

Training Course on

Geo-Informatics for Health Planning & Management (20th to 31st December 2010)

Introduction to GIS



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****** G. I. S ******

- **Geographic?**
 - Reality
 - Spatial location, scale, and time
- **Information?**
 - Data and meaning of data
 - Collections of facts, knowledge base, personal or collective value
- **Systems?**
 - Computers and methods
 - Physical and conceptual entities or networks
- **Science?**
 - Knowledge, System of Knowledge

What is GIS.....??????

Cower (1988) defines GIS as “a decision support system involving the integration of spatially referenced data in a problem solving environment”.

According to Aronoff (1989) defines GIS as

“a computer-based system that provides four sets of capabilities to handle georeferenced data:

- i) data input**
- ii) ii) data management (data storage and retrieval)**
- iii) iii) manipulation and analysis**
- iv) iv) data output.”**

What is GIS (Aronoff, 1993)

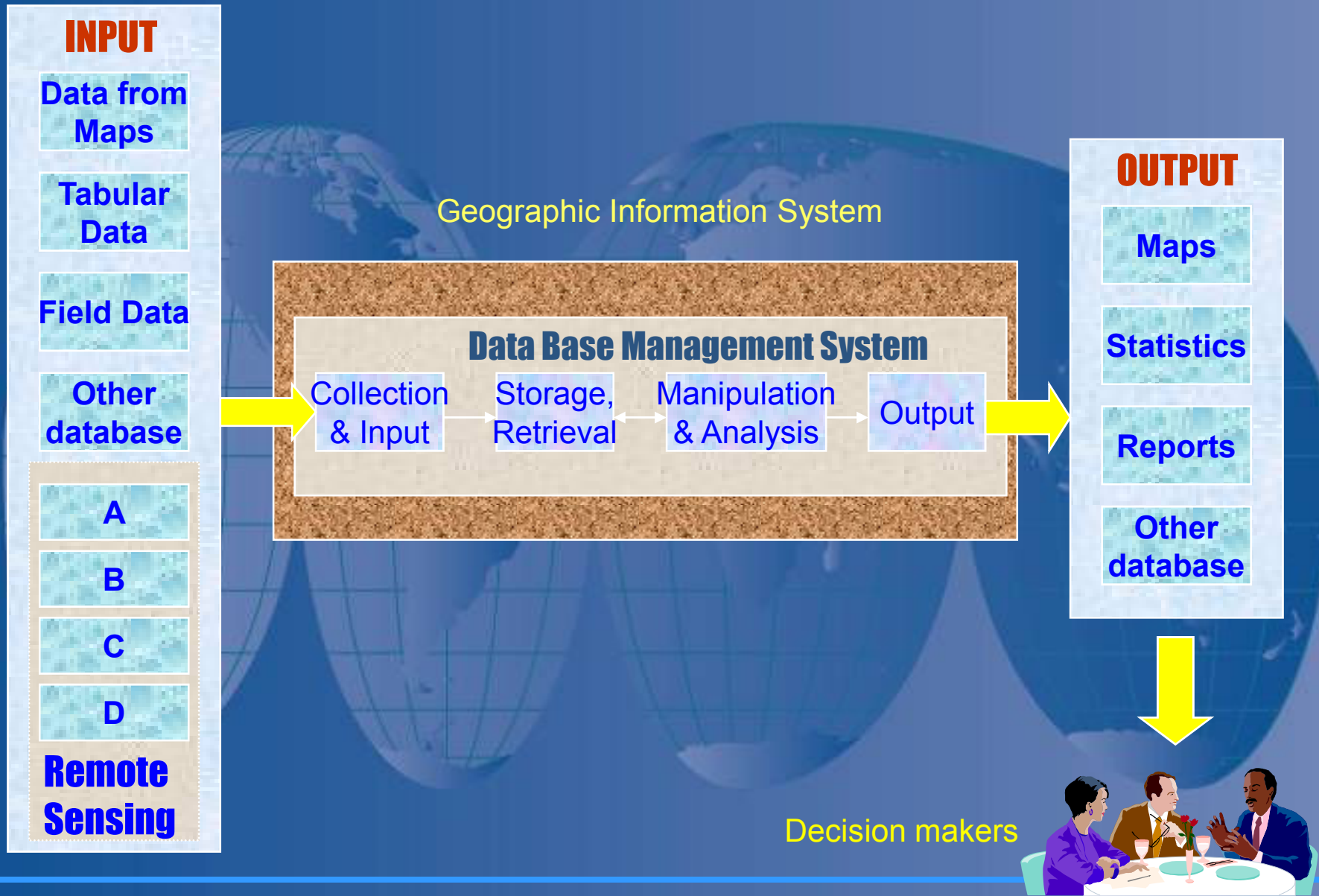
“A system for the input, management, analysis and output of spatial data
Information”

A computer based system with best tools available for

data entry, data management, data analysis, and data representation

of Geographically referenced data

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GIS stores related map features as separate map themes



The beauty of GIS
(Layer by layer analysis)

Advantage:
e.g. Integration of data
from different sources
to a single Georeferenced
Platform for spatial analysis.

