

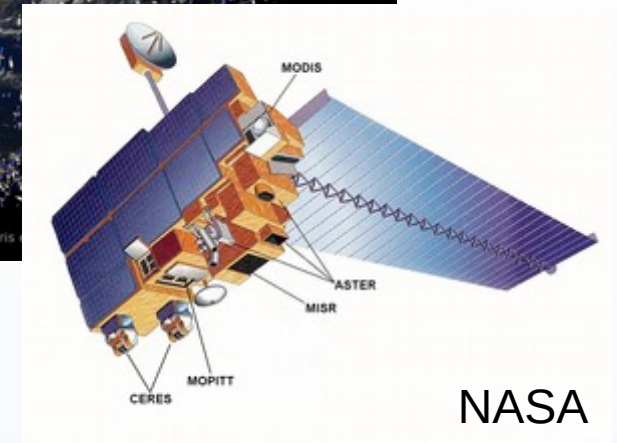
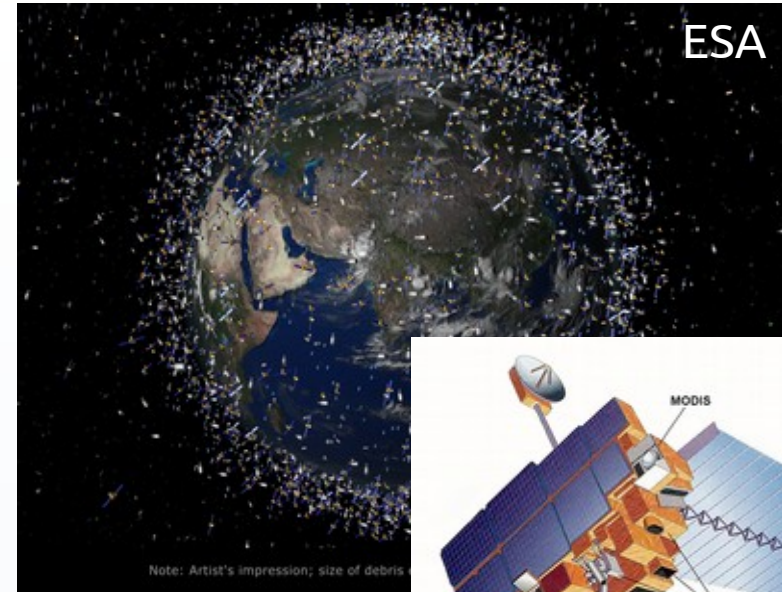
EGM310: GIS and Remote Sensing

Week 10, Part 1: Satellites and Sensors

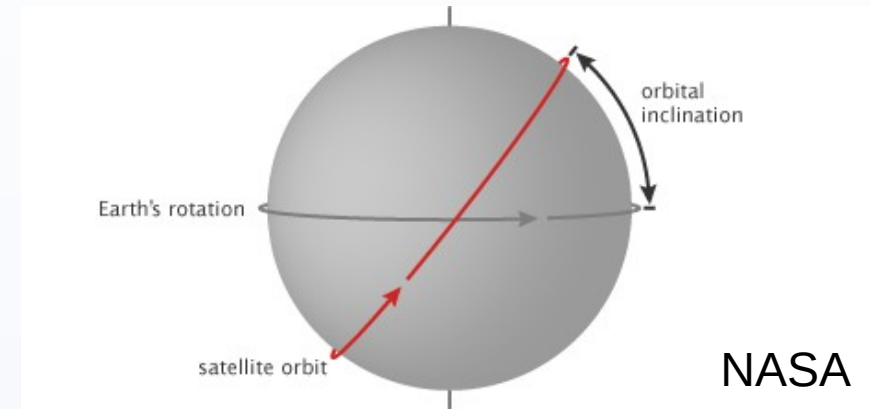
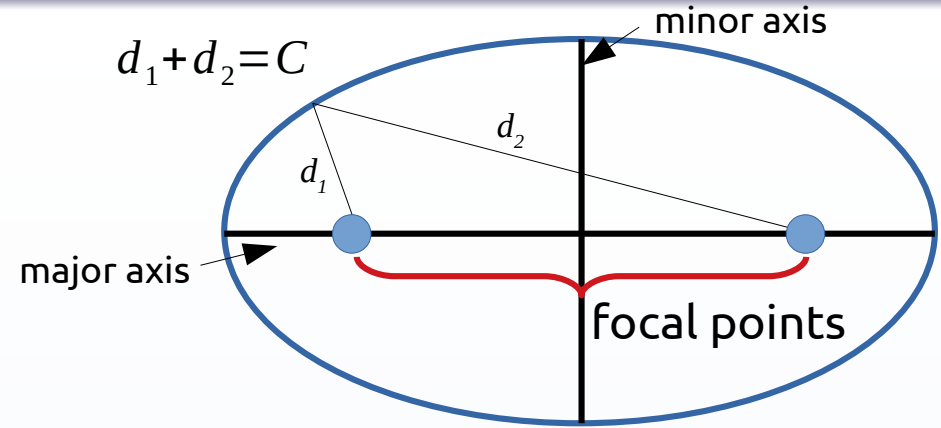
1. Satellites and sensors
2. Active sensors
3. Passive sensors
4. Sensor distortions and corrections
5. Satellite data
6. Where to find satellite data
7. Introduction to digital imagery

