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The Climate Assessment of Iraq Region

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Abstract
In this work we have access to weather map for the area of Iraq, this work is of great importance, especially in the field of future planning and management of projects and resources as well as agriculture in Iraq. The climate assessment of the area of Iraq has been done in multiple ways to reach a clear conception of the nature of the climate in Iraq. We used the data of the last 15 years to achieve stable results. The Information was put in the form of grid points and has been processed by MATLAB program.
Keywords: agriculture, atmospheric sciences, climate classification, drought, precipitation.

1. Introduction

Climate is the most important components of the environment where humans live, because of its effect on humans comfort and health In addition to the economic impact, agricultural challenge, and all other humans' activities. So for all these reasons, climate had to be studied and classified so that human life can be more advanced. There are many studies dealing with climate classification as in climate change (Marius Lungu.et.al. 2011) they tried to study drought risk as climatic phenomenon in DOBRUDJA, (Marius and Liliana 2011) and (P. Frich.et.al.2002) tried to study the coherent changes in climatic extremes during the second half of the 20th century where the authors choses 10 indicators of extreme climatic events, defined from a larger selection that could be applied to a large variety of climates (P. Frich et al. 2002). On the subject of agriculture (Jorge Tonietto 2003) tried to put climatic classification system for grape-growing regions worldwide by using multi criteria (Jorge and Alain 2004), and (Victor Brovkin et al.1997) used bioclimatic classification up to two classification of climate types (trees region and grass region) (Victor Brovkin et al.1997).

2. De Martonne's Climate Classification

De Martonne Climate Classification considers precipitation and temperature with other parameters. Beside the annual precipitation and temperature (Serhat and Mesut 2010), this classification depends on the dry index (A) and we can calculate it as shown (Peguy Ch. P. 1970):

$$A = \frac{P}{T + 10} \tag{1}$$

Where;
P = the annual mean of precipitation in (mm).
T = the annual mean of temperature (°C).

Table 1. De Martonne index and climate types

Climate types	A
dry	5>
Semi dry	5 – 10
Semi humid	10 – 20
Humid	20 – 30
Very humid	30<

3. N.N.Ivanove Climate Classification

In 1985, Ivanove established a climate classification depending on evapotranspiration where we can calculate the evapotranspiration (ep) as shown:

$$\mathrm{ep} = 0.0018 \times (25 + t)^2 \times (100 - \mathrm{h}) \tag{2}$$

Where:
t = the Monthly average of temperature (C)
h = the Monthly average of Relative humidity (%)
Therefore, we can calculate the moisture Factor (Im) which Ivanove put it as shown:

$$\mathrm{Im} = \frac{p}{ep} \tag{3}$$

Where:
P = quantitative annual precipitation

Table 2. Im and climate types (Ivanov N.N. 1958)

Climate types	Im
very dry	0.12>
Dry	0.12 - 0.30
Semi dry	0.30 – 0.60
Semi humid	0.60 – 1.00
Humid	1.00 – 1.50
Very humid	>1.50

4. H.Bailey classification

It is divided into two parts : moisture index (Biley H.P 1958) and warmth of climate (Biley,H.P 1960).

For moisture index (Mi) we can estimate it as shown:

$$Mi = \frac{p}{(1.025)^t} \quad (4)$$

Where:

P = the accumulation of the monthly precipitation (inches).

t = Monthly temperature average

Table 3 shows the climatic classifications adopted by (H.Bailey) depending on the value of (Mi)

Category	*Climate types*	Mi
A	Very humid	> 16.2
B	humid	16.2 - 8.7
C	Semi humid	8.7 - 4.7
D	Semi dry	4.7 - 2.5
E	dry	2.5>

In warmth of climate (w) Bailey was depending on Months which has extreme temperatures and the Annual temperature range to be calculate as shown:

$$w = \frac{64.2 \times \bar{t} - 50 \times \bar{\bar{t}}}{d - 14.4} \quad (5)$$

Where:

$\bar{t}$ = Average temperatures for the warmth Month during the year (F)

$\bar{\bar{t}}$ = Average temperatures for the coldest Month during the year (F)

d = Annual temperature range $d = \left(\bar{t} - \bar{\bar{t}}\right)$

Depending on the values of warmth of climate, the world has been divided into ten major thermal regions are shown in Table 4.

