EWC 206: GIS IN ENVIRONMENTAL AND WATER RESOURCES ENGINEERING

Prepared By: Lecturer Fariha Islam Mou

Department of Environmental, Water Resources, and Coastal Engineering (EWCE)
Military Institute of Science and Technology (MIST)

Introduction to Map, Map Projections and Co-ordinate Systems, Map Design

What is Map

- **A map is the most efficient shorthand to show locations of objects with attributes and their spatial distribution.**

- **Mapping is a process by which real-world objects are measured, documented and stored on a medium (Commonly paper)**

Why Maps are important in case of GIS

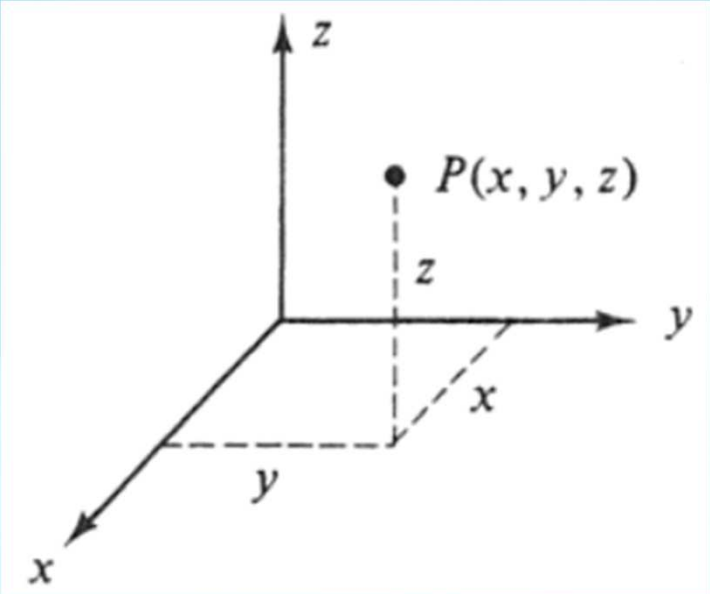
- **Maps are intermediate steps in an analysis of GIS**
- **Knowledge about the basic principles of map making (cartography) makes the use of GIS more effective.**
- **Shrink or expand of paper over time causes distortion of features depicted on maps.**
- **To make spatial analysis of maps more easier & efficient.**

What is a coordinate system?

A coordinate system is a reference system used to represent

- the locations of geographic features,
- imagery and
- observations, such as Global Positioning System (GPS) locations

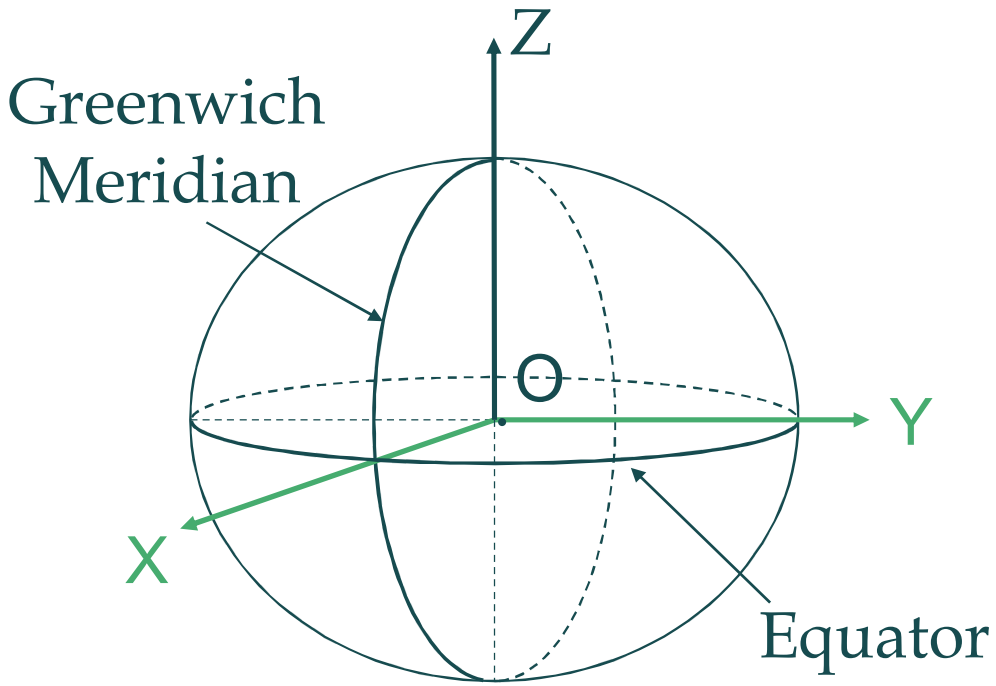
within a common geographic framework.



