

Chapter 2

What is Location?

2.1 Location Categories

Descriptive locations

Spatial locations

Network locations

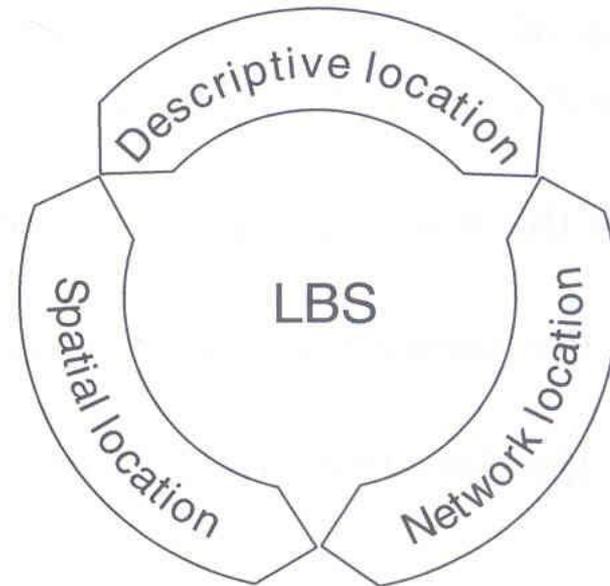


Figure 2.1 Location categories.

2.2 Spatial Location

2.2.1 Coordinate Systems

2.2.1.1 Cartesian Coordinate Systems

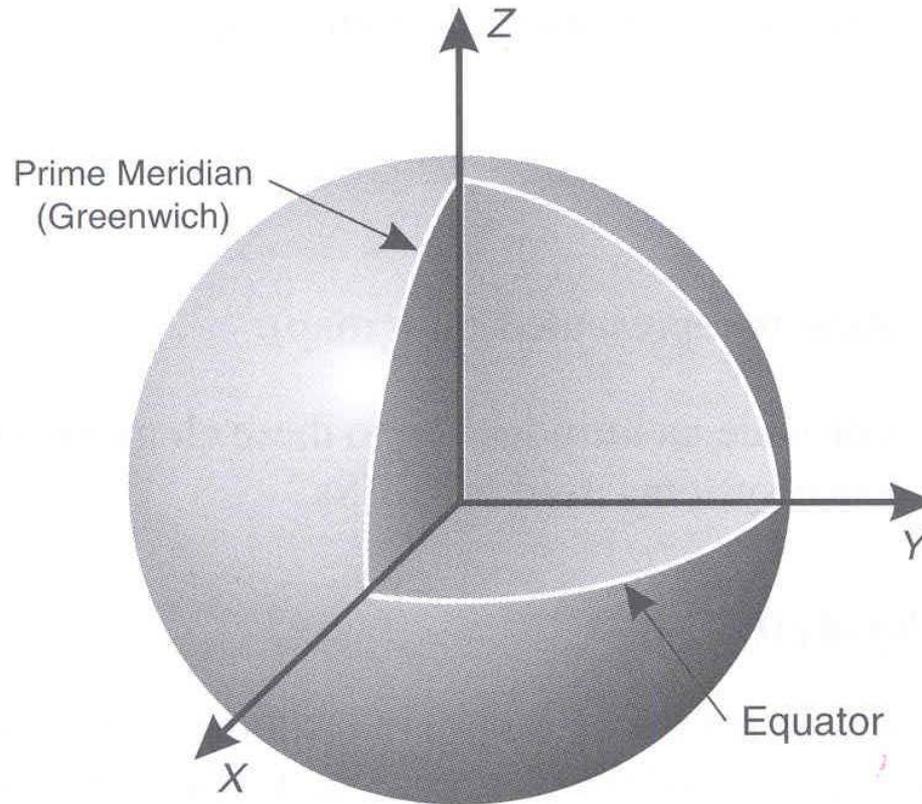


Figure 2.2 Earth Centered, Earth Fixed X, Y, Z.

