



## ESTIMATING SEASONS STARTING POINT TIME AS A RESULT OF CLIMATE CHANGE IMPACTION

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### Abstract

The temperature is considered the main variable that controls other variables and it has important impact on air mass movement and rain formation, as well as its impact on climate behavior in several countries (McCarthy, Canziani et al. 2001). This paper method depends on real, huge data obtained from measurement that carried out for long time, which extended from the middle of the past century to the starting period of the current century 1940-2010 in about 70 years of average temperature over Baghdad city.

After calculating and plotting results of different months; the results show that the mean temperature varied in smaller perturbation through the first six decades (1940-2000), but it increased after that period, to record the unreturned point. The results, also, show that in summer and spring seasons the temperature change shifted back to the earlier time in comparison to the first period of study, which may cause the early sense of summer before its normal time, especially in the last period of study. In common way, the study shows that the behavior of temperature is very different from the past, and this may lead to a large variation in the future.

### Introduction

The study of a variable needs a large value of data to be examined, and the temperature is considered the most important variable on seasonally and climatologically level, as it corresponds with other atmospheric variables directly and indirectly (Hsiang 2010). The helpful thing in this study is the availability of data.

The radio sound data is commonly used to measure atmospheric variables for upper atmospheric layer, so most of works insist on three main variables which are atmospheric pressure, temperature and wind speed, and this work mainly depends on the surface temperature. The impact of the climate change became noticeable especially in last decade, and this change had a large impact on human life (Karl, Melillo *et al.*, 2009).

The most important variable that can be interesting, is the temperature because it has a direct impact on the earth's surface, and its values have been clearly increased, which caused a large impact. It is important because the climate change has a global scale and represent a real danger on fields of life (Shupe and Intrieri 2004).

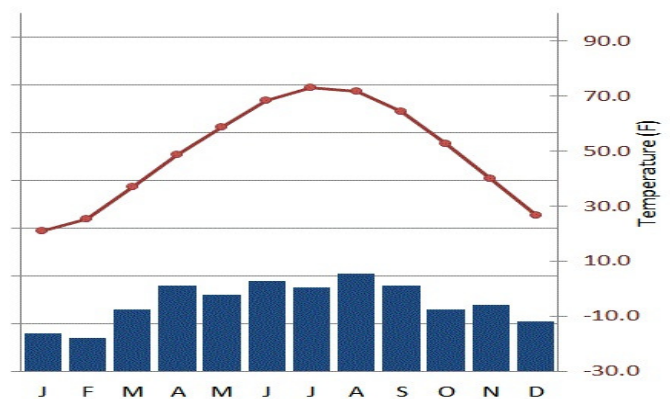
The studies showed that there is a direct relationship between the upward IR and the temperature, and inverse proportion between the upward IR and CO<sub>2</sub> concentration, which has a large impact on temperature and its impact on global warming (Bazzaz 1990).

The meteorological data records gained a great attention from many decades, and this will be helpful for future studies, so this study depends on calculating data of mean temperature for selected periods obtained from a group of data for seven decades. The temperature is vary harmonic over the years of study, due to the solar radiation that is shown in figure(1), but this change became different from the past because of climate change (Broccoli and Manabe 1987).

### Material and Methods

The mean surface temperature has been studied for Baghdad city by making statistical calculation for huge number of climate range data. The study extends from 1940 to 2010 and it also depends on statistical method to calculate the monthly means for every year. Besides, calculating the

monthly mean for every decade of study which is seven decades to show the variation of temperature between past and present.



