ATL08 Known Issues -- Release 001 (May 28, 2019)

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Known Issues

The first release (Release 001) of ICESat-2 data is now available from NSIDC. With this first release, there are some known caveats and issues regarding some parameters on the data products.

1) Sigma_h: On the ATL03 data product, the geolocation uncertainty of the heights (sigma_h) are not being calculated and are set to a constant value of 0.4 m. The ATL08 algorithm uses sigma_h along with the slope of the local topography for each footprint to calculate the point spread function. Within the ATL08 data product, the point spread function value is used as the threshold to separate ground from canopy photons above the estimated ground line. Figure 1 illustrates an error (not often observed) where the ground surface is mislabeled as canopy rather than ground. This error is attributed to poor ground finding or a PSF value set too low. In future versions of the ICEsat-2 software and data releases, this value for sigma_h will be calculated and should provide a more accurate PSF value on the ATL08 data value.
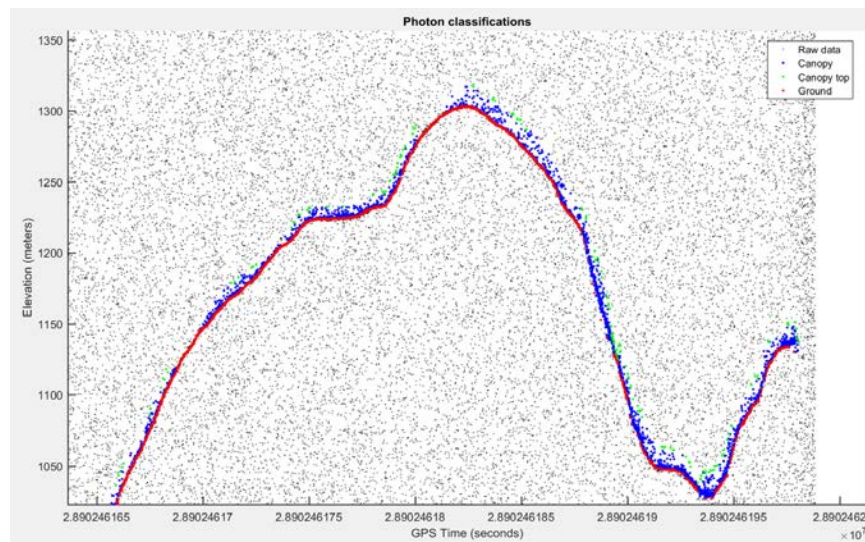
Figure 1. Profile of ICESat-2 data collected during a day acquisition. In this particular example, a portion of the ground surface was mislabeled as canopy photons (blue) –one potential source for this error could be due to a PSF value set too low.

2) Cloud flags: In release 001, there is currently not a cloud flag on the ATL08 data product due to the lack of a suitable cloud flag option from the atmospheric data product (ATL09). With this knowledge, the ATL08 algorithm first examines the calibrated atmospheric backscatter and identifies clouds above 400 m from the surface. These photons are removed from the ATL08 surface finding algorithm and generally those segments are left empty. There will be instances, however, where low clouds, fog, smoke or other aerosols could result in an incorrect terrain or

canopy height estimate. If height anomalies occur, it is suggested to examine the results from ATL08 with the photons in ATL03 to confirm the accuracy of the output. Cloud flags will be included on the ATL08 data product for release 002 and beyond. Figure 2 shows an example where cloud flags would not work, even if there were on the ATL08 data product.
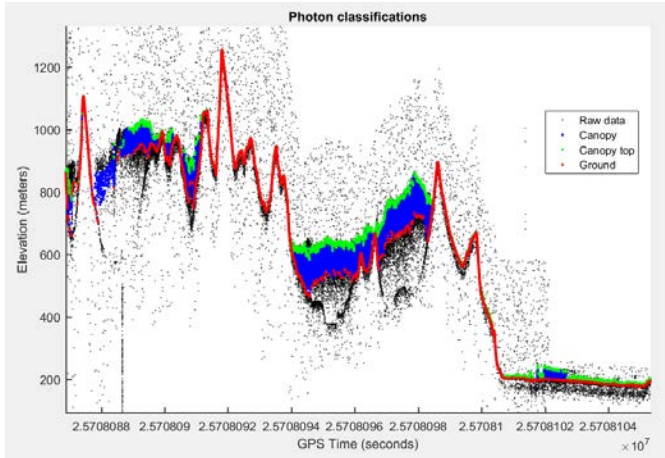
Figure 2. Profile of ICESat-2 data over Alaska. Here, a layer of low clouds or fog sits in the valley in between the mountains. Because the clouds are close to the ground surface and reflect back strong to the detector, the ATL08 surface finding follows the cloud top and bottom rather than the true ground surface.