2.2.1.2 Ellipsoidal Coordinate Systems

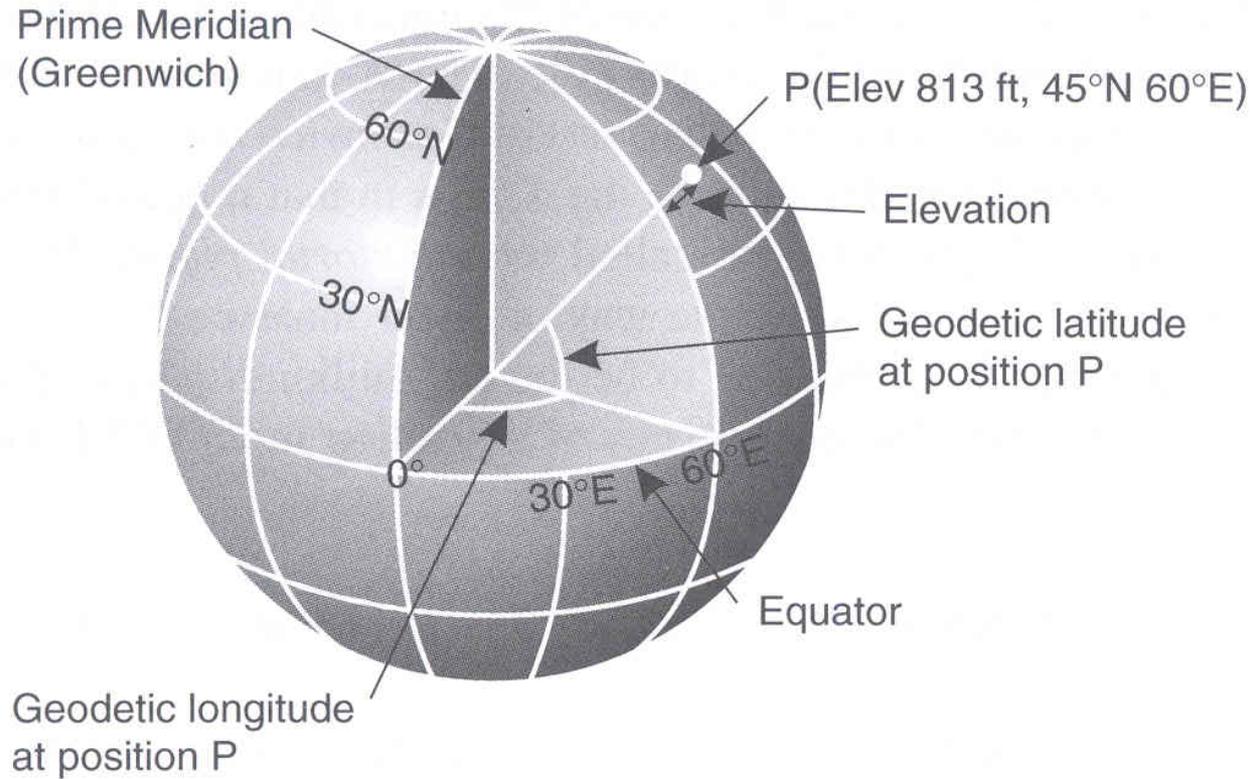


Figure 2.3 Latitude, longitude, and height.

Table 2.1 Notations for latitude, longitude, and height

Notation	Example
Degrees, minutes, seconds of lat. and long.	Elev 505 m N 48° 08' 57" E 11° 35' 47"
Tenth of seconds of latitude and longitude	Elev 505 m N 48° 08' 57.2" E 11° 35' 47.6"
Hundreds of thousands of degrees	Elev 505 m N 48. 14,922° E 11.596,83°

