ICESat-2 Land and Vegetation Data Products Overview

Amy Neuenschwander

University of Texas at Austin

April 30 – May 2, 2019 USFS-NASA Applications Workshop

ICESat-2: Not just a cryospheric mission

ICESat-2 will collect range measurements globally (land, forests, lakes, oceans)

ICESat-2 will be off-pointed in the mid-latitudes to increase density of measurements

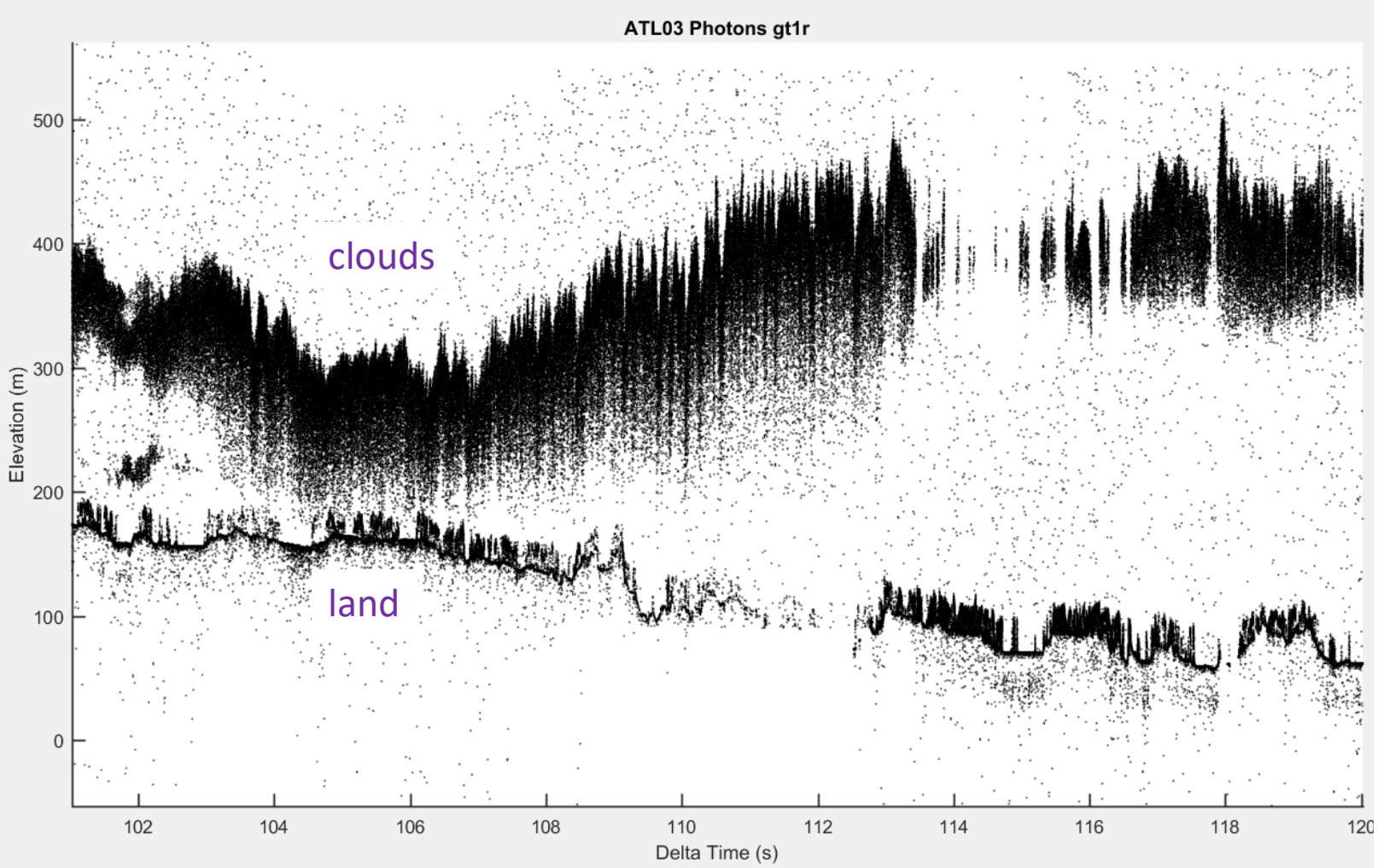
- high along-track density
- low cross-track density

ATL08 (Land and Vegetation) Data Product will report terrain and canopy heights, and other parameters

- Suitable for stand level/regional assessments

Applications for biomass mapping, habitat/biodiversity, fuel loads, snow pack, and more!!

What about Clouds? Can ICESat-2 see through them?



Answer: Generally speaking NO

But, ICESat-2 green laser (532 nm) does penetrate through SOME (TBD) optical depth in the atmosphere.

Science Team and ICESat-2 Project Office is working hard to improve cloud flags.

ICESat-2 Data Products

When are they available? **On or about May 28, 2019**

Where can you get them? **NSIDC or through Earth Data Search**

What's the latency for final products? **Approximately 49 days from acquisition**

