Training Program on

Heat Wave Preparedness and Response in SAARC Region

Gandhinagar, India

8-10 March, 2018

Heat Wave Warnings: Thresholds, Customization, Dissemination and Cooperation

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भारत मौसम विज्ञान विभाग

INDIA METEOROLOGICAL DEPARTMENT

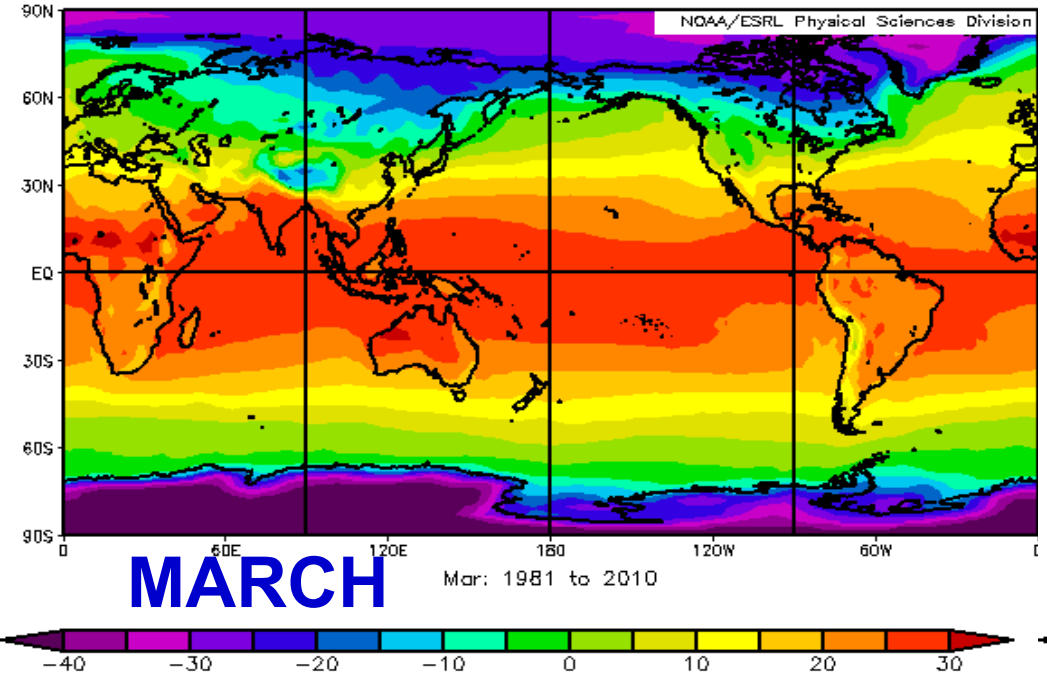
Summer Temperatures in the Region

Certain parts of the region are among the hottest part of the world

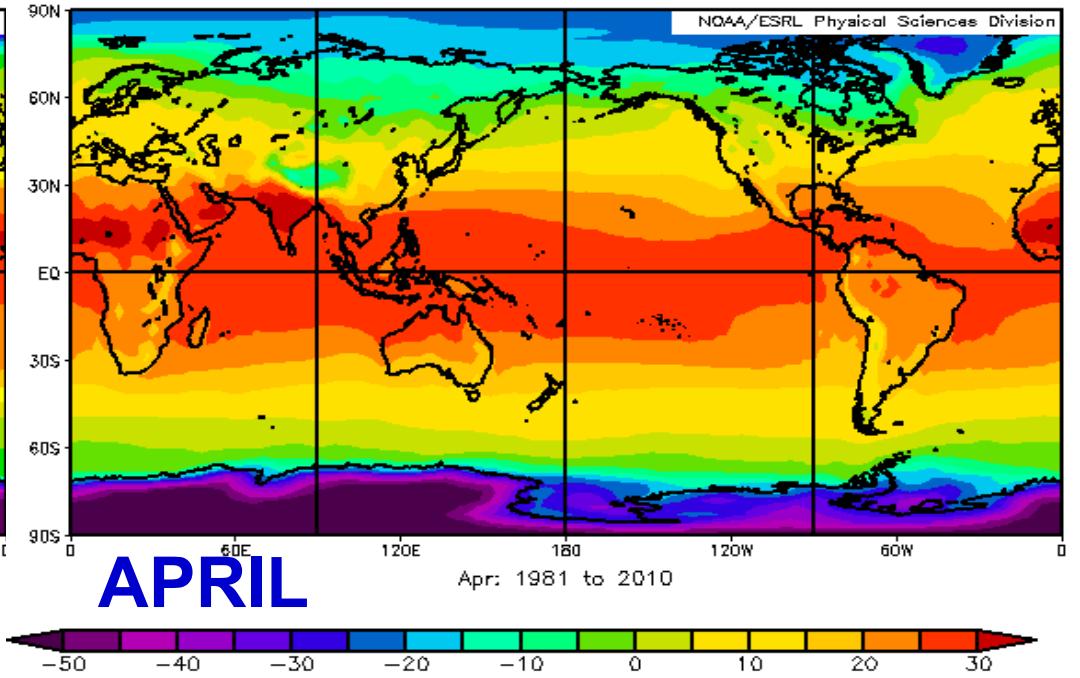
Heat starts building up from southern parts of the region in the month of March with northward movement of the Sun.

May and Early part of June are the hottest. However, certain parts may remain hot till late June/Early July