3) Canopy Filtering: The ATL08 algorithm was developed on simulated data. As such, the background noise rates that we are observing with actual ICESat-2 data are much less than we had simulated. For this reason, there is a final photon filtering step that removes noise photons from the identified canopy photons. It is apparent that this final photon filtering step is too aggressive or not required during night acquisitions of ICESat-2. We anticipate that a modification for this output is made for release 002.
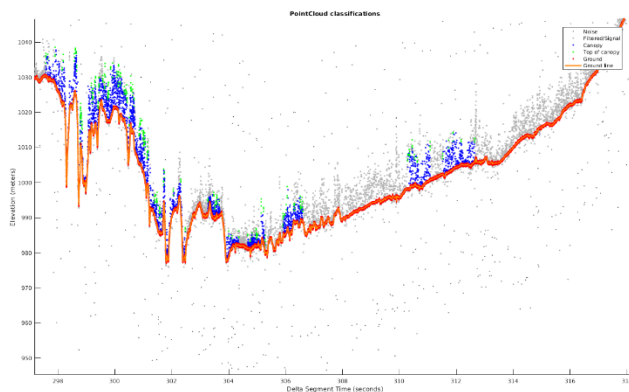
Figure 3. Profile of ICESat-2 photons acquired during the night. Here the canopy photons are originally considered as signal but are relabeled as noise in the final filtering step in the ATL08 algorithm.

4) Parameterization of filtering window: The ATL08 algorithm sets a moving window size for filtering based upon several factors, including the topographic relief. In only a few instances, it seems as though this window filtering size might need to be adjusted, particularly for high relief areas. It is anticipated that the next release of the ATL08 will correct for this problem.
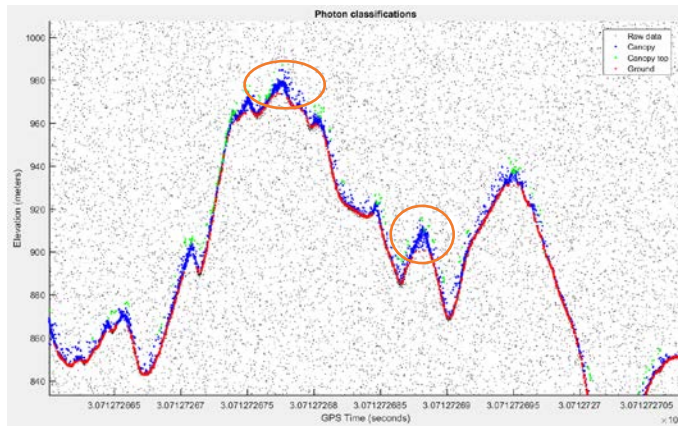

Figure 4. Profile of ICESat-2 photons acquired during the day. Here the estimated ground line has under estimated the surface, resulting in an incorrect classification of ground and canopy photons.