Along-track Products

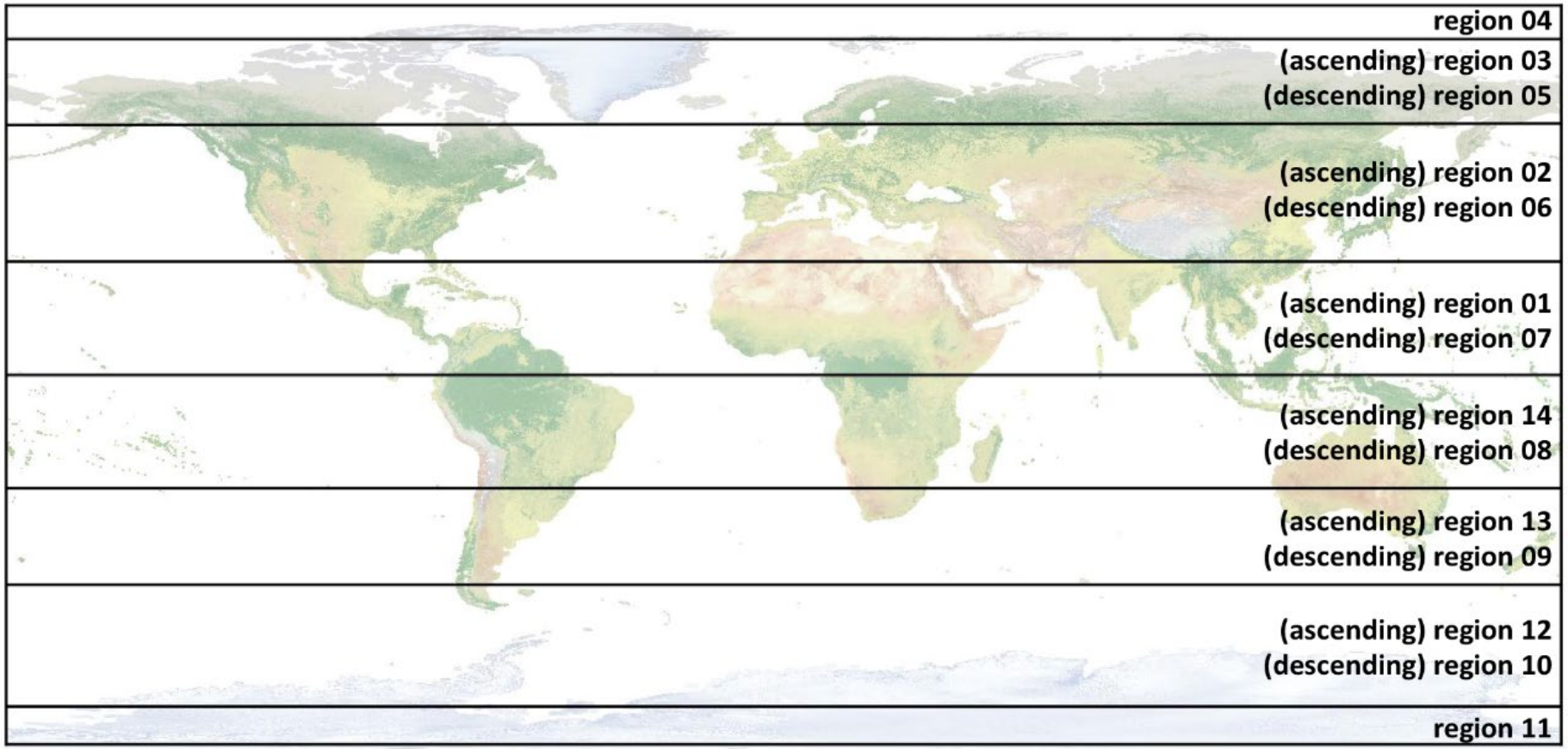
- ATL03 – Along-track Geolocated Photons ← You might want this product too
- ATL06 – Along-track Land Ice Data Product
- ATL07 – Along-track Sea Ice Data Product
- ATL08 – Along-track Land/Vegetation Data Product ← Definitely get this product
- ATL09 – Along-track Atmospheric Data Product
- ATL12 – Along-track Ocean Data Product
- ATL13 – Along-track Inland Water Data Product

User's Guide for each data product is available from NSIDC

Algorithm Theoretical Basis Document is available for each data product at https://icesat-2.gsfc.nasa.gov

ICESat-2 Data Products

Along-track Granule Regions (ATL03 and ATL08 use same granule regions)



