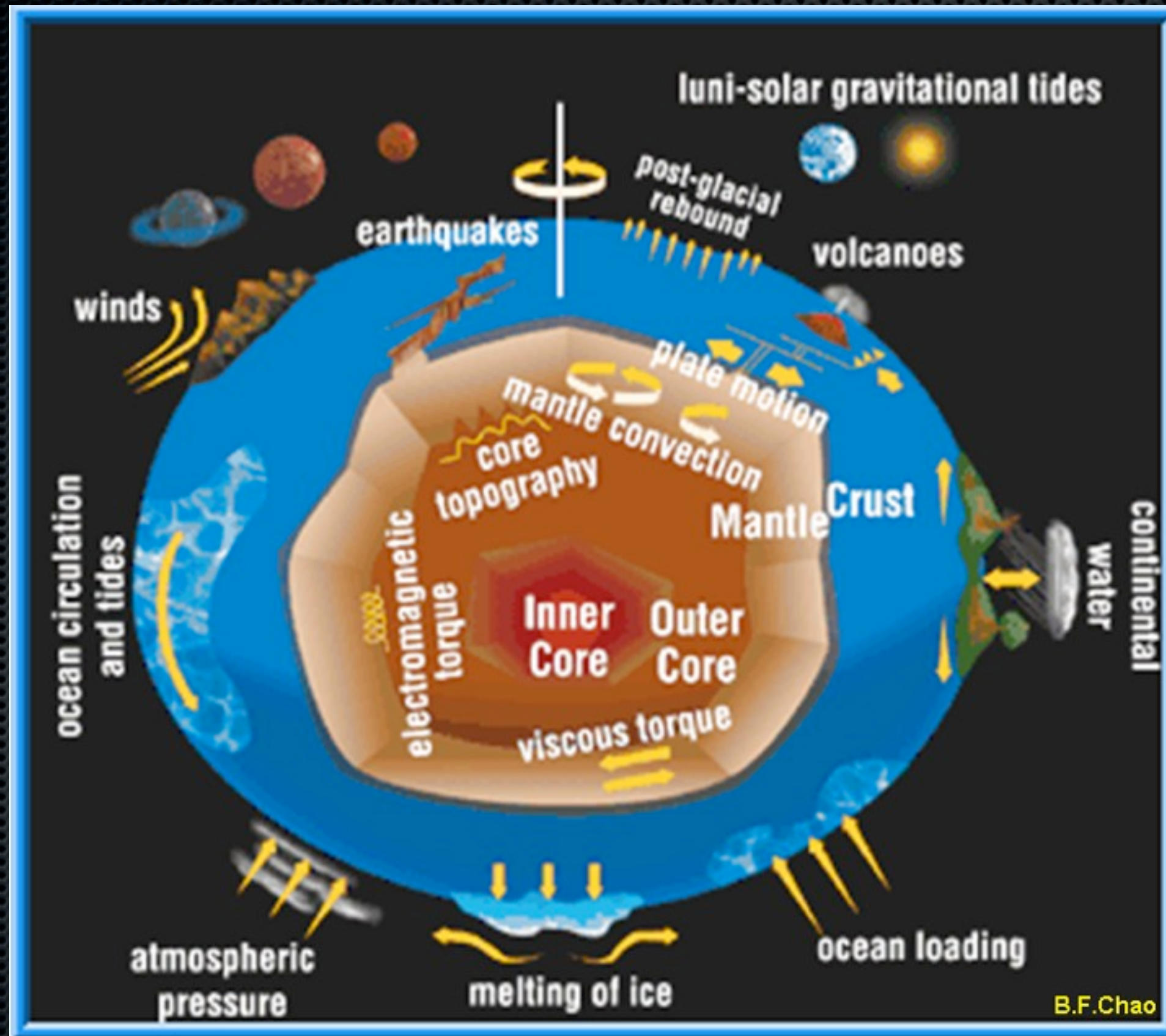


Geodesy Lab -Introduction

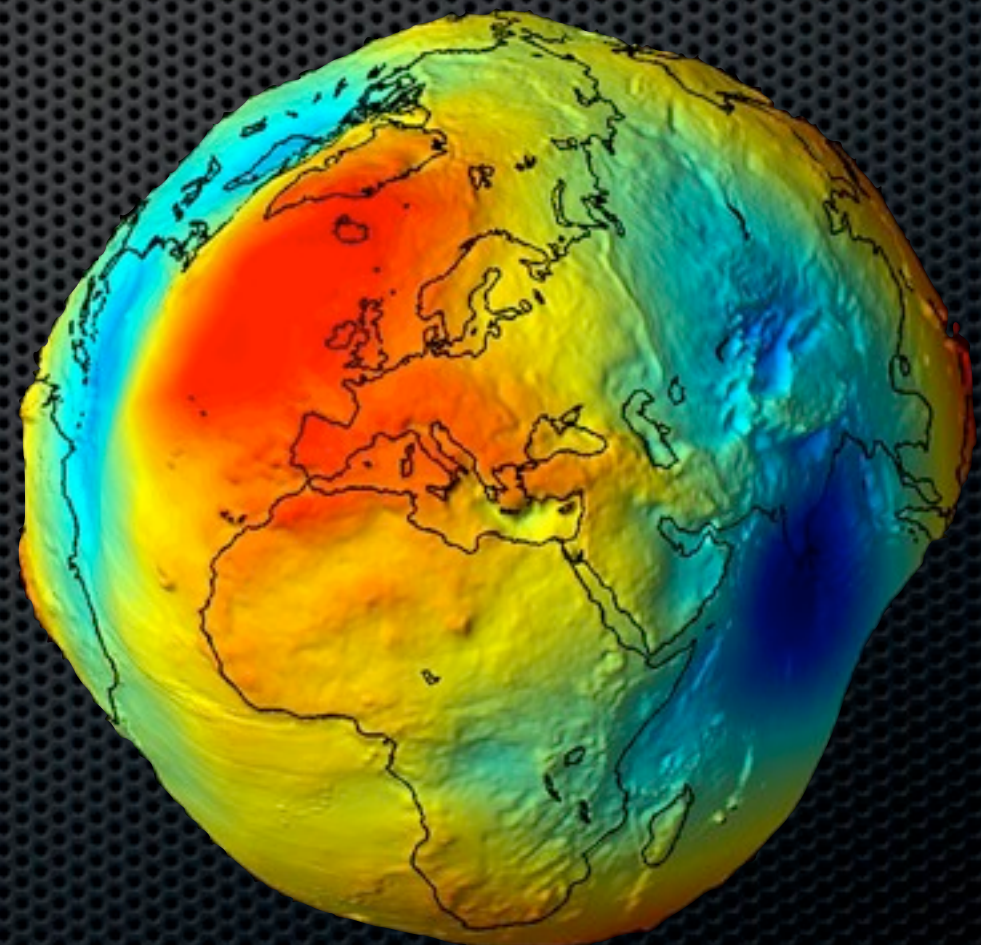


Is the shape of the Earth Really That Complex?