Types of Coordinate Systems

1. Global Cartesian coordinates (x,y,z) for the whole earth
2. Geographic coordinates (f, l, z)
3. Projected coordinates (x, y, z) on a local area of the earth's surface

Global Cartesian Coordinates (x,y,z)



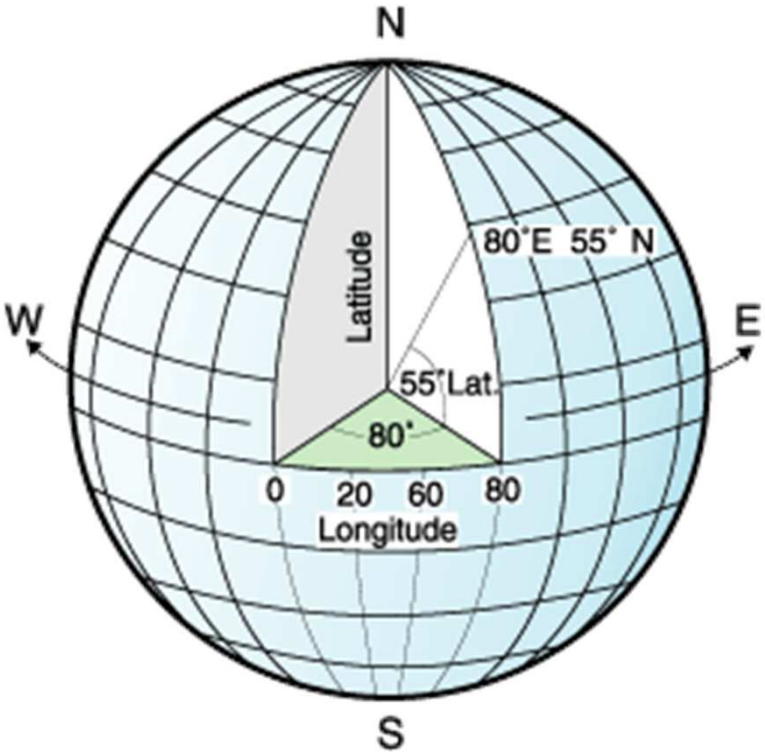
Geographic coordinate systems

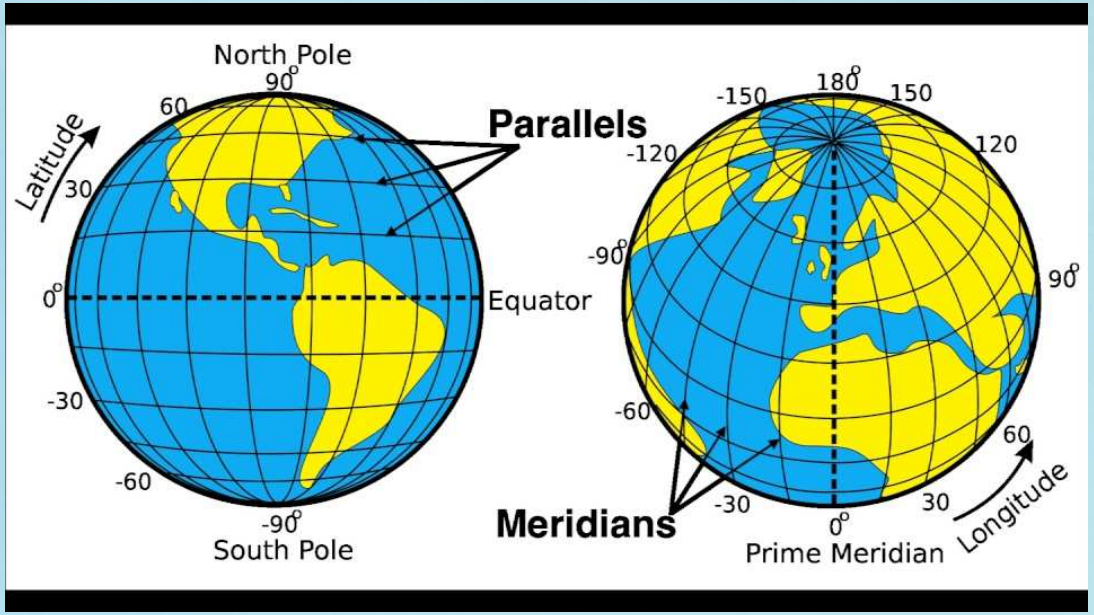
A geographic coordinate system (GCS) uses a three-dimensional spherical surface to define locations on the earth

A point is referenced by its longitude and latitude values

Longitude and latitude are angles measured from the earth's center to a point on the earth's surface.

The angles often are measured in degrees





