

# ATL06 Product Data Dictionary

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Product Type: ATL06, Format Version : SET\_BY\_PGE

Group: /				
Conventions	(Attribute)	CF-1.6		
citation	(Attribute)	SET_BY_META		
contributor_name	(Attribute)	Thomas E Neumann (thomas.neumann@nasa.gov), Thorsten Markus (thorsten.markus@nasa.gov), Suneel Bhardwaj (suneel.bhardwaj@nasa.gov) David W Hancock III (david.w.hancock@nasa.gov)		
contributor_role	(Attribute)	Instrument Engineer, Investigator, Principle Investigator, Data Producer, Data Producer		
creator_name	(Attribute)	SET_BY_META		
data_rate	(Attribute)	Data within this group pertain to the granule in its entirety.		
date_created	(Attribute)	SET_BY_PGE		
date_type	(Attribute)	UTC		
description	(Attribute)	Land ice surface heights for each beam, along and across-track slopes calculated for beam pairs. All parameters are calculated for the same along-track increments for each beam and repeat.		
featureType	(Attribute)	trajectory		
geospatial_lat_max	(Attribute)	0.0000000000000000		
geospatial_lat_min	(Attribute)	0.0000000000000000		
geospatial_lat_units	(Attribute)	degrees_north		
geospatial_lon_max	(Attribute)	0.0000000000000000		
geospatial_lon_min	(Attribute)	0.0000000000000000		
geospatial_lon_units	(Attribute)	degrees_east		
granule_type	(Attribute)	ATL06		
hdfversion	(Attribute)	SET_BY_PGE		
history	(Attribute)	SET_BY_PGE		
identifier_product_doi	(Attribute)	10.5067/ATLAS/ATL06.001		
identifier_product_doi_authority	(Attribute)	http://dx.doi.org		
identifier_product_format_version	(Attribute)	SET_BY_PGE		
identifier_product_type	(Attribute)	ATL06		
institution	(Attribute)	SET_BY_META		
instrument	(Attribute)	SET_BY_META		
keywords	(Attribute)	SET_BY_META		
keywords_vocabulary	(Attribute)	SET_BY_META		
level	(Attribute)	3A		
license	(Attribute)	Data may not be reproduced or distributed without including the citation for this product included in this metadata. Data may not be distributed in an altered form without the written permission of the ICESat-2 Science Project Office at NASA/GSFC.		
naming_authority	(Attribute)	http://dx.doi.org		
platform	(Attribute)	SET_BY_META		
processing_level	(Attribute)	L3A		
project	(Attribute)	SET_BY_META		
publisher_email	(Attribute)	SET_BY_META		
publisher_name	(Attribute)	SET_BY_META		
publisher_url	(Attribute)	SET_BY_META		
references	(Attribute)	SET_BY_META		
short_name	(Attribute)	ATL06		
source	(Attribute)	SET_BY_META		
spatial_coverage_type	(Attribute)	Horizontal		
standard_name_vocabulary	(Attribute)	CF-1.6		
summary	(Attribute)	SET_BY_META		
time_coverage_duration	(Attribute)	SET_BY_PGE		
time_coverage_end	(Attribute)	SET_BY_PGE		
time_coverage_start	(Attribute)	SET_BY_PGE		
time_type	(Attribute)	CCSDS UTC-A		
title	(Attribute)	ATLAS/ICESat-2 L3A Land Ice Height		
Group: /ancillary_data				
Description	(Attribute)	Contains information ancillary to the data product. This may include product characteristics, instrument characteristics and/or processing constants.		
data_rate	(Attribute)	Data within this group pertain to the granule in its entirety.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
atlas_sdp_gps_epoch (Compact Dataset)	DOUBLE (1)	ATLAS Epoch Offset (not_set)	seconds since 1980-01-06T00:00:00.000000Z	Number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS Standard Data