5) Signal Finding/Noise Filtering: Both the ATL03 and ATL08 algorithms have a signal finding/noise filtering component. In some instances, particularly if the vegetation is sparse and the background noise rate is high, it is possible that the parameters used to identify noise from signal photons are off. In Figure 5 below, it is apparent that the parameter used to identify noise and signal photons is changing in the along-track direction and is not accurate for some stretches of data. It is anticipated that this condition will be corrected in future version of the ATL08 software.
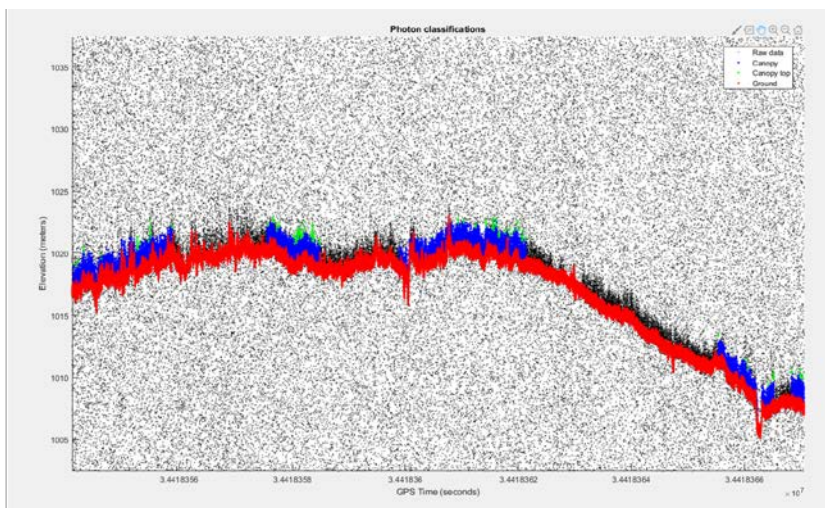

Figure 5. Example of ICESat-2 photons where the signal/noise filtering missed the canopy photons.

6) Signal Attenuation: Clouds or aerosols above the telemetered window can sometimes result in few photons being reflected back to the detector. In figure 6, it is apparent that the signal is attenuated near the 147.5 second mark. As a result of the signal attenuation, the identified surfaces (canopy and ground) may be less accurate.
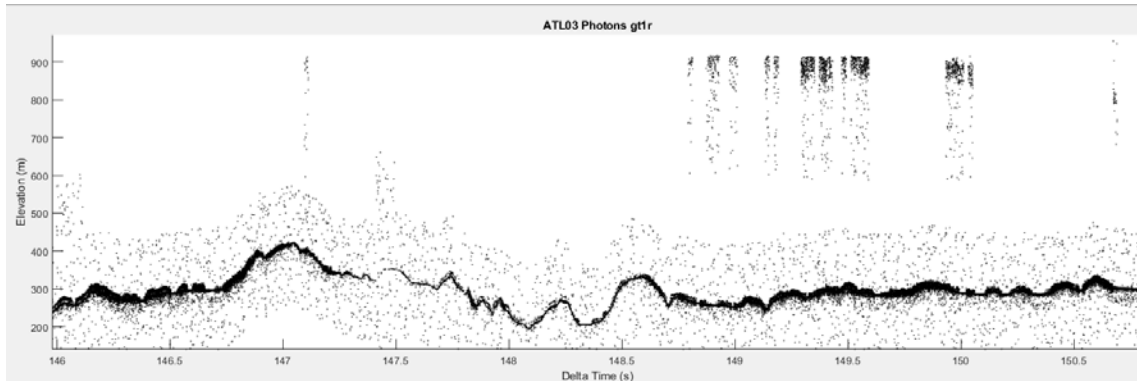

Figure 6. Profile of ICESat-2 photons showing the impact of atmospheric signal attenuation on the reflected surface photons.

7) Water signature: Due to the detector characteristics, photons reflected from a specular surface often result in a strong signature with a characteristic "water after pulse" beneath the water surface. This signature is typically observed for flat water (river, lakes) and not typically seen over open ocean. It is anticipated that a "detected water" flag will be added for future versions the ATL08 software.
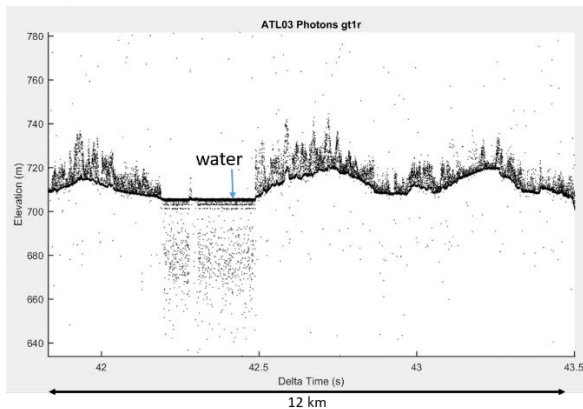

Figure 7. *Profile of ICESat-2 photons showing the specular return beneath water surfaces.*

8) Segment_latitude: The latitude reported for each 100 m segment may not represent the middle of that 100 m segment. It is anticipated that this condition will be corrected in future version of the ATL08 software.