Basic Geodesy

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Universal Transverse Mercator (UTM) Grid System

Roger Foster
Coordinate System Analysis Branch (CSAT)

There are many Transverse Mercator (sometimes referred to as Gauss-Kruger) grid systems used in mapping. The grid system portrayed on many NGA products is the Universal Transverse Mercator grid (UTM). This system uses specific parameters for its definition.

The world is divided into 60 zones each 6° wide and extending from 84° North to 80° South and identified from UTM Zone 1 to UTM Zone 60 (See Figure 2 on Page 2). There are some notable exceptions to the 6° wide zone rule around Norway.

The longitude line that is in the middle of each zone is referred to as the Central Meridian and is the Longitude of Origin for each zone (See Figure 1). The latitude of origin for all UTM zones is the Equator. During the design of the UTM grid system, a decision was made to avoid negative numbers for grid coordinates, the Central Meridian and Equator were given False Easting and False Northing values (see Figure 1). The Central Meridian for each zone is given a False Easting value of 500,000 meters. The Equator is given a False Northing value of 0 meters when working in areas north of the Equator and a value of 10,000,000 meters when working in areas south of the Equator.

The Central Meridian has a Scale Factor of 0.9996 and the unit of measure for UTM grid system is meters. Grid values can be repeated within a zone so it is often necessary to specify whether a point is in the Northern or Southern Hemisphere. (As an example, UTM grid zone 31 extends from 0° East to 6° East and has a Central Meridian of 3° E. A complete UTM grid value would include a Northing and Easting value along with the zone number, 31, and whether the point was in the Northern or Southern Hemisphere.)

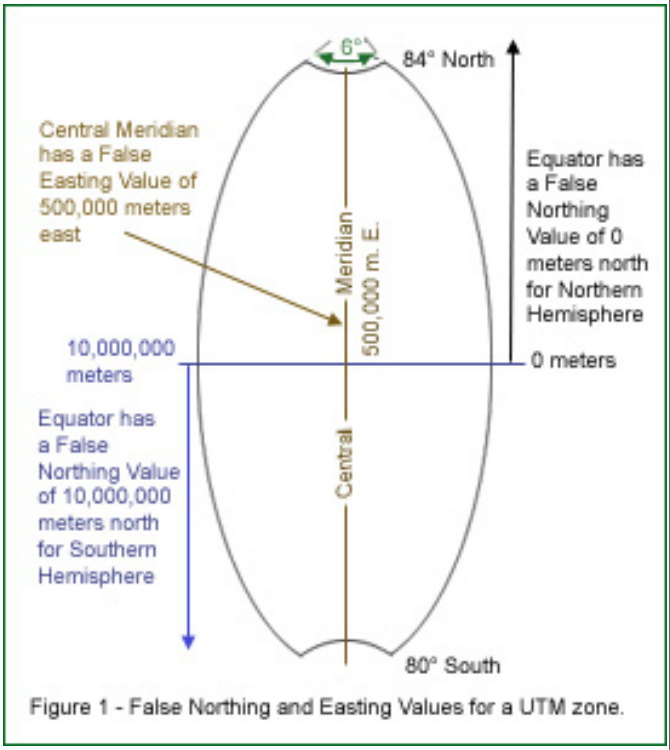

Figure 1 - False Northing and Easting Values for a UTM zone.

UTM Grid System vs. TM projection

A "projected coordinate system" is not exactly the same as a "projection". Rather, it is a set of map projection parameters with specific values, of which the map projection itself is one element. Transverse Mercator refers to the projection type in which the world is projected onto a horizontal cylinder, and values for the parameters (Central Meridian, Scale Factor, etc.) could include any of a wide range of values. UTM is a grid coordinate system based on the TM projection with specific values for the parameters.

Next Article

The next article will focus on the Military Grid Reference System (MGRS) which is a specific method for reading UTM (Universal Transverse Mercator) and UPS (Universal Polar Stereographic) grid coordinates used mostly by the military. The MGRS has also been adopted for the U.S. National Grid.

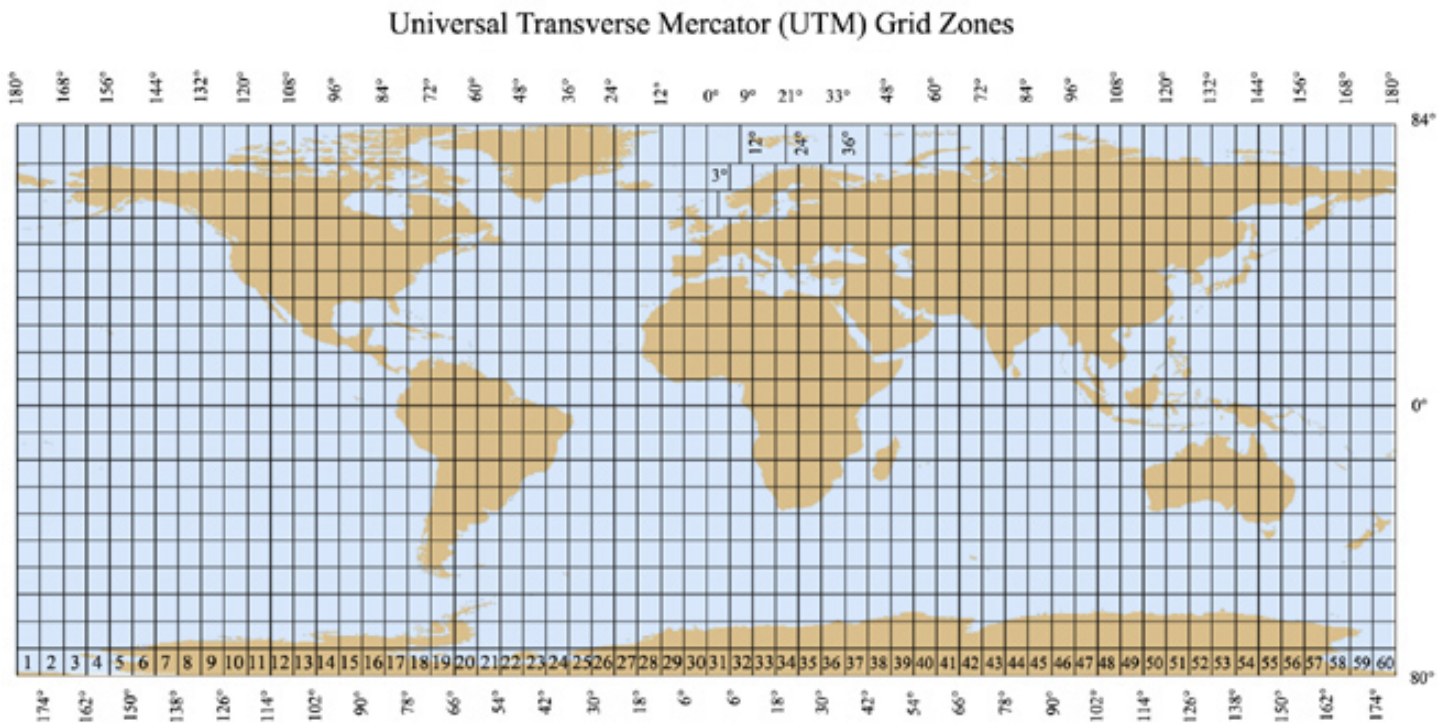

Figure 3 - UTM Grid Zones, typically 6° wide (Note exceptions in Norway region).

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