL [#]	SCT	WS	FWS	FWS	ISOL	ISOL
LEH (Division)	ISOL [#]	SCT [#]	FWS [#]	FWS [#]	SCT [#]	ISOL [#]	ISOL [#]
JAMMU (Division)	SCT	FWS	WS	WS	SCT	ISOL	ISOL
HIMACHAL PRADESH (High Hills region)	ISOL [#]	SCT	FWS [#]	WS	SCT	DRY	DRY
HIMACHAL PRADESH (Lower Hills region)	ISOL	ISOL	FWS	FWS	ISOL	DRY	DRY
UTTARAKHAND (Garhwal Region)	DRY	ISOL	SCT	FWS	ISOL	DRY	DRY
UTTARAKHAND (Kumaun Region)	DRY	ISOL	SCT	SCT	ISOL	DRY	DRY

SPATIAL DISTRIBUTION (% of stations reporting Rain/Snowfall)

%Stations	Category	%Stations	Category
76-100	WS-Widespread/Most Places	26-50	SCT-Scattered/At a Few places
51-75	FWS-Fairly Widespread/Many Places	1-25	ISOL-Isolated Places
#	Rain/Snowfall		DRY



Weather Warning during next 5 days

SUB DIVISION	D1	D2	D3	D4	D5
	20.04.2016	21.04.2016	22.04.2016	23.04.2016	24.04.2016
KASHMIR (Division)	NIL	NIL	HEAVY RAIN LIKELY AT ISOLATED PLACES	NIL	NIL
LEH (Division)	NIL	NIL	NIL	NIL	NIL
JAMMU (Division)	NIL	NIL	HEAVY RAIN LIKELY AT ISOLATED PLACES	NIL	NIL
HIMACHAL PRADESH (High Hills region)	NIL	NIL	NIL	NIL	NIL
HIMACHAL PRADESH (Lower Hills region)	NIL	NIL	NIL	THUNDERSQUALL/HAIL LIKELY AT ISOLATED PLACES	NIL
UTTARAKHAND (Garhwal Region)	NIL	NIL	NIL	THUNDERSQUALL/HAIL LIKELY AT ISOLATED PLACES	NIL
UTTARAKHAND (Kumaun Region)	NIL	NIL	NIL	THUNDERSQUALL/HAIL LIKELY AT ISOLATED PLACES	NIL

WARNING

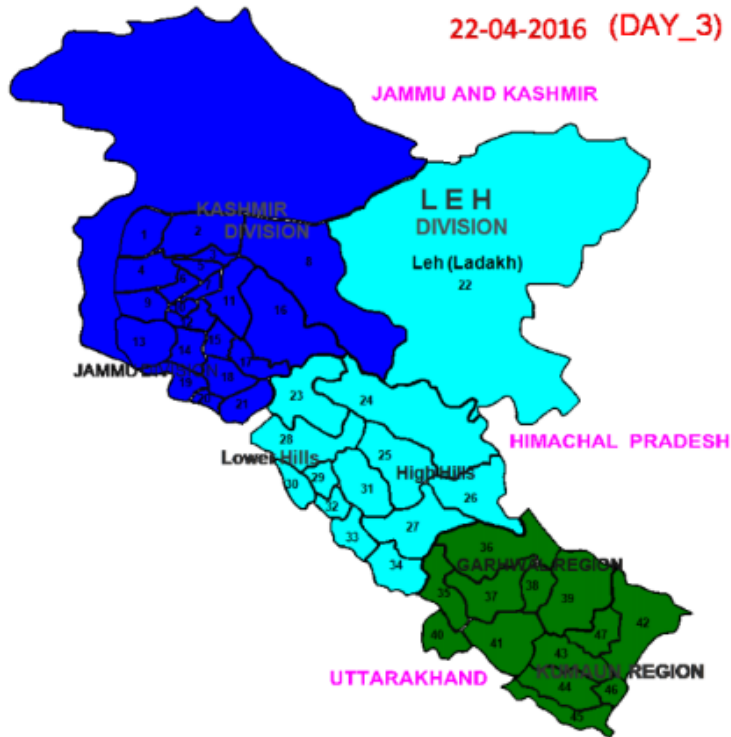
WARNING (TAKE ACTION)
ALERT (BE PREPARED)
WATCH (BE UPDATED)
NO WARNING (NO ACTION)

Probabilistic Forecast

Terms	Probability of Occurrence (%)
Unlikely	< 25
Likely	25 - 50
Very Likely	50 - 75
Most Likely	> 75

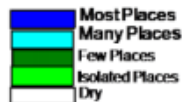


Precipitation Forecast
22-04-2016 (DAY_3)

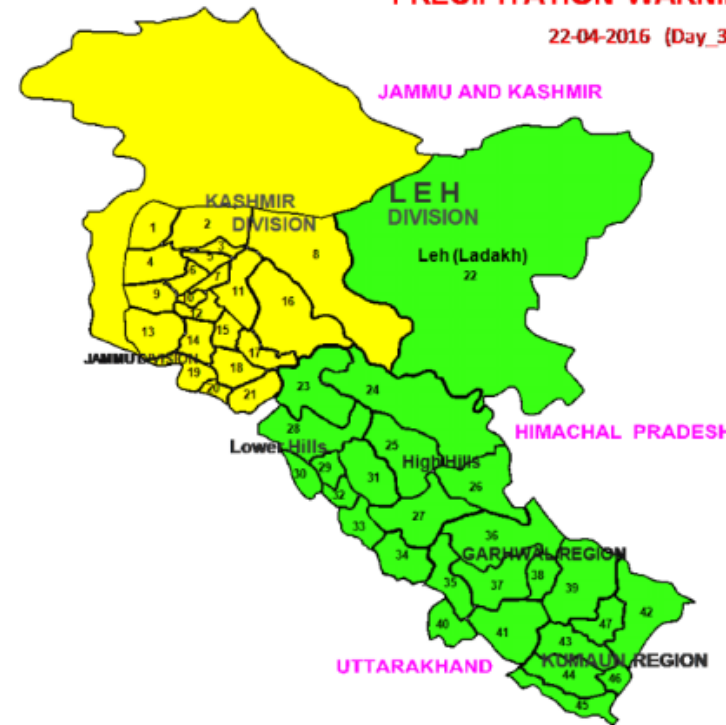


- KASHMIR DIVISION**
1. KUPWARA
2. BANDIPORE
3. GANDERBAL
4. BARAMULA
5. SRINAGAR
6. BADGAM
7. PULWAMA
8. KARGIL
9. PUNCH
10. SHUPIYAN
11. ANANTNAG
12. KULGAM
JAMMU DIVISION
13. RAJOURI
14. REASI
15. RAMBAN
16. KISHIWAR
17. DODA
18. UDHAMPUR
19. JAMMU
20. SAMBA
21. KATHUA
LEH DIVISION
22. LEH (LADAKH)
H. P. (HIGH HILLS REGION)
23. CHAMBA
24. LAHUL & SPITI
25. KULLU
26. KINNAUR
27. SHIMLA
H.P. (LOWER HILLS REGION)
28. KANGRA
29. HAMIRPUR
30. UNA
31. MANDI
32. BILASPUR
33. SOLAN
34. SIRMAUR

- GARHWAL REGION**
35. DEHRADUN
36. UTTARKASHI
37. TEHRI
38. RUDRAPRAYAG
39. CHAMOLI
40. HARIDWAR
41. GARHWAL
KUMAUN REGION
42. PITHORAGARH
43. ALMORA
44. NANITAL
45. CHAMPAWAT
47. BAGESHWAR

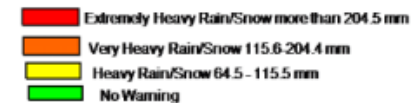


PRECIPITATION WARNING
22-04-2016 (Day_3)



- KASHMIR DIVISION**
1. KUPWARA
2. BANDIPORE
3. GANDERBAL
4. BARAMULA
5. SRINAGAR
6. BADGAM
7. PULWAMA
8. KARGIL
9. PUNCH
10. SHUPIYAN
11. ANANTNAG
12. KULGAM
JAMMU DIVISION
13. RAJOURI
14. REASI
15. RAMBAN
16. KISHIWAR
17. DODA
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20. SAMBA
21. KATHUA
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22. LEH (LADAKH)
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24. LAHUL & SPITI
25. KULLU
26. KINNAUR
27. SHIMLA
H.P. (LOWER HILLS REGION)
28. KANGRA
29. HAMIRPUR
30. UNA
31. MANDI
32. BILASPUR
33. SOLAN
34. SIRMAUR

- GARHWAL REGION**
35. DEHRADUN
36. UTTARKASHI
37. TEHRI
38. RUDRAPRAYAG
39. CHAMOLI
40. HARIDWAR
41. GARHWAL
KUMAUN REGION
42. PITHORAGARH
43. ALMORA
44. NANITAL
45. CHAMPAWAT
47. BAGESHWAR



Legend



→ उज्जैन यात्रा मानचित्र/Ujjain Road Map

→ यात्रा रूट मौसम पूर्वानुमान / Yatra route weather forecast (including warning)

→ उज्जैन का सूर्योदय / सूर्यास्त समय (भारतीय समयानुसार)/ Ujjain SUNRISE/SUNSET (hrs IST)

→ मौसम पूर्वानुमान - उज्जैन/ Weather forecast Ujjain (valid for next 24 hrs)

