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Determine the Vertical Sections of the Winds By Varieties Stability, in Semi-Urban Atmosphere of Hilla

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Abstract

In this research has been analyzed data wind speed and direction to measure the length of rough surface of the city of Hilla, in a way the logarithm of wind, weather has been the use of data recorded by the system meteorological installed on the surface of the Earth rise (10 m) in the College of Education for Pure Sciences at the University of Babylon , south-west of the city of Hilla to the specific duration to perform the search from 01/01/2013 until 04/01/2013 , the results proved that the average value of roughness length of the studied area in all directions (0.5m) so one of the areas similarities urban density few were also to find the relationship between the length of roughness and stability, air to determine as the law of wind power engineering , as I found these values for each case stability was getting these values whenever whistled about the most stable situation . Finally, values were identified and form horizontal wind variation with height according to varieties stability , air and surface roughness length as these forms were changed from one class to another.

1. Introduction .

The length of the surface roughness (zo) of the important factors affecting the movement of wind near the surface of the earth, that the surface roughness of great importance in determining a lot of physical factors such as the dispersion of pollutants and the values of evaporation rates and the rates of energy troubled and engineering fields different from the design of residential complexes to build airports, as well as the selection the best locations to set up power plants through wind

As for stability, the air , the importance of not less than the importance of roughness are also of great significance in the spread of pollutants When choosing locations for the establishment of power plants and oil refineries and farms of wind turbines , the study of stability, the air within the first steps on the basis of which is choice because the stability, the air of the site chosen will provide predictions of future for the behavior of pollutants emitted from flue dispersion and moving with the wind .

Aim of this research to study the average length of the surface roughness of the area studied for the city of Hilla, and the results were ((0.5m)) as one of the areas similarities urban and study the stability of the atmosphere of the area and find the average length of the roughness of each case, the stability and identify sections vertical Raahaly height (50)

2. Surfaceroughness

Is the surface roughness of the important factors affecting the movement of winds near the earth's surface, and is defined as the height at which the logarithmic form begins to change with the change of wind speed increase. Either physically refers to the vertical scale of the spiral on the surface of the earth when the wind faded and a coefficient of discrimination Aleirodaanmikih roughness of the surface (schools, 1986).

We will use this research in a mathematical formula to calculate the length of roughness (Z0) method of the logarithm of the wind which is intended for devices with slow response and the level of Artvai one, and the formula can be written as follows: -

$U_Z=(U_*/K)Ln(Z-Z_d)/Z_O$ (1)

That's where UZ average wind speed measured in the height of the earth's surface for Z , Zd length of zero displacement , K constant (Von Karaman = 0.35), U * wind speed friction , and through the conversion function Allegartim natural exponential function to the result we have: -

$Z_0=(Z-Z_d)/exp(-U_ZK/U_*)$ (2)

It can compensate U * = Ϭ U / ΦU where Ϭ U is the standard deviation of the wind speed, the equation becomes (Beljaars, 1987).

$Z_0=(Z-Z_d)/exp(-U_Z\Phi_UK/Ϭ_U)$ (3)

The calculated ΦU according to state stability, the ΦU = Ϭ U / U * It has been found from the directory observational and experimental that the percentage of the standard deviation of the average wind speed Ϭ U to wind speed friction U * characterized constant under conditions of a tie, which are worth (2.4 to 2.5) also said researchers (Lumley, Panofsky.1964) Roth, 1993)), where we used in this research Φu value when conditions equalizer,Φu=2.45.

As in the case of unstable Φu can be calculated from the following equation: -

$\Phi_u=a(1-b\ Z/L)^{1/3}$ (4)

In case stable can be calculated from :-

$\Phi_U=a(1+b\ Z/L)^{1/3}$ (5)

Where a, b constants obtained in this study of the results obtained by the researcher(AL-JIBOORI, 2001) where compare its results with the results of the researcher(Yumao XU and Yongfu Qian) either Z / L is a function of the state of stability, where the length L Abokhov (, Z is the rate of rise, were obtained values of the source (AL-Jiboori, 2009) by source (kaimal, 1973). was taking rate results and applied in each of the equations (4.5) to obtain the values of Φu each case the stability and compensated for in the equation along roughness (2) to extract values (Z0).

