



Case Study of Moderate to Severe Heat Wave over Gujarat Region during May 2010

*Kamaljit Ray and Manorama Mohanty and Chicholikar J.R
 Meteorological Centre, India Meteorological Department, Ahmedabad*

Abstract: During the period from March to May, normal temperature is quite high over the state. The region is said to be in a grip of “moderate heat wave” when the recorded maximum temperatures are above normal by 5°C to 6°C and it will be called “severe heat wave” if the maximum temperatures are 7°C or more above normal. Generally heat waves develop in the north west parts of India or the northern parts of Pakistan and expands into the neighboring subdivisions of the country including Gujarat region. Heat waves may also develop in situ over the region in case of a development of an upper- air anti-cyclonic circulation. Ahmedabad recorded 45°C and more from 13th to 15th May and from 20th to 25th May with the highest recorded being 46.8°C on 21st May. Idar recorded 48.7°C and Deesa 47.3°C on 21st May 2010 (highest in the history of Idar and Deesa Observatory). The paper discusses the synoptic conditions responsible for the severe heat wave conditions by using various satellite products and model products. The climatology of extreme temperature conditions over IMD observatories in Gujarat have also been discussed.

CLIMATOLOGY

DECADAL FREQUENCY OF HW (heat wave) AND SHW (severe heat wave) OVER IMD STATIONS

STATION	MONTH	SHW					HW					TOTAL HW+SHW
		1971 TO 1980	1981 TO 1990	1991 TO 2000	2001 TO 2010	Total SHW	1971 TO 1980	1981 TO 1990	1991 TO 2000	2001 TO 2010	Total HW	
AHMEDABAD	MARCH	0	0	1	0	1	8	0	6	10	24	25
	APRIL	0	0	0	0	0	10	6	4	6	26	26
	MAY	0	0	0	0	0	9	16	12	20	58	58
	TOTAL	0	0	1	0	1	27	22	22	36	108	109
BARODA	MARCH	0	0	0	1	1	6	4	7	13	30	31
	APRIL	0	0	0	0	0	7	5	2	9	23	23
	MAY	0	0	0	2	2	4	5	6	15	30	32
	TOTAL	0	0	0	3	3	17	14	15	37	83	86
RAJKOT	MARCH	0	0	1	1	2	2	0	8	13	23	25
	APRIL	0	0	0	0	0	1	0	8	3	12	12
	MAY	1	0	0	0	1	2	2	5	17	27	28
	TOTAL	1	0	1	1	3	5	2	21	33	62	
BHUUJ	MARCH	0	0	1	1	2	8	3	10	8	29	31
	APRIL	0	0	0	0	0	11	13	14	4	42	42
	MAY	1	1	6	1	9	16	24	12	10	63	72
	TOTAL	1	1	7	2	11	35	40	36	22	134	145
DEESA	MARCH	0	0	0	4	4	5	0	7	14	26	30
	APRIL	0	0	0	0	0	4	1	3	5	13	13
	MAY	0	0	0	7	7	4	2	3	12	22	29
	TOTAL	0	0	0	11	11	13	3	13	31	61	

Frequency of Moderate to severe heat wave conditions were found to be highest in the last decade (2000-2010)

CASE STUDY

Maximum Temperatures recorded over some IMD stations where moderate to severe heat waves were prevailing

Station	20 th May	21 st May	22 nd May	23 rd May	24 th May	25 th May
Ahmedabad	44.5	45.6	46.8	45.5	45.8	44.9
Deesa	45.2	46.5	47.3	46.0	46.2	44.2
Baroda	44.8	44.4	45.2	44.6	43.2	44.7
Bhuj	44.0	44.8	46.0	43.6	42.4	40.8
Rajkot	43.7	44.7	45.5	44.7	44.3	43.5