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Data

concept in GIS

Raw fact which is collected from specific environment for specific requirements

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Data

Data in everyday language is a synonym for information therefore often used indiscriminately.

But in the exact sciences there is a clear distinction between data and information because they both have a specific meaning.

Data can be described as different observations and measurement which are collected and stored and can be organized .

Data may relate to **reality**, or to **fiction** as in a fictional movies.

Data about reality consists of propositions . A large class of practically important propositions are measurements or observations of a variable. Such propositions may comprise numbers, words or images.

Information



when data is organized then it becomes **information**.

Information is data which is used in answering queries or solving a problem. Digitizing a large number of maps provides a large amount of data after hours of painstaking work, but the data can only render useful information if used in analysis.

Information it is the context in which data is taken from the real world and then entered into a system. Then after processing (i.e. gathering, manipulating and organizing), that data in a way that adds to the knowledge of the receiver.

SOURCES OF DATA

1. Primary data sources:

(Direct Data Acquisition)

Like Field survey, observations and GPS surveys etc.

2. Secondary data sources:

(Indirect Data Acquisition)

Digitizers, Scanners, available Statistical data, charts, tabular data, maps, satellite imageries (RS) , GPS data, reports, and research papers etc.

TYPES OF DATA

1. Geographic data

(Spatial data) i.e each feature has a location on earth surface
Map features: point, line, polygon, Electric pole, road, soil type)

2. Attribute data

(Non-spatial data, non-geographic data)

Properties of map features e.g. name of city, road, river, land use type,)

Spatial data types

Features of the earth surface are also called as **Geo-Objects**
(Geo-objects (processes or phenomena, things) occupy space)