It can also calculate the length of the zero displacement Zd through mathematical relationship that Achtgaha (Bottema, 1995).

$Z_d=[\sum A_{Pb}+\sum(1-p)A_{Pt}/A_T]^{0.6} *Z_H$ (6)

That's where space is APb level surface of buildings, P is the permeability coefficient refers to the airways of the trees and is equal to 0.6 in winter and 0.4 in the spring and fall and 0.2 in summer (Bottema, 1995), (Grimmond, 1999). In this research, we used (0.6) because the period in which it was the winter of the search was 01/01/2013 up to 01/04/2013. ZH also been calculated rate of rise of the harshness of the elements during the monitoring and calculation of height of buildings in the area of research and find the rate of rise in the following equation: -

$Z_H=(Z_{H1}+Z_{H2}+Z_{H3}+\ldots\ldots Z_n)/N$ (7)

ZH where the height of the roughness 1,2,3 ..... n refers to the number of elements and N the total number of elements.

3. Classify Stability Atmosphere

Classified stability atmosphere to seven varieties which relates to the different variables atmosphere basic velocity wind , temperature , wind direction, solar radiation and the amount of clouds in this research were chosen method Basquil to classify stability where class world English Basquil 1961 stability, to six classes A, B, C, D, E, F (Pasquil, 1961).

This method requires measurements of wind speed U in units of m / s and estimate the amount of cloud cover (N) during the night and measurement class solar heating (Solar Insolation Class) during

the day and then the evolution Ranked add some modifications by the World Turner Turner , which make it more inclusive (turner, 1961) and could be clarified in the table following: -

Table-1. Classifications Basquil modified for the stability of the air (Mohan, 1998)

U m/s at 10m	Daytime Incoming Solar Radition W/m^2				Nighttime cloud amount (oktas)		
	Strong (>600)	Moderate (300-600)	Slight (<300)	overcast	0-3	4-7	8
U<2	A	A-B	B	C	ForG	F	D
2≤U<3	A-B	B	C	C	E	E	D
3≤U<5	B	B-C	C	C	D	D	D
5≤U<6	C	C-D	D	D	D	D	D
6≤U	C	D	D	D	D	D	D

4. Exponential Wind Low

Increasing wind speed rise up from the surface and this is due to the impact of two factors: the degree of disorder and confusion prevailing in the air for the time fairly stability classification and surface roughness, so the change in wind speed with height has to do with topography surface. (Beychok,1994). In engineering applications can calculate the approximate value of wind speed with increasing height and any area depending on the law of force.(Rosen, 1998).

$$u = u_r \left(\frac{z}{z_r}\right)^p \qquad (8)$$

That's where ur wind speed at the height of former zr.
U wind speed at any height z.
P is assumed to be constant with height at any given height range.
When taking the logarithm of both sides we get:

$$\ln \frac{u}{u_r} = p \ln \frac{z}{z_0} \qquad (9)$$

$$P=\frac{\ln \frac{u}{u_r}}{\ln \frac{z}{z_r}} = \frac{\partial \ln \frac{u}{u_r}}{\partial \ln \frac{z}{z_r}} = \frac{\partial \ln u}{\partial \ln z} \qquad (10)$$

$$\Phi_m\left(\frac{z}{L}\right)=\frac{KZ\partial u}{u_* \partial z} \qquad (11)$$

Since Φm, (z / L) function to change the zero-dimensional vertical wind shear in various weather conditions, z rate rise, L is the length of Abu caves along the dimensionless where it is known that the increase which equals the effect of buoyancy and shear conditions at non-neutral.

When adding and subtracting 1 to the right of the equation (11) and the integration of land (where Z = Z0, u = 0) to any height we get:

$$u = \frac{u_*}{k}\left[\ln \frac{z}{z_0} - \Psi_m\left(\frac{z}{L}\right)\right] \qquad (12)$$

That's where Ψm public function to determine the vertical section of the wind under the conditions non-neutral

$$\Psi_m\left(\frac{z}{L}\right) = \int_0^{\frac{Z}{L}} \left[1 - \Psi_m\left(\frac{z}{L}\right)\right] \frac{d\frac{Z}{L}}{\frac{Z}{L}} \qquad (13)$$