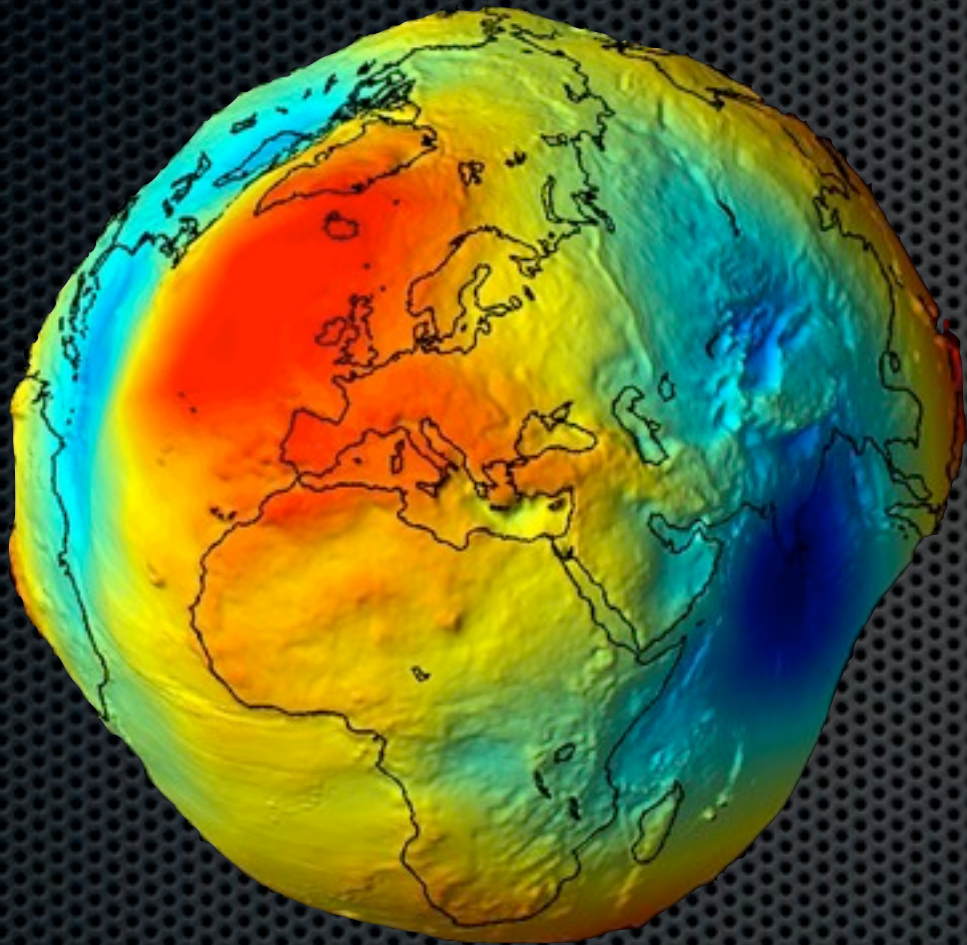


Geodesy

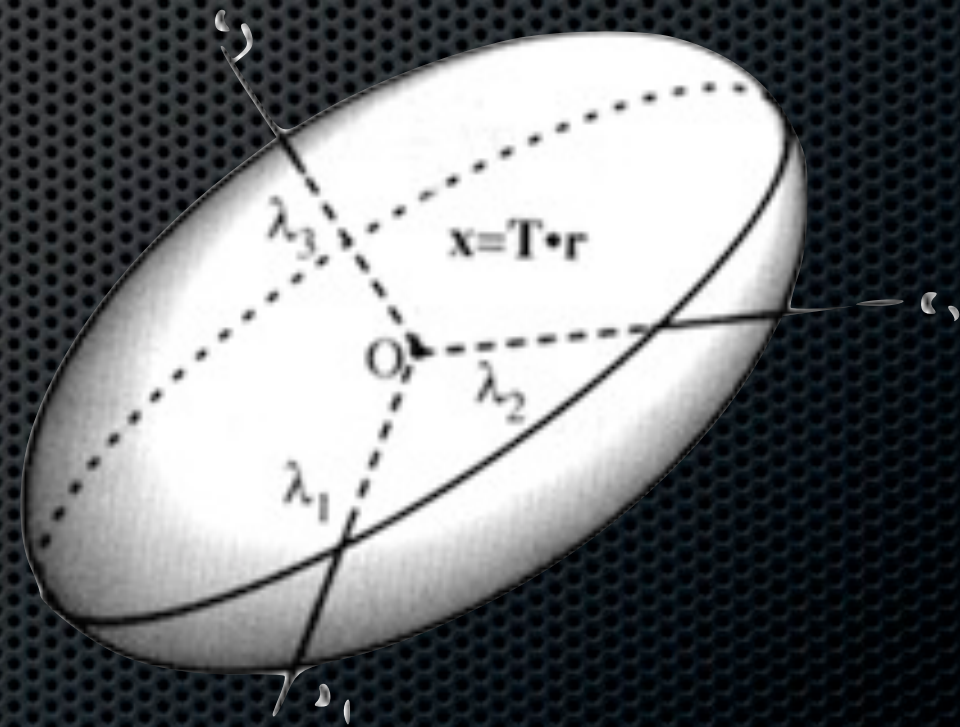
- The scientific discipline that deals with the measurement and representation of the Earth, including its gravitational field, in a three-dimensional, time varying space.



Geoid vs. Ellipsoid



Vs.

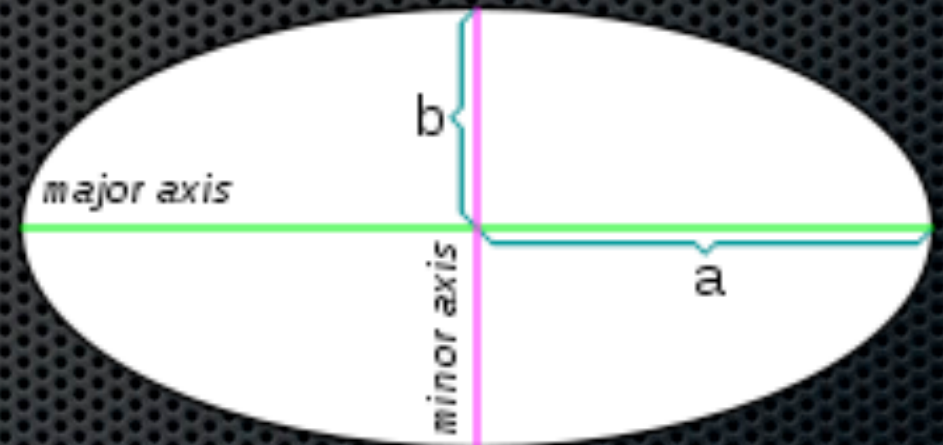


Geoid vs. Ellipsoid

- ✦ Geoid - Equipotential surface that would correspond with mean sea level on a rotating planet if the oceans were otherwise at rest.
- ✦ Ellipsoid - Mathematically nice representation of the shape of the planet (normally chosen to have the same volume as the geoid)

