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CALCULATING THE WIND-CHILL INDEX FOR SELECTED STATIONS IN IRAQ

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ABSTRACT: *The Wind-Chill Index (K_o) is used to express a sense of human comfort depends on where the wind speed and temperature together, if considered the human body is a thermal machine liberate energy on an ongoing basis anything that affects the heat loss from the body, which in turn affects the nature of the sensation rate warming to his body and thus affect the rest, and can predict all sense of human beings too hot or cold through calculate the Wind-Chill Index. The aim of this research to clarify the relationship between air elements of each of the temperature and wind speed, can be human comfort through calculate the Wind-Chill Index, using temperature and wind speed data for the period (2005-2015) of the general body from the Iraqi meteorological organization and seismology for selected stations in Iraq (Mosul, Baghdad and Basra), by using of statistical sophisticated programs (Simple Linear Regression and Spearman Rho Test), It was found that the monthly average calculation for the period of the study Wind-Chill Index that the highest value for the index were in Baghdad station 642.47W/m^2 for the month JAN, and it found that the lowest value was in Basra station -193.26W/m^2 for the month JUL, and found when the seasonal average for calculate the Wind-Chill Index, the winter has high values in addition to the month MAR also has high values in the Mosul and Baghdad stations, except Basra station the month MAR is considered ideal, either for the summer months, it owns and lowest values in Basra and Baghdad stations, where he extends decline to include the month of MAY of the spring and the month SEP of autumn, either Mosul station, the decreasing values includes the month SEP of all autumn, but the rest of the months illustrates months close to human comfort, except Baghdad station the month NOV is a cool, also found through analysis the annual average for Wind-Chill Index the highest value was in Mosul station 288.53 W/m^2 in 2013, the lowest value of Basra station 146.45W/m^2 in 2015, and found through the statistical operations between temperature and Wind-Chill Index that there is a strong inverse relationship degree of correlation -0.99, as well as the relationship between wind speed and Wind-Chill Index, is a strong inverse relationship, Medium and low in Mosul station reverse correlation is weak the rank correlation -0.252, the station Baghdad high inverse correlation degree of correlation -0.748, while the Basra station, it is an inverse relationship to moderate correlation -0.594.*

KEYWORDS: Temperature, Wind speed, Human comfort, Spearman Rho Test, Iraq.

INTRODUCTION

Considered human attempts to see the impact of different climate in which elements directly as old as the man himself, and several attempts have emerged in the past trying to explain this effect, but it was limited to the limited availability of climate information elements, but the

man himself and through his experiences he was able to note that influence simple, where the human recourse to the caves to prevent free direct sun or cold in the winter and heat in summer is an expression of doth human beings to the impact of climate elements on it, and the man went towards the leather put on his body naked and then different quality clothes different depending on changes the climate in that region, which turn them an expression in the same direction. The human feeling is comfortable in different climates, which is known as physiological climatology. In addition to the natural factors (heat, humidity, radiation, and winds), there are psychological factors that play a large role and there is an adaptation to the succession of generations in a given region. The natural side effect in rest only, it is not possible to deal with all the factors affecting human comfort in order to put a clear end to the human feeling comfortable, there are many cases of human sense of the elements of the climate on a certain aspect of his life, the concept of comfort varies between human and human group and another since there is a relationship between these elements, any element alone cannot be a sufficient indicator of a sense of comfort and here came the complexity of the discovery of a law governing the human sense of comfort, and thus the emergence of the science of statistics and development has helped to bring the image to the human through the finding of the statistical relationship between phenomenon that is, the only method currently known to deal with some applied climate issues that can detect some aspects of the relationship between climatic elements and various matters of life.

Scientists have studied and determined the comfortable atmosphere of man despite the difficulty they found in the definition of a general concept of physiological comfort, because of human differences in interaction with environmental conditions, what is comfortable for someone may be annoying to another at the same time depends on the type of person and age and clothing and housing ... etc. In addition to the overlap of physiological and psychological factors, however, there have been attempts to develop a general concept of physiological comfort, has been known by some as that atmosphere that raises feelings of satisfaction and psychological warmth and meets perceptions of feelings in one way or another, and to create a sense of comfort must be met In the particular environment, consistent physical relationships or the concept established by the American Society of Refrigeration and Air Conditioning Engineers 1973 (Holly et al., 1979). That rest is the state of mind in expressing its satisfaction with the environment 1989 (Omar, F. 1989).

Comfort physiological is a sense of stalking man and makes him feel psychological comfort fully in accordance with the specific climate and natural conditions, wants to sustain without an increase or decrease, a central nervous system condition that leads to human feeling good about the surrounding environment and be two types, physiological comfort and psychosomatic comfort, the former what however, expression of the state of thermal equilibrium between the body and the surrounding environment in light of maintaining the normal body temperature which is the body resulting from the chemical reactions that take place within the so-called process of metabolism, equal to the amount of heat outside through load, conduction, radiation and evaporation (Mahdi, A., F. 1990).

The climate is one of the most important natural factors that interfere directly or indirectly with the formation of the surface of the earth and its various manifestations, and with the availability of accurate climate data and the development of means of processing by statistical methods, has taken the research climate progress rapidly in recent times, Climate, each of which is concerned with studying a particular aspect of life emerged what is known as the science of biological climate, one of the branches of Applied Climatology, which is concerned with the