			Operations	Product (SDP) epoch (2018-01-01:T00.00.00.000000 UTC). Add this value to delta time parameters to compute full gps_seconds (relative to the GPS epoch) for each data point.
control (Contiguous Dataset)	STRING:100000 (1)	Control File (not_set)	1 Operations	PGE-specific control file used to generate this granule. To reuse, replace breaks (BR) with linefeeds.
data_end_utc (Compact Dataset)	STRING:27 (1)	End UTC Time of Granule (CCSDS-A, Actual) (not_set)	1 Derived	UTC (in CCSDS-A format) of the last data point within the granule.
data_start_utc (Compact Dataset)	STRING:27 (1)	Start UTC Time of Granule (CCSDS-A, Actual) (not_set)	1 Derived	UTC (in CCSDS-A format) of the first data point within the granule.
end_cycle (Compact Dataset)	INTEGER_4 (1)	Ending Cycle (not_set)	1 Derived	The ending cycle number associated with the data contained within this granule. The cycle number is the counter of the number of 91-day repeat cycles completed by the mission.
end_delta_time (Compact Dataset)	DOUBLE (1)	ATLAS End Time (Actual) (time)	seconds since 2018-01-01 Derived	Number of GPS seconds since the ATLAS SDP epoch at the last data point in the file. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
end_geoseg (Compact Dataset)	INTEGER_4 (1)	Ending Geolocation Segment (not_set)	1 Derived	The ending geolocation segment number associated with the data contained within this granule. ICESat granule geographic regions are further refined by geolocation segments. During the geolocation process, a geolocation segment is created approximately every 20m from the start of the orbit to the end. The geolocation segments help align the ATLAS strong a weak beams and provide a common segment length for the L2 and higher products. The geolocation segment indices differ slightly from orbit-to-orbit because of the irregular shape of the Earth. The geolocation segment indices on ATL01 and ATL02 are only approximate because beams have not been aligned at the time of their creation.
end_gpssow (Compact Dataset)	DOUBLE (1)	Ending GPS SOW of Granule (Actual) (not_set)	seconds Derived	GPS seconds-of-week of the last data point in the granule.
end_gpsweek (Compact Dataset)	INTEGER_4 (1)	Ending GPSWeek of Granule (Actual) (not_set)	weeks from 1980-01-06 Derived	GPS week number of the last data point in the granule.
end_orbit (Compact Dataset)	INTEGER_4 (1)	Ending Orbit Number (not_set)	1 Derived	The ending orbit number associated with the data contained within this granule. The orbit number increments each time the spacecraft completes a full orbit of the Earth.
end_region (Compact Dataset)	INTEGER_4 (1)	Ending Region (not_set)	1 Derived	The ending product-specific region number associated with the data contained within this granule. ICESat-2 data products are separated by geographic regions. The data contained within a specific region are the same for ATL01 and ATL02. ATL03 regions differ slightly because of different geolocation segment locations caused by the irregular shape of the Earth. The region indices for other products are completely independent.
end_rgt (Compact Dataset)	INTEGER_4 (1)	Ending Reference Groundtrack (not_set)	1 Derived	The ending reference groundtrack (RGT) number associated with the data contained within this granule. There are 1387 reference groundtrack in the ICESat-2 repeat orbit. The reference groundtrack increments each time the spacecraft completes a full orbit of the Earth and resets to 1 each time the spacecraft completes a full cycle.
granule_end_utc (Compact Dataset)	STRING:27 (1)	End UTC Time of Granule (CCSDS-A, Requested) (not_set)	1 Derived	Requested end time (in UTC CCSDS-A) of this granule.
granule_start_utc (Compact Dataset)	STRING:27 (1)	Start UTC Time of Granule (CCSDS-A, Requested) (not_set)	1 Derived	Requested start time (in UTC CCSDS-A) of this granule.
qa_at_interval (Compact Dataset)	DOUBLE (1)	QA Along-Track Interval (not_set)	seconds/cell control	Statistics time interval for along-track QA data.
release (Compact Dataset)	STRING:80 (1)	Release Number (not_set)	1 Operations	Release number of the granule. The release number is incremented when the software or ancillary data used to create the granule has been changed.
start_cycle (Compact Dataset)	INTEGER_4 (1)	Starting Cycle (not_set)	1 Derived	The starting cycle number associated with the data contained within this granule. The cycle number is the counter of the number of 91-day repeat cycles completed by the mission.
start_delta_time (Compact Dataset)	DOUBLE (1)	ATLAS Start Time (Actual) (time)	seconds since 2018-01-01 Derived	Number of GPS seconds since the ATLAS SDP epoch at the first data point in the file. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
start_geoseg (Compact Dataset)	INTEGER_4 (1)	Starting Geolocation Segment (not_set)	1 Derived	The starting geolocation segment number associated with the data contained within this granule. ICESat granule geographic regions are further refined by geolocation segments. During the geolocation process, a geolocation segment is created approximately every 20m from the start of the orbit to the end. The geolocation segments help align the ATLAS strong a weak beams and provide a common segment length for the L2 and higher products. The geolocation segment indices differ slightly from orbit-to-orbit because of the irregular shape of the Earth. The geolocation segment indices on ATL01 and ATL02 are only approximate