Ellipsoid Parameters

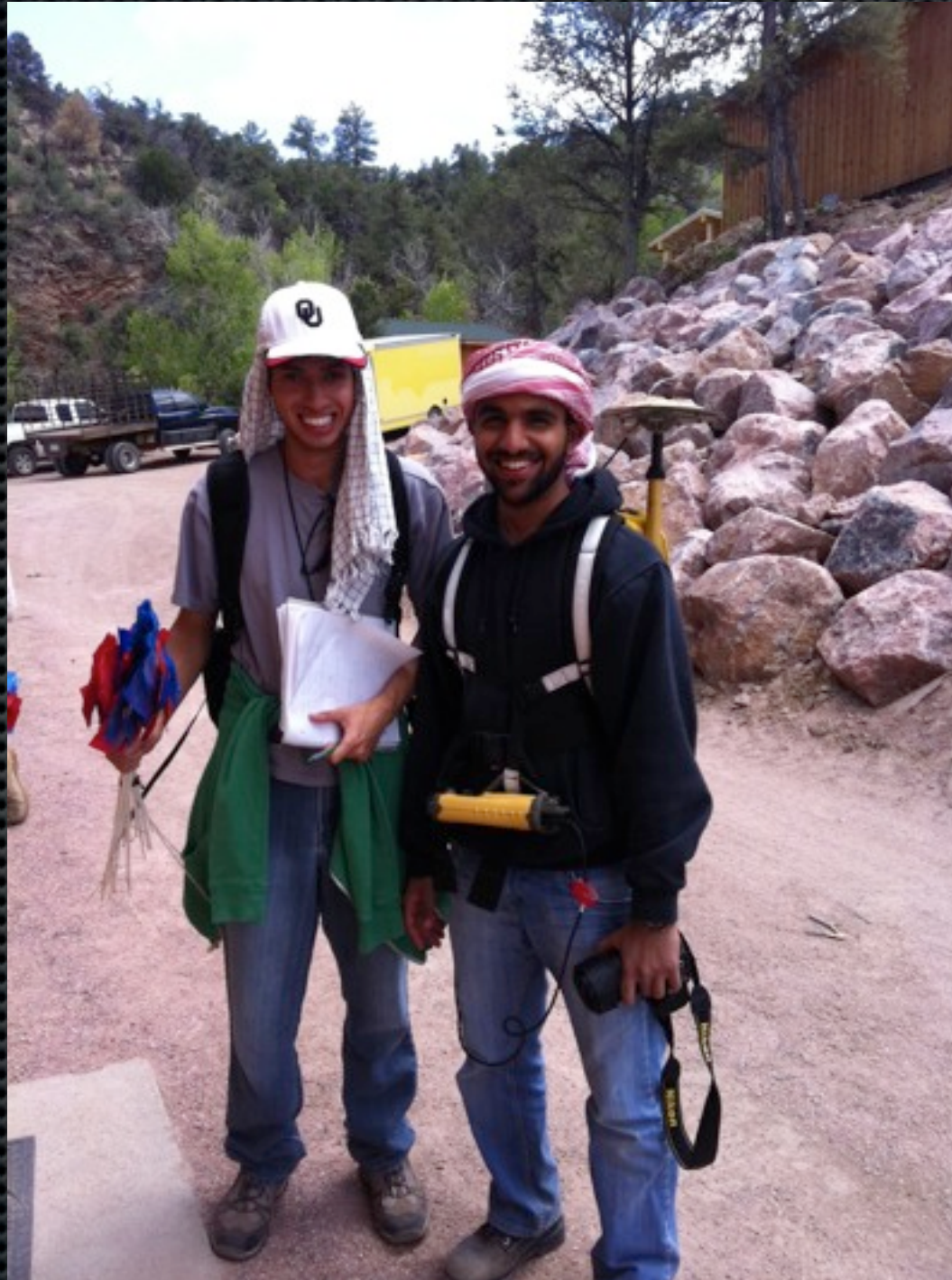
- ✧ a = major axis
- ✧ b = minor axis
- ✧ flattening = $f = (a-b)/a$