In the spherical system, horizontal lines, or east–west lines, are lines of equal latitude, or parallels

Vertical lines, or north–south lines, are lines of equal longitude, or meridians

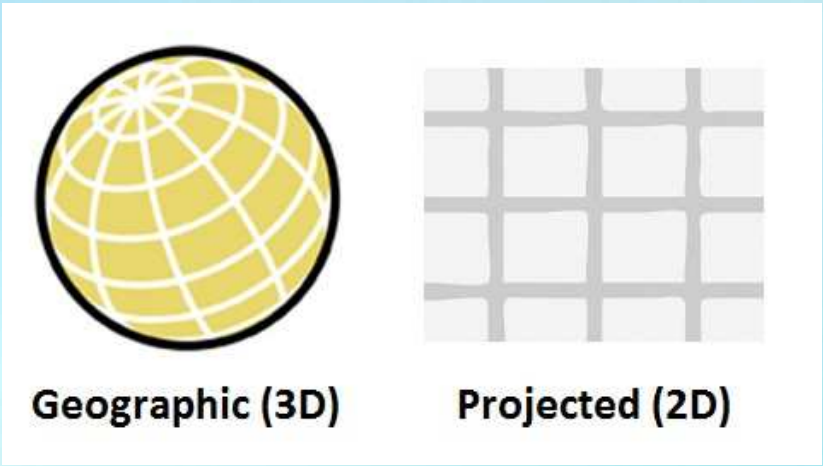
These lines encompass the globe and form a gridded network called a graticule

Projected coordinate systems

A projected coordinate system (PCS) is defined on a flat, two-dimensional surface.

Unlike a GCS, a PCS has constant lengths, angles, and areas across the two dimensions

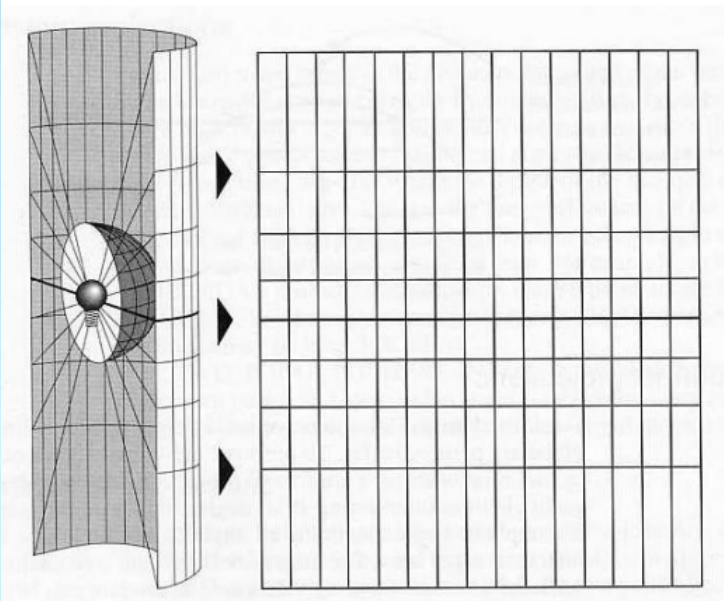
A PCS is always based on a GCS that is based on a sphere or spheroid. In addition to the GCS, a PCS includes a map projection