2.2.2 Datums

- **Horizontal datums**
- **Vertical datums**

2.2.2.1 Horizontal Datums

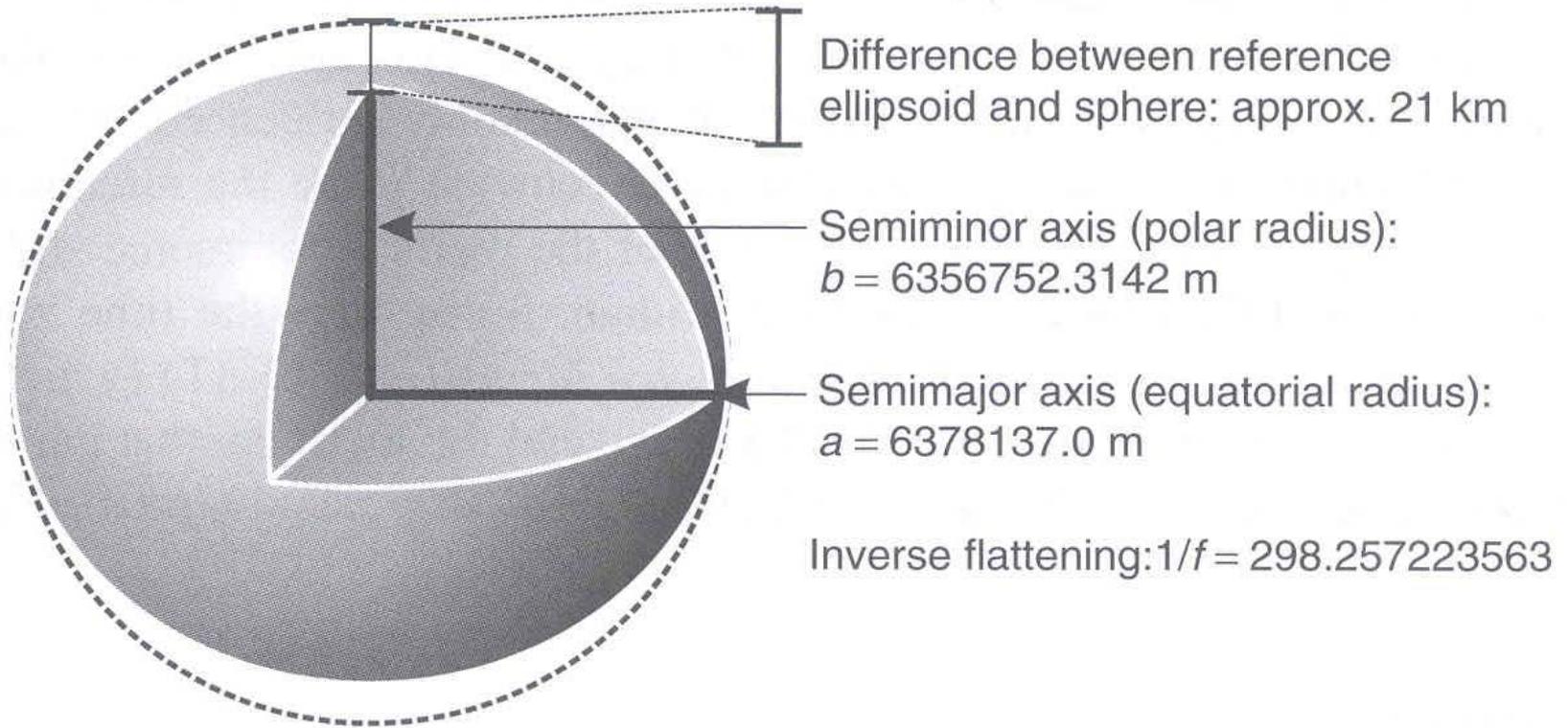


Figure 2.4 Parameters of a reference ellipsoid.

$$f = \frac{a-b}{a} \quad (2.1)$$

Table 2.2 Examples of reference ellipsoids

Ellipse	Year	Semimajor axis [m]	1/Flattening
Airy	1830	6,377,563.396	299.3249646
Everest	1830	6,377,276.345	300.8017
Bessel	1841	6,377,392.155	299.1528128
Clarke	1866	6,378,204.400	294.9786982
Clarke	1880	6,378,249,136	293,465
International (Hayford)	1924	6,378,388.0	297,0
WGS-72	1972	6,378,135.0	298.26
WGS-84	1984	6,378,137.0	298.257223563

Table 2.3 Selected local datums and their reference ellipsoids

Datum	Ellipsoid	Datum shift (D_x, D_y, D_z)
NAD-27 (Central America)	Clarke 1866	(0 m, 125 m, 194 m)
NAD-27 (Alaska)	Clarke 1866	(−5 m, 135 m, 172 m)
European 1950	Hayford	(−87 m, −98 m, −121 m)
Tokyo	Bessel 1841	(−148 m, 507 m, 685 m)