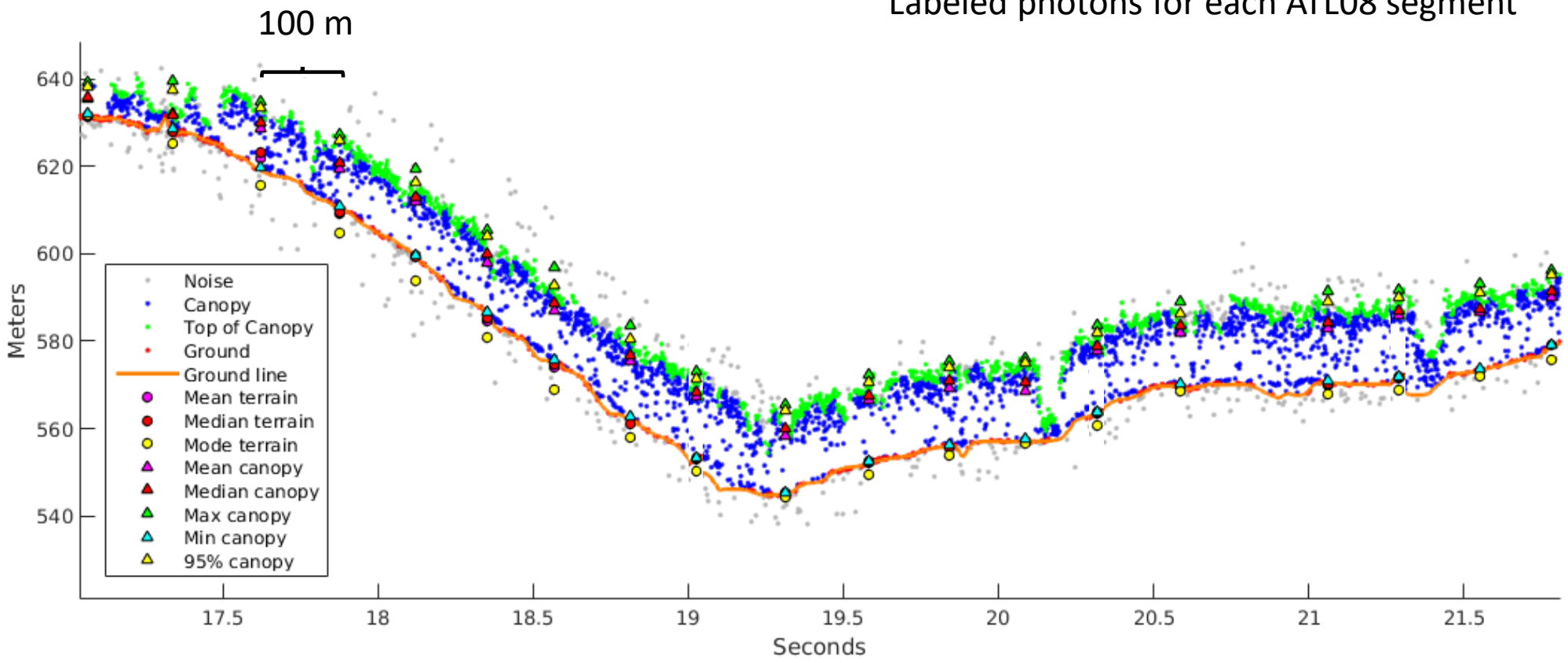
ICESat-2 Land/Vegetation Data Products

- **ATL08 - Level-3 (Along-track)**
  - Products computed on a per-orbit/ per-beam basis
    - Labeled Photons with indices back to ATL03
    - Statistical parameters of canopy and terrain based on fixed 100 m distance to capture fine-scale geomorphology
    - Segments output in 100 m step size

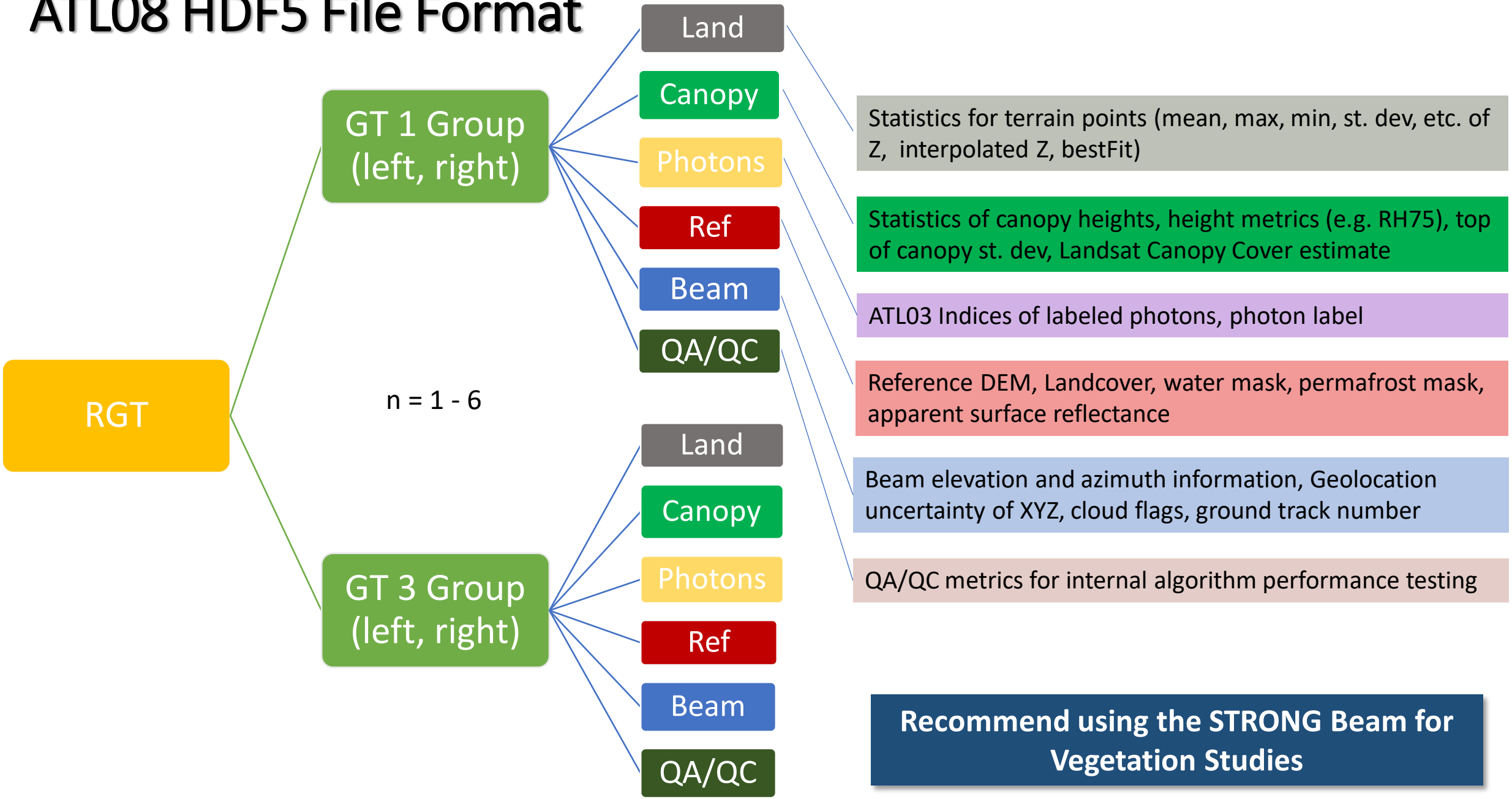
- **ATL18 - Level-4 (Gridded)**
  - Products released annually at a coarse resolution (1 km resolution tiles)
    - Canopy Height
    - Ground Elevation
  - Higher resolution grid (e.g. 100 – 500 m, TBD) produced at end of mission
  - Requires approximately 2 or 3 years of collections to produce a gridded product