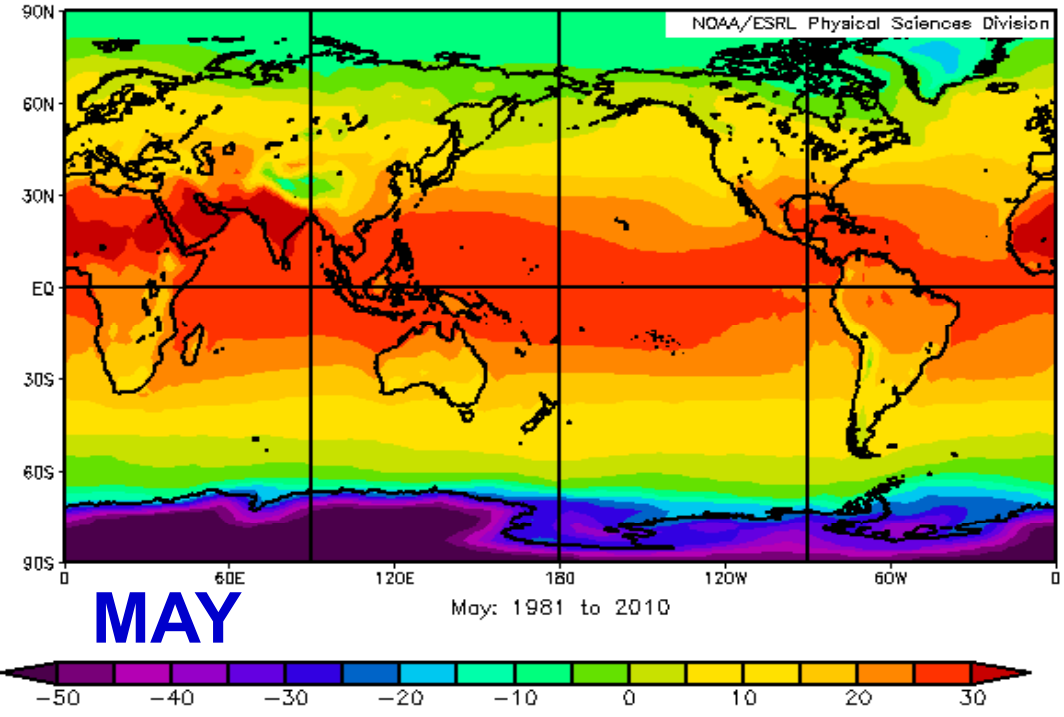
Summer Temperatures in the Region



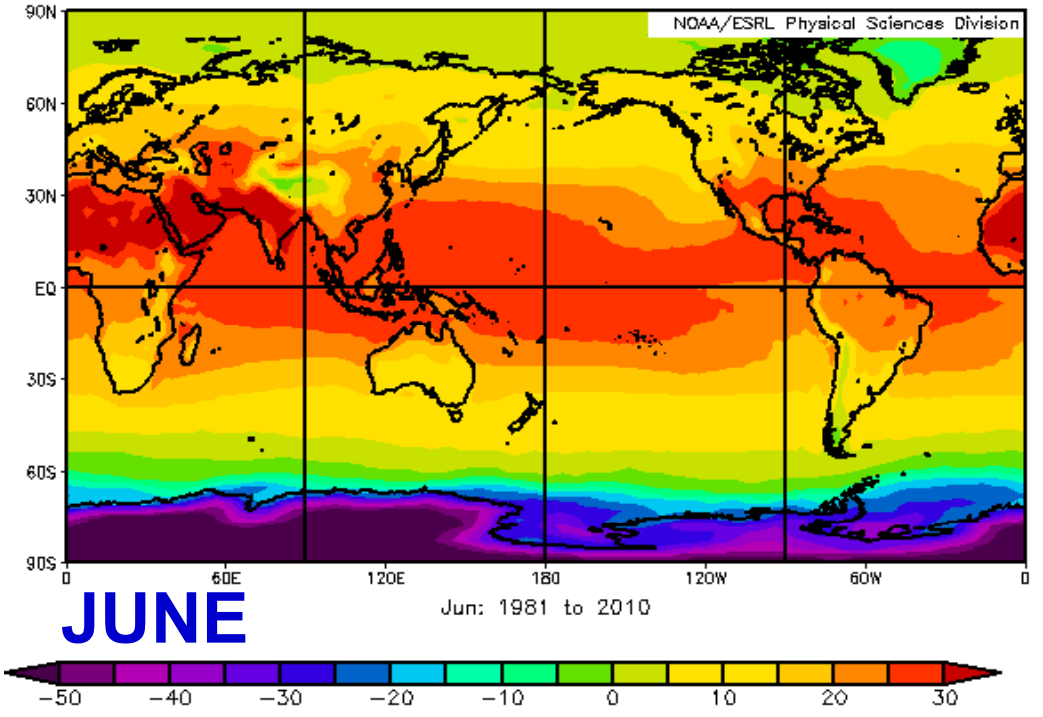
MARCH



APRIL



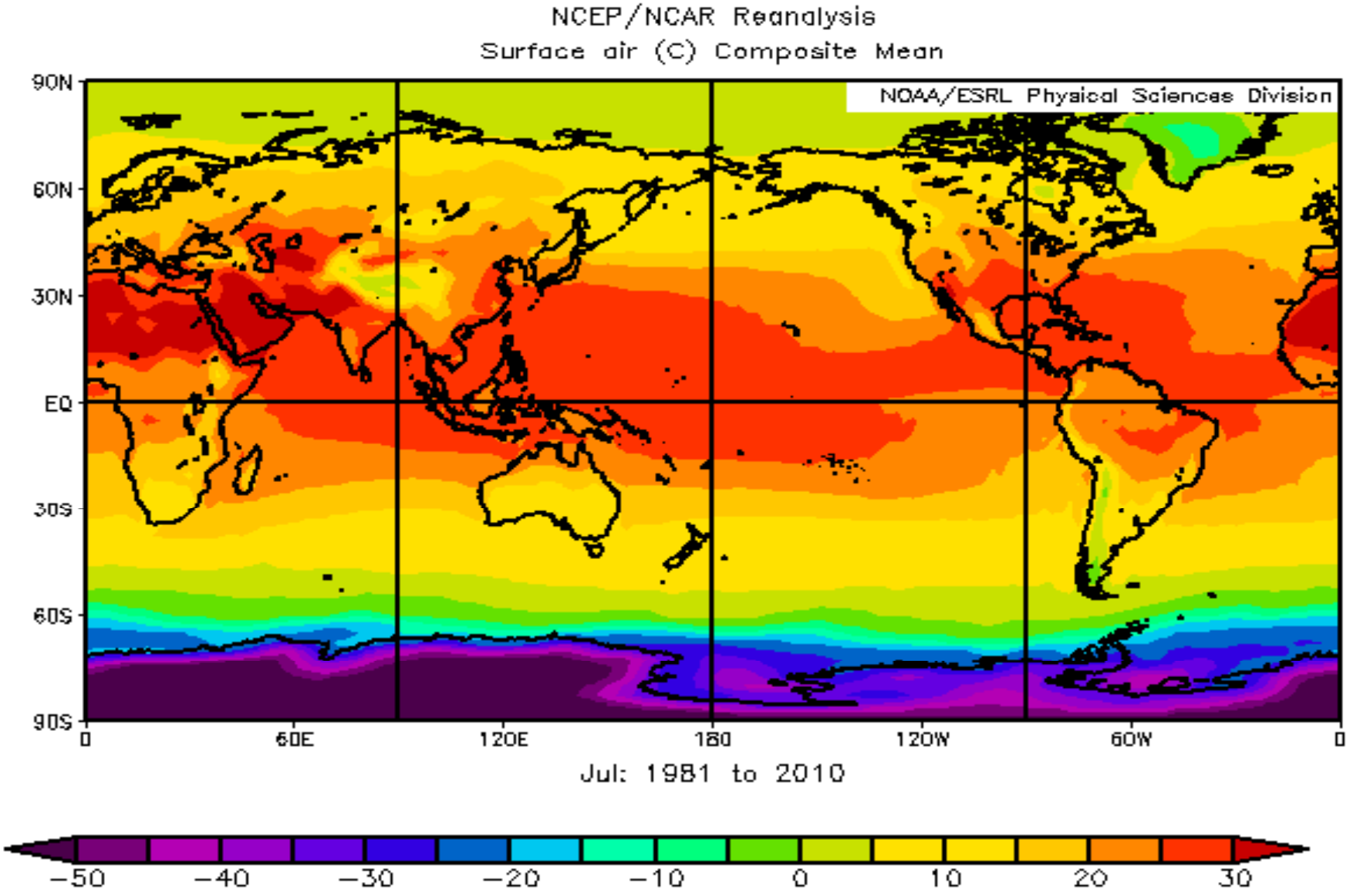
MAY



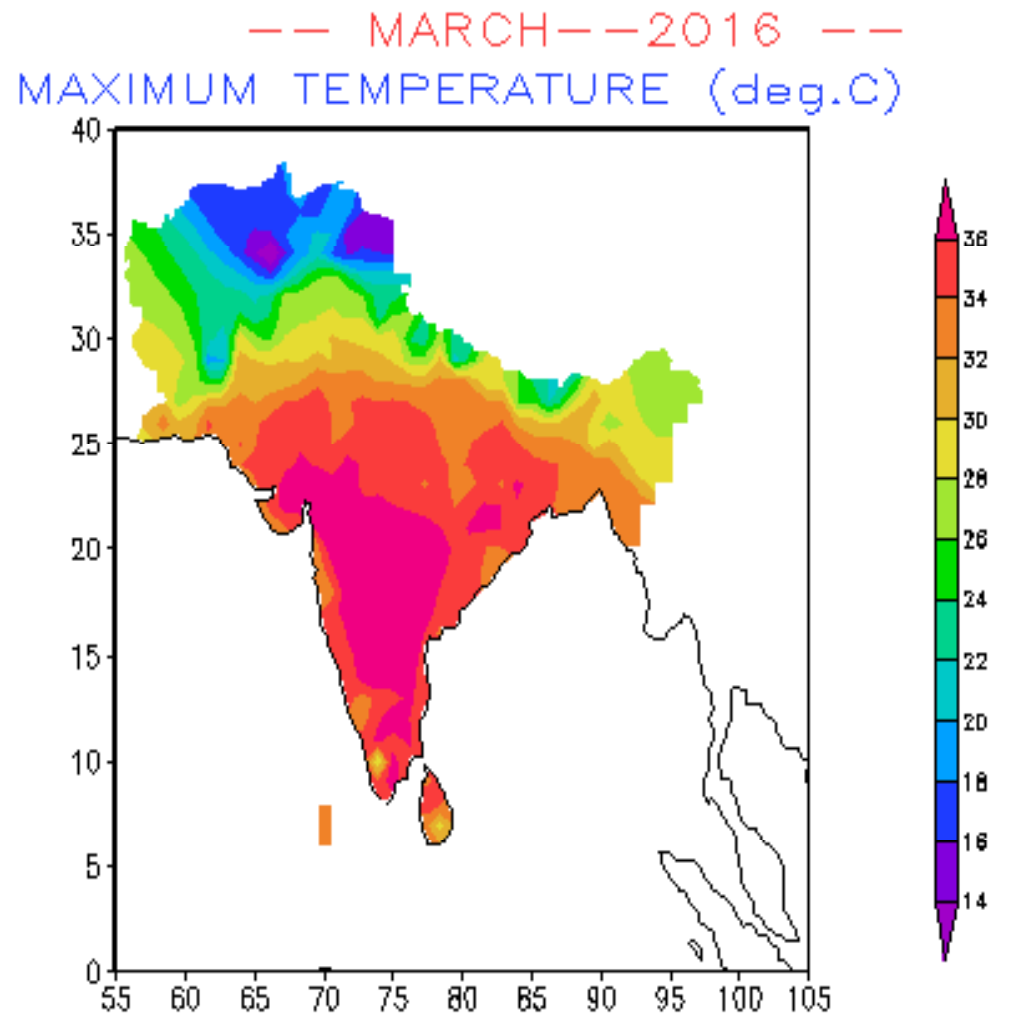
JUNE

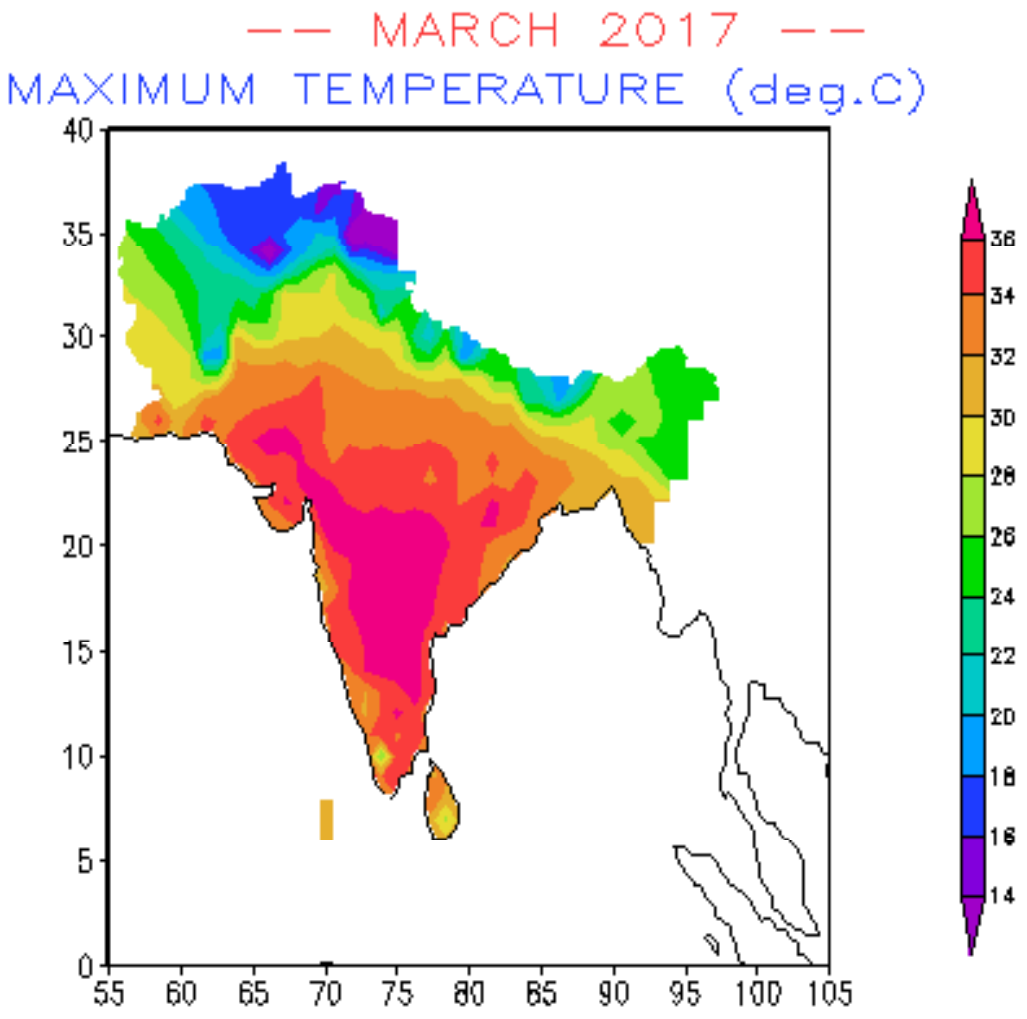
Summer Temperatures in the Region

JULY



