

Hello student. I am Dr. Sanjay Gaikwad, Assistant professor, department of Geography and Research Center, of Parvatibai Chowgule College of Arts and Science (Autonomous), is here to present a module on application in GIS and geography. The model that I'm going to deal is coordinate systems, types of geographic coordinate system.

Here we have our layout of presentation.

I'll be introducing the coordinate system, what we call as coordinate referencing system.

- We will also discuss the basic concept of Earth shape and form.
- We will also discuss Earth centered Earth fixed coordinates.
- We will also discuss a geographic coordinate system and its structure.
- We will also talk about coordinate measurement, horizontal coordinate, global map and how to write the coordinates.

At the end you will also learn the longitudinal length equivalents at selected latitudes. And we'll also discuss at the end the difference between data and geographic coordinate system.

- Difference at the end of the model you will learn the basic concept of Earth shape, datum, latitude and longitude.
- You will also learn the concept of Earth centered Earth fixed coordinates.
- You will also learn the geography coordinate referencing system and its structure.
- You will also learn at the end of the module the concept of horizontal coordinates and world map layout. Student will be able to express and write coordinates and calculate the distance between longitudes.
- You will also understand the difference between our datum, geography coordinate system.

### **Introduction**

As you all know, geography is very old discipline. But 300 BC Eratosthenes had started with the attempts of mapping the world, and the legacy is continued by Ptolemy, and the same map of the Ptolemy was used for more than 700 years, until the Arab geographers had done some modification in it, we can't ignore even the contribution of Indian geographers who tried to measure the circumference of the Earth and that was the beginning of the what we call modernist cartography. So in cartography we introduced the coordinate system where the distance between the vertical longitudes were considered to measure the space on the earth surface.

So **geographic coordinate systems** are often optimal when you need to locate place on the Earth's surface. So any place you want to locate will have a reference of latitudes and longitudes, or when you need to create global maps that time. Also we need to consider the geographic coordinate system.

So before we go further geography coordinates system and how to represent it on the earth surface and use it in GIS, we need to understand the basic concept of the earth shape.

Earth is not exactly the sphere so it is similar to the **spherical model**. We have **ellipsoid** as a concept. We have a geoid as a model and we have enjoyed. So in the diagram you can see the exact curves of ellipsoid. Then blue line represents the geoid and the black dark lines represent the actual shape of the earth. So the geoid model represents the difference between the ellipsoid angles as well as the difference between the altitudes above the earth surface or the depths below the ocean so this kind of representations called as separation.

When it comes to the vertical datum, we're representing all the places besides of their latitude and longitude with their elevation reference also. So elevation of the point on earth surface means the difference from the mean sea level is the arithmetic mean of the hourly water elevations taken over the specific 19 years of the cycle, which is defined as a zero elevation. So it is actually done at the sea level. OK, so once it is defined for 19 years, then it is defined as a fix at zero elevation for the local area and it is close, approximate to the geoid and this geoid is known as your height. So this your height is used whenever we are considering the height above mean sea level, height above mean sea level. In the sketch you can see the blue line represents the mean sea level OK and then the. Orange line represent the earth surface, so there are depths as well as there are other very high elevation points. So difference between the depth and elevation is also represented by the geoid model. So the vertical Datum is an ellipsoid as the reference surface. The relationship between ellipsoidal height that is X and Y add height that is small. It is given  $X$  given  $SH$  is equal to small  $H + n$ ,  $N$  represents the geoid ellipsoid separation.

The gap between the ellipsoid so there are three concepts, and the sketches also represented very well horizontal datum, local geodetic datum and global geocentric datum. So horizontal definition is defined as ellipsoidal reference surface for the planimetric measurement, that is, latitudes and longitudes local geodetic datum is result in uneven connectivity of Longitude and larger ~~Electric terminal~~ alliance between different countries or regions, whereas global geodetic datum. This datum represents the world geodetic system 84. That is usually referred in GPS. It consists of three dimensional Cartesian coordinate system and associated ellipsoids.

This is also very important concept we call it Earth centered Earth fixed coordinates or centered or fixed coordinates in relation to the latitude in longitude. It refers to the center of the earth. OK, we call conventional the terrestrial coordinate system when Earth rotates with its origin at the center of the Earth so the conventional right handed coordination system is put the origin at the center of the mass of the earth on a point close to the center of the earth OK, and the get axis of the line between the North and South poles with a positive value increases northward.

That means the Earth is considered a circle, and then the Latitudes and longitudes are the OR the  $x$  is taken from the center of Earth as see in the diagram this center of Earth and then the Axis  $X$  axis  $Y$  axis  $Z$  indicated the North Pole and  $Y$  &  $X$  indicate the horizontal angles on the equator. OK, so this is represented by  $\lambda$  and  $\pi$ . So  $\pi$  represent longitude & latitude and  $\lambda$  represents longitude and all other taxes are being shown here OK, so this concept gives you the idea of latitude in longitude, how they are taken from the center of Earth. So when we get the three dimensional representation, so we try to present the data in the form of Easting's, and northings, and the elevation above the surface. OK, so this diagram shows you the ~~Efe and use that is~~. Longitude in the  $\lambda$  and let you do in the  $\pi$  coordinates and the relationship between them. So this is the center of the earth when the angle is taken exactly on the. Equator, so it is representing the longitude when angle is taken from equator to the pole that is representing the other north latitudes. OK, so this way one can understand how the latitude and longitude has been considered. So geographic coordinate system is coming out of this particular models geographic coordinate system is also called as ECS is a coordinate system associated with position on

the Earth and that is also called in short geographic position. GCS can give positions with respect to as a spherical coordinate system using electric launch showed an elevation map coordinate that is projected onto the plane, possibly including elevations. The earth centered or fixed Cartesian coordinates in the 3D space.