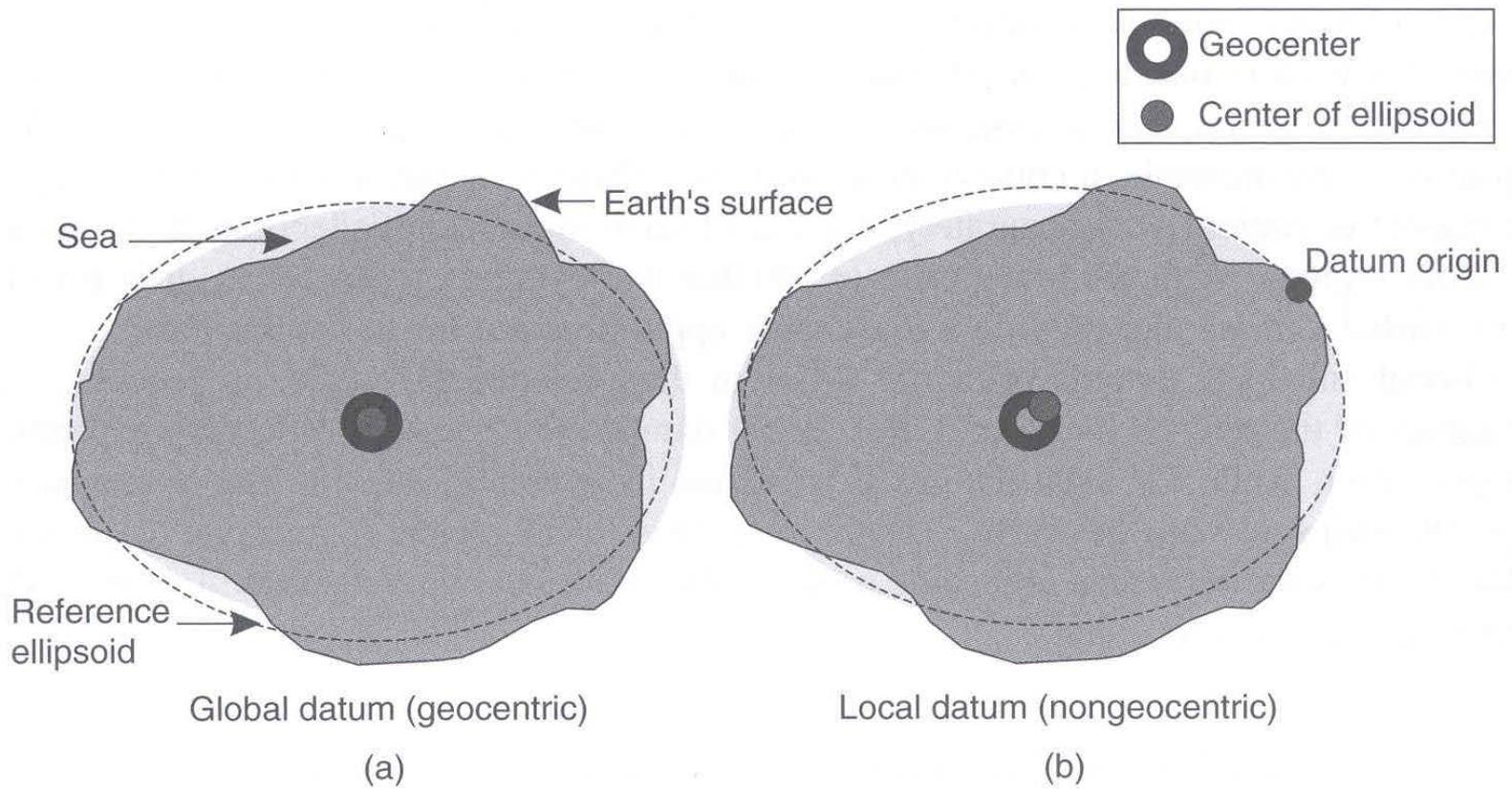


Figure 2.5 Global and local datums.

2.2.2.2 Vertical Datums

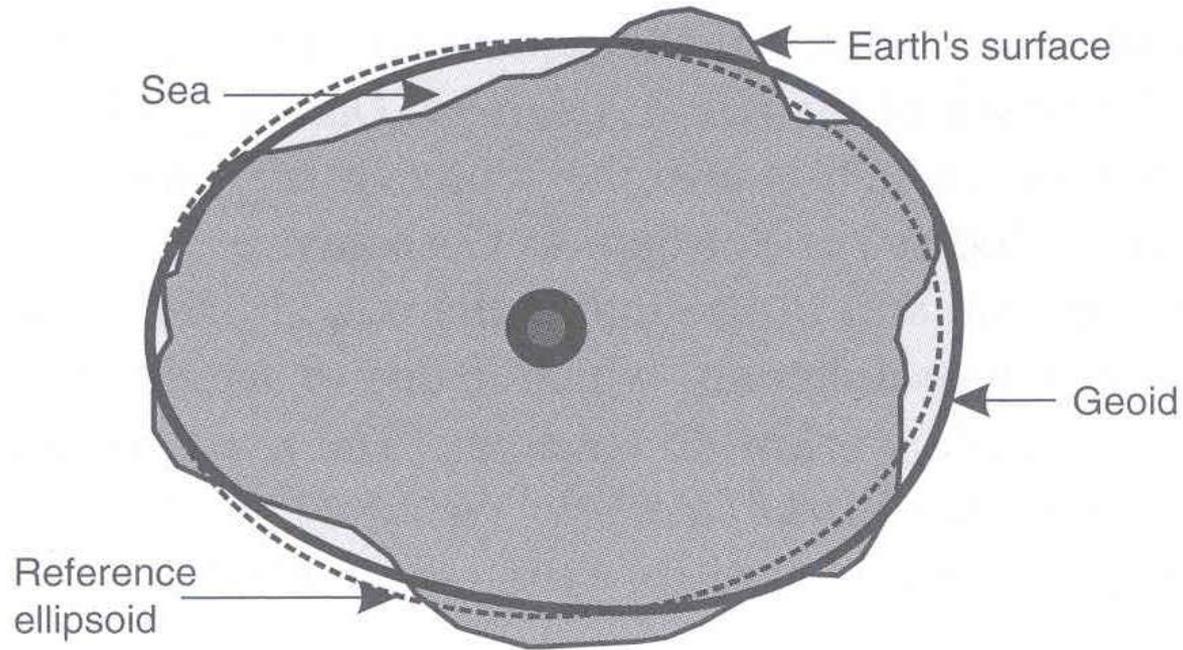


Figure 2.6 Difference between geoid and reference ellipsoid.