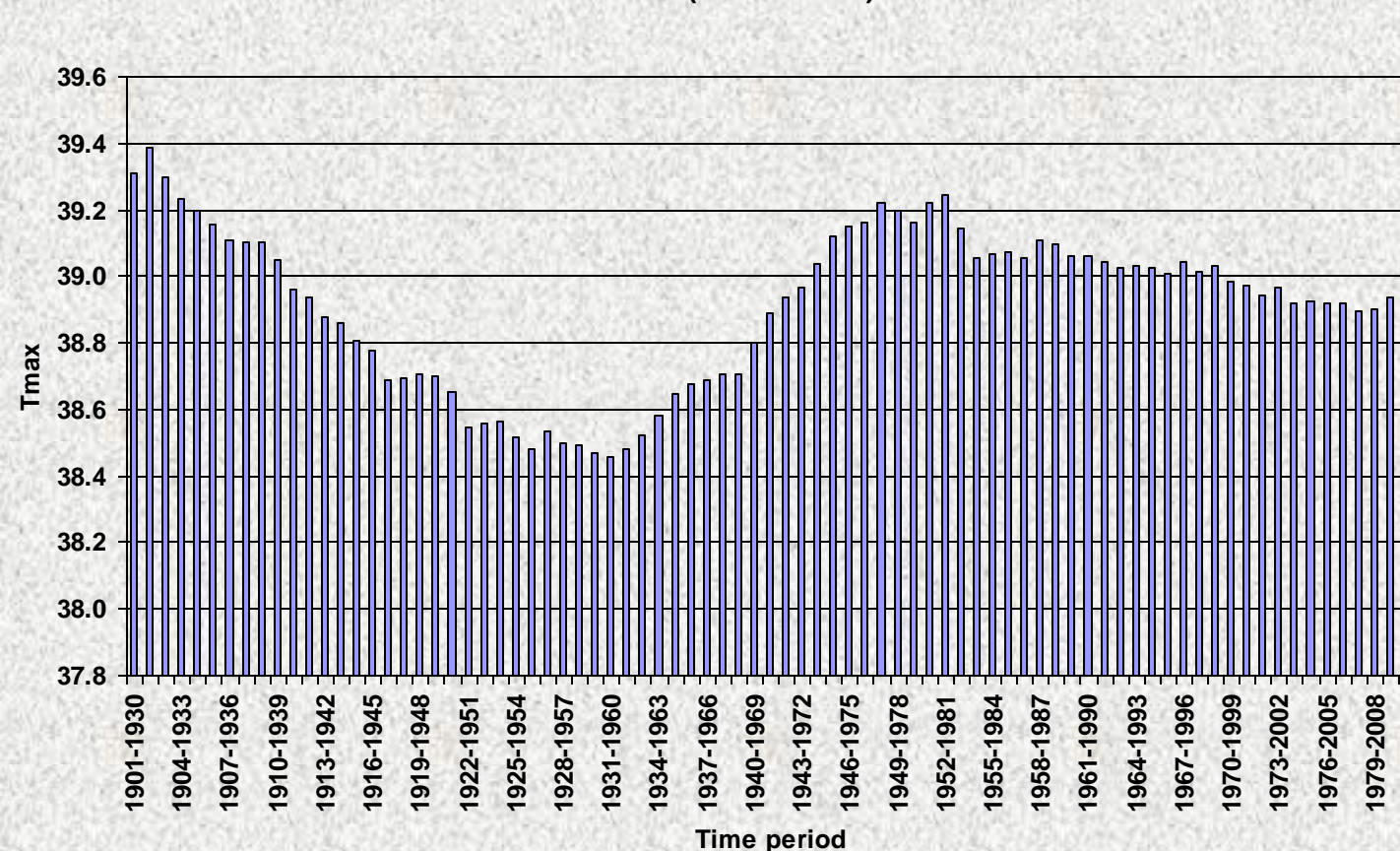
Introduction:

Generally heat waves develop in the north-western parts of India and from this area they progress to neighboring subdivisions of the country. On some occasions, heat waves also develop *insitu*. The favorable factors responsible for severe heat waves are:

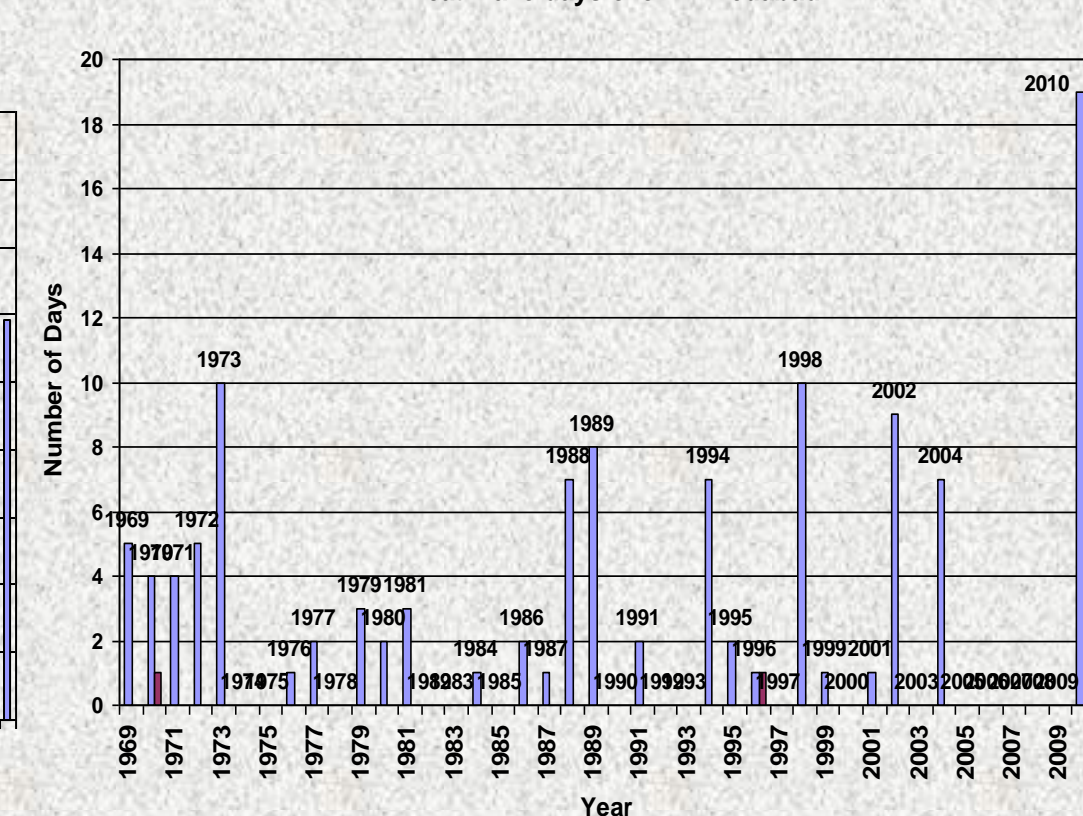
1. There should be a region of warm dry air and appropriate flow pattern for transporting hot air over the region;
2. There should be little or no moisture present in the upper air over the area;
3. The sky should be practically cloudless to allow maximum insolation over the region;
4. The lapse rate should approach dry adiabatic;
5. There should be a large amplitude anticyclonic flow or the thickness should be considerably above normal in all layers.

Hot dry winds blowing across the south-western Thar desert The position of the jet stream allows air on one side to be considerably warmer than the other side.

