University of Anbar

College of Science

Department of Applied Geology

Field Geology

Title of the lecture

UTM Coordinate Systems

Assistant Prof. Dr. Abdulkhaleq A. Alhadithi

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Second/ Universal Transverse Mercator (UTM) Grid Coordinate System

The USGS also uses a measurement system called the Universal Transverse Mercator (UTM) grid coordinate system, which divides the earth into a perpendicular grid with constant linear surface distances, in meters, between each of its grid lines in all directions. UTM was developed in order to reduce the complexity of the calculations needed to transfer a location on our spherically-shaped planet to a flat surface. The Transverse Mercator Projection, which divides the earth like the slices of an orange and flattens the slices, introduces a negligible amount of distortion for map scales typical of most topographic maps. The slight amount of distortion of the geographical features within a zone is negligible and may be ignored by most map users. The UTM Grid Coordinate System superimposes a perpendicular grid over these earth slices with constant linear surface distance values between each of its grid lines in all directions. Since the pattern of UTM grid lines was superimposed on the grid zones after they were flattened, these grid lines are straight, perpendicular, and they are not distorted. This grid is designed to create a system where each location can be determined from the 0,0 point in meters or by its grid coordinates. A reference in the UTM system can be converted into a reference in another system, such as latitude and longitude using computer software.

UTM Measurements & Coordinates: EASTINGS

Each UTM zone is 6° wide, and uses the central meridian (halfway of each zone) as a reference. Zone numbers designate 6-degree longitudinal strips extending from 80degrees South latitude to 84 degrees North latitude, for a total of 60 zones. For example, Zone 10 extends from 126° west to 120° west Longitude. The central meridian is 123°, halfway (3°) from the boundary meridians. As another example, Zone 14 has a central meridian of 99° west Longitude. Eastings, longitudinal

measurements within each zone, are measured from the central meridian. The central meridian has a false easting of 500,000m to assure positive coordinates. Thus, a location in Zone10 that falls directly on the 123° meridian would have an easting of 500,000 meters written: 500000Em.

A location 10,382 meters west of the central meridian (500,000 - 10,382= 489,618) would be written as 489618Em; likewise, a location 85,640 meters east of the central (123°) meridian would appear as 585640Em…on a GPS unit, this would be 10 Q 585640. (Note that the Q in this example is arbitrary, see Northings which describe Zone characters) figures (4 and 5).

UTM Measurements & Coordinates: NORTHINGS

Northings are measured from the equator (with a 10,000,000 km false northing for positions south of the equator). Zone characters designate 8-degree zones extending north and south from the equator. Zones are divided into sections of latitude that are 8 degrees in height. These sections are lettered C through X, with M and N bracketing the equator. The letter designators give a quick reference as to the latitude of a point indicted by the coordinates. The letter designator is merely a help, however. While the zone number is critical, as the easting coordinate is referenced to it, the northing coordinate specifies the total number of meters from the equator, regardless of lettered zone section. Again, eastings indicate the number of meters of longitude within the numbered zone... the same easting coordinate value will repeat for each zone. Eastings are specified as six-digit numbers. Northings, however, are specified regardless of lettered section. Northings specify the absolute number of meters from the equator. Northings are specified as seven-digit numbers. There are special UTM zones between 0° and 36° longitude above 72° latitude and a special zone (32) between 56° and 64° north latitude.