→ उज्जैन के लिये / NOWCAST for Ujjain

→ वर्तमान मौसम प्रेक्षण / Current weather observation

यात्रा रूट मौसम पूर्वानुमान / Yatra route forecast (valid for 24 hrs)
Date 24/04/2016 AT 08:30 hrs IST

Station(to Ujjain)	Forecast	Warning
Bhopal	MAINLY CLEAR SKY. WEATHER LIKELY TO BE DRY	STRONG SURFACE WIND LIKELY DURING DAY/EVENING TIME . WIND SPEED AROUND 24-26 KMPH.
Indore	MAINLY CLEAR SKY. WEATHER LIKELY TO BE DRY.	STRONG SURFACE WIND LIKELY DURING DAY/EVENING TIME . WIND SPEED AROUND 24-26 KMPH.
Ratlam	MAINLY CLEAR SKY. WEATHER LIKELY TO BE DRY.	STRONG SURFACE WIND LIKELY DURING DAY/EVENING TIME . WIND SPEED AROUND 24-26 KMPH.
Gwalior	CLEAR SKY. WEATHER LIKELY TO BE DRY.	NIL



Satellite image



DWR product

Expedition Forecast

Government of India
India Meteorological Department
Ministry of Earth Sciences

BULLETIN NO: - 27

Mausam Bhawan, Lodi Road, New Delhi – 110 003

DATE:- 24-04-2016

Forecast for "Everest/Lhotse MASSIF EXPEDITION Height 8848 M (Lat 27° 59'N Long 86° 55'E)

(Day 1). Valid for 24 hrs commencing from 1330 hrs IST of 24-04-2016 to 1330 hrs IST of 25-04-2016

WEATHER: - Clear sky.

Wind and temperature in free air:-

Sl No	Height(AMSL)	Wind Direction	Wind Speed (Km/hour)	Temperature(Deg C)
1	3.1 km (700 hPa)	South-southwesterly to Westerly	20-30	6 to 12
2	4.5 km (600 hPa)	South-southwesterly to Westerly	20-30	-2 to 4
3	5.8 km (500 hPa)	South-southwesterly to Westerly	20-30	-11 to -6
4	7.6 KM (400 hPa)	West-southwesterly	40-70	-22 to -21
5	9.6 KM (300 hPa)	-	-	-

(Day 2). Valid for 24 hrs commencing from 1330 hrs IST of 25.04.2016 to 1330 hrs IST of 26-04-2016

WEATHER:- Clear sky.

Wind and temperature in free air:-

Sl No	Height(AMSL)	Wind Direction	Wind Speed (Km/hour)	Temperature(Deg C)
1	3.1 km (700 hPa)	South-southwesterly to Westerly	10-20	7 to 11
2	4.5 km (600 hPa)	South-southwesterly to Westerly	20-30	2 to 4
3	5.8 km (500 hPa)	West-southwesterly	20-30	-10 to -7
4	7.6 KM (400 hPa)	Westerly	30-40	-21 to -19
5	9.6 KM (300 hPa)	-	-	-

(Day 3) Valid for 24 hrs commencing from 1330 hrs IST of 26.04.2016 to 1330 hrs IST of 27-04-2016

WEATHER: Clear sky.

Wind and temperature in free air:-

Sl No	Height(AMSL)	Wind Direction	Wind Speed (Km/hour)	Temperature(Deg C)
1	3.1 km (700 hPa)	South-southwesterly to Westerly	10-20	9 to 13
2	4.5 km (600 hPa)	South-southwesterly to Westerly	10-20	1 to 5
3	5.8 km (500 hPa)	Westerly	20-30	-9 to -5
4	7.6 KM (400 hPa)	Westerly	30-40	-20 to -18
5	9.6 KM (300 hPa)	-	-	-

(Day 4) 1330 hrs IST of 25.04.2016 to 1330 hrs IST of 27-04-2016

Clear sky.

(Day 5) 1330 hrs IST of 26.04.2016 to 1330 hrs IST of 28-04-2016

Clear sky.



ADVANCES IN DISSEMINATION MECHANISM

- Telephone, Tele-fax
- Mobile Phones (SMS)
- VHF/HFRT/Police Wireless
- Satellite based warning dissemination System
- Global telecommunication system (GTS) :
(International Telecom centres)
- Internet (e-mail), ftp
- Websites
- Radio/TV, News Paper network (AM, FM, Community Radio, Private TV) : Prasar Bharati and private broadcasters





WMO/ESCAP RECOGNISED Regional Specialised Meteorological Centre, New Delhi

Provides cyclone advisories and daily outlooks to 8

Members countries

Bangladesh

India

(RSMC, New-Delhi)

Maldives

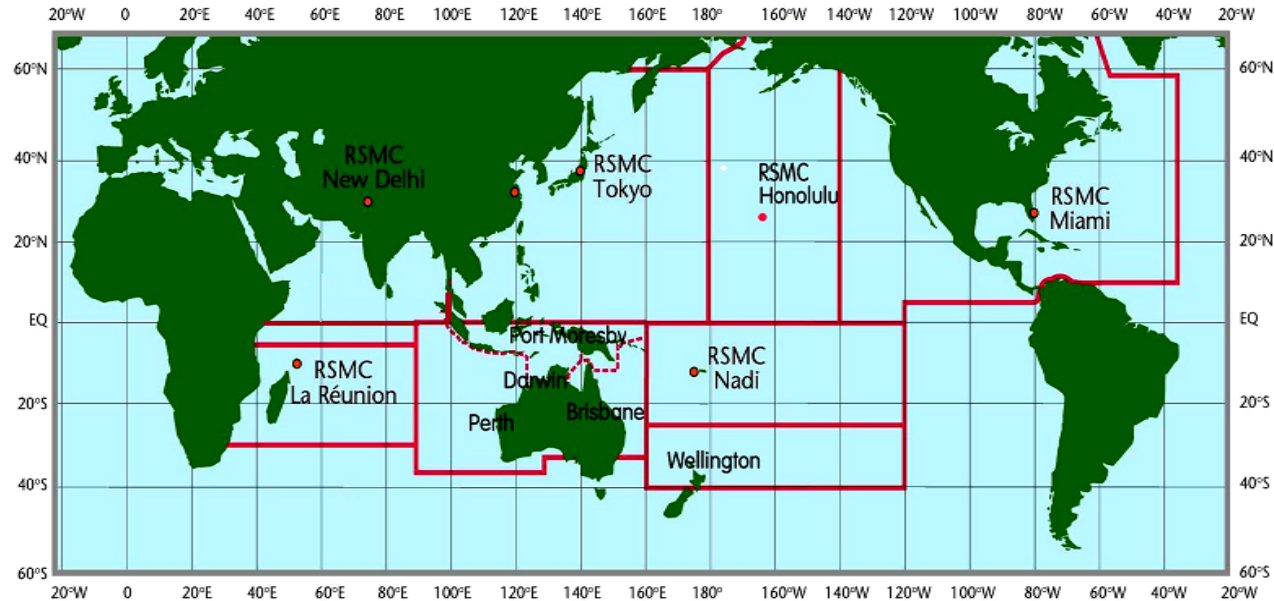
Myanmar

Oman

Pakistan

Sri Lanka

Thailand



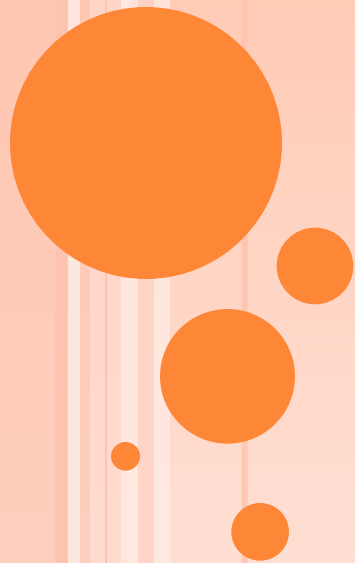
- For national purpose, IMD has 3 tier organisation to provide cyclone warning
- Area Cyclone Warning Centres at Mumbai, Kolkata and Chennai
- Cyclone Warning Centre at Ahmedabad, Visakhapatnam and Bhubaneswar
- Cyclone Warning Division at New Delhi