study of the impact of climate elements on all living organisms in a particular geographical area, has been branched climate studies in this area and took several trends in the study of a particular aspect of human, including the study of the effects of climate in the physiological functions of man, the sense of human comfort in different climates, which is known as physiological climate science, as well as the effects of climate on human health, which is known as medical climate science (Holly et al., 1979). Either The factors that affect the human sense of comfort or distress are different, so the factors that measure them are also different. The person feels comfortable during climatic conditions that are proportional to his body temperature, which is 37^{o}C. However, these conditions change. The body always tries to generate energy by acting and if the weather conditions exceed the ability of the body generates a sense of distress and discomfort, and if it becomes acuter, whether the high temperature or decline of severe, lead to a sun strike in the first case and in the second case the incidence of frostbite may get death in both. The scientists have proposed several measures to know the human interaction with climatic conditions and thus to determine its sense of comfort. It is difficult to assess the extent of human response to one of the different elements of the climate, such as (temperature, relative humidity, wind speed, etc.) because these elements are affected together and each depends on the other. In the degree of influence of the sense of human comfort, and therefore requires the calculation of this effect on the sense of comfort, and the translation into the language of measurement by reaching comfort formulas, and in fact there is not yet a mathematical law to calculate the sense of human comfort taking into account all elements of the climate except because of the difficulty of finding the relationship between these elements or measuring the effects of each individually, was one of the main reasons for the existence of more than one indicator or plan to measure its impact on human comfort, due to the large number of climatic elements and the difficulty of measuring the physiological and psychological effects in humans, from person to person depending on the different age, Gender and health status of the person and the quality of clothes and food. Many experiments have been carried out by scientists on humans, they have chosen samples that represent a real-life society, put them in different climatic conditions and analyzed their response to be a measure of the relationship between climate and man. These experiments showed several indicators that include changing two or more climatic elements, the classification of the physiological climate is based on the basic elements of the climate affecting the physiological comfort of the human being, based on the so-called Comfort Zone, which most people find comfortable in terms of temperature and amount of moisture (Ali H., 2002). The impact of the local climate in determining the extent of human activity is important to many researchers because it affects the urban planning and the quality of the materials used in construction, as well as the parks and green spaces to find the physical comfort of the human and even the quality of clothing used in some areas (Jabouri, M., 2007). Siple and Passel 1945 found a formula for calculating the wind equivalent temperature, which is based on two elements: wind speed and air temperature (Siple et al., 1945).

In 1966, Tanjung introduced its criterion of a table that includes the study of the effect of several climatic elements on people's sense of cold and cold, in which the United States climate was classified into twenty physiological climatic regions (Tanjung W., 1966).

METHODOLOGY

The Statistical Using

- *Simple Linear Regression (SLR)*

In statistics, simple linear regression is a linear regression model with a single explanatory variable. That is, it concerns two-dimensional sample points with one independent variable and one dependent variable (conventionally, the x and y coordinates in a Cartesian coordinate system) and finds a linear function (a non-vertical straight line) that, as accurately as possible, predicts the dependent variable values as a function of the independent variables. The adjective simple refers to the fact that the outcome variable is related to a single predictor. Simple linear regression is the study of the relationship between two variables just to get to the linear relationship (i.e. a straight line equation) between these two variables, a parametric test, which assumes that the data are distributed normally distributed and to find out the gradient value is calculated slope of the regression through the linear equation of the following (Yazdani M., 2011).

$$\overline{Y} = a + b\overline{X} \qquad (1)$$

$$b = \frac{\sum_{i=1}^{n}(X_i-\bar{X})-(Y_i-\bar{Y})}{\sum_{i=1}^{n}(X_i-\bar{X})^2} \qquad (2)$$

Where a: Steady decline or part of the cross axis ($\overline{Y}$) to the equation of the straight line, equation (1) and b: The Slope of the regression and found a slope straight line.

- *Probability Value (P-Value)*

In statistical hypothesis testing, the p-value or probability value is the probability for a given statistical model that, when the null hypothesis is true, the statistical summary (such as the sample mean difference between two compared groups) would be the same as or more extreme than the actual observed results. The use of p-values in statistical hypothesis testing is common in many fields of research such as economics, finance, political science, psychology, biology, criminal justice, criminology, and sociology. Their misuse has been a matter of considerable controversy. Is purely a statistical term, a number is used to assess the statistical measures, which show that the value of the corresponding factor is actually an influential factor or not? If the (P-Value) less than 0.05, the corresponding factor is an influential factor in the variable that we are trying to study the change. Influential factor has even considered the value of (P-Value) is equal to 0.1, but that increased about 0.1, this factor should be excluded from the model is ineffective (Mohamed S., 2009).

- *Spearman Rho Test*

In statistics, Spearman's rank correlation coefficient or Spearman's rho, named after Charles Spearman and often denoted by the Greek letter (ρ) (rho) or as (r_s), is a nonparametric measure of rank correlation (statistical dependence between the ranking of two variables). It assesses how well the relationship between two variables can be described using a monotonic function.

The Spearman correlation between two variables is equal to the Pearson correlation between the rank values of those two variables; while Pearson's correlation assesses linear relationships, Spearman's correlation assesses monotonic relationships (whether linear or not). If there are no repeated data values, a perfect Spearman correlation of +1 or −1 occurs when each of the

variables is a perfect monotone function of the other. Intuitively, the Spearman correlation between two variables will be high when observations have a similar (or identical for a correlation of 1) rank (i.e. relative position label of the observations within the variable: 1st, 2nd, 3rd, etc.) between the two variables, and low when observations have a dissimilar (or fully opposed for a correlation of -1) rank between the two variables. Spearman's coefficient is appropriate for both continuous and discrete variables, including ordinal variables. Both Spearman Rho and Kendall's tau can be formulated as special cases of a more general correlation coefficient.

Spearman Rho Is a test of non-parametric range of observed data $\{X_i, i = 1,2, ..., n\}$ based on nothingness any hypothesis that all (X_i) values are independent and have the same distribution and to calculate the Spearman rho coefficient statistical ranks (r_s) must be converted model original to the ranks mediated arranged in descending order in terms of amount is then calculate the amount of (d_i) through $(d_i = k_i\text{-}i)$ where (i) value ranging from 1 to (n) and (r_s) is given by the following (Kendall's., 2011).

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n(n^2-1)} \qquad (3)$$

If the great value (n) can test the value of (r_s) importance by calculating the amount of (t_s) which is given by the equation:

$$t_s = r_s \sqrt{\frac{n-2}{1-{r_s}^2}} \qquad (4)$$

If the value of (t_s) false calculated within the trusted boundary for a two-tailed test of this we can deduce that there is no trend in the data series (MEI, 2007).