When integrate equations (11) and (12) we get

$$\boldsymbol{P = \frac{\Phi_m\left(\frac{z}{L}\right)}{\ln \frac{Z}{Z_0} - \Psi_m\left(\frac{z}{L}\right)}} \qquad \textbf{(14)}$$

5. Site and Hardware

The region represented by the study are the University of Babylon , south -west of the city of Hilla , which lies on the line of View (440) east longitude (320) in the north and away from the city center (15km) where the region semi-urban (low-density and height of buildings , trees and scattered) . The study area extends over an area of radius 800m)) its system weather forecasters in the Faculty of Education, Science Pure Almthbh on the surface of the earth , up 10m)) were divided the area into four sectors to measure each sector (900) as Homodh in the picture OBTAINED high to Tllk sectors , as well as describes the roughness in the area studied the following table shows the trend of sectors :

Table-2. what it represents every sector of the grades in the study area.

Direction	Dir. With degree
NE	0 – 90
SE	90 – 180
SW	180 – 270
NW	270 – 360

Figure-1. A picture taken from the top of the site study at the University of Babylo

These divisions have been used to calculate the length of roughness (Z0) of the area of the logarithm of the way through the wind has used the system to monitor the information necessary to find the value of (Z0) during the period from 01/01/2013 up to 01/04/2013. We have used in this study, the slow response devices a collection devices which are used to measure wind speed and direction and the amount of solar radiation , pressure, temperature , humidity and the amount of water vapor and the devices installed on the system as a column in the picture (2) . Where the information is monitored and stored in a computer related, and is working 24 hours calculated wind speed and direction at heights m (2,10).

6. Monitorinformation

In this study, taking information daily from the computer connected to the system included wind speed and direction and the amount of solar radiation recorded information every 10 minutes while taking the rate per hour for the purpose of obtaining an appropriate value for the standard deviation of the accelerated wind (б u) and the rate of direction and solar radiation during the time depending on the source (Beljaars, 1987).
It was also taking quantitative data clouds from the Public Authority for the rough waters of the air that have been monitored every three hours to determine the stability of the atmosphere at night time ,

the number of observations taken (736) balances during the period in question , have been identified case of stability, the air in which they can choose the information to calculate the length of roughness (Z0) for the specific area of study

Figure-2. A photograph is taken of the system weather forecasters at the University of Babylon

7. Results and Discussion

7.1. Calculate the Length of the Zero Displacement

The offset value of zero Zd very important in the process of calculating the surface roughness of the city of Hilla, according to standard methods. It has been the adoption of the equation (4) to calculate the value of Zd site study and the results were as shown in Table 3:

Table-3. Shows the values of the rate rise ZH roughness elements and the length of the zero displacement Zd in the study site

Direction	$\bar{Z}_H$ (m)	$\bar{Z}_d$ (m)
NE	4.7	0.7
SE	6.07	0.9
SW	7.3	0.95
NW	8	1.09

The table shows (3) the values of the length of displacement zero Zd and also shows the rate of rise of the components of roughness ZH Per trends in the study area and through the table note values Zd few because the area is semi-urban (low height and density of buildings and trees) in any case, the less value for Zd in the direction NE 0 (0-90) as well as the lower value of ZH in the same direction and the highest value for Zd in the direction NW 0 (360-270) as well as the highest value for any zH that the length of the zero displacement rate increases with increasing height of the buildings.

7.2. Calculate the Length of Roughness

We have adopted the method of obtaining the logarithm of the wind in the values of roughness length Z0 for the city of Hilla each direction under all circumstances (A stability cases and cases of a tie and stable situations) are as follows (Table 4) illustrates this

.

Table-4. Shows the roughness length values for each direction with a number of observations

DIR.	N.of observation	Range of Z_0	Z_0 (m)
NE	121	0.014-1.2	0.59±0.85
SE	149	0.018-0.89	0.48±0.74
SW	93	0.015-0.9	0.5±0.75
NW	216	0.04-0.8	0.46±0.79

The table (4) shows that the highest value for z0 in the direction NE because of the large number of buildings and trees relative to other sectors and less valuable in the direction NW was calculated rate along the roughness of the study area is(0.5m), where one of the areas similarities urban according to the classification(GRIMMOND, 1998).