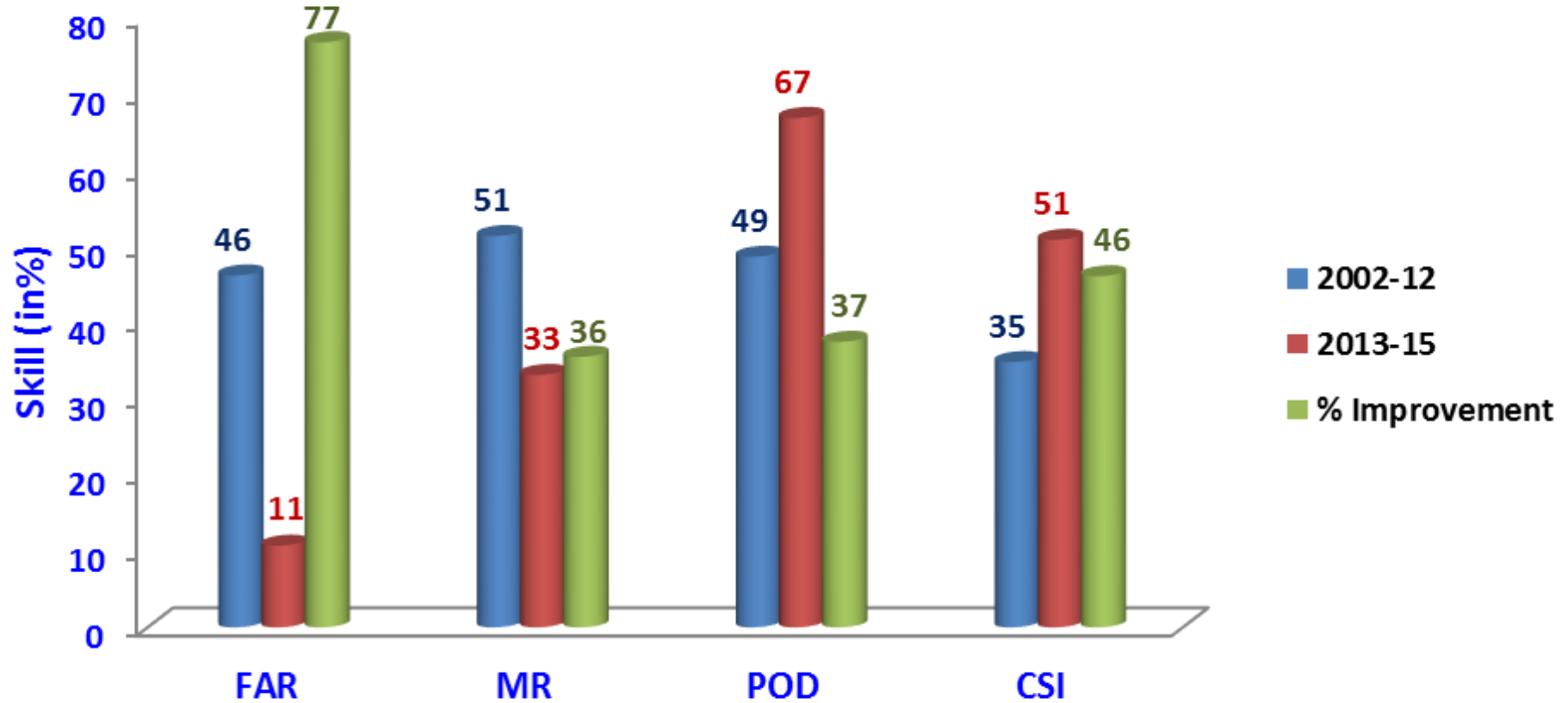
FOREIGN TRAINEE TRAINED IN RSMC, NEW DELHI

Year	Name of Training	Period	Countries
2007	WMO cyclone forecasters training	12-23 Feb.	Bangladesh, Myanmar and Sri Lanka
2008	WMO cyclone forecasters training	14-25 Feb	Thailand and Sri Lanka
2009	WMO cyclone forecasters training	09-20 Feb.	Bangladesh and Maldives
2010	WMO cyclone forecasters training	1-12 feb.	Myanmar and Sri Lanka
2011	WMO cyclone forecasters training	28Feb.-11 March	Bangladesh, Oman, Myanmar, India
2012	WMO cyclone forecasters training	20 Feb-02 March	Thailand, Srilanka, Maldives, India
2013	WMO cyclone forecasters training	1-12 April	Bangladesh, Myanmar, Oman, India
2014	WMO cyclone forecasters training	17-28 February	Myanmar, Sri Lanka, Thailand, India
2015	ITWTCF-International Training Workshop on Tropical Cyclone Forecasting	03-14 August	Myanmar, Sri Lanka, Thailand, India, Maldieves, Oman, Bangladesh, Laos, Cambodia.