The Data and Study Areas

Were used the data for monthly averages of meteorological variables (temperature and wind speed) from the Iraqi Meteorological organization and Seismology for a period of eleven years (2005-2015). Were calculated the Wind-Chill Index values of three different stations Mosul, Baghdad, and Basra representing the northern, central and southern regions of Iraq, respectively. These areas differ in terms of climate change, terrain and altitude from sea surface level (see "Figure 1" and "Table 1") (IMOS, 2015).

Table 1. Latitude, Longitude, and Altitude from sea level for study stations.

Stations	Longitude (°E)	Latitude (°N)	Altitude (meter)
Mosul	43.15	36.32	223.5
Baghdad	44.23	33.23	31.7
Basra	47.78	30.57	2.4

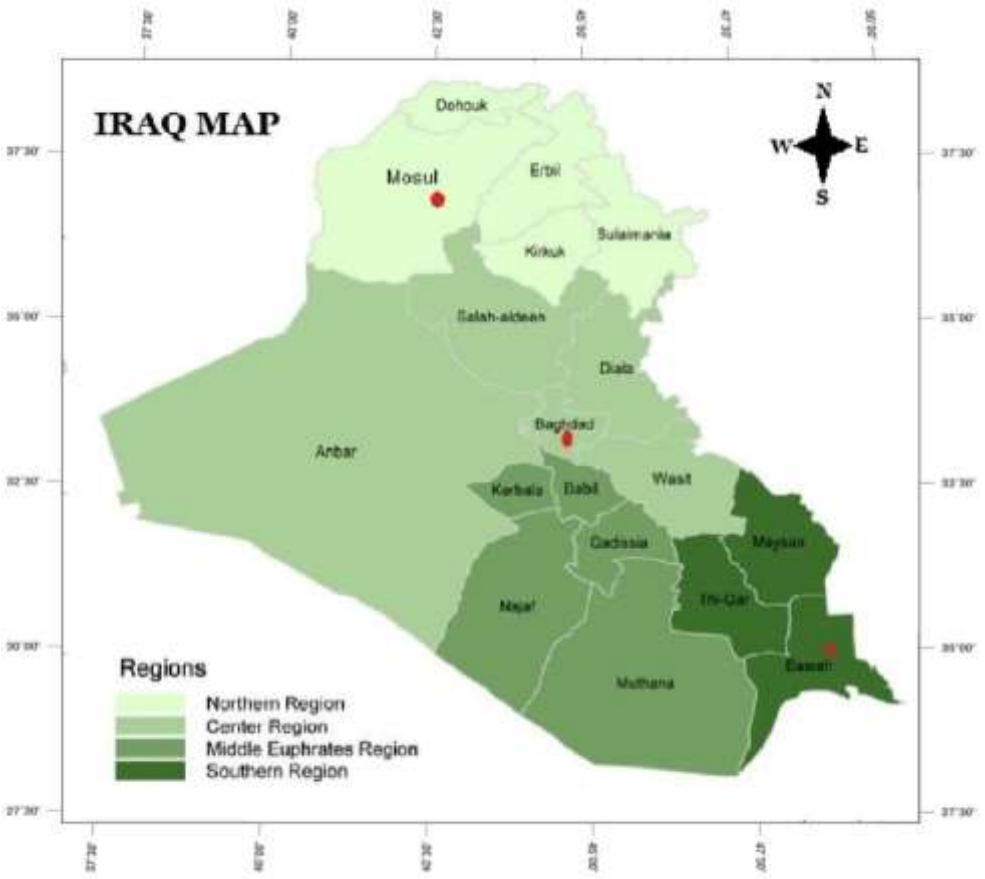


Figure 1. Study areas.

Calculate the Wind-Chill Index (K_o)

The air plays a big role in the human feeling of low temperature, so it is the air that plays a big role in the sense of human temperature down, so the index, which treats the feeling of human comfort in the cold areas will focus on the use of the wind in the cold areas will focus on using wind with air temperature, Siple and Passel in 1945 identified the impact of wind in a sense of low heat. They tested their experiences in the US sector of Antarctica and came with a wind-chill indicator. The indicator can be defined as a measurement of the amount of heat that the gas can cover it is necessary to use a mathematical equation that calculates the cooling power in the atmosphere and in the shade without taking into account evaporation from the body and on an open surface. Can be calculated the wind-chill index from the following equation (Siple et al., 1945).

$$K_0 = (\sqrt{100\,WS} + 10.45 - WS)(33 - T_a) \quad (5)$$

Where K_o: Wind-Chill Index in W/m^2, WS: Wind speed in m/sec and T_a: The air temperature in ^{o}C. The equation (5), which are based only on experiments in a particular area, do not suit

all regions and individuals, but they provide a good explanation of wind power. The equation assumes that the skin temperature is 33ºC, so the results can be interpreted as (0-100) W/m^2 as hot and more than 600 W/m^2 as severe cool as in "Table 2" and "Table 3" (Adel et al., 1990).

Table 2.The Wind-Chill Index value and the equivalent of human comfortable feeling.

Wind-Chill Index	Human Comfortable Feeling
< 0	Very hot (Discomfort)
0-49	Hot (Discomfort)
50-99	Warm (Discomfort)
100-199	Perfect
200-299	Perfect
300-399	Perfect
400-499	Cool (Discomfort)
500-599	Too cool (Discomfort)
>600	Severe cool (Discomfort)

Table 3. The Wind-Chill Index value by categories and symbols of human comfort.

