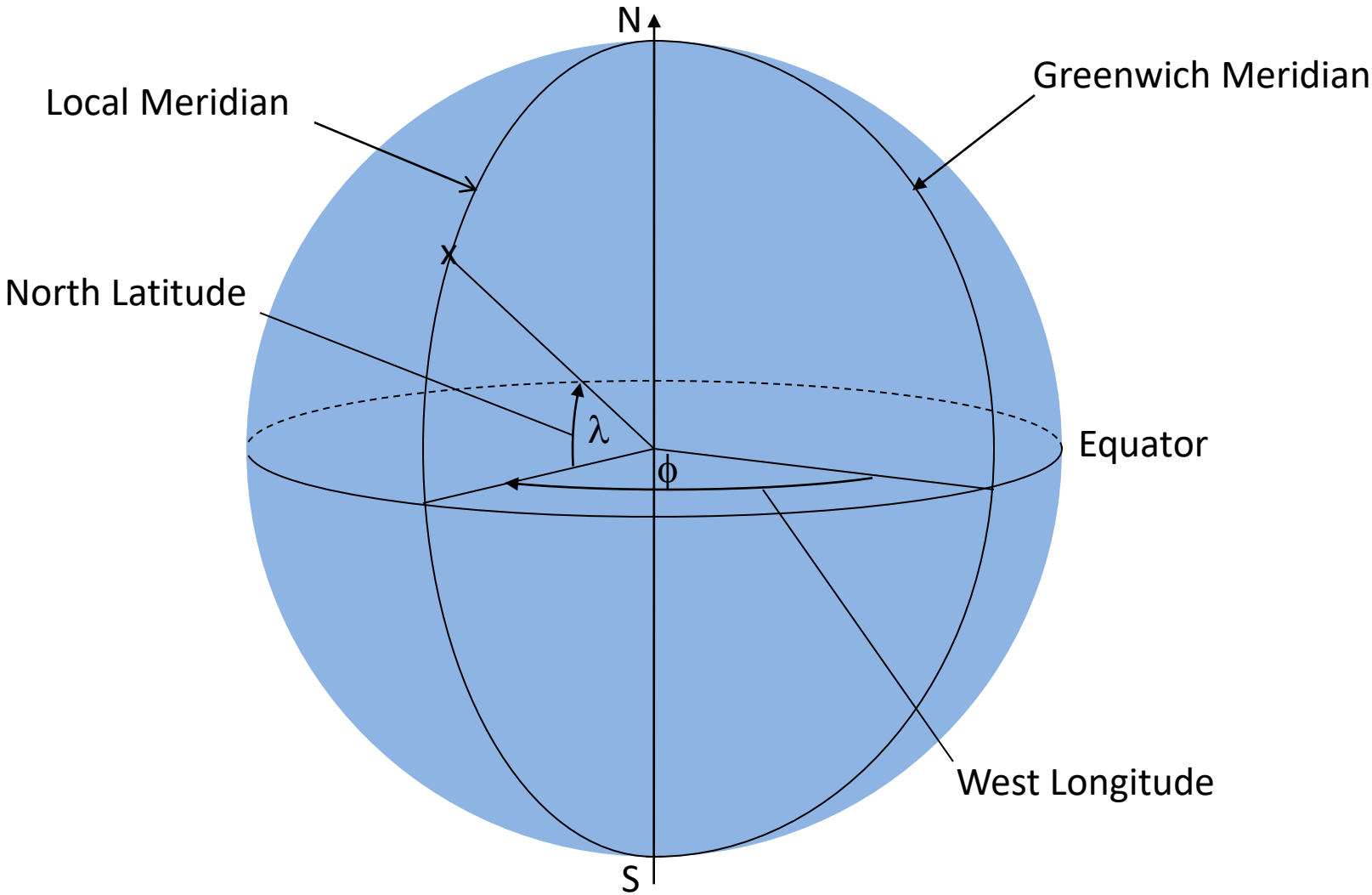
Map Coordinates

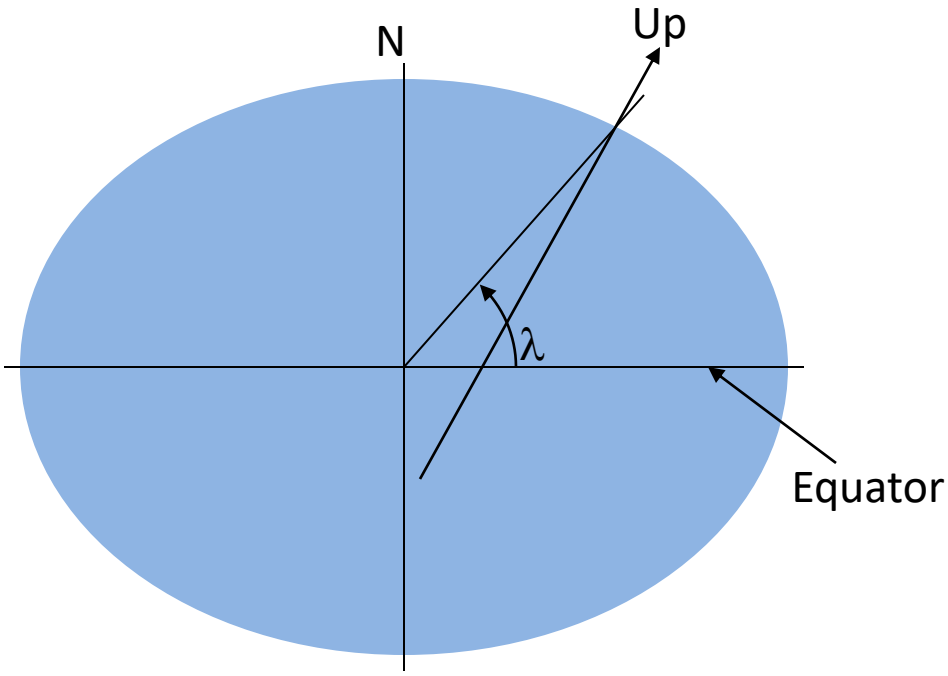
Latitude and Longitude
vs.
Universal Transverse Mercator (UTM)