Example of Along-Track Data Products

Labeled photons for each ATL08 segment



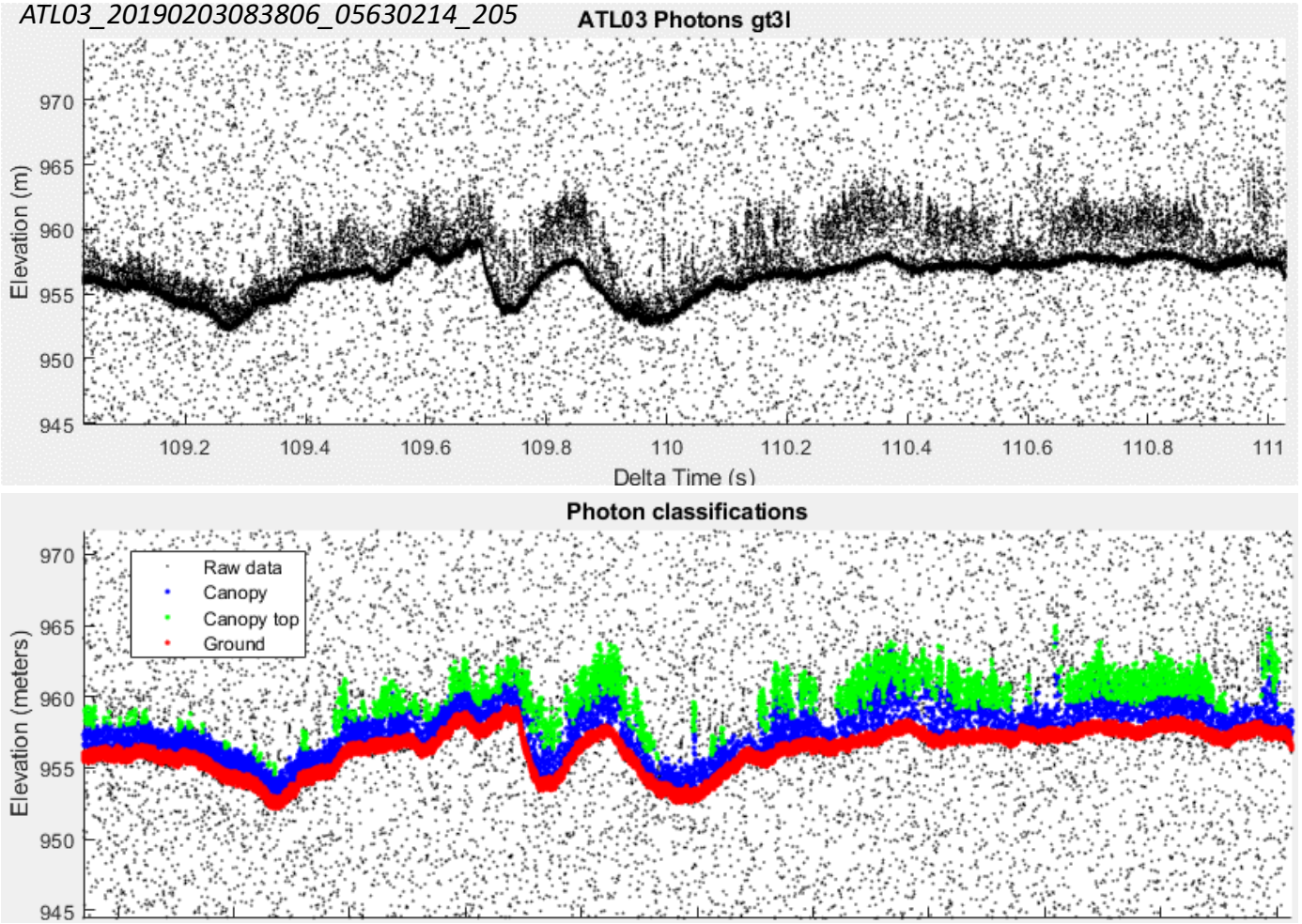
ATL08 HDF5 File Format



Recommend using the STRONG Beam for Vegetation Studies

Semi-arid Woodlands in Botswana

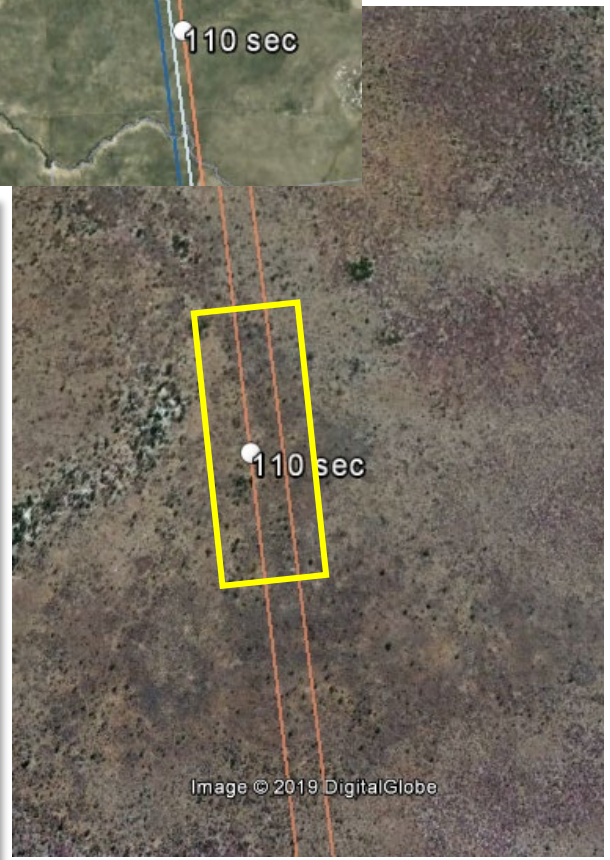
February 3, 2019 day acquisition of ICESat-2 over northern Botswana. Trees with heights < 5m are detected and labeled with ICESat-2.



A mixture of Mopane and Acacia trees dot the landscape in this region of Botswana

Biomass from woodlands are typically estimated empirically from optical data (e.g. Landsat).

