

Basic Geodesy

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Geodetic Coordinates

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In order to discuss geodetic coordinates, we must first discuss the three axes. (See Figure 1) The Z-axis is the rotational axis of the ellipsoid. The X-axis lies in the equatorial plane and intersects the prime meridian. The Y-axis also lies in the equatorial plane and is 90 degrees from the X-axis. (Please note that all of the axes extend completely through the ellipsoid, but only half of each axis is shown for illustrative purposes.)

In the example in figure 1, we are determining the geodetic coordinates (longitude, latitude, and geodetic height) of a point on the earth surface near the border of India and Pakistan. The light green colored line is perpendicular to the ellipsoid at the example point and therefore, does not intersect the center of the ellipsoid. The darker green line is this line projected onto the equatorial plane.

To measure the geodetic longitude, symbolized by the Greek letter lambda, λ , we would measure the angle from the X-axis (or the Prime Meridian) to the dark green line on the equatorial plane. The geodetic latitude, symbolized by the Greek letter phi, ϕ , would be the angle between the two green lines.

Figure 2 illustrates geodetic height, which is represented by a lower case letter "h". Consider a line drawn from a point on the earth's surface perpendicular to the ellipsoid surface. The distance along that line from the earth's surface to the ellipsoid is the geodetic height, also referred to as the "height above the ellipsoid" (HaE). It is important to note that geodetic height is not the same as height above Mean Sea Level, and is not the same as orthometric height (or height above the geoid). Geoids will be discussed in the next article.

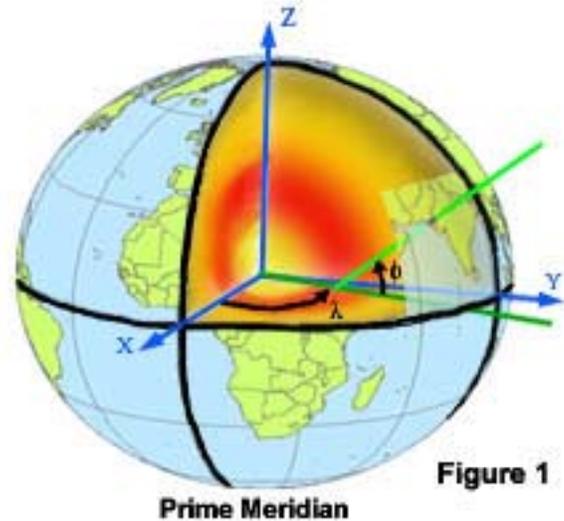


Figure 1

Geodetic coordinates are commonly derived from Global Positioning System (GPS) receivers. A directive by the Joint Chiefs (CJCS 3900.01B) urges the adoption of geodetic coordinates, in particular, geodetic height, for use in weapon systems, targeting and all geospatial information for DoD.

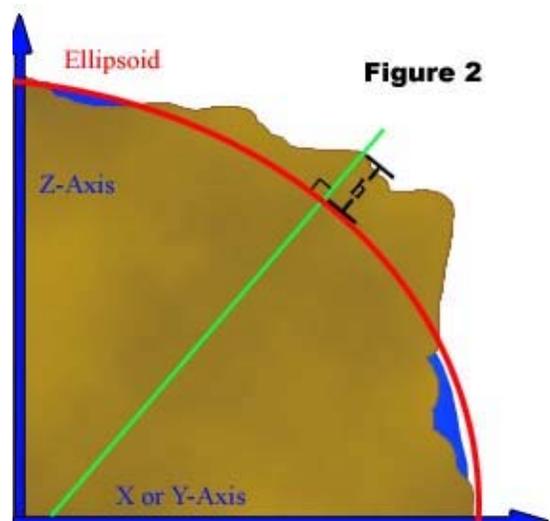


Figure 2

Geoids and Vertical Datums

The next article will discuss geoids and vertical datums.