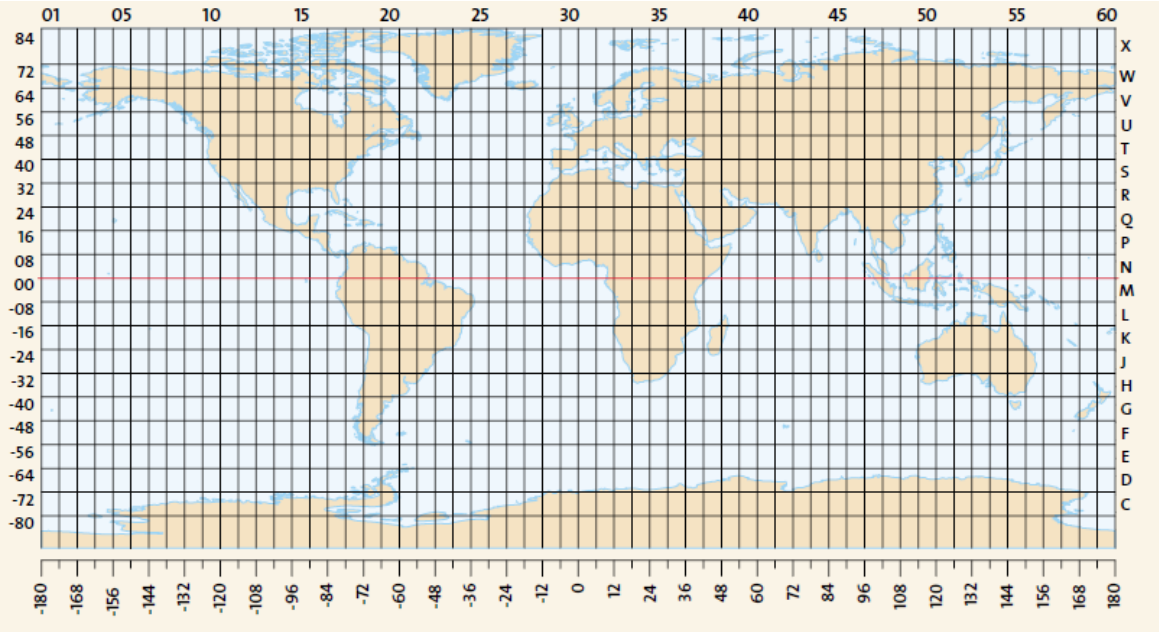


Figure (4) UTM grid showing Zone Numbers, 1 – 60, and Zone Characters, C – X

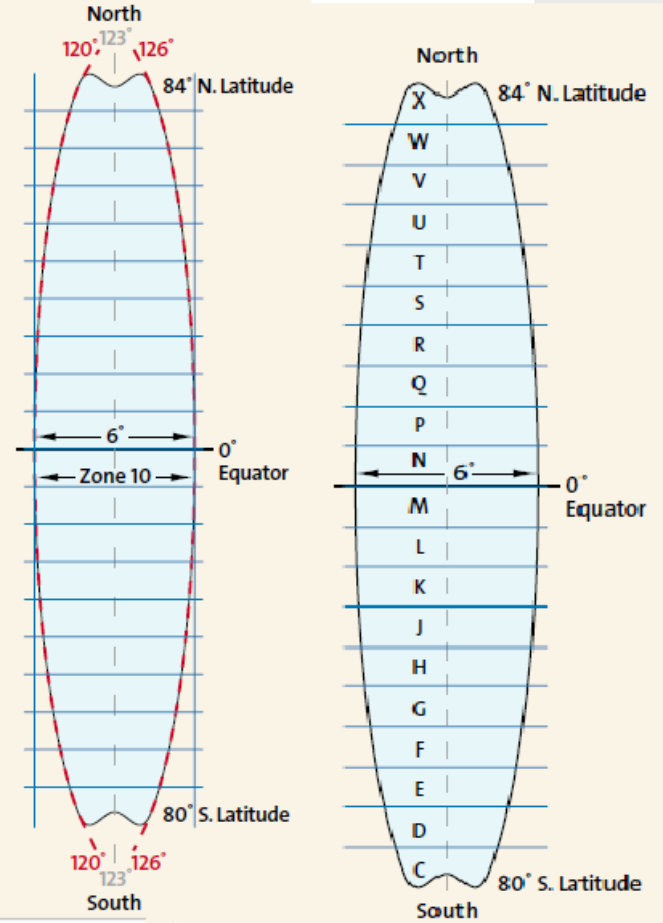
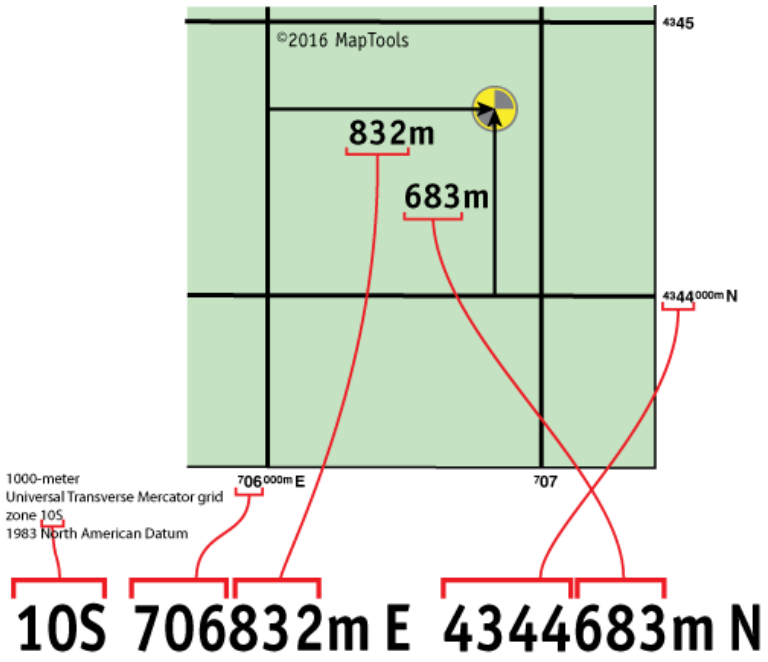
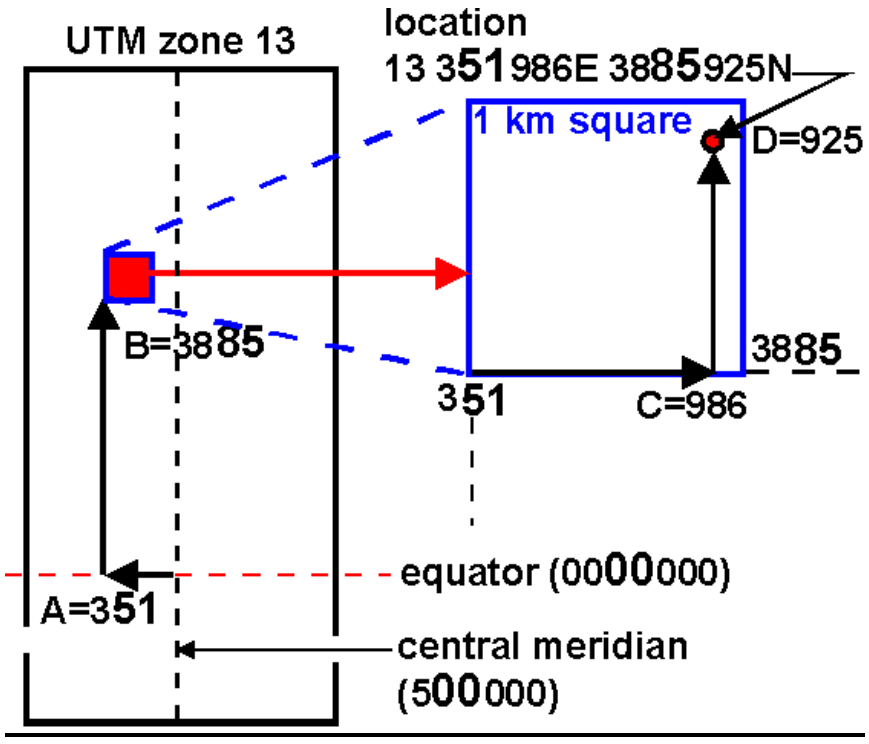


Figure (5) UTM Slice

For example


©2016 MapTools
4345
832m
683m
4344 000m N
1000-meter
Universal Transverse Mercator grid
zone 10S
1983 North American Datum
706 000m E
707
10S 706832m E 4344683m N


UTM zone 13
location
13 351986E 3885925N
1 km square
D=925
B=3885
3885
351
C=986
equator (0000000)
A=351
central meridian
(500000)

Reference

Angela L. Coe Tom W. Argles David A. Rothery Robert A. Spicer. 2010 GEOLOGICAL FIELD TECHNIQUES, Department of Earth and Environmental Sciences, The Open University, Walton Hall, Milton Keynes, UK