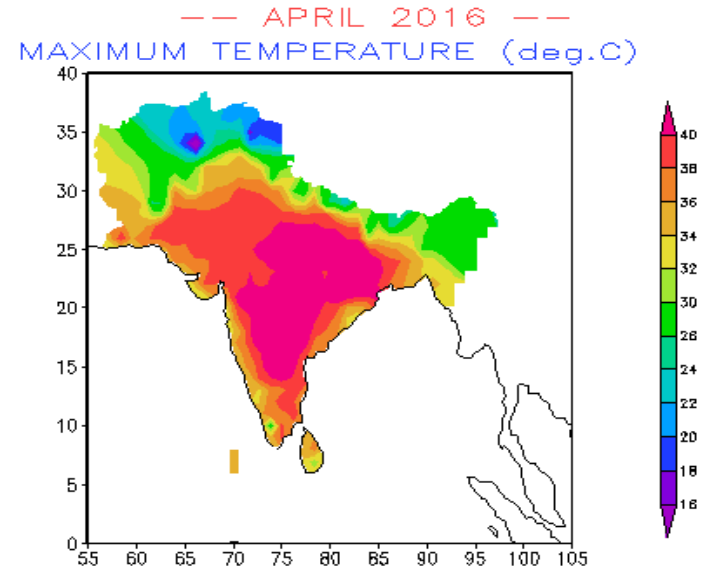
Summer Temperatures in the Region

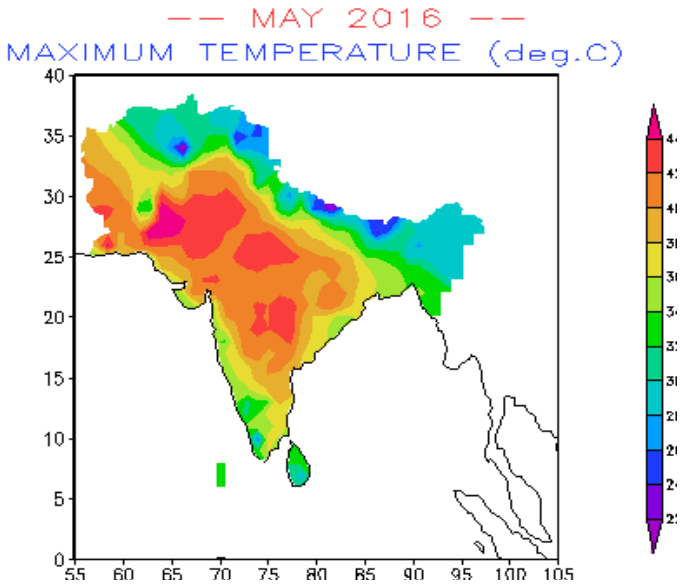


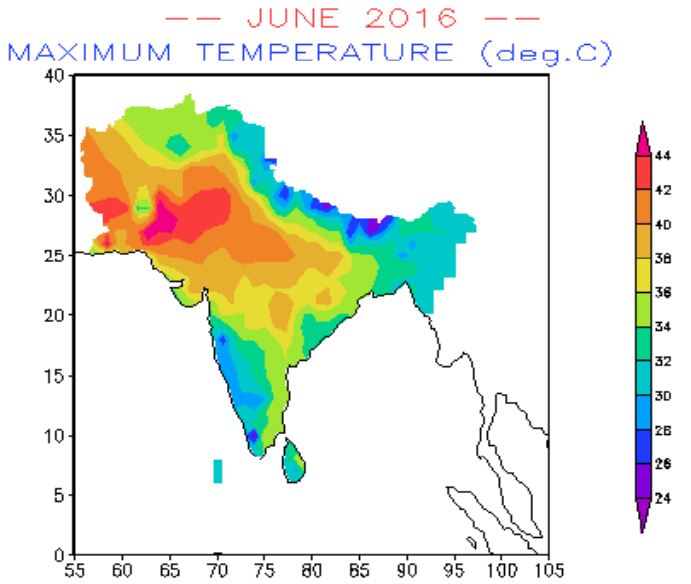


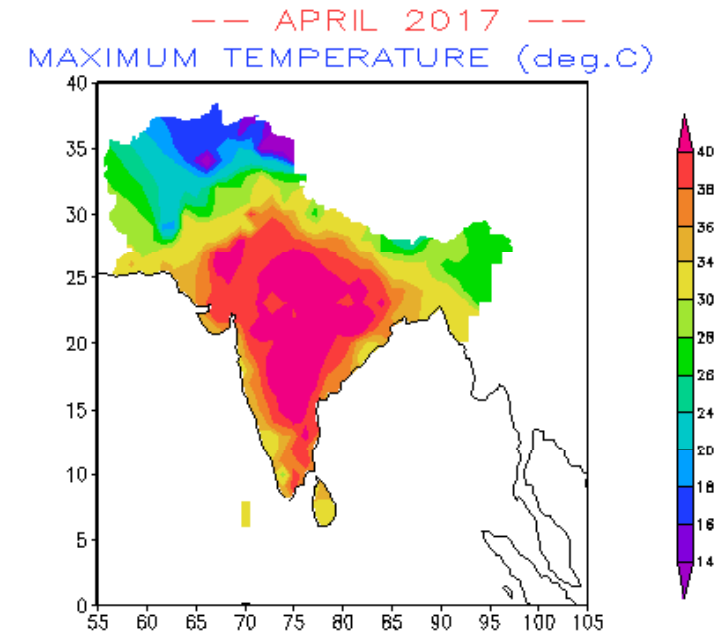
Summer Temperatures in the Region

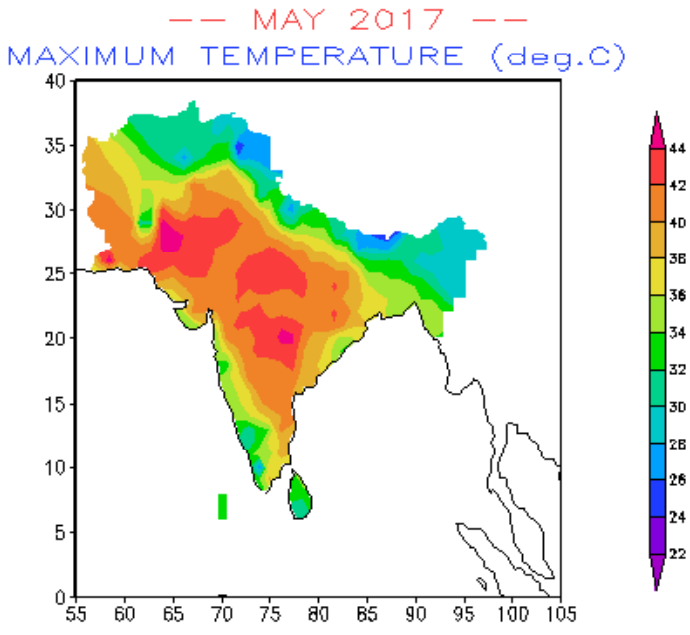
- **Peaks towards end of May/early June**

