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Salient features of maximum temperature distribution over Tamil Nadu

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सार - इस शोध पत्र में तमिलनाडु के अधिकतम तापमानों में स्थानिक विभिन्नताओं के अध्ययन का प्रयास किया गया है। 1981 से 1997 तक की अवधि के पहले छः महीनों के तमिलनाडु के ग्यारह स्थानों के दैनिक अधिकतम तापमान के आँकड़ों से यह पता चला है कि वहाँ पर जनवरी से मई तक दो भिन्न क्षेत्र नामतः अंदरूनी भागों में अधिकतम उच्च तापमान वाला क्षेत्र तथा तटीय भागों में अधिकतम कम तापमान वाला क्षेत्र रहता है। तापमान की यह भिन्नता जून के महीने में समाप्त हो जाती है। पर्वतीय स्थान कोडईकनाल में जनवरी से मई तक मे महीनों के दौरान उटकमंडल की अपेक्षा अधिकतम कम तापमान रिकार्ड किए गए हैं तथा जून के महीने में इसके विपरीत तापमान का पता चला है। दक्षिणी-पश्चिमी मानसून वर्षा ऋतु की आरम्भिक अवस्था के समय कोयम्बटूर, पामवन और कन्याकुमारी के अधिकतम तापमान में कमी आ जाती है। बंगाल की खाडी में चक्रवातीय तूफान के समय जब मई और जून के महीनों में तूफान तमिलनाडु और तटीय आँध्रप्रदेश को प्रभावित करता है तब वहाँ के अधिकतम तापमान में गिरावट आ जाती है। इसके विपरीत जब तूफान तटीय क्षेत्रों से आगे बढ़ जाता है तब अंदरूनी क्षेत्रों के अधिकतम तापमान में कमी और तटीय क्षेत्रों के उत्तरी भागों के अधिकतम तापमान में वृद्धि होती है।

ABSTRACT. In this paper an attempt is made to study the spatial variations of maximum temperature over Tamil Nadu. From the data of daily maximum temperature of eleven stations in Tamil Nadu for the first six months from 1981 to 1997, it is observed that there are two separate regions namely high maximum temperature region of interior stations and low maximum temperature region of coastal stations from January to May and the distinction disappears in June. Hill station Kodaikanal recorded less maximum temperature than Ootacamund from January to May and it reverses in June. During onset phase of southwest monsoon, maximum temperature decreases over Coimbatore, Pamban and Kanyakumari. In the presence of cyclonic storm over the Bay of Bengal the maximum temperatures are fallen during the period when the storm affects Tamil Nadu or Andhra coast in May and June whereas when the storms moves farther away from the coast maximum temperature over interior places decreases and increases over north coastal stations.

Key words – Maximum temperature, Highest temperature, Average temperature, Cyclonic storms, T-test, χ^2 -test.

1. Introduction

Daily changes in the maximum temperature during summer months is of immense importance as the general public are greatly concerned about these changes. Joseph and Amatya (1986) concluded that the temperature variation during the last 100 years in the low latitudes especially over south India is almost following the Glessberg cycle in the reverse scale. Sarkar and Thapliyal (1988) found that the warming of 0.4° C has taken place during recent 8 decades. This trend changes from one season to another. In the post monsoon and winter season 0.7° C whereas it is 0.4° C during premonsoon season and slight negative (-0.3° C) during monsoon season. Earlier studies provide information about seasonal and annual variation of maximum and minimum temperature over a sub-division. It is equally important to know the spatial variation within a sub-division. These information will be very much useful for agricultural operation and water management authorities to estimate the loss of water due to evaporation and related other process.

Therefore, 11 stations have been chosen in Tamil Nadu to study maximum temperature distribution for the first six months of the year. Their relationship with southwest monsoon and cyclonic systems over Bay of Bengal have also been studied.