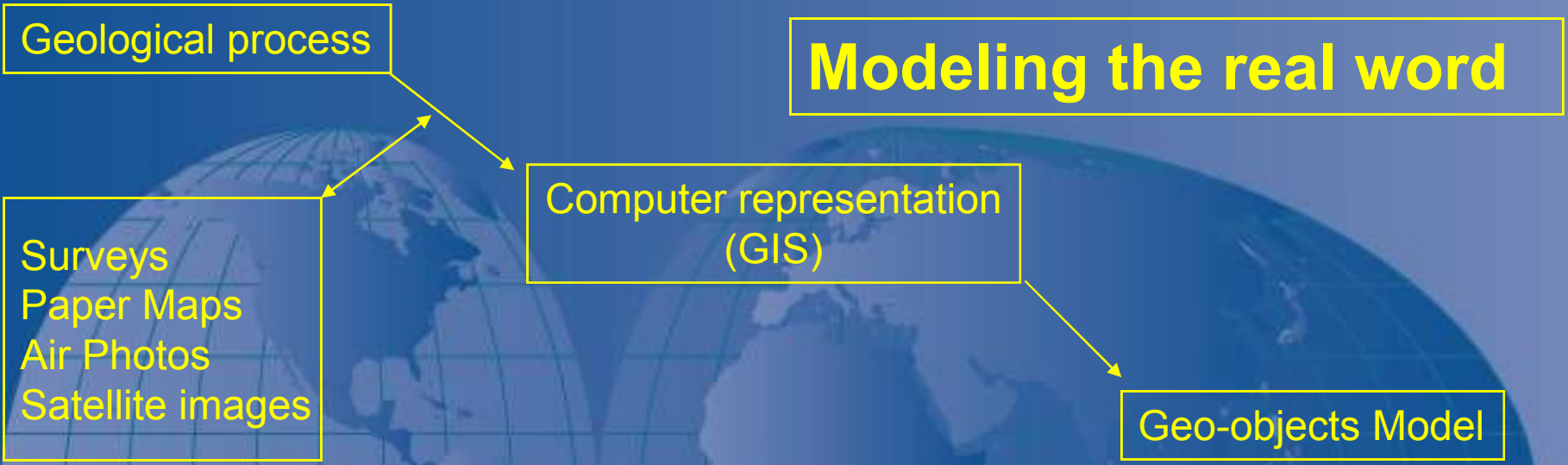
Types of Geo-objects

1. Natural geo-objects

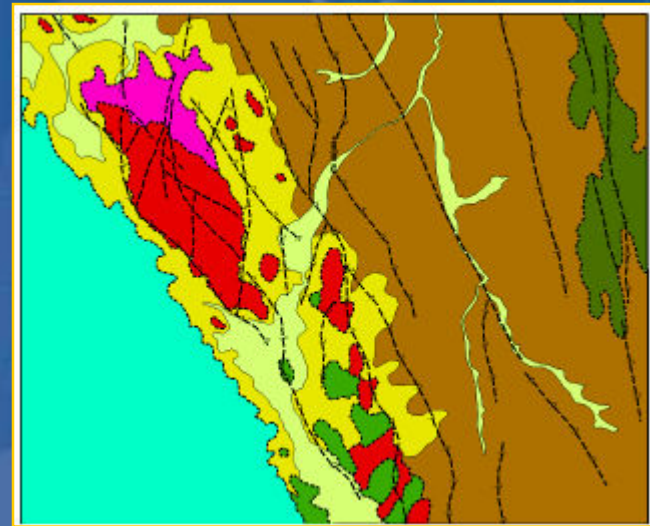
Discrete spatial entities recognizable in the real world
Examples: river channels, forests, mountains

2. Imposed geo-objects

Artificial or man-made spatial entities
Examples: property boundary, Built-up areas, fields



Real world



Simulation world

Spatial data can be considered to be a collection of spatially referenced features that acts as a model of reality. There are two important components of spatial data;

- Geographic position
- Attributes or properties

In other words

- spatial data (where is it?)
- attribute data (what is it)

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Computer Representation of Spatial Data

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Computer Representation of Spatial Data

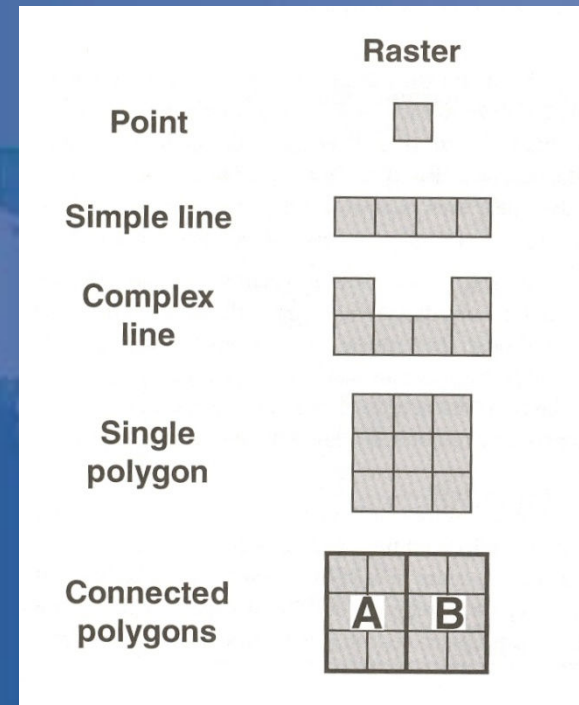
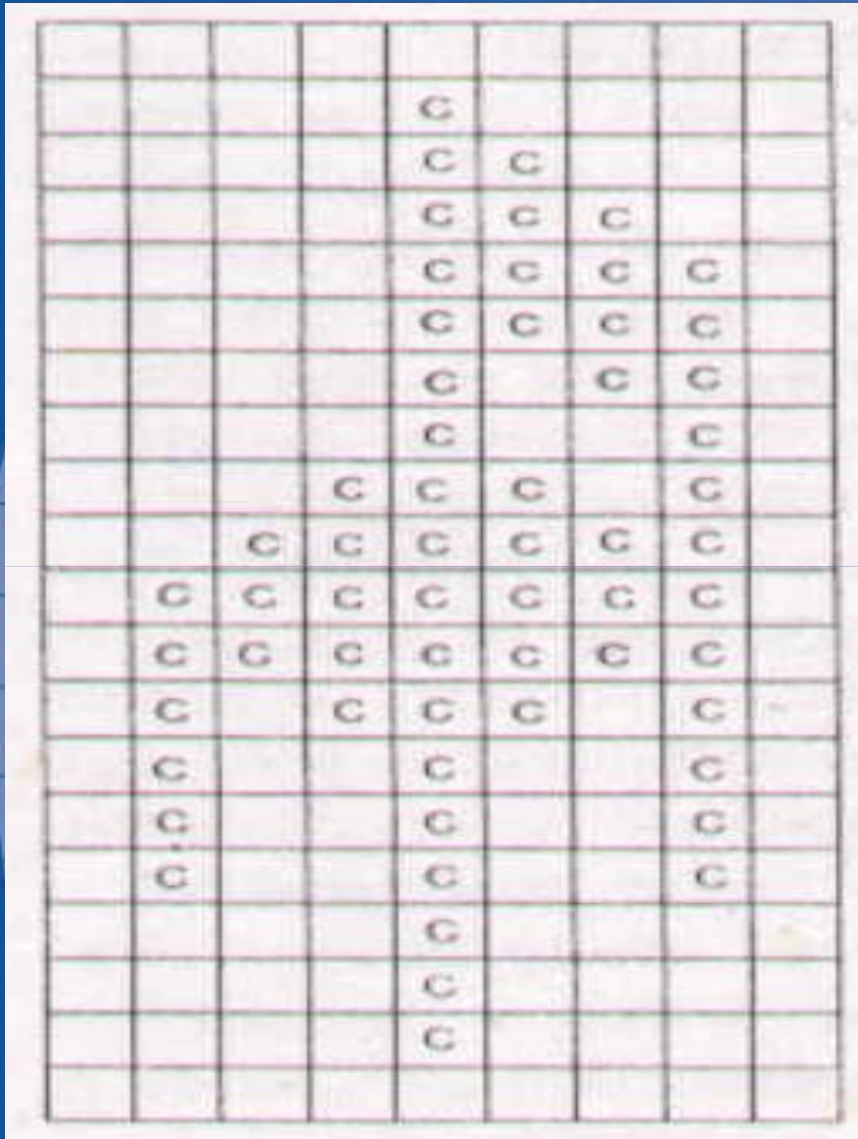
The human eye is highly efficient at recognizing shapes and forms, but the computer needs to be instructed exactly how spatial patterns should be handled and displayed.