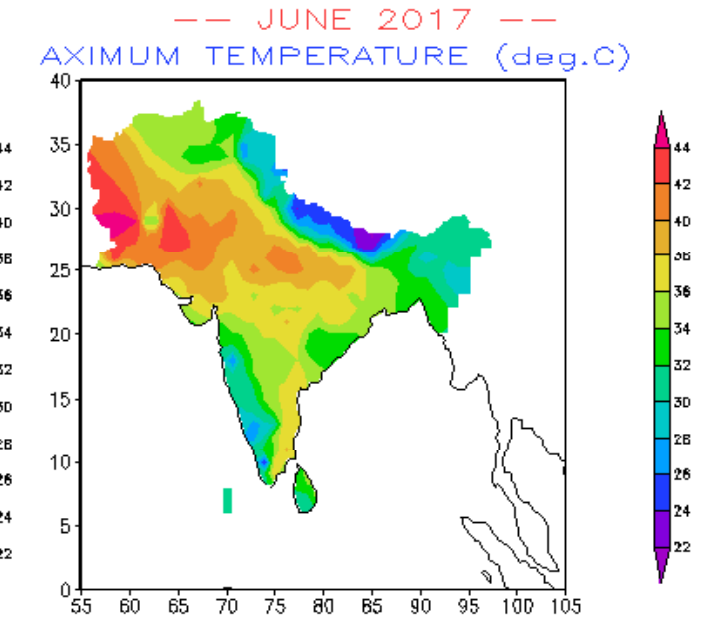




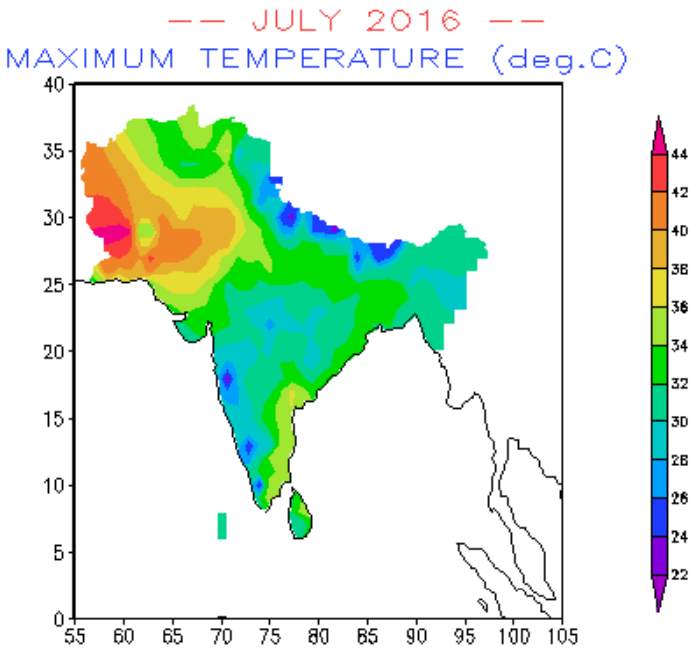


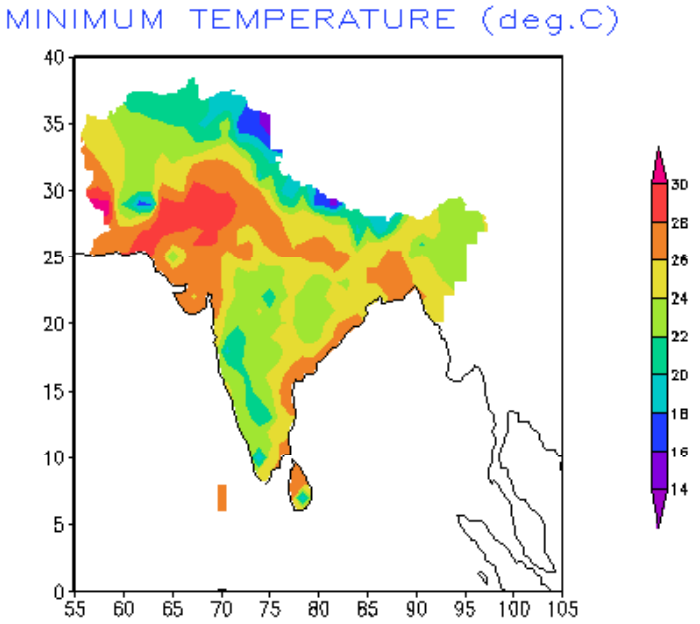




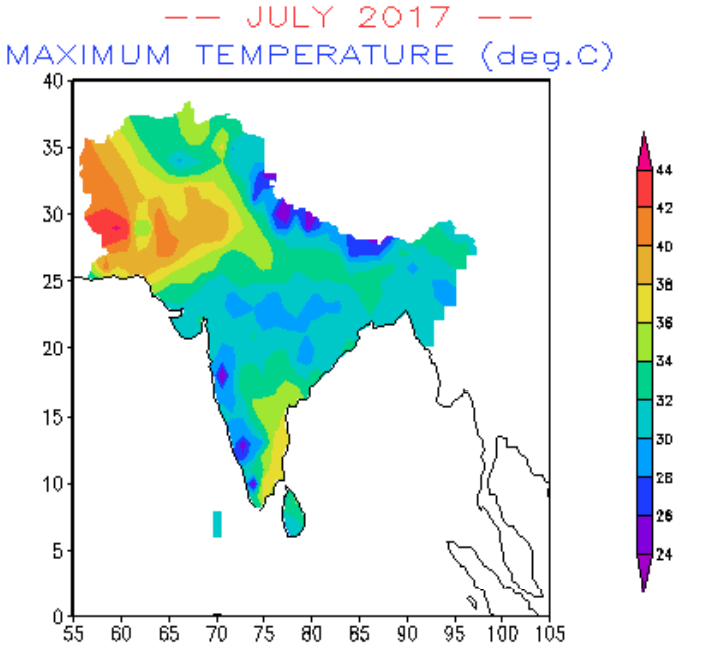


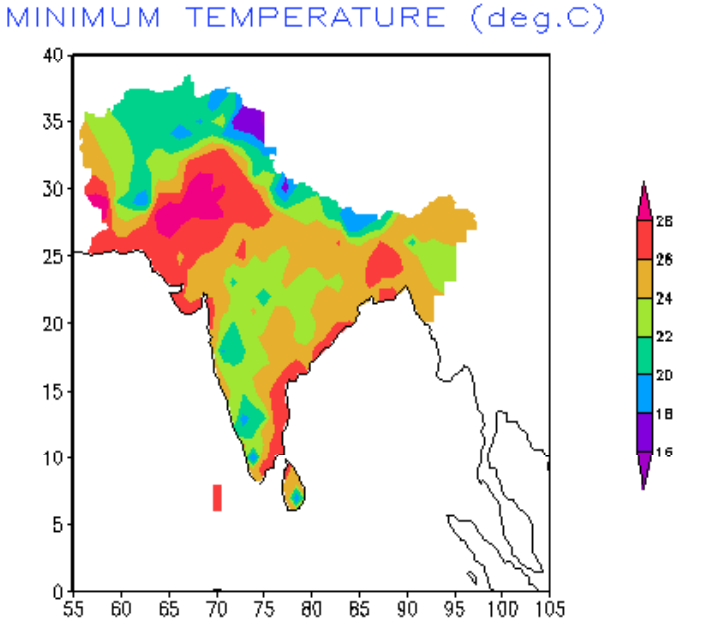
Summer Temperatures in the Region





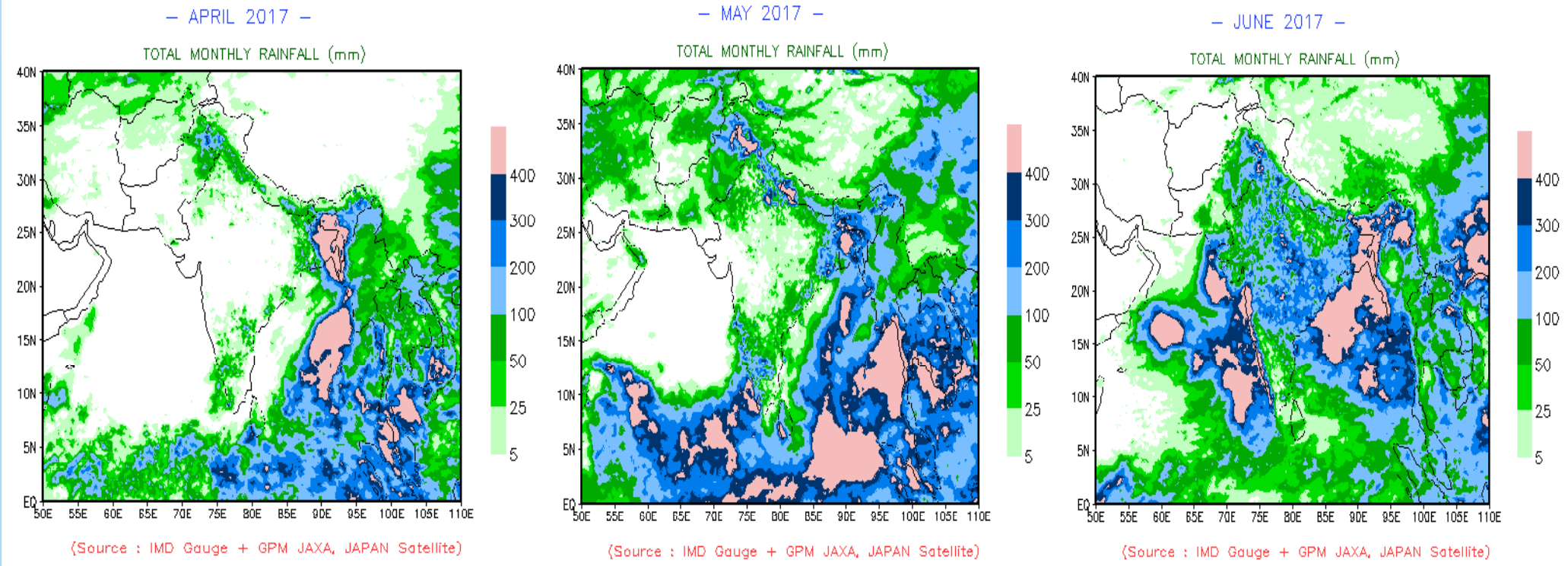
- **Some parts, particularly northwest India and southern half of Pakistan, could remain quite warm into entire June/ early July in case of**
  - **late onset OR**
  - **weak monsoon**





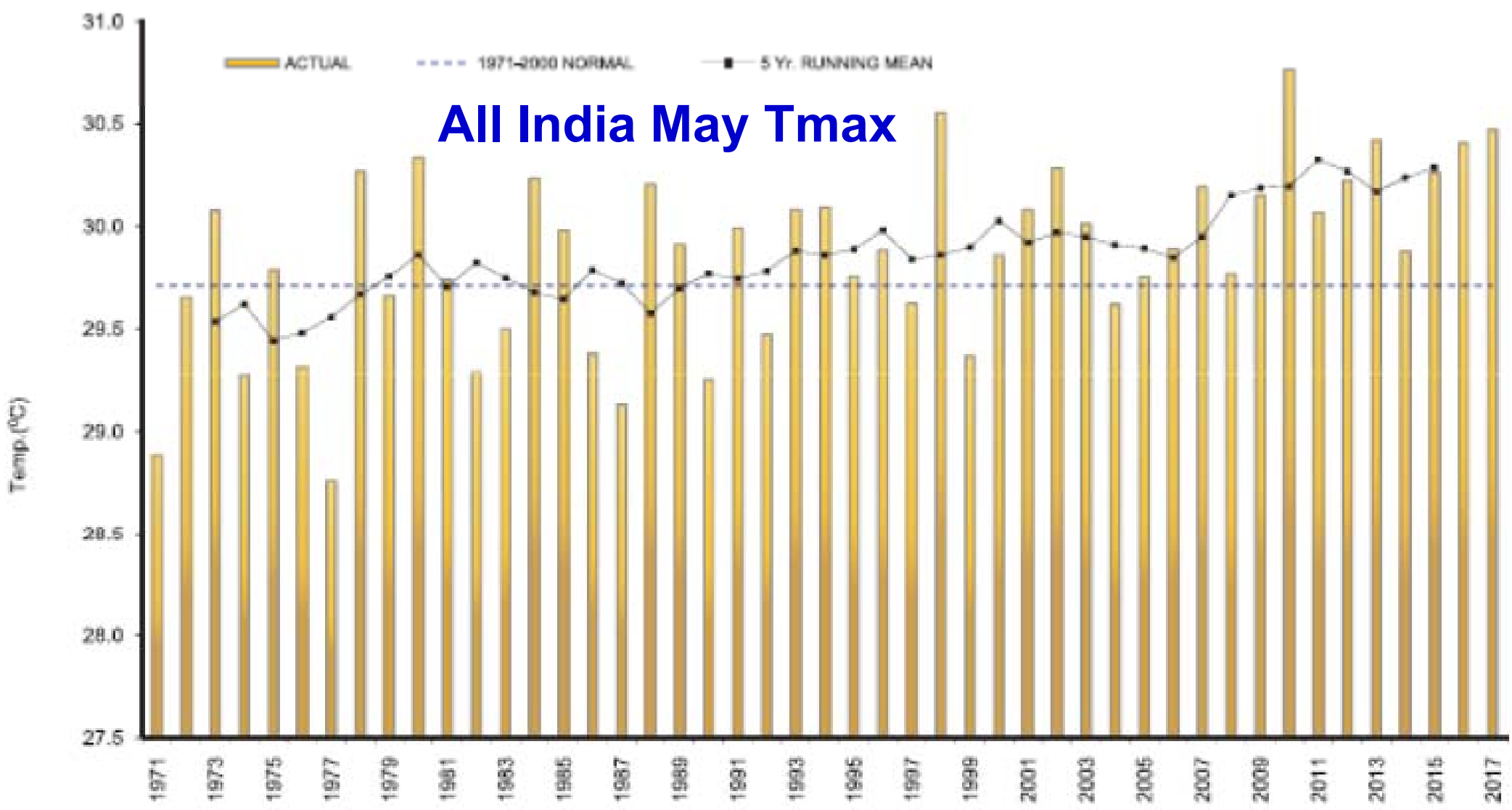
Summer 2017
Cumulative Rainfall

Pre-monsoon rainfall activity and timings of onset of southwest monsoon rains modulate the severity of heat (particularly in the later parts of season AND length of the hot season

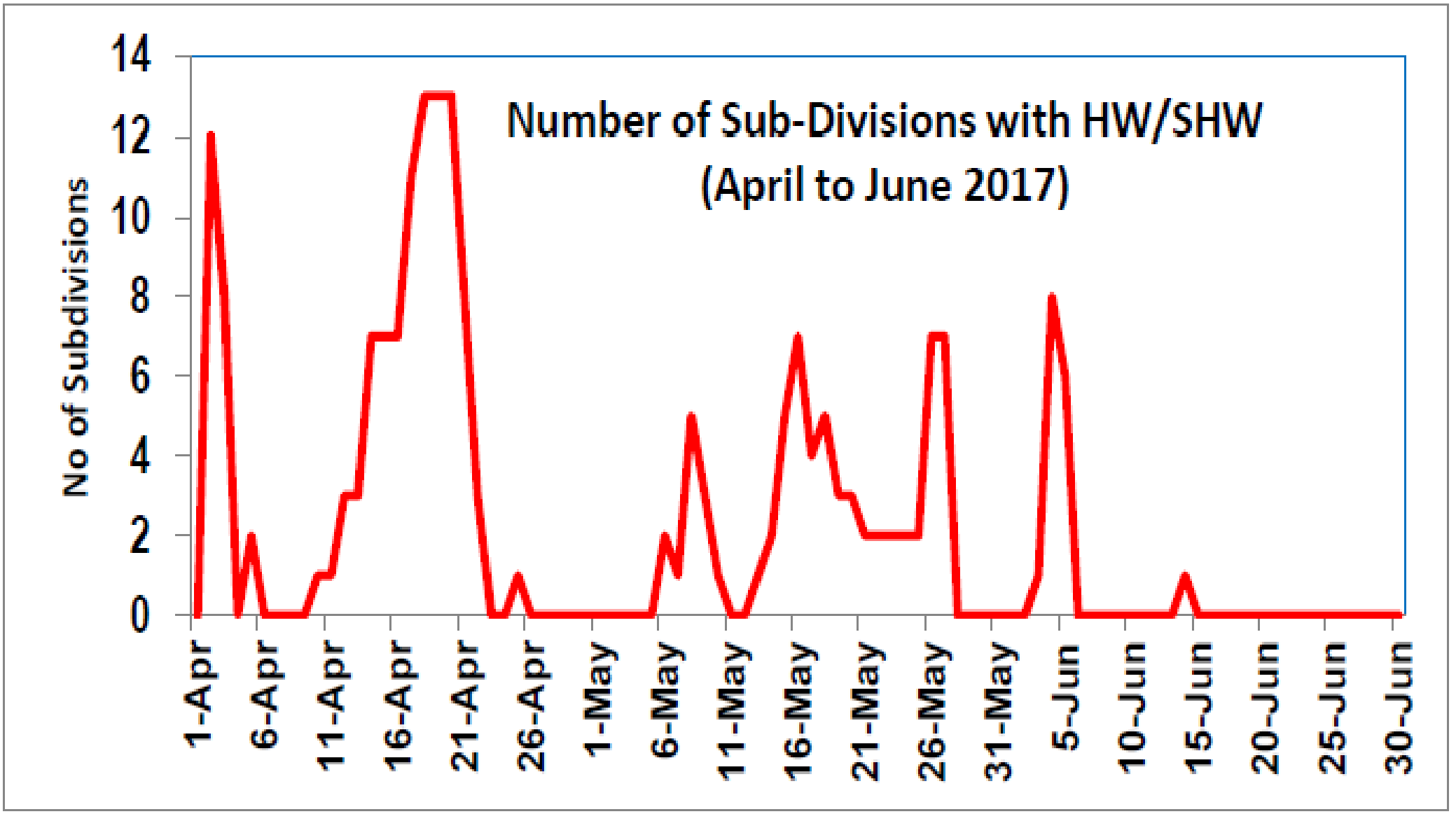


There are large inter-seasonal and intra-seasonal variations in intensity, duration and areal spread.

