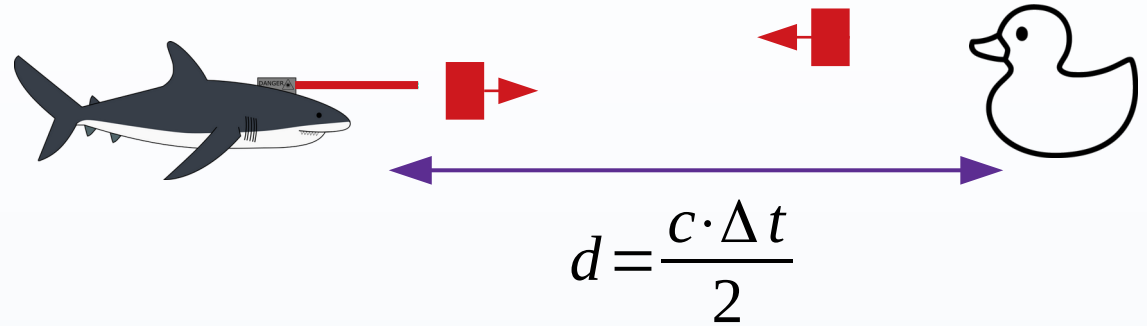


EGM702 – Photogrammetry and Advanced Image Analysis

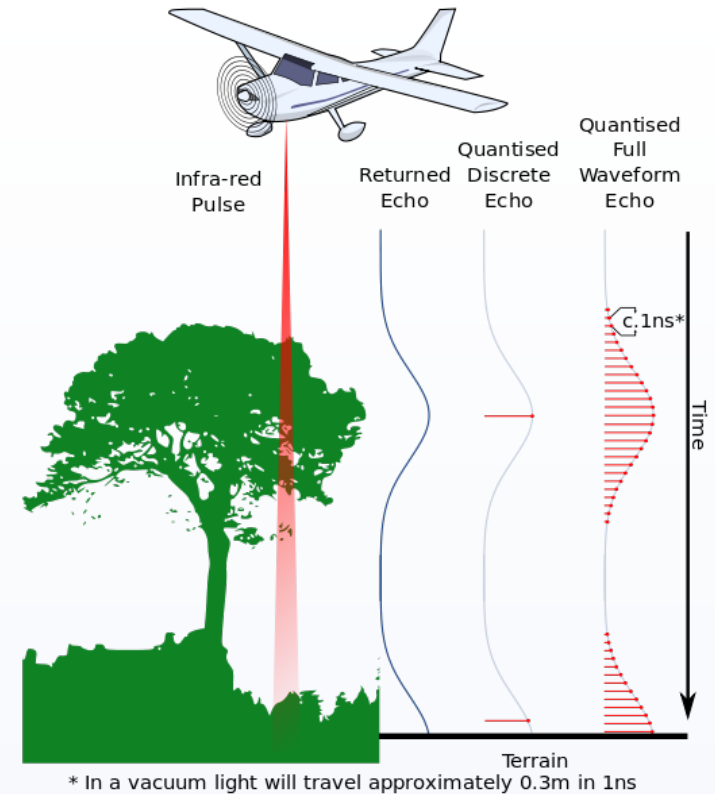
Week 2, Part 4: LiDAR

LiDAR (or Lidar, lidar, ...)

- Light Detection and Ranging
- Similar principal to radar:
 - Send signal toward target
 - Signal reflects off target toward receiver
 - Use travel time to calculate distance
- Typically 600-1000 nm lasers