Prepared by Chris Houlberg

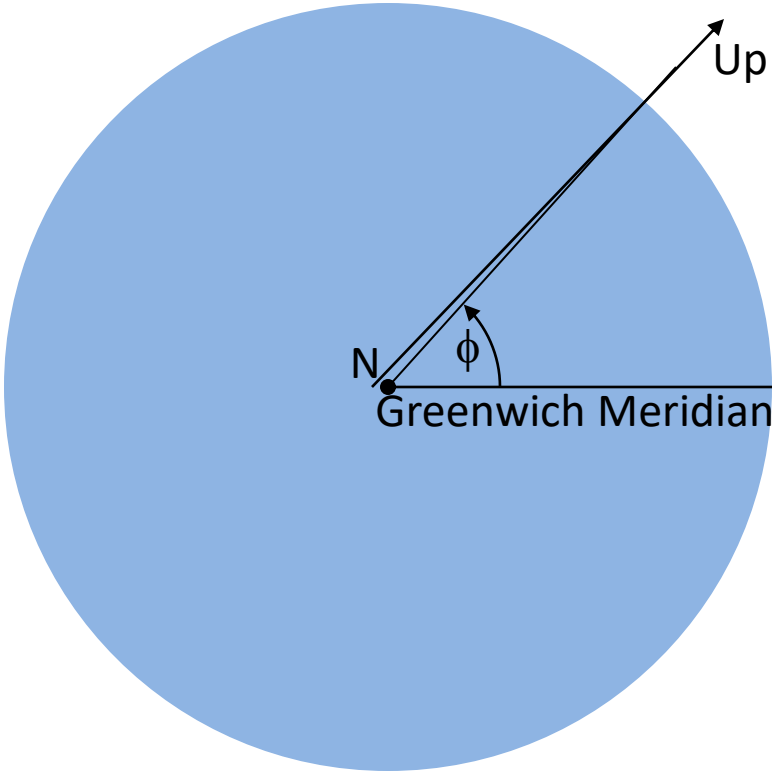
Latitude (λ) and Longitude (ϕ)



Problems with Latitude and Longitude (Earth is Lumpy and not a Sphere)



Exaggerated flattening of Earth



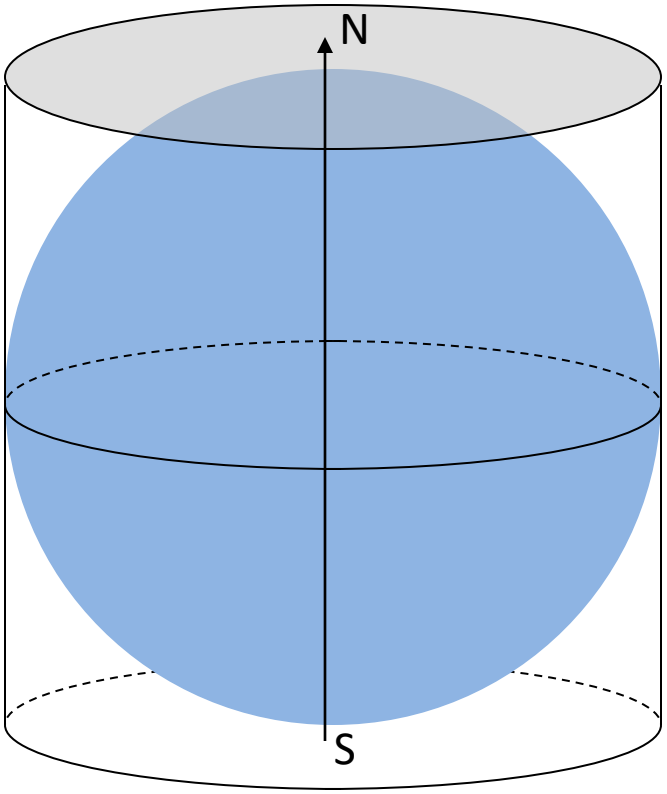
What is Latitude?

- Terrestrial Latitude (λ_t): The angle a ray makes from the center of the Earth geoid to the celestial equatorial plane.
- Geocentric Latitude (λ_c): The angle a ray makes from the center of the standard ellipsoid to the equatorial plane of the standard ellipsoid.
- Astronomic Latitude (λ_a): The angle a normal to the geoid makes to the celestial equatorial plane.
- Geodetic Latitude (λ): The angle a normal to the standard ellipsoid makes to the equatorial plane of the standard ellipsoid.

