



Early Warning Mechanism

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**भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT**

Weather Related Natural hazards occur throughout the year

❖ WINTER
(JAN-FEB)

❖ WD
❖ COLD WAVE, FOG,
HEAVY SNOW,
AVALANCHE

❖ PRE-MONSOON
(MAR-MAY)

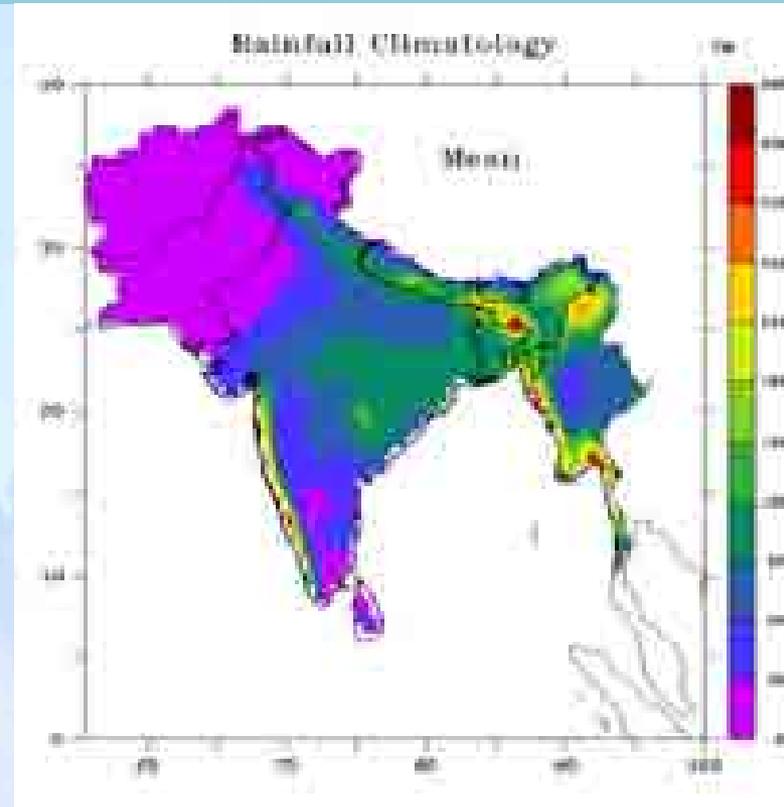
❖ CYCLONIC
DISTURBANCES
HEAT WAVE
THUNDER STORMS,
SQUALLS
HAIL STORM
TORNADO

❖ MONSOON
(JUN-SEP)

❖ HEAVY RAINFALL,
❖ FLOODS
❖ FLASH FLOOD
❖ DROUGHTS

❖ POST-MONSOON
(OCT-DEC)

❖ CYCLONIC
DISTURBANCES
❖ NORTHEAST MONSOON
❖ EASTERLY WAVE



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



FLASH FLOODS RECORDED BETN 1979-2009



SIGNIFICANT FLASH FLOODS RECORDED BETWEEN 1979 - 2009



FLASH FLOOD

- In India, flash flood are occurred more frequently over the northern states of India from Kashmir in the west to Arunachal Pradesh in the east.
- The major cause of flash floods in these areas are due to incidence of heavy rainfall and cloudbursts.
- Other causes of flash floods are landslide, dam bursts and rapid snow/glacier melts. The states of Himachal Pradesh, Uttaranchal and Arunachal Pradesh are the worst affected by flash flood (S. Chandra, 2007).
- Some times, Cyclonic Disturbances in the coastal areas of Orissa, West Bengal, Andhra Pradesh, Karnataka, and Tamil Nadu also cause flash floods .
- In Past, there are many instances, when flash flood in the mountain streams of the Himalayas have caused immense loss like washing away many villages, bridges and roads etc.



Meteorological features associated with severe weather over Himalayas and adjoining plains



Western Disturbance

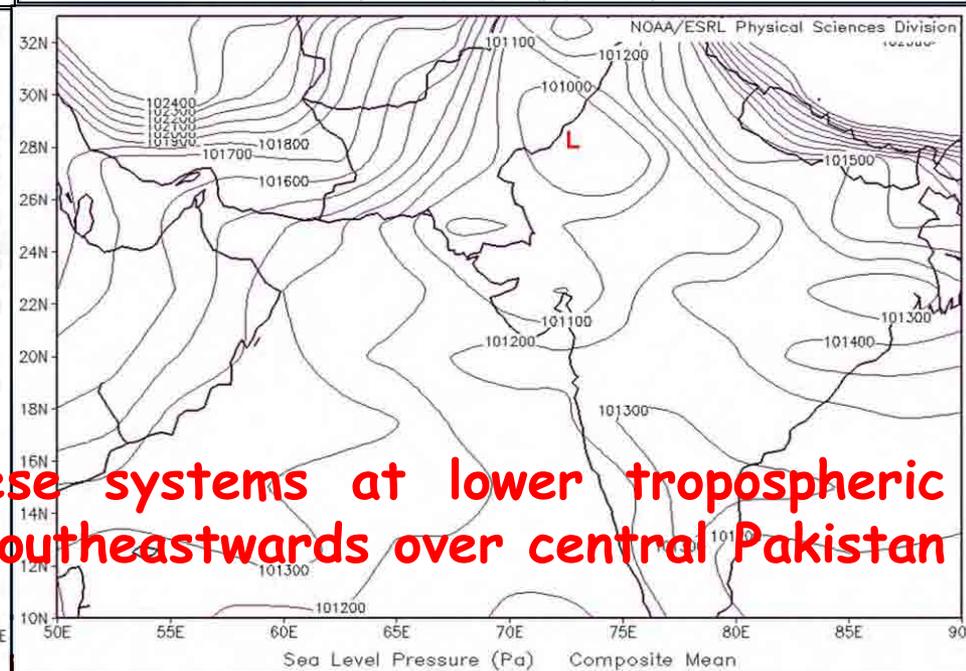
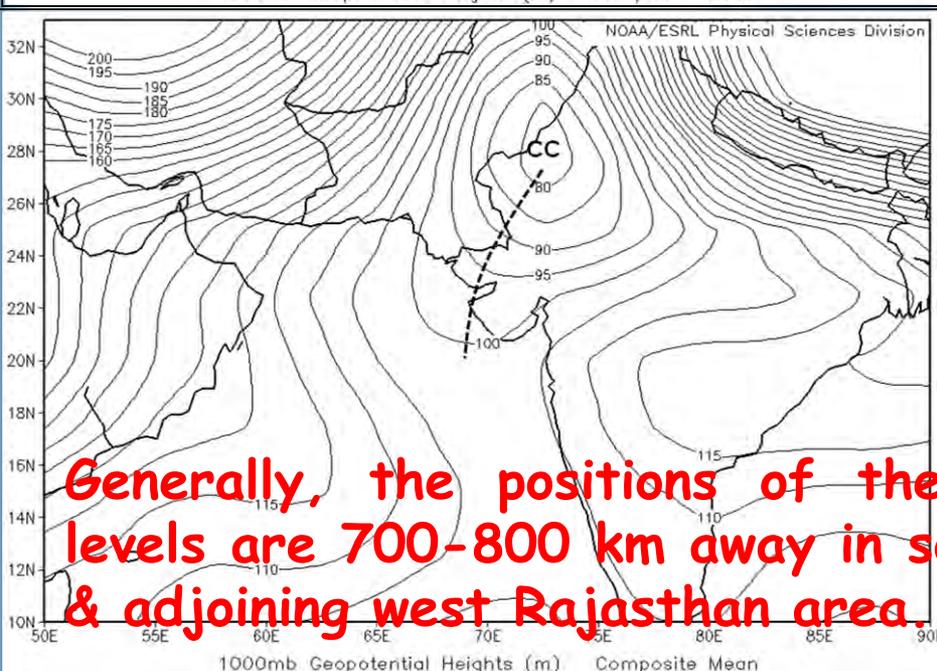
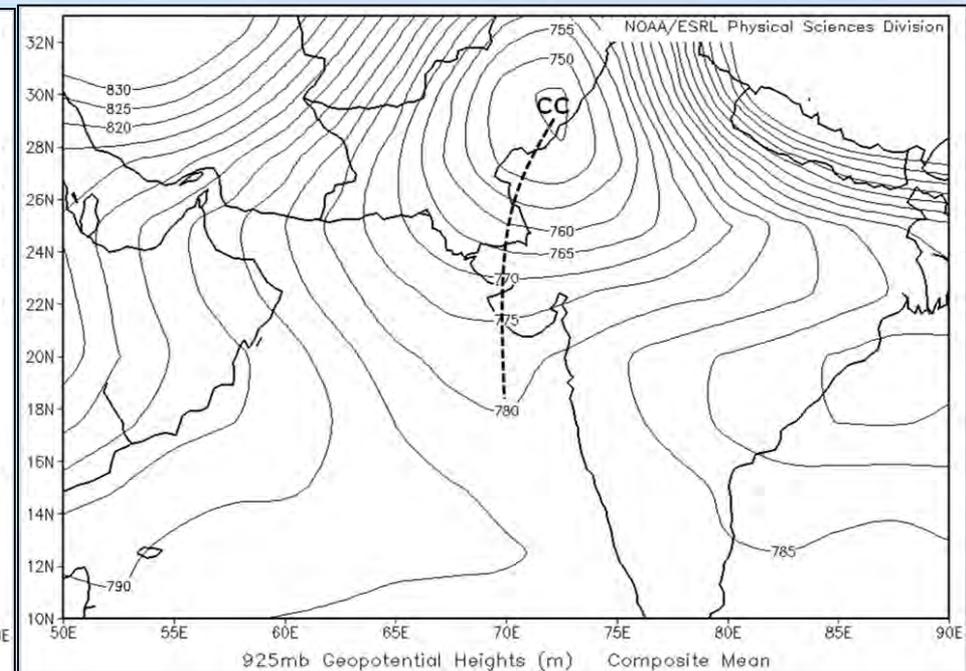
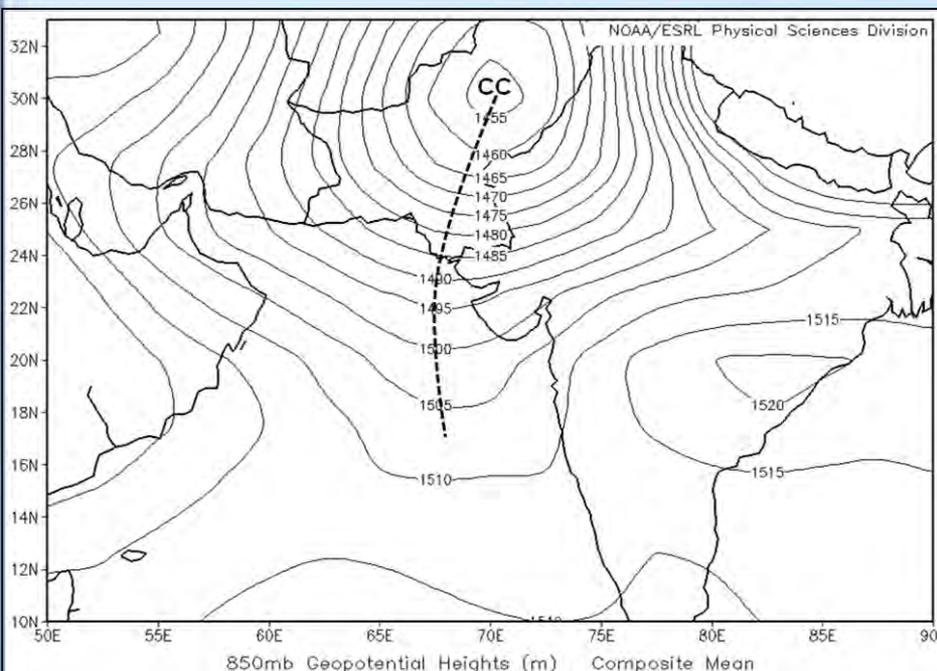
- Western Disturbances are the extra-tropical baroclinic systems in the form of upper air troughs or cyclonic circulations (CCs) in mid-latitude westerlies that move west to east across northwest India (Das et al., 2002; Lang and Barros, 2004; Puranik and Karekar, 2009, Naresh et al. 2015, 2017).
- Movement of WDs five degrees in a day, sometimes much lesser.
- Firstly these systems cause weather over Iran, Afghanistan & Pakistan. Thereafter, it take fresh moisture feed from Arabian Sea and cause precipitation over WHR & adjoining plains.



Western Disturbance

- Thereafter while moving eastward, it cause some precipitation over Nepal, Bhutan and Arunachal Pradesh.
- In the absence of fresh moisture feed from Arabian Sea, it only cause light precipitation over higher reaches of WHR.
- Generally after passage of WD, T_{min} falls significantly over adjoining plains due to cold northwesterly winds. As a result Cold Wave, Frost and FOG occurs over adjoining plains of Himalayas.



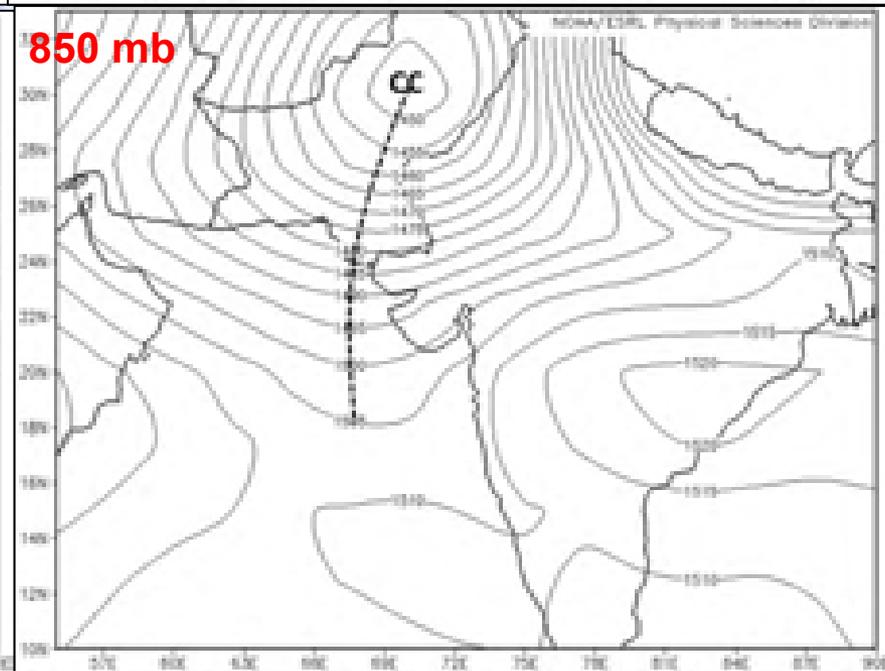
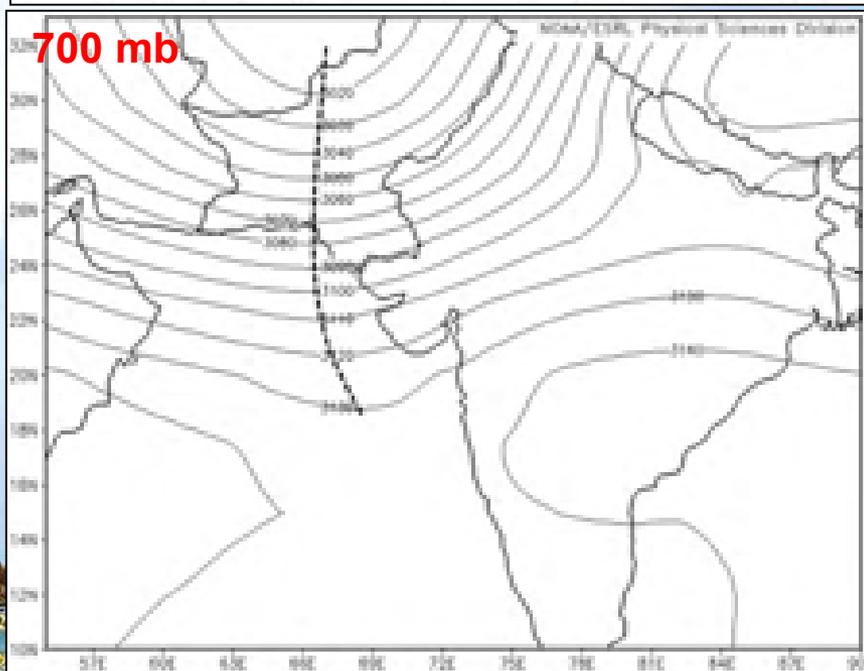
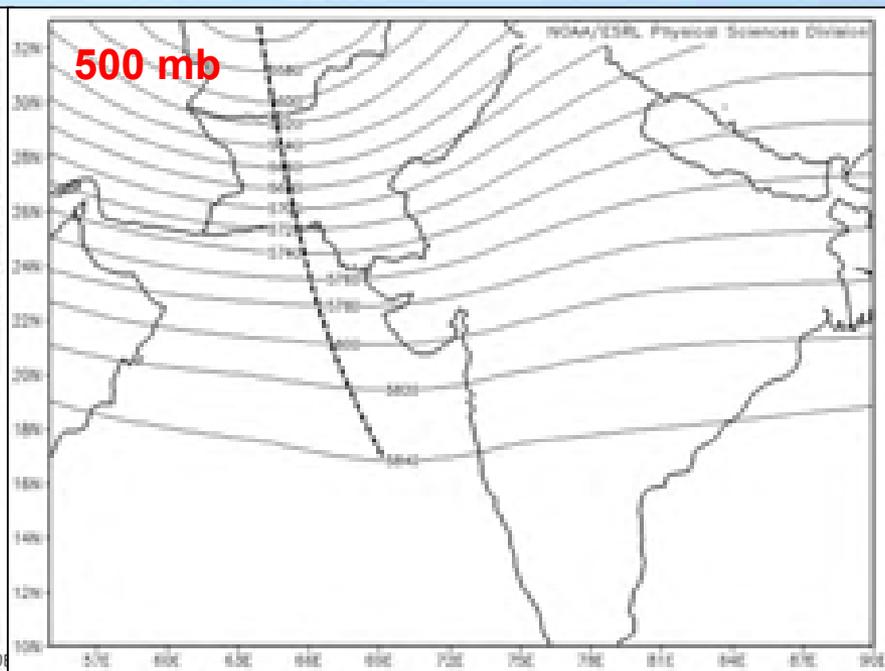
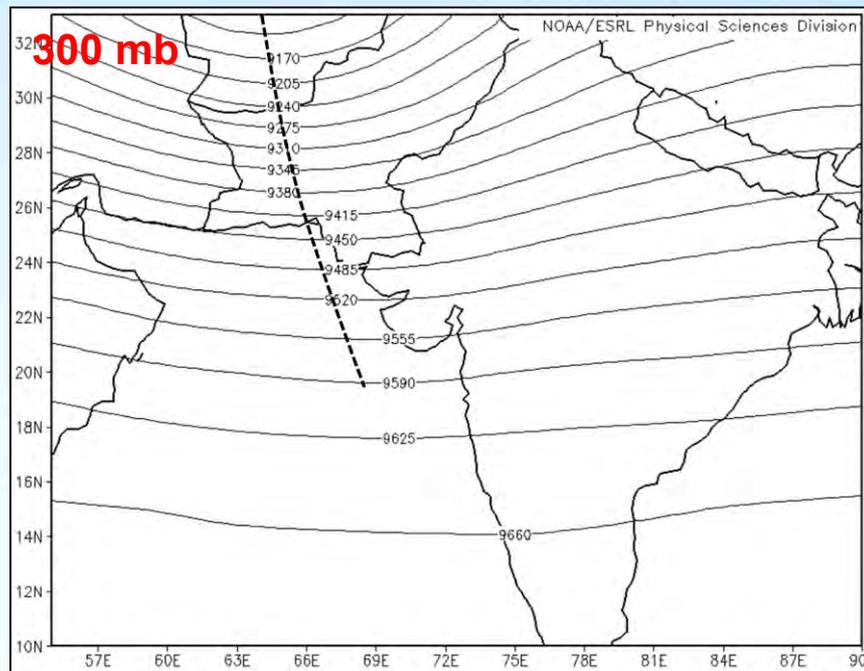


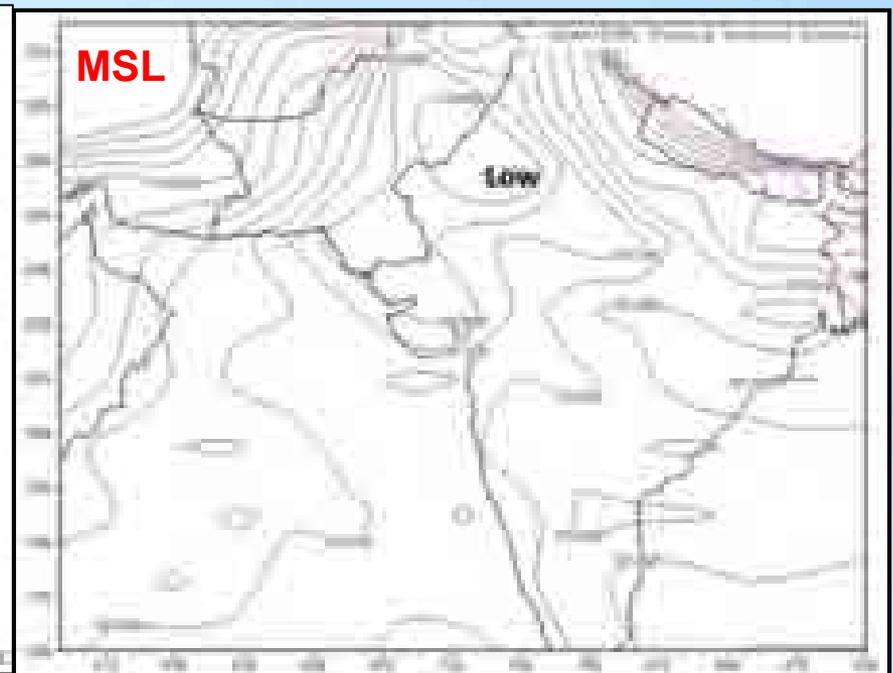
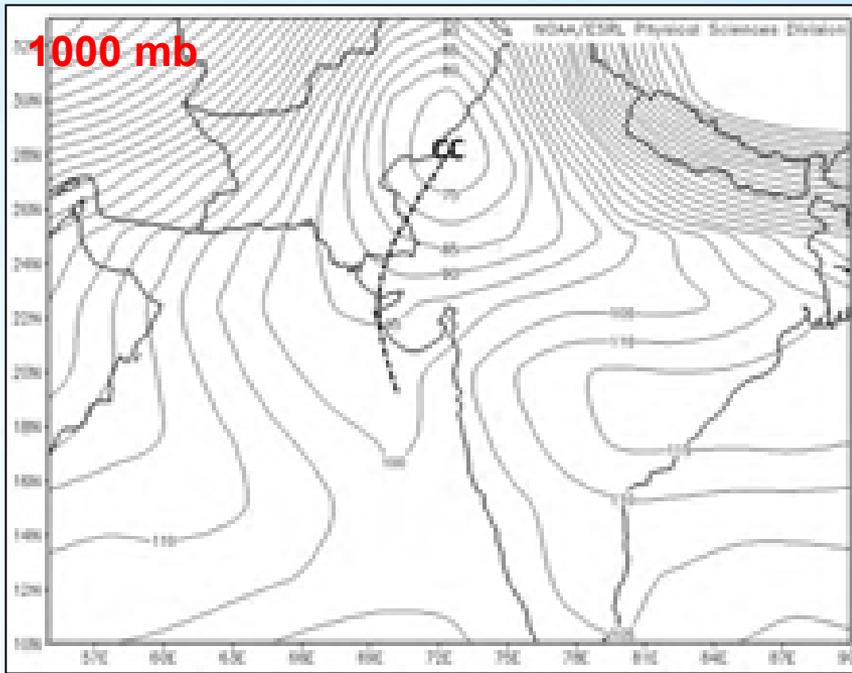
Generally, the positions of these systems at lower tropospheric levels are 700-800 km away in southeastwards over central Pakistan & adjoining west Rajasthan area.

