

## Monday 11 June, 08:30 – 09:20 Remote sensing III: Active sensors (Brunt)

### Notes:

The goal of this lecture is to introduce students to active sensors, with a focus on NASA's laser altimeters. The lecture will help students understand what tools are out there and the various parameters to consider when thinking about lidar applications. Finally, this lecture will cover geophysical corrections and sources of error within the data.

### Instruments

NASA airborne laser altimeters

- 1) ATM
- 2) LVIS
- 3) UAF Riegl
- 4) MABEL

Considerations between instruments:

Accuracy and precision  
Altitude  
Footprint/spot size  
Swath extent  
Wavelength  
Heritage/maturity  
Applications

NASA airborne radars

- 1) Ku-band radar
- 2) Snow radar
- 3) Accumulation radar
- 4) MCoRDS

Considerations between instruments:

Frequency  
Depth  
Applications  
Heritage/maturity

NASA satellite laser altimeters

- 1) ICESat
- 2) ICESat-2

Considerations between instruments:

Accuracy and precision  
Footprint/spot size  
Along-track density  
Across-track density  
Wavelength

The lecture goes into detail on ICESat-2, which will launch 12 September 2018. ICESat-2 is a global mission, providing datasets for land types including ice, ocean, land (vegetation), and atmosphere. There are various slides covering the operational plan (orbits, off-pointing, data products, etc.) for this new satellite.

### **Error Sources**

- 1) Reference Frame
  - Geoid vs Ellipsoid: 100's m
  - Ellipsoid vs Ellipsoid: 100's m
  - ITRF vs ITRF: mm
- 2) For a single measurement
  - Aircraft (PRY and reference frames)
  - Instrument (MABEL, ICB, etc.)
  - Geolocation
- 3) For a repeat assessment
  - Across-track slope
  - Different instrumentation (aircraft)

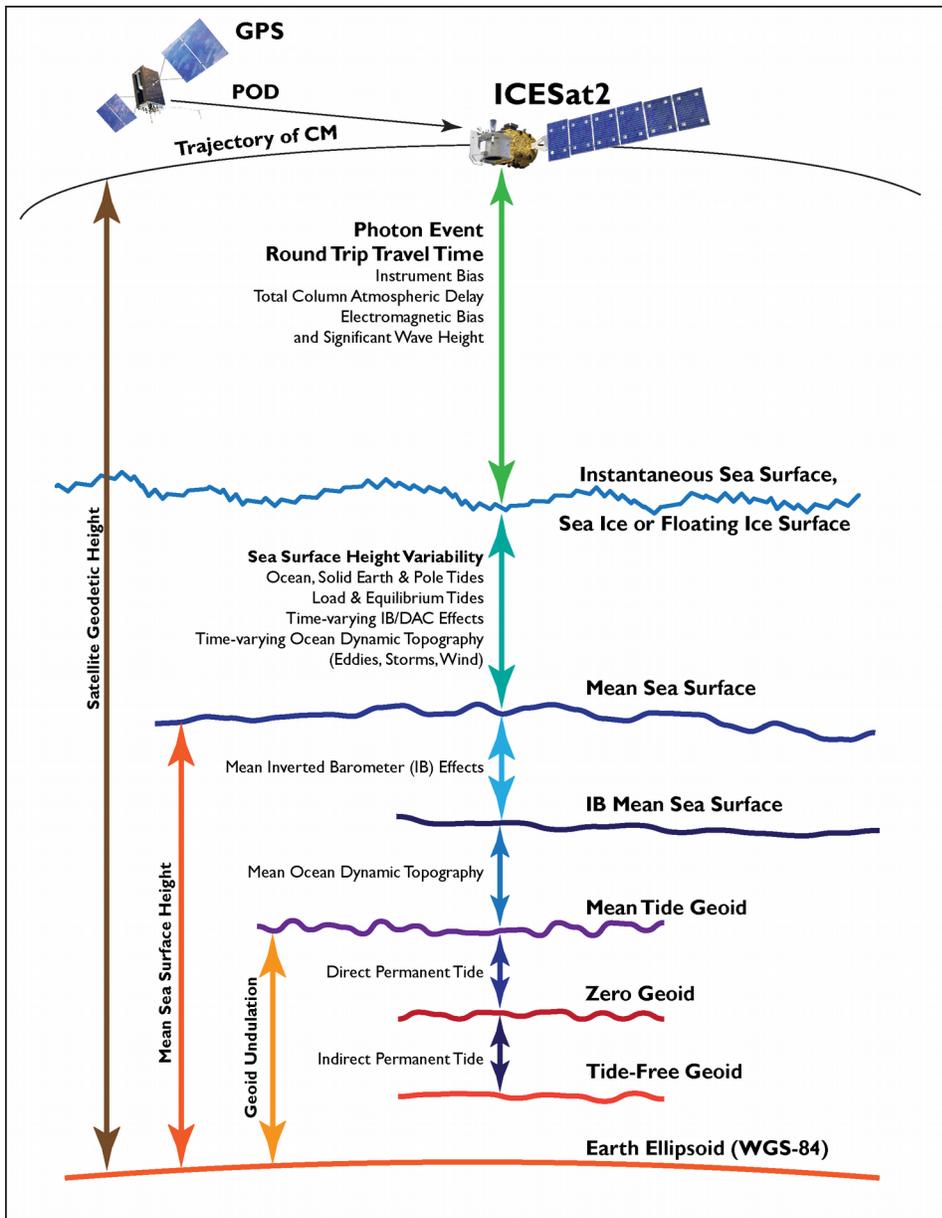
### **Geophysical Corrections**

- 1) Geoid
  - 105 to +90 m
- 2) Tides
  - 1a) Ocean tides
    - $\pm 5$  m in polar regions!
    - $\pm 8$  m in Bay of Fundy!!
  - 1b) Solid earth tide (body tide)
    - $\pm 40$  cm
  - 1c) Ocean loading
    - 6 to 0 cm
  - 1d) Pole tides
    - Solid earth pole tide:  $\pm 1.5$  cm

Ocean pole tide:  $\pm 0.2$  cm

3) Dynamic Atmospheric Correction (DAC)  
and the IBE (Inverse Barometer Effect)  
 $\pm 50$  cm

4) Total column atmosphere correction  
-2.6 to -0.9 cm



Modified from: Tapley, B. D. & M.-C. Kim, Applications to Geodesy, Chapt. 10 in *Satellite Altimetry and Earth Sciences*, ed. by L.-L. Fu & A. Cazenave, Academic Press, pp. 371-406, 2001.