2. Data used and methodology

The maximum temperature data of 11 stations in Tamil Nadu is collected from the daily weather reports of ACWC Chennai for the years 1981 to 1997 for the first six months of the years, as shown in Fig.1. The highest/ lowest maximum temperature are computed for every stations in each month for 11 years. The detailed results

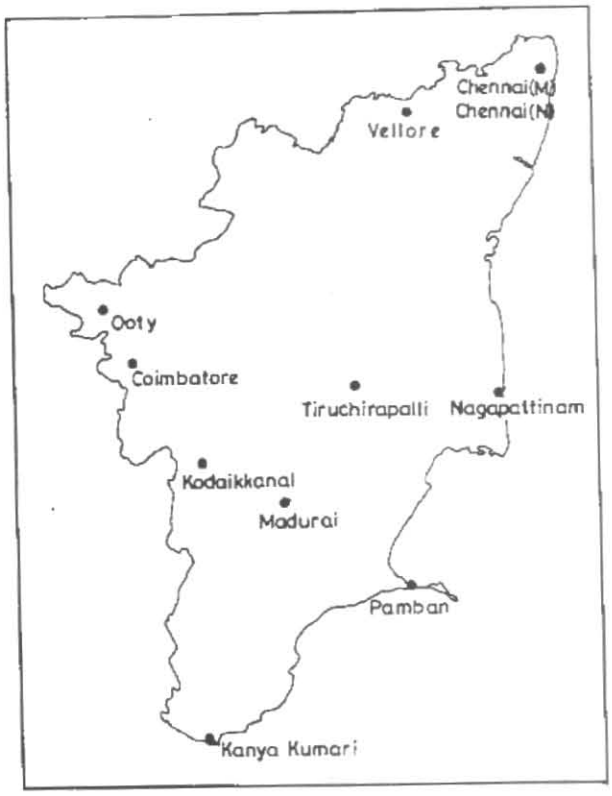
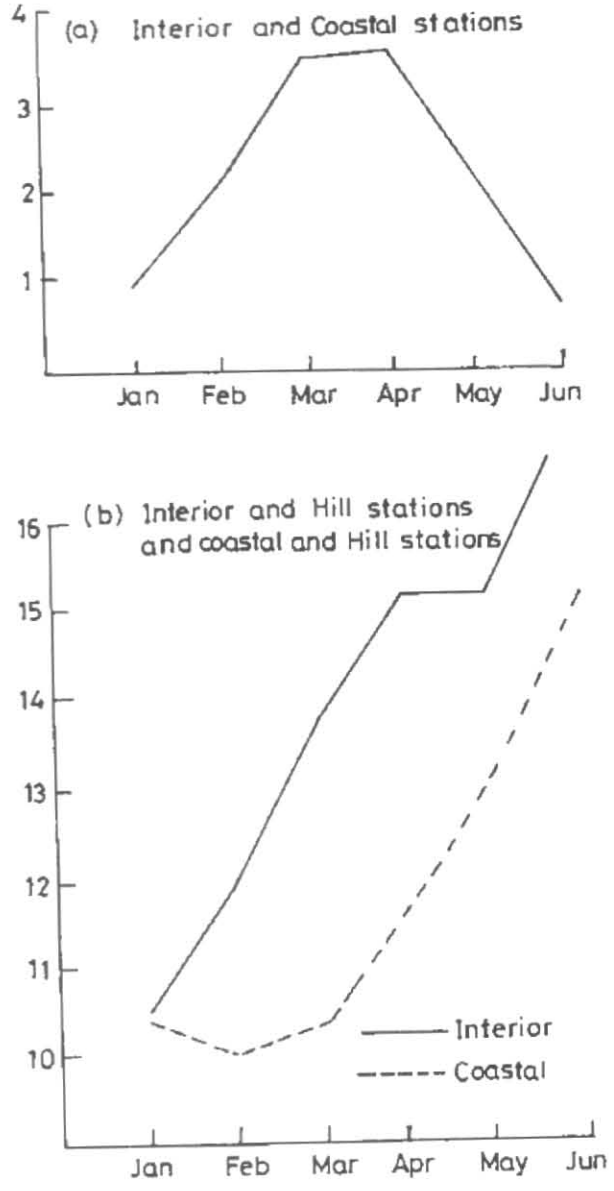


Fig. 1. Location of stations



Figs. 2(a&b). Difference in maximum temperature between (a) interior and coastal stations (b) interior and hill station & coastal and hill station

are discussed. In order to find out the homogeneous region of temperature T-tests were conducted among the station to find out the difference in mean temperatures.

3. Results and discussion

3.1. *The highest and lowest Maximum temperature of the month*

Table 1 gives the highest / lowest maximum temperature of station in each months. In January the highest temperature recorded was 35° C in Coimbatore, Kanyakumari, Madurai, Trichirapalli and Vellore. Over the coastal stations it is 33 or 34 and over hill stations it is 23 in Kodaikanal and 28 in Ooty.