Table 4 shows the climatic classifications adopted by (H.Bailey) depending on the value of warmth of climate (W)

Category	Climate types	warmth of climate
A1	TORRID	75.4<
A2	HOT	69.4 – 75.4
A3	VERY WARM	64.4 – 69.4
B1	WARM	62.1 – 64.4
B2	WARM	59.9 – 62.1
C1	MILD	58.0 – 59.9
C2	MILD	56.1 – 58.0
D1	COOL	54.4 – 56.1
D2	COOL	52.9 – 54.4
E1	VERY COOL	51.4 – 52.9
E2	VERY COOL	50.0 – 51.4
F1	COLD	47.5 – 50.0
F2	VERY COLD	45.5 – 47.5
F3	GLACIAL	45.5 >

5. Location and Data set

In this work we tried to classify the climate in multiple ways concerning the area of Iraq, and because Iraq does not represent a large area to form a climatic system especially that it is necessary to include the surrounding

areas to form an integrated image. The study location extended of longitude from 350 east to 500 east, and latitude from 250 north to 400 north. We divided the region into a grid points. The distance between the grid point and the other approximately equal to half the distance between the longitude and other or equivalent of approximately 50 kilometers.

The data obtained from (The European Centre for Medium-Range Weather Forecasts (ECMWF), the times period of the information recorded extended from 1/1/2000 to 1/1/2015. the data were processed and represented using MATLAB software

6. Result and discussion

6.1 De Martonne's Climate Classification

By using equation no. (1) .The dry index (A) has been calculated and the result shown in figure 1.

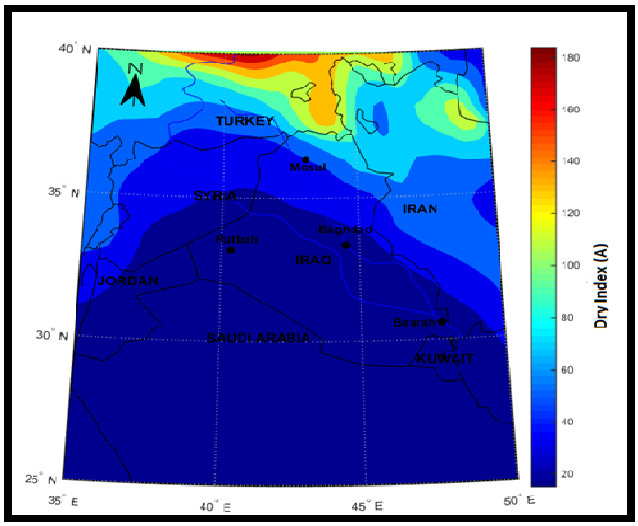

Figure 1:The distribution of drought index (A) values in Iraq and surrounding areas.

Figure 1 Shows that the area of Iraq can be classified approximately to three zones, in the southern, southeastern and southwestern regions to the limits of Central Region of Iraq we will find a semi humid zoon which is characterized by the presence of steppe plants. In the north and northwestern regions we will find humid zoon which is characterized by the presence of Rich grasses mixed with trees the northeastern region we will find the very humid zoon which is characterized by the presence of Forests.

6.2 N.N.Ivanove Climate Classification

From equation no. (3) The moisture Factor (Im) was calculated and its results will shown in figure 2.

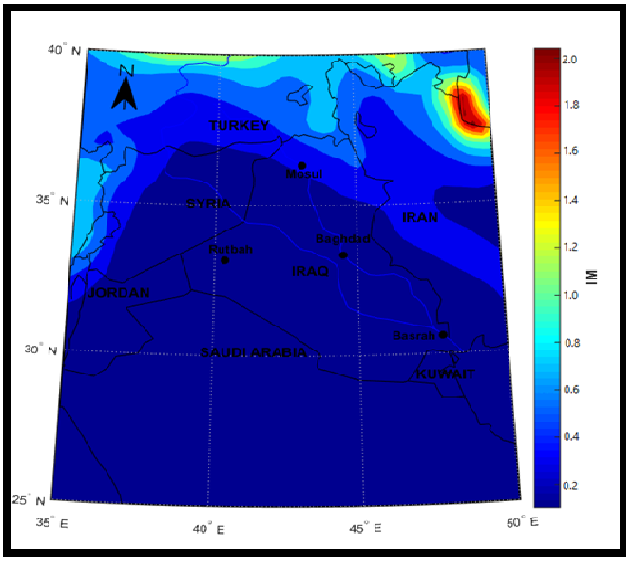

Figure 2 :The distribution of moisture Factor (Im) values in Iraq and surrounding areas.

Figure 2 makes us conclude the following points: (Iraq region) divided into two zones; in the far north of the area of Iraq (Latitude above 35^0 N) we find the semi dry zoon. Stretching from southern Iraq to offer approximately 35^0N latitude line, we find the dry zoon.

