Fluctuating Temperatures as one of the Important Causes for Desertification in Iraq

S. M. Ali, Alaa S. Mahdi, Qutaybah M. Hussan[(a)] & Fadia W. Al-Azawi[(b)]
(a) University of Baghdad-College of Science- Remote sensing unit, Ministry of Agricultural and
(b) College of Dijlla, Department of Optics Technology
deanoffice@scbaghdad.edu.iq
Phone: 009647711176231

Abstract

Desertification is regarded as one of the most problems over the entire world. There are many climatic factors leads to desertification. Temperatures degree is one of the important parameters. Temperature data were taken from the Iraqi metrological department. In this paper the climatic data and geographical information system (GIS) were used to study and provides GIS maps for Iraq. To achieve these study different climatic stations distributed around the country was taken. The approach used in this research is based on minimum, maximum and mean temperature for the duration data from 1990 to 2011. The full Iraq photomap of Landsat TM (bands 1, 3, 5) with 28.5m in spatial resolution was used to overlay the results. The output of research was excelling tables and GIS map that locates the variation of temperatures all over the years for the stations used.

1-Introduction

Desertification is land degradation in arid, semi-arid and dry sub-humid areas. These phenomena started spreading worldwide at high speed since the second half of the last century. United Nations reports indicate that about 35 million square kilometers of land are subject to Desertification effects [1]. It becomes a serious problem in Iraq. Peoples are directly affected by desertification and one billion people in over 100 countries are at risk. Fighting desertification is essential to ensuring the long-term productivity of inhabited drylands [2].

To study temperature as one of the climatic factors that related to desertification, temperature data were taken. They are missing data in some months or in some stations, first these values were estimating by used SAS program then statistical study and geographic information maps (GIS) were done.

2-Study area

Iraq lies between latitudes 29° and 38° N, and longitudes 39° and 49° E (a small area lies west of 39°). According to FAO (1984), Iraq, with a total area of 438 320 km² including 924 km² of inland waters, is surrounded by Iran to the east, Turkey to the north, Syria and Jordan to the west, Saudi Arabia and Kuwait to the south, and the Persian Gulf to the south-east. Iraq mainly consists of desert but near the two major rivers (Euphrates and Tigris) are fertile alluvial plains. Topographically Iraq is shaped like a basin, consisting of the Great literally, the land between two rivers. This plain is surrounded by mountains in the north and the east, which can reach altitudes of 3 550 m above sea level, and by desert areas in the south and west, which account for over 40% of the land area. For administrative purposes, the country is divided into 18 governorates, of which three are gathered in an autonomous region [3].

The local climate is mostly semi arid, with mild to cool winters and dry, hot, cloudless summers. The northern mountainous regions have cold winters with occasional heavy snows, sometimes causing extensive flooding.

It is estimated that 26% of the total area of the country estimated to be used for agriculture is 8 million ha, which is almost 93% of the cultivable area [3].