With ICESat-2, we can now calculate canopy heights for these landscapes –thus reducing uncertainty in global biomass estimates

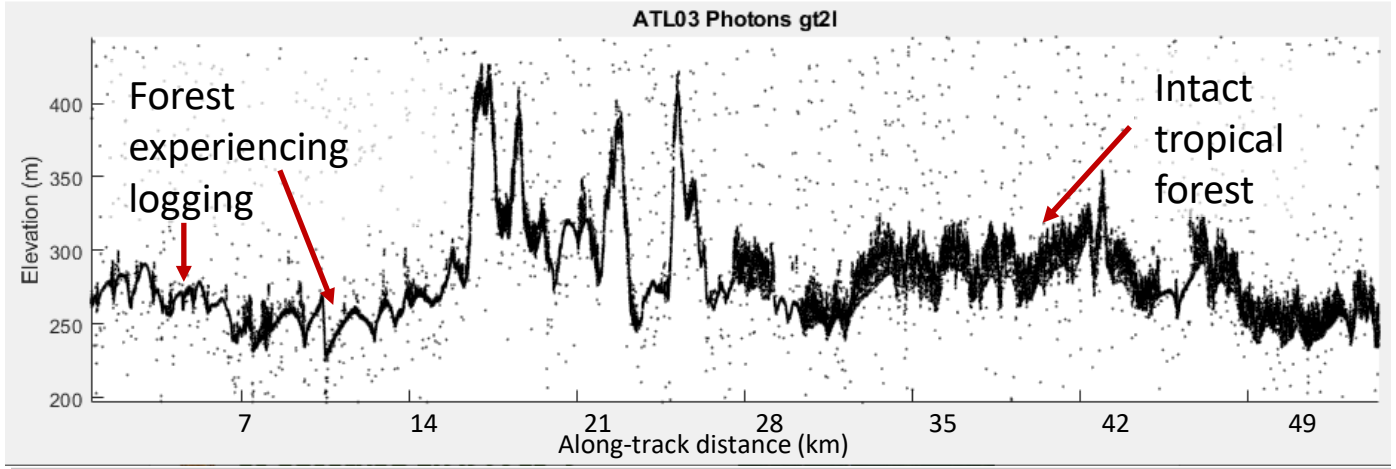


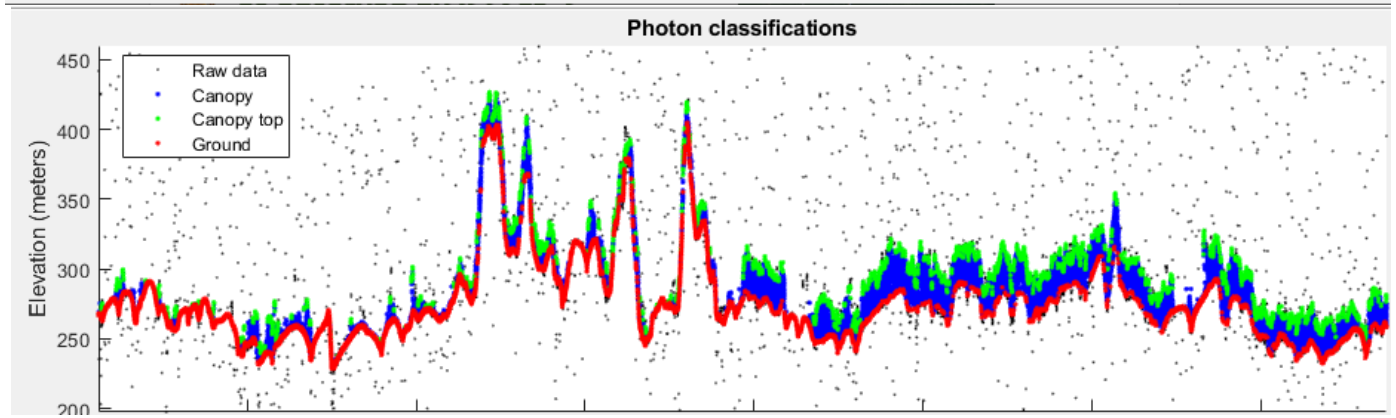
A. Neuenschwander, University of Texas at Austin

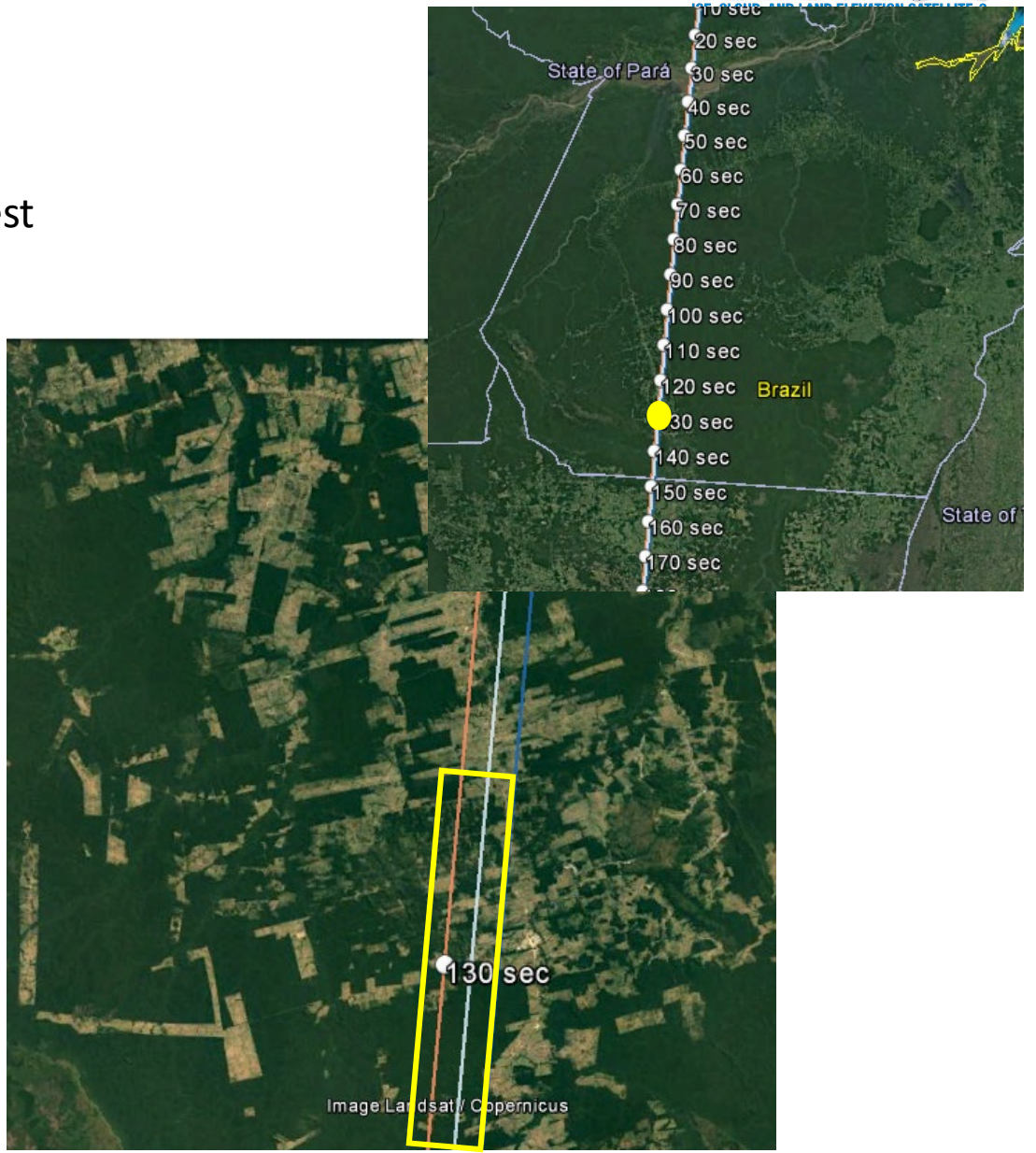
Deforestation from Logging as observed by ICESat-2

