

Maps and Coordinate Systems



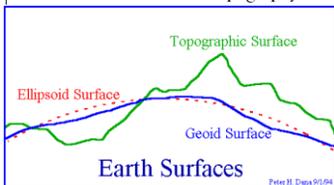


sphere?



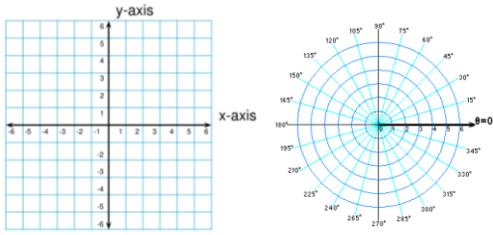
Figure of the Earth

- sphere
 - radius: 3,959 mi (off < 10 mi at poles)
- ellipsoid (biaxial)
 - Airy, 1830: 3,962mi, 3,949mi
 - WGS, 1984: 3,963mi, 3,949mi
- geoid
- topography



from
http://www.colorado.edu/geography/gcraft/notes/datum/datum_f.html

2D Systems



from commons.wikimedia.org

Systems

3D

- Euclidean Geometry (x,y,z)
- ECEF XYZ
- longitude, latitude, altitude

Projection-based

- UTM, MGRS
- UPS
- zip-codes

Longitude, latitude, altitude



Prime Meridian
0 Degree Longitude

Equator
0 Degree Latitude

E.g. DePaul: N41° 52' 42.00" W87° 37' 32.00" or
N41.87833 W87.625

1 degree roughly 69mi (latitude, longitude: at equator)

xyz

Earth Centered, Earth Fixed X, Y, Z

Euclidean

from
<http://www.colorado.edu/geography/gcraft/notes/gps/gf/ecefxyz.gif>

Maps

require projection resulting in distortion

parameters:

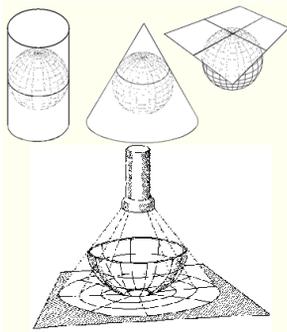
- distance
from one point
- direction
- scale
- area
- conformality
(angles remain the same)

methods:

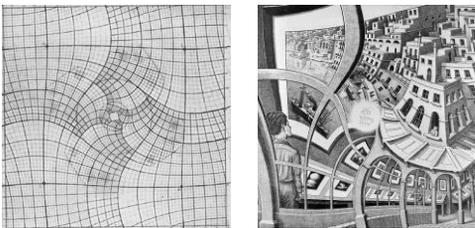
- orthographic
- cylindrical projection
- conic projection
- other

<http://www.colorado.edu/geography/gcraft/notes/mapproj/mapproj.html>

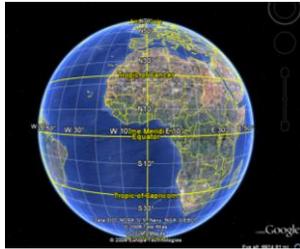
Projections



Conformality

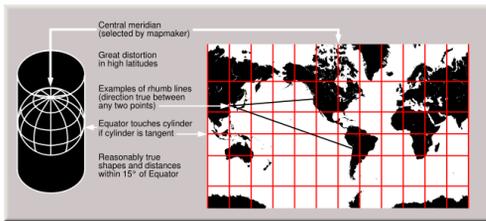


Orthographic vs vertical perspective



<http://www.mgaqua.net/AquaDoc/Projections/img/Orthographic.jpg>

Mercator



http://commons.wikimedia.org/wiki/File:Usgs_map_mercator.svg

Mercator in Google Maps



Cylindrical Methods

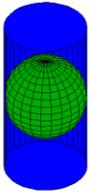
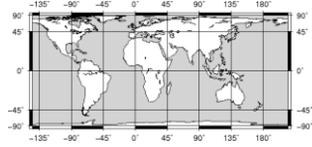


Photo by: EranuGG2004

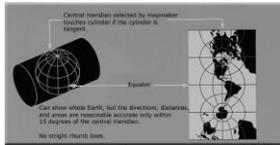
Cylindrical Projection Surface



Behrman/Lambert Equal Area projection

- meridians and parallels are straight lines
- modified to preserve areas, but not conformality

UTM



Central meridian selected by repositioning
cylinder of the cylinder is
shown.

Equator

Can show whole Earth, but the directions, distances,
and areas are measurable accurate only within
22 degrees of the central meridian.

No straight rhumb lines.



- transversal Mercator
- 60 zones (a 6 degrees)
- MGRS (Military Grid Reference System based on it and Universal Polar Stereographic)