Essentially there are two contrasting but complementary ways of representing data in the computer that we shall refer to as explicit and implicit ways of describing spatial entities.

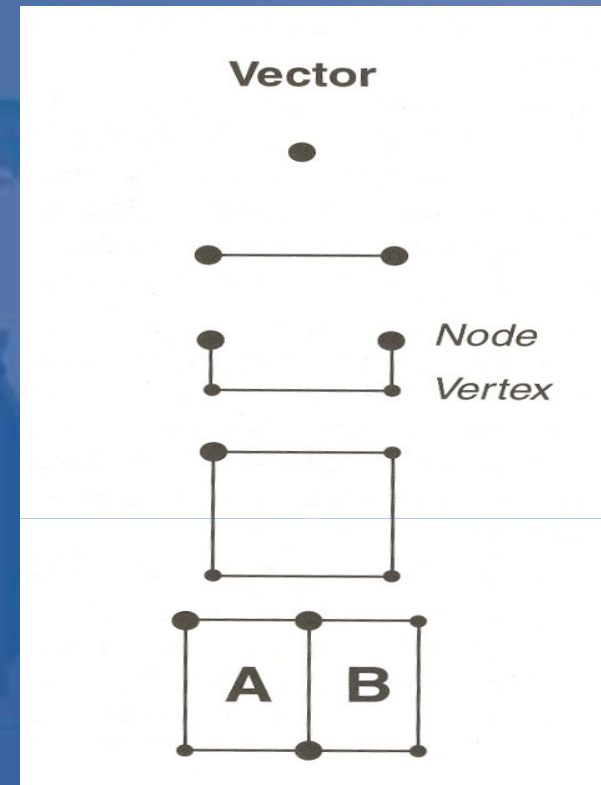
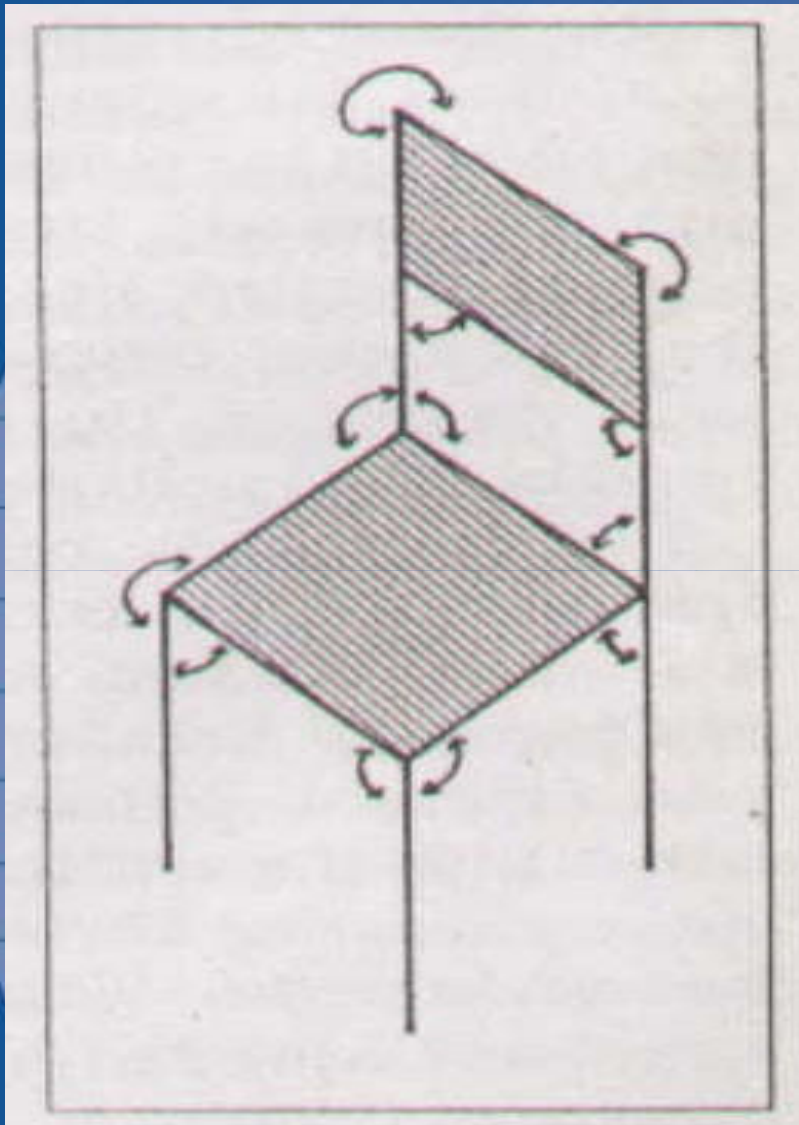
GIS uses primarily two spatial data models