Surveying your position - Then



Surveying your position - Now

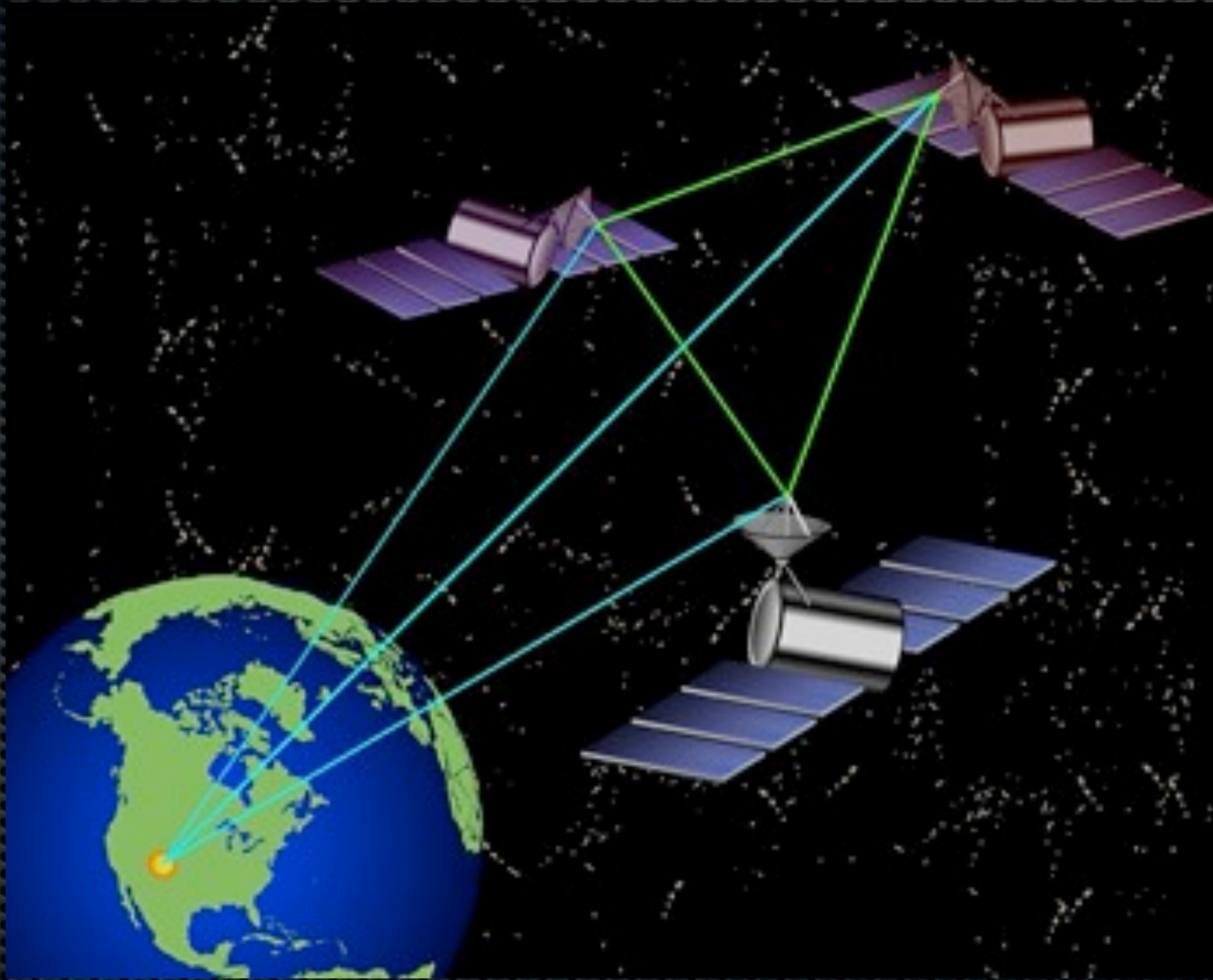


Global Positioning System