March 19, 2019 night acquisition of ICESat-2 over Brazil's tropical forest

ATL03_20190319234325_12450208_206

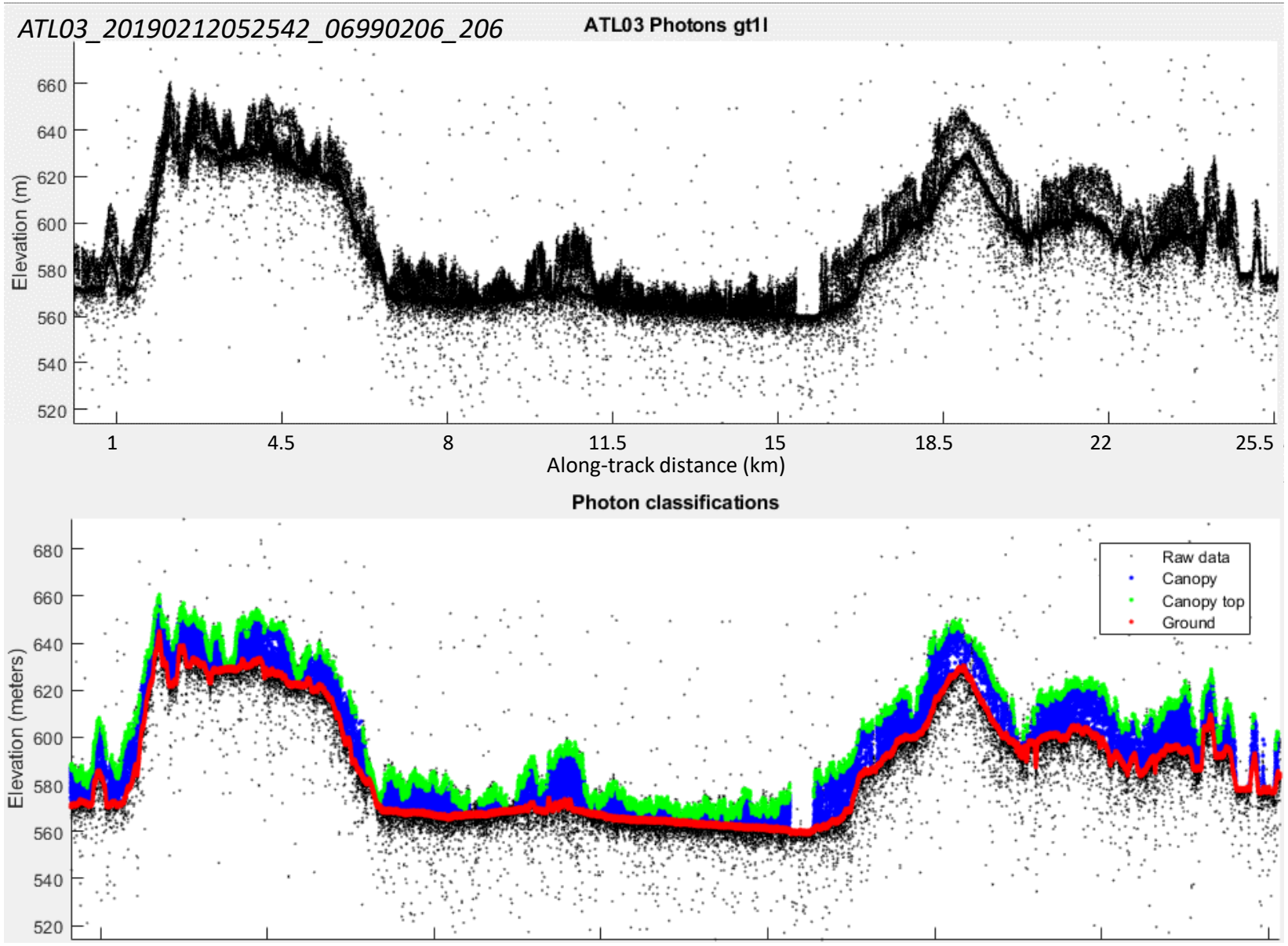