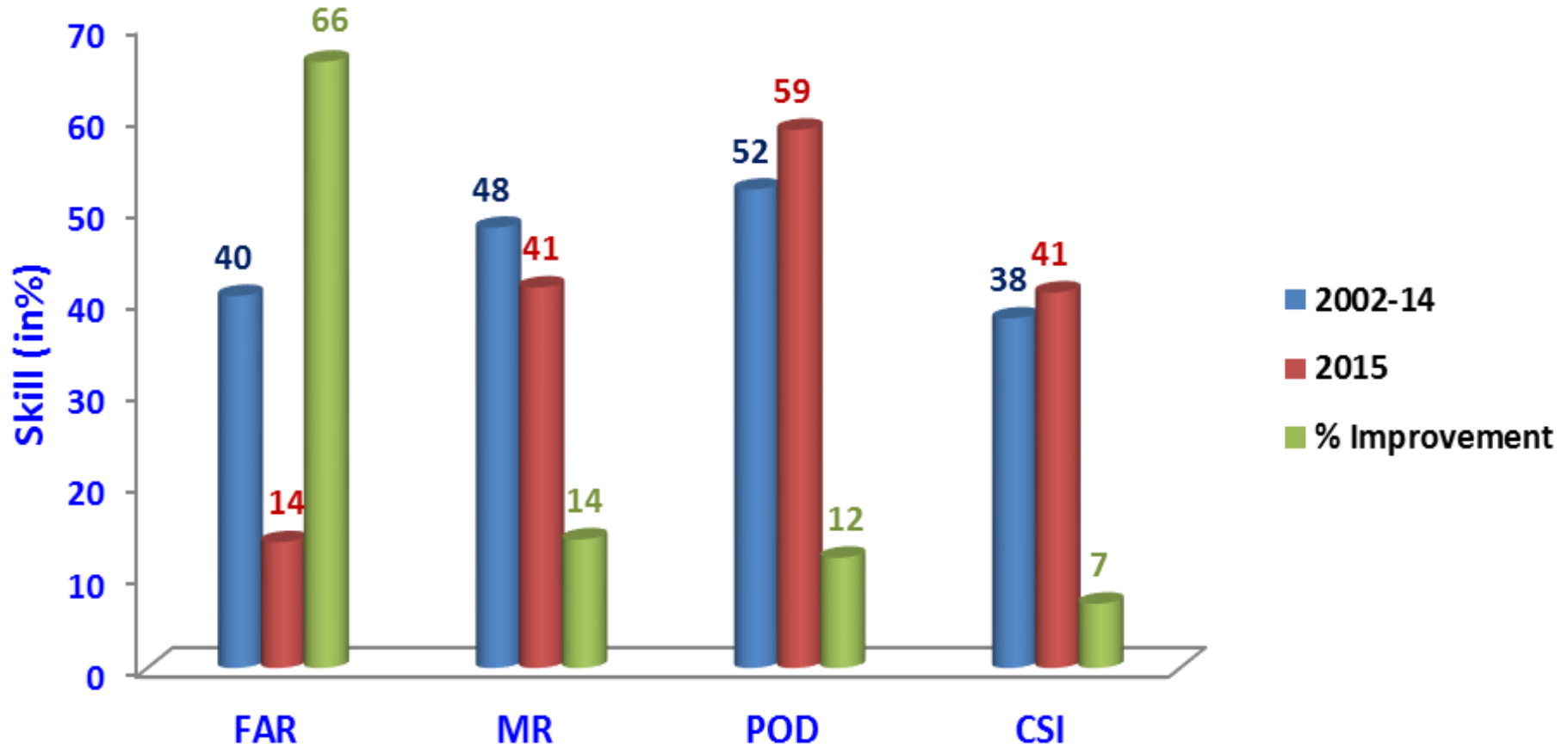
WARNINGS SKILL SCORES



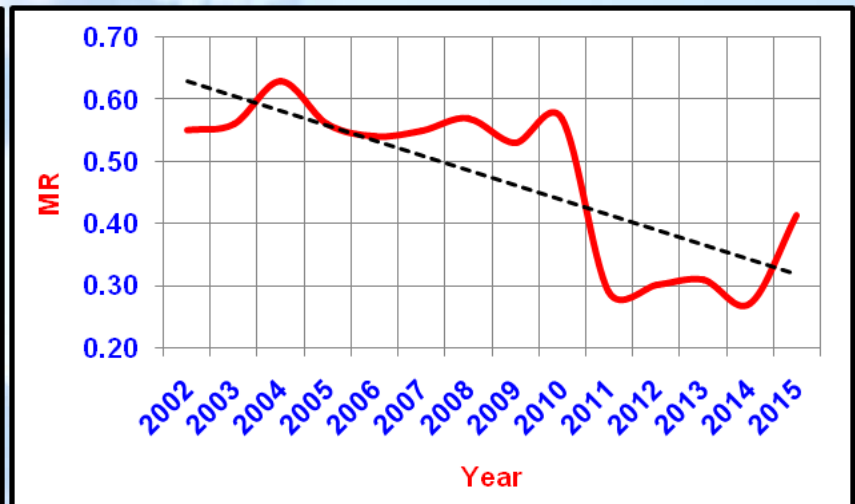
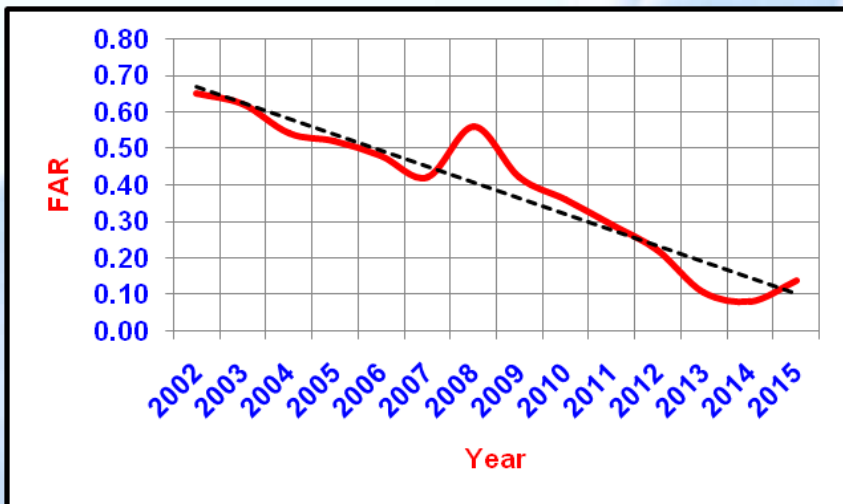
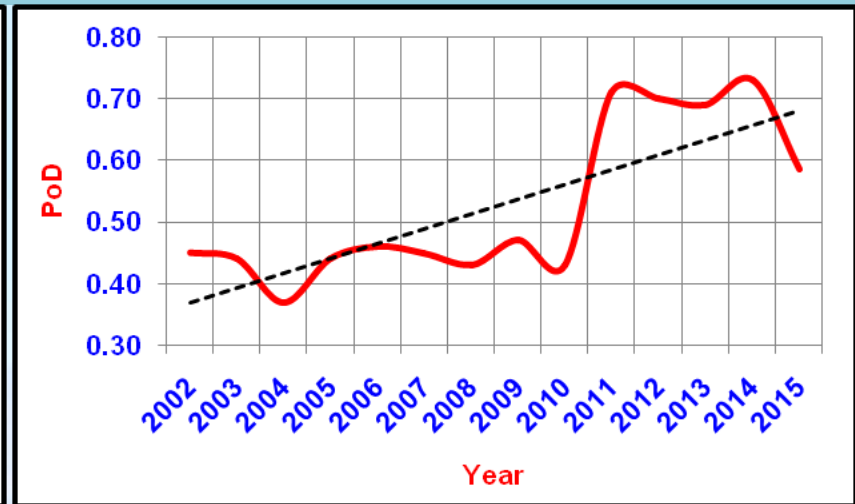
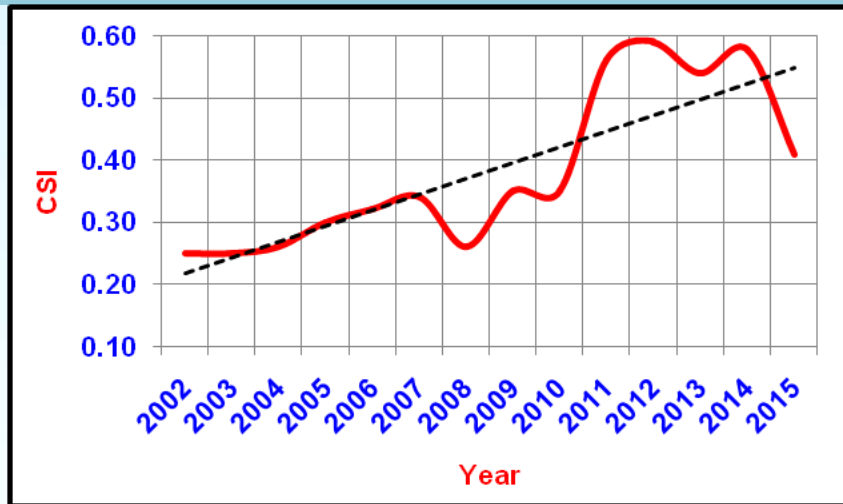
Heavy rainfall warning (2002-15)



Heavy rainfall warning (2002-15)



Trend in heavy rainfall warning (2002-15)



Advances in Cyclone Forecasting : Improvement in Track forecast accuracy

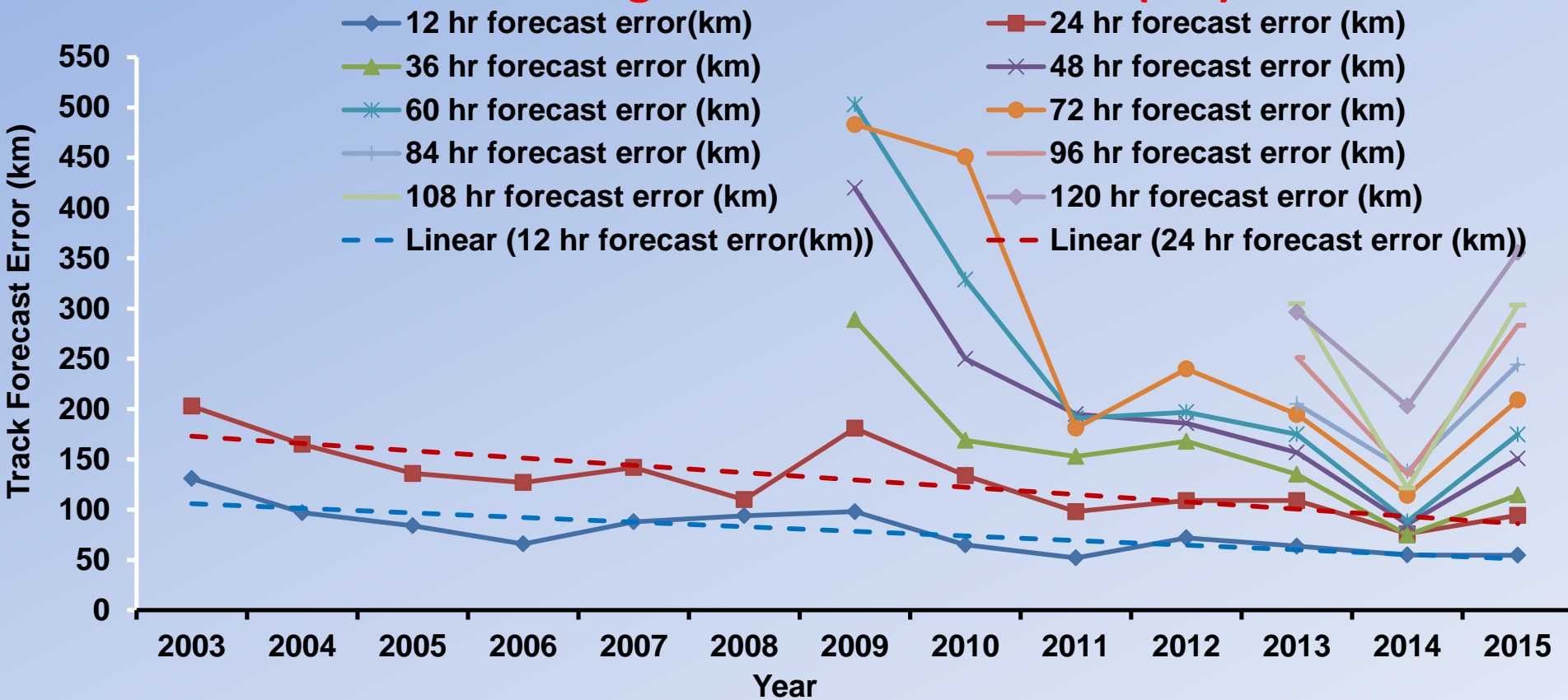
Average error in km (2011-15)

Lead	Error	Lead	Error
12 hr	59.1	24 hr	97.5
36 hr	120.0	48 hr	145.5
60 hr	160.4	72 hr	183.2 km

Reduction in error from 2006-10 to 2011-15 :