In February the highest temperature of 39° C in Coimbatore and Vellore, the next highest being 38 over Madurai and Tiruchi. Over coastal stations it varies between 34 to 36. In Kodaikanal highest being 24 and in Ooty 27. In March 43° C is recorded as highest temperature over Vellore. The next highest being 41 over Coimbatore, Madurai, Nagapattinam and Tiruchirapalli. Remaining places recorded between 36 to 39° C. Ooty recorded the highest temperature of 31° in this month while in Kodaikanal it is only 25° C. In the month of April also the highest temperature recorded remains to be 43° over Vellore and Meenambakkam. The next highest being 42° over Nungambakkam and Tiruchirapalli. Remaining places it varied between 39 to 41° C. The hill stations recorded 29 and 26° in Ooty and Kodaikanal respectively. In May the highest temperature recorded

TABLE 1

The highest /lowest maximum temperature in different stations in Tamil Nadu from 1982 – 1997 for the first six months of the year

Month	CMB	KYK	KDK	CNI-M	CNI-N	MDR	NGP	PMN	TRY	OTY	VLR
Jan	35/32	35/31	23/19	33/29	33/29	35/31	33/29	34/30	35/31	28/23	35/31
Feb	39/34	34/32	24/21	36/32	35/31	38/35	35/30	34/31	38/33	27/24	39/33
Mar	41/37	36/33	25/21	39/35	37/34	41/38	41/32	39/34	41/37	31/25	43/37
Apr	36/33	41/37	26/22	43/37	42/35	41/38	40/34	39/35	42/38	29/25	43/39
May	41/37	36/33	27/23	43/39	43/39	41/39	41/38	39/35	43/39	28/25	44/38
Jun	38/34	36/32	32/21	43/37	43/37	41/38	41/38	39/34	42/39	27/20	44/38

is 44° over Vellore and next highest temperature of 43° in Nungambakkam, Meenambakkam and Tiruchirapalli. 41° is recorded in May in the stations Coimbatore, Madurai, Nagapattinam. In June highest temperature of 44° is recorded in Vellore. It is observed that in the month of May and June all the plain stations recorded same highest temperature except Coimbatore where the highest temperature less by 3° in June. Over hill stations in May the highest temperatures are 28 and 27° whereas in June they are 27 and 32° over Ooty and Kodaikanal respectively.

It is interesting to note that the difference between mean maximum temperatures of Ooty and Kodaikanal decreases from March to May and in June Kodaikanal recorded 5° more than Ooty [Fig. 2 (a)]. Another interesting thing is that in all the plain stations the mean maximum temperature increased from January to June whereas in Coimbatore it is increased only upto March , becomes steady for two months and decreased sharply in June. In Kanyakumari the highest temperature increased to 39° upto April and decreased to 36° in May and June.

The lowest value in the maximum temperature of the month is also computed for all the stations for the period under study. In January it varied between 29 to 32 over plain stations , 23 over Ooty and 19 at Kodaikanal. In February it varied between 30 to 35 over plain stations , 24 over Ooty and 21 at Kodaikanal. In March it varied between 32 to 38 over plain stations. In April, May and June it varied between 33 to 39 over plain stations, over Ooty it is 25 in April and May, 20 in June, Whereas in Kodaikanal it is 22 in April, 23 in May and 21 in June. In June the lowest value in the maximum temperature of the month decreased in all the stations except in Tiruchirapalli where it is same as that of May.

3.2. *Comparative study between coastal, interior and hill stations*

In order to find out homogeneous region in respect of maximum temperature, χ^2-test was conducted for the mean maximum temperature at all stations. From the χ^2-test it is observed that during January and February the temperatures are homogeneous throughout Tamil Nadu. But during March to May Kanyakumari differs from the interior stations but similar to coastal stations. In June coastal stations especially Nagapattinam, Pamban and Kanyakumari the mean maximum temperatures are significantly not similar to interior station. In same manner Coimbatore and Vellore differs from coastal stations.