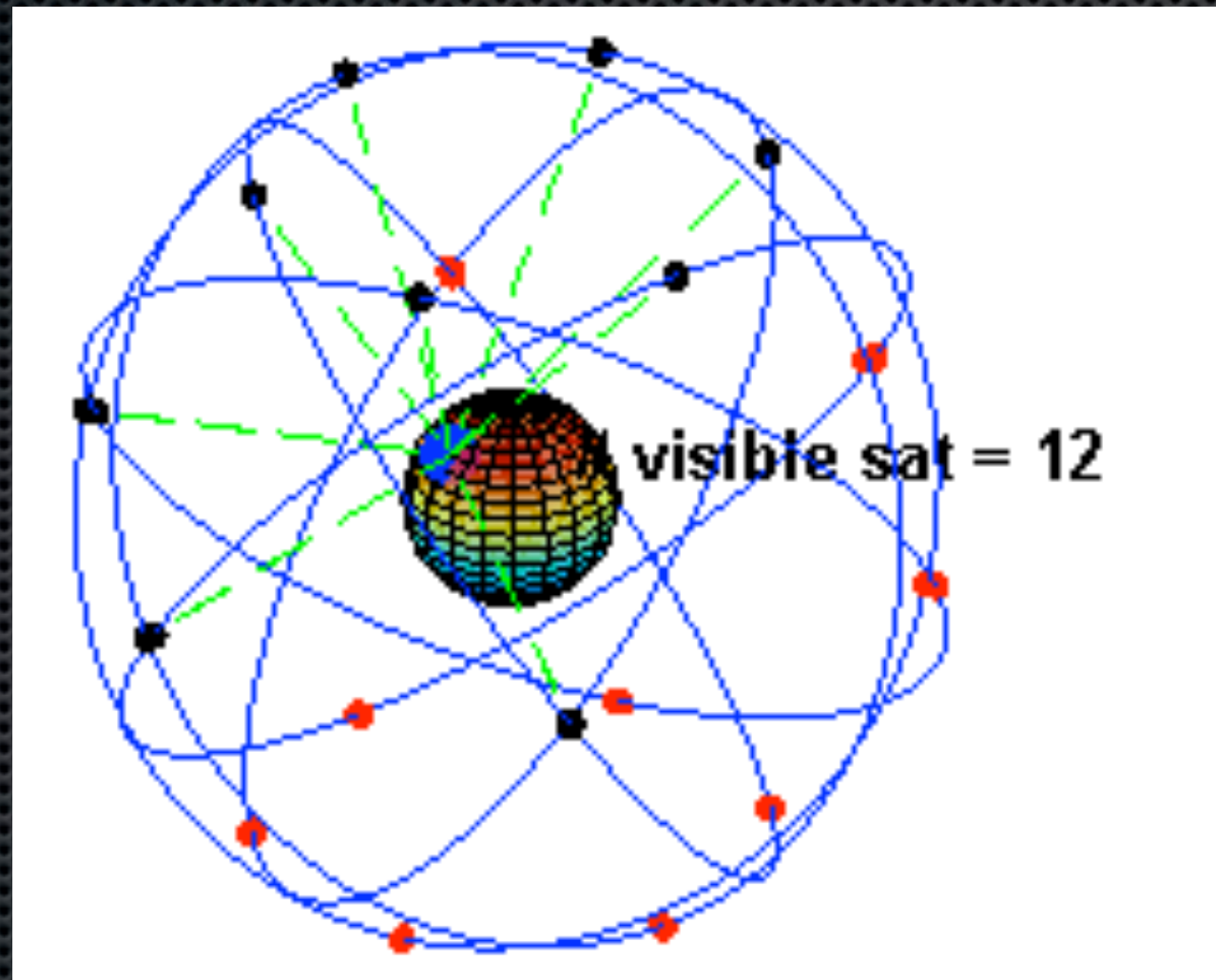
- ✦ Developed 1974 by DOD
- ✦ Functional in 1994 with 24 Satellites
- ✦ 2007 GLONASS became available