**Fig. 1 :** Typical Monthly Change in Mean Temperature in one Year (Ahrens 2011) .

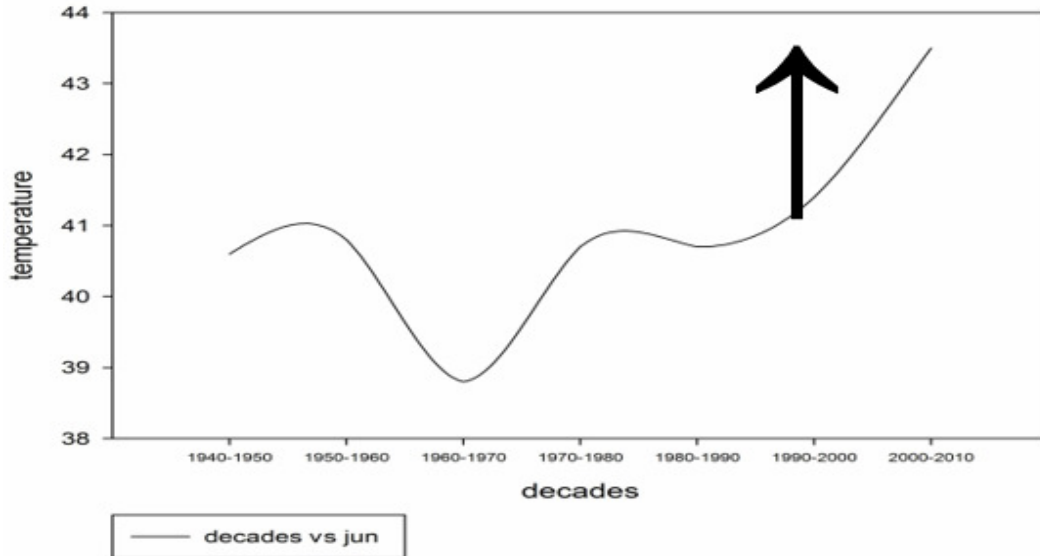
### Result and Discussion

The results show, after doing all calculations, there is a simple fluctuation in temperature values in the first six decades, which is for the period 1940-2000. Table (1) shows that the value of mean temperature has been clearly increased in the last period of the study 2000-2010. Also, it is shown that there is no any value in this decade below others in comparison to the previous decades of the study. For example, we see that the value of mean temperature in the first six decades for March is fluctuated between (18.8-25), but it reached its maximum recorded value (26.1) in the last decade. If we examine June values, we find them don't exceed (41.4) but its recorded values jumped to a large value in last decade of study (43.5), and so on for the rest of months.

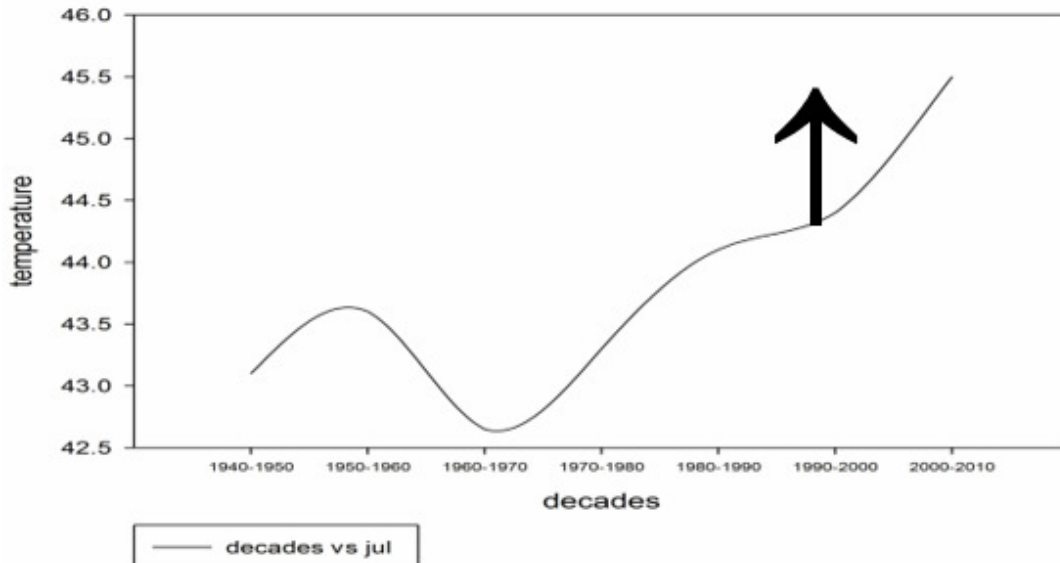
It is worth to mention that the mean temperature value recorded a higher increase in the last decade especially in summer seasons. Figures(2), (3) and (4) show that for the months June, July and August had large jumps in their mean temperature value in comparison to other months such as March, for example, figure (5). This could be because of the impact of climate change is clearly influential in summer seasons, whose the largest temperature effect.