- Raster data model
- Vector data model

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A spatial data model that uses a grid and cells to represent the spatial variation of a feature – Raster data.



Vector format has points, lines, polygons that appear normal, much like a map.

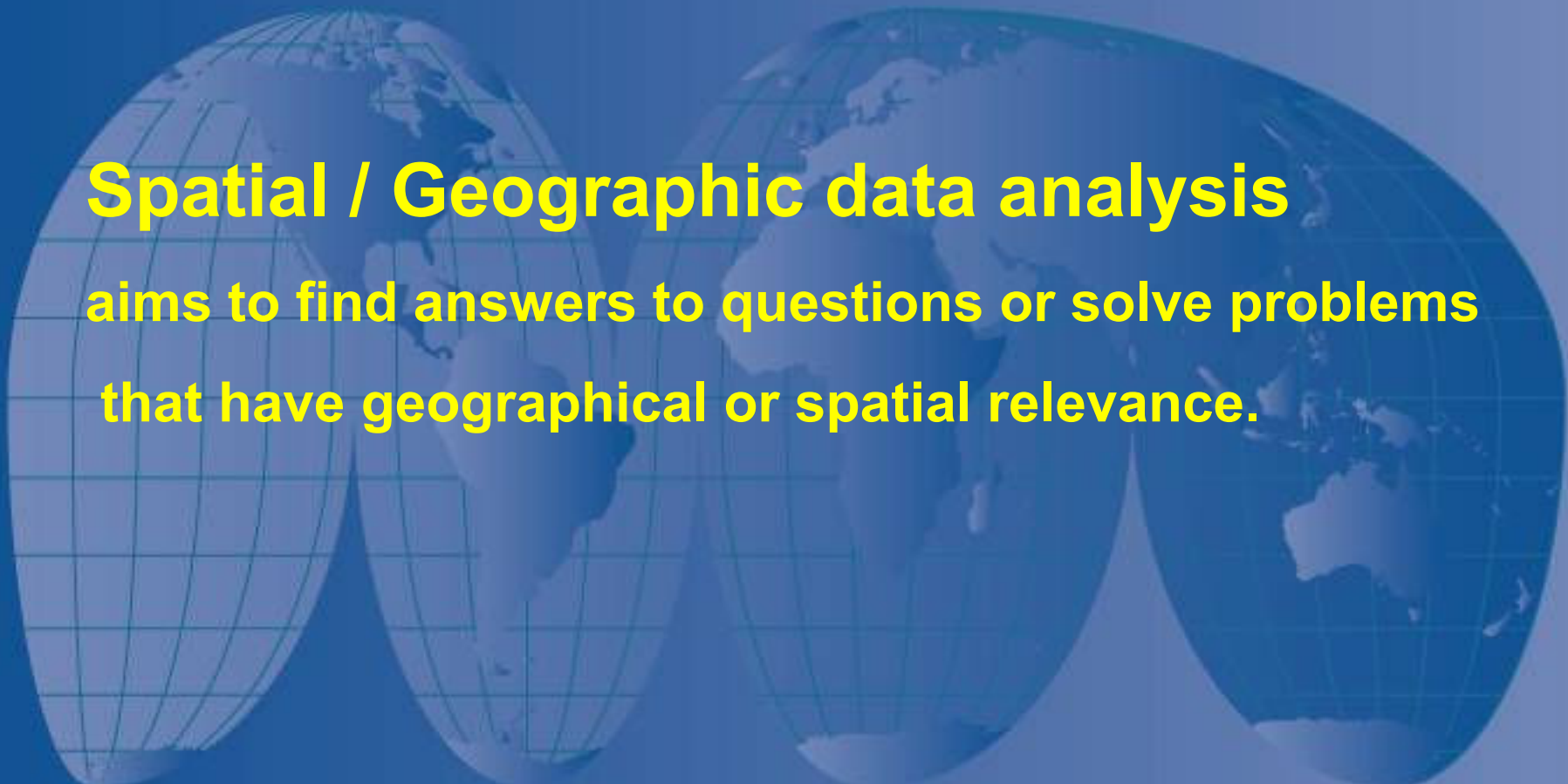
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Spatial Analysis