Triangulation



GPS “Constellation”

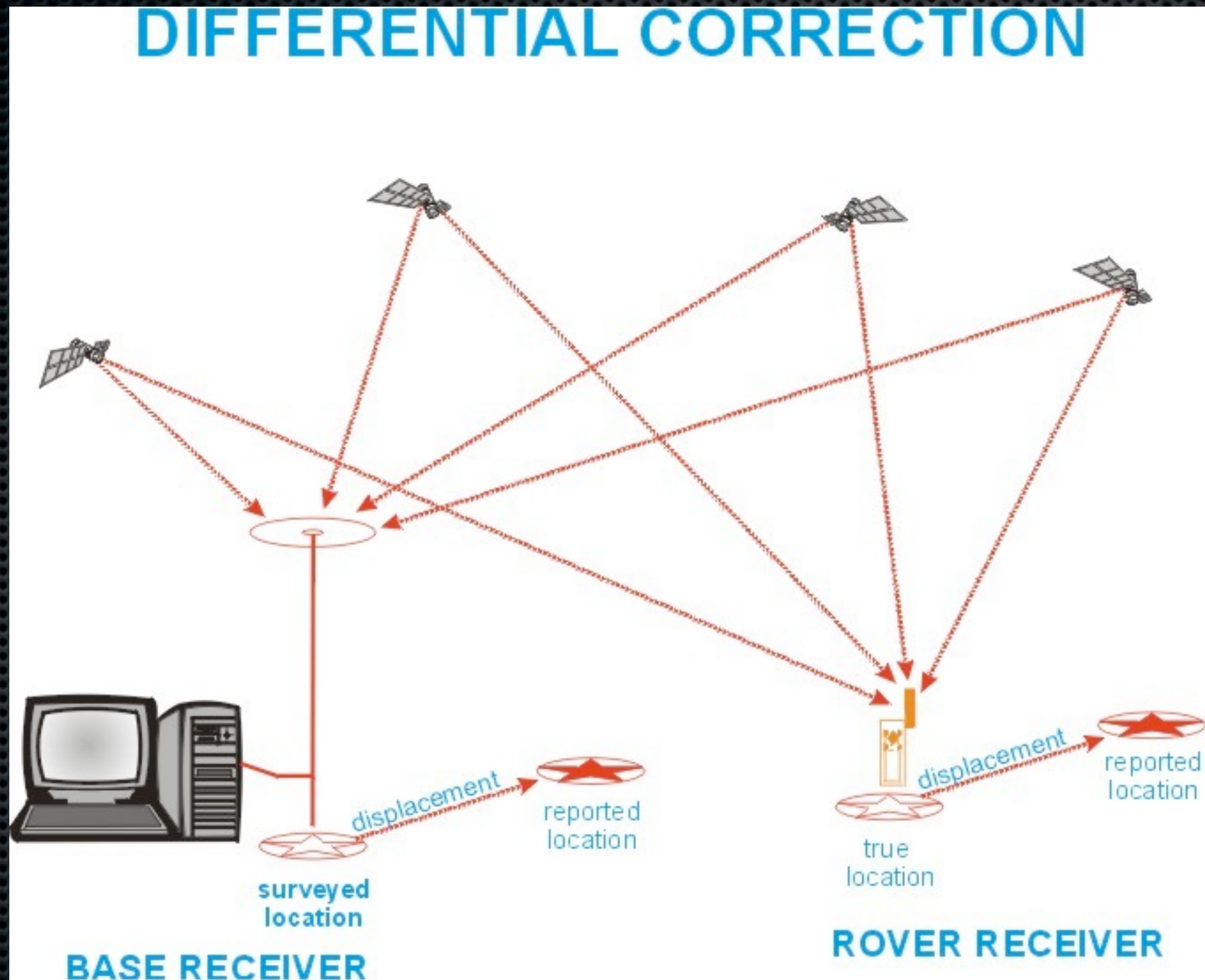


http://www.youtube.com/watch?v=v_6yeGcpoyE

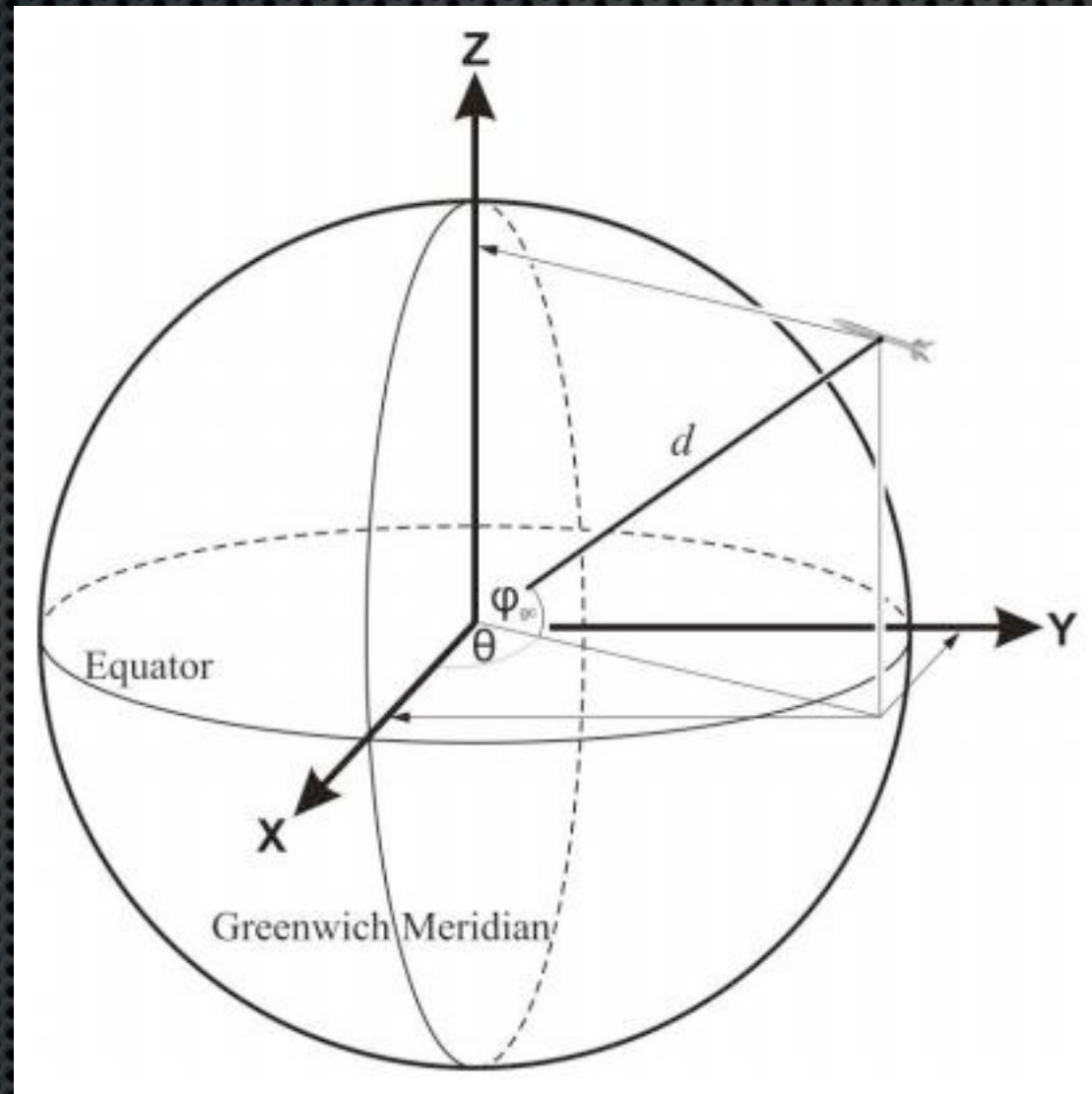
Complications

- ✦ Satellite Visibility
- ✦ Satellites are constantly moving
- ✦ Signal slowed/attenuated by atmosphere
- ✦ Multipath Reflection
- ✦ Receiver Clock Error
- ✦ Orbital Errors
- ✦ Satellite Geometry