Features associated with extreme precipitation over Himalayas

- Daily precipitation data of all surface observatories located in Jammu & Kashmir for the winter season (December to March) from 1985-2016 are used to find the extreme precipitation events over the region.
- During analysis, total 14 intense WDs cases are found.





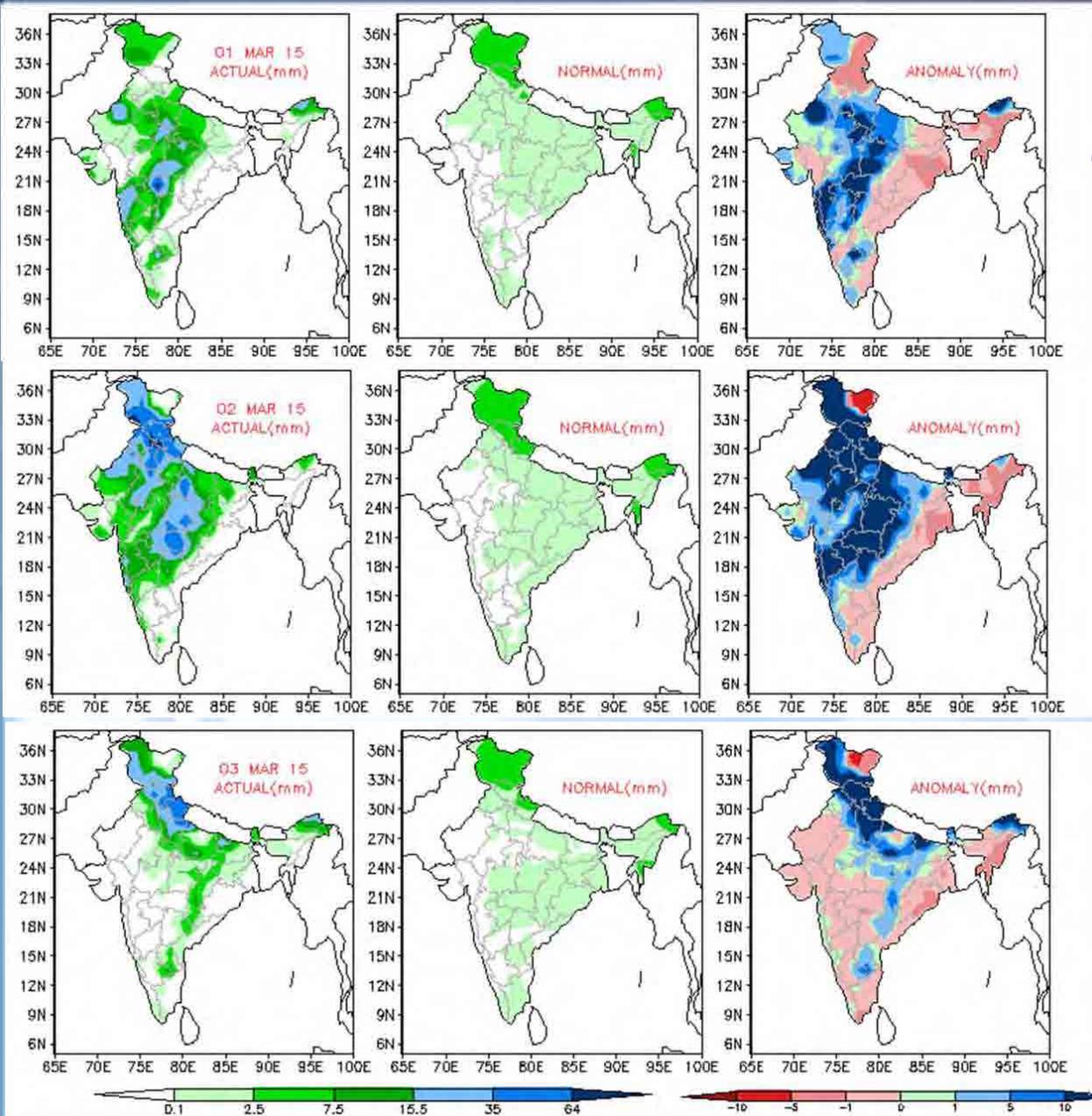


The composite mean charts of very heavy precipitation days associated with all the 14 WDs indicated that these are seen as **CCs upto 850 mb** over **central Pakistan & adjoining west Rajasthan area** along with a **trough from the centre of CCs to deep in central Arabian Sea** and as a **deep north-south trough between longitude 63° to 67°E** with its southern tip deep in central Arabian Sea between 700 to 200 mb resultant in huge moisture feed from Arabian Sea to Himalayan region from lower & upper levels.



Features associated with extreme precipitation over Plains

Actual, normal & anomaly of precipitation in past 24 hours of 1st, 2nd & 3rd March 2015 (reported at 0830 hours IST)



(Source: IMD Pune)

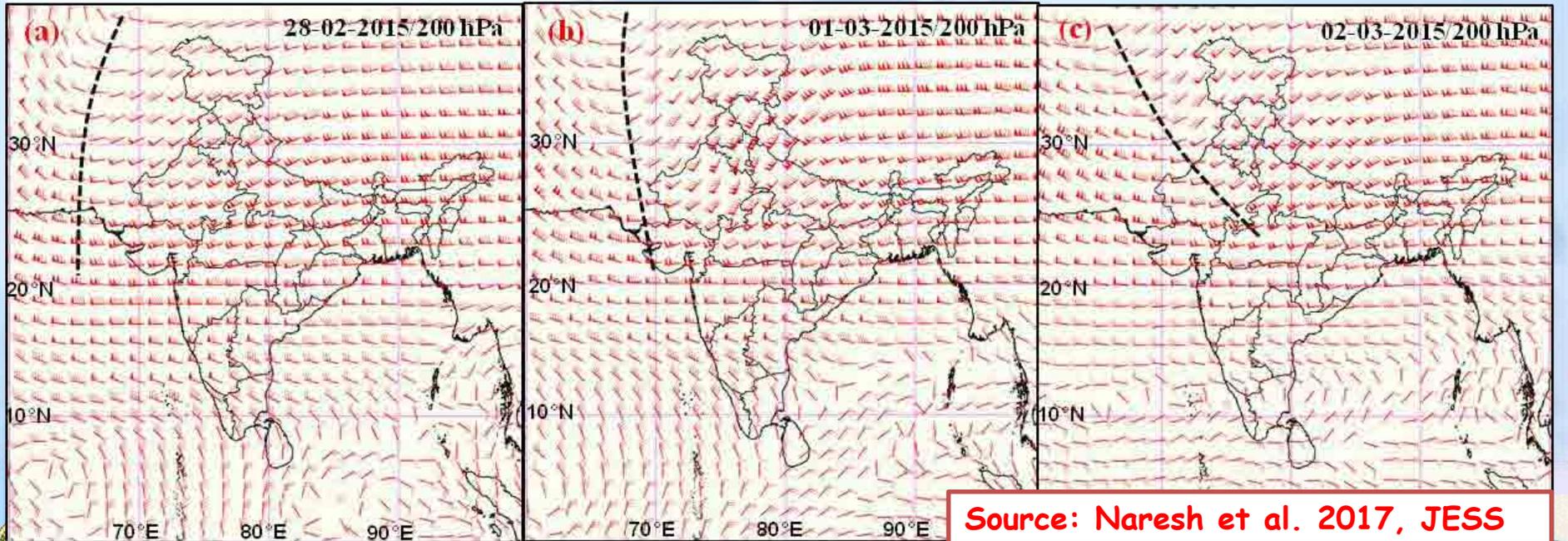
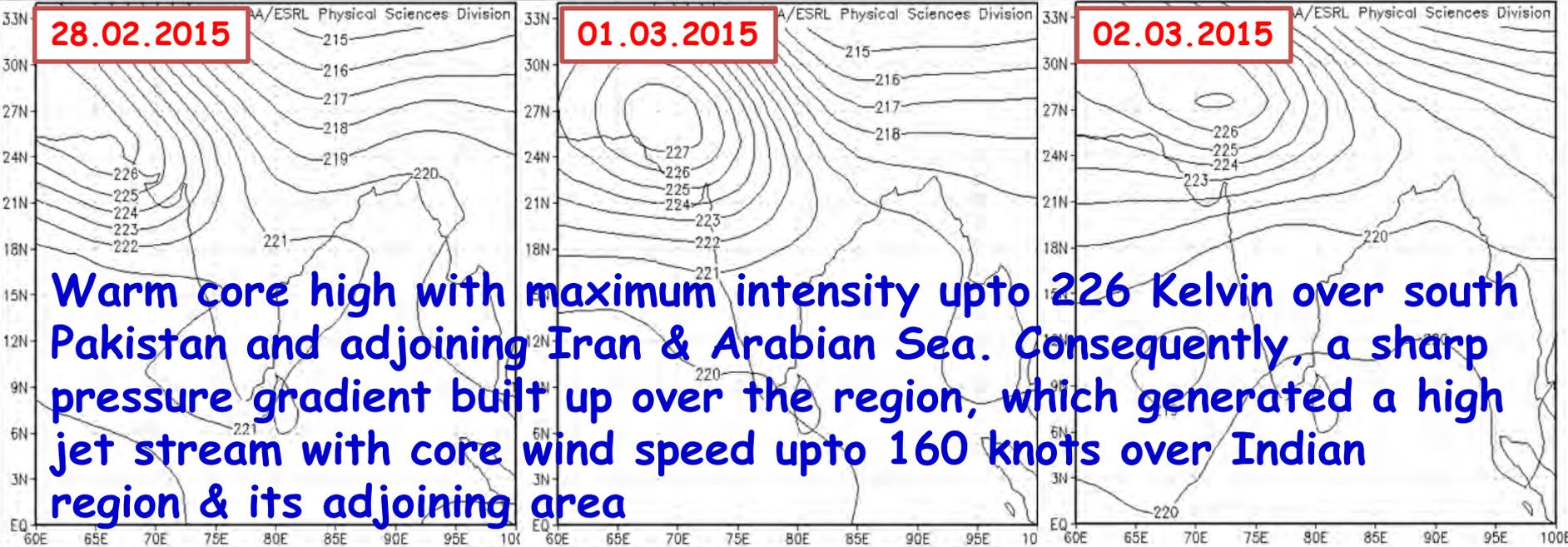


28.02.2015

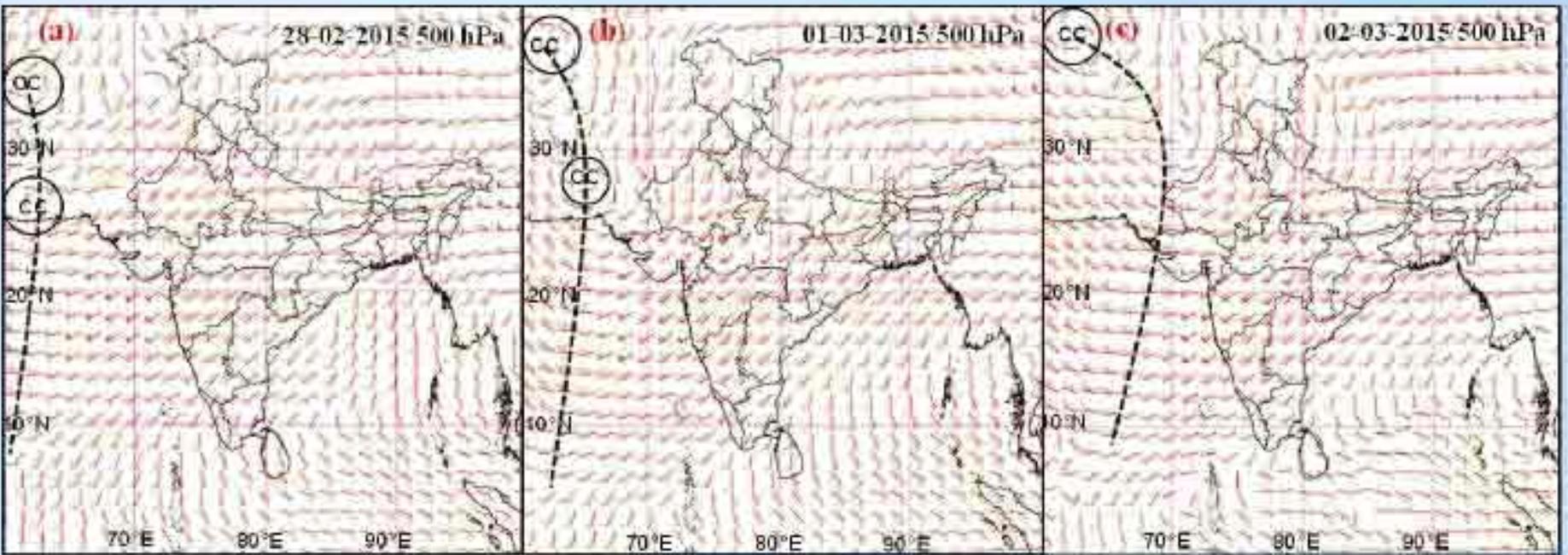
01.03.2015

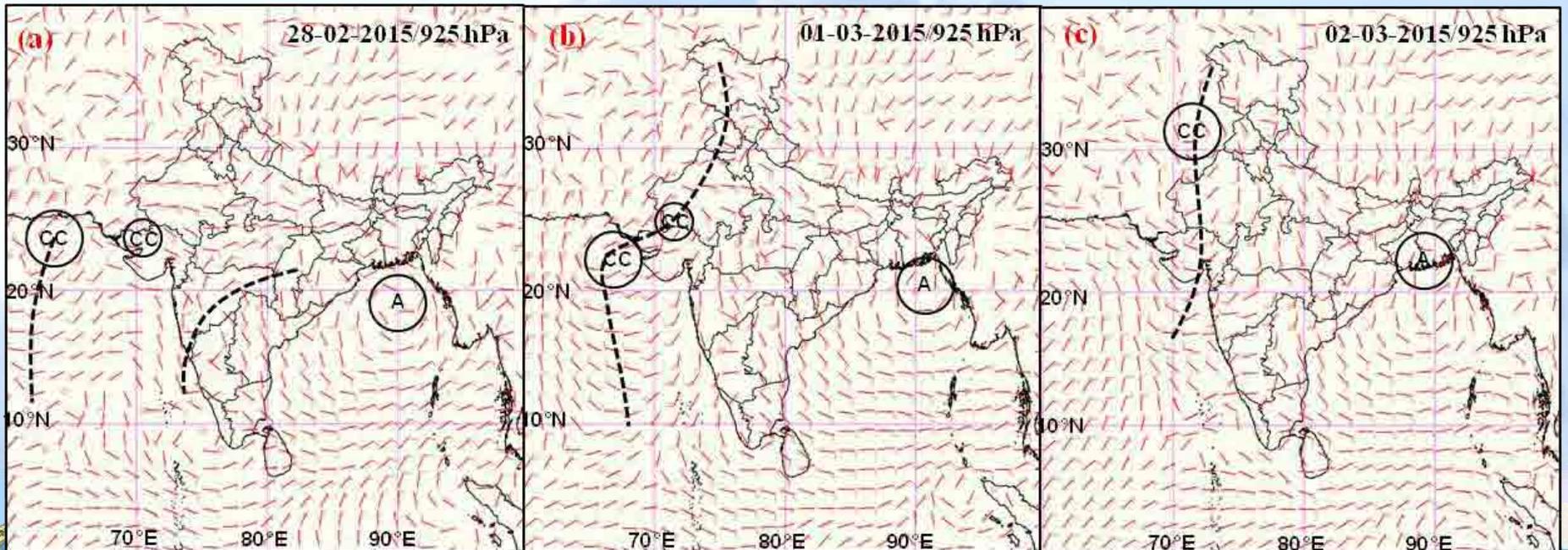
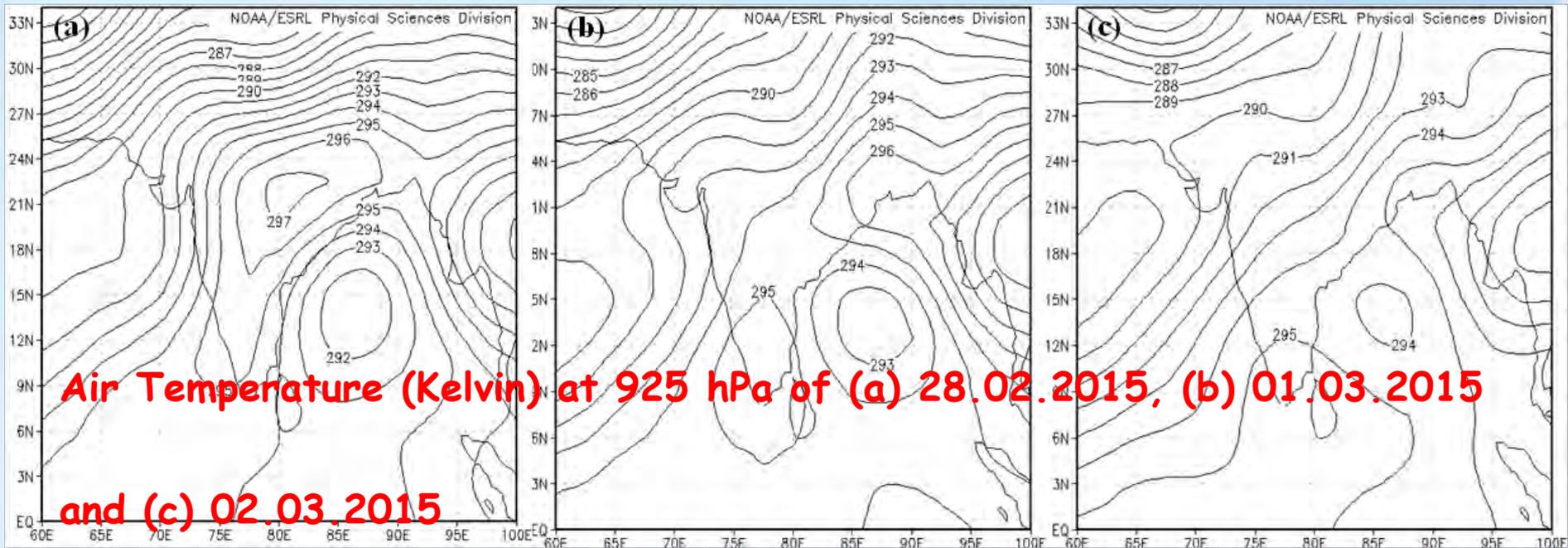
02.03.2015

Warm core high with maximum intensity upto 226 Kelvin over south Pakistan and adjoining Iran & Arabian Sea. Consequently, a sharp pressure gradient built up over the region, which generated a high jet stream with core wind speed upto 160 knots over Indian region & its adjoining area



Source: Naresh et al. 2017, JESS





The WD was in the form of north-south **deep westerly trough in middle & upper tropospheric levels** with its southern end deep in Arabian Sea, which pumped huge moisture feed over Indian region.

Also, there was a Jet stream with core wind speed upto 160 knots that generated **high positive divergence** at upper tropospheric level over Indian region.

It caused intense upwards motion and forced lower levels air to rise and strengthen the lower levels **CCs/Lows**.

Also, the induced **CCs/Lows** at lower tropospheric levels associated with WD were very much **south of its normal position**.

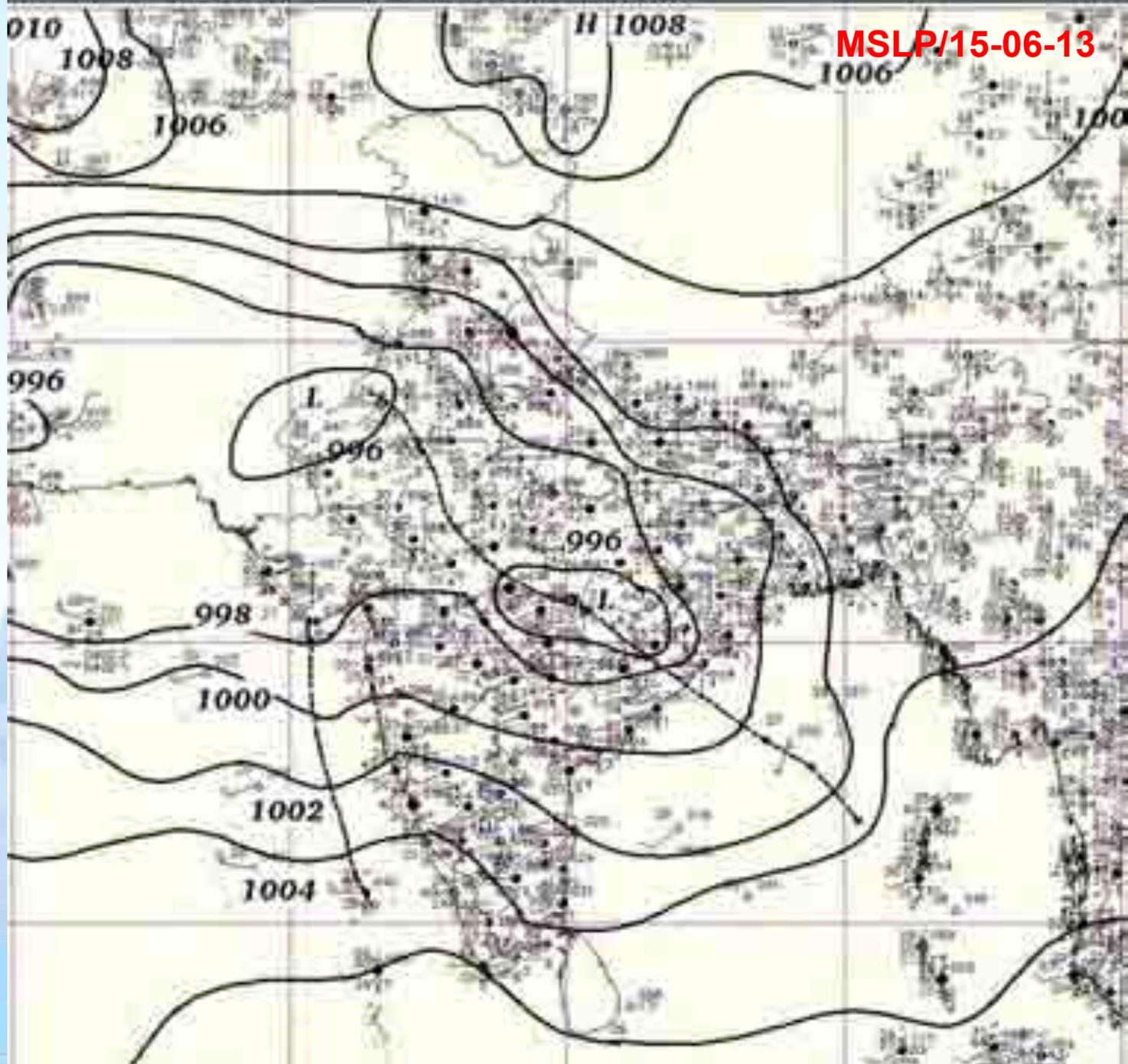
Additionally, there was **high wind confluence over central parts India** due to westerlies in association with WD and easterlies from anticyclone over north Bay of Bengal.