- Orthometric height
- Ellipsoid or geodetic height
- Geoid height

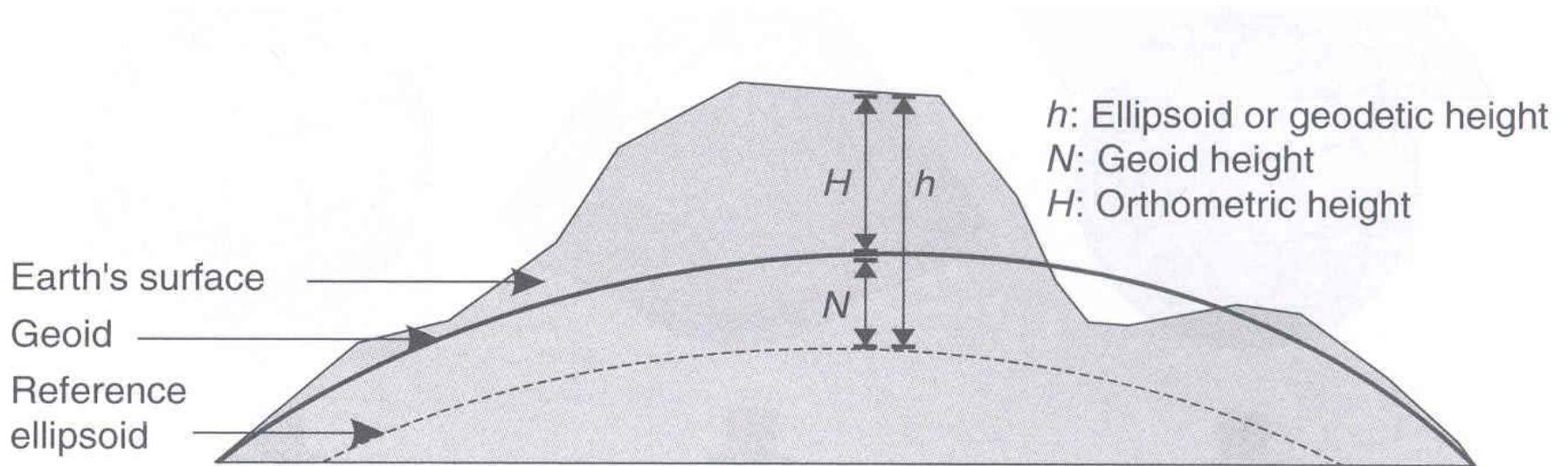


Figure 2.7 Ellipsoid, orthometric, and geoid heights.