In order to differentiate station in terms of mean maximum temperature T-test was conducted for difference in mean maximum temperature among various stations. From the T-test it is seen that January to April the temperature of interior stations are significantly higher than that of coastal stations (excluding hill stations). But the month of May in Coimbatore mean maximum temperature is significantly lower than the rest of interior stations. From the T-test it is clear that the monthly mean maximum temperature among the coastal stations are not different from January to May, Same is the case for interior stations from January to April. The mean maximum temperature recorded at Kanyakumari is significantly lower than rest of the plain stations from April to June. Therefore it can be concluded that from January to April there is separate two homogeneous regions in terms of mean maximum temperature namely low temperature regions of coastal places and higher temperature region of interior places. In the month of June, the demarcation between coastal and interior places disappears, but the stations Coimbatore, Kanyakumari and

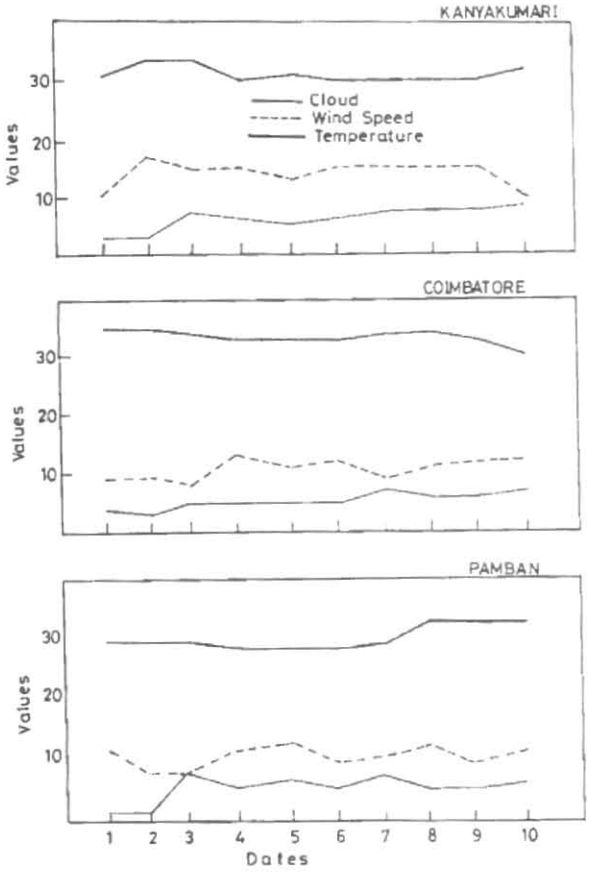


Fig. 3(a). Temperature cloud and wind speed distribution during southwest monsoon onset phase

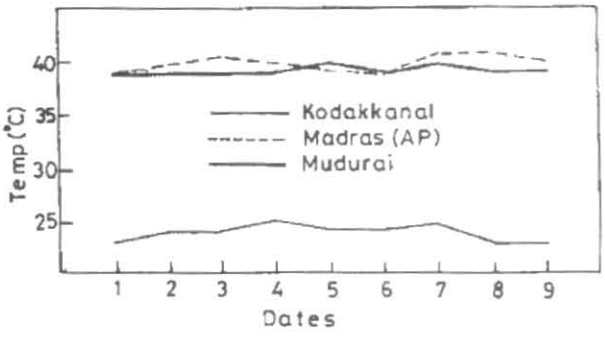
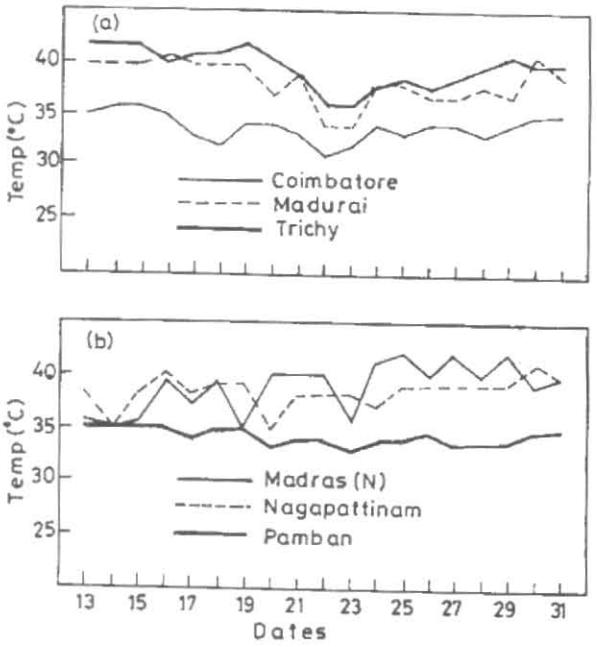
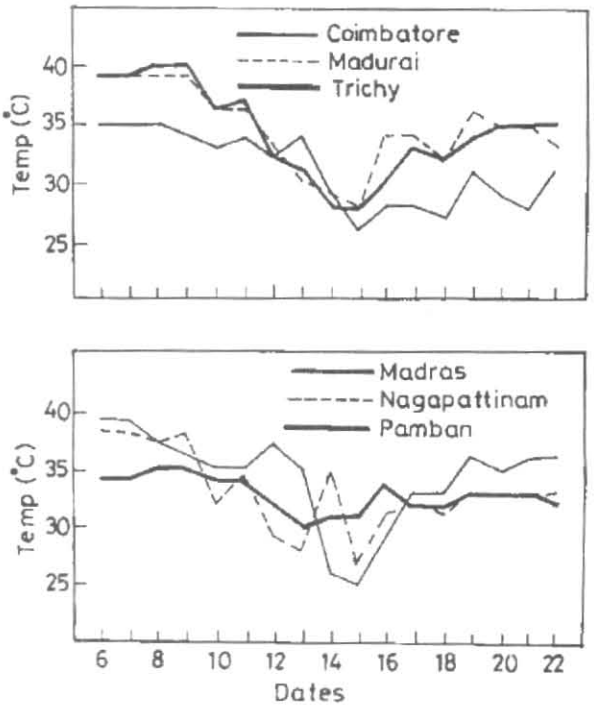


