

ATL07/10

Notes to users and known issues

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11/25/2019

Record of updates:

Date	Release	Notes
06/03/2019	R001	
09/12/2019	R002	
11/25/2019	R002	Release of summer data (Note 3)

Notes to users and known issues

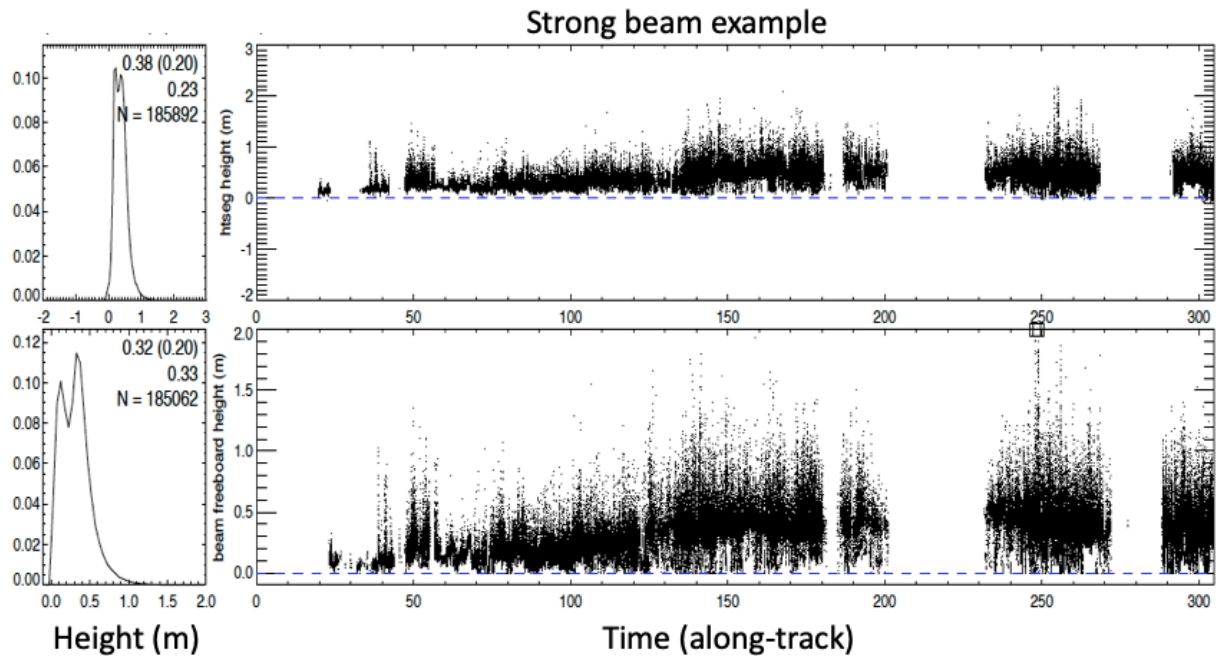
This document contains notes, which are of use in the analysis of the sea ice products, and issues that are known to the developers, which may be fixed in future releases of these products.

Feedback from the community will be added to future revisions of this document.

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Note 1. ATL07/10 granules



The two panels (above) show the retrieved along-track surface heights (in ATL07, top right panel) and corresponding freeboards (in ATL10, bottom right panel) and their distributions (x-axis in meters, left panels) from a strong beam, in ~300 s (or ~2100 km) of ICESat-2 data. The gaps in the data are due to clouds. Retrievals (though of different resolutions) are available from both the strong and weak beams.

Granules. The ATL07 and ATL10 products each consist of approximately 32 files (granules) per day, 16 for the northern hemisphere and 16 for the southern hemisphere; each granule contains the sea ice retrievals (heights and freeboards) from data acquired over half an orbit. Six ground tracks within each granule span the width of the orbital swath with an across-track distance of 6 km.