Human Comfort	Category	Symbol	Wind-Chill Index
Discomfort cold	Very hot	H$^-$	0>
	Hot	H*	0-49
	Warm	H	50-99
Perfect	Perfect	P	100-199
	Perfect	P*	200-299
	Perfect	P$^-$	300-399
Discomfort heat	Cool	C	400-499
	Too cool	C*	500-599
	Severe cool	C$^-$	>600

RESULTS AND DISCUSSION

In the practical side, the equation (5) was used to calculate the Wind-Chill Index (K_o) by data of temperature and wind speed recorded. The change in monthly temperature, wind speed and Wind-Chill Index (K_o) For the period (2005-2015) and the stations (Mosul, Baghdad, and Basra) through the "Figure 2", Can be observed change the behavior of temperature and by regions where the temperature is lower in Mosul and higher in Basra and moderate in Baghdad either for wind speed, the highest value was in Basra in JUN and the lowest value was in Mosul in DEC. And in general, the highest rates of wind speed in Basra, the lowest wind speeds in Mosul and the average values in Baghdad, and the Wind-Chill Index (K_o), The behavior of the indicator is similar in all stations and is contrary to the behavior of the temperature, and also

found that the highest value of the Wind-Chill Index (K_o) in Baghdad was 642.47 W/m^2, and the lowest value of Basra in JUL was -193.26 W/m^2

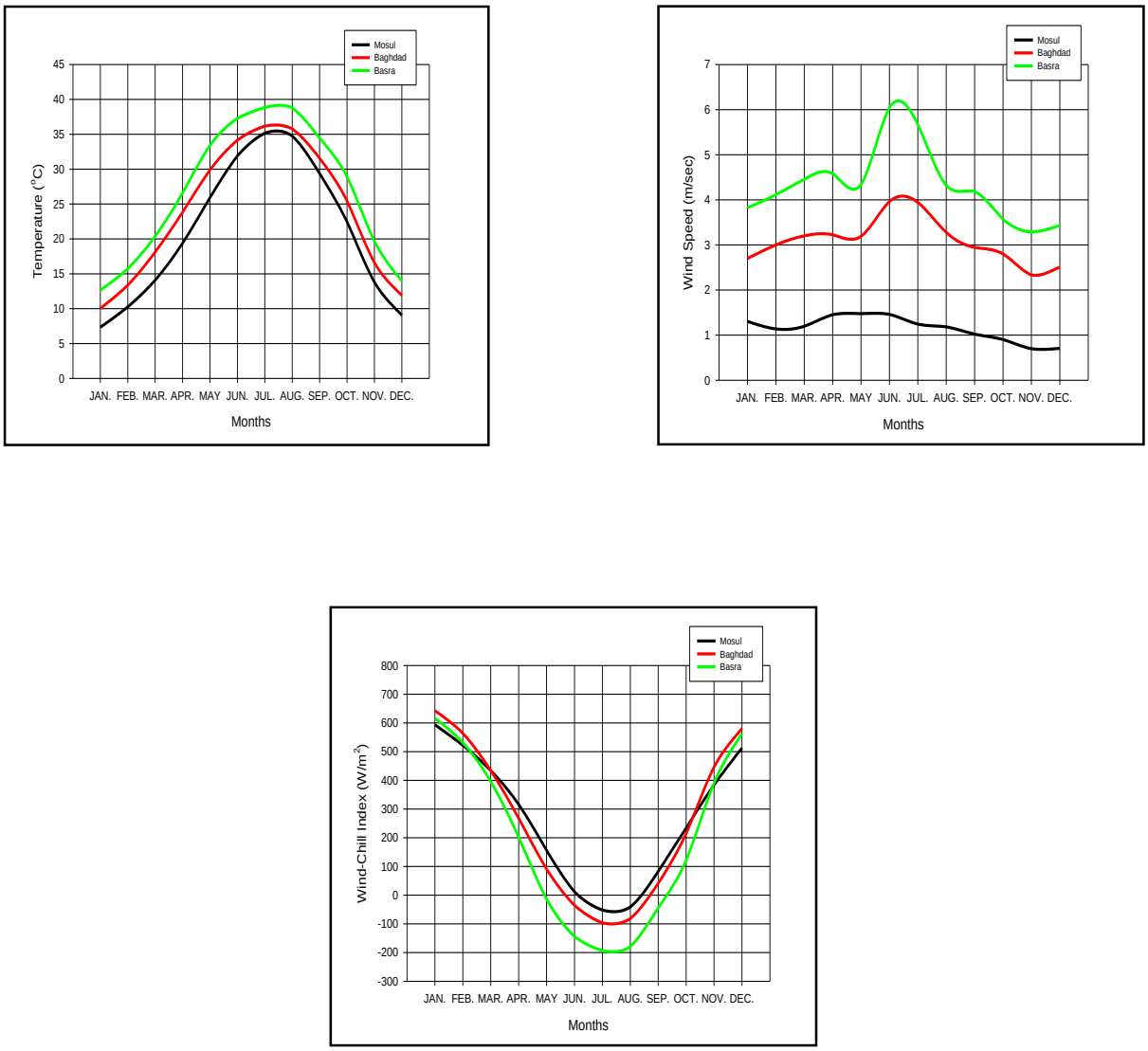


Figure 2. The change in the monthly average of temperature, wind speed and Wind-Chill Index (K_o) for the period (2005-2015) for stations (Mosul, Baghdad, and Basra).

Through the "Figure 3", that show the seasonal average change of the Wind-Chill Index (K_o) for eleven years (2005-2015) for the stations (Mosul, Baghdad, Basra) in winter can be observed that the highest value was in Baghdad 673.99W/m^2 In 2008, the lowest value of the index was the city of Mosul 467.34W/m^2 in 2009, and in general, the year 2008 saw a rise in the index values in all study areas, And in the spring can be seen that the highest value was in Mosul 343.40W/m^2 in 2007, the lowest value was Basra 155.69W/m^2 in 2015, and we find that the index values of them Mosul in 2007 witnessed a rise to record the highest value for the period and areas of study and then fell in 2008 to become the lowest from Baghdad and Basra, in summer can be seen that the highest value in Mosul station was 9.89W/m^2 in 2012,

and the lowest value of the index in Basra -210.28W/m^2 in 2012, and generally characterized by the summer down index values (because the values of the indicator are inversely proportional to the temperature). In the autumn it can be noted that the highest value of the index was in Mosul 288.31W/m^2 in 2011, and the lowest value of the index was in Basra 100.21W/m^2 in 2015, The values of the index in Baghdad and Mosul are close except in 2008, where there was a decrease in the values of the index of the Mosul to the minimum, and then return values and almost be identical to the values of Baghdad away from the values of Basra.

