LAB. METEOROLOGICAL DATA ANALYSIS .... FOURTH STAGE

(The second Semester)

Department of Atmospheric Sciences

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((The First Lecture))

correlation coefficient

It is the relationship between two variables representing each of the two variables or phenomena **(linear relationship).**

If one of the two phenomena changes in a certain direction, the second changes in the direction of the first or in an opposite direction to the first,

*If the two changes appear in the same direction, meaning an increase in the first, corresponding to an increase in the second, or a decrease in the first, corresponding to a decrease in the second, then the relationship is direct **increasing (positive).**

* If the increase in the first is offset by a decrease in the second, or vice versa, the correlation is inverse or **decreasing (negative).**

* acrrelation of zero means there is **no relationship(dis corrrlation)** between the two variables.

Correlation scale :

1-pearson correlation(r): is astatisical formula that measures linear correlation between two variables Xand Y.

The strength of the correlation between two variables (r) is measured and denoted by the correlation coefficient, It is a numerical measure that measures the strength of the correlation between two variables, where its value ranges between (+1 and -1).

$$\boxed{\mathbf{r} = \frac{n(\sum xy)-(\sum x)(\sum y)}{\sqrt{[n\sum x^2-(\sum x)^2][n\sum y^2-(\sum y)^2]}}}$$

where :

r = Pearson Coefficient

n= Data number

Σxy = sum of products of the paired stocks

Σx = sum of the x scores

Σy= sum of the y scores

Σx2 = sum of the squared x scores

Σy2 = sum of the squared y scores

- **To calculate the correlation , the excel program is done using a function**

  = **correl**

the following table shows the types of correlation and the direction of the relationship for each type:

Type of correlation and relationship	**positive value**
dis correlation	**0**
Weak direct correlation	> **+ 0.5**
Direct correlation is acceptable	**+0.5**
Medium direct correlation	**+0.6**
good direct correlation	**+0.7**
Very good correlation	**+0.8**
Excellent or strong direct correlation	**+0.9**
perfect connection	**+1**

Type of correlation and relationship	**Negative value**
Weak reverse correlation	> **-0.5**
Acceptable reverse correlation	**-0.5**
Medium reverse correlation	**-0.6**
Good reverse correlation	**-0.7**
Very good reverse correlation	**-0.8**
strong reverse correlation	**-0.9_ -1**

Example (1) // The following data represents temperature and relative humidity, Find is the pearson coefficient (low, function).

T	33	35	34	33	33.5	36
RH	55	56	60	54	50	45

Solue

$$r = \frac{n(\sum xy)-(\sum x)(\sum y)}{\sqrt{[n\sum x^2-(\sum x)^2][n\sum y^2-(\sum y)^2)]}} \qquad n=6$$

NO	X	Y	XY	X^2	Y^2
1	33	55	1815	1089	3025
2	35	56	1960	1225	3136
3	34	60	2040	1156	3600
4	33	54	1782	1089	2916
5	33.5	50	1675	1122.25	2500
6	36	45	1620	1296	2025
n =6	$\sum x=204.5$ $\sum x^2=41820.25$	$\sum y=320$ $\sum y^2=102400$	$\sum=10892$	$\sum=6977.25$	$\sum=17202$

$$r = \frac{6(10892)-(204.5)(320)}{\sqrt{[6(6977.25)-(41820.25)][6(17202)-(102400)]}} \longrightarrow \mathbf{r=} \qquad \longrightarrow \mathbf{r=}$$

relationship is

Example (2) // Find is the pearson coefficient (low, function) for the following table:

NO	X	Y
1	40	78
2	21	70
3	25	60
4	31	55
5	38	80
6	47	66

Multiple correlation coefficient:

This coefficient, which is symbolized by the symbol R, also measures the strength of the relationship between more than two variables, which are continuous random variables (multivariate distribution), and calculating the value of R is an extension of the value of the simple correlation coefficient (r) with the replacement of X, Y with X1–Xk, Y and taking three variables X1, X2, X3 we get the following formulas:

Y , X_1 , X_2

$$r_{YX_1} = \frac{n\sum YX_1 - \sum Y \sum X_1}{\sqrt{N\sum Y_I^2 - (\sum Y_I)^2}\sqrt{n\sum X_1^2 - (\sum X_1)^2}}$$

$$r_{YX_2} = \frac{n\sum YX_2 - \sum Y \sum X_2}{\sqrt{n\sum Y_1^2 - (\sum Y_1)^2}\sqrt{n\sum X_2^2 - (\sum X_2)^2}}$$

$$r_{X_1X_2} = \frac{n\sum X_1X_2 - \sum X_1 \sum X_2}{\sqrt{n\sum X_1^2 - (\sum X_1)^2}\sqrt{n\sum X_2^2 - (\sum X_2)^2}}$$

$$R_{YX_1X_2} = \sqrt{\frac{r^2{}_{YX_1} + r^2{}_{YX_2} - 2r_{YX_1} r_{YX_2} r_{X_1X_2}}{1 - r^2{}_{X_1X_2}}}$$