2013 Monsoon extreme rainfall event from 15-17 June over Uttarakhand

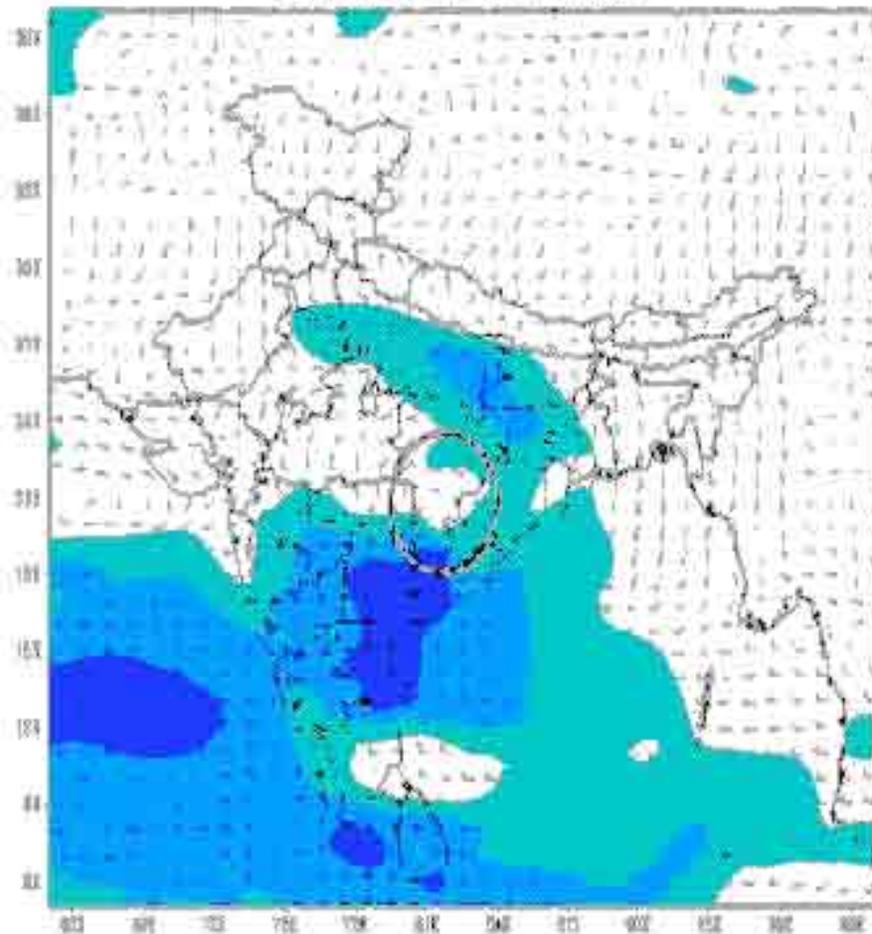


MSLP/15-06-13



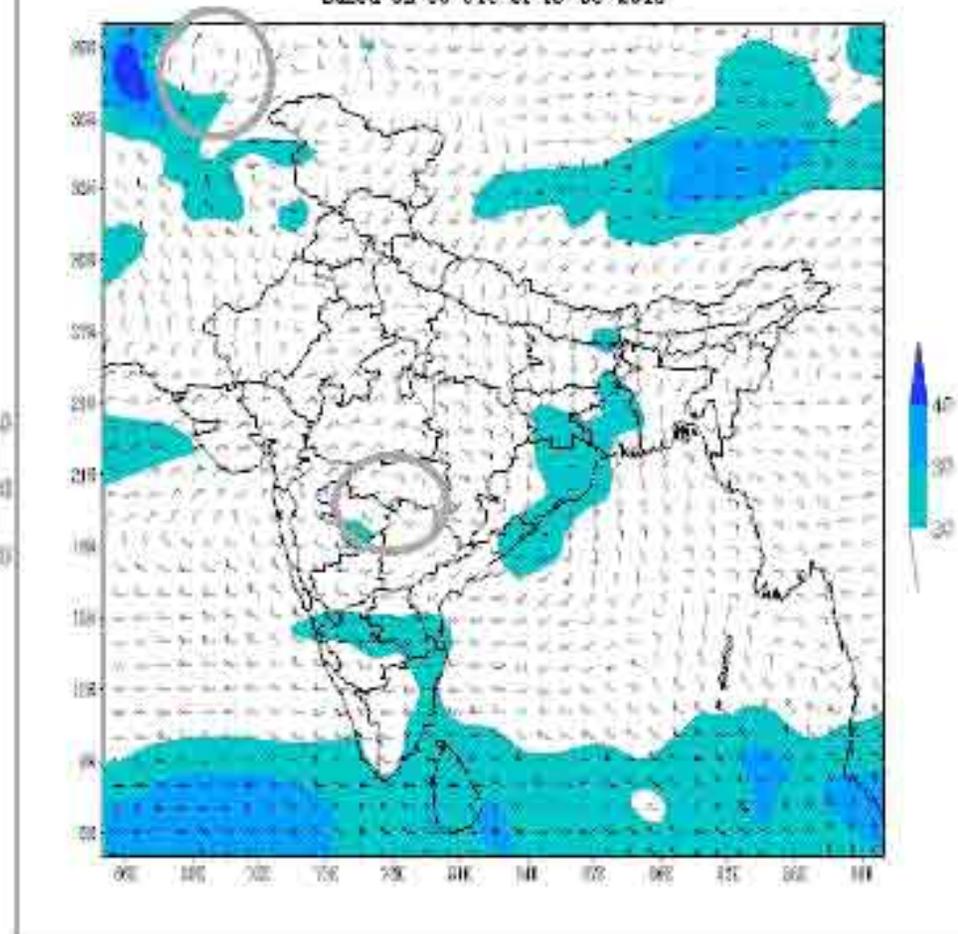
IMD GFS 850 hPa WIND (kt) ANALYSIS (00H)

Based on 00 UTC of 15-06-2013

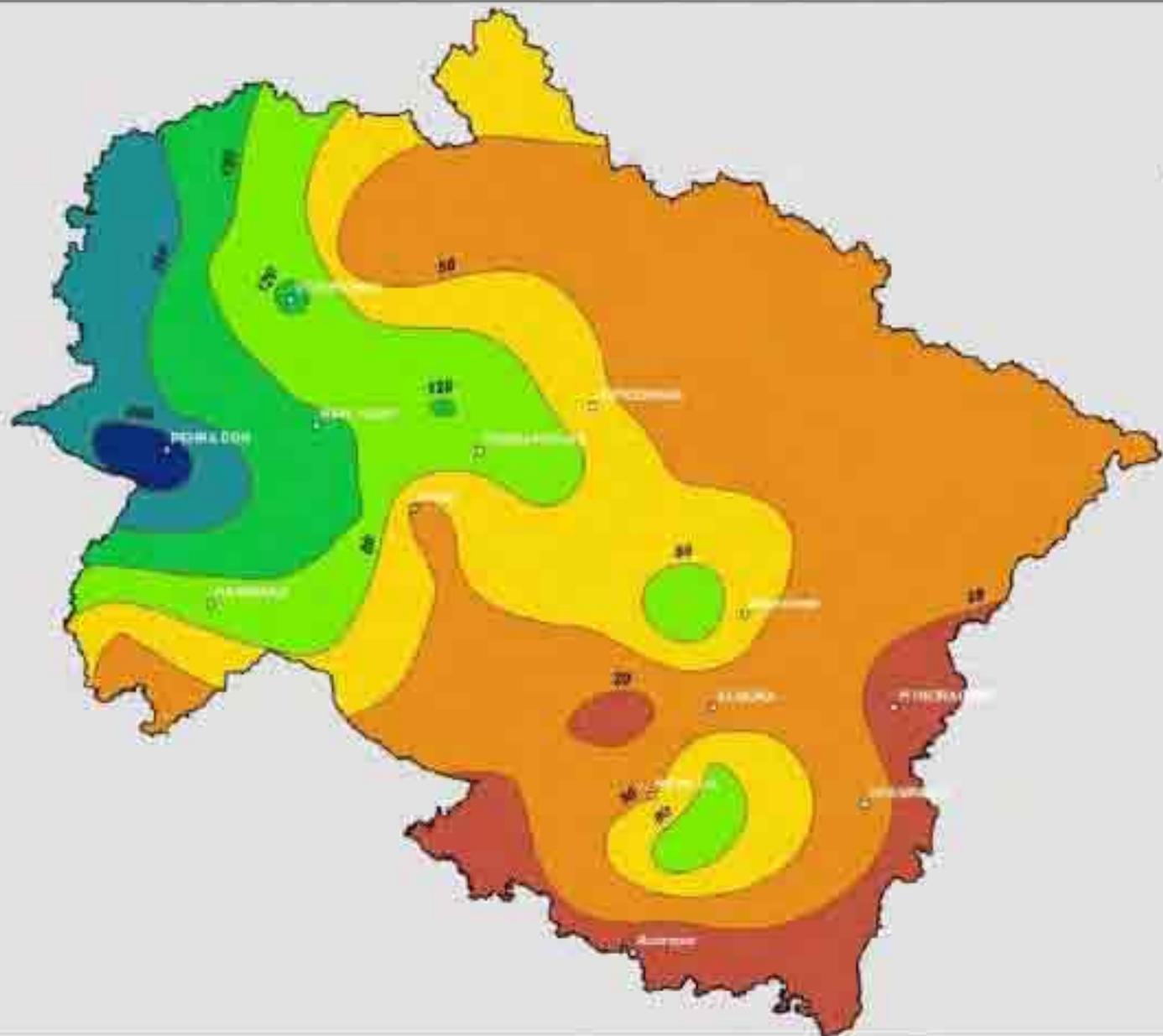


IMD GFS 500 hPa WIND (kt) ANALYSIS (00H)

Based on 00 UTC of 15-06-2013

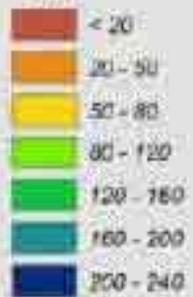


Uttarakhand Rainstorm : 16 June 2013

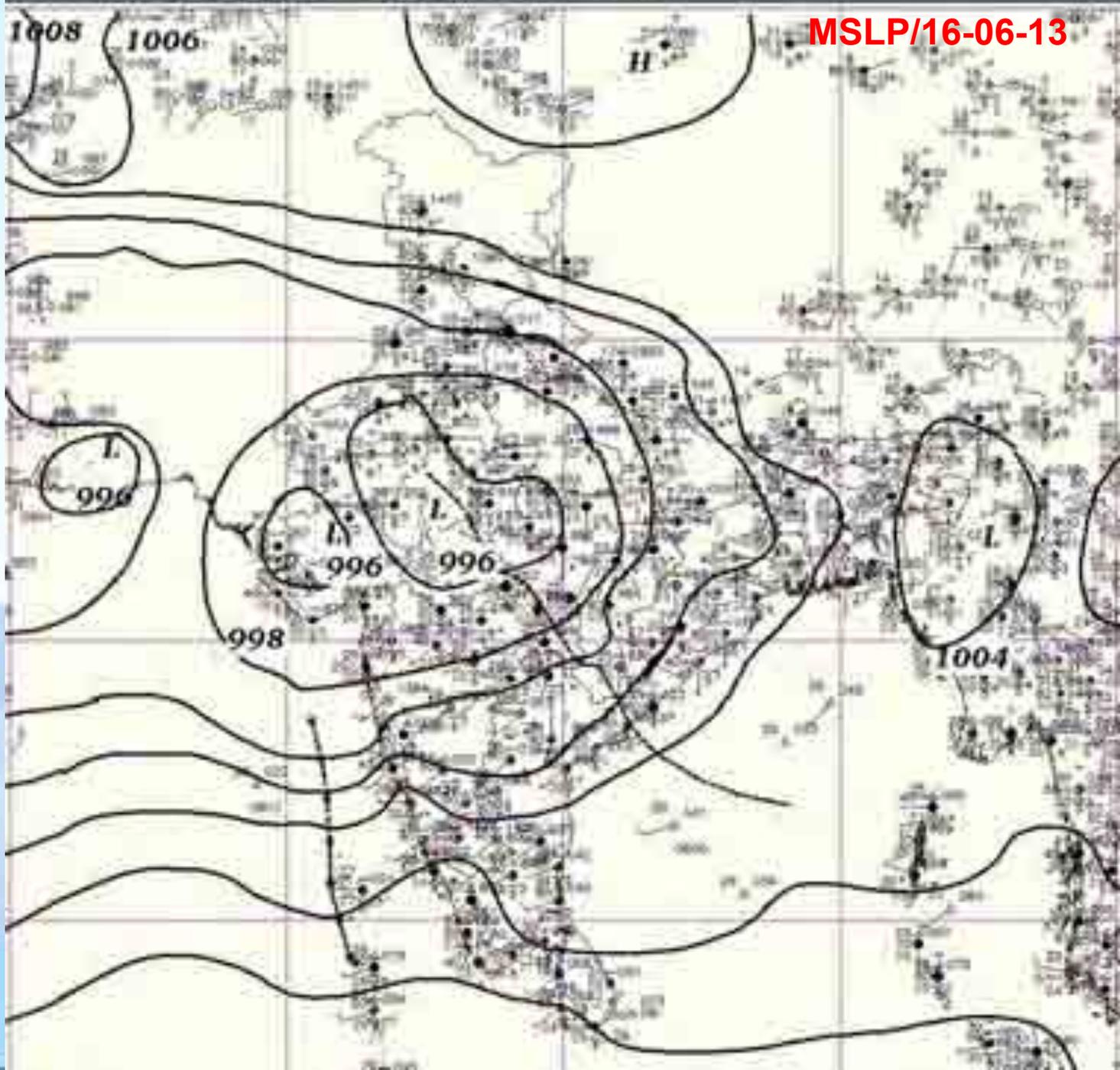


Legend

Rainfall
<mm>

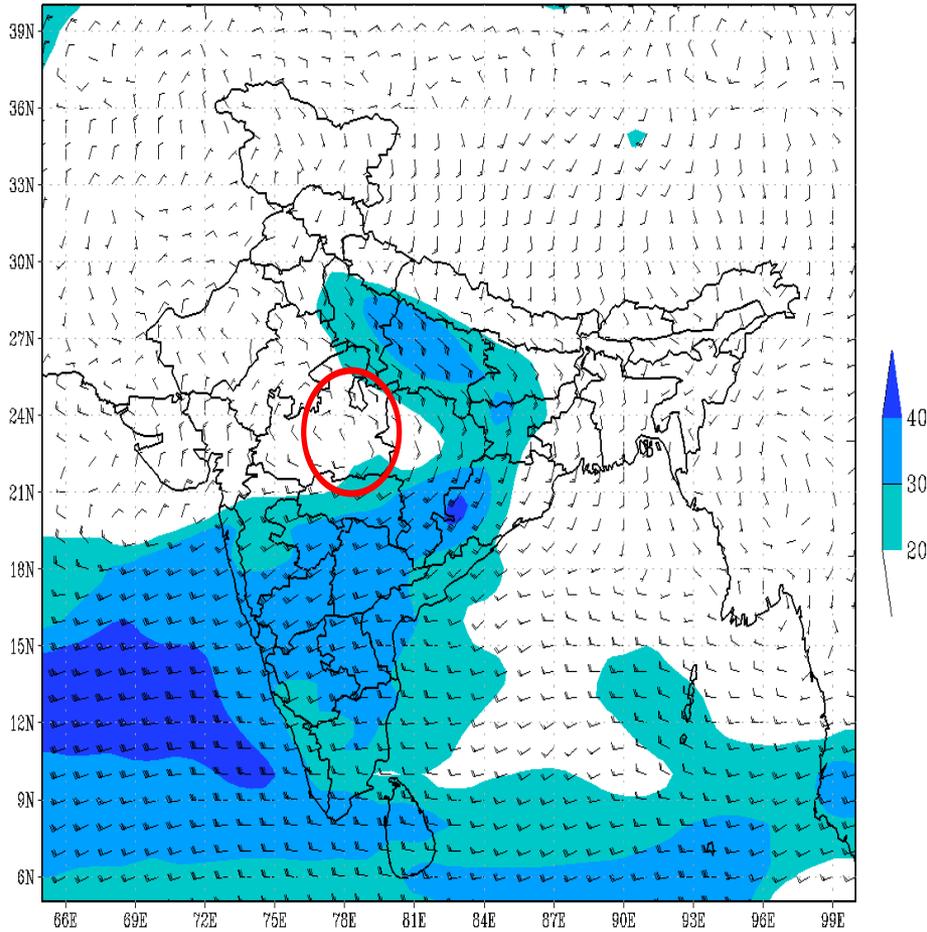


MSLP/16-06-13



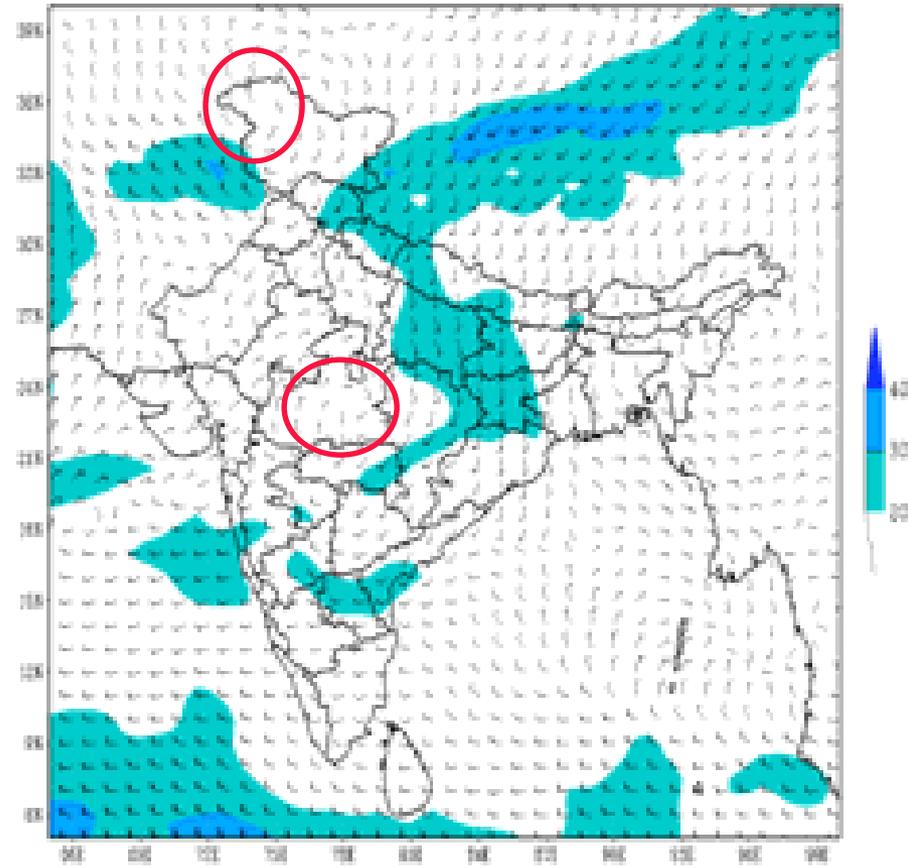
IMD GFS 850 hPa WIND (kt) ANALYSIS (00H)

Based on 00 UTC of 16-06-2013

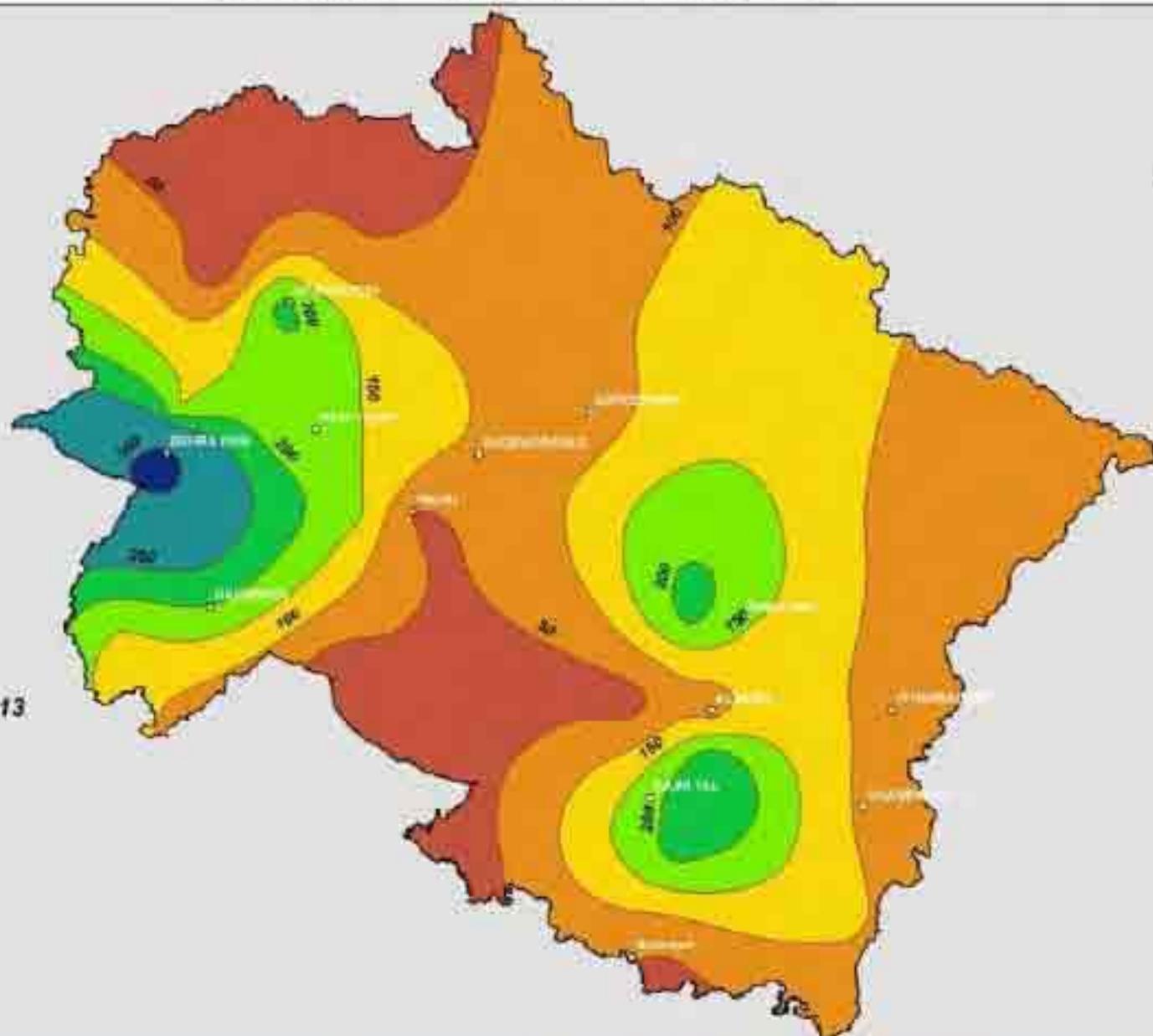


IMD GFS 500 hPa WIND (kt) ANALYSIS (00H)