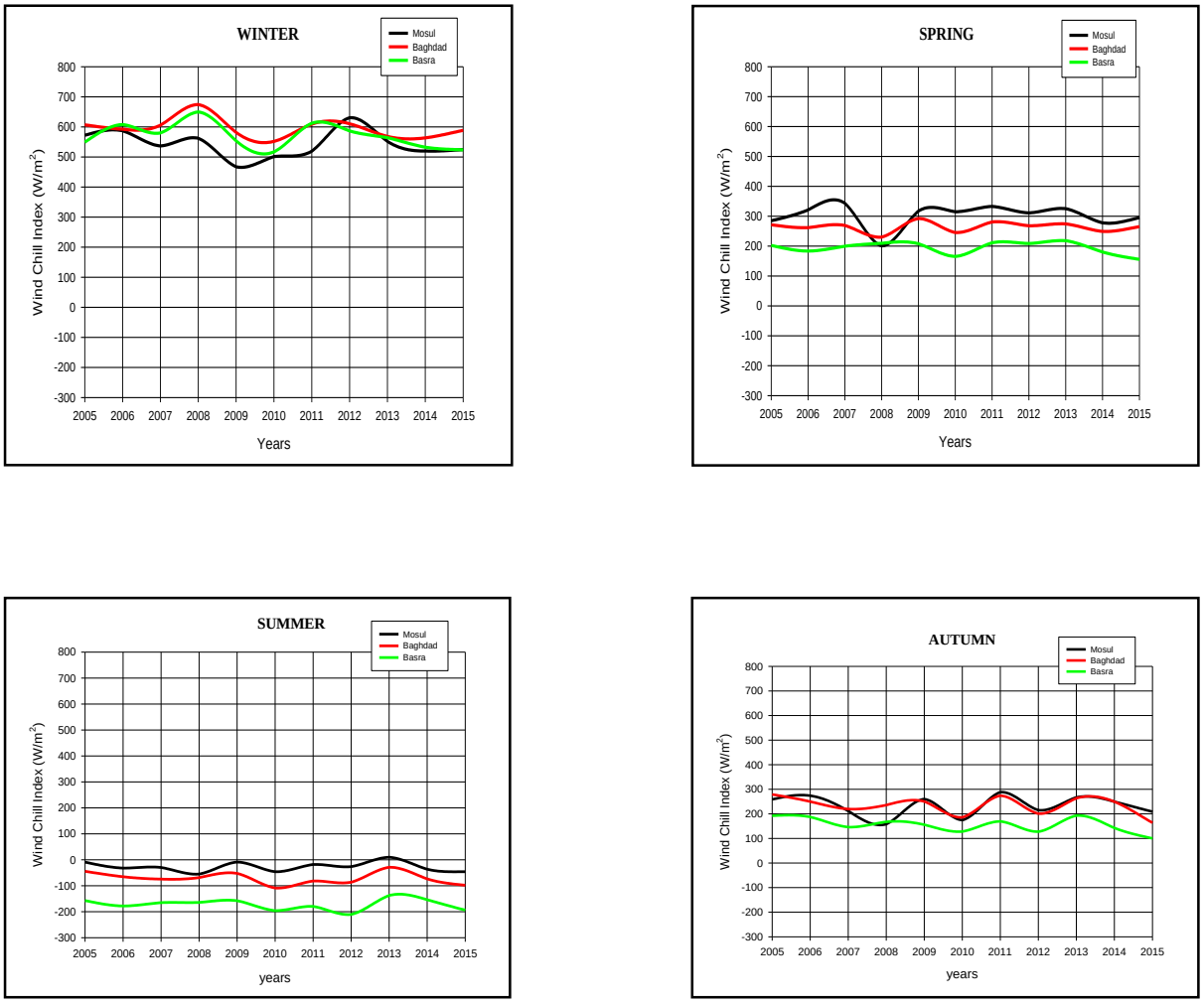


Figure 3. The change in the seasonal average of Wind-Chill Index (K_o) for the period (2005-2015) for the stations (Mosul, Baghdad, and Basra).

The "Table 4" and "Table 5" showing values the seasonal change of the Wind-Chill Index (K_o) at the Mosul station and the Baghdad station respectively for the period (2005-2015), it can be

observed that the winter is very uncomfortable cold, the months of spring at the beginning of the season are not comfortable was cool, and monthly APR and MAY are ideal for human comfort. The summer months are generally very uncomfortable was very hot. Autumn when starting an extension of the summer and be (an uncomfortable warm) and then begin to change the atmosphere to become perfect in the end autumn.

Table 4. Values the seasonal change for the Wind-Chill Index (K_o) by categories and symbols of human comfort in Mosul station for the period (2005-2015).

Seasons	Months	K_o (W/m^2)	Category	Symbol
Winter	DEC	512.86	Too cool	C*
	JAN	593.67	Too cool	C*
	FEB	522.16	Too cool	C*
Spring	MAR	434.31	Cool	C
	APR	315.99	Perfect	P^-
	MAY	156.52	Perfect	P
Summer	JUN	12.24	Hot	H*
	JUL	-51.86	Very Hot	H^-
	AUG	-41.24	Very Hot	H^-
Autumn	SEP	82.43	Warm	H
	OCT	233.61	Perfect	P*
	NOV	384.00	Perfect	P^-

Table 5. Values the seasonal change for the Wind-Chill Index (K_o) by categories and symbols of human comfort in Baghdad station for the period (2005-2015).

Seasons	Months	K_o (W/m^2)	Category	Symbol
Winter	DEC	580.75	Too cool	C*
	JAN	642.48	Severe cool	C^-
	FEB	563.77	Too cool	C*
Spring	MAR	434.02	Cool	C
	APR	268.21	Perfect	P*
	MAY	91.00	Warm	H
Summer	JUN	-35.10	Very Hot	H^-
	JUL	-96.33	Very Hot	H^-
	AUG	-81.63	Very Hot	H^-
Autumn	SEP	41.25	Hot	H*
	OCT	214.44	Perfect	P*
	NOV	445.99	Cool	C