12 hr	: 26%,	24 hr	: 31%
36 hr	: 41%,	48 hr	: 49%
60 hr	: 56%,	72 hr	: 60%

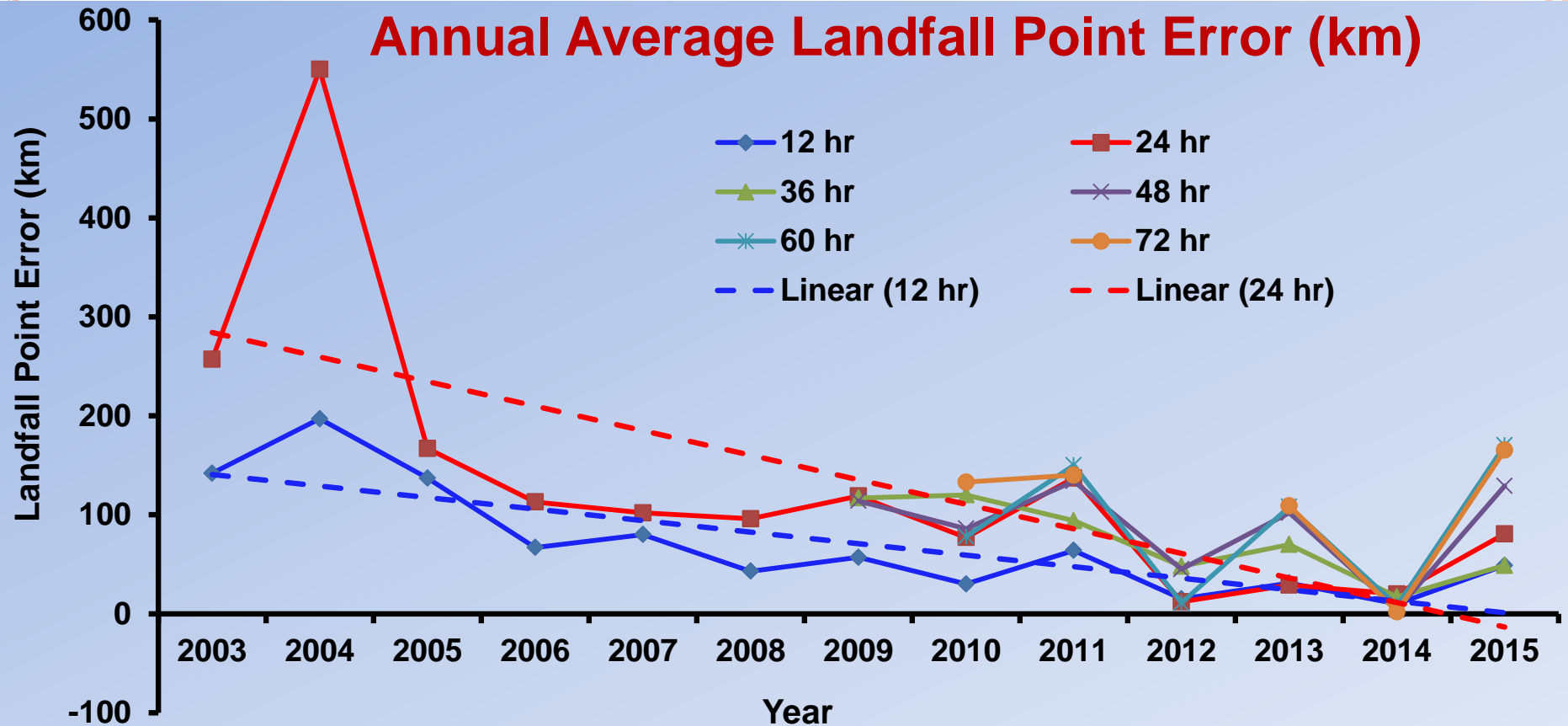
Annual Average Track Forecast Error (km)



Advances in Cyclone Forecasting : Improvement in landfall point forecast

Average error in km (2011-15)

Lead	Error	Lead	Error
12 hr	36.5	24 hr-	56.3 km,
36 hr	60.6	48 hr-	93.5 km
60 hr	95.2	72 hr-	105.7 km



Advances in Cyclone Forecasting : Intensity forecast skill (%) Improvement (AE)

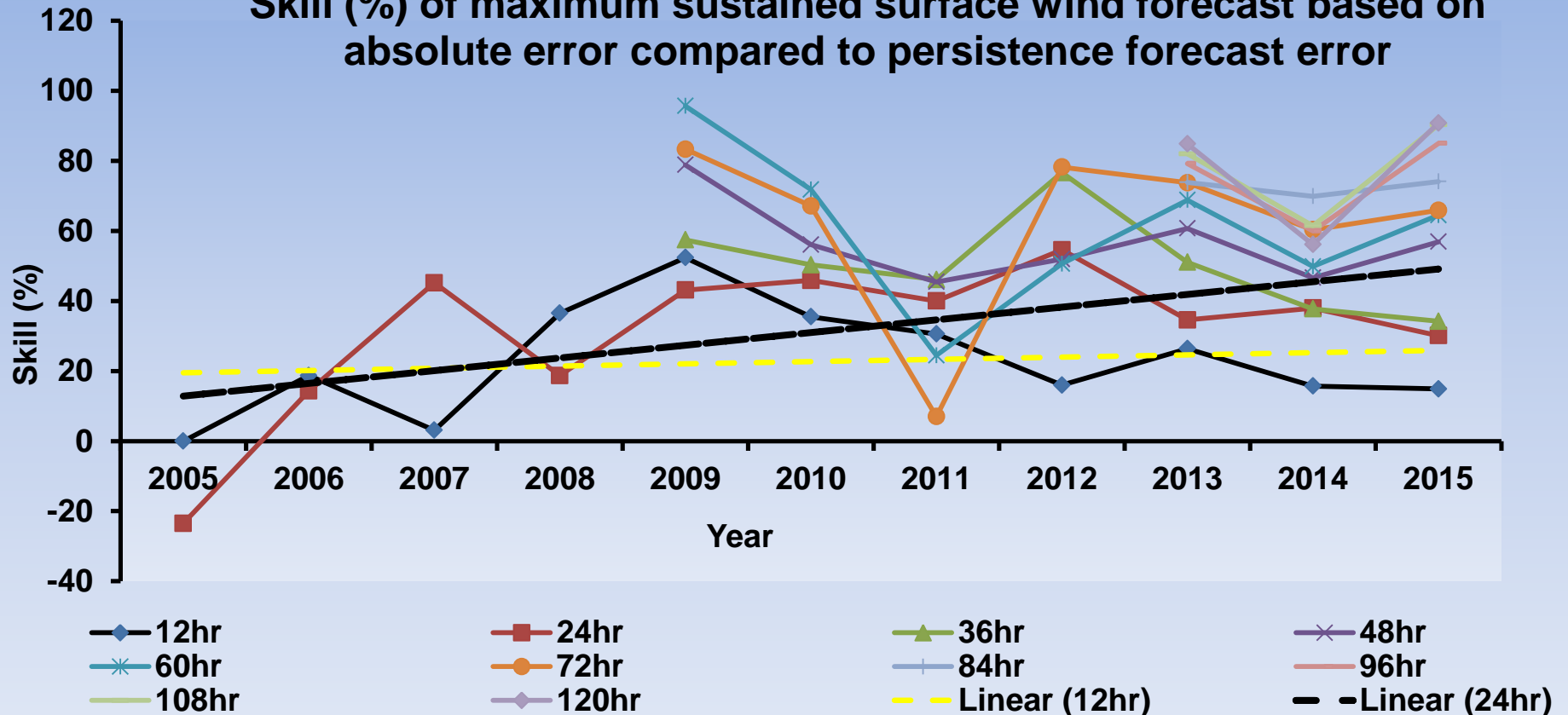
Average Skill (%) - (2011-15)

Lead	Skill	Lead	Skill
12 hr-	20.9	24 hr-	36.4
36 hr-	49.4	48 hr-	55.8
60 hr-	62.3	72 hr-	67.3

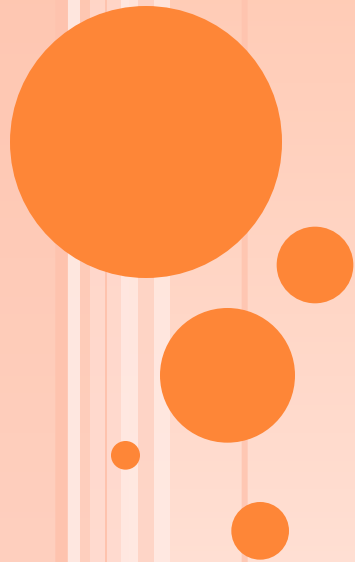
Improvement in skill from 2006-10 to 2011-15

12 hr :	26.7%	24 hr:	7.0%,
36 hr :	5.2%,	48 hr :	9.9%
68 hr :	17.8%,	72 hr :	0.3%

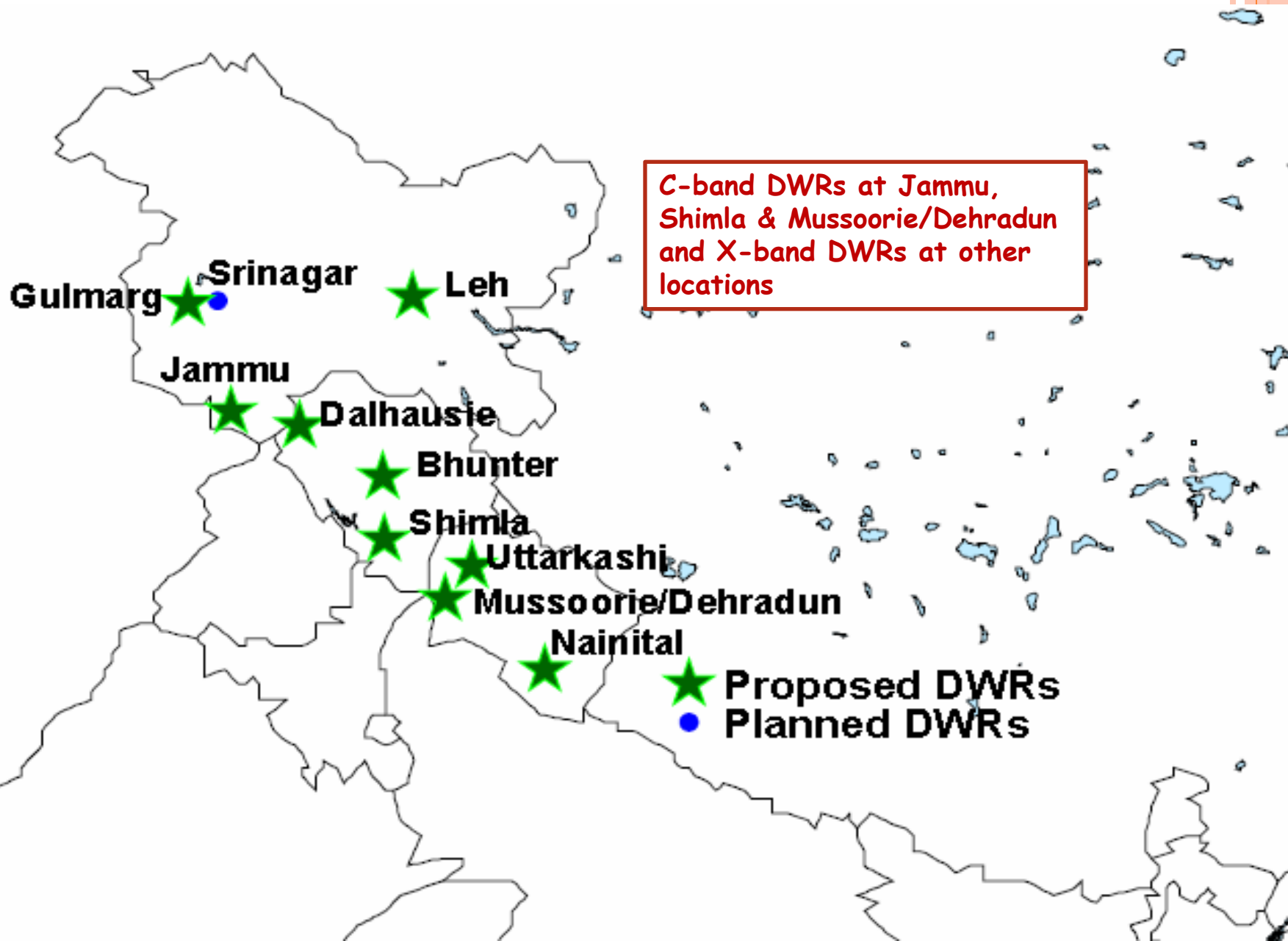
Skill (%) of maximum sustained surface wind forecast based on absolute error compared to persistence forecast error



