LAB. METEOROLOGICAL DATA ANALYSIS ..... FOURTH STAGE

(The second Semester)

Department of Atmospheric Sciences

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((Sixh Lecture))

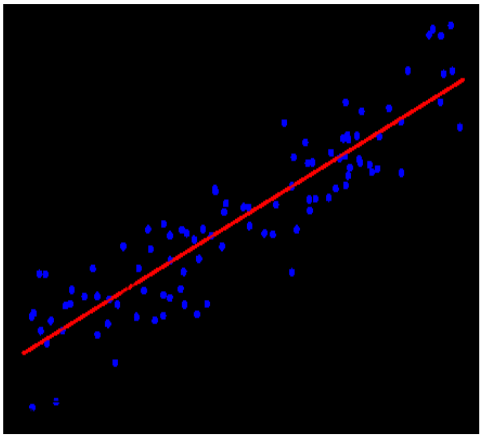
Time Series

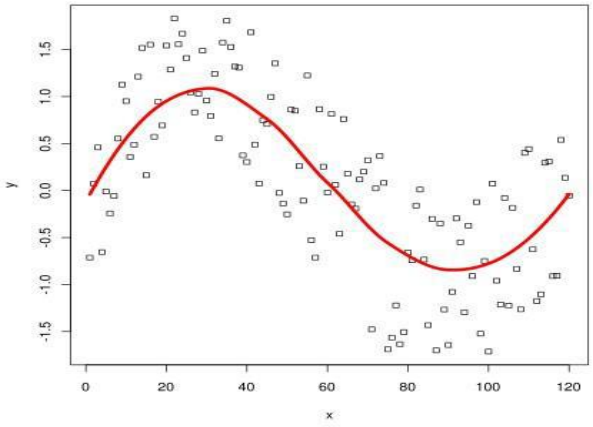
The time series for any phenomenon is a set of numbers resulting from tracking that phenomenon for a relatively long period of time. Then recording observations or data at regular intervals. The series depends on two variables, one independent and the other dependent.

Time series components

The four categories of the components of time series are:

1-Trend*:* The general trend depends on long-term changes in time series, which are Reflect the amount of growth and development where the general trend line is positive, or reflect the amount of decrease, so it is the general trend line is negative. Rainfall, drought, the population, agricultural production, number of births and deaths, number of schools or colleges are some of its example showing some kind of tendencies of movement. The general trend can be in the form of a straight line (linear) or on the Curved shape (non-linear). It is preferable to study the general trend that the time series be large.

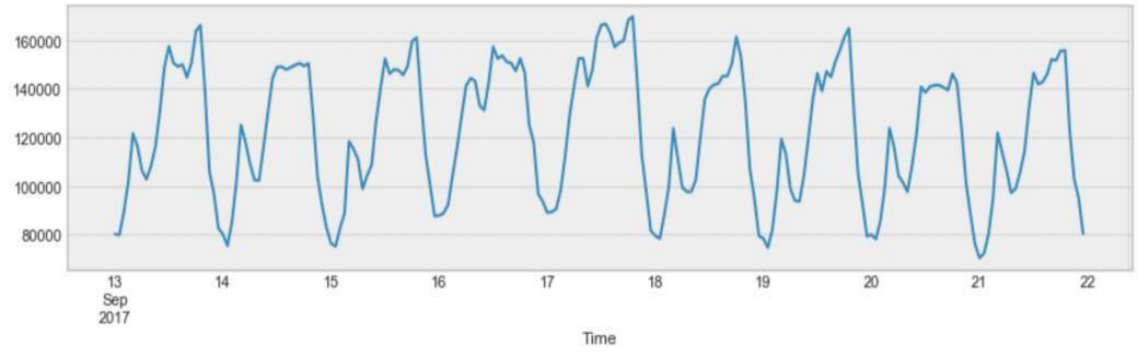




2- Seasonal Variations: These are the regular changes that affect the phenomenon during a period A maximum period of one year (12 months), For example Production of crops depends on seasons. the most important factors that cause these changes:

1- Climate and weather conditions.

2- Social customs and traditions.



3- Cyclic Variations: they are periodic movements around the general trend and they are not short-term changes. This oscillatory movement has a period of oscillation of more than a year. One complete period is a cycle. The cycles are not of fixed length – some last 8 or 9 years and others last longer than 10 years.

4- Random or Irregular Movements: these changes do not repeat regularly as in the seasonal and cyclical changes. These fluctuations are unforeseen, uncontrollable, unpredictable, and are erratic. These forces are earthquakes, wars, flood, and any other disasters.