Fig. 3(b). Temperature distributions over interior stations during the southwest monsoon onset phase

Pamban recorded significantly lower temperature than rest of the plain stations. From Fig. 2 (a) it can be noted that the difference in monthly mean maximum temperature between interior and coastal stations gradually increases from January to April and in June the difference becomes insignificant. The difference in mean maximum temperature between interior stations and hill stations



Figs. 4(a&b). Temperature distribution over (a) interior and (b) coastal stations during the May 1989 cyclone



Figs. 4(c&d). Temperature distribution over (c) interior and (d) coastal stations during the June 1996 cyclone

increases from 10.5° in January to 16.1° in June though the mean maximum temperature of interior stations decreases in June. The difference between hill stations

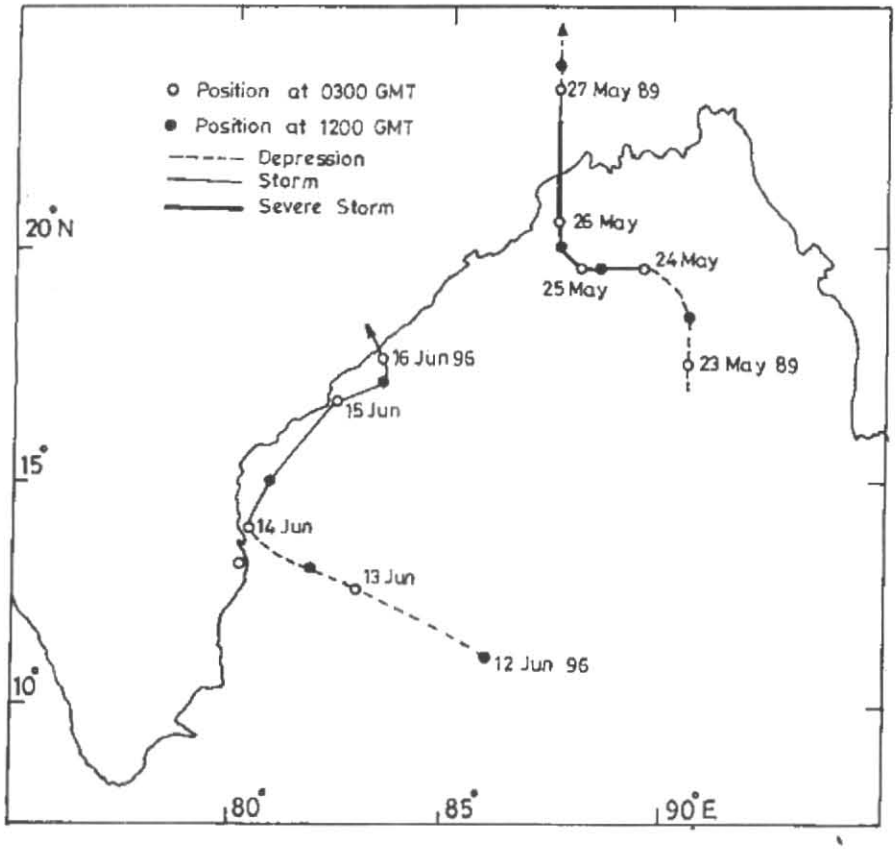


Fig. 5. Tracks of cyclonic storms

and interior stations continue to increase in June because of fall in temperature of about 3° over hill stations. In the same manner the difference between coastal stations and hill stations also increases from 9.6 in January to 15.2 in June. The increase is rather slow up to April but there is sudden increase in May and June Fig.2(b). The reason is the fall in temperature over hill stations in June.

3.3. *Maximum temperature and other meteorological events*

In order to find out the relation between rainfall over Tamil Nadu and mean maximum temperature of interior stations and coastal stations, correlation coefficient have been computed. The correlation coefficient between interior stations monthly mean maximum temperature and Tamil Nadu rainfall is negative and significant in all the months except in March and June. As regards the coastal stations mean maximum temperature and Tamil Nadu rainfall, the correlations are insignificant in the first four months and significantly negative in May and significantly positive in June.

The reason for negative correlation coefficient between mean maximum temperature of interior stations is trivial by the fact that during the rainy days due to cloudy sky, the maximum temperature likely to fall down. The reason for the negative correlation coefficient between the mean maximum temperature over the coastal stations and Tamil Nadu rainfall can also be explained as above. But the reason for the positive and significant correlation coefficient in the month of June is due to the fact that the higher the maximum temperature the more chance for convective activity is possible over Tamil Nadu during evening or night which reflects the positive correlation.

It is also observed that during the onset phase of the monsoon the maximum temperature in Kanyakumari, Coimbatore and in Pamban decreases [Fig.3(a&b)]. While studying the reason for the decrease in temperature during onset phase of the southwest monsoon the correlation coefficient between maximum temperature and cloud amount and that of between maximum temperature and wind speed have been computed for the above stations . It is found that the correlation coefficient of Kanyakumari