Based on 00 UTC of 16-06-2013



Uttarakhand Rainstorm : 17 June 2013



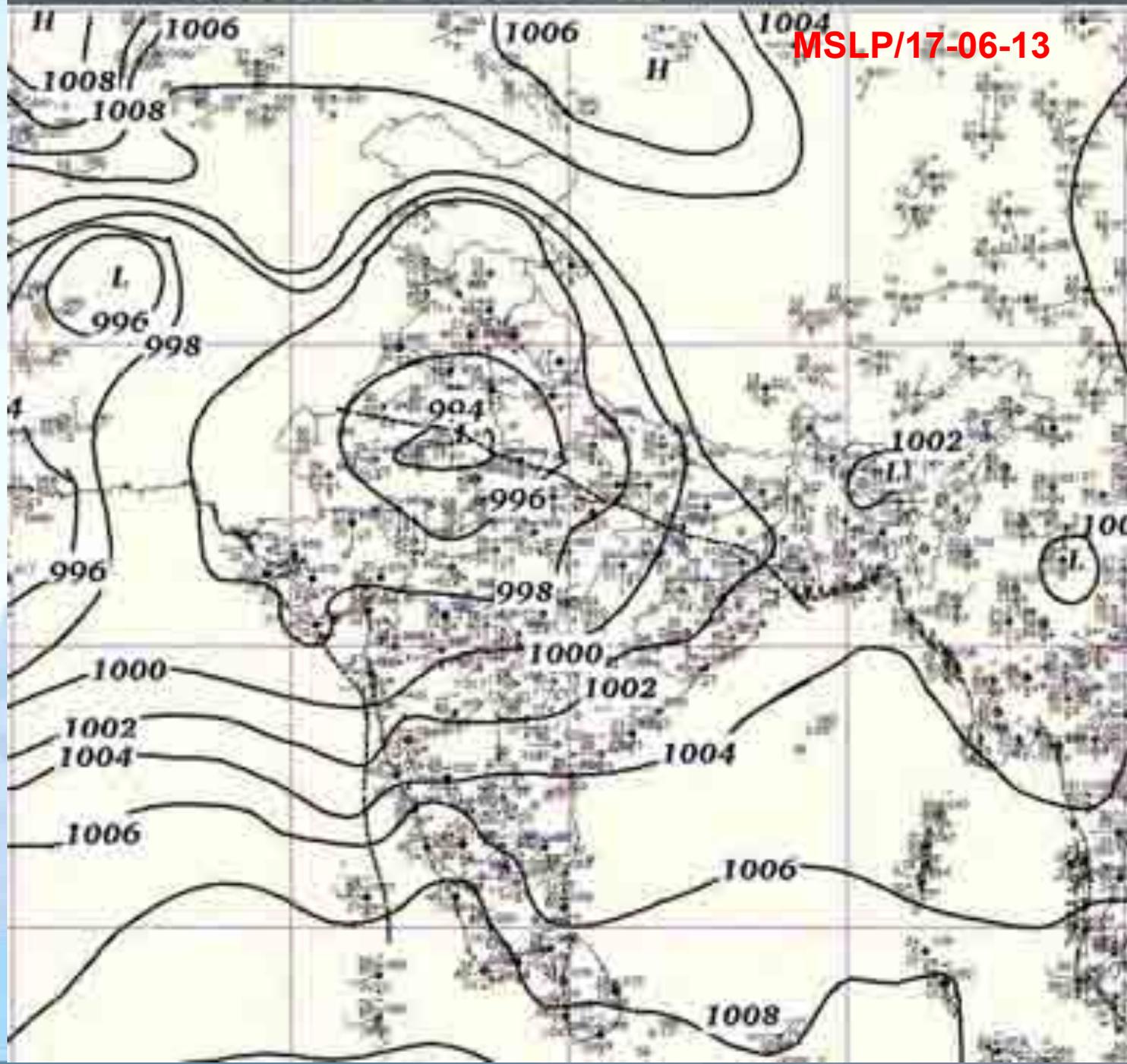
Legend

Rainfall_17Jun2013

<mm>

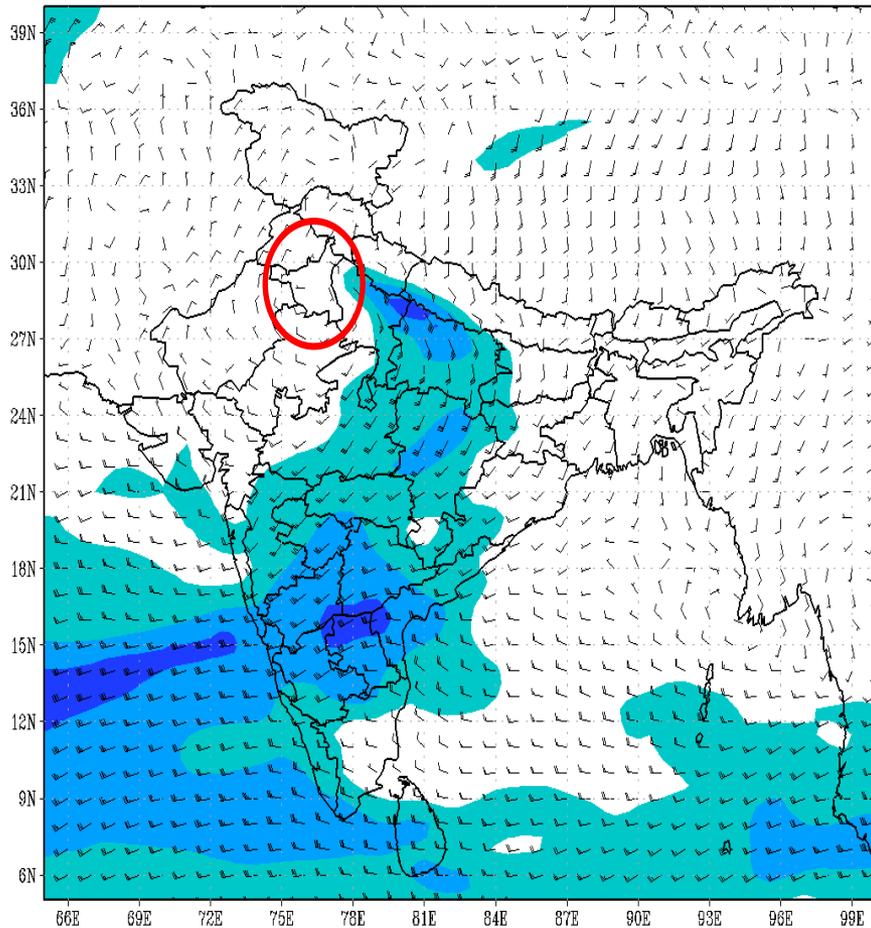
- < 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- 250 - 350
- 350 - 400

MSLP/17-06-13



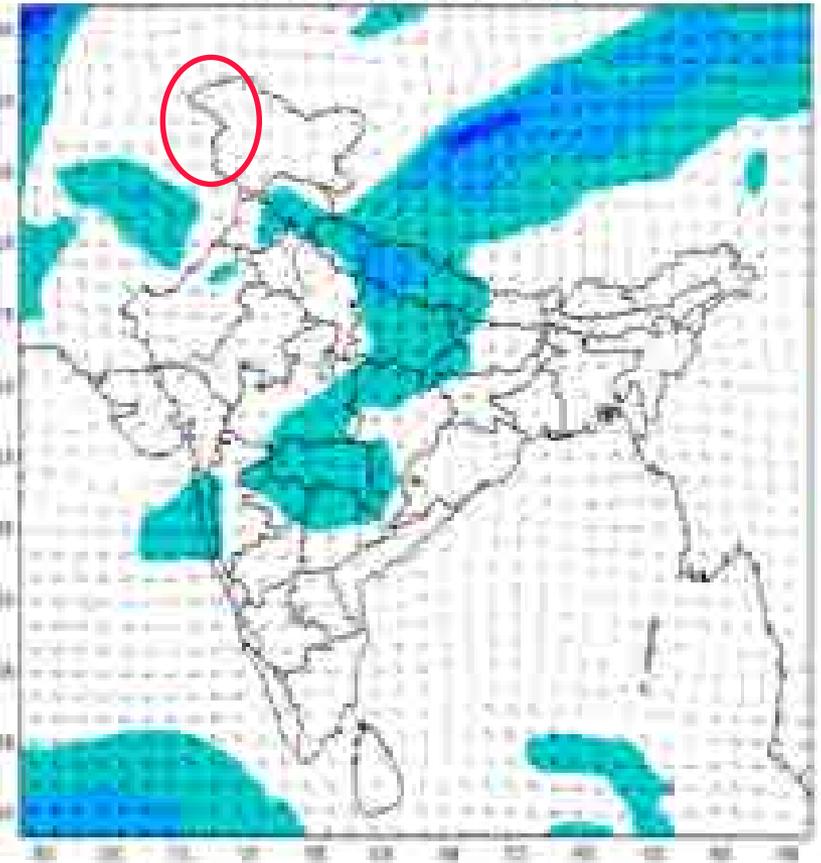
IMD GFS 850 hPa WIND (kt) ANALYSIS (00H)

Based on 00 UTC of 17-06-2013

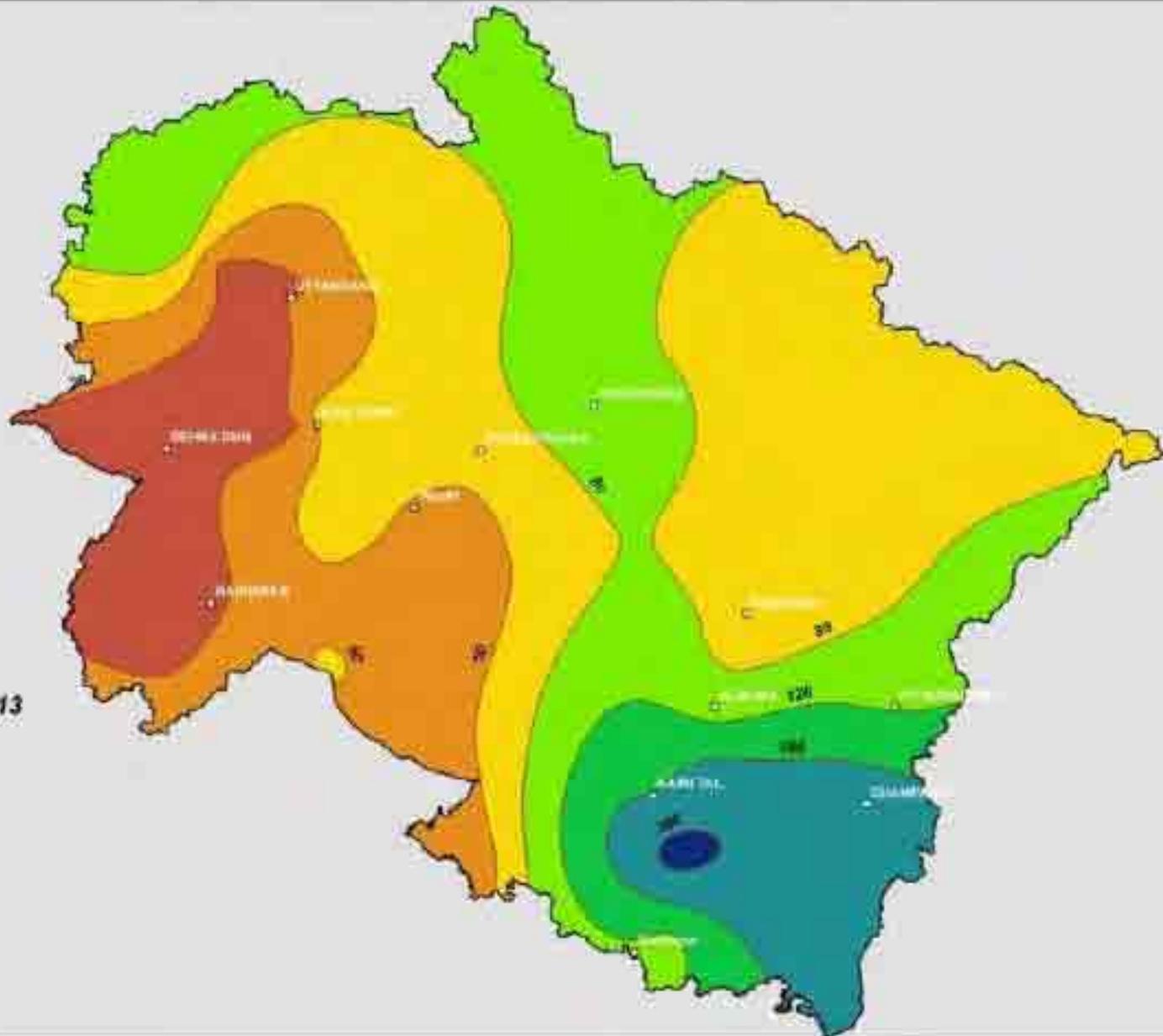


IMD GFS 500 hPa WIND (kt) ANALYSIS (00H)

Based on 00 UTC of 17-06-2013



Uttarakhand Rainstorm : 18 June 2013



Legend

Rainfall_18Jun2013

<mm>



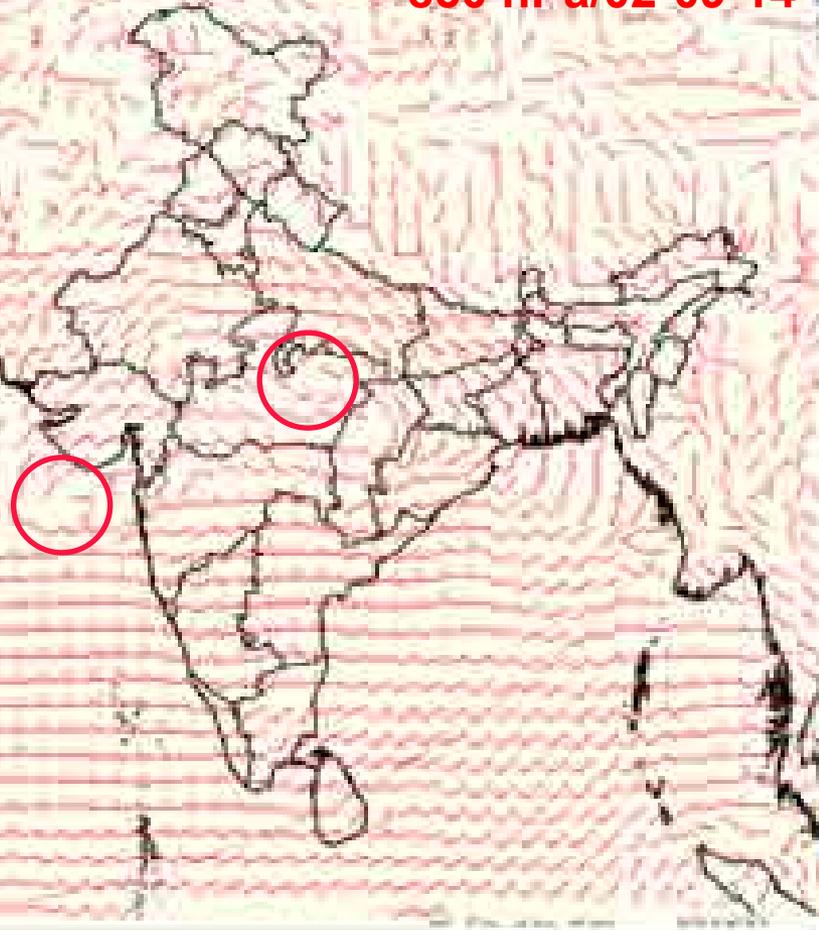
2014 Monsoon extreme rainfall event from 2-5 September over Jammu & Kashmir