Modeling time series:

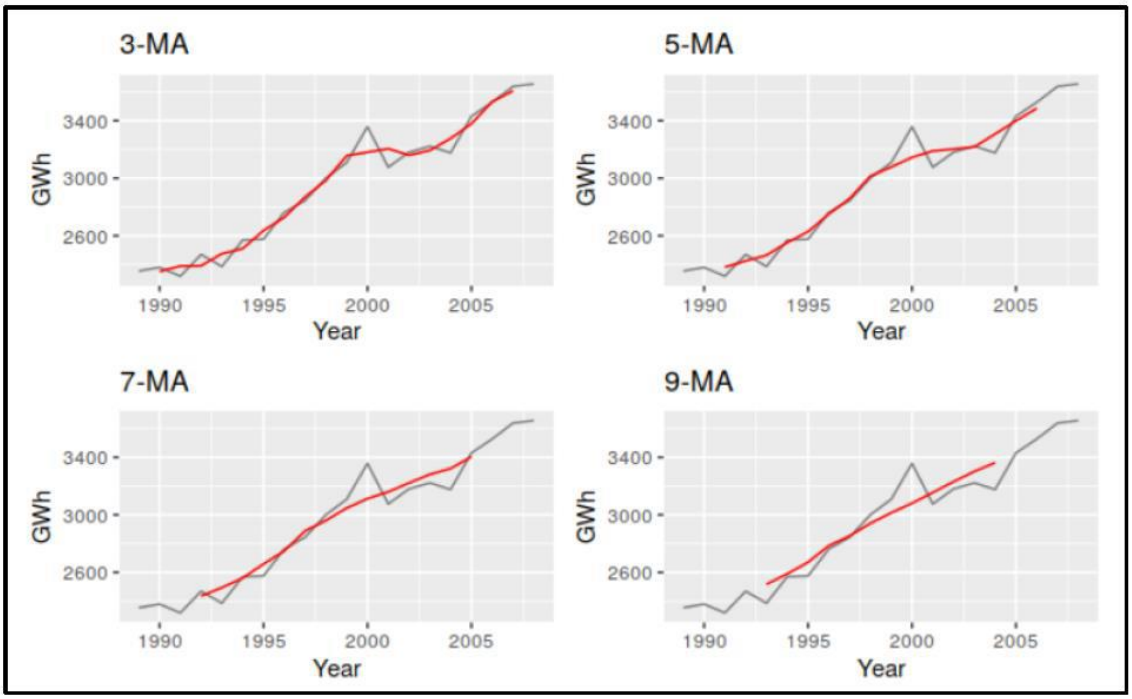
There are several methods of time series modeling to make forecasts:

1- Moving Average
2 – Exponential Smoothing
3 – ARIM

1-Moving Average Model:

A moving average is a model used to get a general idea of trends in a data set; That is, it is the average of any subset of numbers. A moving average is very useful for predicting long-term trends. It can also be calculated for any time period.

The mean value of a group of numbers is exactly the same moving average, but the average is computed multiple times for multiple subsets of data. For example, if you wanted a two-year moving average for a data set of 2000, 2001, 2002, and 2003, you would find averages for the 2000/2001, 2001/2002, and 2002/2003 subgroups. Moving averages are usually plotted and are better visualized.



Residential electricity sales represented by (the black line) with different moving averages applied to the data represented by (Red line).

Example // Calculate the five-year moving average for the data set given in the table below:

year	Rain (mm)
2003	40
2004	60
2005	50
2006	80
2007	90
2008	50
2009	40
2010	30
2011	70
2012	80

.

- First average: $= \frac{X_1 + X_2 + X_3 + X_4 + X_5}{5}$

Moving Average(2003 – 2007) = $\frac{(40+60+50+80+90)}{5}$ = 64 *mm*

- Second average: $= \frac{X_2 + X_3 + X_4 + X_5 + X_6}{5}$

Moving Average(2004 – 2008) = $\frac{(60+50+80+90+50)}{5}$ = 66 *mm*

Moving Average(2005 – 2009) = $\frac{(50+80+90+50+40)}{5}$ = 62 *mm*

year	Rain (mm)	Moving Average
2003	40	
2004	60	
2005	50	64
2006	80	66
2007	90	62
2008	50	58
2009	40	56
2010	30	54
2011	70	
2012	80	

H.W. // Calculate the two-year moving average for the data set given in the table below:

year	T (C^O)
2005	5
2006	7
2007	12
2008	15
2009	21

H.W// Draw the general trend of the series and extract its annual average every 3 years.

year	1988	1989	1990	1991	1992	1993	1994
Rain (mm)	20	30	32	23	34	39	32