Map projections

A map projection is simply a method of showing the 3-D planet Earth on a 2-D plane

In other words A map projection is a conversion between geographic and planar coordinates based on a method with its geometric properties

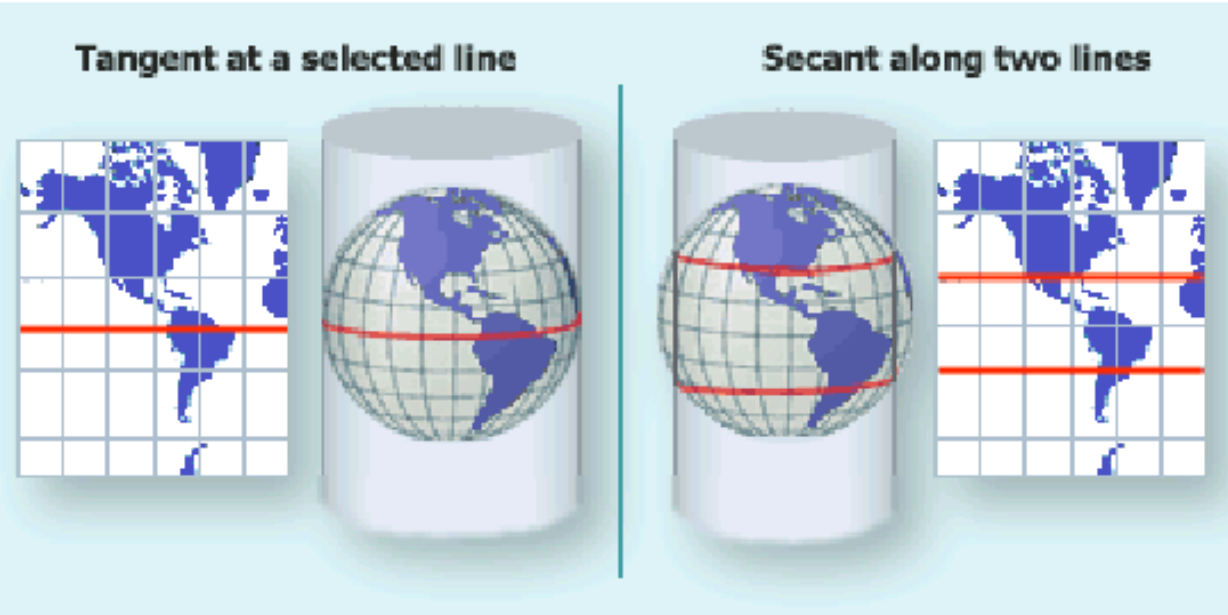


Types of Map Projection

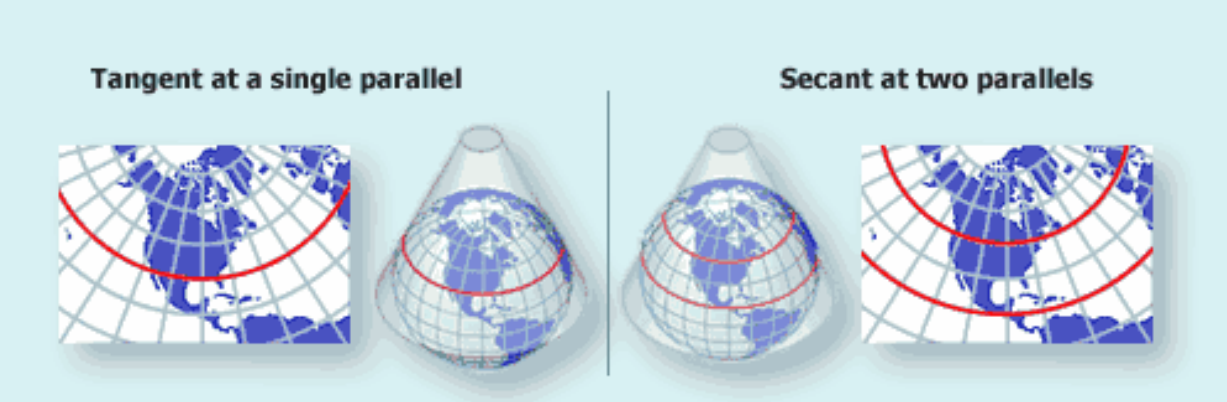
Classification based on geometrical model of projection

- **Cylindrical** (Transverse Mercator) - good for North-South land areas
- **Conic** (Albers Equal Area, Lambert Conformal Conic) - good for East-West land areas
- **Azimuthal** (Lambert Azimuthal Equal Area) - good for global views