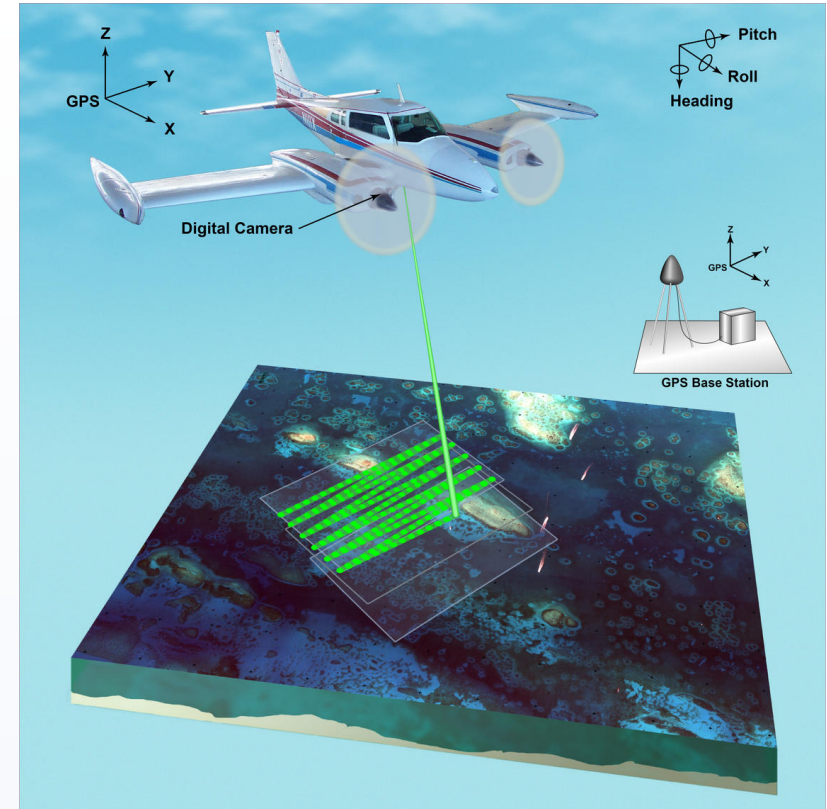


- Signal normally returns from multiple targets
- E.g., vegetation, water surface/bottom
- Use to study vegetation structure, health
- “Remove” vegetation: digital terrain model

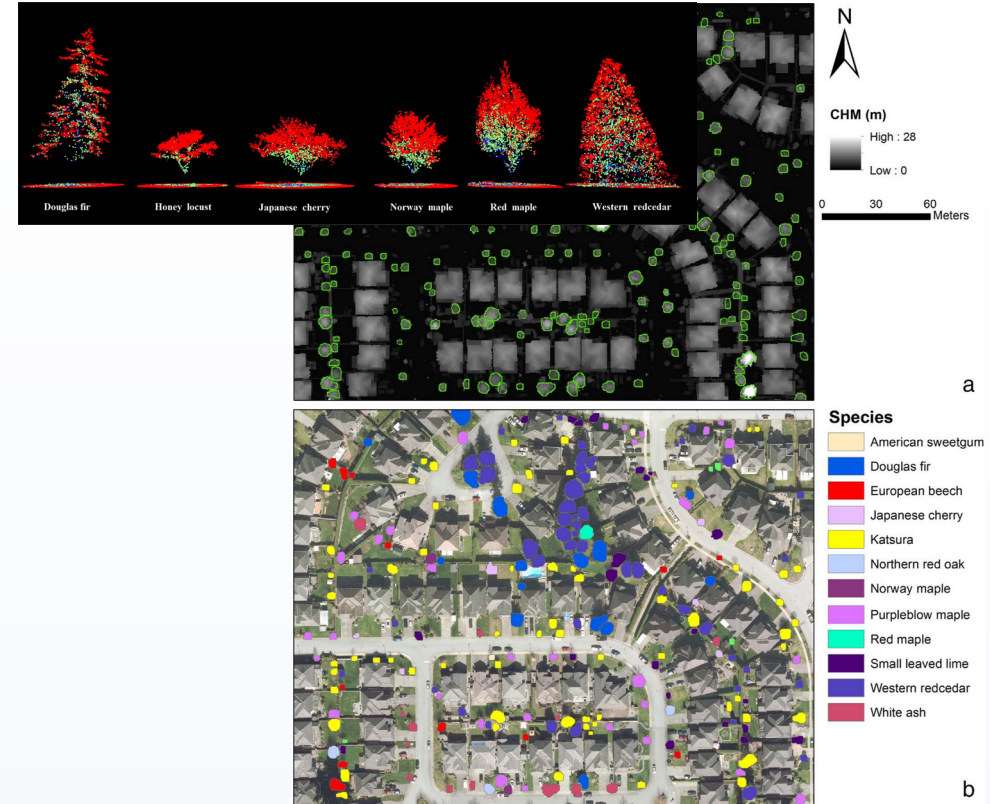


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- Laser/detector
- Inertial Measurement Unit (IMU)
- GPS/GNSS
- Ground component (RTK/dGPS)