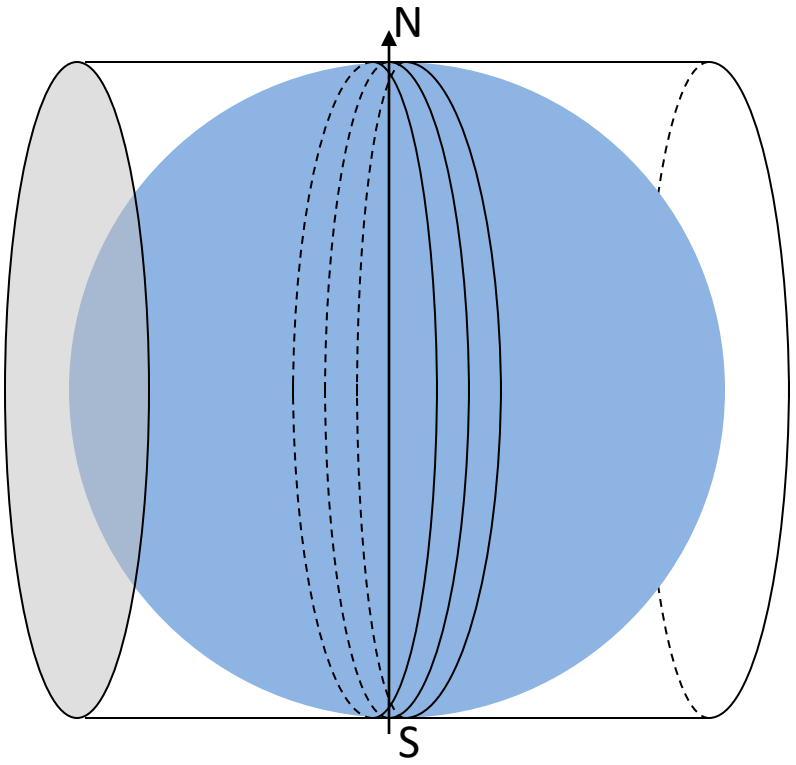
What is Longitude?

- Terrestrial Longitude (ϕ_t): The angle the projection of a ray on the equatorial plane makes from the center of the Earth geoid to the Greenwich meridian.
- Geocentric Longitude (ϕ_c): The angle the projection of a ray on the equatorial plane makes from the center of the standard ellipsoid to the Greenwich meridian.
- Astronomic Longitude (ϕ_a): The angle the projection of a normal to the geoid on the equatorial plane makes to the Greenwich meridian.
- Geodetic Longitude (ϕ): The angle the projection of a normal to the standard ellipsoid on the equatorial plane makes to the Greenwich meridian.