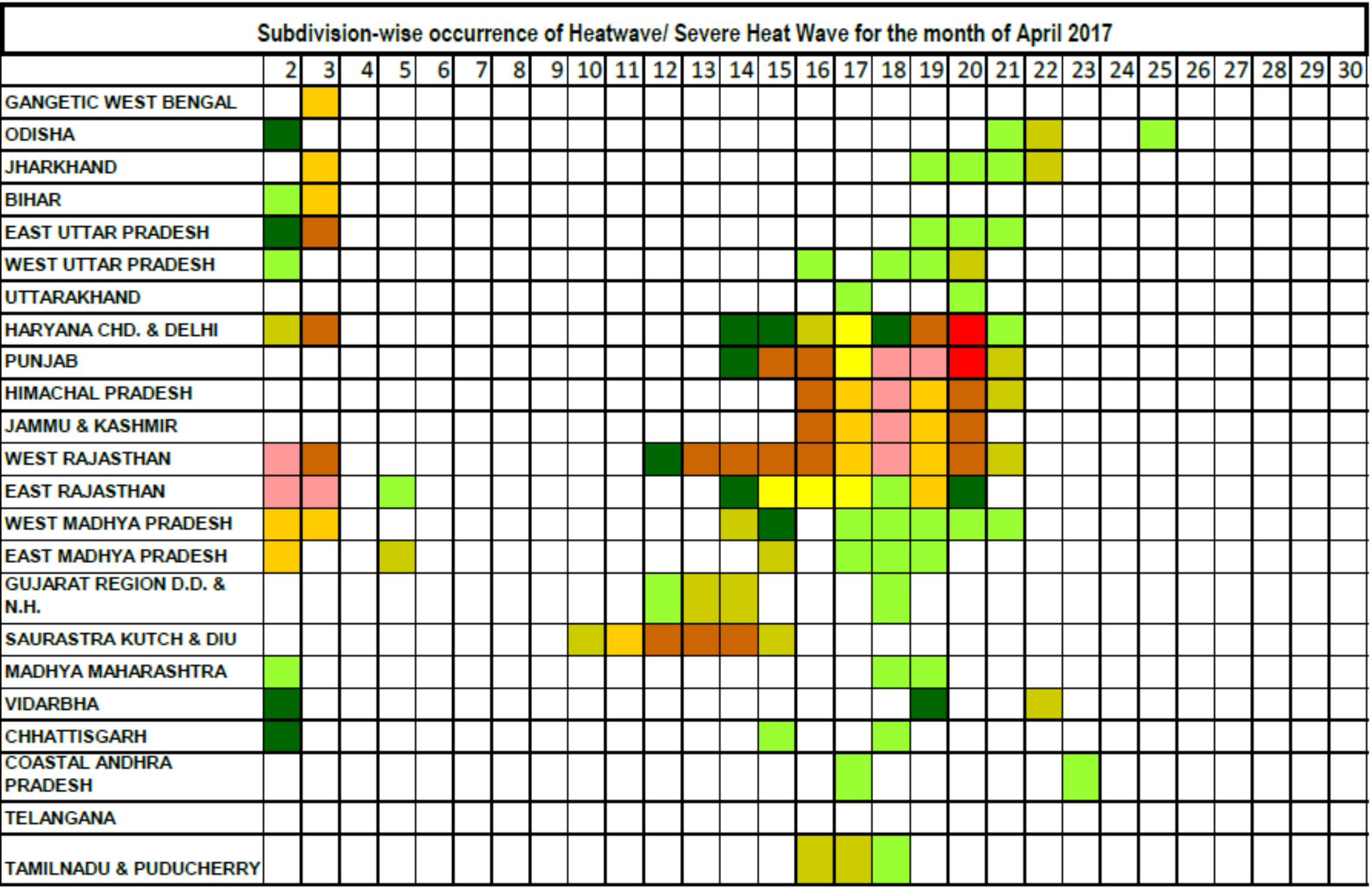
Hence predictions in different time and space scales are important.



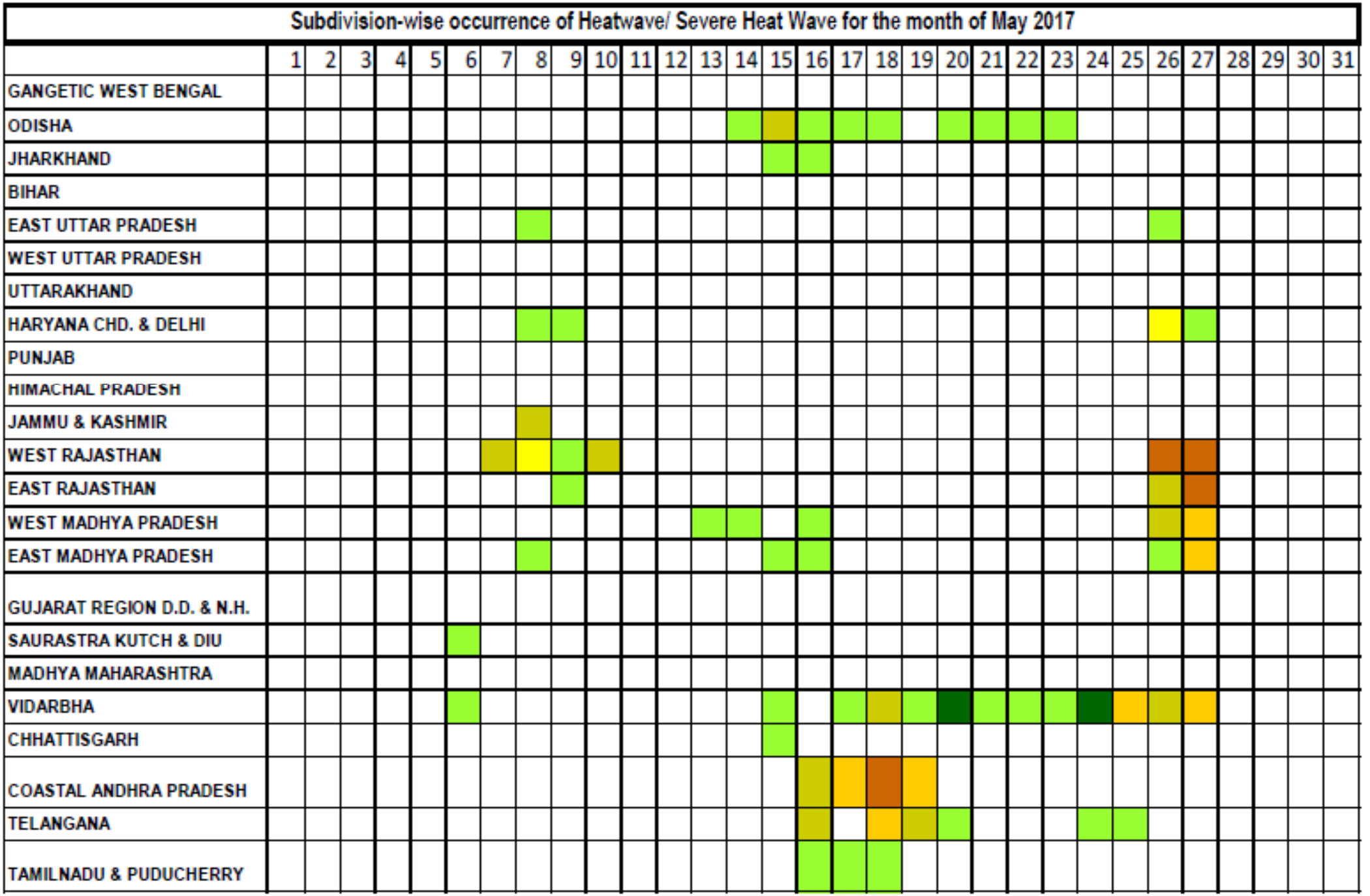
Intra-seasonal variations



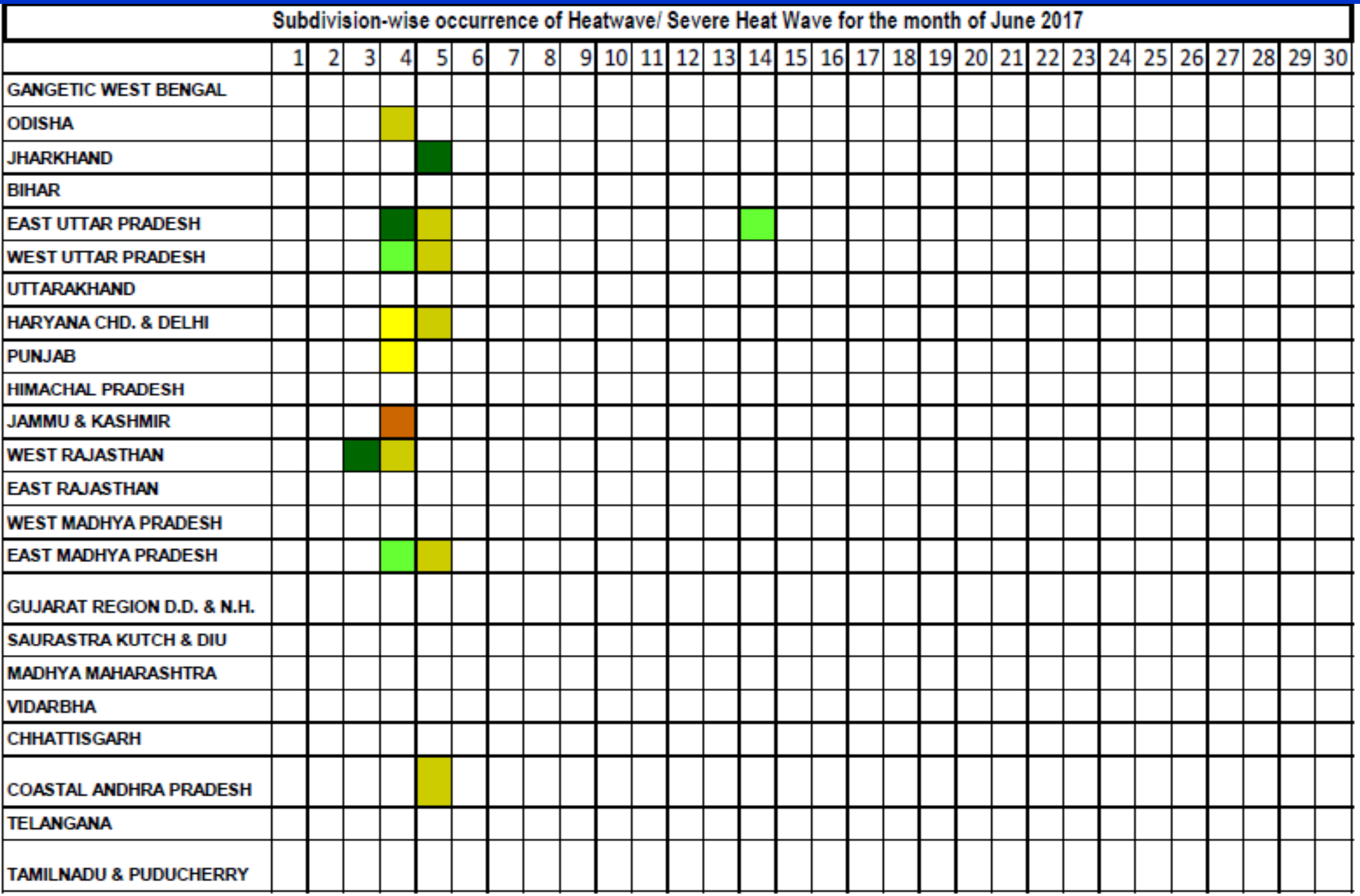
Spatio-temporal distribution of Heat Waves - April 2017