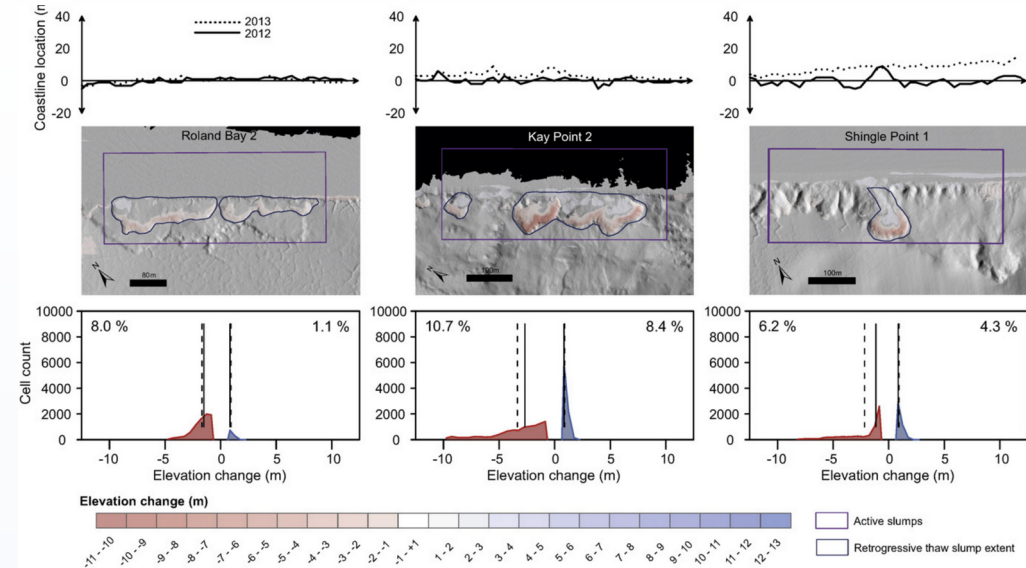


- Trees are important in urban areas:
 - Mitigate urban heat island effect
 - Support biodiversity
 - They're just nice.
- Field mapping can be difficult
- Combination of LiDAR, hyperspectral data can aid classification
- LiDAR can also give height, structure, other physical parameters