7.3. Calculate Stability Atmosphere

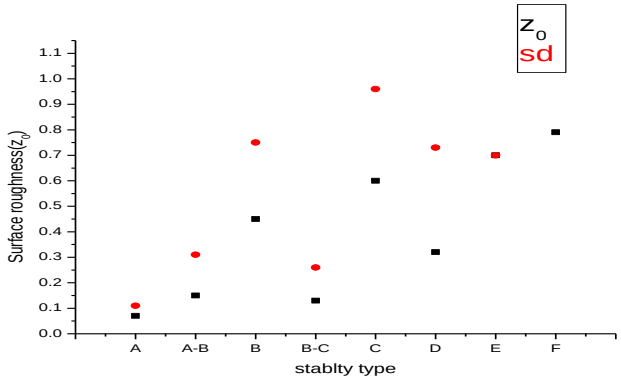
Was calculated stability, air Basquil way dependent on wind speed and the amount of solar radiation in the times of the day and the amount of clouds during the night hours has been to determine the status stability, depending on the table Basquil as mentioned above. It has been determine the status of stability, during the specified period to search for the study area are as follows (Table 5) shows the cases of stability, and repetition rates and the length of roughness in each case: -

Table-5. Shows the rates of repetition and roughness length values for each case.

Class stability	Stable type	No.of observation	Frequency ratio %	Range of Z_0	Z_O
A	Un stability strong	41	6	0.001-0.46	0.07
A-B		52	7.4	0.002-1.2	0.15
B	Un stability medium	121	17	0.003-1.2	0.45
B-C		52	7	0.009-1.2	0.13
C	Un stability low	95	12	0.02-1	0.6
D	Clear	139	19	0.001-1.3	0.32
E	Stability low	53	7.5	0.001-1.3	0.7
F	Stability strong	185	25	0.002-1.5	0.79
	Total	736	100%		

We note from((Table 5)) that the highest percentage of repeat of the case of F is the case, the most stability, and these are the hours of the night because the earth's surface is colder and the wind speed is less than 2m / s, followed by the case of a tie D by 19% and are often in the hours of sunset and sunrise when the overcast skies or high wind speed is greater than 6m / s, then cases A Stability medium case B by 17% during the first hours of the day where the amount of solar radiation between w/m2 (300-600) and wind speed ranging from 3m / s - 5m / s. As for the case of A is the case A stability severe that did not appear in the month of January, but appeared in the February and March because of winter, which is the amount of solar radiation less than w/m600 Lama in February and March increased the amount of solar radiation is greater than in the hours w/m600 The first and only where the wind speed is less than 2m / s. well as contrasting note along with the roughness stability, as in the cases (Figure 3).

Figure-3. Shows the cases of stability, and its impact on the length of roughness Z0.



7.3. Account Codes Wind

After selecting the type of stability atmosphere and surface roughness of the atmosphere in the semi-urban city of Hilla, has been to find different values of p stability of each type as in the following table:

Table-6. Over the P values with the average for each type stabilizing atmosphere .