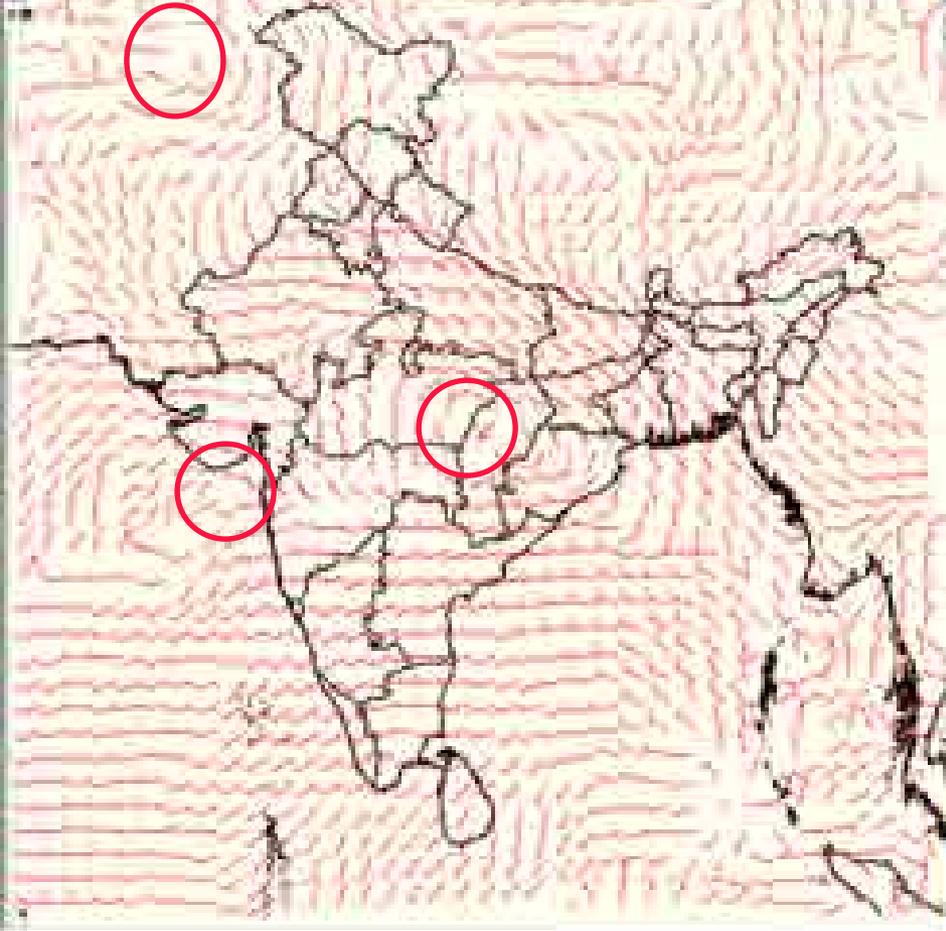
MSLP/02-09-14
2 LPA



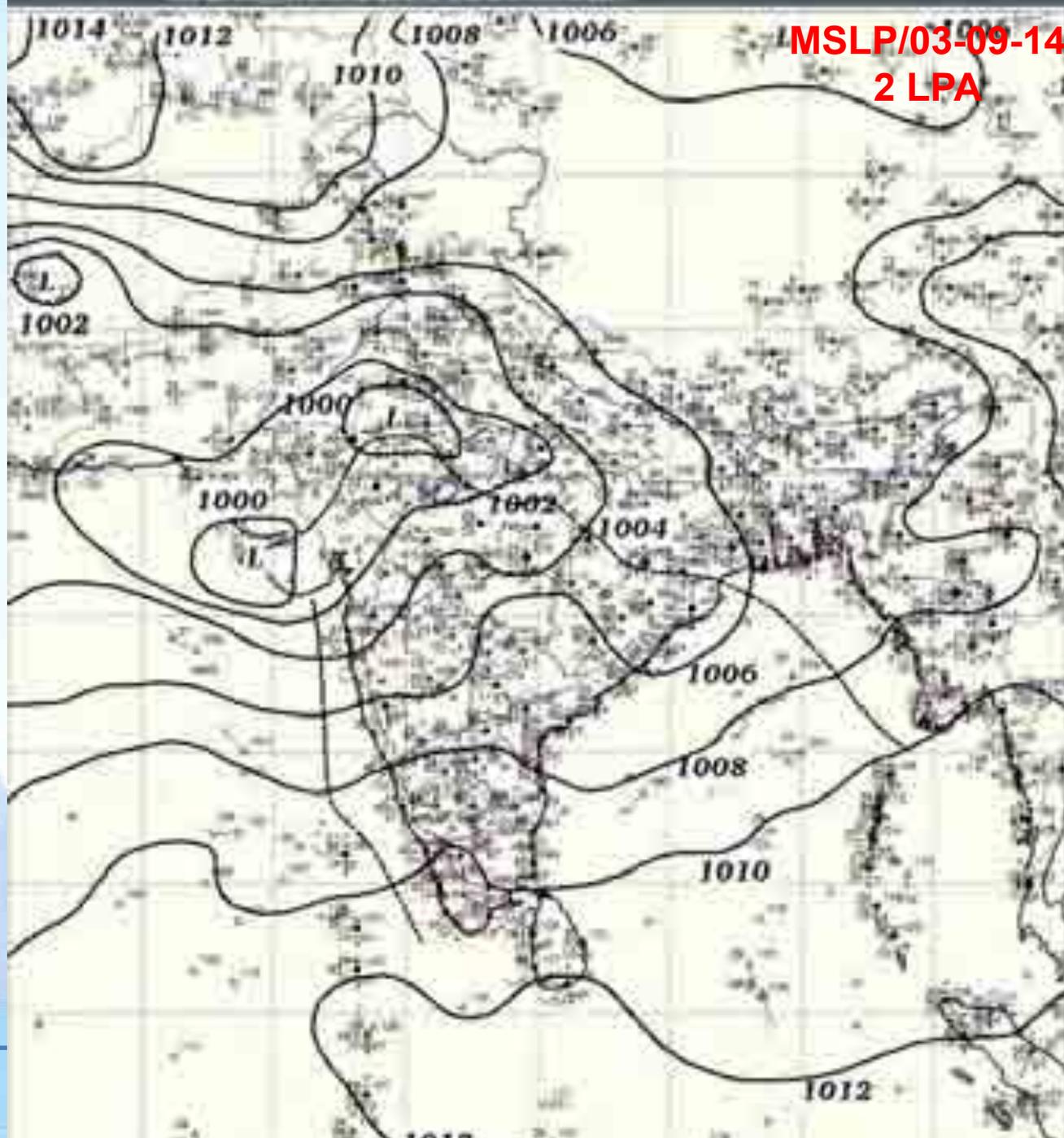
850 hPa/02-09-14



500 hPa/02-09-14



MSLP/03-09-14
2 LPA



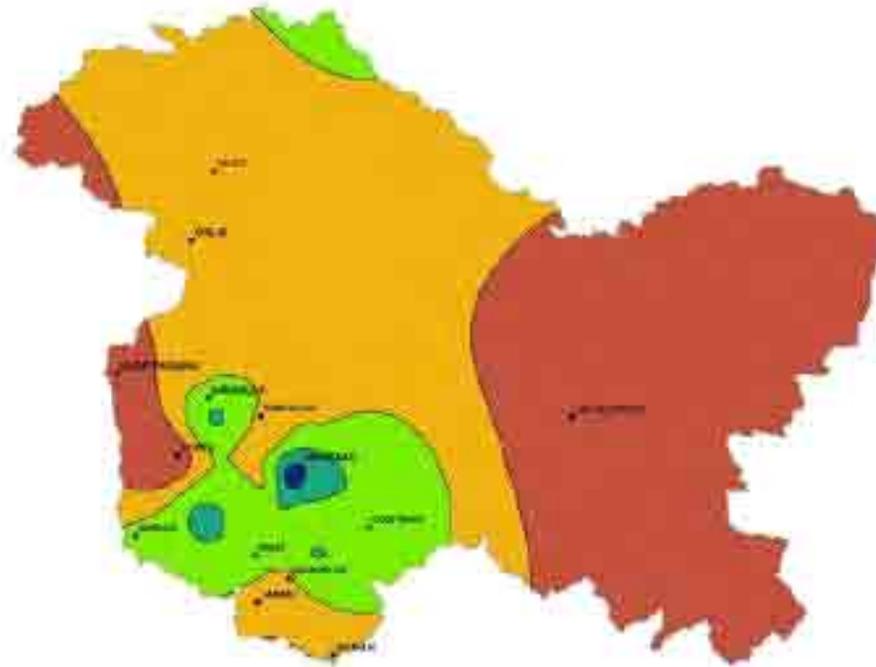
NCGFS 850 hPa/03-09-14



NCGFS 500 hPa/03-09-14



Jammu & Kashmir - Rainstorm 04 Sep 2014



Legend

Rainstorm_04092014

<mm>



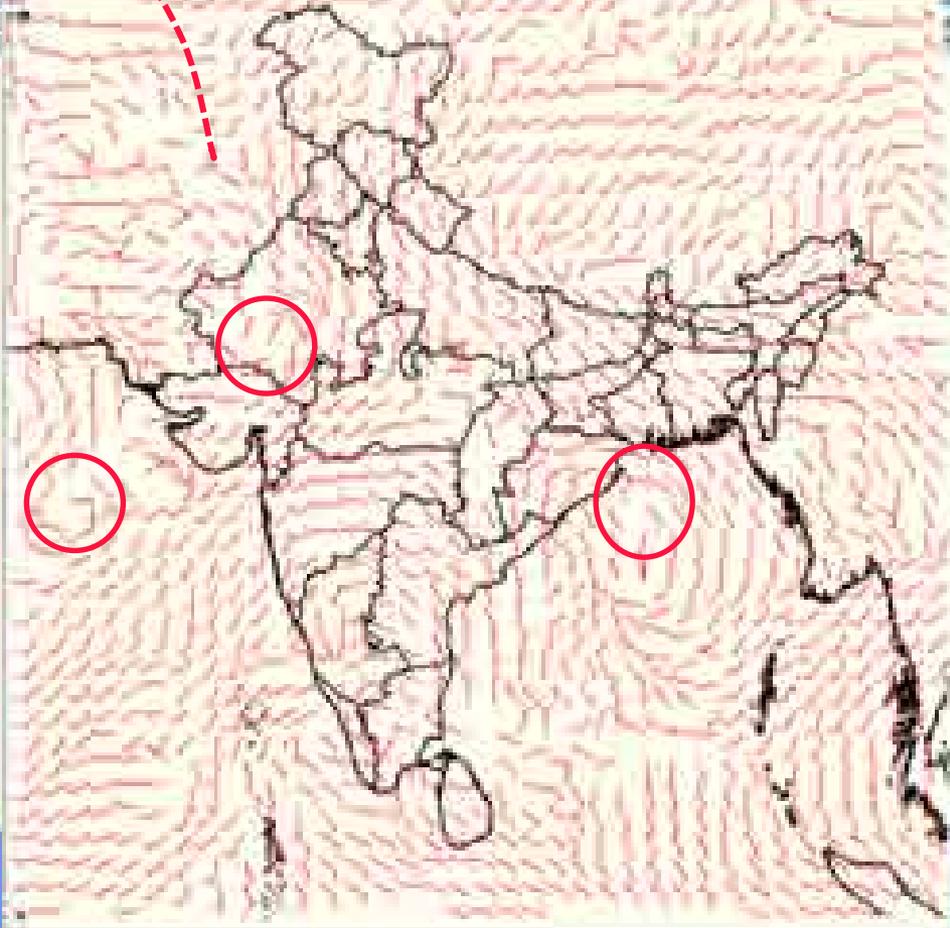
MSLP/04-09-14
2 LPA



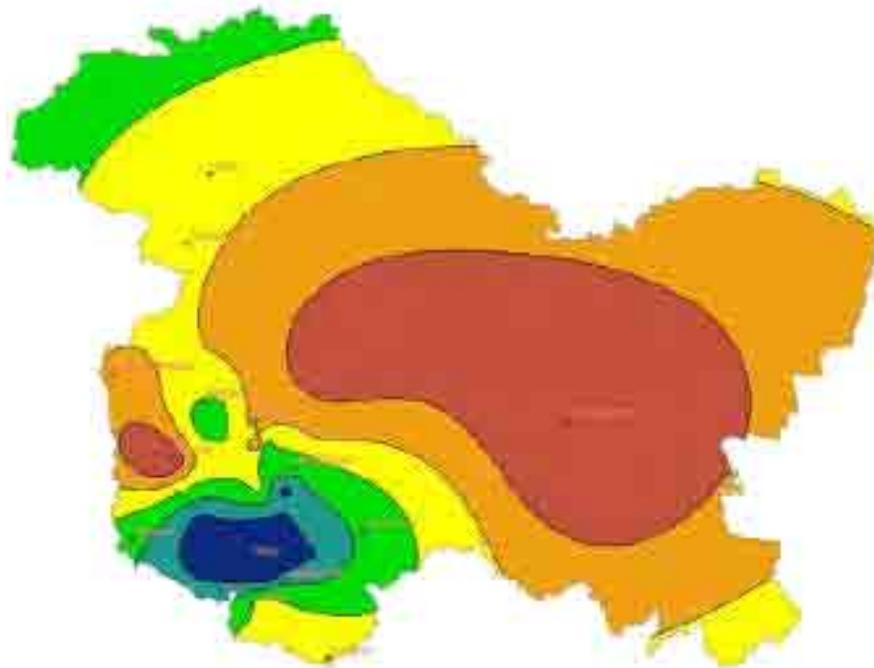
NCGFS 850 hPa/04-09-14



NCGFS 500 hPa/04-09-14



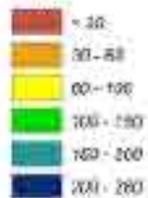
Jammu & Kashmir - Rainstorm 05 Sep 2014



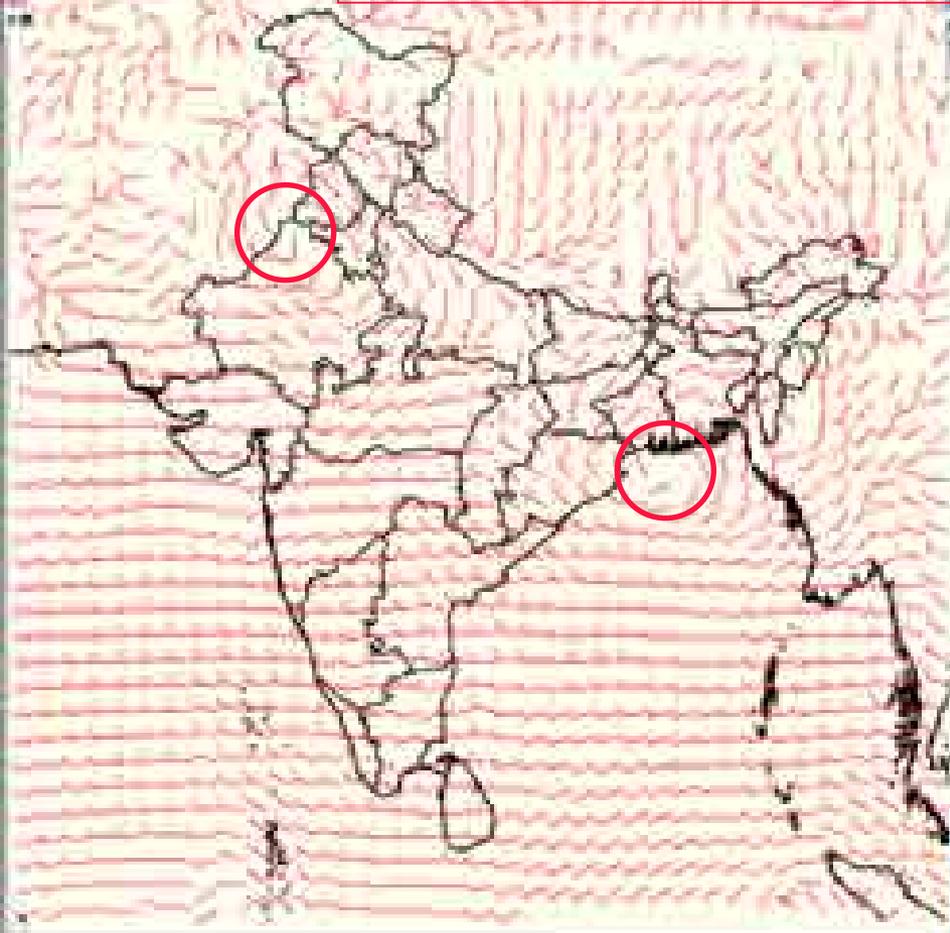
Legend

Rainstorm_05092014

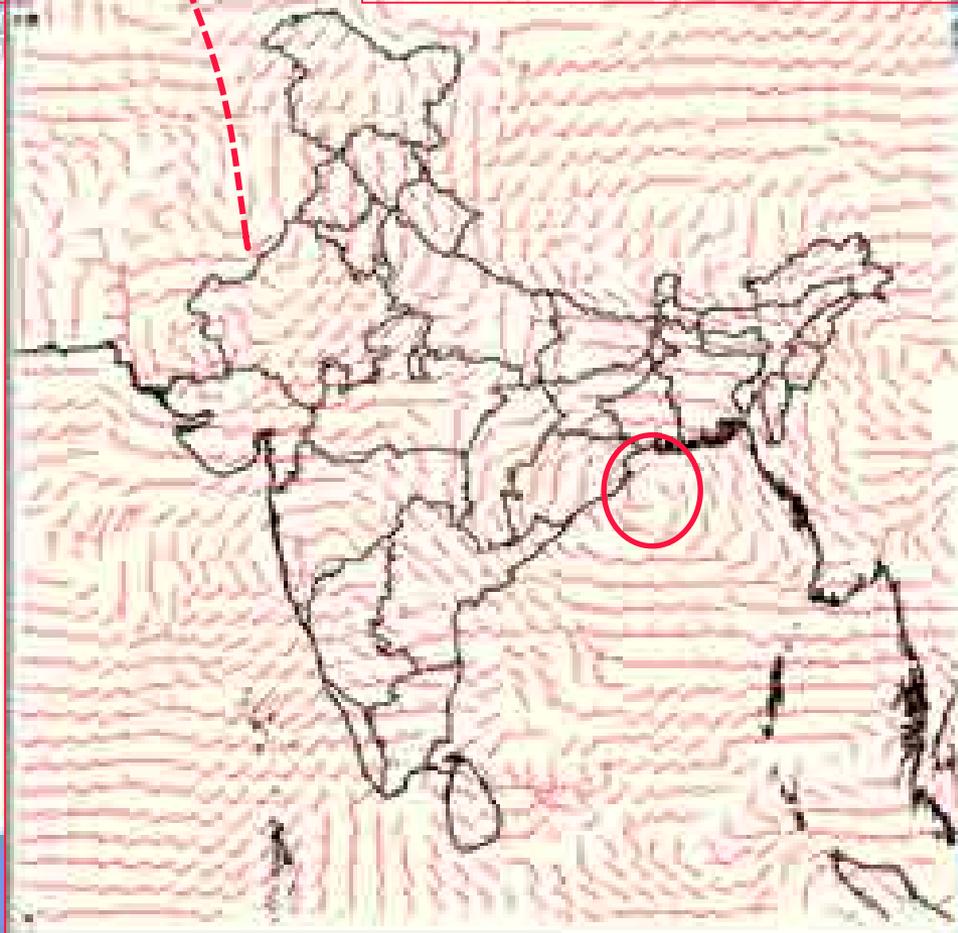
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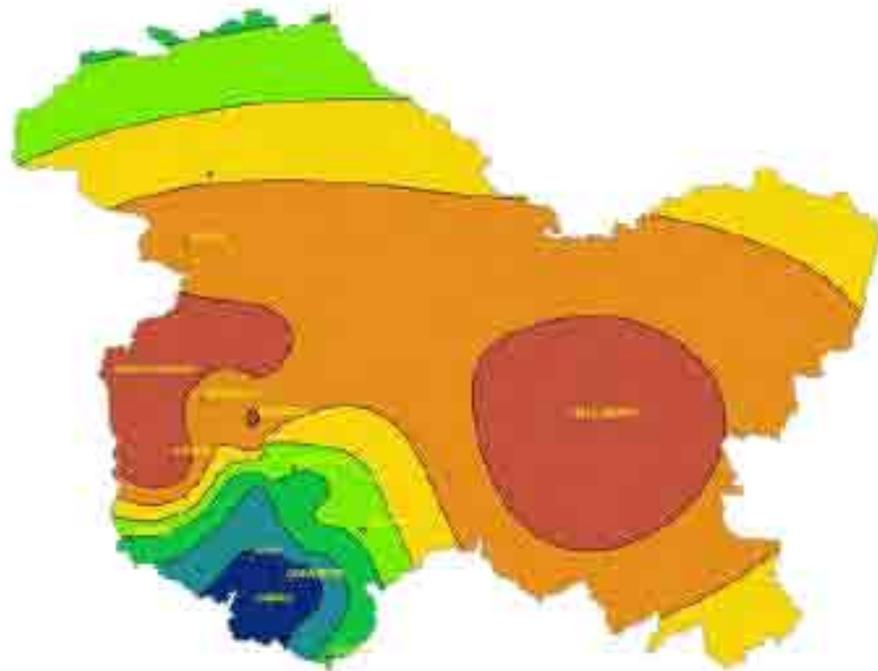
NCGFS 850 hPa/05-09-14



NCGFS 500 hPa/05-09-14



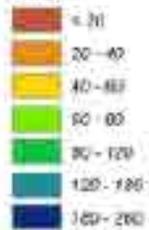
Jammu & Kashmir - Rainstorm 06 Sep 2014



Legend

Rainstorm_06092014

<map>



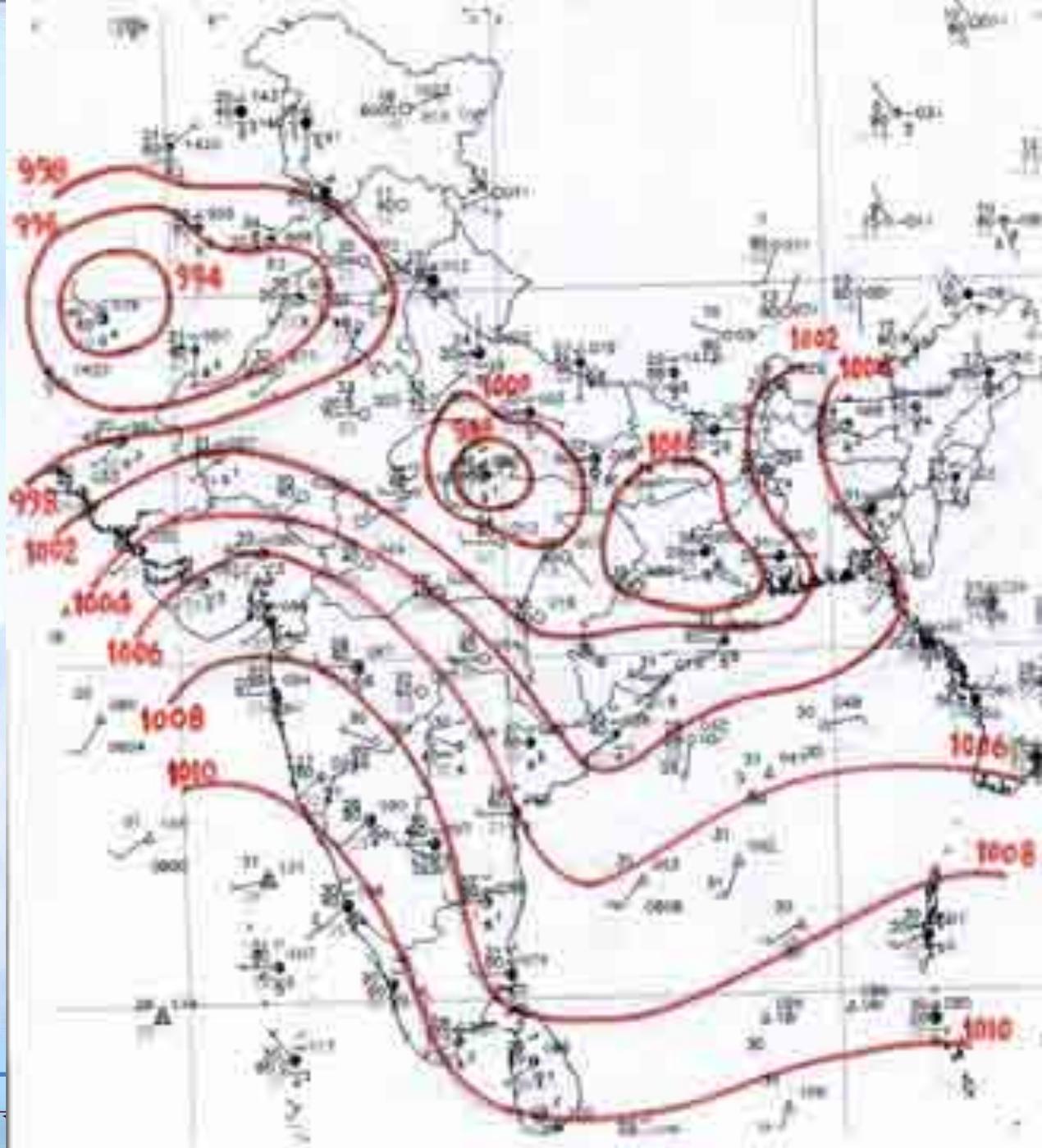
- In J & K episode, there was a WD in form of CC/trough in mid-tropospheric level, which remained practically stationary over Afghanistan and adjoining north Pakistan from 2-5 September, 2014 due to presence of intense TH, which was west of its normal position. During this period, there was three more synoptic system viz. 1st was LPA over Saurashtra & nbd and 2nd was WML over central & northwest India, in addition there was CC over north BoB. As result, a very high moisture feed over the region both from BoB and Arabian Sea..
- In UK episode, WD was in form CC firstly over Pakistan & nbd and moved slowly over J& K thereafter. Also there was a LPA over Central & northwest India during 15-17 June 2013. in this case, maximum moisture feed was mainly from Arabian Sea.