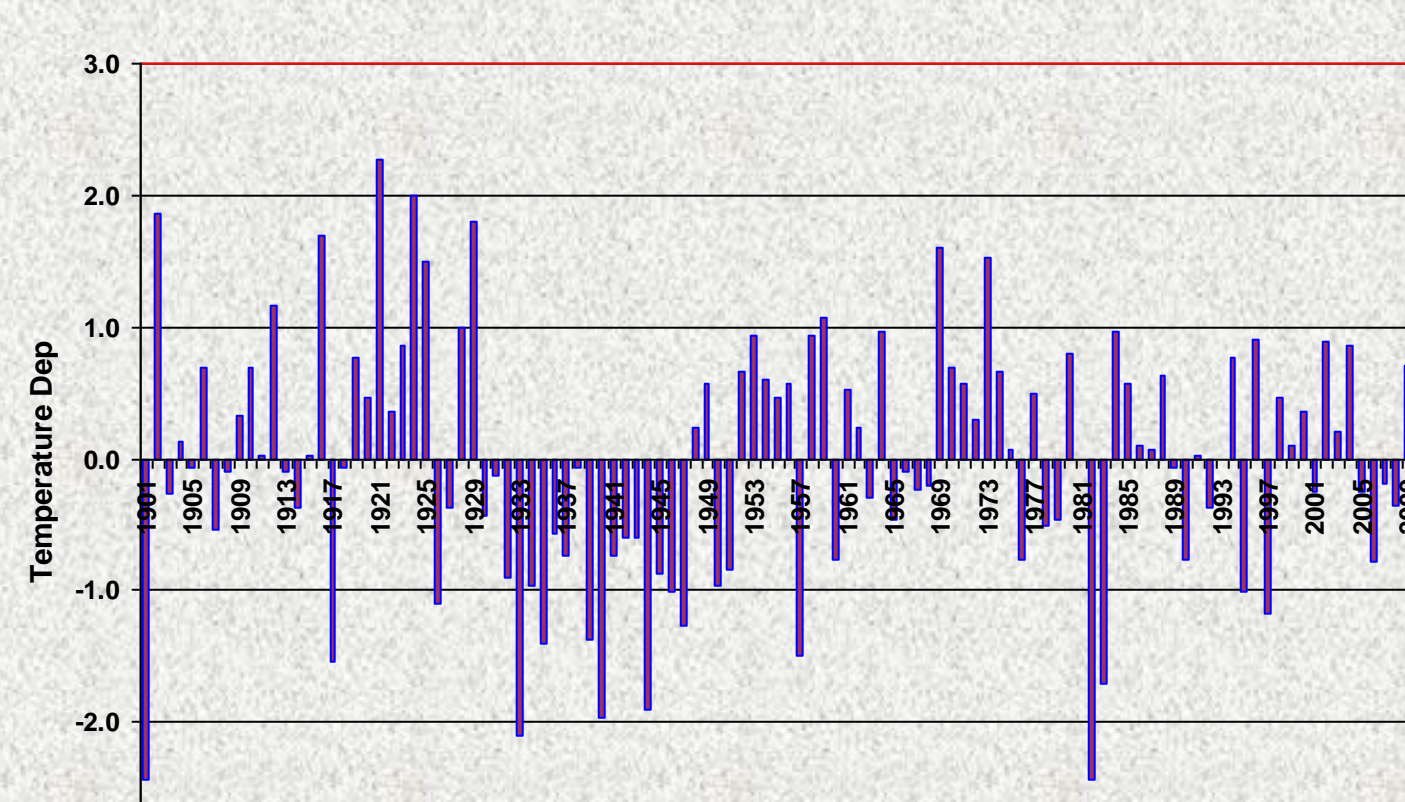
Moving Averages(30 years) of summer Maximum temperature for Ahmedabad for 110 Years (1901 to 2010)