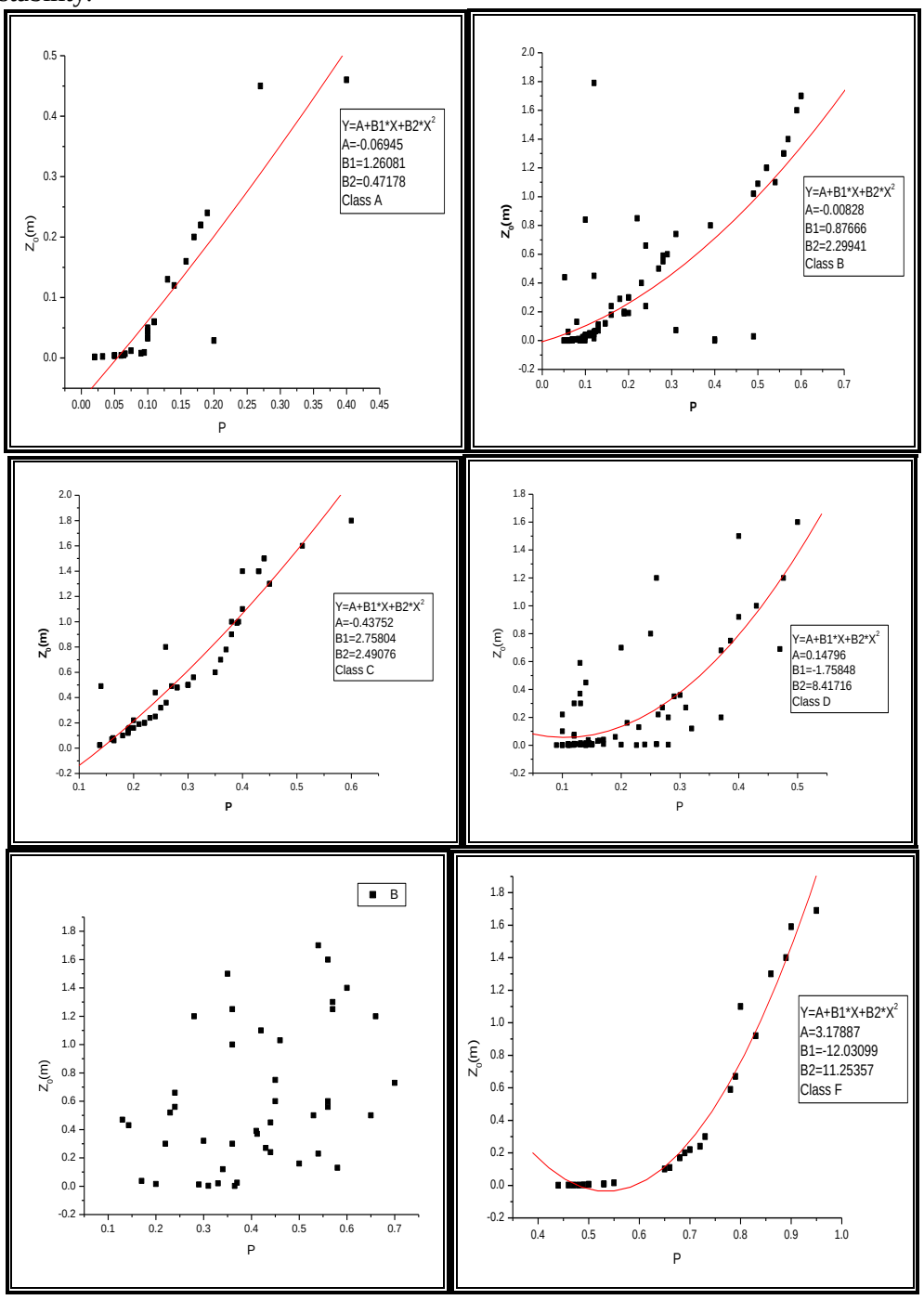
Class stability	Range of p	p
A	0.02-0.4	0.11±0.076
B	0.05-0.65	0.2±0.16
C	0.13-0.6	0.3±0.11
D	0.09-0.5	0.2±0.1
E	0.13-0.7	0.4±0.14
F	0.4-0.95	0.66±0.15

Where it was noted that there is a relationship increasingly clear to the values of P when increasing surface roughness, except for the case of medium stability, E type look where the relationship is not clear.