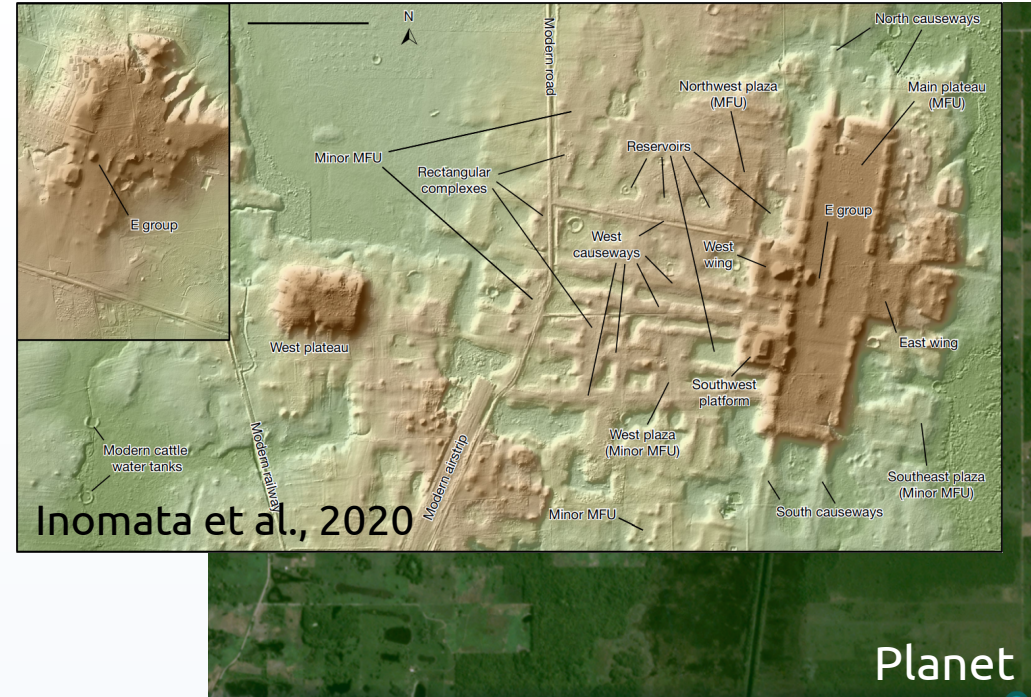
Liu et al. 2017

- Erosion of permafrost coasts a big problem in Arctic
- Highly variable in both space and time
- High-quality, high-resolution LiDAR surveys help document, quantify changes



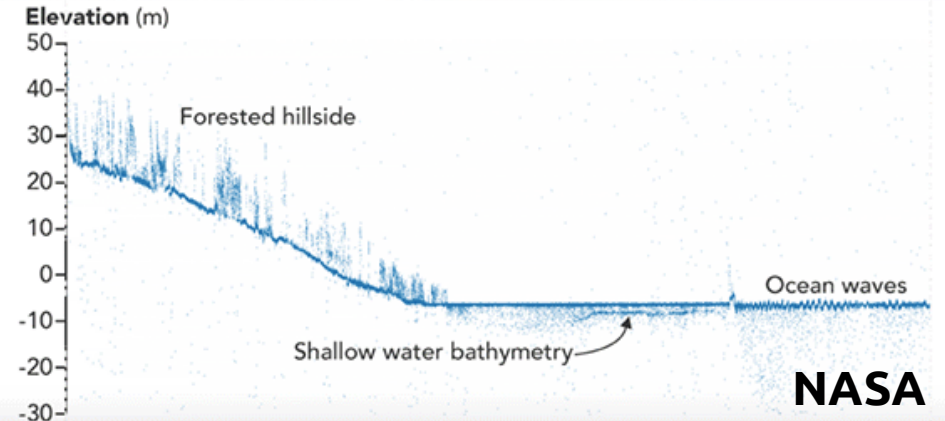
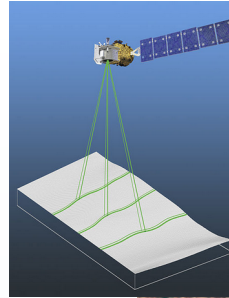
Obu et al., 2017

- Excavating full extent of monuments, cities is difficult
- Especially with thick vegetation cover
- LiDAR can “see” ground underneath vegetation
 - Reveals archaeological sites
- Example: Aguada Fénix, Mexico (1000-800 BC)



Ice, Cloud, and Elevation Satellite (ICESat)

- ICESat(-1): 2003-2009
 - Laser altimeter
 - ~70 m footprint
 - ~150 m spacing
- ICESat-2: 2018–
 - 6 beams (3 pairs)
 - Pair: 90 m spacing
 - measurement every ~70 cm



- LiDAR: a technique for measuring distance between sensor, object
- Returns highly accurate* measurements (subject to post-processing)
- Many applications, from cryosphere to urban forestry and archaeology

- Tempfli et al., Chapter 10.3
- Liu et al., 2017 [[Remote Sens. Env.](#)]
- Obu et al., 2017 [[Geomorphology](#)]
- Inomata et al., 2020 [[Nature](#)]
- ICESat-2 Mission Page [[NASA](#)]
- Introduction to LiDAR [[NEON](#)]
- ICESat-2 Introduction [[NASA](#)]