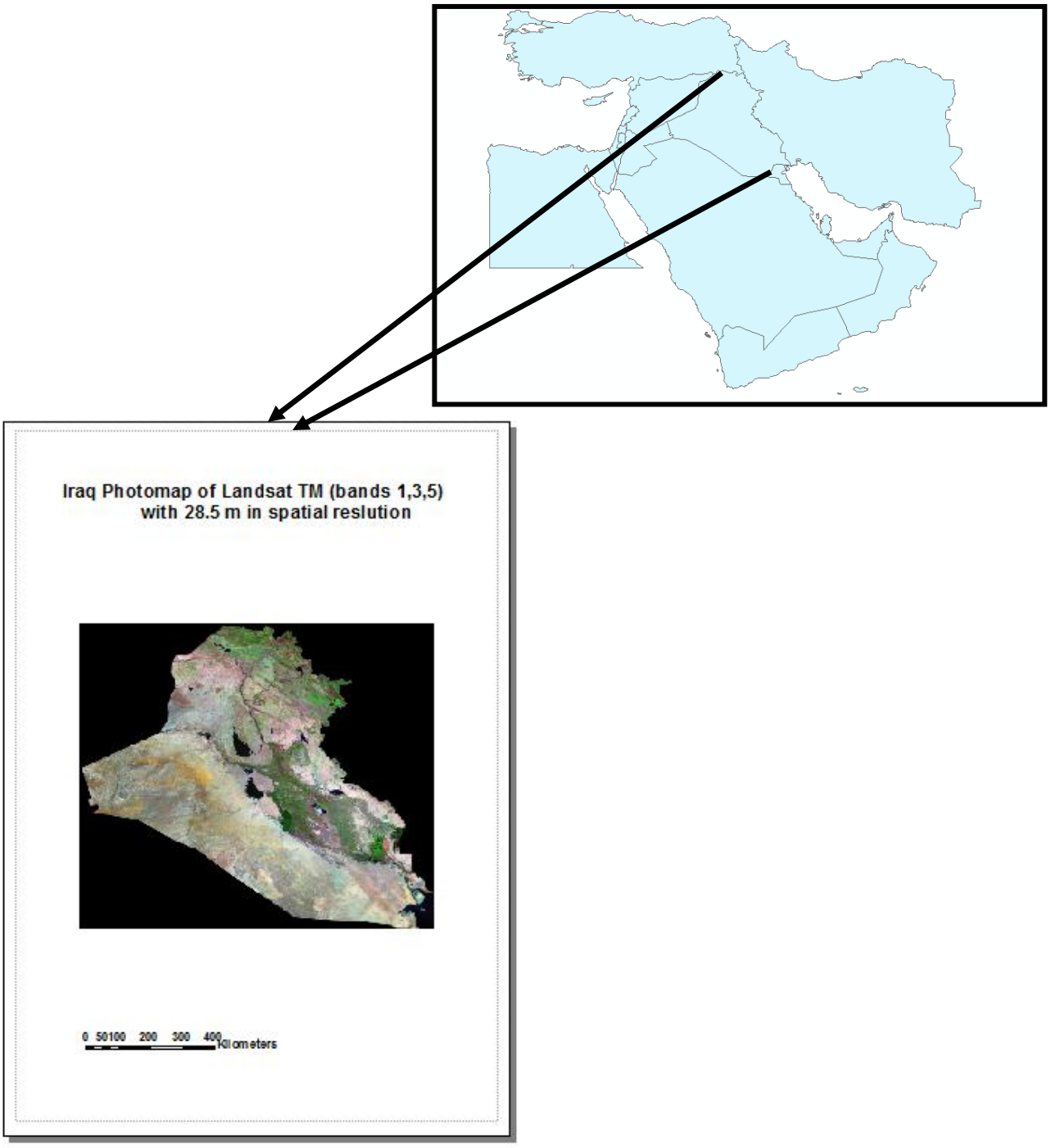

Figure (1):- The study Area, Iraq

3-Methods

First the data rearranged and the missing values estimated by using SAS program. As a general rule, SAS procedures that perform computations handle missing data by omitting the missing values. Second statistical study was done to calculate the mean ($\mathbf{Y}^-$) and the standard deviation (SD) for the monthly values and for different years. The mean is obtained by dividing the sum of observed values by the number of observations (N) [4]. Although data points fall above, below or on the mean it can be considered a good estimate for predicting subsequent data points. The formula for the mean is given by equation (1).

$$\mathbf{Y}^- = \sum y_i / N \quad \text{..... (1)}$$

Standard deviation (σ) shows how much variation exists from the average (mean or expected value). A low standard deviation indicates that the data points tend to be very close to the mean; high standard deviation indicates that the data points are spread out over a large range of values. The formula for (σ) is given by equation (2).

$$\text{S.D} = \sqrt{\frac{\sum(Y_i - \bar{Y})^2}{n-1}} \quad \text{..... (2)}$$

Third GIS is the tool that provides to issuance the output of this research. GIS was used to issuance the output of this study. Inverse Distance Weighted (IDW) interpolation is chosen to establish the maps [5].

4-Results and discussions

Relations between the three factors (Months, Years and Stations) as the following:-

Table (1):- Effect of month in temperature C^0 (mean and SD)

NO.	Month	Mean = Y^-	SD
1	Jan.	12.13	7.36
2	Feb.	14.13	6.50
3	March	18.03	4.86
4	Apr.	23.78	4.33
5	May	29.46	3.13
6	Jun	33.63	2.74
7	July	36.03	2.49
8	Aug.	35.75	2.59
9	Sep.	31.83	2.51
10	Oct.	26.55	3.31
11	Nov.	18.70	4.86
12	Dec.	13.75	6.41