FUTURE SCHEMES



COMMISSIONING OF 9 DWRs



COMMISSIONING 18 MRRs

Useful for measurement of rain rate, liquid water content and drop size distribution from near ground to several hundred metres.

Also used for now-casting of precipitation i.e., it may detect the start of rain from ground level (in 10 Km radius) to high above the radar several minutes before the start of rain at ground level.

Kupwara
Sonmarg

Kargil

Banihal
Patnitop

Kangra
Manali

Kyelang
Kalpa

Sundernagar

Kedarnath
Dehradun

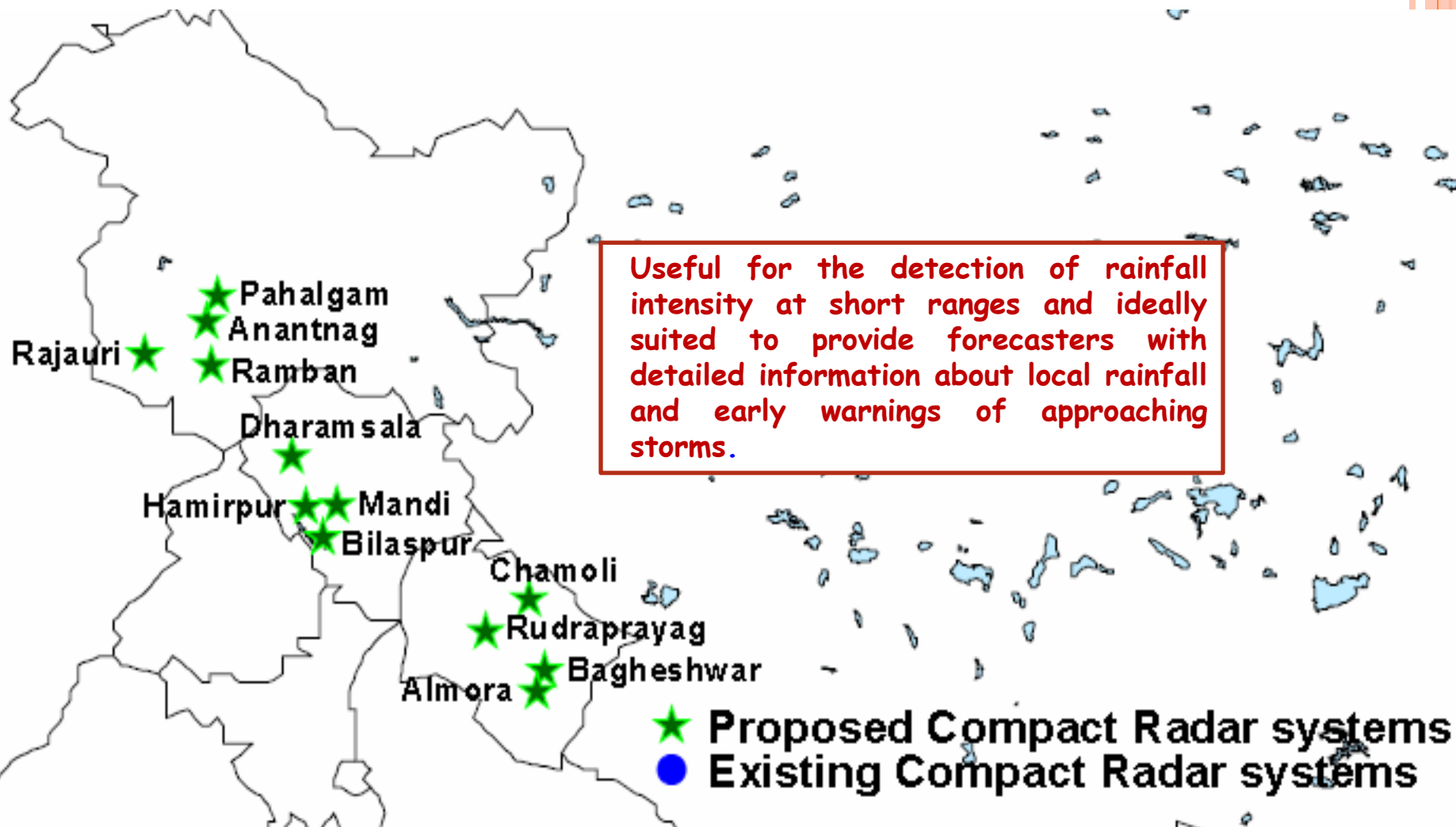
Pauri

Pithoragarh

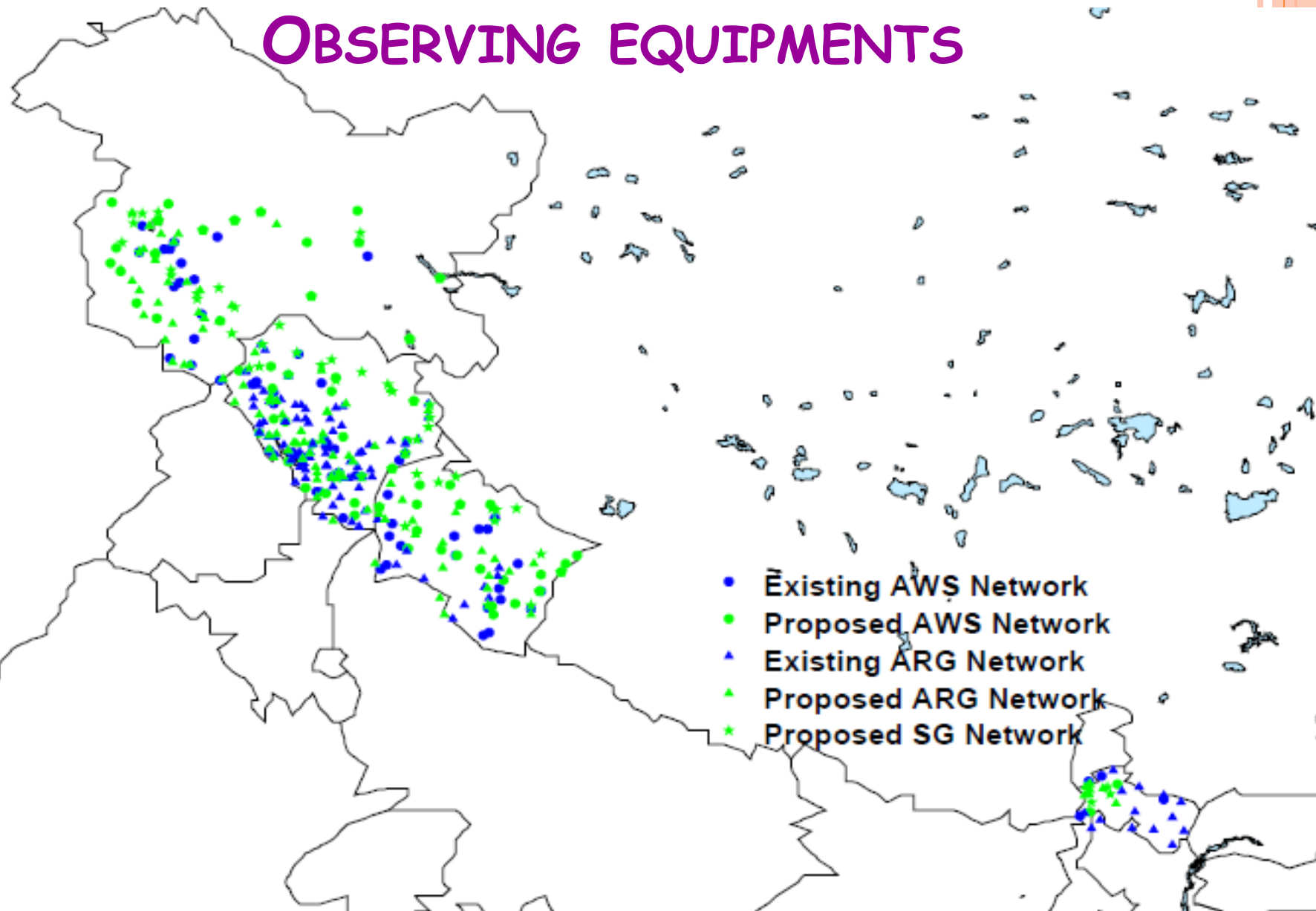
★ Proposed Micro Rain Radars (MRRs)
● Existing Micro Rain Radars (MRRs)