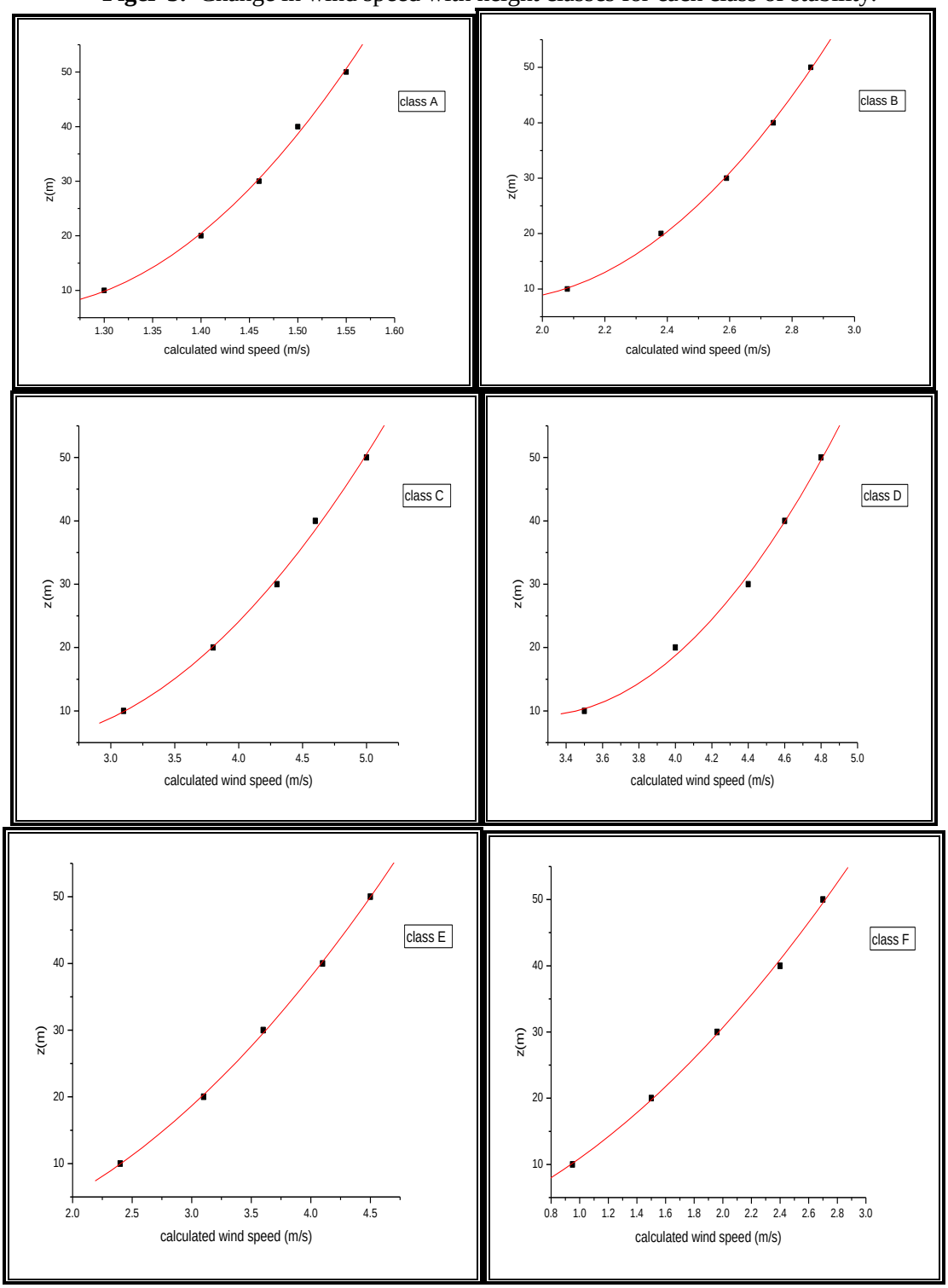
7.5. Determine the Vertical Sections of the Wind

After thorough study of the values MSI Wind Engineering, which was found to be a function of both roughness and surface stability atmosphere has been identified section shape and vertical values of wind with height up to 50m)) and using equation (2-7) got the figure (3-10) for each class stability of the choosing this rise is the model for the monument stations, wind power turbines used to generate electricity as well as the attainment of high surface layer semi-urban cities when((Touma, 1977)).

Figer-4. Change the values of the exponent p -Along with the values of surface roughness by varieties stability.



Figer-5. Change in wind speed with height classes for each class of stability.



8. Conclusions

Through the collection of data recorded by the system Meteorological erected in Babylon University's College of Education Science Pure and analyzed according to the weather conditions that accompanied the recording time data to the current study found the following:

1 - The average height of the roughness elements ZH and after taking it for all directions in the study area is 6.5m)).

2 - that the rate of displacement along the zero-Zd for all directions in the study area is 0.9m)).

3 - The average length of the surface roughness of the area studied was 0.5m)) at all directions.

4 - classified the area studied by the length of the roughness of the surface that it lies within the semi-urban areas.

5 - was diagnosed cases of stability, in a way Basquil has been found that the instabilities appear in the early morning, during the day and the state of A did not appear in the month of January, but appeared in the February and March and the ratio of cases Allastaqraria is 35.6% either case of a tie, which appeared when the sky is cloudy rain and high wind speed is greater than 6m / s shall be repetition rate of 20%, which is the case of a coup to be the case that stability during the night by 34.5% with a repeat does not appear the case of G during the study period.

7. Incorporate the values of law as wind engineering classes between stability, air and surface roughness length difference.

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