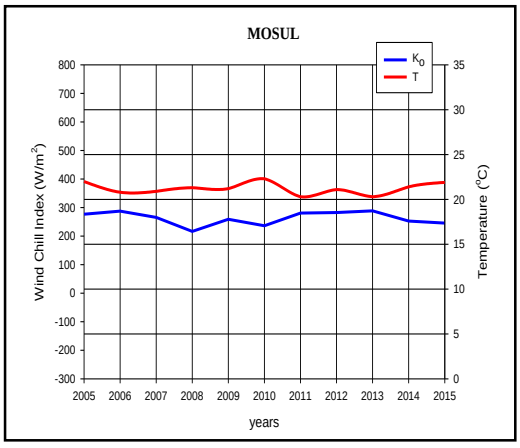
The “Table 6” shows values the seasonal change for the Wind-Chill Index (K_o) in the city of Basra for the period (2005-2015), it can be observed that the winter is characterized as uncomfortable cold in the FEB, and therefore the winter is not perfect for human comfort, MAR, and APR at the beginning of the season is the perfect temperature increases during the month MAY to become comfortable with high temperature which is considered the beginning of a hot summer. The summer months are usually very uncomfortable and very hot. They are

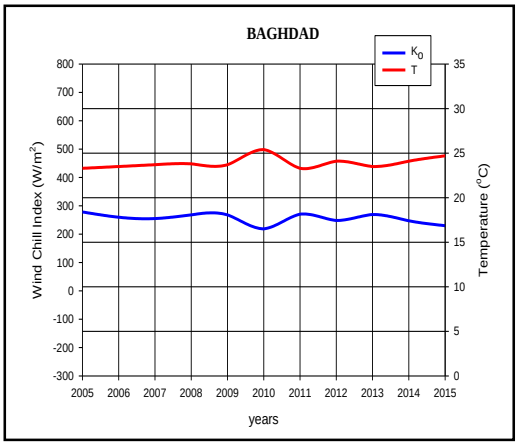
not ideal for human comfort. Autumn is a very uncomfortable start to the summer heat. Temperatures begin to decline slightly to become ideal in the end autumn.

Table 6. Values the seasonal change for the Wind-Chill Index (K_o) by categories and symbols of human comfort in Basra station for the period (2005-2015).

Seasons	Months	K_o (W/m^2)	Category	Symbol
Winter	DEC	563.32	Too cold	C*
	JAN	616.51	Cooler	C^-
	FEB	531.76	Too cold	C*
Spring	MAR	395.70	Perfect	P^-
	APR	202.07	Perfect	P*
	MAY	-13.31	Very Hot	H^-
Summer	JUN	-143.52	Very Hot	H^-
	JUL	-193.27	Very Hot	H^-
	AUG	-179.24	Very Hot	H^-
Autumn	SEP	-45.00	Very Hot	H^-
	OCT	120.83	Perfect	P
	NOV	390.56	Perfect	P^-

Through the "Figure 4", that show the average annual temperature change and the Wind-Chill Index (K_o) for the study period (2005-2015) for the stations (Mosul, Baghdad, and Basra), at the Mosul station were the highest in 2013 was 288.53W/m^2, and the lowest value in 2008 was 216.52W/m^2, at the Baghdad station was the highest value in 2005 was 278.34W/m^2, and the lowest value was in 2010 was 218.78W/m^2, the Basra station was the highest value in 2008 was 215.56W/m^2. The lowest value was in 2015 was 146.45W/m^2. It was found that the values of the indicator behave in a manner contrary to the behavior of the temperature.





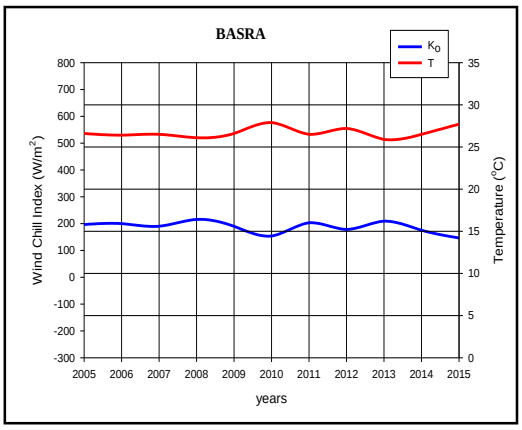
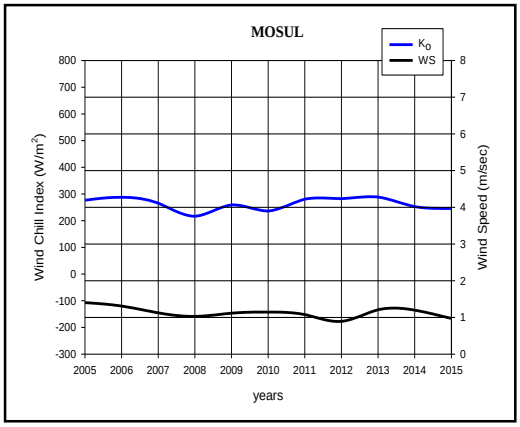
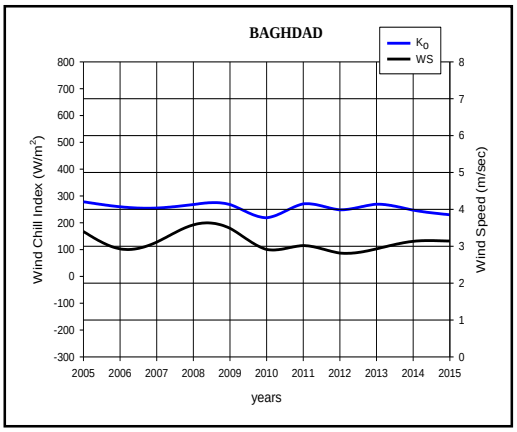


Figure 4. The annual change of Temperature (T) and the Wind-Chill Index (K_o) for the period (2005-2015) for stations (Mosul, Baghdad, and Basra).

The "Figure 5", shows the annual wind speed change and the Wind-Chill Index (K_o) for the study period (2005-2015) and the stations (Mosul, Baghdad, and Basra). The wind speed behavior is similar to the behavior of the Wind-Chill Index (K_o). The relation between the values is inverse. As the wind speed decreases, the value of the indicator increases. The reason is that the relation between the Wind-Chill Index (K_o) and temperature is inverse. The relation between wind speed and temperature is inverse. Therefore, the relation between wind speed and Wind-Chill Index (K_o) is reversed, and "Figure 6", which shows the values of the total annual change of the Wind-Chill Index (K_o) for eleven years (2005-2015).