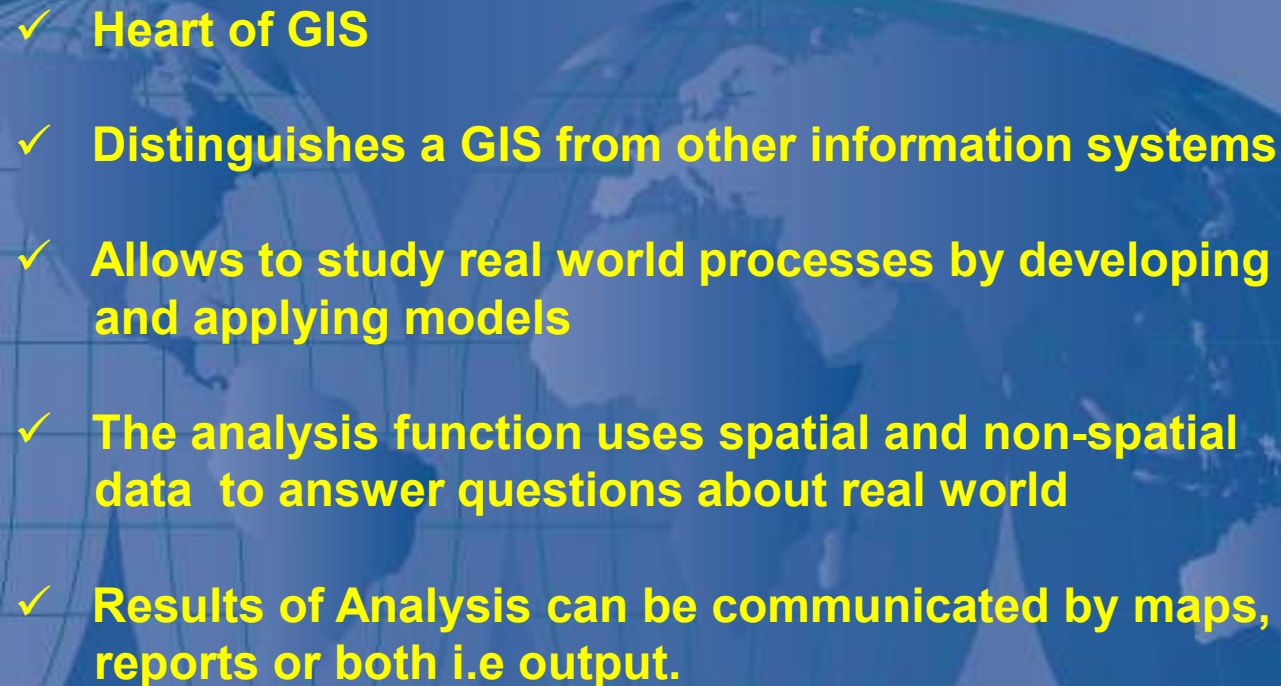
or Geographic Analysis

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Spatial / Geographic data analysis

aims to find answers to questions or solve problems that have geographical or spatial relevance.