				because beams have not been aligned at the time of their creation.
start_gpssow (Compact Dataset)	DOUBLE (1)	Start GPS SOW of Granule (Actual) (not_set)	seconds Derived	GPS seconds-of-week of the first data point in the granule.
start_gpsweek (Compact Dataset)	INTEGER_4 (1)	Start GPSWeek of Granule (Actual) (not_set)	weeks from 1980-01-06 Derived	GPS week number of the first data point in the granule.
start_orbit (Compact Dataset)	INTEGER_4 (1)	Starting Orbit Number (not_set)	1 Derived	The starting orbit number associated with the data contained within this granule. The orbit number increments each time the spacecraft completes a full orbit of the Earth.
start_region (Compact Dataset)	INTEGER_4 (1)	Starting Region (not_set)	1 Derived	The starting product-specific region number associated with the data contained within this granule. ICESat-2 data products are separated by geographic regions. The data contained within a specific region are the same for ATL01 and ATL02. ATL03 regions differ slightly because of different geolocation segment locations caused by the irregular shape of the Earth. The region indices for other products are completely independent.
start_rgt (Compact Dataset)	INTEGER_4 (1)	Starting Reference Groundtrack (not_set)	1 Derived	The starting reference groundtrack (RGT) number associated with the data contained within this granule. There are 1387 reference groundtrack in the ICESat-2 repeat orbit. The reference groundtrack increments each time the spacecraft completes a full orbit of the Earth and resets to 1 each time the spacecraft completes a full cycle.
version (Compact Dataset)	STRING:80 (1)	Version (not_set)	1 Operations	Version number of this granule within the release. It is a sequential number corresponding to the number of times the granule has been reprocessed for the current release.

**Group: /ancillary\_data/land\_ice**

Description	(Attribute)	Contains land-ice-specific information ancillary to the data product. This may include product characteristics, instrument characteristics and/or processing constants.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
dt_hist (Compact Dataset)	DOUBLE (1)	Histogram Bin Size (not_set)	seconds Operations	Bin size for histograms (sec)
fit_maxiter (Compact Dataset)	INTEGER_4 (1)	Maximum Iterations of Fit (not_set)	1 Operations	Maximum number of iterations in at_seg_fit
fpb_maxiter (Compact Dataset)	INTEGER_4 (1)	Maximum Iterations for FPB (not_set)	1 Operations	Maximum number of iterations in fpb_corr
max_res_ids (Compact Dataset)	INTEGER_4 (1)	Max Segments (not_set)	1 Operations	Maximum number of segment ids in each residual_histogram
maxiter (Compact Dataset)	INTEGER_4 (1)	Maximum Iterations (not_set)	counts Operations	Maximum number of iterations in tx_shape_corr
min_dist (Compact Dataset)	FLOAT (1)	Minimum Distance (not_set)	meters Operations	Min dist between first and last selected PEs
min_gain_th (Compact Dataset)	FLOAT (1)	Minimum Gain Threshold (not_set)	1 Operations	Minimum estimated gain threshold (3.1.6)
min_n_pe (Compact Dataset)	INTEGER_4 (1)	Minimum Photons (not_set)	1 Operations	Minimum # PEs for fit
min_n_sel (Compact Dataset)	INTEGER_4 (1)	Minimum Number of Photons (not_set)	1 Operations	Minimum number of selected PEs in pe_select
min_signal_conf (Compact Dataset)	INTEGER_4 (1)	Minimum Signal Confidence (not_set)	1 Operations	Minimum signal confidence level for a photon to be considered valid.
n_hist (Compact Dataset)	INTEGER_4 (1)	Number of Histogram Bins (not_set)	1 Operations	Number of bins in a histogram
n_sigmas (Compact Dataset)	FLOAT (1)	Number of Sigmas (not_set)	1 Operations	Multiplied by sigma_expected to get h_win
nhist_bins (Compact Dataset)	INTEGER_4 (1)	Number of Bins (not_set)	1 Operations	Number of bins in residual histogram
proc_interval (Compact Dataset)	INTEGER_4 (1)	Processing Interval (not_set)	seconds Operations	Processing interval in number of geolocation segments..
rbin_width (Compact Dataset)	FLOAT (1)	Bin Size (not_set)	meters Operations	Residual histogram bin size
sigma_beam (Compact Dataset)	FLOAT (1)	Sigma of Gaussian Footprint (not_set)	meters Operations	Spatial sigma of the Gaussian footprint (m)
sigma_tx (Compact Dataset)	FLOAT (1)	Duration of Transmit Pulse (not_set)	seconds Operations	Temporal duration of the transmit pulse (sec), calculated from the FWHM of the TEP waveform
t_dead (Compact Dataset)	DOUBLE (1)	Dead-time (not_set)	seconds Operations	Dead-time for any channel in the detector (sec)
win_nsig (Compact Dataset)	FLOAT (2)	Sigma Est Multiplier (not_set)	1 Operations	Multiplied by sigma_est to get dz_ph_win