Kalimpong
Darjeeling
Baghdogra

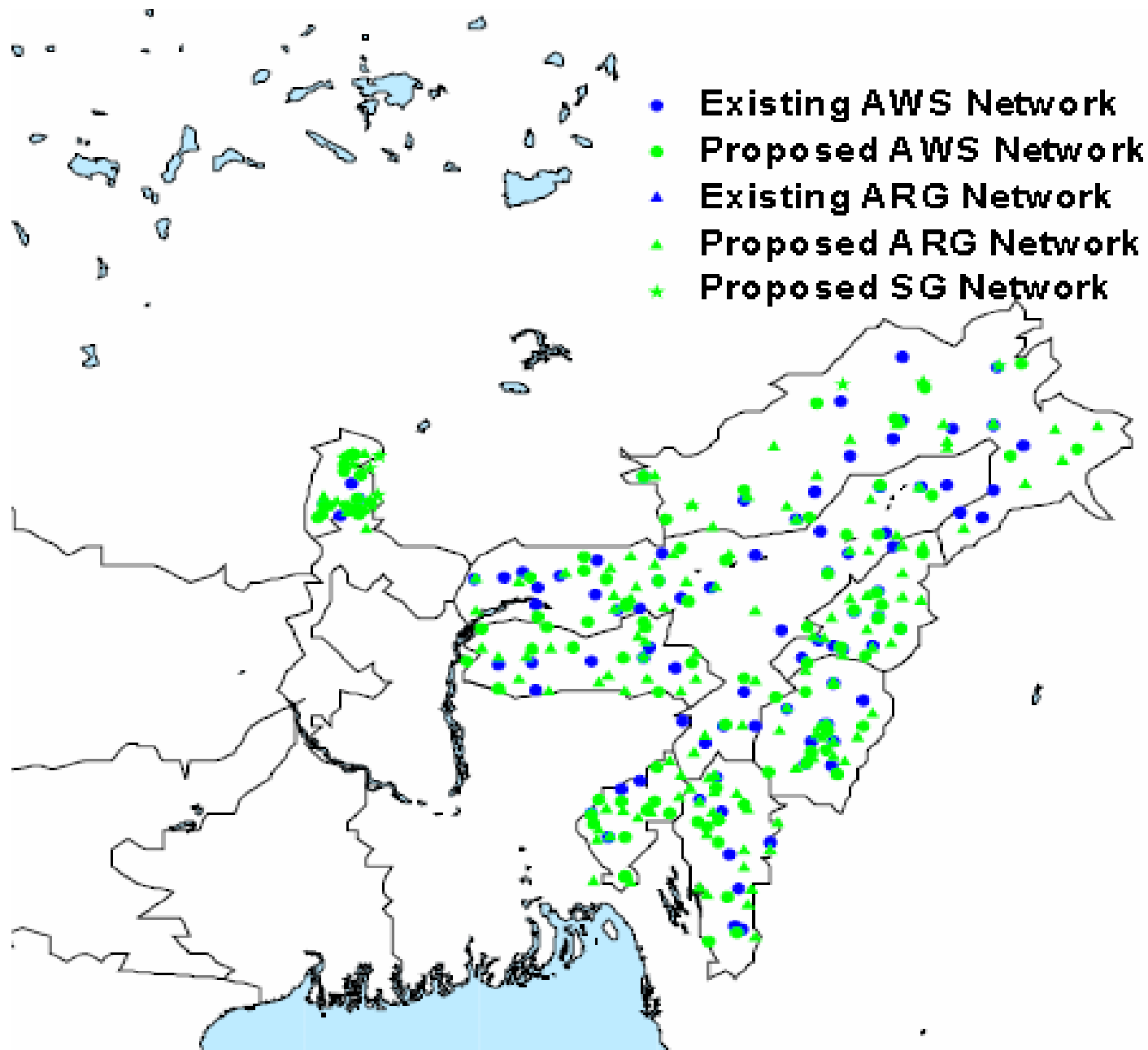
COMMISSIONING OF 12 COMPACT SEVERE WEATHER DETECTION RADAR SYSTEMS



COMMISSIONING OF 230 SURFACE OBSERVING EQUIPMENTS



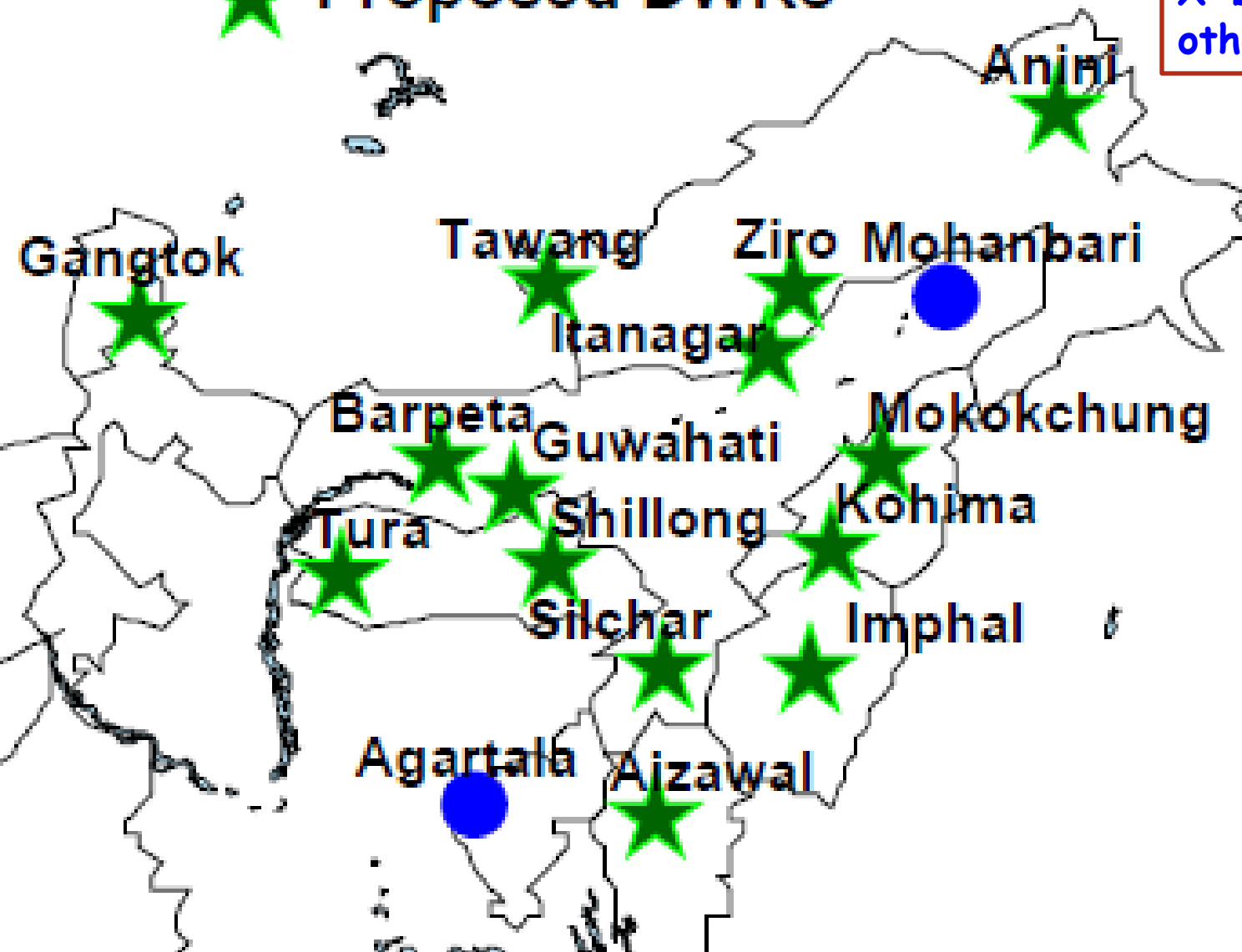
Commissioning of 270 Surface Observing equipments