**Table 1 :** Temperature Values from 1940-2010, and the Monthly Mean for every Ten Years

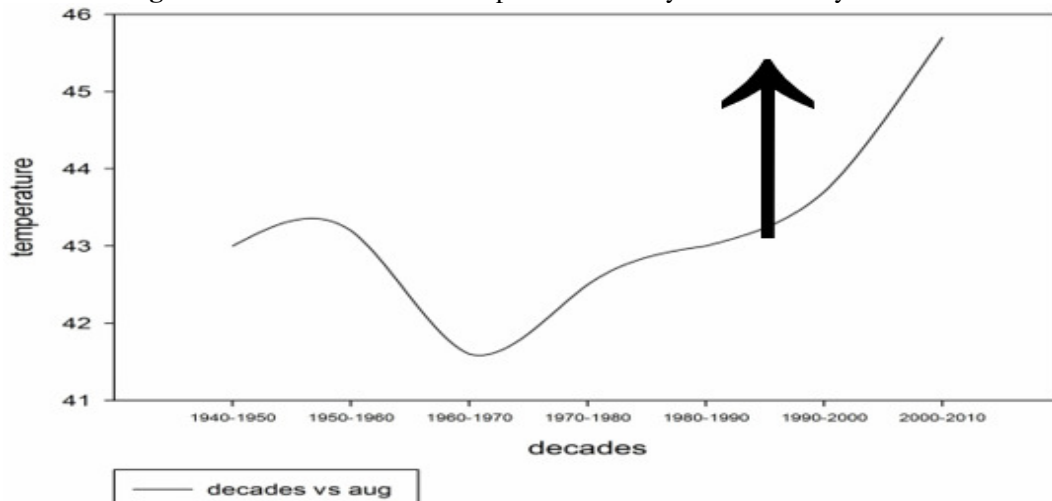
Decades	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1940-1950	15.4	18	23	29	36	40.6	43.1	43	39.8	33	24.7	17.8
1950-1960	16.2	19.3	25	31.2	37.2	40.8	43.6	43.2	39.8	34.8	24.2	17.8
1960-1970	16.1	17.4	21.5	27.6	33.2	38.8	42.65	41.6	39.09	33.9	23.2	17
1970-1980	14.6	18.8	23	28.9	36	40.7	43.3	42.5	39.4	33.5	23.6	16.9
1980-1990	15.6	17.9	22.5	29.9	36.1	40.7	44.1	43	40.2	32.4	23.5	16.9
1990-2000	15.8	18.8	24.2	30.1	36.6	41.4	44.4	43.7	40.3	33.5	23.7	17.4
2000-2010	16.3	19.8	26.1	32.2	38.3	43.5	45.5	45.7	41.2	34.2	25.7	18.6