**Group: /gtx**

Description	(Attribute)	Contains subgroups organized by Ground Track (gt1l, gt1r, gt2l, gt2r, gt3l and gt3r)		
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**Group: /gtx/land\_ice\_segments**

Description	(Attribute)	The land_ice_height group contains the primary set of derived ATL06 products. This includes geolocation, height, and standard error and quality measures for each segment. This group is sparse, meaning that parameters are provided only for pairs of segments for which at least one beam has a valid surface-height measurement.		
data_rate	(Attribute)	Data within this group are sparse. Data values are provided only for those ICESat-2 20m segments where at least one beam has a valid land ice height measurement.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description

atl06_quality_summary (Chunked Dataset)	INTEGER_1 (:)	ATL06_Quality_Summary (not_set)	1 section 4.3	The ATL06_quality_summary parameter indicates the best-quality subset of all ATL06 data. A zero in this parameter implies that no data-quality tests have found a problem with the segment, a one implies that some potential problem has been found. Users who select only segments with zero values for this flag can be relatively certain of obtaining high-quality data, but will likely miss a significant fraction of usable data, particularly in cloudy, rough, or low-surface-reflectance conditions. flag_values: 0, 1 flag_meanings : best_quality potential_problem
delta_time (Chunked Dataset)	DOUBLE (:)	Elapsed GPS seconds (time)	seconds since 2018-01-01 section 4.4	Number of GPS seconds since the ATLAS SDP epoch. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
h_li (Chunked Dataset)	FLOAT (:)	Land Ice height (not_set)	meters section 4.4	Standard land-ice segment height determined by land ice algorithm, corrected for first-photon bias, representing the median- based height of the selected PEs
h_li_sigma (Chunked Dataset)	FLOAT (:)	Expected RMS segment misfit (not_set)	meters section 4.4	Propagated error due to sampling error and FPB correction from the land ice algorithm
latitude (Chunked Dataset)	DOUBLE (:)	Latitude (latitude)	degrees_north section 3.10	Latitude of segment center, WGS84, North=+,
longitude (Chunked Dataset)	DOUBLE (:)	Longitude (longitude)	degrees_east section 3.10	Longitude of segment center, , WGS84, East=+
segment_id (Chunked Dataset)	INTEGER_4 (:)	Reference Point, m (not_set)	1 section 3.1.2.1	Segment number, counting from the equator. Equal to the segment_id for the second of the two 20m ATL03 segments included in the 40m ATL06 segment
sigma_geo_h (Chunked Dataset)	FLOAT (:)	Vertical Geolocation Error (not_set)	meters section 3.10	Total vertical geolocation error due to PPD and POD, including the effects of horizontal geolocation error on the segment vertical error.
<b>Group: /gtx/land_ice_segments/bias_correction</b>				
Description	(Attribute)	The bias_correction group contains information about the estimated first-photon bias, and the transmit-pulse-shape bias.		
data_rate	(Attribute)	Data within this group are stored at the land_ice segment rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
fpb_mean_corr (Chunked Dataset)	FLOAT (:)	first photon bias mean correction (not_set)	meters section 3.4.3.1	Estimated first-photon bias (fpb) correction to mean segment height
fpb_mean_corr_sigma (Chunked Dataset)	FLOAT (:)	fpb mean corr sigma (not_set)	meters section 3.4.3.1	Estimated error in fpb_mean_corr
fpb_med_corr (Chunked Dataset)	FLOAT (:)	fpb median corr (not_set)	meters section 3.4.3.2	First-photon-bias correction giving the difference between the mean segment height and the corrected median height
fpb_med_corr_sigma (Chunked Dataset)	FLOAT (:)	fpb median corr sigma (not_set)	meters section 3.4.3.2	Estimated error in fpb_med_corr