What is a satellite?

- Any smaller object that orbits a larger object
 - Natural
 - Artificial
- Serve as a platform for sensors/equipment
- Many different purposes:
 - Communication
 - Weather forecasting
 - **Earth-observing**
 - Military
 - Astronomy
 - Navigation (GPS, GLONASS, Galileo)

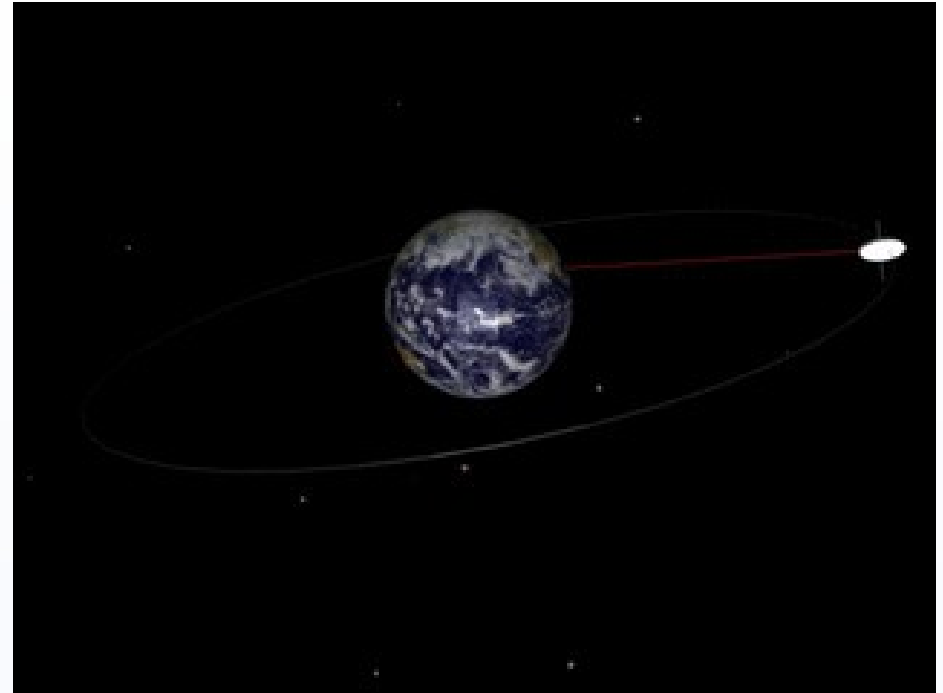


- **Orbit**: the path/trajectory of an object
- (Partial) anatomy:
 - Semimajor axis
 - **Altitude**
 - Eccentricity
 - **Inclination**
 - **Period**
- Main categories for remote sensing:
 - Polar (in Low-Earth Orbit, ~400-900 km)
 - Geosynchronous (35,770 km)
- For artificial satellites, choice of orbit largely depends on application



Geostationary orbits

- Special class of geosynchronous
- Period of orbit matches Earth (23 h, 56 m, 4 s)
- Inclination of 0° → from ground, appear fixed in sky
- Great for:
 - Weather satellites
 - Communication
 - Navigation