6.3 H.Bailey classification

From equation no. (4) The moisture Index (Mi) was calculated and its results will shown in figure 3.

Figure 3 Show that the area of Iraq can be classified approximately to three zones, the first zoon is from the southern of Iraq to the middle of Iraq where the (Mi) value was less than 2.5 or what may be called the dry zoon. In the second zoon (from 33^0 N to 36^0N) the value of moisture index (Mi) was ranging from: (2.5 to 5) this zoon called semi dry. In the far north of Iraq (Latitude above 360 N), we find the third zone where the value of moisture index (Mi) was equal to 5 and above where the region's semi-humid zoon was located. From equation no. (5) The warmth of climate (W) was calculated and its results are shown in figure 4.

From figure 4 we can divide Iraq region into three zones (warm zoon, mild zoon C1 and mild zoon C2).

The warm zoon stretching from southern of Iraq to the Latitude 35^0 N the symbol of this category has indicated by (B2).The second zone is the mild zone is a region symbolized by the symbol C 1 and it covers parts of the northern areas, as well as the north-eastern and north-western regions of Iraq and part of the western regions. Finally mild region symbolized by the symbol C 2 which covers the far north-east region of Iraq.

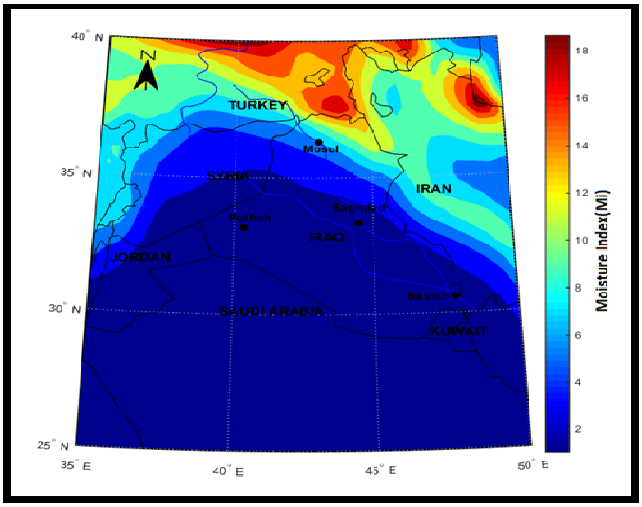

Figure 3 the distribution of moisture Index (Mi) values in Iraq and surrounding areas.

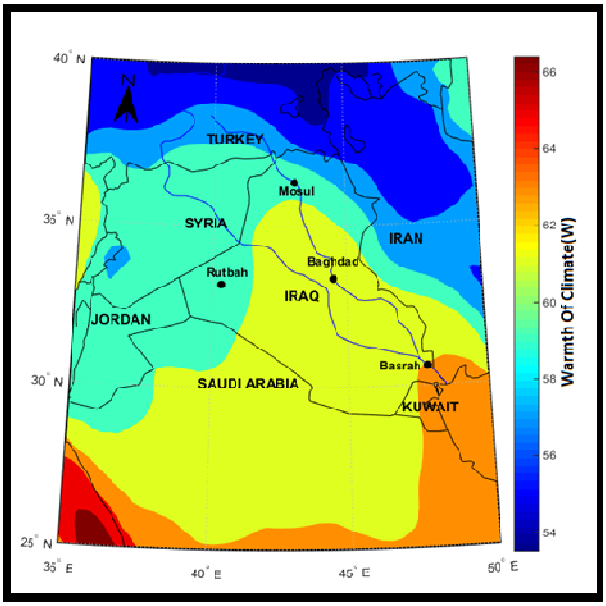

Figure 4 the distribution of warmth of climate (W) values in Iraq and surrounding areas.

7. Conclusion

The southern areas from Iraq even Latitude 35^0N are a semi humid , dry and warm areas the types of plants that arise in these areas are steppe. Northern Iraq (from latitude 36^0N and above almost) is divided into two types of climate (humid and very humid), (semi dry or / and semi humid) and (mild climate classes C1 or C2).

Types of plants that are endemic to the northern region is of rich grasses mixed with trees and forest in the far north of Iraq.

It seems that the main reason for the diversity of climate in Iraq is a change in latitudes thus changing the value of solar radiation, leading to a change in climatic characteristics of the region.

Also, mechanical and physical properties of the soil and the nature of the earth's surface also affect in the climate diversity, where it seems clear in the area from central of Iraq to the far area of southern Iraq which is a plain area formed by deposits of the Tigris and Euphrates, It has the same climatic characteristics in all climatic classifications.

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