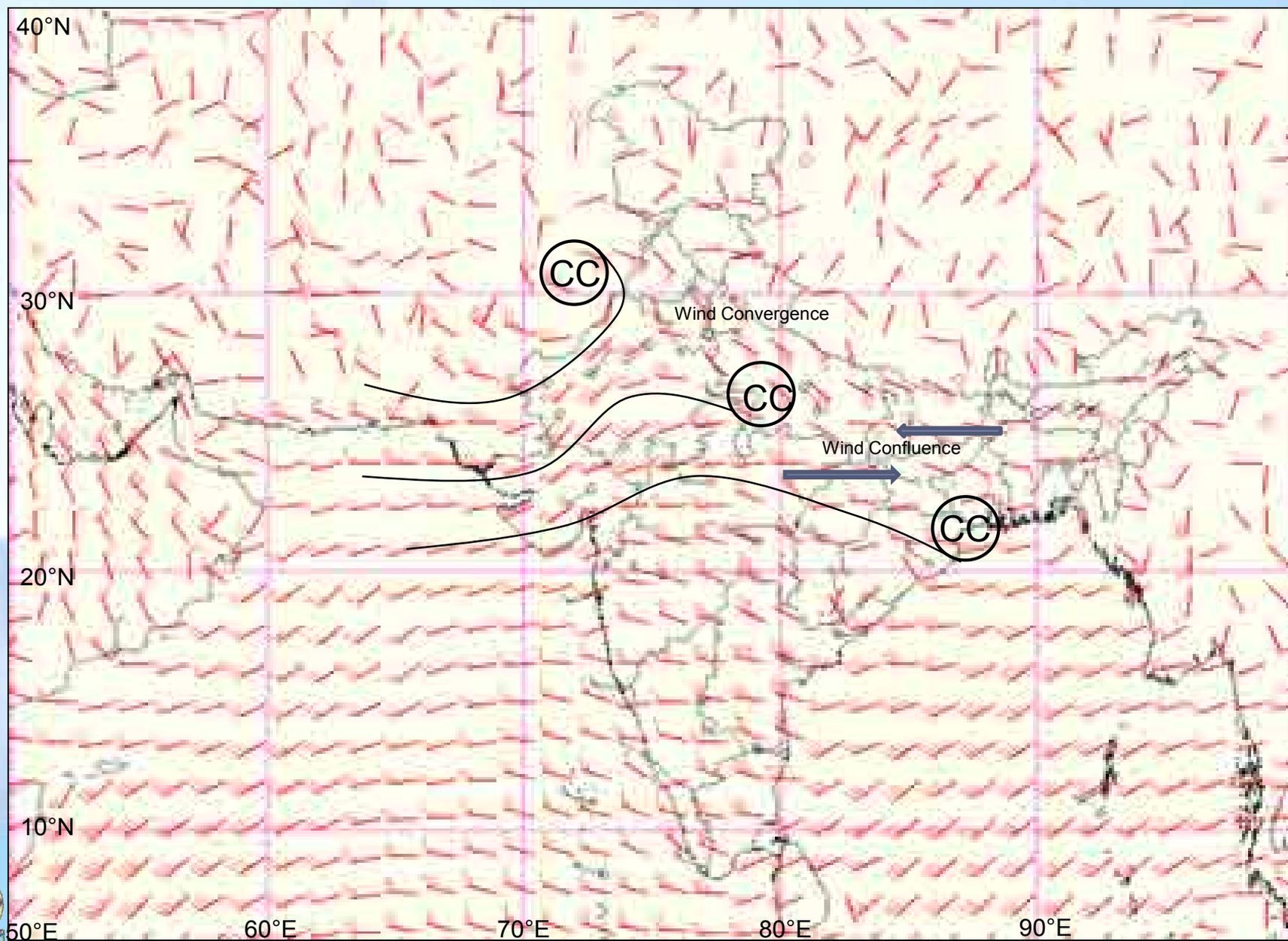
Unprecedented weather activity
over foothills of Himalayas during
pre-monsoon season in form of
heavy rainfall, severe
thunderstorm, hailstorm and dust
storm



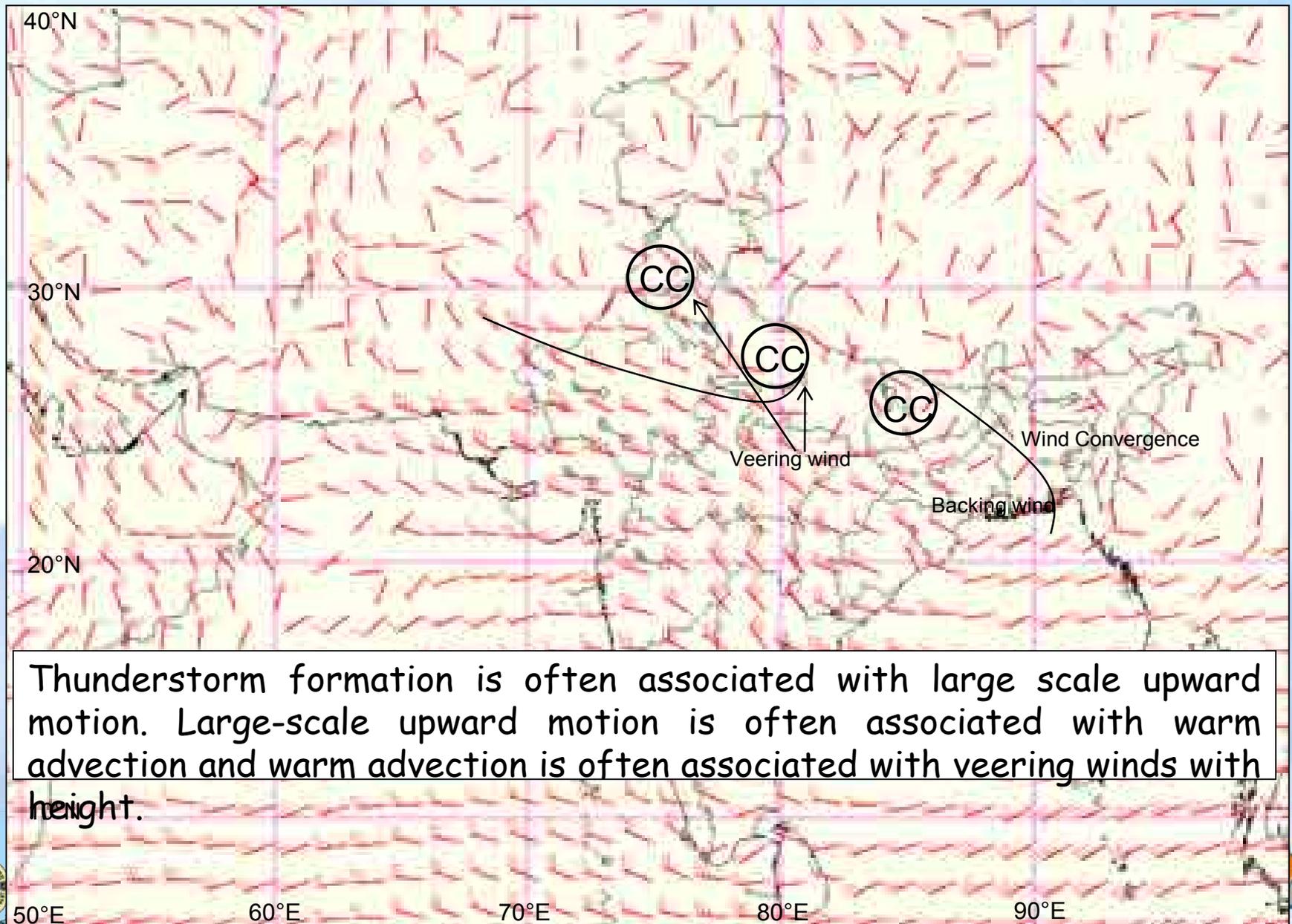
Mean Sea
Level Chart
based on
0300 UTC of
dated
23.05.2016



925 hPa wind analysis dated 23.05.2016

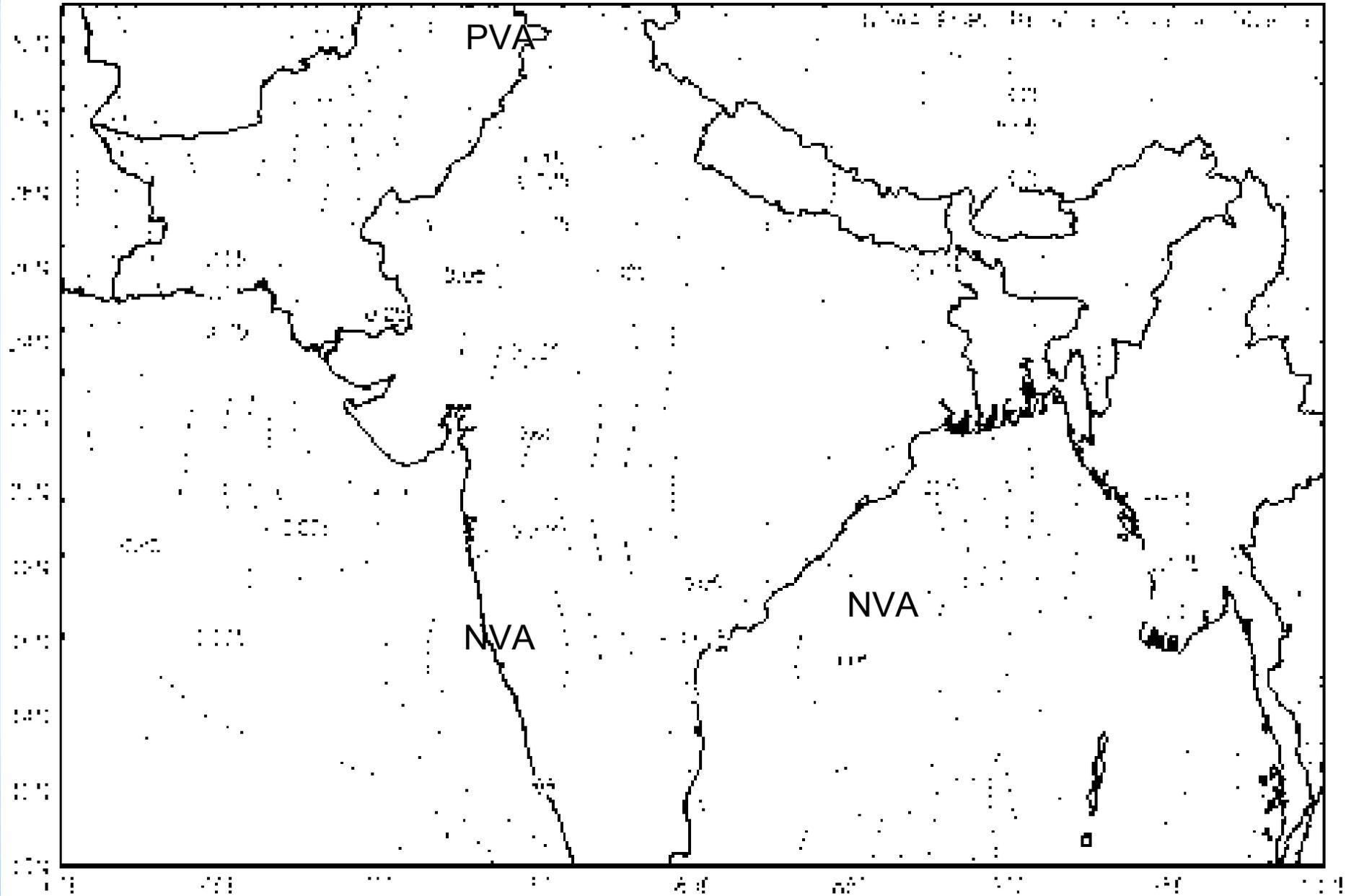


850 hPa wind analysis dated 23.05.2016



Thunderstorm formation is often associated with large scale upward motion. Large-scale upward motion is often associated with warm advection and warm advection is often associated with veering winds with height.

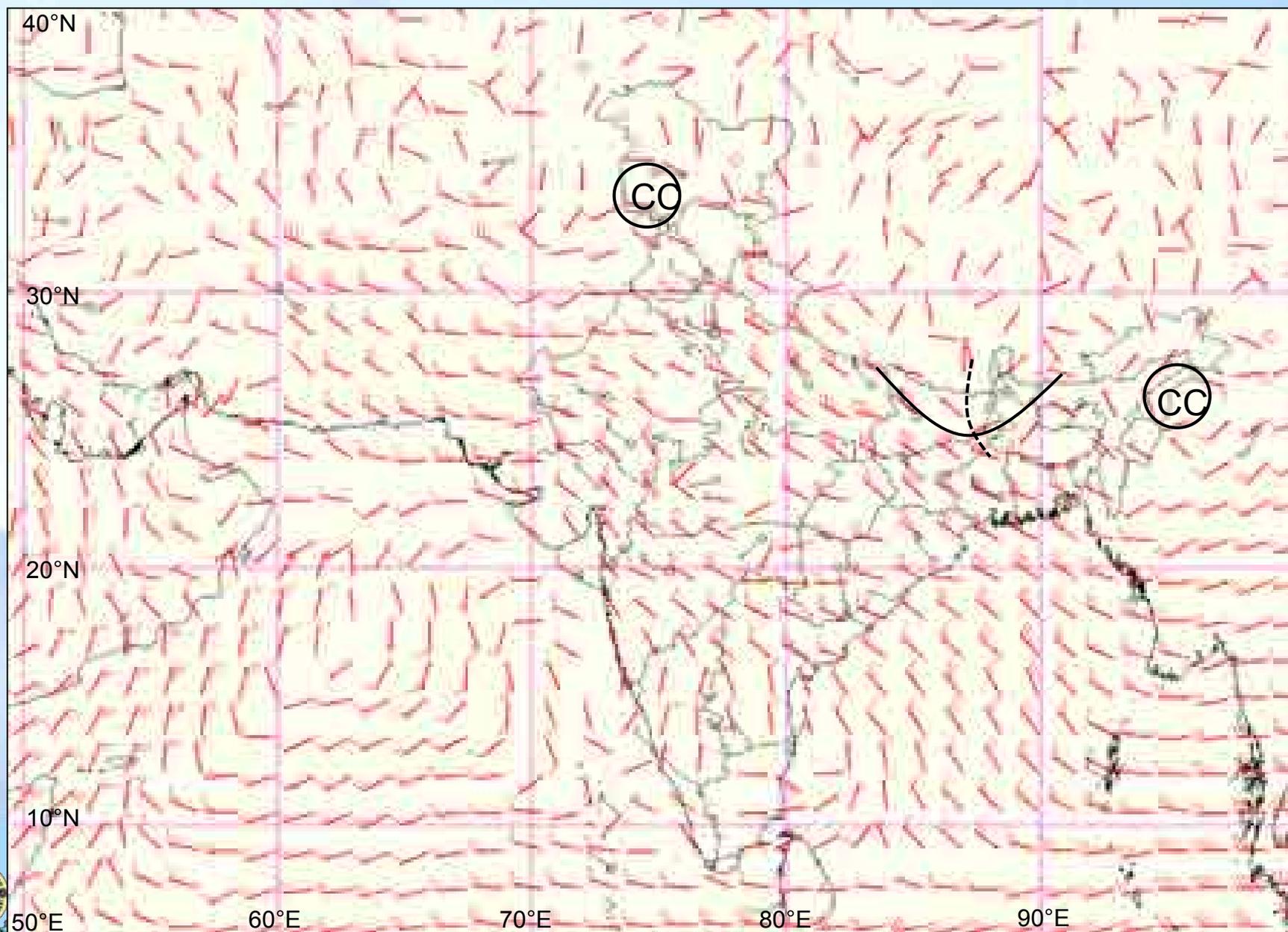




Source: *Journal of the Royal United States Service*
1968, p. 100. (p. 100)

Source: *Journal of the Royal United States Service*
1968, p. 100. (p. 100)

700 hPa wind analysis dated 23.05.2016



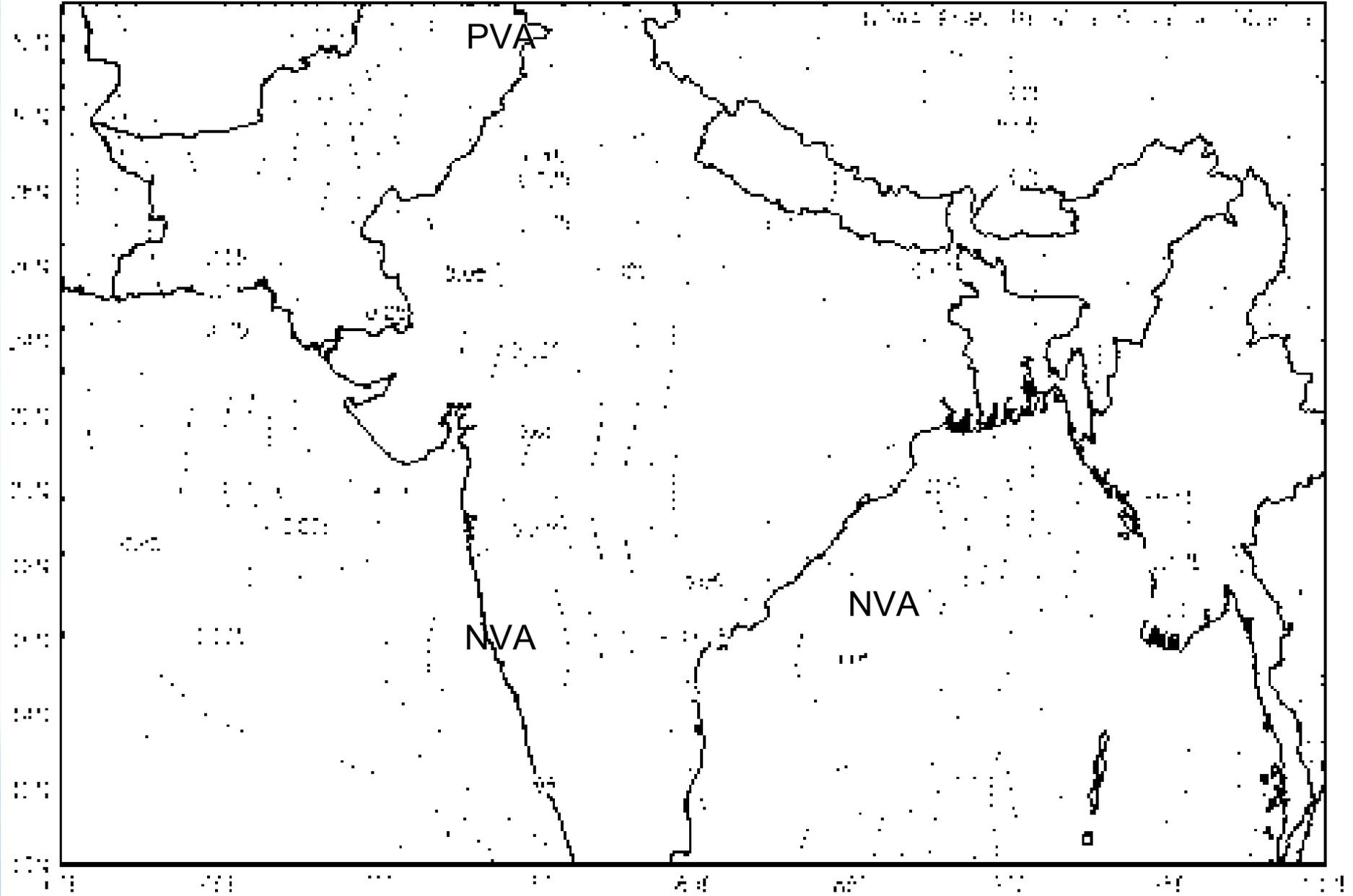
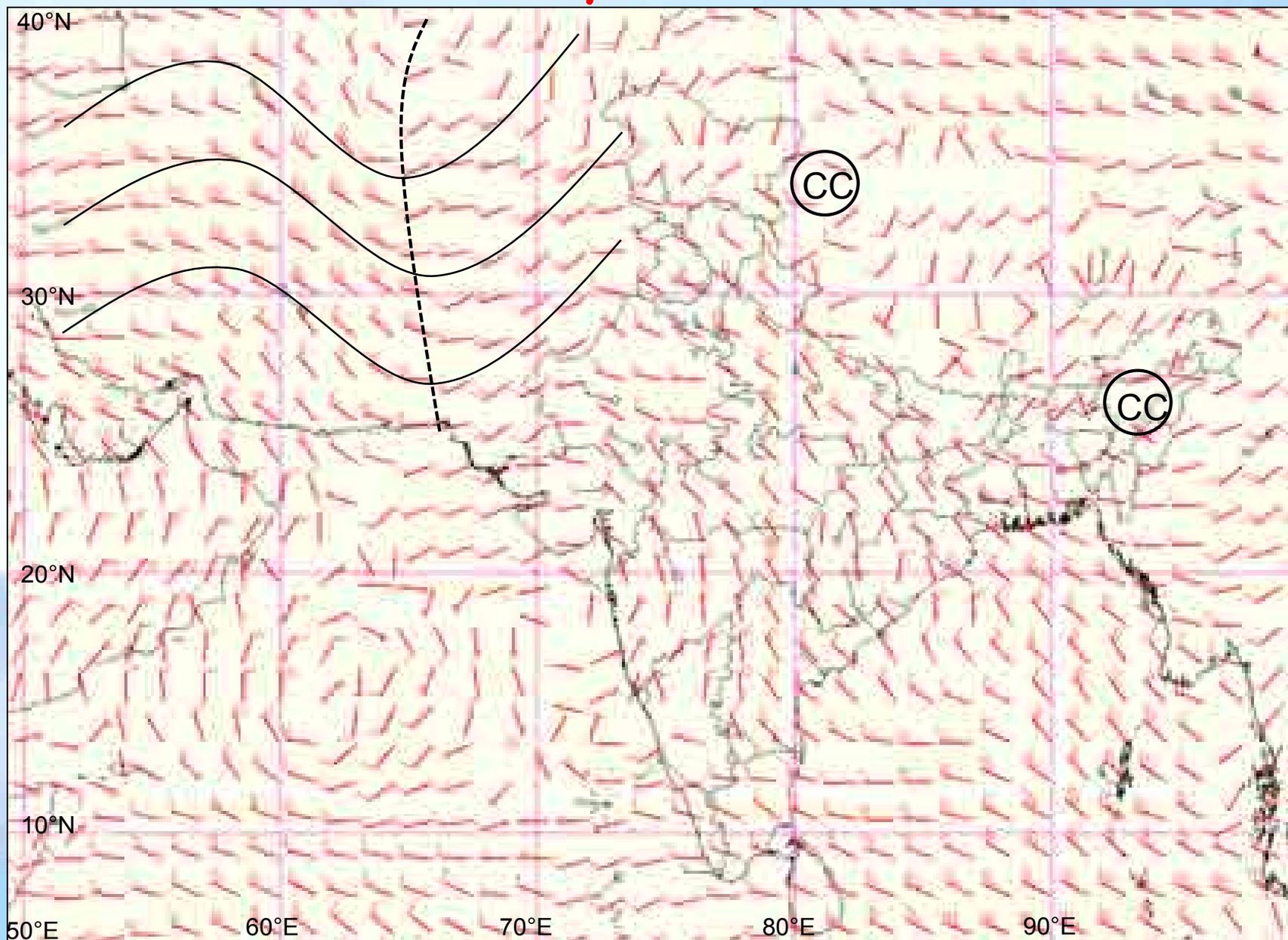
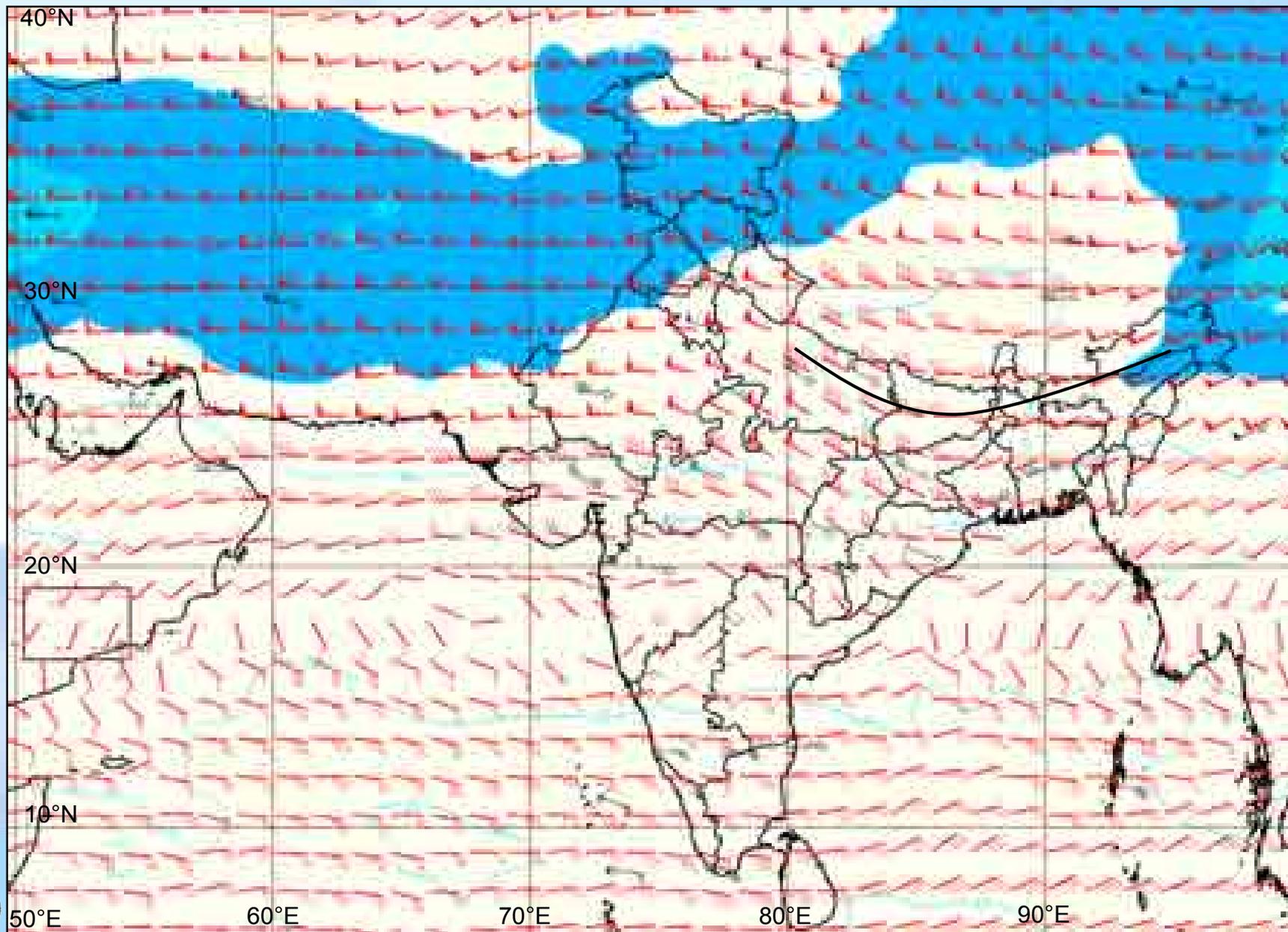


Figure 1. Pacific Viceroy (PVA) and North Viceroy (NVA) units. The map shows the outlines of the continents and the Pacific Ocean. The labels 'PVA' and 'NVA' are placed within their respective regions. The map also shows the outlines of the continents of North America, South America, and Australia. The latitude lines are marked from 10°N to 60°N, and the longitude lines are marked from 120°W to 150°W.