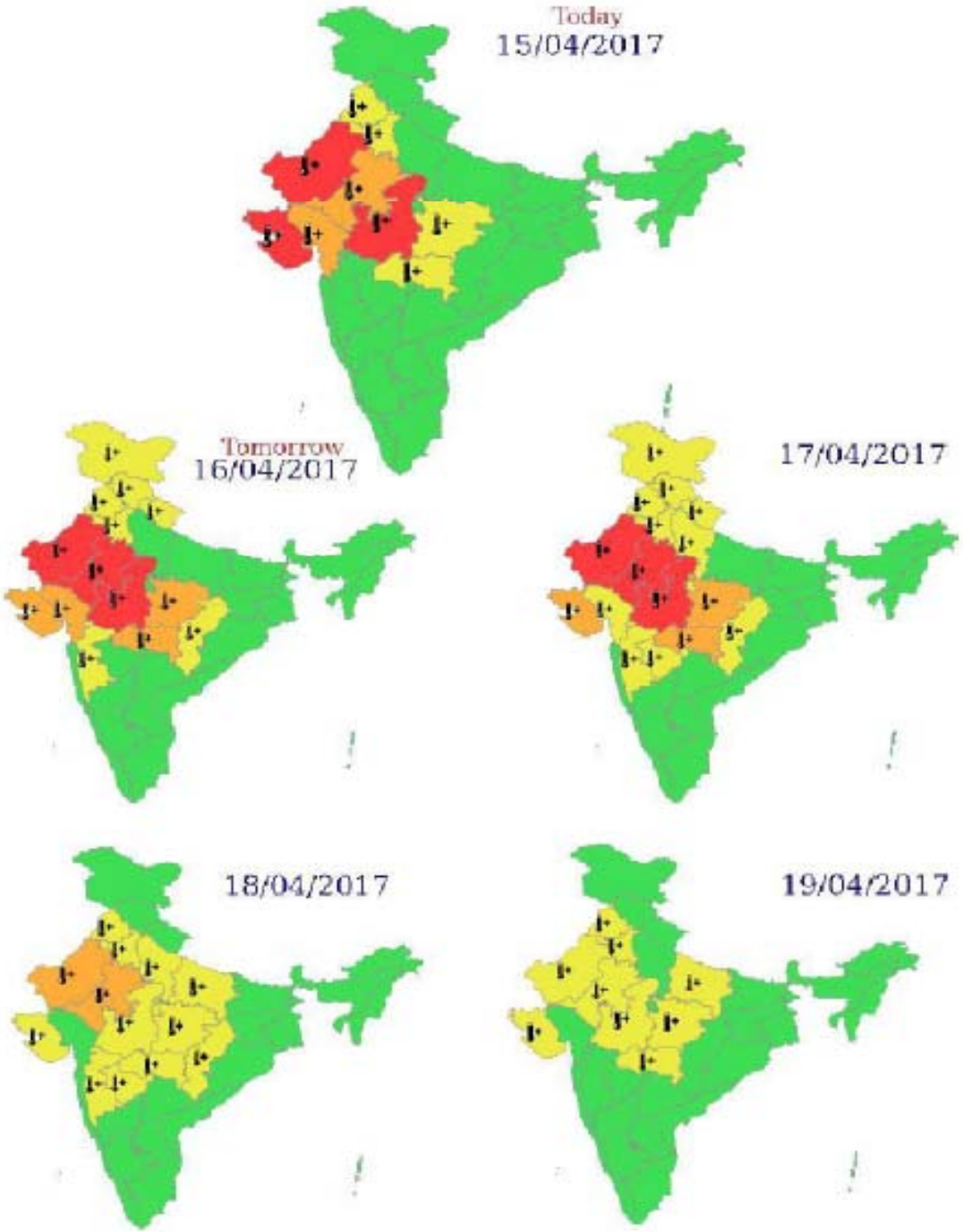
Spatio-temporal distribution of Heat Waves – May 2017

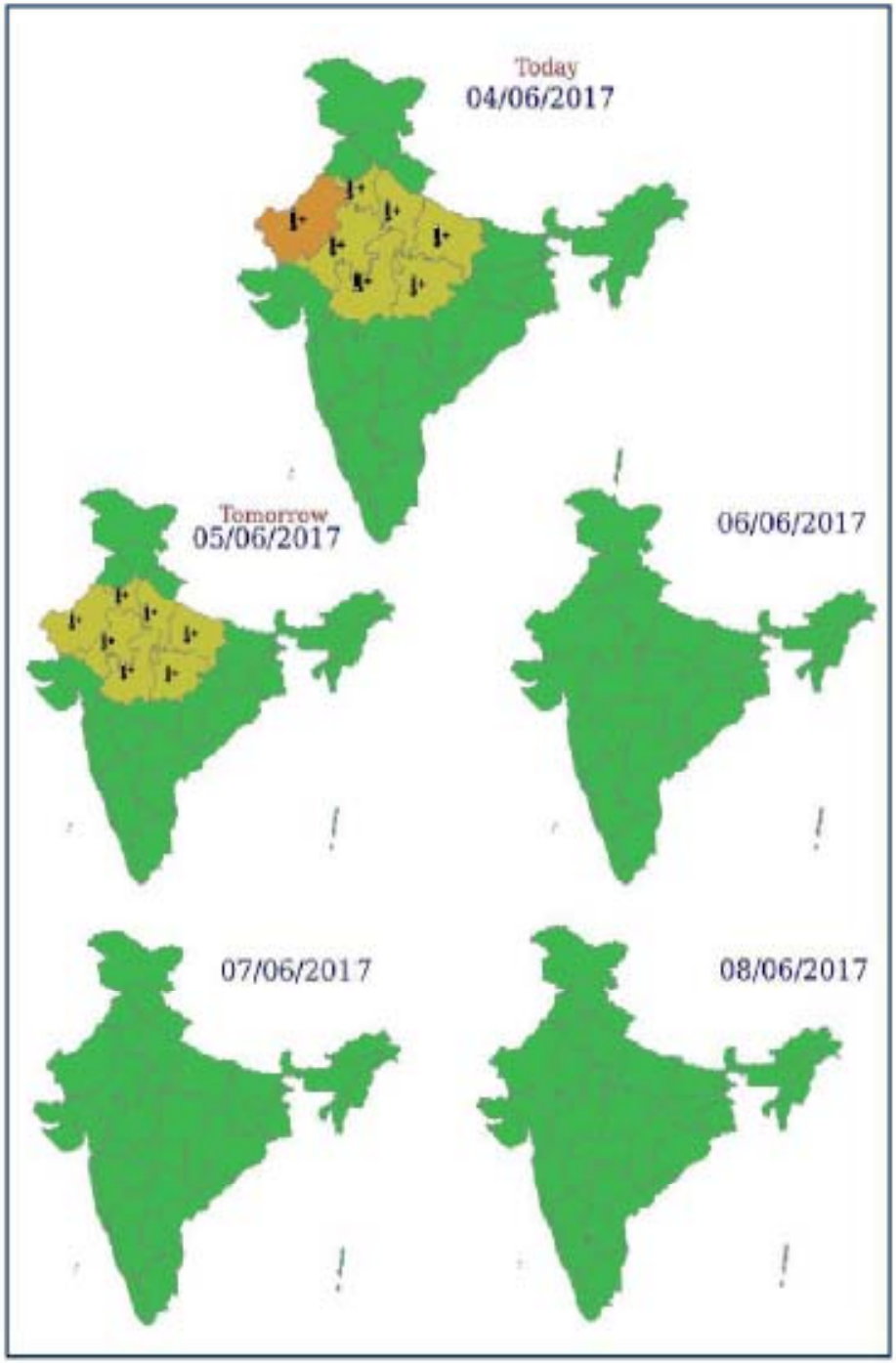


Spatio-temporal distribution of Heat Waves – June 2017

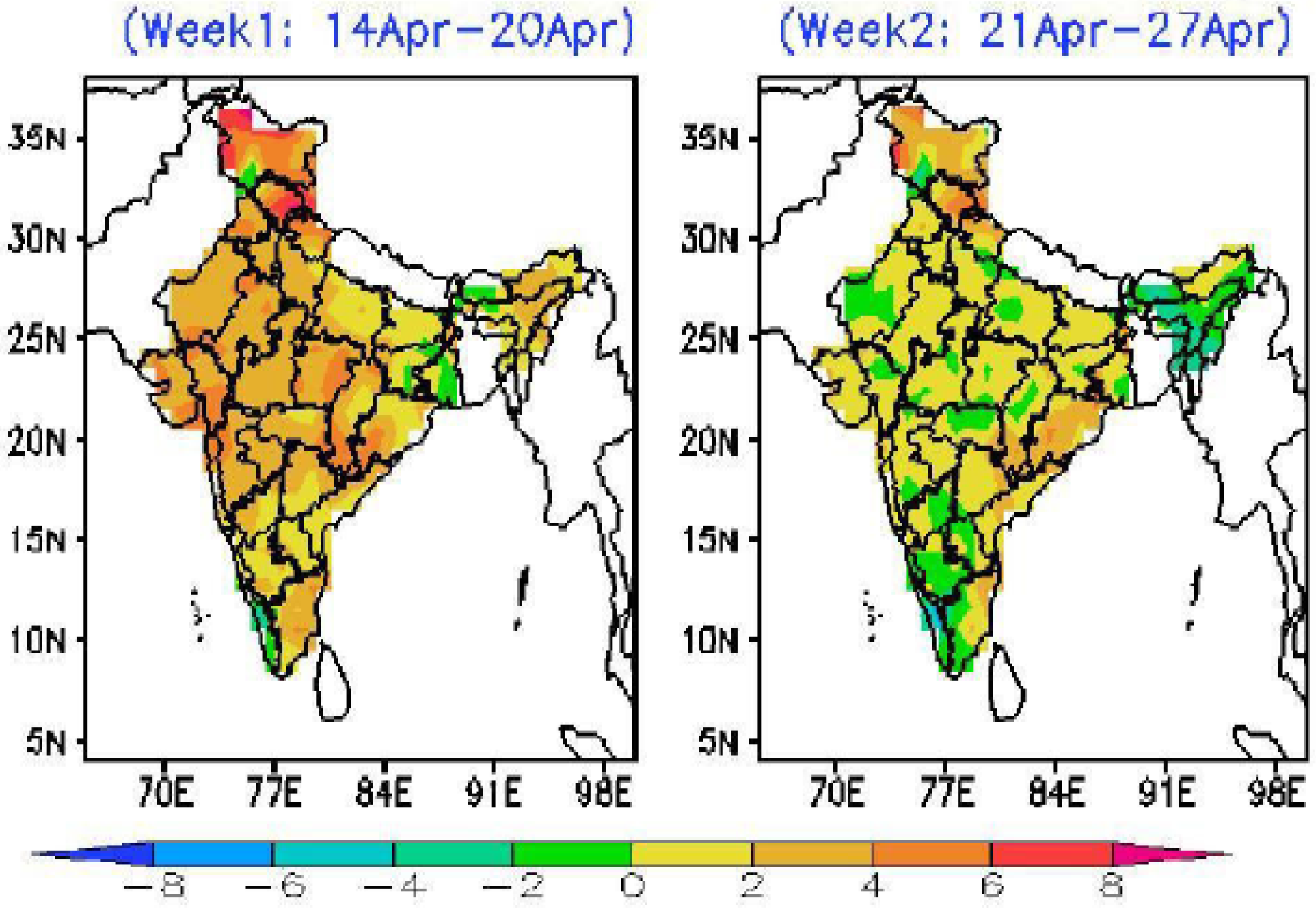


Warnings – Medium Range





Warnings – Extended Range



Warning Dissemination

- Subdivision wise: From HQs
  NDMA, Chief Secretaries, SDMAs, Indian Red Cross Society, IMA
- District wise: From and State Met Centres
  State and District level functionaries
- City Specific: From Regional/State Met Centres
  Through normal dissemination channels for about 350 cities across the country
- Warnings for exceedance of thresholds are given by State Met Centres only for cities which have established impact based warning thresholds