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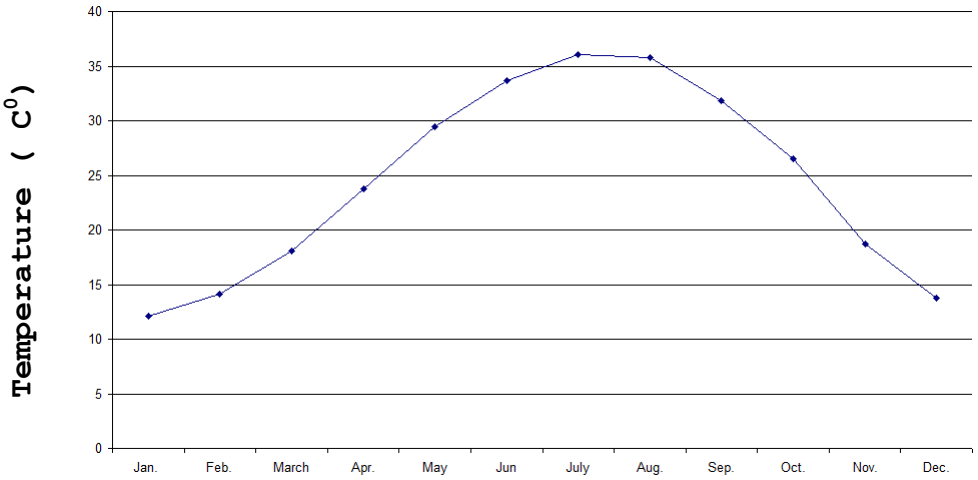

Months of the year

Figure (2):- Variation of temperature according to month

Table 2:- Effect of year in temperature C^0 (mean and SD)

NO.	Year	Mean = Y^-	SD
1	1990	23.45	9.19
2	1991	23.16	9.39
3	1992	22.48	10.54
4	1993	22.90	9.53
5	1994	23.83	9.14
6	1995	23.31	9.00
7	1996	24.15	9.16
8	1997	22.96	9.46
9	1998	26.23	10.18
10	1999	24.64	9.19
11	2000	24.32	9.83
12	2001	24.48	9.31
13	2002	25.08	9.34
14	2003	24.95	9.11
15	2004	24.71	9.02
16	2005	24.08	9.22
17	2006	32.30	10.25
18	2007	24.64	9.98
19	2008	24.49	9.97
20	2009	24.42	9.01
21	2010	26.04	9.06
22	2011	23.57	9.96

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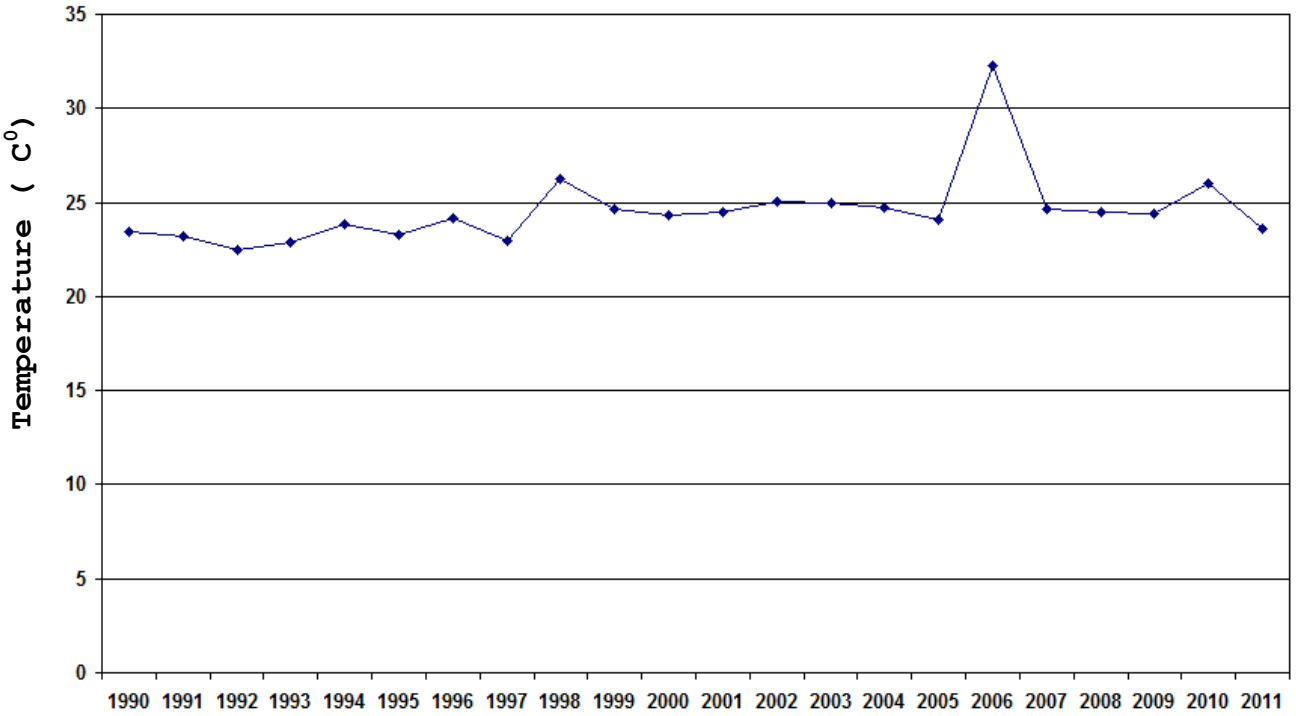