Commissioning of 14 Doppler Weather Radars

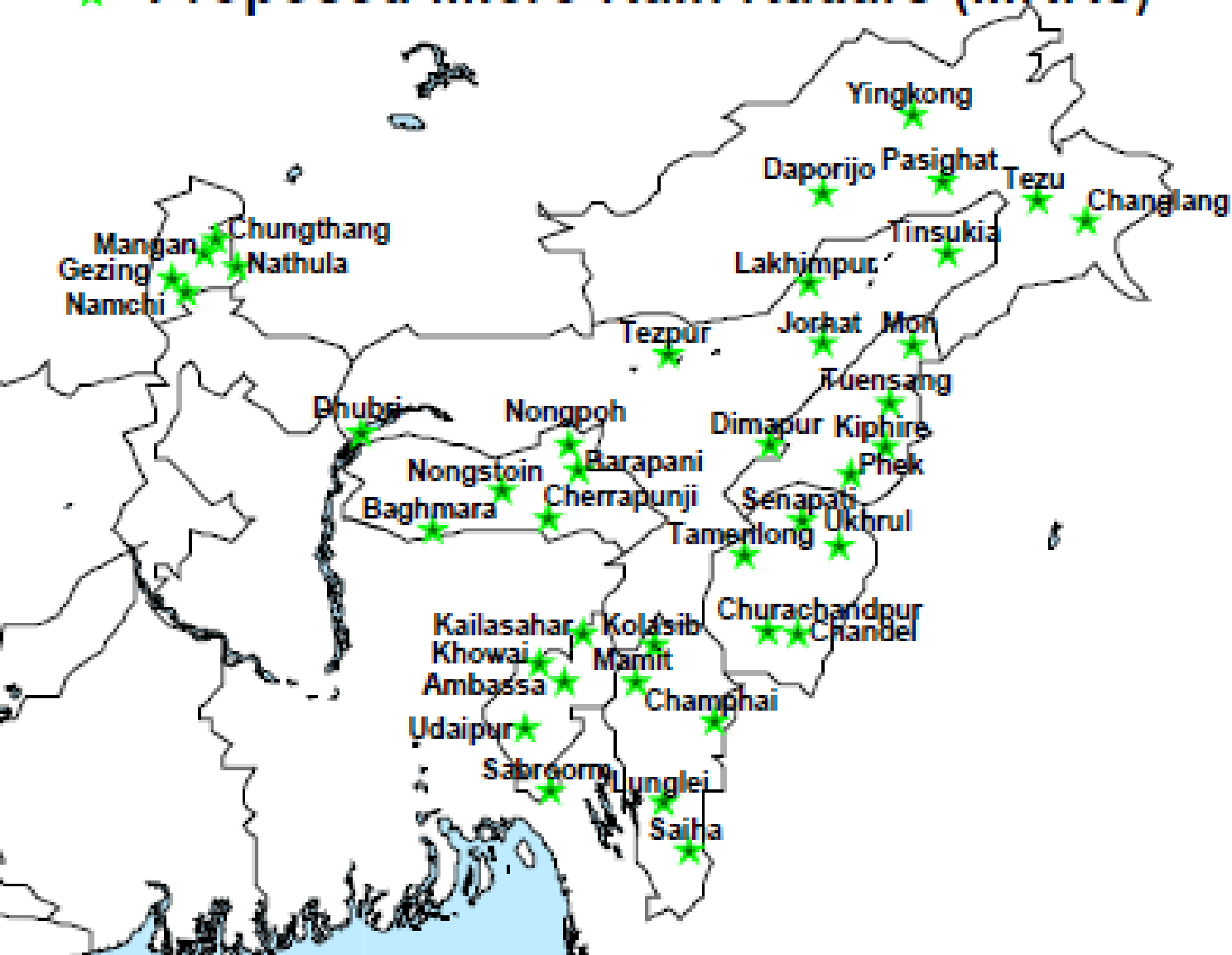
- Existing DWRs
- ★ Proposed DWRs

One C-band DWR at Guwahati and X-band DWRs at other 13 places



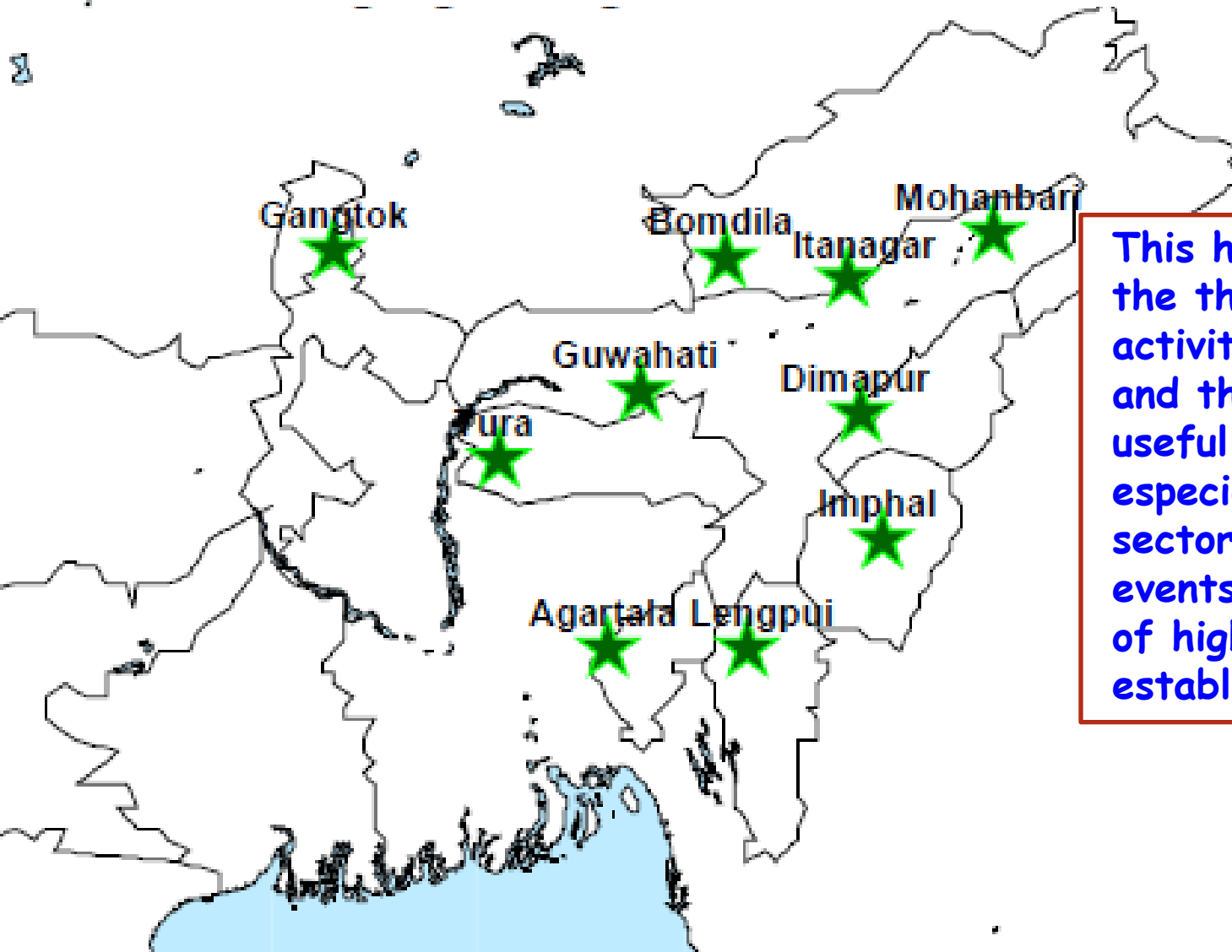
Commissioning 40 MRRs

★ Proposed Micro Rain Radars (MRRs)



Commissioning of 10 Lightning Detection Systems (LDS)

★ Proposed Lightning Detection Network



This helps in tracking the thunderstorm activity in real time and thus is very useful in nowcasting especially in aviation sector, planning sport events and functioning of high risk establishments etc.



Commissioning of 8 Microwave Radiometers

★ Proposed Microwave Radiometer Network

Gangtok

Mohanbari

Guwahati

Dimapur

Silchar Imphal

Agartala Lengpui



Commissioning of 8 Doppler Wind Lidars/Wind Profilers

★ Proposed Wind Lidar Network

Gangtok

Mohanbari

Guwahati

Dimapur

Silchar Imphal

Agartala Lengpui

Used for wind shear, low level jet identification, clear air turbulence, fog detection, PBL dynamics monitoring etc.



PROPOSED NETWORK

Type of Equipment	Integrated Himalayan Scheme		High Impact Severe Weather Warning	Modelling of Changing Water cycle
	Western & Central	North-eastern		
(C/X Band DWRs)	9	14	2	-
Micro Rain Radars (MMRs)	18	40	-	-
Cloud/Precipitation Radar	-	-	2	-
GPS based Upper Air	7	9	2	-
(AWS)/ (ARG)/ (SG)	230	270	200	200
Compact Severe Weather Detection Radar Systems	12	-	-	-
Lightning Detection	-	10	-	-
Heliport AWOS	9	19	-	-
Microwave Radiometers	-	8	4	-
Wind LIDARs	-	8	3	-
Mobile AWS	7	20	10	-
UAV	-	-	6	-
Disdrometer	-	-	6	-
SODAR	-	-	1	-
Surface/Snow Observatory	15	-	-	40

PROPOSED NETWORK-MODERNIZATION PHASE-11

S.N.	Item	Number
1	Automatic Weather Station (AWS)	500
2	Automatic Rain Guages (ARG)	4000
3	Portable Upper Air stations	5
4-a	Wind Profiler (tropospheric)	5
4-b	Wind Profiler (boundary layer type) for aviation	5
5	Electrolyzers for H ₂ generation	38
6-a	Doppler Weather Radar- S-band	17
6-b	Doppler Weather Radar- C/X-band	12
6-c	Doppler Weather Radar- Portable	2
7	Microwave Radiometer for aviation	4
8	Heliport AWOS for aviation	20
9-a	Public weather systems (PWS) full	7
9-b	Public weather systems (PWS) truncated	27*
10	Forecasting System	102*
12	Video wall	1*

Thanks