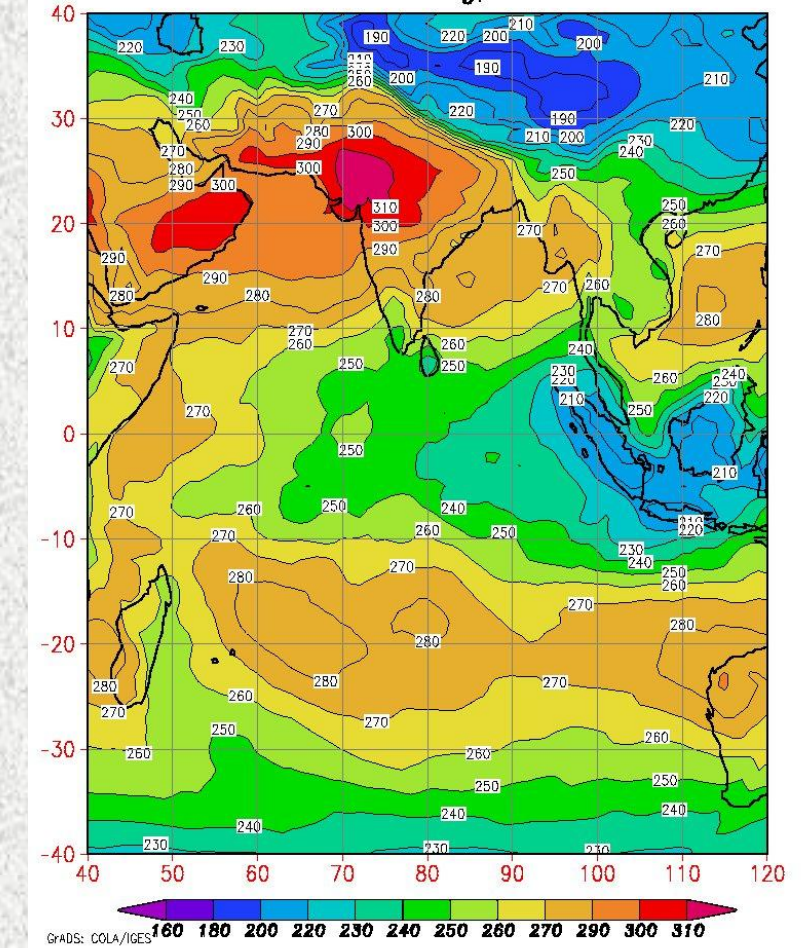
Heat wave days over Ahmedabad



110 Years Maximum Temperature Anomaly in Summer for Ahmedabad



Kaipana Mean OLR (w/m-2) for Pre Monsoon Season March to May, 2010

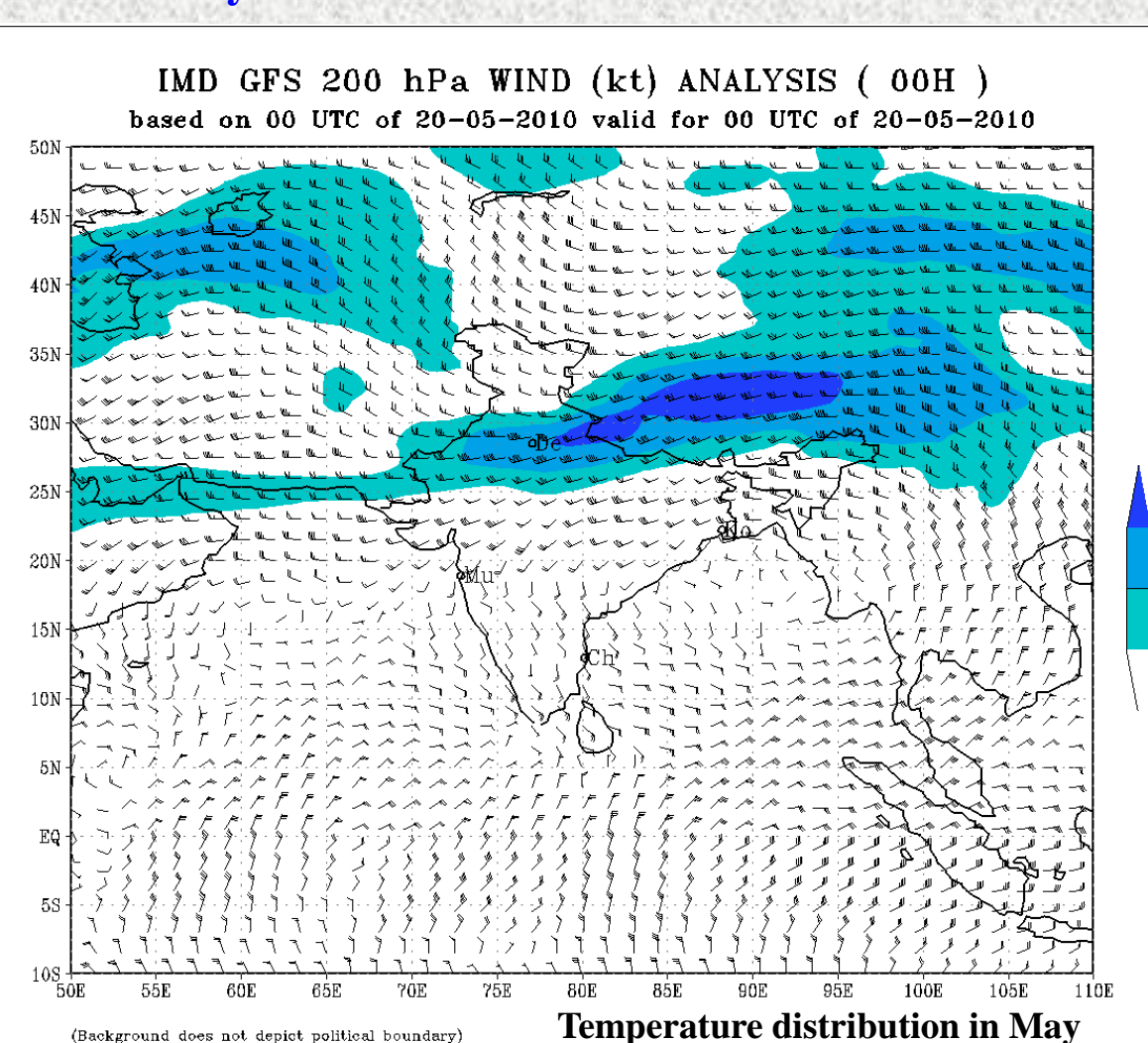