Mercator Projections

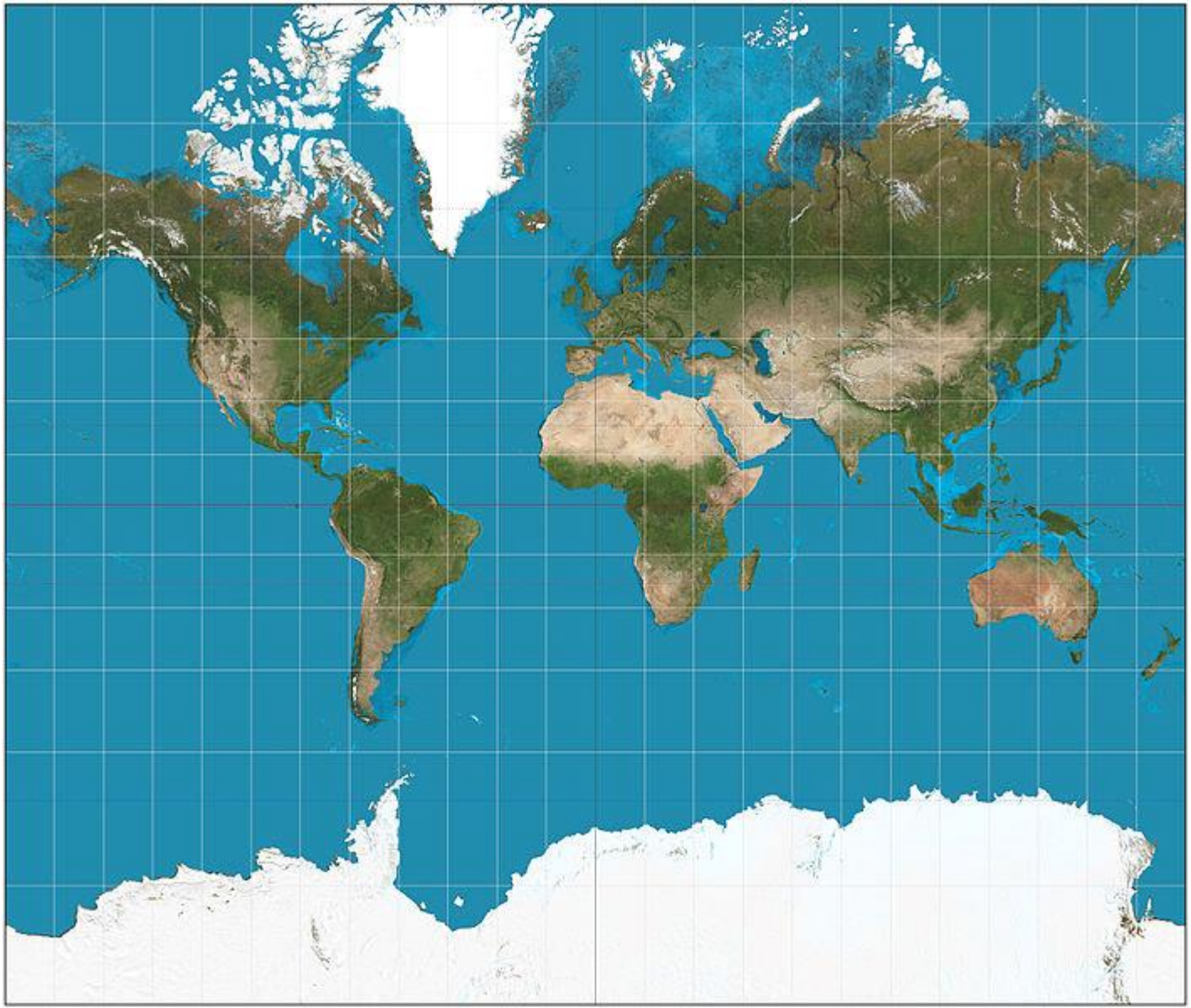


Mercator Projection

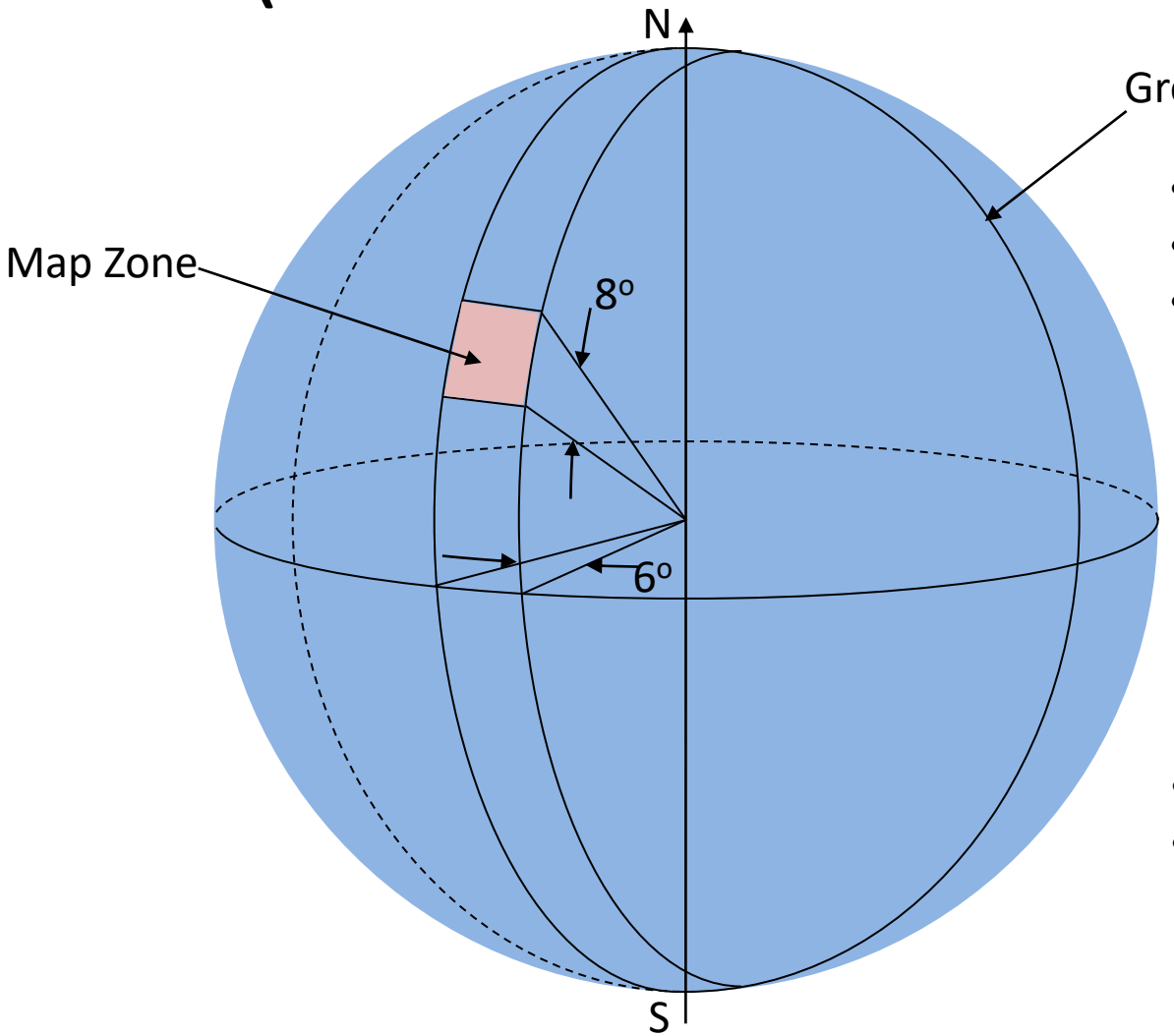


Transverse Mercator Projection

Mercator Projection



Universal Transverse Mercator (UTM) (Artificial Coordinate System)