As a set of numbers, letters, or symbols, forming a geocode that is likely to launch code or northing listings or East End South so that way the numbers are in this case and the of course I keep on the structure of geographic Coordinate representation system that uses a grid that warp around the entire globe. Each point on the globe is defined using the same coordinate system and the same unit as defined within the particular geographic coordinate represents representation system.

This GCR's are best for global analysis however, it is important to remember that the distance is distorted. Using a geographic latitude and longitude, why this distortion pick list 'cause the Earth is not exactly flat or the square or any geometrical shape so the distortion is likely to be there because the ~~electrician~~ should tend to change there. Spacing OK, so the geographic world geodetic system 1984 has ~~electric-launch~~ tool and then see Alice has an origin at zero degree north and Zero degree East or Zero degrees South and Zero degree West. The located at the intersection of the Earth that is at the equator where the Zero line due to have and then the zero latitude we have and the Prime Meridian that is zero longitude on the globe.

So the intersection point of the ~~electrical~~ on stool is always called 0, 00 degrees north and zero degree store jewelry South and Zero degree West when the coordinate system is measured, the global. Pattern is taken into consideration, so full Earth circumferences considers 360 degrees circle, so one circle is equal to 360 degrees. Then it is divided into further 60 minutes, so every one degree is equal to 60 minutes and every minute is further divided into 60 seconds so every minute is up 60 seconds, so the angle is expressed in degrees, minutes and seconds so all the angles as shown in the figure that angles are taken from the center to the equator and center to the equator to the pole so that way the angles are taken, so enter. ~~Dollars~~ are components or equal circumferences considers 360 degrees, so we have 90 degrees North 90 degrees South on both sides, so it becomes 360 same way. The Longitude also 180 degrees on east and 180 degrees on West, so that also becomes 360 degrees. So this way the ~~electrician lawsuits~~ are arranged, so latitude, so we have all horizontal lines and that are the angles taken from the center of the earth. OK, and that are extending from zero degrees equator to the north, 90 degrees and zero degrees, equator to the South, 90 degrees so you can see the arrangement of latitudes, whereas longitudes are the lines connecting the pole to pole so that are also crossing by the every degree angle taken on the equator.

When it comes to the representation of the world, OK, this is very simple representation in the geographic coordinate system that is WGS 1984 datum is used for this The unit is degree ~~electrician~~ longitudes so you can see the extension from zero degree 280 degrees East as well as West and zero to 90 degrees North and South. So this is represented by the letters large tool and world is as conventionally presented by like the very famous transverse Mercator's projection. In short, will see how the coordinates are written. A reference ellipsoid is a mathematical model of shape of the earth with the major axis along the

equator, Equatorial radius; a geographic coordinate system uses longitude and latitude it is expressed in decimal degrees. For example, WGS 1984 and North American Datum that is NAD 1983 are the most common datum today. Before 1983, North American Datum 1927 was the most commonly used data, and America, the North American Datum is always been updated. Four degree minutes, seconds, and minutes ranging from zero to 60 degrees, for example, geographical coordinates are expressed in degrees, minutes, seconds for New York City is like 40 degree, 42 minutes and 51 seconds north latitude and 74 degrees 0 minutes 21 seconds West longitude so this is a way of representing or writing the coordinate position of any place on the globe while writing coordinates of the location using latitudes as followed by the longitudes. For example, coordinates of Delhi is to be written as 28 degree, 36 minute, 52nd north and 77 degree 12 minutes, 32 degrees East. The decimal degrees another format representing the coordinates of our location to convert the location coordinates we can see here in the method shown 28 degrees, 36 minutes, 50 seconds are represented as 28.6138. The calculation is shown in this. 36 minutes are divided by one up on 36 minutes are multiplied by one upon 60. Same way 50 seconds are applied by one upon 60 into one up on 60.

As we know the lines of longitudes are not straight, they are bending toward the pole. It has a maximum distance at the equator that is zero degree that is 130 kilometers, whereas at the 60 degree north or 60 degrees South. That distance is coming around 55.8 kilometers and their difference of the lateral logical differences 5.58 meters. You can go through the other places the difference has been shown here in this. What the difference between the data and geographic coordinate system that is always your question. A datum is 1Parameter in geographic coordinate system. The datum is the part of geography coordinate system that determines which model that is spheroid is used to represent the earth surface and where it is positioned relative to the surface. Since the earth surface is not perfectly a smooth or around, there is many different datum design for different parts of the world as a geographic coordinate system is the full definition of how to tie coordinate values to the real location on the earth. In addition to the datum, GCS includes a Prime Meridian which specifies the location of zero degree longitude and an angular unit often in the degree form.

There are some limitations of this geographic coordinate system. Each geographic coordinate representation system is optimized to best represent the shape. Scale or distance and the area of a feature in a data set. There is not a single ZCRS mean geography coordinate system that does a great job at optimizing all three elements. The district distance and area some CSS are optimized for shape, some are optimized for distance and some are optimized for the area. Some CRS are also optimized for particular reason for instance the United States or Europe. However, Longitude and latitude Locations are not located using uniform measurement units. This ~~year~~ are not ideal for measuring distance. This is why another projected CRS have to be developed.

Dear friends, these are some references you can go into the details of this.  
And thank you for patiently Hearing