



# Objective Analysis in Atmospheric Sciences

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# Headlines

- **Introduction**
- **Statistics and its applications in Meteorology**
- **Raw data, array, grouped data**
- **Cumulative frequency**
- **Ogives**
- **Summary**

# STATISTICS

- **An imposing form of Mathematics**
- **Suggests tables, charts and figures**
- **Numbers play essential role:-**
  - **Provide raw material**
  - **Must be processed further, to be useful**

# STATISTICS

- Statistics is concerned with scientific methods for:-
  - **Collection** of Data
  - **Organisation** of Data
  - **Summarising** and **Presentation** of Data
  - **Analysis** of Data
  - Drawing valid **Conclusions** and making reasonable **Decisions** based on analysis

# STATISTICS

- Involves methods of refining numerical and non-numerical information into useful forms
- When numbers are collected and compiled, they become Statistics
- Synonymous with ways and means of presenting and handling Data, making inferences logically and drawing relevant conclusions

# CHARACTERISTICS

## Affected by multiplicity of causes

- Facts and figures are affected by number of forces operating together . Statistics of production of rice are affected by the rainfall, quality of soil, seeds and manure ,methods of cultivation ,etc It is difficult to study separately the effect of each of these forces separately on the production of rice.

## Numerically expressed

- All stats are numerical statements of facts i.e. expressed in numbers. Qualitative statements such as the population of Iraq is rapidly increasing is not statistics

# CHARACTERISTICS

## Accuracy

Facts and figures about any phenomenon can be derived in two ways:

By actual counting and measurement.

By estimate.

## Collected in systematic manner

Before collecting data a suitable plan should be made and worked out in systematic manner.

Data collected in haphazard manner would very likely lead to fallacious conclusions.

# **CHARACTERISTICS**

## **Collected for pre-determined purpose**

Purpose must be decided in advance

It should be specific and well defined

## **Should be placed in relation to each other**

They should be comparable



# FUNCTIONS

- Presents facts in definite form.
- **Simplifies** mass of data.
- Facilitates **comparison**.
- Helps in **formulating and testing hypothesis**.
- Helps in **prediction**.
- Helps in **formulation of suitable policies**.

# DISTRUST OF STATISTICS

- Statistics can prove almost anything : figures are convincing; hence, people are easily led to believe them.
- Data can be manipulated : to establish foregone conclusions.
- Even with correct figures, misled presentation can be made.

# STATISTICS

- **Descriptive Statistics. Collection, Presentation and Description of numerical data (e.g., Means, Medians, Counts, Variance, Deviations, etc.).**
- **Inferential Statistics. Process of interpreting what the values of your statistical tests mean and making decisions from those.**

# Basic Concepts

- Population. A collection, or set of individuals, objects, or measurements whose properties are to be analysed.
- Sample (a subset of the population). It consists of the individuals, objects or measurements selected by the sample collector from the Population.

# BASIC DEFINITIONS

- Variables. A variable is a symbol X ,Y A etc which can assume any of a prescribed set of values called the domain of the variable.
- Constant. If the variable can assume only one value it is called a constant
- Data. The set of values collected for the variable from each of the elements belonging to the sample.

# VARIABLES

- Discrete : Result of counting (counts), usually Integers.
- Counting give rise to discrete data.
  - Example : No. of children in each house of a village.
- Continuous : A measurement of quantity, can assume any value between two given values.
- Measurement give rise to continuous data.
  - Example : Rainfall amount, Temperature, etc.