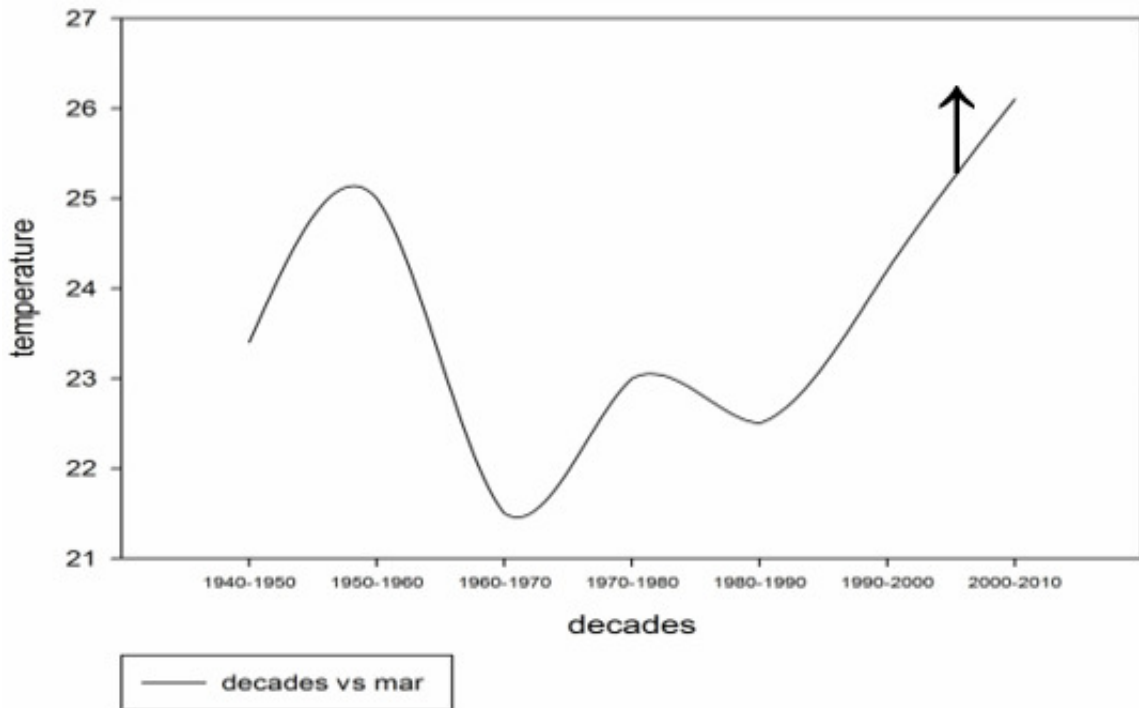
**Fig. 2 :** Increment Variation Temperature for June over the Study Decades



**Fig. 3 :** Increment Variation Temperature for July over the Study Decades



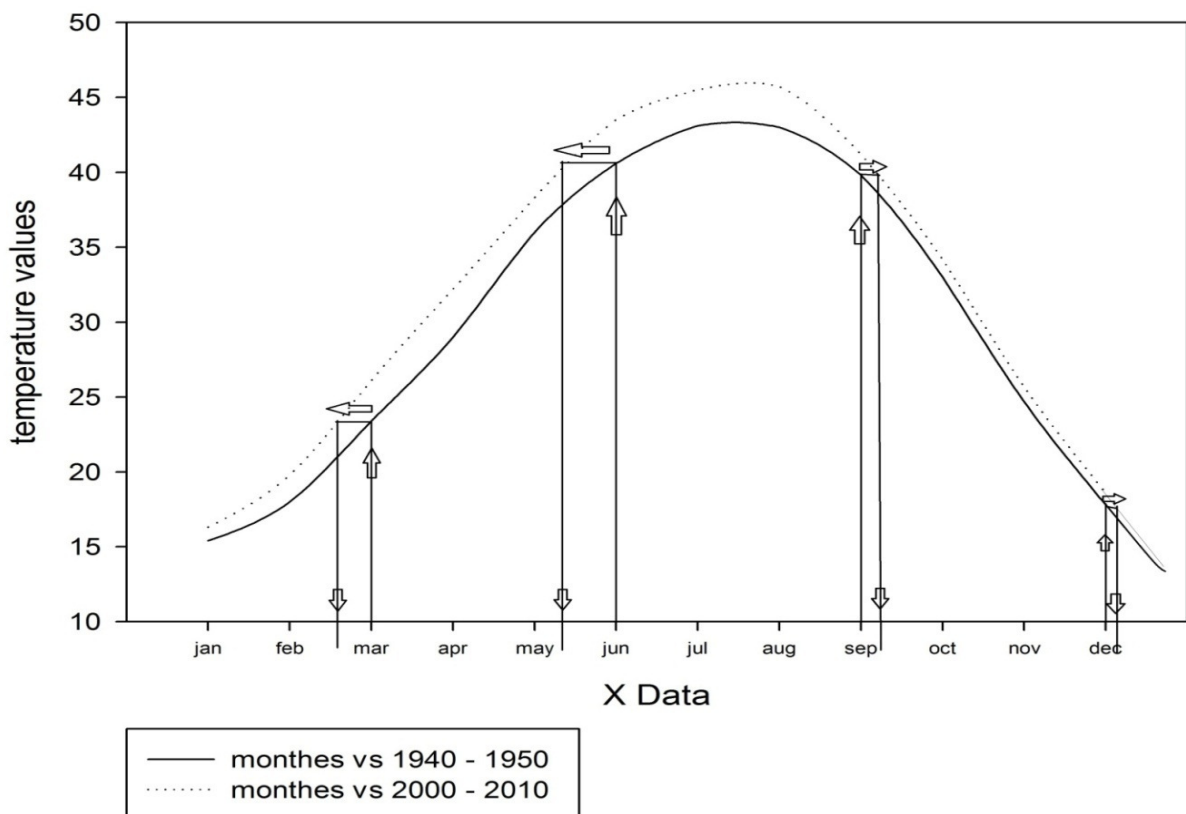
**Fig. 4 :** Increment Variation of Temperature for August over the Study Decades