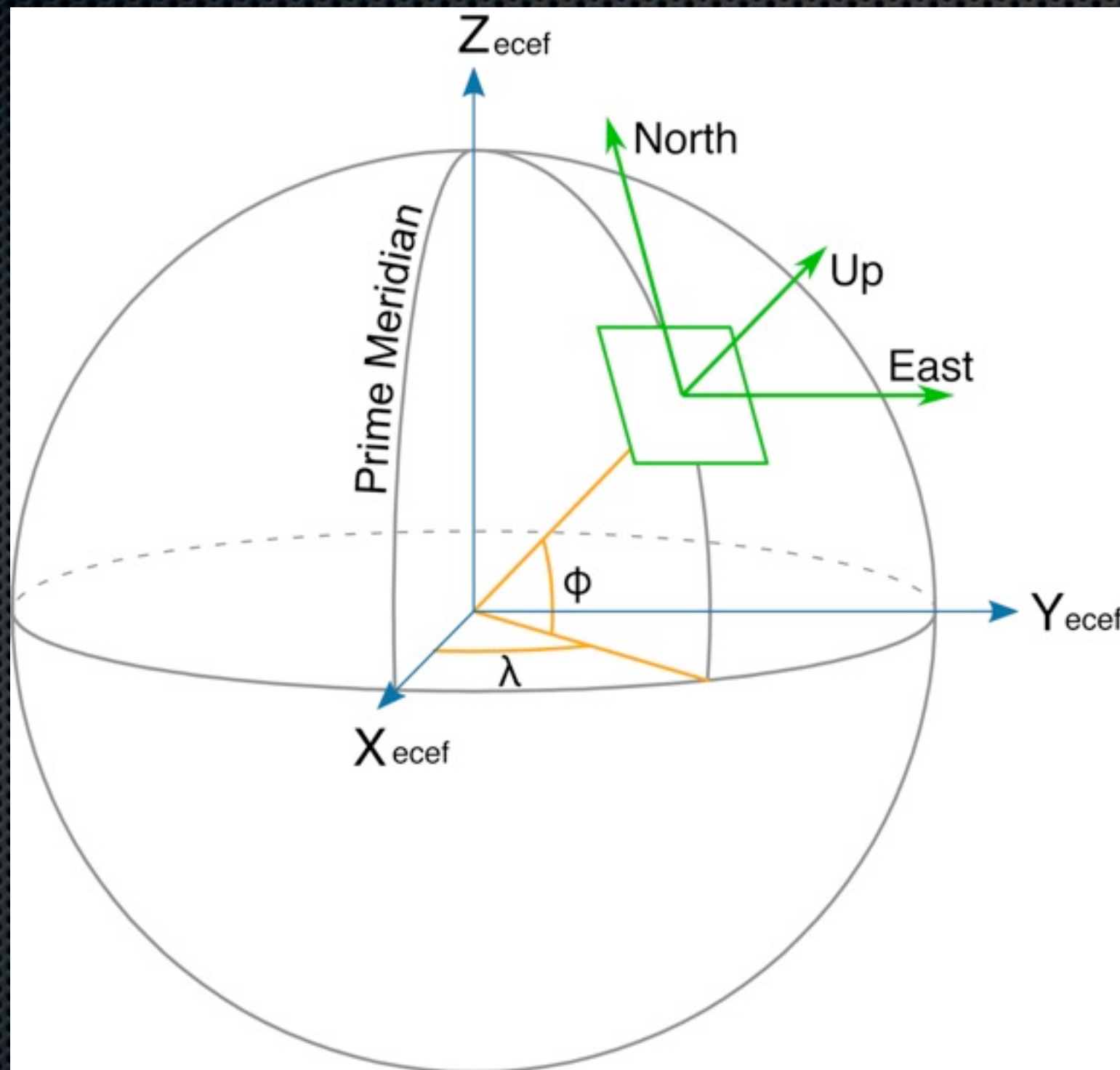
Differential GPS



ECEF Coordinates



ENU Coordinates



Lat/Lon to ECEF

$$a = 6378137\text{meters}$$

$$(1/f) = 298.257224$$

$$C = \frac{1}{\sqrt{\cos^2(\phi) + (1-f)^2 \sin^2(\phi)}}$$

$$S = (1-f)^2 C$$

$$x_{ecef} = (aC + h)\cos(\phi)\cos(\lambda)$$

$$y_{ecef} = (aC + h)\cos(\phi)\sin(\lambda)$$

$$z_{ecef} = (aS + h)\sin(\phi)$$

Next Week - QUIZ!

- ✦ Introduction to Geophysical Methods Lab
 - ✦ Rock Properties and when they are useful
- ✦ Mathematical Constructs Lab
 - ✦ Taylor/Binomial Approximation
 - ✦ Vectors/Points/Distance
 - ✦ Gradients/Divergence/Curl