## BASIC DEFINITIONS FUNCTION

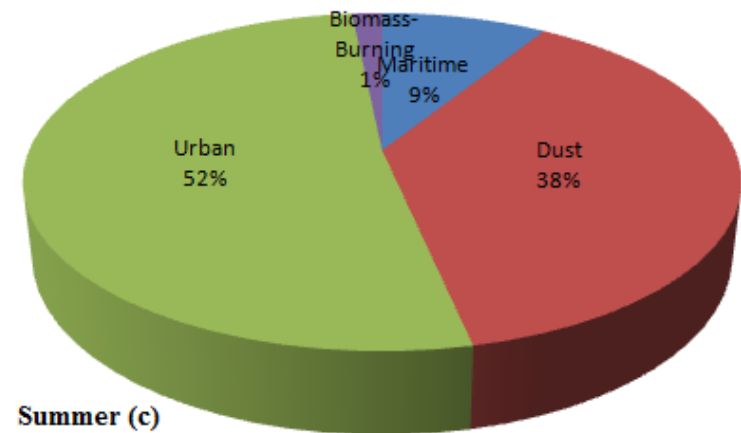
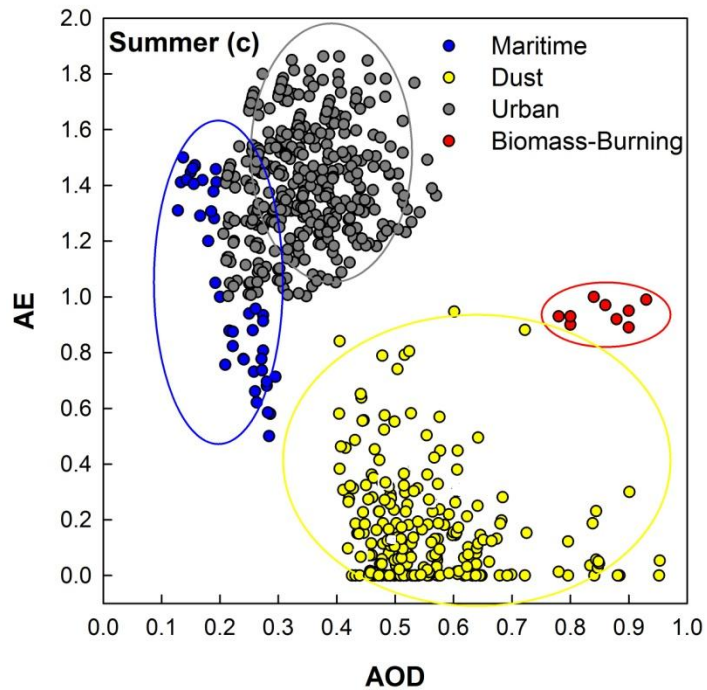
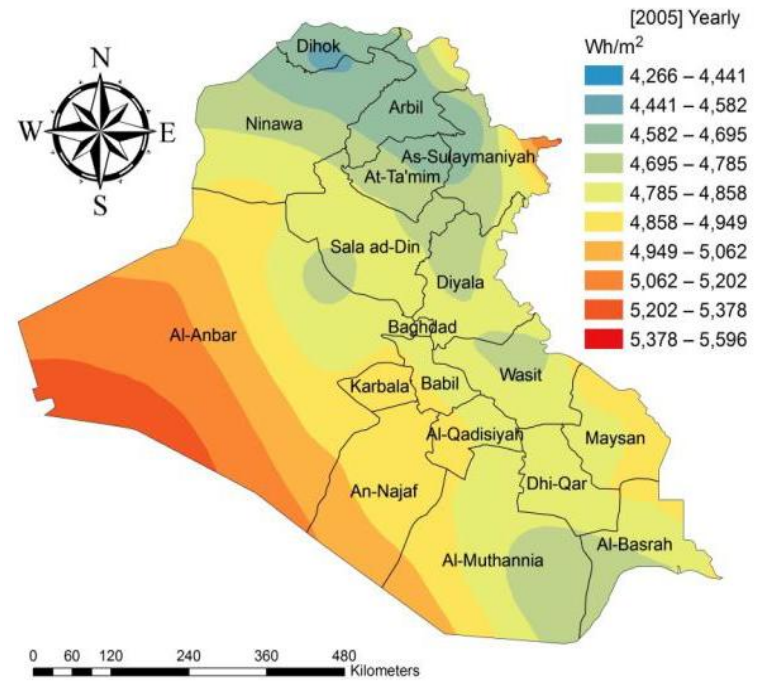
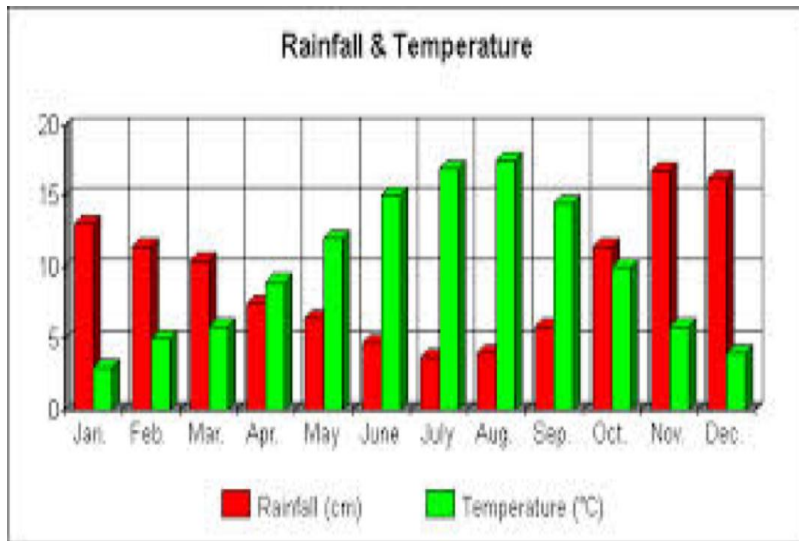
■ If to each value which a variable  $X$  can assume there corresponds one or more values of a variable  $Y$ , we say that  $Y$  is a function of  $X$ .

- $Y = F(X)$
- Variable  $X$  is independent variable
- Variable  $Y$  is dependent variable
- Single valued function
- Multiple valued function

## BASIC DEFINITIONS GRAPHS

- A graph is a pictorial presentation of the relationship between variables.
- Many types of graphs are used in stats depending on
  - Nature of data involved.
  - Purpose for which graph is intended.
- Example: Bar graphs ,Pie graph, Scatter graph, Map etc.
- Graphs also referred as charts / diagrams





TABULATION OF DATA  
and  
FREQUENCY  
DISTRIBUTION

# BASIC DEFINITIONS

- **Raw Data** : Collected data, which has not been numerically organized.
- **Arrays** : An arrangement of raw data in ascending / descending order of magnitude.
- **Frequency Distribution** : A tabular arrangement of data by classes, together with the corresponding Class Frequencies.

# CLASSIFICATION OF DATA

- After collection and editing of data the next step is classification
- Classification is grouping of related facts into classes
- Sorting of facts
- Ex:
  - Post Office
  - School

# CLASSIFICATION OF DATA

## ■ Objectives

- To condense the mass of data in such a manner that similarities and dissimilarities can be readily apprehended
- To Facilitate comparison
- To pin point the most significant features of data at a glance
- To give prominence to the important information gathered and dropping out the unnecessary elements
- To enable statistical treatment of data

# TYPES OF CLASSIFICATION

- Geographical – Area wise ,cities, districts etc.(State wise production of food grains)
- Chronological – on basis of time( Population of Iraq from 1951-2011)
- Qualitative - According to attributes or qualities (On basis of literacy, religion etc)
  - Dichotomous or two fold classification
  - Manifold classification
- Quantitative – In terms of magnitudes(Students of college on the basis of weight)