500 hPa wind analysis dated 23.05.2016



200 hPa wind analysis dated 23.05.2016



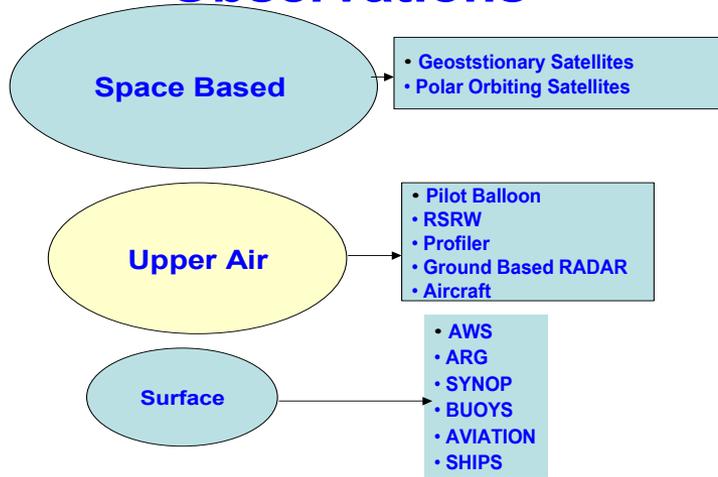
Observed past
24 hours
precipitation
at 0300 UTC
of 24.05.2016



Early warning Mechanism in IMD



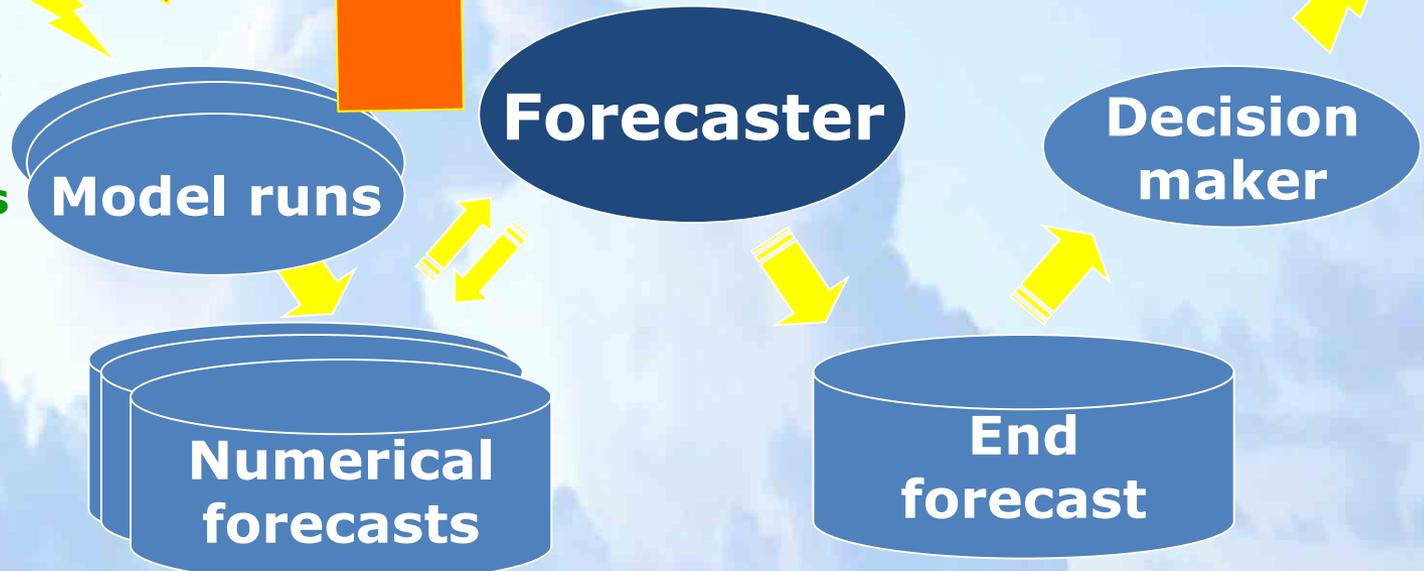
Broad Classification of Observations



**Initial conditions
(Observations)**

Action

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



Monitoring and Forecast Process



Wednesday, November 27, 2019

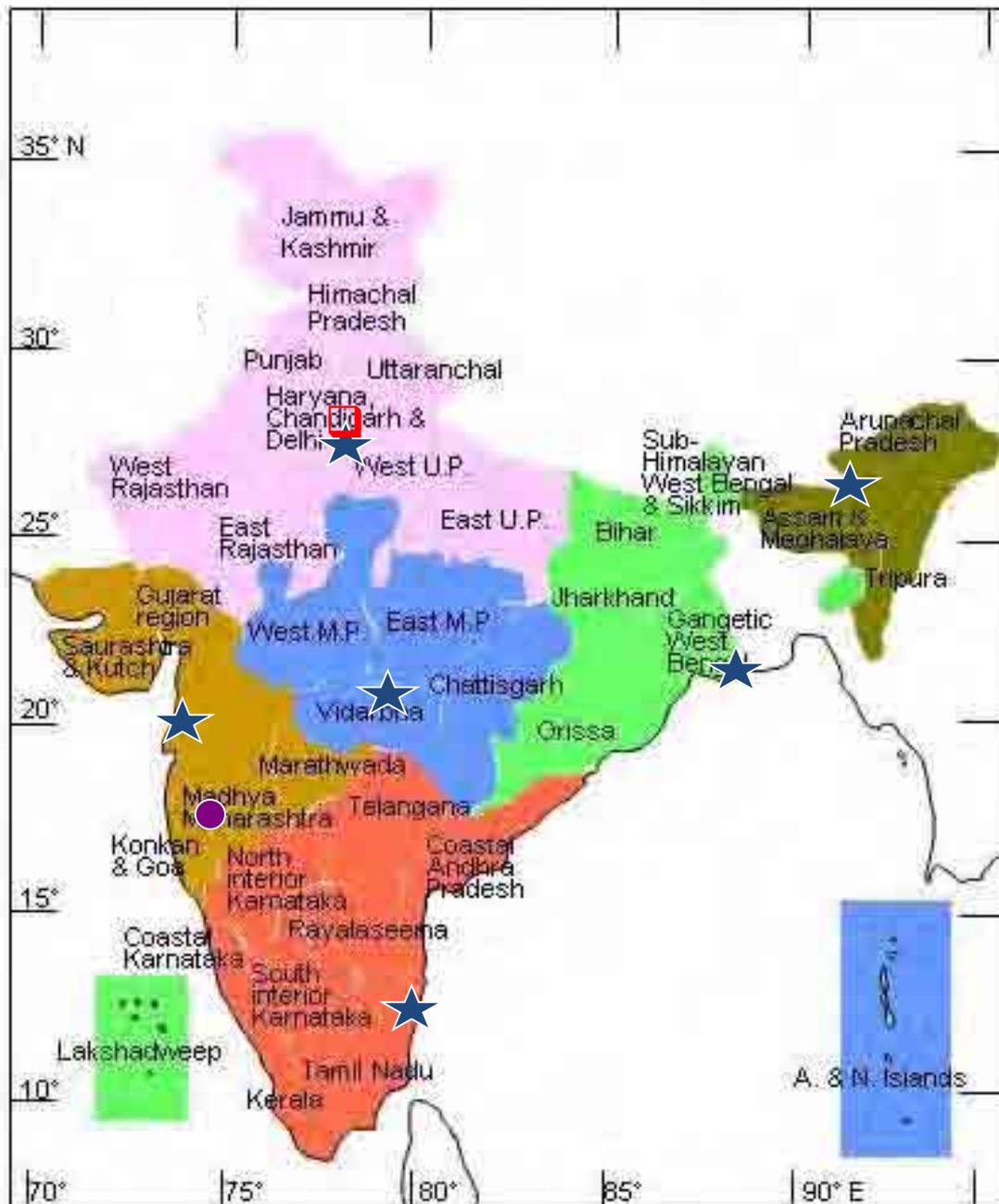
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT



Three Tier Forecasting Structure

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

6 Meteorological Regions



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

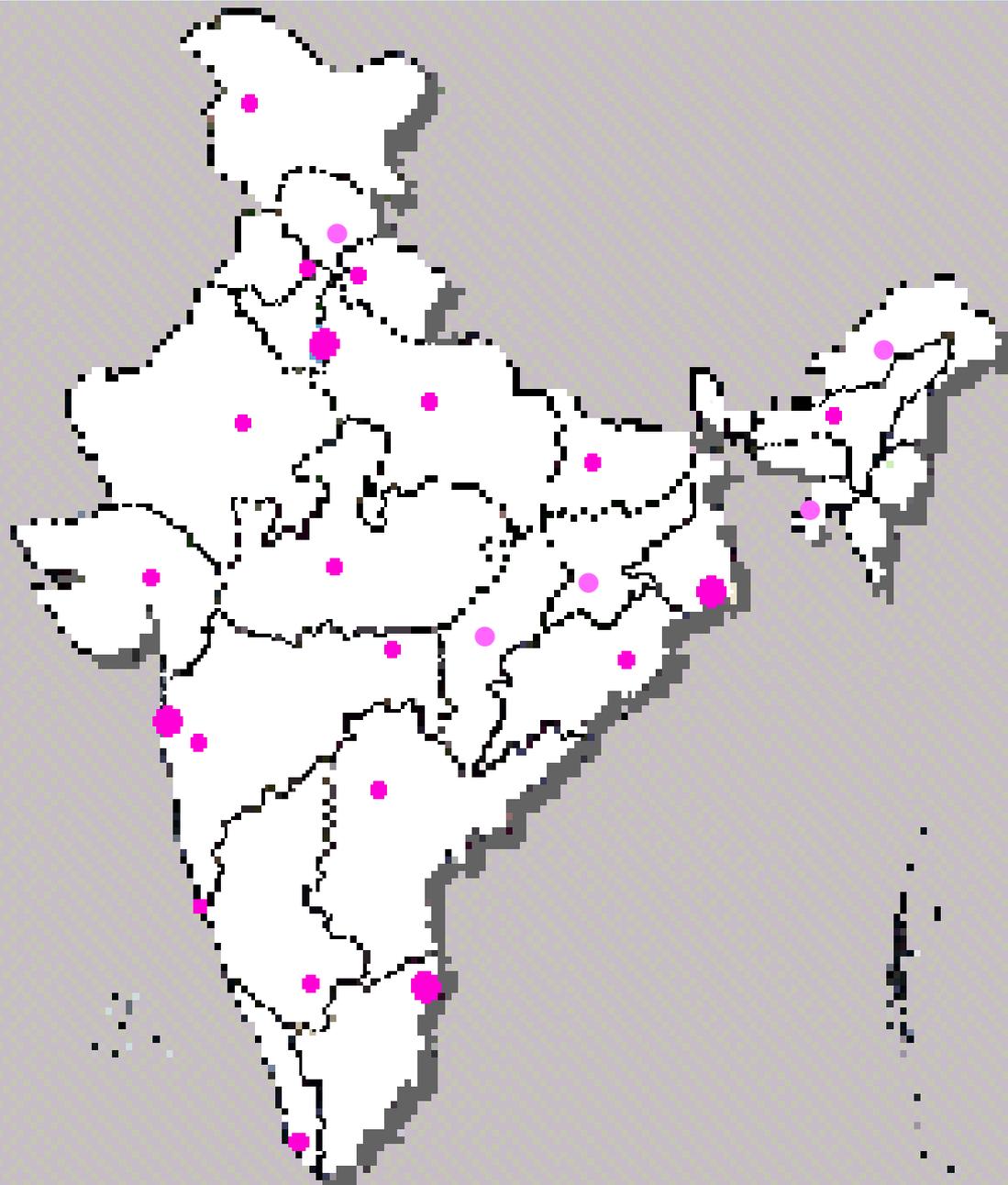
□ **NWFC at New Delhi and WF at Pune**

★ **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. Agartataala
11. Ahmedabad
12. Bhopal
13. Raipur
14. Bhuvaneshwar
15. Hyderabad
16. Bangalore
17. Thiruvananthapuram
18. Panjim
19. Gangtok



VIDEO- CONFERENCING

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



Weather Parameters for which forecasts & warnings are issued

Rainfall/snowfall

- Spatial distribution & intensity.
- Warnings for Heavy rain/ snow.

Temperature

- Minimum/ Maximum
- Heat wave/ Cold wave

Special Weather Phenomena

- Hailstorm/ Thunderstorm
- Squall
- Ground Frost



Classes of Weather Forecasts

- ❖ **Nowcast- Few hours**
- ❖ **Short to Medium Range Forecasting < 3-10 days**
- ❖ **Extended Range Forecasting (ERF)- 10-30 days**
- ❖ **Long Range Forecasting (LRF) >30 days**



All India Weather Warning Bulletin issue 4 times in a day



Heavy Rainfall



Heat Wave & Thundersquall



Fog/Visibility



Heavy Snow



Cold wave/ visibility & frost



Heat Wave



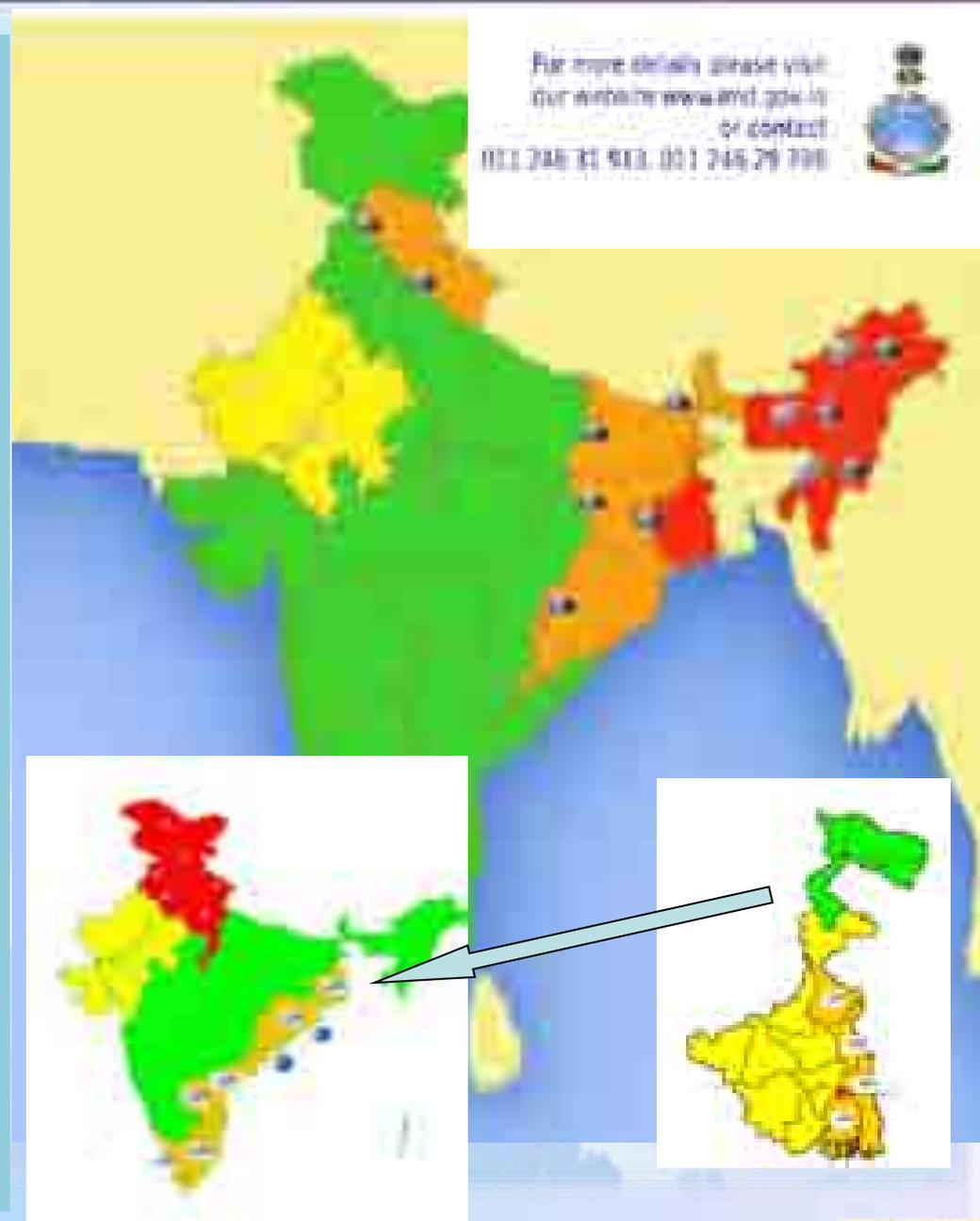
Multi Hazard Warning System

Green – No warning

**Yellow – Be aware
Be updated**

**Orange – Be prepared
Keep vigil
Be updated**

**Red - Most vigil
Take action**



36 Meteorological Sub-Divisions

LEGENDS

1. अंडमान और निकोबार द्वीप समूह
2. अरुणाचल प्रदेश
3. असम और मेघालय
4. नागालैंड, मणिपुर, मिजोरम और त्रिपुरा
5. उप हिमालय पश्चिम बंगाल एवम् सिक्किम
6. पश्चिम यांगेय बंगाल
7. ओडिशा
8. झारखंड
9. बिहार
10. पूर्वी उत्तर प्रदेश
11. पश्चिम उत्तर प्रदेश
12. उत्तराखंड
13. हरियाणा चंडिगढ़ एवम् दिल्ली
14. पंजाब
15. हिमाचल प्रदेश
16. जम्मू एवम् कश्मीर
17. पश्चिम राजस्थान
18. पूर्वी राजस्थान
19. मध्य प्रदेश
20. पूर्वी मध्य प्रदेश
21. गुजरात क्षेत्र
22. सौराष्ट्र एवम् कच्छ
23. मध्य प्रदेश
24. मध्य महाराष्ट्र
25. महाराष्ट्र
26. विदर्भ
27. छत्तीसगढ़
28. तटिय आंध्र प्रदेश
29. तेलंगाना
30. तमिलनाडु
31. कर्नाटक
32. उत्तरी कर्नाटक
33. आन्ध्र प्रदेश
34. दक्षिणी कर्नाटक
35. केरल
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. Marathawada
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)

Widespread (WS/ Most Places)	76-100	Scattered (SCT/ A Few Places)	26-50
Fairly Widespread (FWS/ Many Places)	51-75	Isolated (ISOL)	1-25
Mainly Dry	Very Light Rain	Dry	No Rain

WARNING

Most Vigil (Take Action)	Be prepared/updated (Keep Vigil)
Be aware (Be updated)	No Warning



Heavy Rain



Heavy Snow



Hailstorm



Dust Storm



Strong Winds



Visibility



Cyclone



Squall



Frost



Cold Wave



Heat Wave



Sea State



Mountain Meteorology Division

भारत मौसम विज्ञान विभाग
दूरदर्शन केंद्र, दिल्ली
भारत मौसम विज्ञान विभाग,
एन. सिटी, दिल्ली



India Meteorological Department
National Weather Forecasting Centre
Mountain Meteorology Division
Jammu, Jammu & Kashmir
Phone: 0191-263222 & 263223
Fax: 0191-263222 & 263223

एन. सी.टी. दिल्ली

14th Mountain Meteorology Division, 10 September 2019
EVENING WEATHER BULLETIN

संस्कृत: दूरदर्शन केंद्र, एन. सी.टी. दिल्ली

The following observations were received & synthesized during the 12 hours from 04:00 to 16:00 hours.