- 
- ✓ **Heart of GIS**
 - ✓ **Distinguishes a GIS from other information systems**
 - ✓ **Allows to study real world processes by developing and applying models**
 - ✓ **The analysis function uses spatial and non-spatial data to answer questions about real world**
 - ✓ **Results of Analysis can be communicated by maps, reports or both i.e output.**



The objective of Spatial/Geographic analysis is to transform data into useful information to satisfy the requirements or objectives of decision Makers.

For instance.....

Where is the most suitable site for waste disposal?

Which areas are not prone to landslides?

Which areas will be submerged underwater upstream of a new dam?

Where are the best exploration targets for gold deposits?

The range of analysis procedures can be subdivided into the following categories :

- ✓ **Database Query**
- ✓ **Overlay operations**
- ✓ **Proximity Analysis (Buffering)**
- ✓ **Network Analysis**
- ✓ **DEM, DTM (Surface analysis)**
- ✓ **Statistical & Tabular Analysis**

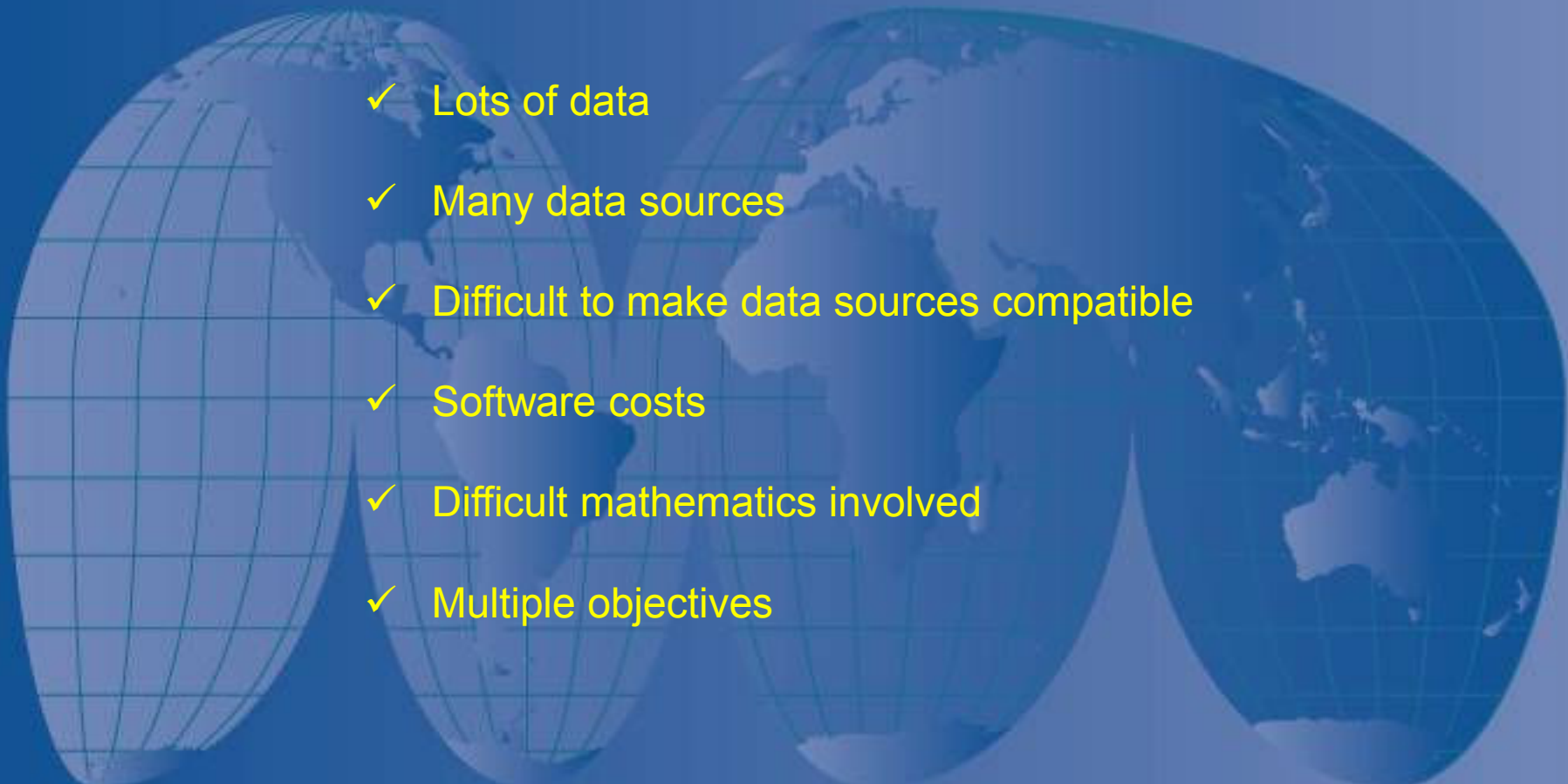
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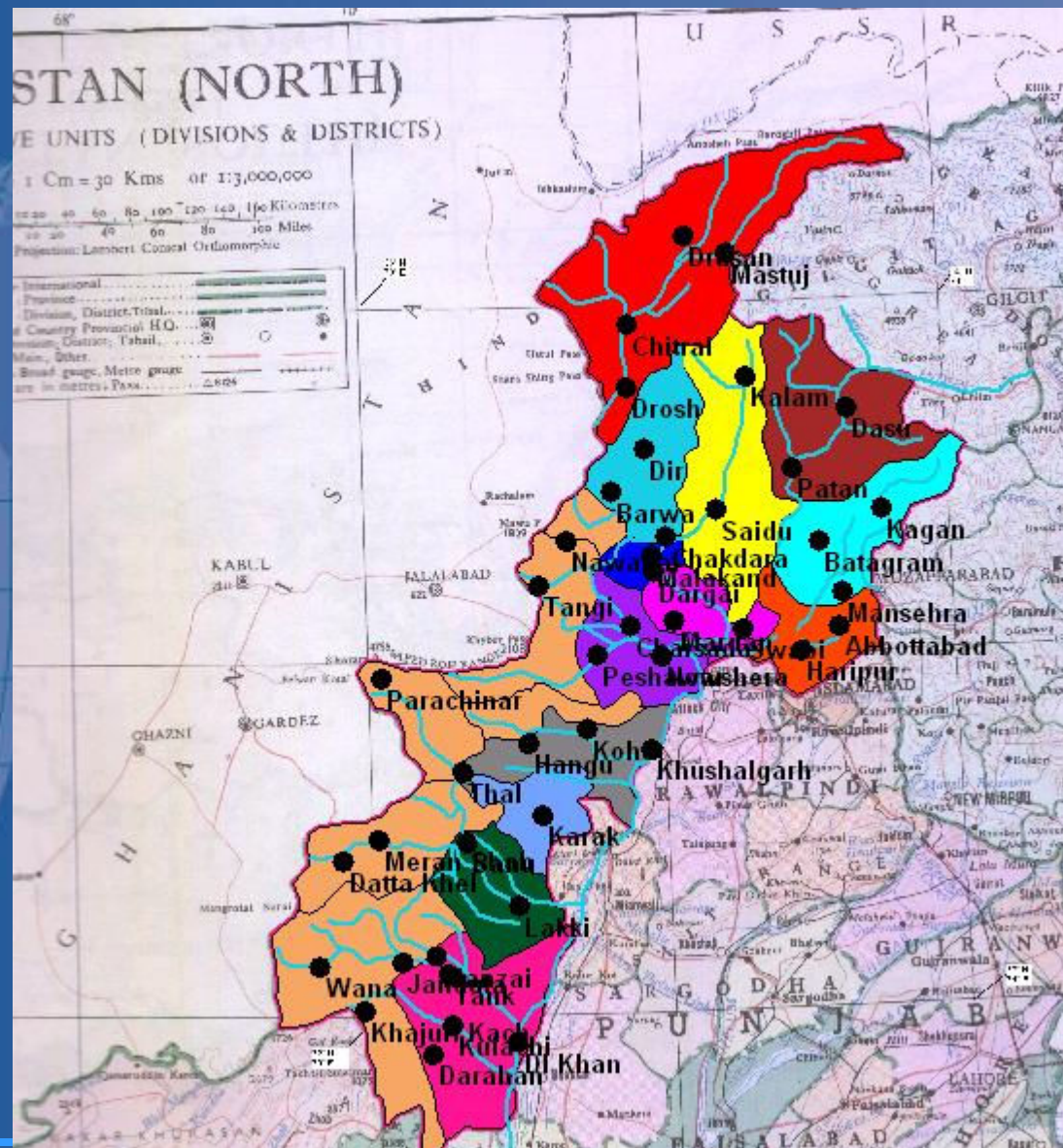
John Snow's 1855 map of the cholera outbreak showing the clusters of cholera cases in the London epidemic of 1854

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Difficulties of Geographic/spatial Analysis

- 
- ✓ Lots of data
 - ✓ Many data sources
 - ✓ Difficult to make data sources compatible
 - ✓ Software costs
 - ✓ Difficult mathematics involved
 - ✓ Multiple objectives

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The End *****