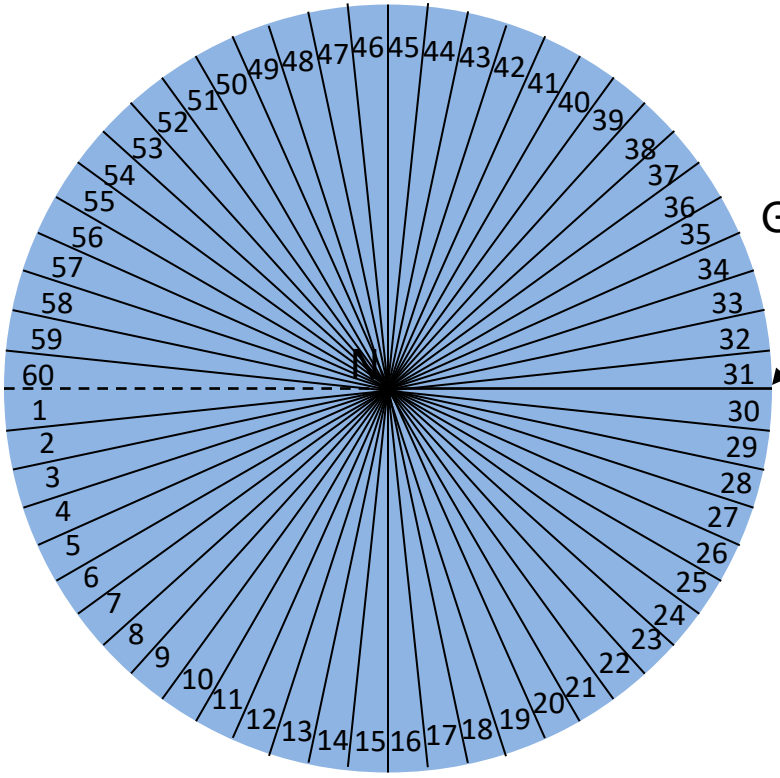
- 6º Longitude Bands
- 8º Latitude Bands
- There are some exceptions
  - Zone X
  - Around Norway

<u>Montalvo School Location</u>

- UTM Zone: 11S
- Coordinate:
  - Easting: 296744.26
  - Northing: 3792729.07

UTM Zones

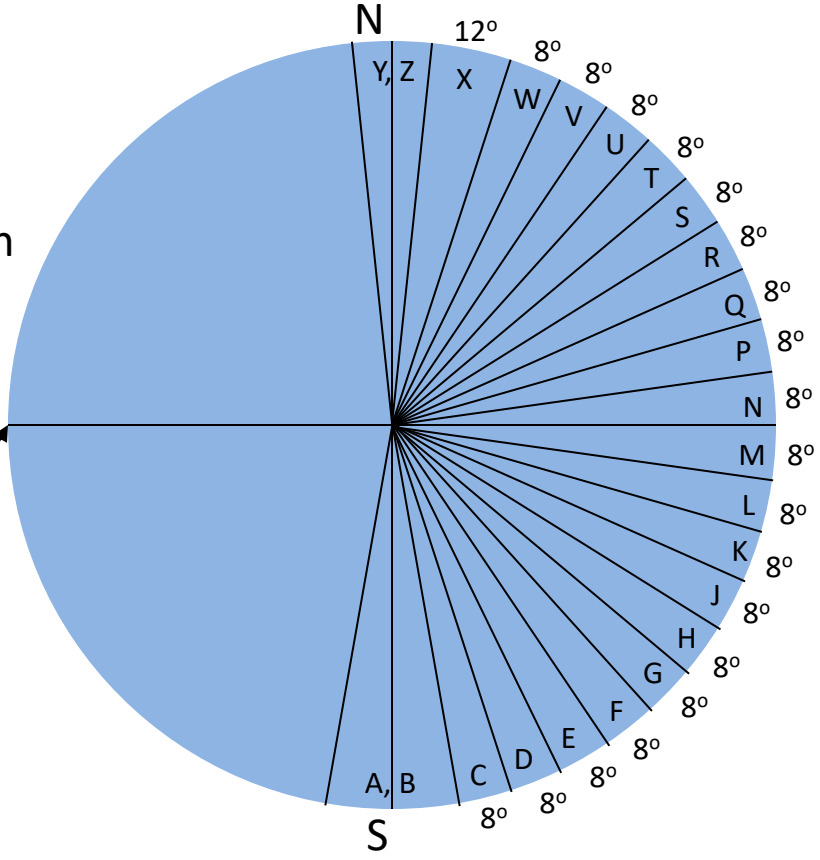
- UTM Zone letters A, B, Y and Z do not indicate latitude bands
- At the poles a different coordinate system is used (Universal Polar Stereographic)