2.2.3 Map Projections

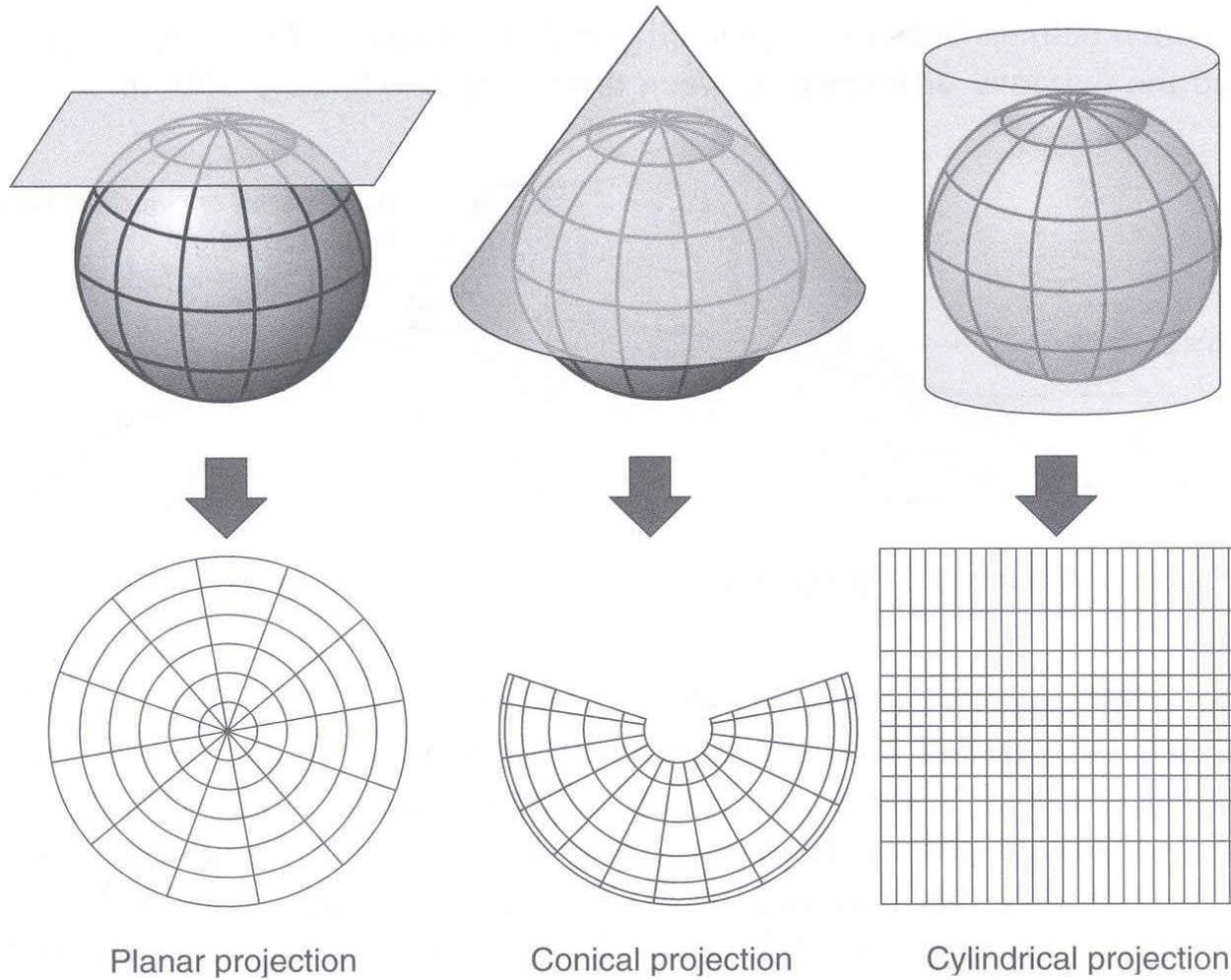


Figure 2.8 Types of map projections.

- **Areal distortion**
- **Angular distortion**
- **Scale distortion**
- **Distance distortion**
- **Direction distortion**