Sun-synchronous orbits

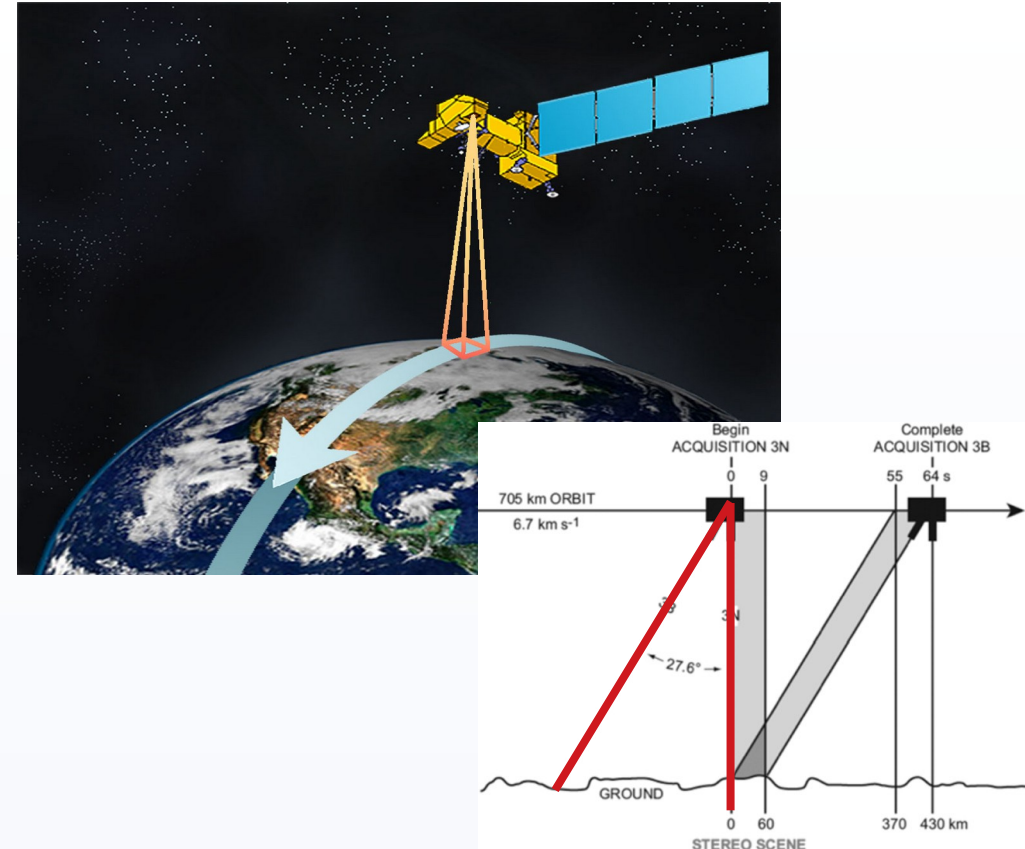
- Special class of polar orbit
- Orbit **precesses** a complete revolution each year
 - i.e., satellite crosses equator at the same time on each pass
- Inclination is typically $\sim 98^\circ$
 - **Retrograde** orbit
- Great for:
 - Imaging
 - Spying



- **Spatial** resolution: how small an object can we distinguish with our sensor? (not the same as pixel size!)
- **Spectral** resolution: how small of a spectral separation can we measure?
- **Temporal** resolution: how often do we get a repeat observation?
- **Radiometric** resolution: how sensitive is our detector?

Some definitions

- **Swath**: the area imaged during an orbit
 - Depends on altitude, sensor
 - Related to **Field of View** (FOV), viewing angle
- **Ground track**: the path directly under the sensor
- **Nadir**: pointing directly down
- **Off-nadir**: pointing down at an angle



- (Artificial) satellites serve as a platform for sensors, other equipment
- Orbit determines how much, how often, and when sensor observes Earth surface
- Different kinds of resolution help determine what we can actually see

- Lillesand, Kiefer & Chipman – Chapter 5
- Campbell & Wynne – Chapter 6
- Natural Resources Canada [Remote Sensing Tutorials](#)
- Kepler's Laws (series) [[Socratica](#)]
- Classical Orbital Elements [[NSSI](#)]
- Orbit Types [[NSSI](#)]