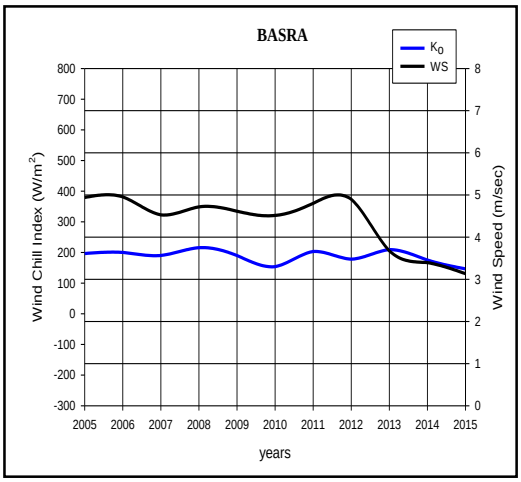


Figure 5. The annual change of Wind Speed (WS) and the Wind-Chill Index (K_o) for the period (2005-2015) for stations (Mosul, Baghdad, and Basra).

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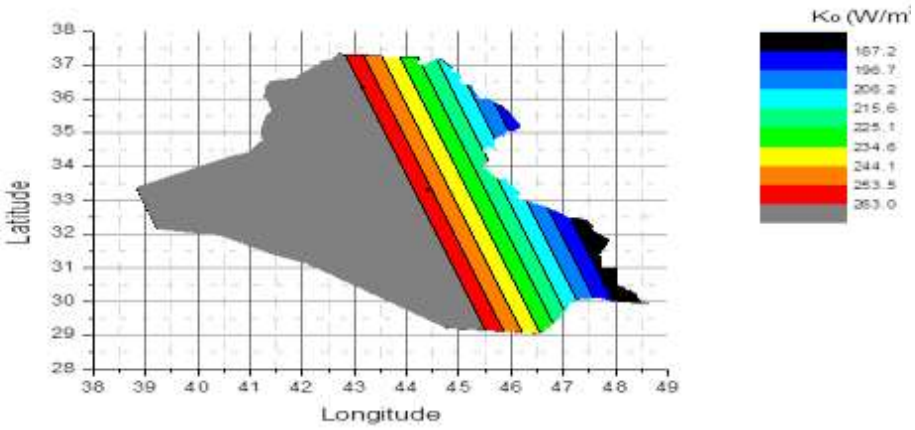


Figure 6. The total annual change of the Wind-Chill Index (K_o) for the study period (2005-2015) and stations (Mosul, Baghdad, and Basra).

The "Figure 7" and "Table 7" show that the relationship between temperature and Wind-Chill Index (K_o) is a strong inverse relationship as the increase in temperature leads to decrease by the Wind-Chill Index (K_o) of the three stations (Mosul, Baghdad and Basra) for Simple Linear Regression (SLR) and low P-value, it is less than 0.001, so the relationship is linear.

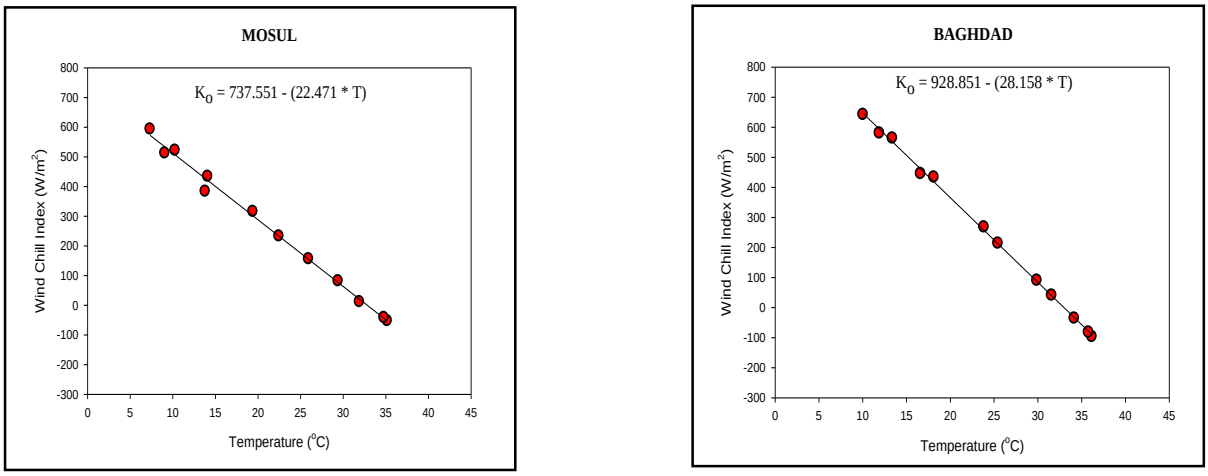
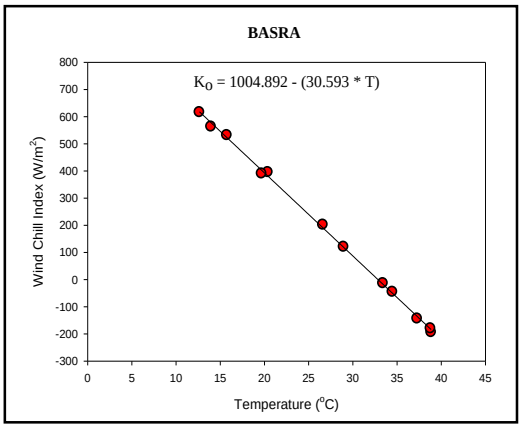


Figure 7. The relationship between Temperature and Wind-Chill Index (K_o) for stations (Mosul, Baghdad, and Basra) for the study period.



Followed the Figure 7.

Table 7. The results of Simple Linear Regression and Spearman Rho Test and the strength of the relation between Temperature (T) and Wind-Chill Index (K_o) for stations (Mosul, Baghdad, and Basra), for the study period.