2.2.3.1 Mercator Projections

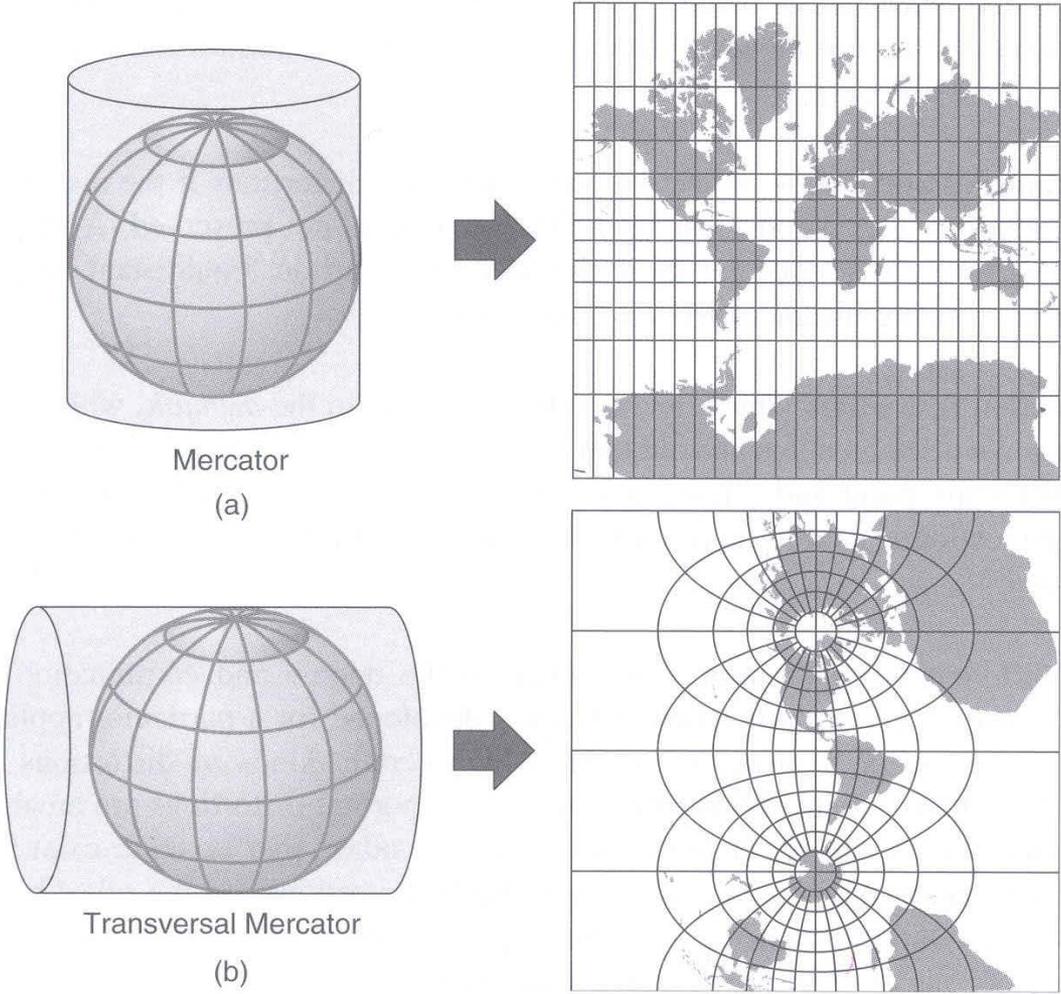


Figure 2.9 Mercator projections.

2.2.3.2 Universal Transverse Mercator

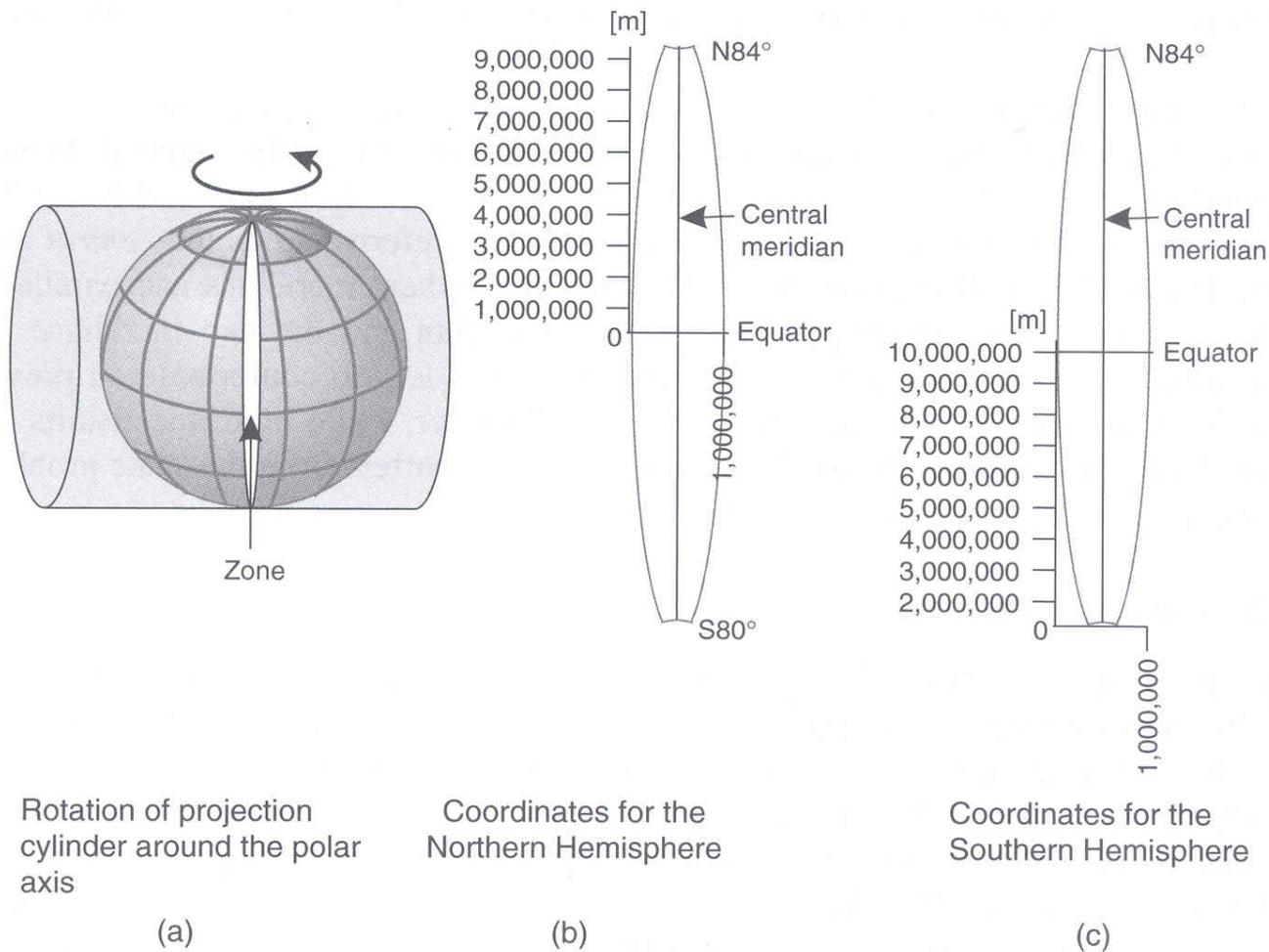


Figure 2.10 Composition of UTM coordinate system.