Figure (3):- Variation of temperature according to year

Table (3): Effect of Station in temperature C^0 (mean and SD)

NO.	Station	Mean = $\bar{Y}$	SD
1	Mosul	20.74	9.58
2	Kirkuk	23.63	9.74
3	Ramadi	23.30	9.08
4	Khanaqin	24.59	10.02
5	Baghdad	23.98	9.37
6	Kerebala	24.54	9.41
7	Najaf	25.63	9.53
8	Nasrya	26.14	9.07
9	Basra	28.29	9.45

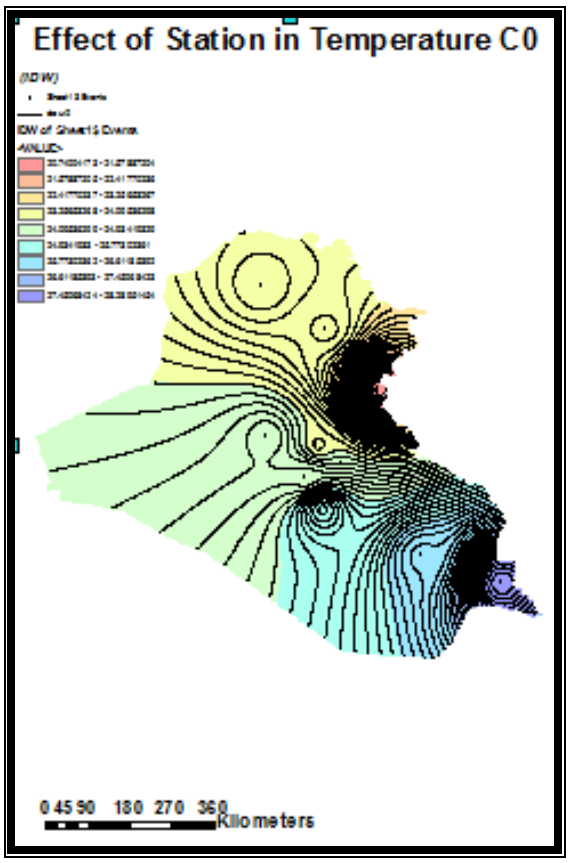

Figure (4):- Effect of station in temperature

From the mean and standard deviation calculations, we can conclude that there is a variation in temperatures among the study years (1990 – 2011) this variation leads to variation in the climatic and to the desertification. Temperatures range from an average July maximum mean (36.03) ^{0}C to an average January minimum mean (12.13) ^{0}C. Temperatures warm quickly once rainfall begins to taper off and skies clear of the last storm clouds. Because of the arid atmosphere, the diurnal temperature spread between daily highs and lows spread as rainfall slows and then stops. Summer is hot and dry throughout Iraq and the desert is the hottest part of the country. Diurnal temperature spreads are the widest of the year in summer because the air is so dry it cannot retain heat after sunset.

5- Conclusion

There is a relation between the three factors which used to perform this study (months, years and stations). The different in (mean and standard deviation) values among the month and the different in mean values among the year and their relation with the stations. From these relations the most desertification station can be determined as Basra station with a mean of temperature (28.29) ^{0}C and standard deviation (9.45). Basra station is the hottest station according to these results.

6- References

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