Stations	Simple Linear Regression		Spearman Rho Test	
	P-value	Interpretation	r_s	Correlation
Mosul	<0.001	Linear	-0.986	Inverse High
Baghdad	<0.001	Linear	-0.998	Inverse High
Basra	<0.001	Linear	-0.993	Inverse High

The “Figure 8” and “Table 8” shows that the relationship between wind speed and Wind-Chill Index (K_o) is inversely different in all study stations. For Simple Linear Regression and P-value, the ratio is less than 0.001 the relationship is linear except for the Mosul station, the Simple Linear Regression is greater than 0.001, so the relationship is nonlinear.

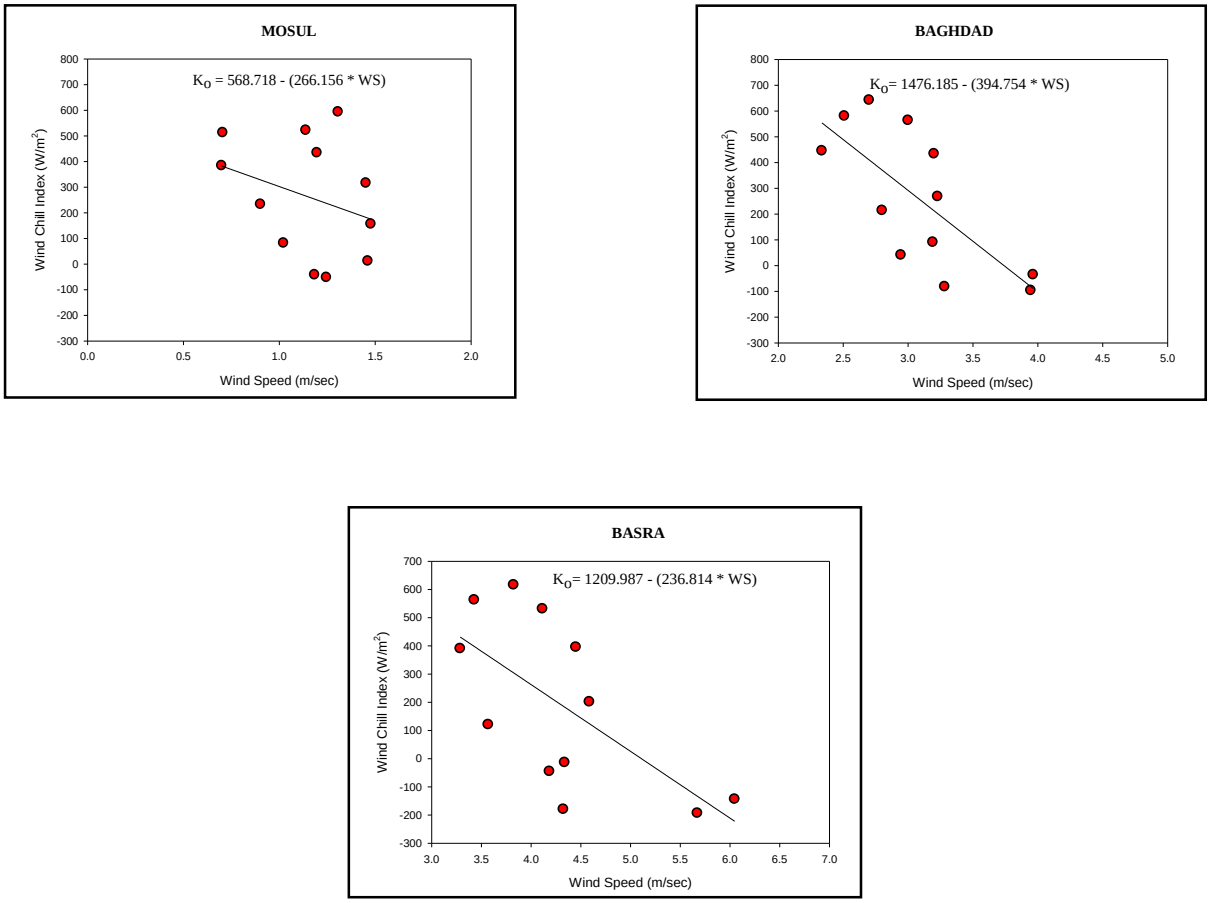


Figure 8. The relationship between Wind Speed (WS) and Wind-Chill Index (K_o) for stations (Mosul, Baghdad, and Basra) for the study period.

Table 8. The results of Simple Linear Regression and Spearman Rho Test and the strength of the relation between Wind Speed (WS) and Wind-Chill Index (K_o) for stations (Mosul, Baghdad, and Basra), for the study period.

Stations	Simple Linear Regression		Spearman Rho Test	
	P-value	Interpretation	r_s	Correlation
Mosul	0.321	Non-Linear	-0.252	Inverse Low
Baghdad	0.008	Linear	-0.748	Inverse High
Basra	0.022	Linear	-0.594	Inverse Medium

CONCLUSIONS

- The variation in weather elements (Temperature and Wind Speed) during the months and seasons of the year led to a variation of the human feeling of comfort from one season to another and from one region to another where the most livable areas are the Mosul station and the least comfortable cities are Basra and Baghdad. Intermediate areas rest.

- Uncomfortable weather during the summer months (June, July, and August) in all areas due to high temperature, during the winter months (December, January, and February) is also uncomfortable.

- The spring season is different in all areas. In the Mosul station, there is a difference between the cold uncomfortable in the month of MAR and the ideal in APR and MAY at the Baghdad station.

- The feeling of comfort varies between the cold uncomfortable in the month of MAR and the ideal month APR and warm uncomfortable in the month MAY, the Basra station is ideal in the months of APR and MAR. And very uncomfortable heat in the month MAY and is an extension of the summer.

- The autumn of the Mosul station varies between the warm uncomfortable in the month SEP and the ideal in the month OCT and NOV, the Baghdad station is uncomfortable hot in September and be perfect for human comfort in October and uncomfortable cool in a month. The Basra station is extremely uncomfortable in September and is ideal for human comfort in October and November.

- Through the statistics used it was found that ideal areas to live the Mosul and then Basra and followed by Baghdad.

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