Longitudinal Divisions

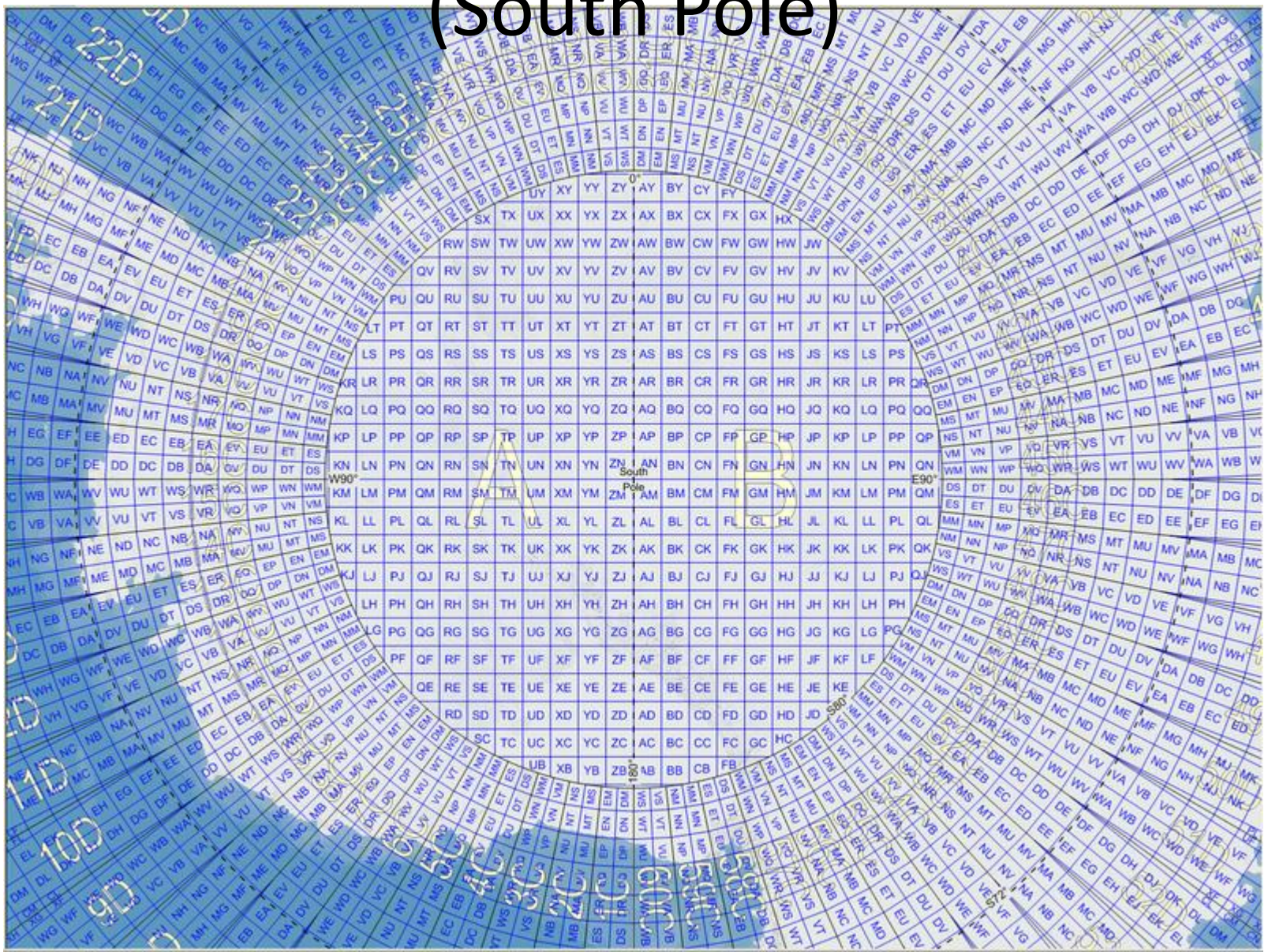
Greenwich Meridian

Equator

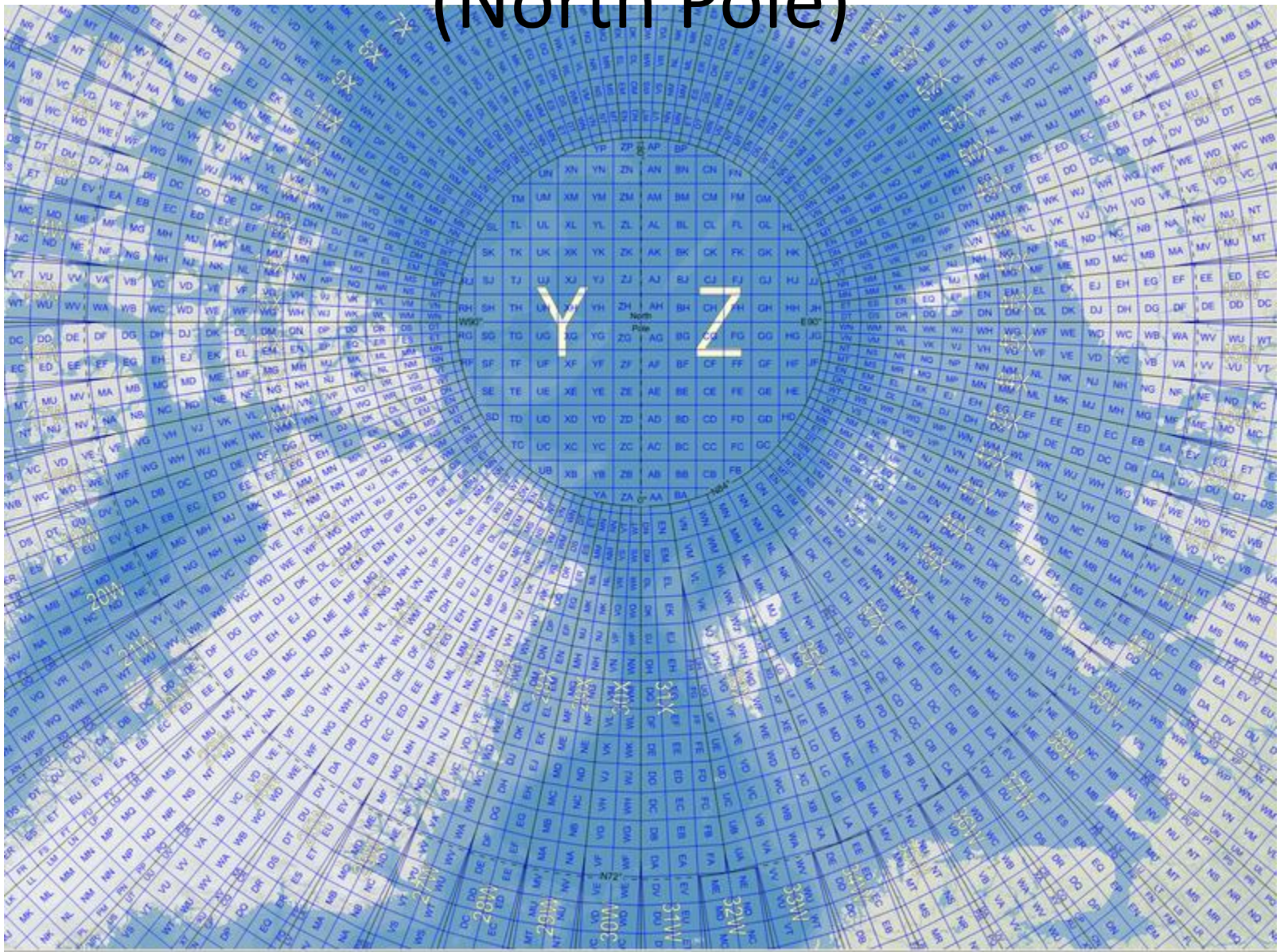