Dissemination

- Website
- TV
- Radio
- News papers
- Government Agencies
- Targeted Users
- Regular weekly press releases AND special releases for significant episodes
- International Federation of Red Cross and Red Crescent Societies
- Indian Medical Association

Issues to be addressed Temperature Thresholds

- These Forecasts are based only on deviations of Maximum Temperatures from their average values for that time of the year
- Neither based on impacts nor do these provide any advisory on suggested actions on part of different levels of stakeholders - need established thresholds to provide impact based forecasts on which advisories/actions can be initiated at different levels

Issues to be addressed Temperature Thresholds

Need for Impact Based Thresholds

Same temperature will qualify to be called heat wave in a region at some point of time and not at the other OR

some parts of the region and not in some other parts

- **A temperature of 44 C will not qualify for Heat wave for many places in Central India from first week of April to first week of June whereas the same temperature would be called Heat wave after first week of June.**
- **A temperature of 43 C during first week of May, shall be termed as heat wave in northwest India, Sri Lanka, Pakistan and Bangladesh BUT not in Central India.**

Thresholds: Chandigarh Case Study

Max T	Number of Deaths per Day		
(^{O}C)	Male	Female	Total
<35	23.4	13.7	37.1
<40	24.4	13.4	37.8
>40	26.2	15.5	41.7
>42	26.5	15.5	41.9

Average Tmax for days having Number of deaths >1 SD: 39.7 C

Average Tmax for days having Number of deaths <1 SD: 37.2 C

40^{O}C seems to be the point of inflexion. Though it may not qualify to be heat wave on certain days

Impact Based Forecasts as Per Thresholds Provided By The Users

10 CITIES IN 2016

	≤ 41 deg. Selsius
	41.1 to 43 Celcius
	43.1 to 44.9 Celcius
	> or eq. 45 deg Celcius

DATE		Forecast in colour code	May-16	ACTUAL in
	FC	COLOUR CODE	ACT	COLOUR CODE
01	42		43.1	
02	41		43.3	
03	42		42.1	
04	42		42.5	
05	40		39.6	
06	41		40.0	
07	41		39.9	
08	41		40.6	
09	43		42.4	
10	43		42.7	
11	42		43.0	
12	44		43.5	
13	44		44.0	
14	44		44.6	
15	44		44.0	
16	44		44.3	
17	45		43.5	
18	46		45.0	
19	47		46.9	
20	46		48.0	
21	43		44.6	
22	43		44.0	
23	43		42.6	
24	42		43.0	
25	41		41.9	
26	42		41.5	
27	41		41.4	
28	42		41.5	
29	41		40.8	
30	41		41.3	
31	41		41.5	

Heat Wave defined in India

a) Based on Departure from Normal

Heat Wave: Departure 4.5°C to 6.4°C

Severe Heat Wave: Departure >6.4°C

b) Based on Actual Maximum Temperature

Heat Wave: Maximum Temperature ≥ 45°C

Severe Heat Wave: Maximum Temperature ≥47°C

c) Criteria for describing Heat Wave for coastal stations

When Max Temp departure from normal is 4.5°C or more,

Heat wave considered only when the actual Max. temp. is 40°C or more for Plains, 30°C or more for Hilly regions, and 37°C or more for the Coastal stations.

Heat Wave defined in India

- To declare heat waves, the criteria should be met at least in 2 stations in a Met. sub-division for at least two consecutive days and it will be declared on the second day.

- Forecasts of heat and cold waves over a sub-division are issued only if at least two stations in the sub-division are expected to experience such conditions.

Definitions are based on climatological considerations and NOT on any possible IMPACTS

Heat Wave defined - other countries

No universal definition. Generally defined as a prolonged period of excessive heat.

- **UKMO: An extended period of hot weather relative to the expected conditions of the area at that time of year.**
- **WMO: When the daily maximum temperature exceeds the average maximum temperature by 5°C for more than five consecutive days.**
- **BOM: Three or more days of unusually high maximum and minimum temperatures in any area.**

The level of heat discomfort is determined by a combination of meteorological (temp, RH, wind, direct sunshine), social/cultural (clothing, occupation, accommodation) and physiological (health, nutrition/ hydration levels, fitness, age, level of acclimatization) factors.

Issues to be addressed - thresholds

- **Definition:**
  - ✓ Deviation from Climatologically expected value
  - ✓ OR
  - ✓ Temperatures causing adverse health impacts irrespective of their values.
  - ✓ OR
  - ✓ Combination of Temperature and Humidity

Issues to be addressed – temp + RH ?

Metrication of Template:HeatTable

Relative Humidity (%)	temperature (°C)																
	27	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
40	27	28	29	30	31	32	34	35	37	39	41	43	46	48	51	54	57
45	27	28	29	30	32	33	35	37	39	41	43	46	49	51	54	57	
50	27	28	30	31	33	34	36	38	41	43	46	49	52	55	58		
55	28	29	30	32	34	36	38	40	43	46	48	52	55	59			
60	28	29	31	33	35	37	40	42	45	48	51	55	59				
65	28	30	32	34	36	39	41	44	48	51	55	59					
70	29	31	33	35	38	40	43	47	50	54	58						
75	29	31	34	36	39	42	46	49	53	58							
80	30	32	35	38	41	44	48	52	57								
85	30	33	36	39	43	47	51	55									
90	31	34	37	41	45	49	54										
95	31	35	38	42	47	51	57										
100	32	36	40	44	49	54											

- Caution
- Extreme Caution
- Danger
- Extreme Danger

Issues to be addressed – Heat Index?

- This index takes care of the cooling power of the atmosphere BUT has some issues attached to it.
- The index is developed based on extension surveys in temperate climates. It does not represent the acclimatisation of the people in tropical countries.
- The highest temperature covered is upto 43^{O} C. Temperatures beyond this range are not uncommon in the region

Temp	RH	HI
35	80	57
37	80	66
43	20	44
45	20	47
40	50	55

Issues to be addressed - customization

Tailoring of Weather Information and suggested actions

- ✓ Recommended actions for different levels of warnings
- ✓ Segregation of warnings of different spatio-temporal scales for different stakeholders
- ✓ As the Emergency Response Mechanism OR the actions to be taken by different stakeholders (disaster managers, health system functionaries, municipalities, power, labour, general public, vulnerable groups etc), are different, advisories have to be different for different target groups for same levels of warnings
- ➢ De-warning process (Weather Services take care to some extend through periodic updates). However, specific procedures can be devised.

Issues to be addressed - dissemination

- Multi-stage (during the season) and periodic update
- Suggested Actions (at different Levels)
- Multi-target (for different actions by nodes & for lead periods. May be extended range scale warnings not needed by end users)
- Dissemination to end users – direct from weather service or through intermediate users?
- Multi-Channel Dissemination – A single means of dissemination not effective for all users.
- Information to Individuals (SMS/Email/ Whatsapp) – with special attention to the vulnerable sections and action takers

With mass dissemination much easier now, weather services can disseminate the warnings to all functionaries if initial coordination is facilitated.

Issues to be addressed - cooperation

- **Stakeholder Engagement, Outreach/Feedback/ Awareness, Community Education/awareness**
  - **District level HAP involving local agencies**
    - **Interpretation of warnings;**
    - **R&D issues such as identifying thresholds, vulnerability assessments, Mitigation strategies.**
    - **Pre-season Preparedness: Identifications of nodes and Process (HAP)**
    - **Identifying and Transferring Successful Community Intervention Strategies**

Issues to be addressed - cooperation

- ✓ **Involvement of local authorities at District/Municipality Level**

Municipal Councils & other local bodies (water, electricity, construction, cooling centres, schools, vendors/ hawkers etc.)

District Medical Officer & Hospitals (for all medical related issues including stock of medicines, rehydration, cooling packs, ambulances etc.)

District Magistrate at centre to ensure appropriate coordination at local and state level

Issues to be addressed- Warning Dissemination

Visual Warnings for Public By the State

IMD issued warnings with suggested actions to the planners and ALSO DIRECTLY TO THE FARMERS THROUGH SMS just before the event (Forecast Based)

शेतकरी बाधवांनो, सावधान !!

मराठवाडा, विदर्भ

10 ते 13 फेब्रुवारीदरम्यान विजांच्या कडकडाटासह गारपिटीची शक्यता

शेतकरी बांधवांनो, आपल्या शेतमालाचे नुकसान टाळा

शेतमाल सुरक्षित ठिकाणी साठवून ठेवावा.

बाजार समितीमध्ये शेतमाल विक्रीसाठी आणला असेल किंवा तसे नियोजन केले असेल तर तो माल व्यवस्थितपणे झाकून ठेवावा.

विजेपासून बचावासाठी सुरक्षित ठिकाणी आश्रय घ्यावा.

मोकळं मैदान, झाडाखाली, पत्र्याच्या शेडमध्ये, विजवाहिनी अथवा ट्रान्सफॉर्मर जवळ थांबू नये.

अतिवृष्टीमुळे शेती मालाचे नुकसान टाळण्यासाठी शेतकरी बांधवांनी नियोजन करावे.

गडचिरोली, गोंदिया, भंडारा, चंद्रपूर, नागपूर, नांदेड, लातूर, तसेच अमरावती, यवतमाळ या जिल्ह्यांत विशेष काळजी घ्यावी...

- आपले महाराष्ट्र शासन

Summer 2018
Seasonal Temperature Outlook

PRESS RELEASE
New Delhi, 28th February, 2018

भारत सरकार
Government of India
पृथ्वीविज्ञानमंत्रालय (एम. ओ. ई. एस.)
Ministry of Earth Sciences (MoES)
भारत मौसम विज्ञानविभाग
INDIA METEOROLOGICAL DEPARTMENT

Seasonal Outlook for the Temperatures during March to May 2018

Highlights

- During the 2018 Pre-monsoon Season (March to May), warmer than normal temperatures are likely in all meteorological sub-divisions of the country. Seasonal (March- May) average temperatures over many of the subdivisions from northwest and neighbouring central India are likely to be above normal by more than 1.0°C.
- Normal to above normal heat wave (HW) conditions are likely over core heat wave zone of the country.