and Pamban are not significant whereas in Coimbatore it is significantly negative for both cloud amount and wind speed. That is fall in maximum temperature in Pamban and Kanyakumari is neither due to increase in clouding nor due to high wind speed but due to cold monsoon current. In Coimbatore the fall in maximum temperature is associated with both increase in clouding and surface wind speed. But in other stations the air gets modified while travelling on the lee side of the mountain and therefore the monsoon current during initial phase does not affect the maximum temperature to fall systematically. Over the hill stations Ooty recorded a decrease in maximum temperature during the onset phase. The temperature at Kanyakumari decreases about 2 to 3 days earlier to the onset date.

An attempt is made to relate the change in maximum temperature in the presence of cyclonic disturbance in the Bay of Bengal. It is observed that when the storm comes closer to Andhra Pradesh or Tamil Nadu coast, all the stations in Tamil Nadu show a decrease in maximum temperature. But when the storm moves northwards at longer distance, the maximum temperature over interior stations in Tamil Nadu decreases whereas in the north coastal stations the maximum temperatures increase. An example is given in respect of the years 1996 and 1989 [Figs.4 (a-d) & Fig. 5]. But during stormy situation in the month of January and February they does not exhibit any significant change in maximum temperature.

4. Conclusions

(*i*) There are two uniform region, of maximum temperature, low temperature region (consisting coastal stations) and high temperature region (consisting of interior stations). But in June this distinction disappears. In the month of May mean maximum temperature of Coimbatore is significantly lower than the rest of the interior stations.

(*ii*) The difference between the average mean maximum temperature of interior station and that of coastal stations increases from January to April and in June this difference is insignificant. Similar difference between hill stations and plain stations increases from January to June and the difference is much higher in June.

(*iii*) The maximum temperatures fall when the cyclonic storm from the Bay of Bengal affects Tamil Nadu or Andhra coast in May and June. When the storms moves farther away from the coast, maximum temperature over interior places decreases and increases over north coastal stations.

(*iv*) During onset phase of southwest monsoon maximum temperature over Coimbatore, Kanyakumari and Pamban decreases. The decrease is advanced by two to three days ahead of onset in Kanyakumari.

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