Lettered Latitudinal Divisions

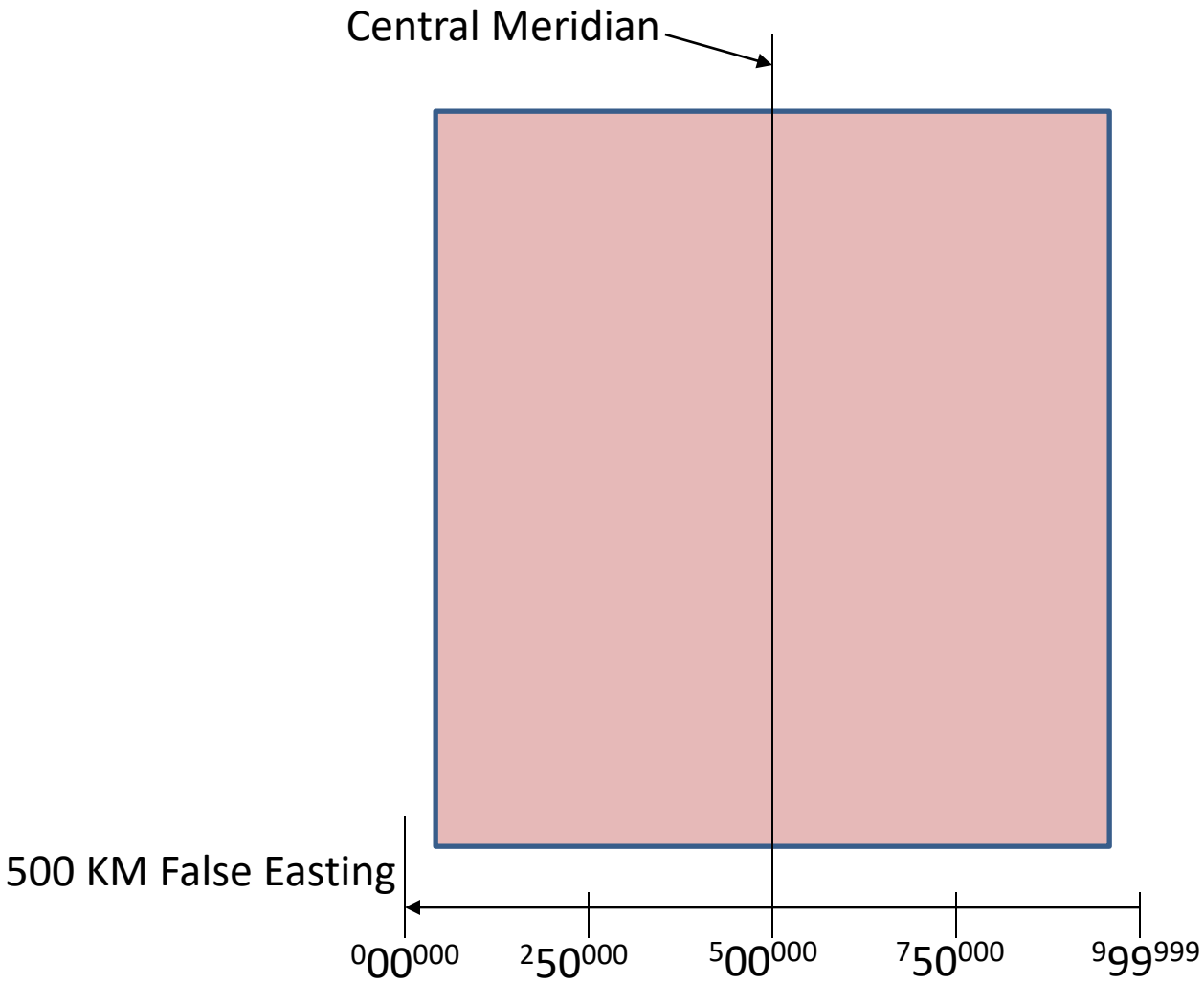
Universal Polar Stereographic (UPS) (South Pole)