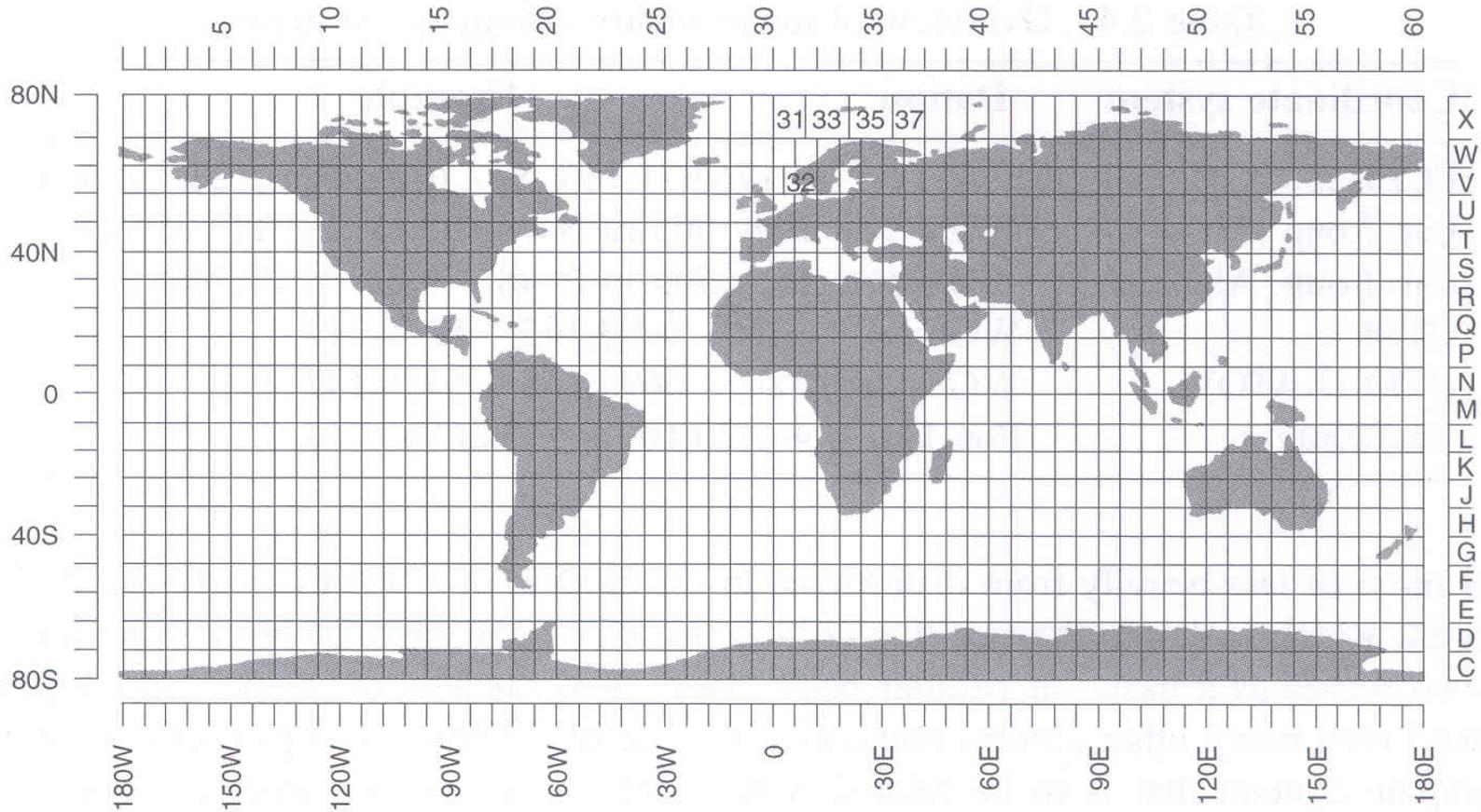


Figure 2.11 UTM world map.

Table 2.4 Overview of notations for coordinate systems

Coordinate system	Datum	Example
ECEF X, Y, Z	–	4,176,671.786, 857,107.334, 4,728,338.964
Lat. Long. Alt.	WGS-84	Elev 505 m N 48° 08' 57" E 11° 35' 47"
Lat. Long. Alt. (dec.)	WGS-84	Elev 505 m N 48.149,22° E 11.59683°
UTM	WGS-84	32N – 0693,145 – 5336,147
UTM (NATO)	WGS-84	32U – 0693,145 – 5336,147
GaußKrüger	Potsdam	4–470,107 – 5334,656

2.3 Conclusion