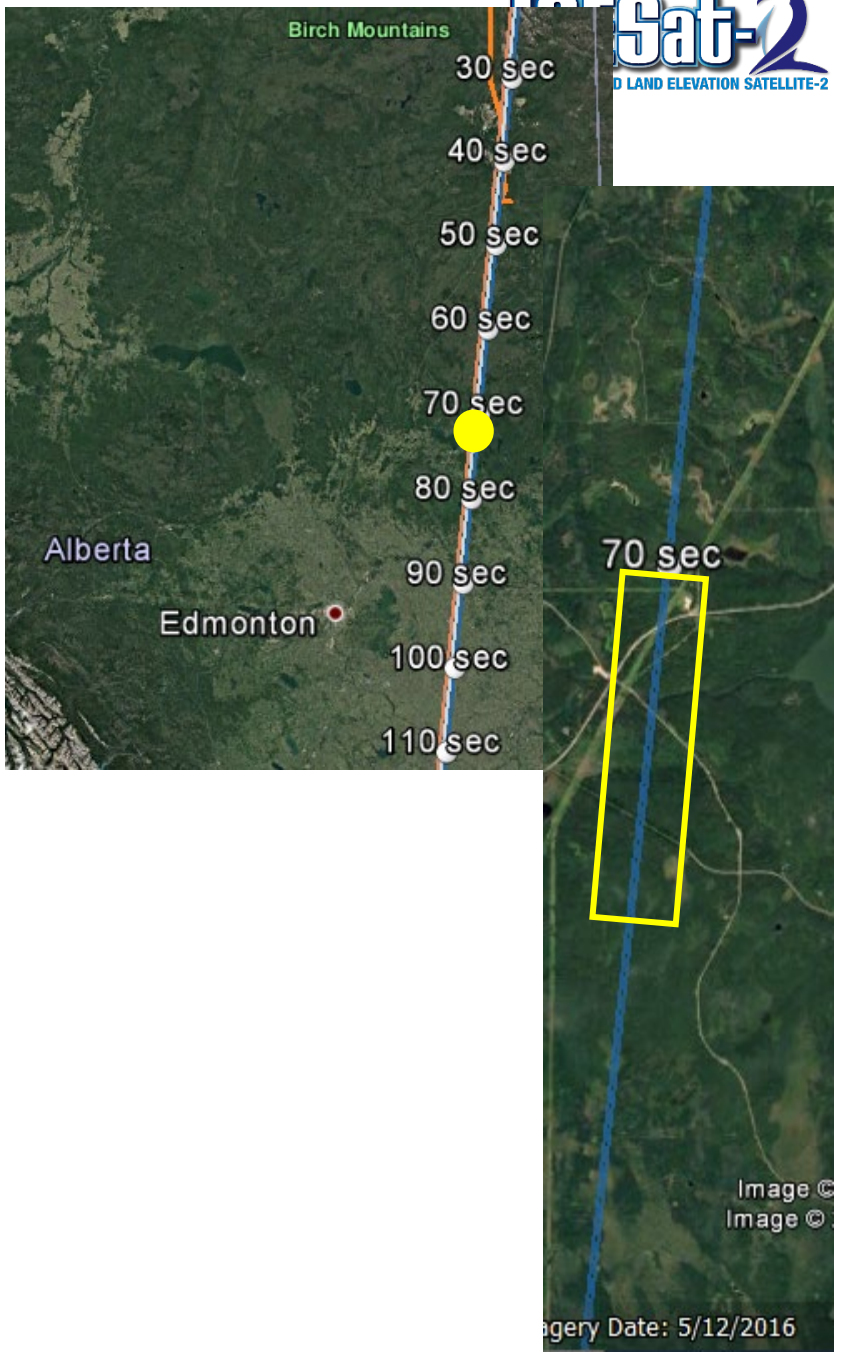




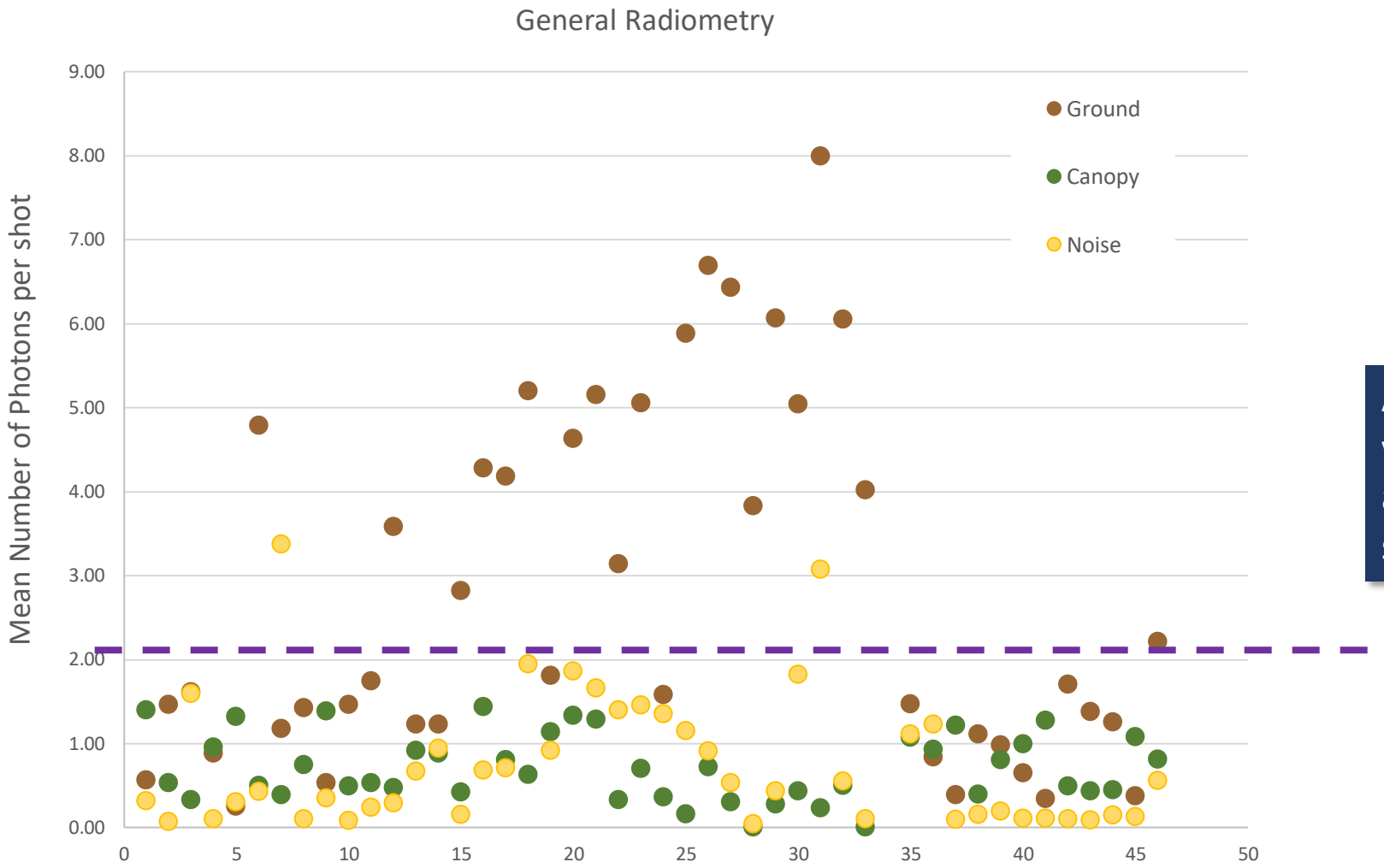
A. Neuenschwander, University of Texas at Austin