Universal Polar Stereographic (North Pole)



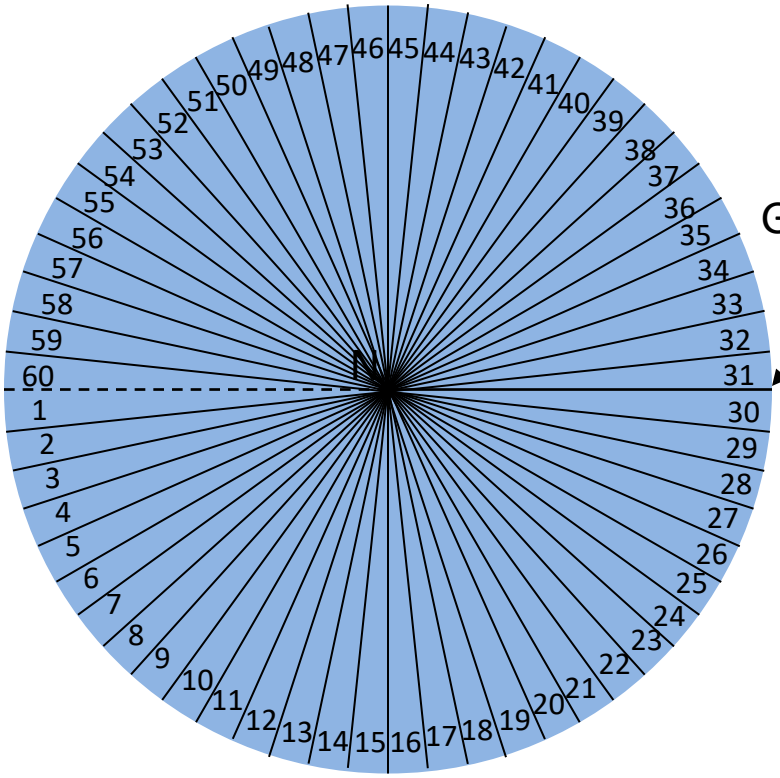
UTM Zone (Easting)



UTM Zones (Northing)

Equator assigned a False Northing of 10,000 Kilometers

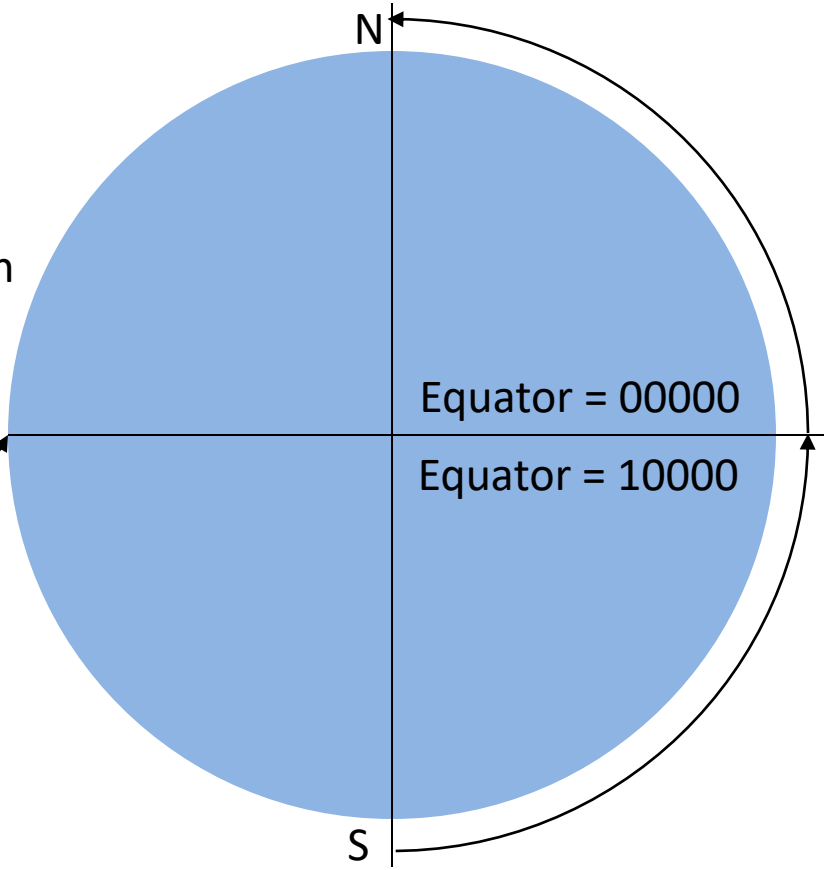
In Northern Hemisphere maps will assign Equator a value of 0 Kilometers



Longitudinal Divisions

Greenwich Meridian

Equator



Numbered Latitudinal Divisions (Northing)

Section of a Typical Map
UTM and Latitude Longitude

Easting is always a 6 digit coordinate
Northing is always a 7 digit coordinate
Maps are constructed on 100KM grid squares

Longitude Zone 15
Latitude Zone S