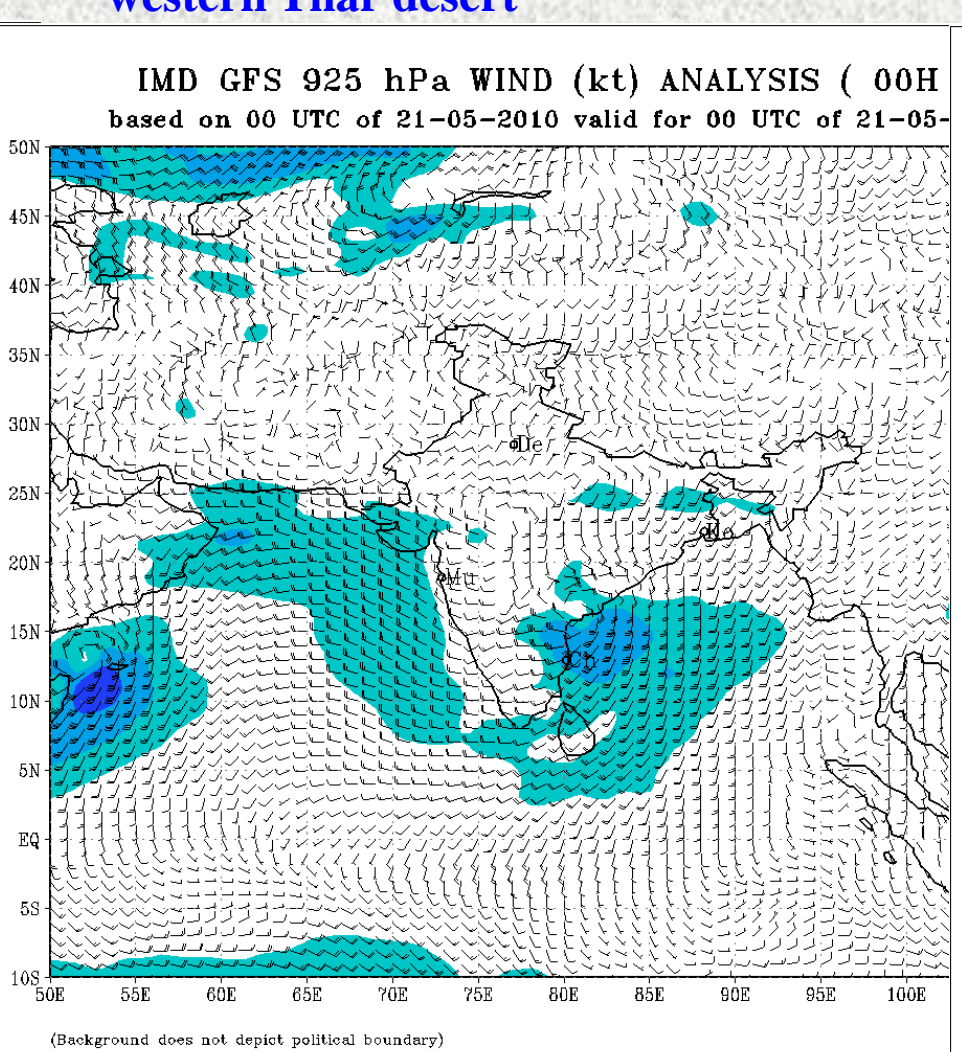
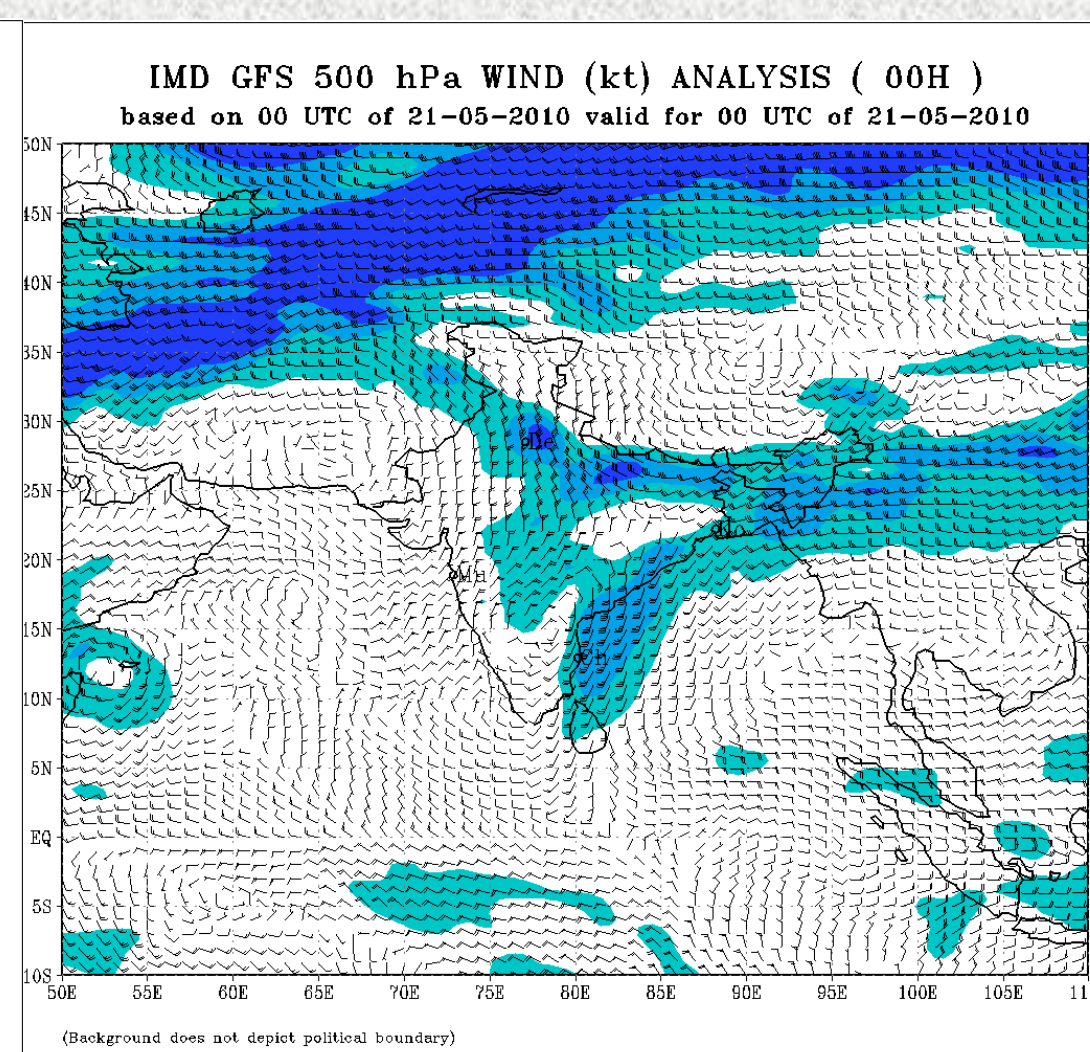
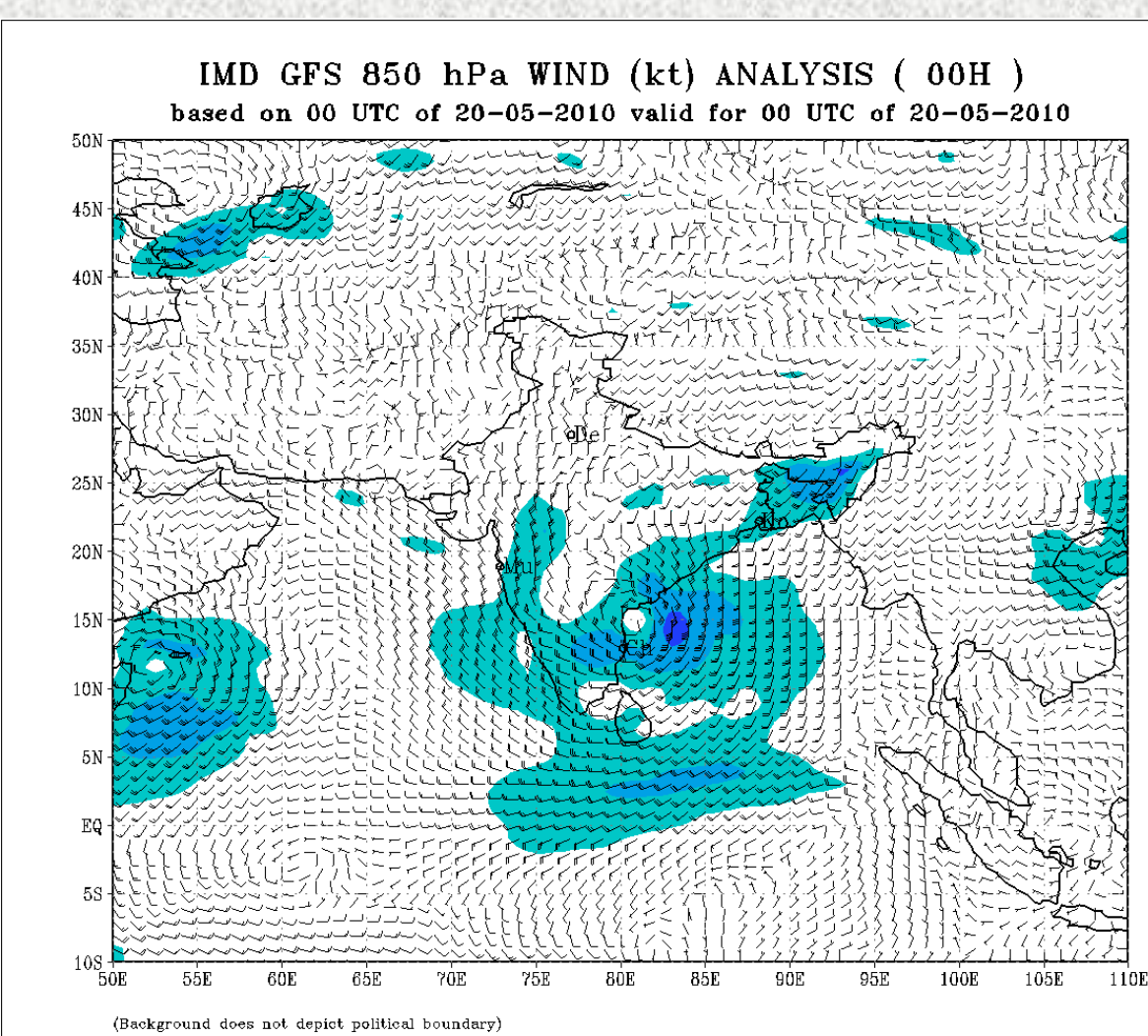


Low Level Northerly winds

Anticyclone over Pakistan and adjoining Gujarat at 500 hPa

Hot dry winds blowing across the south-western Thar desert

The position of the jet stream allows air on one side to be considerably warmer than the other side.



Temperature distribution in May

The record heat was due to :

- Lack of atmospheric humidity,
- Hot dry winds blowing across the south-western Thar desert (Winds from hot deserts typically push hot, dry air towards areas normally cooler than during a heat wave)
- The effects of last year's El Nino cycle.