Coverage. The ATL07 retrievals contain heights from the ice-covered oceans of the northern and southern hemispheres when the surface is visible (relatively cloud free) and the ice concentration > 15%. The ATL10 products are more restrictive, retrievals are provided only when the ice concentration > 50% and 25 km away from the coast.

Note 2. Variable segment lengths and spatial statistics

The ATL07 product contains profiles of surface heights of individual height segments along each of the six ground tracks. The variable along-track length of a height segment (L_s), associated with a height estimate, is determined by the ground distance travelled by the pulse footprints (number of pulses \times inter-pulse distance) in the time it takes to aggregate 150 photons used for surface finding; thus, this length varies with surface reflectance. That is, the segment length adapts to changes in photon rates from surfaces of different reflectance; height segment lengths (L_s) are longer when the returns are lower and vice versa. The ATL10 freeboards have the same segment lengths as those height segments in ATL07. This is an important characteristic to note in the calculation of spatial statistics.

The calculation of spatial statistics and distributions must account for the non-uniform and variable length sampling of height estimates. For example, the spatial mean (\bar{h}) and standard deviation (σ) of heights should be calculated as follows:

$$\bar{h} = \frac{\sum_N L_s^i h_s^i}{\sum_N L_s^i} \quad \sigma^2 = \frac{\sum_N L_s^i (h_s^i)^2}{\sum_N L_s^i} - \bar{h}^2 .$$

That is, the height statistics should be weighted by the corresponding length of the height segment (L_s).

Note 3. Summer ATL10 (May 3 and September 30, 2019) not available – Revised 11/25/2019

All ATL10s are now available for general use. We have found, in general, that the classification procedure does not identify the bottom of melt ponds as sea surface reference and therefore does not cause erroneous freeboard estimates in ATL10.

(09/12/2019)

ATL10s (freeboard product) will not be available for the period between May 3 and September 30, 2019. These products are on hold pending an assessment of the retrieval approaches.

Issue 1. Multi-beam freeboards calculations disabled (ATL10)

Currently the multi-beam freeboard calculations are switched off as the beams have not been leveled relative to each other. Only single-beam freeboards are available in ATL10. That is, freeboards are not calculated using the local sea level from other beams.

Issue 2. Sea surface heights (SSH, cross-beams and absolute SSH levels)

SSHs across the beams have not been leveled relative to each. Although the relative SSH within each beam seems usable, they require further evaluation. And, the quality of absolute sea surface heights have not been assessed.

Issue 3. Lower transmitted energy in Beam 3 (Strong Beam)

The transmit energy of Beam 3 (Strong beam 2R or 2L, depending on orientation of the ICESat-2 observatory) is approximately 80% that of Beam 1 and Beam 5. Thus, the segment lengths and photon return statistics are and will be different from the other two strong beams.

Issue 4. *Layer_flag* in ATL07 and ATL10

The computation of the *layer_flag*, which combines the information in *cloud_flag_atm*, *cloud_flag_asr* and *bsnow_con* into a consolidated flag for indication of cloud coverage, was implemented incorrectly in the current release (R001 - ASAS 5.1). DO NOT USE.

Issue 5. High freeboard samples (near the ice margins) due to sea state

The reference sea surfaces used to calculate freeboards are based on sea surface heights identified in ATL07. Near the ice edge, the reference surfaces within the ice cover are affected by sea state, likely due to scattering from the troughs of waves propagating into the ice cover, resulting in surfaces that may be tens of centimeters below the local mean sea level. This results in higher freeboards, and affect one or perhaps two 10-km freeboard segments. Most of these anomalous retrievals have been filtered out but they still occur.

Issue 6. Gaps in coverage near the coast especially in the weak beams

The current algorithm neglected to take into account the additional photons in the larger telemetry window in the buffer zone between land and sea ice. As a consequence, a large number of shots were treated as saturated and discarded, causing a gap in coverage in the overlapping land ice/sea ice masks. This effect is especially acute in the weak beams and when the solar elevation is high in the spring and summer, and negligible when the sun is below the horizon.