Cylindrical Projection



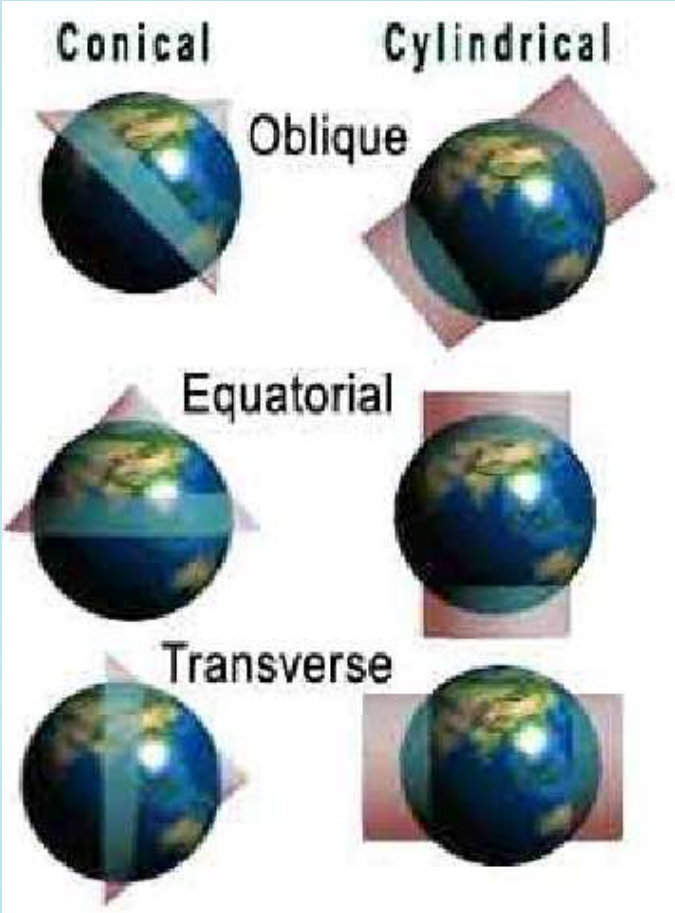
Conic Projection



Types of Map Projection

Classification based on orientation

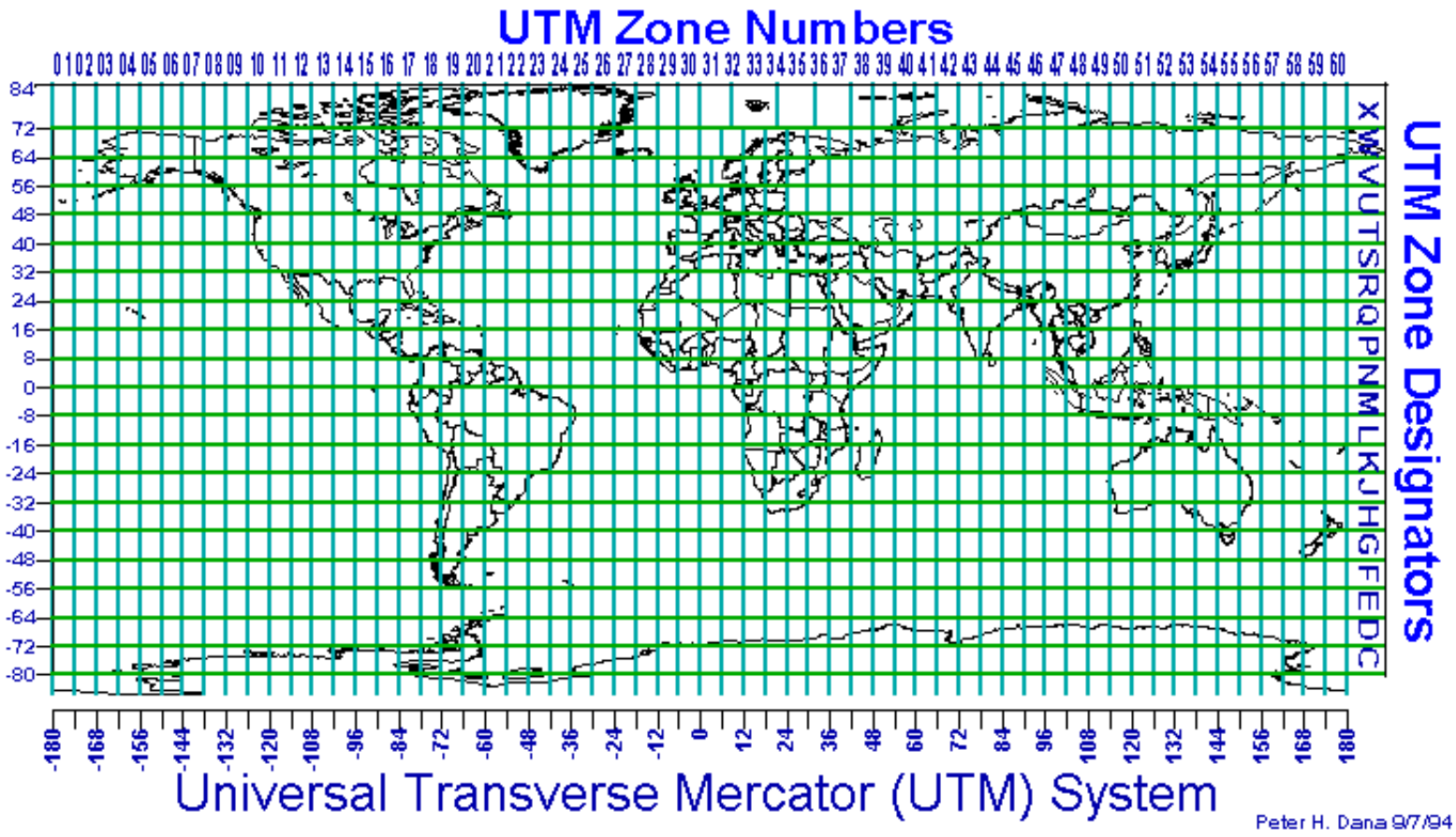
- Equatorial or normal projection
- Transverse projection
- Oblique projection



Universal Transverse Mercator

- The UTM coordinate system is commonly used in GIS **for larger scale areas** within a certain UTM zone
- The UTM projection is formed by using a transverse cylindrical projection
- UTM divides the earth into pole-to-pole zones 6^o of longitude wide
- The first zone starts at the International Date Line (180^o east) and the last zone, 60, starts at 174^o east
- Each zone has a Central Meridian (l_o)
- Reference Latitude (f_o), is the equator
- Because distortion becomes extreme at northern latitudes, UTM is not normally used above 80^o North or South

Universal Transverse Mercator



Spatial Referencing in ArcGIS

ArcGIS terminology

Define projection. Specify the projection for some data without changing the data

Project. Change the data from one projection to another


Thank You!!
ANY Questions?