Summer 2018
Temperature Anomalies (December 2017 IC)

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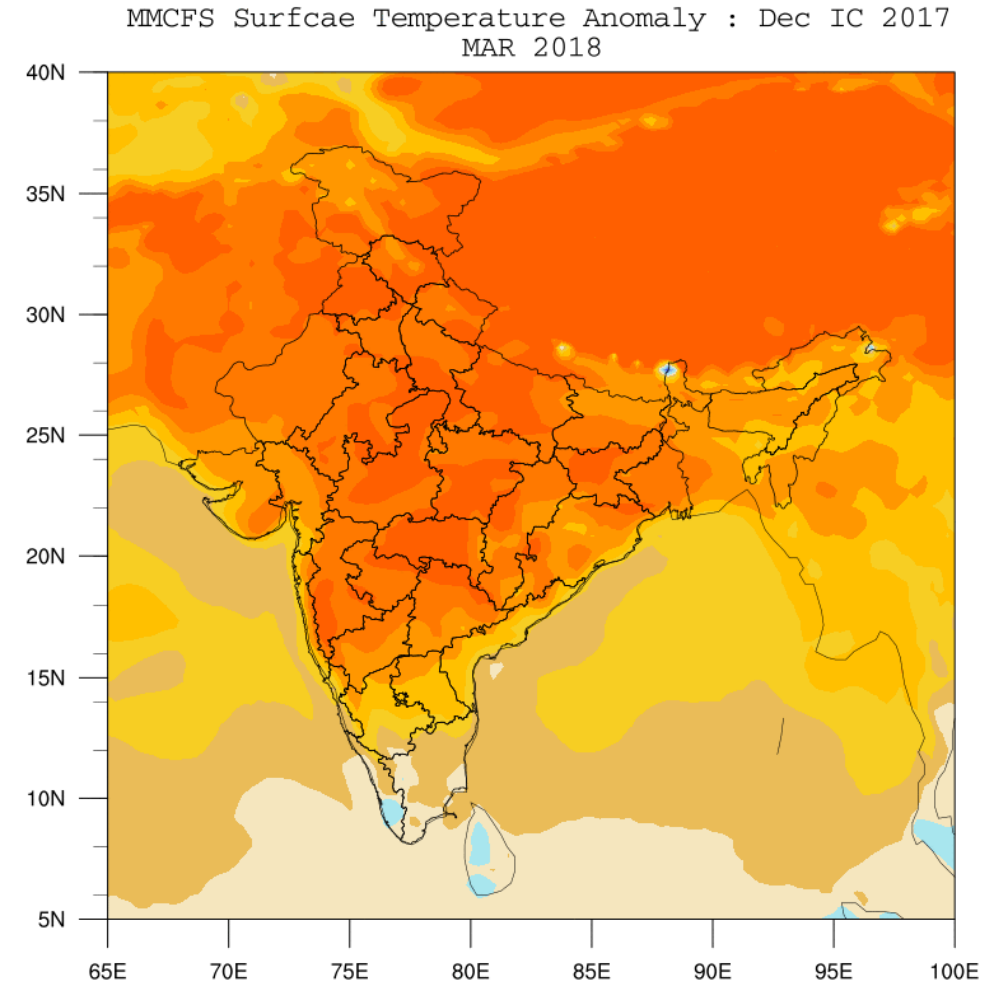

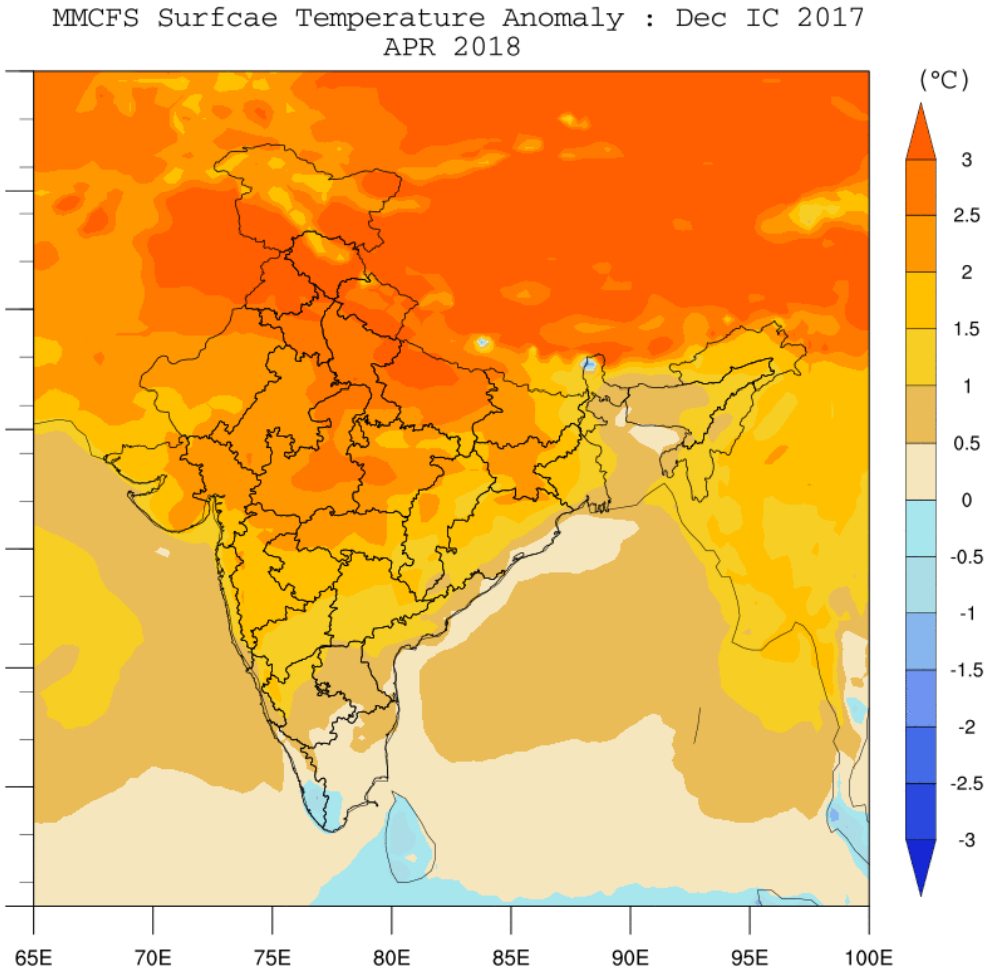

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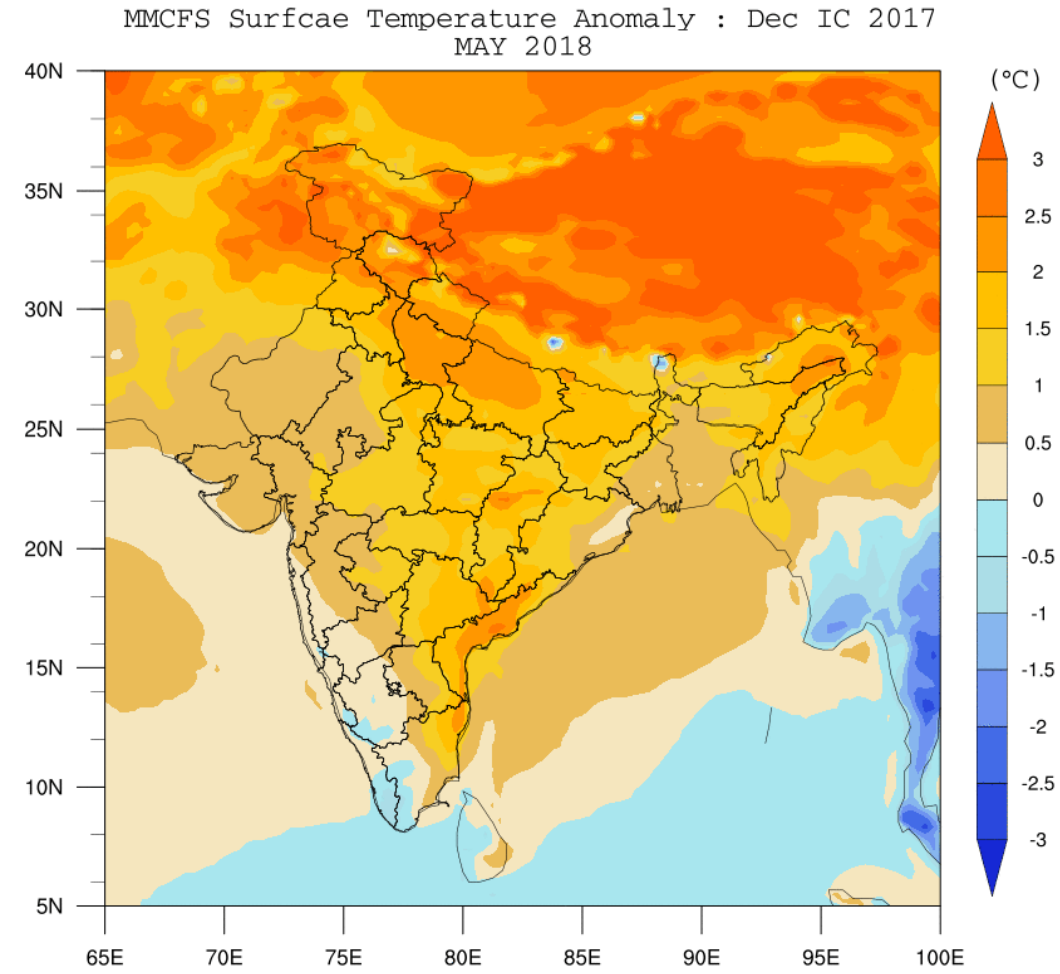
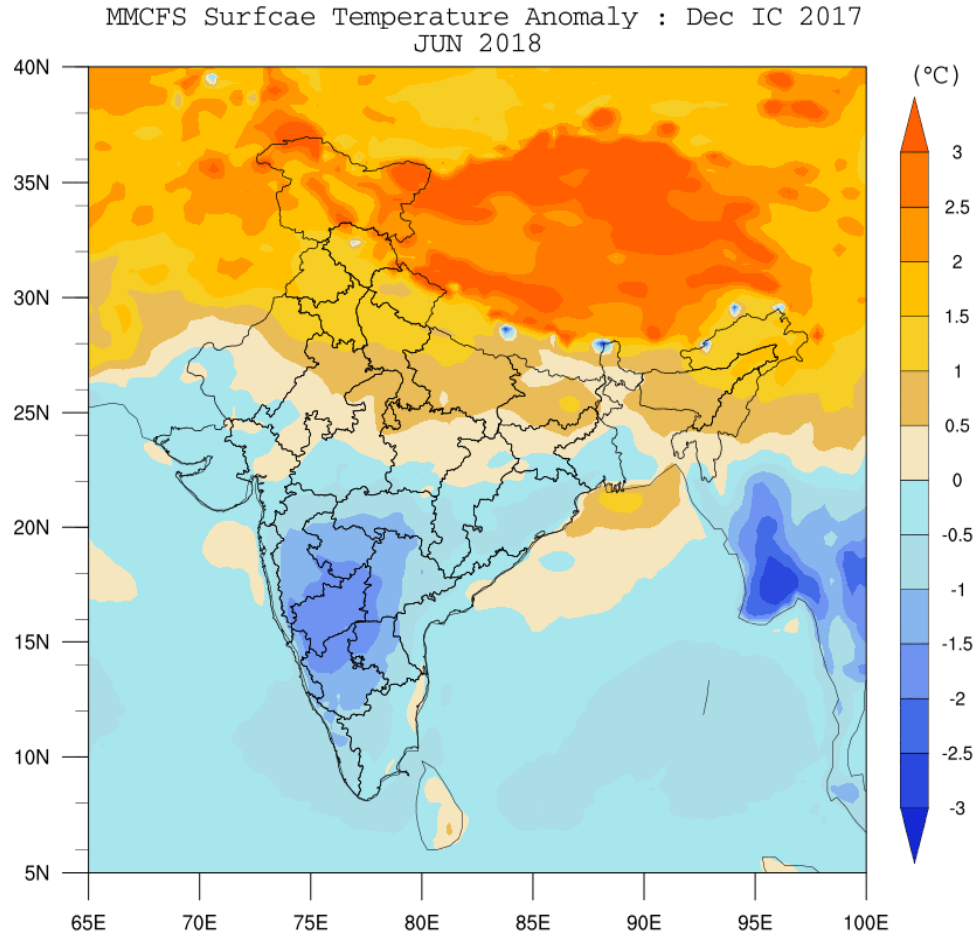
Temperature Anomalies (December 2017 IC)



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INDIA METEOROLOGICAL DEPARTMENT
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Thank you