Boreal forest in Alberta Canada as observed by ICESat-2





ICESat-2 Radiometry over Land/Vegetation



ATL08 segments with a mean value of 2 photons per shot are an indicator of a “bright” surface

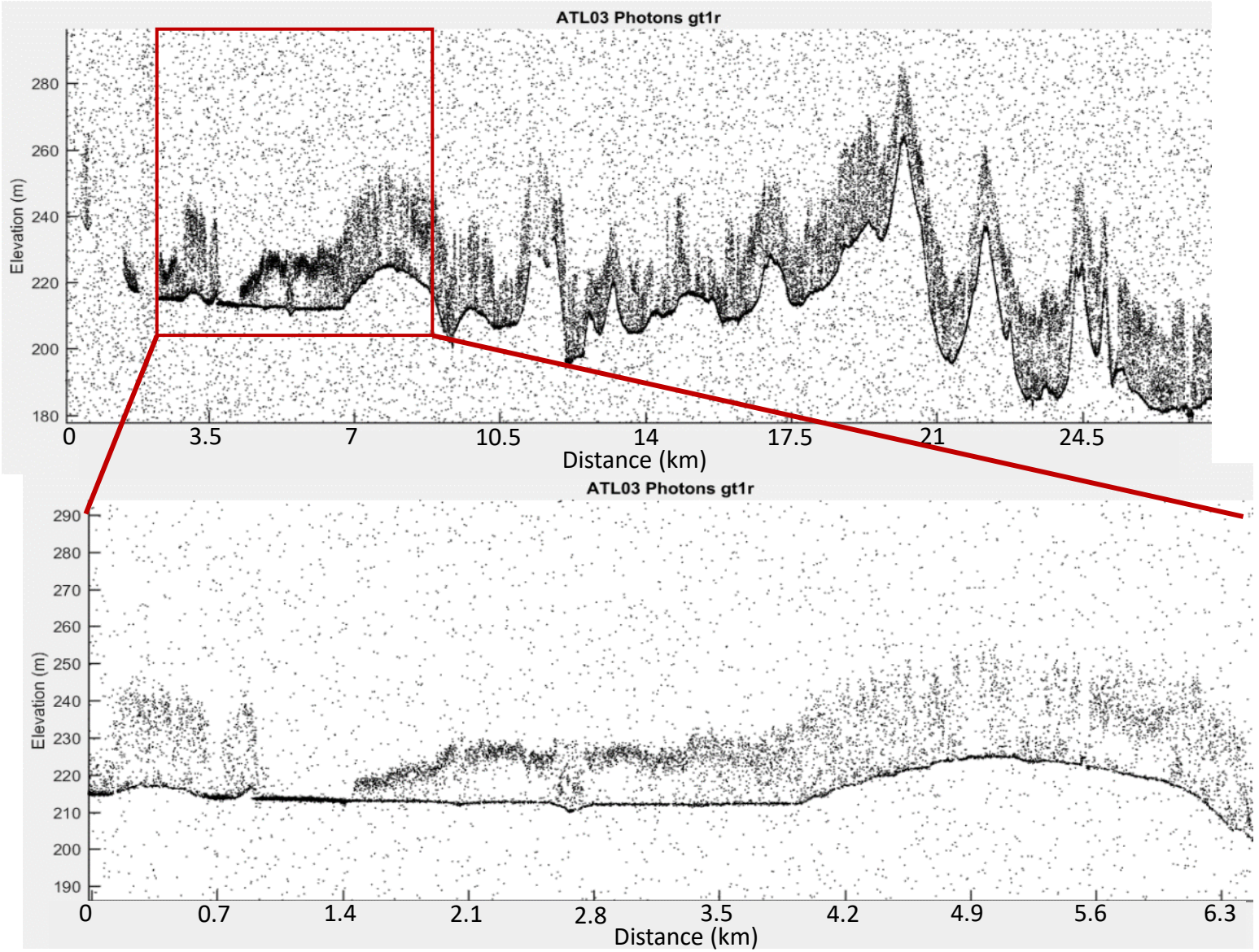
Possible Uses and Applications for ICESat-2

Augment Forest Inventory Data

Estimate Above Ground Biomass

Estimate Fuel Loads

Detect presence of snow on ground beneath vegetation



Key Takeaways

- ICESat-2 is a space-based, profiling lidar mission
  - Does not provide the same resolution as airborne lidar mapping data
  - Does provide global coverage
- Use of strong beams are recommended for vegetation studies
- Night acquisitions are probably better than day acquisitions
  - Less background noise
- Data quality should improve over time
  - more calibration of the laser ranges
  - Improved modeling of orbital variations
  - Improvements to software will continuously be made
  - data will be reprocessed periodically (Release 002 expected September 2019)