**Fig. 5 :** Increment Variation of temperature for March over the Study Decades

In order to clearly show the impact of temperature value change, we must compare data for long range by making a comparison between far past and nearest period of study, and this exactly applied from the first decade of the study that extended from 1940-1950 until the last period of the study that lasted from 2000-2010, which show the large gap and the variation in temperature values. Therefore, figure (6) shows two lines, each one of them show the behavior of temperature in the selected decade.

temperature variation between decades (1940 and 2000)



**Figure 6 :** Comparison of Annual Mean Temperature between the 1<sup>st</sup>decade and the Last Decade

However, by making these diagrams, we can see the clear increase in temperature over all months of the year, and there is no crossing between lines as well, which means there is no equal two values of temperature. The results shown in figure (6) illustrate that the maximum increase is in summer value; in the middle of the year, which is greater when compared to other months of the year. Similarly, the result show there are time laps in arriving of four seasons by showing months that come with winter and summer solstice and also spring and autumn equinox, where the maximum variation is in June, which obviously means the starting of summer. Hence, we can see that the temperature value in first decade from (1940-1950) equals (40) degree but it is the same value for the last period (2000-2010) in the middle of May, so we can conclude that summer season may start early

in as comparison to the past in approximately about (15) days or more, table (2).

While winter, figure (5) and table (2), has a delay in the intensity of decreasing temperature in a period of about a week for ten years as compared with the past for a typical period, which means there is a delay in winter season start. In addition, there is a similar behave of spring and autumn months equinox, where we see, for instance, in September there is a delay in decrease of temperature but we see that the increase in June is coming early of time in about (15) days. In sum, from all that we can conclude that summer and winter intensity became not as in the past exactly and this shift may increase then forbid us from depending on the typical times for winter and summer seasons start.

**Table 2 :** Comparison between temperature value for the beginning of four seasons and the value of time shifting.

Approximately time point for past and present	Temperature for decade (2000-2010)	Temperature for decade (1940-1950)	Months
Before typical point in approximately 15 days	26	23	March
Before typical point in approximately 20 days	44	40	July
after typical point in approximately 7 days	41	40	September
after typical point in approximately 6 days	18	17	November

### Conclusions

Ultimately, temperature values are affected by global climatic change over Baghdad city, where there is an interaction between temperature values and time over climate range, because it deflected from its values of natural fluctuation, while it reaches the last decade of study (2000-2010). The results show that there is a time point at which there is no decreasing in temperature values as compared with the past values and become more increasing at the location of study. Also, the results show that the largest increasing variation is seen at warmer months in summer as compared with other months of the year.

In the meanwhile, the results show that there is a shifting in spring and summer seasons start, where summer season can start before its typical time in about (20) days earlier, and for spring season it starts before its typical time in approximately (15) days earlier. Whereas, for winter and autumn seasons they start later than their typical time for (10) days due to temperature degree. All the above-mentioned facts and calculations are clearly shown in the diagrams and tables in this work.

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