WEATHER DURING LAST 24 HOURS (between 04:00 hrs. of yesterday and 04:00 hrs. of today)

Area	Temperature	Condition	Wind	Relative Humidity	Clouds	Visibility	Remarks
Jammu	ISOL ⁺	DRY	ISOL ⁺	WS ⁺	WS ⁺	WS ⁺	WS ⁺

WEATHER FORECAST

Days	D1	D2	D3	D4	D5	D6	D7
Date	05.09.2019	06.09.2019	07.09.2019	08.09.2019	09.09.2019	10.09.2019	11.09.2019
KASHMIR (General)	SCIT ⁺	SCIT ⁺	ISOL ⁺				
LADAKH (General)	DRY						
JAMMU (General)	SCIT ⁺	SCIT ⁺	ISOL ⁺				
Western Himalayas (High hills region)	WS ⁺	SCIT ⁺	ISOL ⁺				
Western Himalayas (Lower hills region)	WS ⁺	SCIT ⁺	ISOL ⁺				
UTTARAKHAND (General Region)	WS ⁺	FWG ⁺	SCIT ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺
UTTARAKHAND (Western Region)	WS ⁺	FWG ⁺	SCIT ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺

भारत मौसम विज्ञान विभाग
दूरदर्शन केंद्र, दिल्ली
भारत मौसम विज्ञान विभाग,
एन. सिटी, दिल्ली



India Meteorological Department
National Weather Forecasting Centre
Mountain Meteorology Division
Jammu, Jammu & Kashmir
Phone: 0191-263222 & 263223
Fax: 0191-263222 & 263223

Weather Warning during next 5 days

Area	D1	D2	D3	D4	D5
Date	05.09.2019	06.09.2019	07.09.2019	08.09.2019	09.09.2019
KASHMIR (General)	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺
LADAKH (General)	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺
JAMMU (General)	Heavy rain or snow at night & in patches	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺
Western Himalayas (High hills region)	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺
Western Himalayas (Lower hills region) & Garwal Region	Heavy rain or snow at night & in patches	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺
UTTARAKHAND (General Region)	Heavy rain or snow at night & in patches	ISOL ⁺	ISOL ⁺	ISOL ⁺	ISOL ⁺



PROBABILITY FORECAST

Area	Probability of occurrence (%)
ISOL ⁺	75
ISOL ⁻	25
ISOL ⁺	75
ISOL ⁻	25



Mountain Expedition Forecast

Government of India
 India Meteorological Department
 Ministry of Earth Sciences
 Musam Bhasan, Lodi Road, New Delhi - 110003

BULLETIN No. 07

DATE: 30/09/2019

Expedition conducted by NAVY

MT. SATOPANTH Expedition

Forecast for Lat. 30°40'58" N & Long. 78°12'30" E at altitude: 4.8 km

Forecast valid for next 24 hrs commencing from 1130 hrs IST of 30/09/2019 to 1130 hrs IST of 01/10/2019

Time	Wind Direction	Wind Speed (Knots)	Temp. (°C)	Weather
1130 IST of 30/09/19 to 1730 IST of 30/09/19	Southeast	15-18	22-25	Overcast cloudy sky with precipitation up to 15 mm
1730 IST of 30/09/19 to 0230 IST of 01/10/19	West Southeast	15-18	22-25	Partly cloudy sky with occasional sun & rain
0230 IST of 01/10/19 to 0530 IST of 01/10/19	West Southeast	15-18	22-24	Partly cloudy sky
0530 IST of 01/10/19 to 1130 IST of 01/10/19	West	05-15	21-22	Partly cloudy sky

Outlook for subsequent 2 Days

Time	Wind Direction	Wind Speed (Knots)	Temp. (°C)	Weather
1130 IST of 01/10/19 to 1130 IST of 02/10/19	West Southeast	15-20	22-24	Partly cloudy sky with precipitation up to 15 mm
1130 IST of 02/10/19 to 1130 IST of 03/10/19	Southeast	15-18	21-23	Partly cloudy sky with precipitation up to 15 mm



District Level Forecast

भारत सरकार
मौसम विज्ञान विभाग
भारत मौसम विज्ञान विभाग
औद्योगिक विज्ञान विभाग



संस्थापित 1947
मौसम विज्ञान विभाग
भारत मौसम विज्ञान विभाग
औद्योगिक विज्ञान विभाग

30th Sep 2019 Time: 11:00 Hours IST

District-wise Weather Forecast for Uttaranchal

District	WEATHER FORECAST										Remarks (if any)
	01 Sep		02 Sep		03 Sep		04 Sep		05 Sep		
	Temp	Wind	Temp	Wind	Temp	Wind	Temp	Wind	Temp	Wind	
Almora	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Dehra Dun	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Haridwar	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Mussoorie	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Nainital	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Rudrapur	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Udhampur	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Uttarkashi	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Dehradun	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Garhwal	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	
Uttaranchal	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	1.0-1.5	15-15	

भारत सरकार
मौसम विज्ञान विभाग
भारत मौसम विज्ञान विभाग
औद्योगिक विज्ञान विभाग



संस्थापित 1947
मौसम विज्ञान विभाग
भारत मौसम विज्ञान विभाग
औद्योगिक विज्ञान विभाग

30th Sep 2019 Time: 11:00 Hours IST

District-wise Weather Warning for Uttaranchal

District	01 Sep	02 Sep	03 Sep	04 Sep	05 Sep
Almora	Green	Green	Green	Green	Green
Dehra Dun	Green	Green	Green	Green	Green
Haridwar	Green	Green	Green	Green	Green
Mussoorie	Green	Green	Green	Green	Green
Nainital	Green	Green	Green	Green	Green
Rudrapur	Green	Green	Green	Green	Green
Udhampur	Green	Green	Green	Green	Green
Uttarkashi	Green	Green	Green	Green	Green
Dehradun	Green	Green	Green	Green	Green
Garhwal	Green	Green	Green	Green	Green
Uttaranchal	Green	Green	Green	Green	Green

WARNING: SEVERE TO EXTREME HEAVY RAINFALL

WARNING: HEAVY RAIN
Heavy rainfall likely to occur in isolated places especially in Garhwal, Uttarakhand, Pauri & Tehri
Districts of Uttaranchal



City Forecasts

Local Weather Report and Forecast for Bangalore (Temp. Sep 05, 2015)

GENERAL INFORMATION

Station Name: Bangalore (Temp. Sep 05, 2015)

Station ID: 494999

Station Type: Urban

Station Category: Urban

Station Elevation: 900 m

Station Longitude: 76.77° E

Station Latitude: 12.97° N

Station Time Zone: UTC+5:30

Station Status: Active

Station Operational Since: 1951

Station Closed Since: -

Station Reopened Since: -

Station Served By: -

Station Type: Urban

Station Category: Urban

Station Elevation: 900 m

Station Longitude: 76.77° E

Station Latitude: 12.97° N

Station Time Zone: UTC+5:30

Station Status: Active

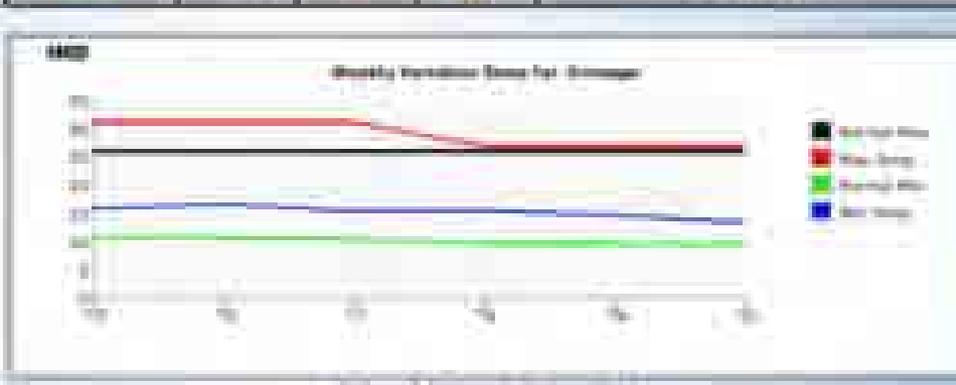
Station Operational Since: 1951

Station Closed Since: -

Station Reopened Since: -

Station Served By: -

Month	Max	Min	Weather	Description
Jan	28	18		Clear, sunny days with light breeze
Feb	29	19		Clear, sunny days with light breeze
Mar	30	20		Clear, sunny days with light breeze
Apr	31	21		Clear, sunny days with light breeze
May	32	22		Clear, sunny days with light breeze
Jun	33	23		Clear, sunny days with light breeze
Jul	34	24		Clear, sunny days with light breeze
Aug	35	25		Clear, sunny days with light breeze
Sep	36	26		Clear, sunny days with light breeze
Oct	37	27		Clear, sunny days with light breeze
Nov	38	28		Clear, sunny days with light breeze
Dec	39	29		Clear, sunny days with light breeze



EXTREME WEATHER EVENTS IN THE MONTH OF SEPTEMBER

Year	Temperature (°C)		Rainfall (mm)	
	Highest Maximum (Date)	Lowest Minimum (Date)	24 Hours Highest (Date)	Monthly Total
1951	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1952	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1953	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1954	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1955	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1956	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1957	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1958	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1959	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1960	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1961	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1962	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1963	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1964	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1965	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1966	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1967	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1968	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1969	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1970	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1971	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1972	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1973	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1974	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1975	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1976	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1977	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1978	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1979	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1980	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1981	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1982	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1983	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1984	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1985	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1986	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1987	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1988	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1989	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1990	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1991	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1992	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1993	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1994	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1995	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1996	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1997	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1998	31.0 (10)	17.0 (10)	1.0 (10)	10.0
1999	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2000	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2001	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2002	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2003	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2004	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2005	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2006	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2007	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2008	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2009	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2010	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2011	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2012	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2013	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2014	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2015	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2016	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2017	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2018	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2019	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2020	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2021	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2022	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2023	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2024	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2025	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2026	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2027	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2028	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2029	31.0 (10)	17.0 (10)	1.0 (10)	10.0
2030	31.0 (10)	17.0 (10)	1.0 (10)	10.0

CLIMATOLOGICAL TABLE
PERIOD: 1971-2000

Month	Mean Temperature (°C)		Mean Total Rainfall (mm)	Mean Number of Rainy Days	Mean Number of days with			
	Minimum	Maximum			WIND	Thunder	FOG	EQUIVALE
Jan	21	31	348.8	4.9	0.1	0.1	1.9	0.0
Feb	22	32	373.3	5.7	0.1	0.1	2.8	0.0
Mar	24	33.9	413.9	6.3	0.1	0.1	3.9	0.0
Apr	27	35.9	488.4	7.3	0.1	0.1	5.1	0.0
May	30.8	38.4	571.7	8.0	0.3	0.0	6.1	0.0
Jun	34.7	40.1	643.7	8.8	0.3	0.0	7.1	0.0
Jul	38.2	40.0	666.8	8.8	0.1	0.0	7.1	0.0
Aug	37.4	39.0	671.8	8.7	0.0	0.0	6.3	0.0
Sep	33.8	37.8	628.8	7.8	0.1	0.0	5.2	0.0
Oct	31.7	35.4	581.3	7.0	0.0	0.0	4.1	0.0
Nov	29.0	33.6	528.3	6.0	0.0	0.0	3.4	0.0
Dec	25.8	31.1	447.8	5.3	0.0	0.0	2.8	0.0
Annual	27.8	34.9	703.8	6.4	1.3	0.1	6.7	0.0



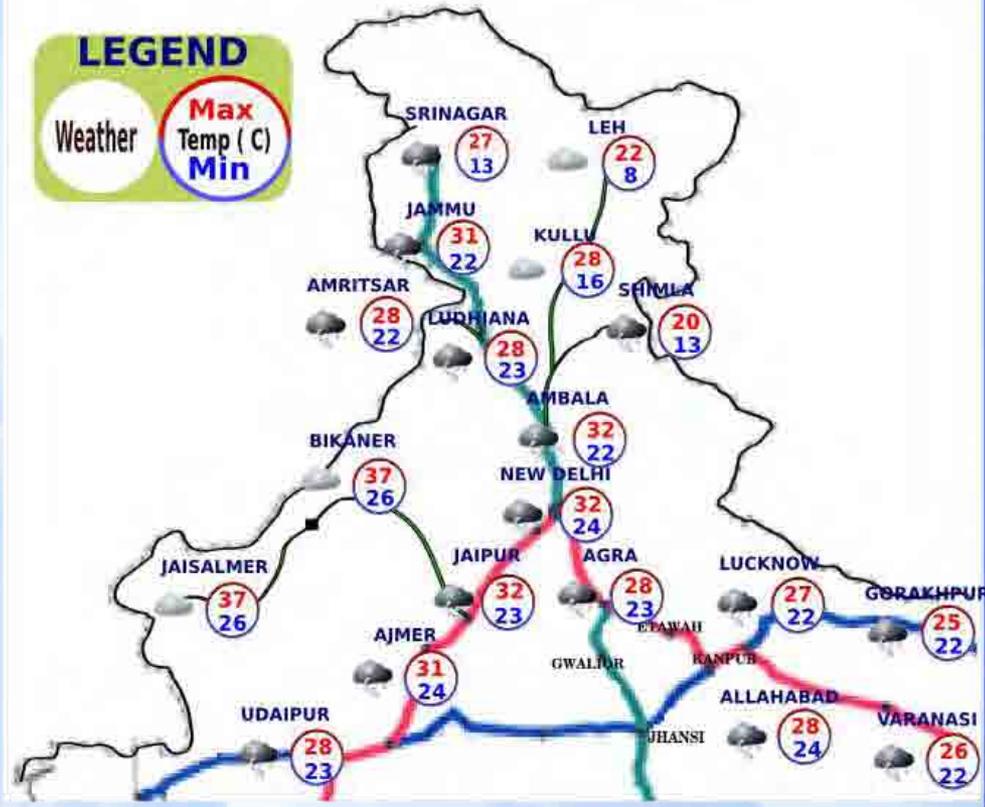


Highway Forecasts

LEGEND

Weather

Max Temp (C)
Min



FORECAST VALID FOR : 30 Sep 2019

RA/TSH LIKELY AT MOST PLACES OVER HP & UKTD, AT MANY PLACES OVER E-U.P & E-RAJ, AT FEW PLACES OVER REST OF THE NW-INDIA.

H. TO V. HEAVY RAINFALL WITH EXTREMELY HEAVY AT ISOL PLACES OVER E-RAJ. HEAVY RAINFALL AT ISOL PLACES OVER JAMMU DIVI OF J & K, H.P, UTKHD, PJB, N-HAR, E-U.P AND W-RAJ. REST OF NW INDIA.

Email: rwfnewdelhi@gmail.com Website: <http://amsdelhi.gov.in>

Weather enquiry for Delhi: +91 11 24629096, 24623537

For weather enquiry of any station in the country 1800 180 1717 (Toll free)

Regional Weather Forecasting Centre (RWFC), Regional Meteorological Centre, New Delhi

India Meteorological Department, (Ministry of Earth Sciences)

Lodhi Road, New Delhi - 110003



Pilgrims Forecasts

क्र.सं.	पर्वत/पर्वत श्रृंखला	पर्वत शिखर	पर्वत शिखर की उचाई (मी.)	पर्वत शिखर की उचाई (फीट)
001	अन्नपूर्णा	अन्नपूर्णा शिखर	8091	26542
002	दhaulagiri	दhaulagiri शिखर	8168	26808
003	Annapurna	Annapurna शिखर	8091	26542
004	विश्वेश्वर	विश्वेश्वर शिखर	7926	25999
005	विश्वेश्वर	विश्वेश्वर शिखर	7926	25999
006	विश्वेश्वर	विश्वेश्वर शिखर	7926	25999
007	विश्वेश्वर	विश्वेश्वर शिखर	7926	25999
008	विश्वेश्वर	विश्वेश्वर शिखर	7926	25999
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018	विश्वेश्वर	विश्वेश्वर शिखर	7926	25999
019	विश्वेश्वर	विश्वेश्वर शिखर	7926	25999
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Forecast and Warning Guidance for Winter Weather

In 2016, a multi-institutional initiative is taken to understand & study the various characteristics of

- WDs & its associated weather i.e. heavy rain/snow, spatial distribution of precipitation
- Dense Fog
- Cold wave/day
- Ground frost etc.

mainly for the northern parts of the country (north of 20°N), so that a better weather forecast & warnings advisories at least five days in advance may be issued.



Forecast and Warning Guidance for Winter Weather

Precipitation and its associated synoptic features:

- The western disturbance (WD) as an upper air cyclonic circulation (CC) over Pakistan and adjoining Jammu & Kashmir between 3.1 km & 4.5 km above mean sea level is very likely to move over Jammu & Kashmir and adjoining Pakistan by tomorrow. It is very likely to cause light snowfall activity over higher reaches of Jammu & Kashmir on 12th night & 13th.
- In quick succession, another active WD is very likely to affect Western Himalayan region (WHR) from 14th and its adjoining plains of northwest India from 15th onwards.
- The 2nd WD is very likely to be seen as trough in mid-tropospheric westerlies somewhere around Longitude 60°E and north of Latitude 20°N on 14th with high moisture feed from the Arabian Sea in the forward sector of the WD and strong winds of order more than 50 knots in right entrance of the trough. In result, the system is very likely to mention its intensity upto 18th.
- Therefore, in the presence of remnant of 1st WD and likely divergence field of 2nd WD over WHR, light to moderate precipitation at a few places is very likely to occur over WHR on 14th. Thereafter, WD would move eastwards gradually with very deep trough in mid-tropospheric westerlies (south of 20°N) and high moisture feed from Arabian Sea on 15th & 16th.
- Also, under its influence an induced CC circulation very likely to develop over Central Pakistan & neighbourhood on 15th. As a result, widespread precipitation activity with heavy falls at isolated places are very likely to occur over WHR on 15th & 16th and scattered to fairly widespread activity over Punjab and Haryana, Chandigarh & Delhi. Light rainfall at isolated places is also likely over northern parts of Rajasthan and northwest Uttar Pradesh during same period.



Forecast and Warning Guidance for Winter Weather

Minimum temperature and its associated synoptic features:

Currently strong northwesterly/westerly dry cold winds of order 10 to 15 knots are prevailing over Indo- Gangetic Plains (IGP) at 10m height above mean sea level with RH less than 60% over plains of northwest India. With speed is very likely to reduce to 5 to 10 knots over most parts of IGP and less than 5 knots over parts of central Uttar Pradesh and over northeastern states on 13th morning. RH is also most likely to be less than 60% over above regions on same day. Thereafter, strong northerly/northwesterly winds of order 10 to 15 knots are very likely to prevail over most parts of northwest and east India with RH less than 60% on 14th & 15th morning.

Due to prevailing above mentioned features, no significant change in minimum temperatures is observed over northwest India except East Uttar Pradesh, where they have dropped by 2-4°C in past 24 hours.

Hence, the prevailing below normal minimum temperatures trend over plains of northwest India are very likely to continue during next 3 days.

Cold Wave Warning:

In the influence of above mentioned scenario, Cold wave conditions at a few places over Punjab, Haryana, Chandigarh & Delhi and Uttar Pradesh most likely to continue to prevail till 14th morning.

Ground Frost Warning:

Considering the prevailing and forecast trends in minimum temperatures, ground frost conditions are also very likely to continue to occur over isolated pockets over Punjab, Haryana, north Rajasthan and Uttar Pradesh during next 2 days.



Forecast and Warning Guidance for Winter Weather

Fog:

Strong winds (10-15 knots) are very likely to continue to prevail over most parts of Indo- Gangetic plains during next 4 days (at 10 m above mean sea level)

RH is also very likely to be less than 60% over most parts of Indo- Gangetic plains during next 4 days

Considering wind pattern at lower levels, RH and likely minimum temperature pattern, no dense fog is likely over Indo- Gangetic plains during next 4 days.

Maximum temperature:

Considering prevailing synoptic & dynamical conditions and NWP model guidance, no significant change in maximum temperatures likely over northwest India during next 3-4 days.

Cold day condition:

No Cold day conditions are likely over any parts of northwest India during next 3-4 days.



PUBLIC WEATHER SERVICES

- “I came to learn very quickly that producing a good forecast was 10% of the work. 90% of the work relate to its efficient information dissemination to the end users through Media and other modes of communications”

Prof. Peter Webster
School of Earth & Atmospheric Sciences,
Georgia Institute of Technology,
Atlanta,



PUBLIC WEATHER SERVICES

A warning must include 3 essentials to be effective:

- 1. It must alert people.**
- 2. It must call them to action.**
- 3. It must be target-oriented.**



Main Warning User Groups

- **The General Public**
- **Media**
- **Stakeholders**
- **Disaster Management Agencies (DMA)**



Disaster Management Agency (and associated Emergency Response Organizations)

DMA

- Ensure the capabilities of the public and provide for the well-being, protection and preparedness of the citizens, their property and the local economy.

Media

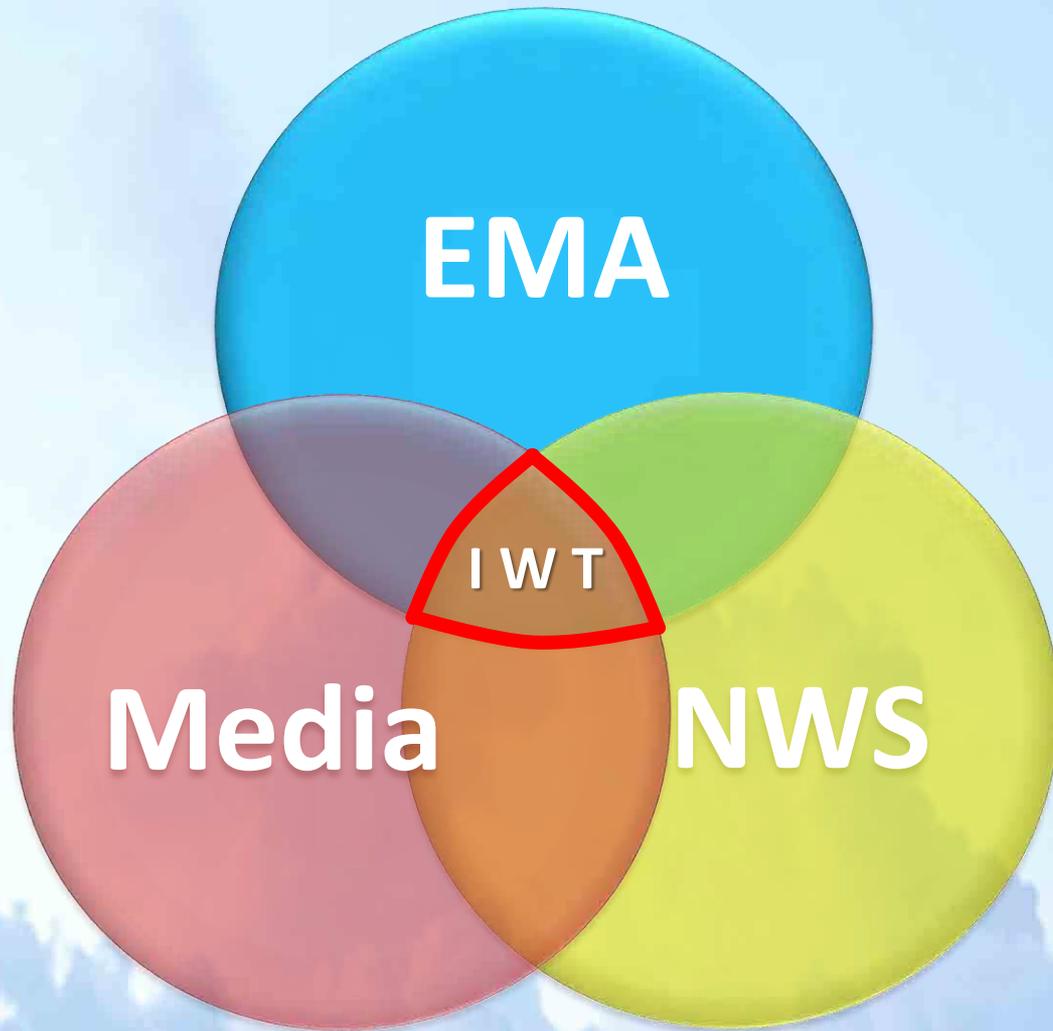
NWS

NWS

- Provide life saving information to the public in nearly continuous manner.

- Provide forecasts and warnings for the protection of life and property.







"Individually we are
one drop, together,
we are an ocean"

Thanks