fpb_n_corr (Chunked Dataset)	FLOAT (:)	fpb number photons corr (not_set)	counts section 4.3.3.3	Estimated window photon count after first-photon-bias correction
med_r_fit (Chunked Dataset)	FLOAT (:)	mean median residual (not_set)	meters section 3.3.5	Difference between uncorrected mean and median of linear fit residuals
tx_mean_corr (Chunked Dataset)	FLOAT (:)	tx shape mean correction (not_set)	meters section 3.5	Estimate of the difference between the mean of the full-waveform transmit-pulse and the mean of a broadened, truncated waveform consistent with the received pulse
tx_med_corr (Chunked Dataset)	FLOAT (:)	tx shape median correction (not_set)	meters section 3.5	Estimate of the difference between the median of the full-waveform transmit-pulse and the median of a broadened, truncated waveform consistent with the received pulse
<b>Group: /gtx/land_ice_segments/dem</b>				
Description	(Attribute)	Contains reference DEM and geoid heights.		
data_rate	(Attribute)	Data within this group are stored at the land_ice segment rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
dem_flag (Chunked Dataset)	INTEGER_1 (:)	DEM Source Flag (not_set)	1 DTU10/GMTED/GIMP	Indicates source of the DEM height. Values: 0=None, 1=GIMP, 2=GMTED, 3=MSS, 4=Antarctic. flag_values: 0, 1, 2, 3, 4 flag_meanings : none gimp gmted mss antarctic
dem_h (Chunked Dataset)	FLOAT (:)	DEM Height (not_set)	meters DTU10/GMTED/GIMP	Height of the DEM, interpolated by cubic-spline interpolation in the DEM coordinate system to the PE location.
geoid_h (Chunked Dataset)	FLOAT (:)	Geoid Height (not_set)	meters EGM2008	Geoid height above WGS-84 reference ellipsoid (range -107 to 86m),
<b>Group: /gtx/land_ice_segments/fit_statistics</b>				
Description	(Attribute)	The fit_statistics subgroup contains a variety of parameters that might indicate the quality of the fitted segment data. Data in this group are sparse, with dimensions matching the land_ice_height group.		
data_rate	(Attribute)	Data within this group are stored at the land_ice_height segment rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
dh_fit_dx (Chunked Dataset)	FLOAT (:)	Along Track Slope (not_set)	meters/meters section 3.3.5.1	Along-track slope from along-track segment fit
dh_fit_dx_sigma (Chunked Dataset)	FLOAT (:)	Sigma of Along Track Slope (not_set)	meters/meters section 3.6.4	Propagated error in the along-track segment slope

dh_fit_dy (Chunked Dataset)	FLOAT (:)	Across Track Slope (not_set)	meters/meters section 3.7	Across track slope from segment fits to weak and strong beam; the same slope is reported for both laser beams in each pair
h_expected_rms (Chunked Dataset)	FLOAT (:)	Expected RMS misfit (not_set)	meters section 3.6.3	Expected RMS misfit between PE heights and along-track segment fit
h_mean (Chunked Dataset)	FLOAT (:)	Height Mean (not_set)	meters ATL06 ATBD	Mean surface height, not corrected for first-photon bias or pulse truncation.
h_rms_misfit (Chunked Dataset)	FLOAT (:)	RMS Misfit (not_set)	meters section 3.6.3	RMS misfit between PE heights and along-track segment fit
h_robust_sprd (Chunked Dataset)	FLOAT (:)	Robust Spread (not_set)	meters section 3.6.3	RDE of misfit between PE heights and the along-track segment fit.
n_fit_photons (Chunked Dataset)	INTEGER_4 (:)	Number of Photons in Fit (not_set)	1 section 3.3.5.2	Number of PEs used in determining h_li, after editing
n_seg_pulses (Chunked Dataset)	INTEGER_4 (:)	Number potential segment pulses (not_set)	counts section 3.3.3	The number of pulses potentially included in the segment
sigma_h_mean (Chunked Dataset)	FLOAT (:)	Height Error (not_set)	meters section 3.6.4	Propagated height error due to PE-height sampling error for height from the along-track fit, not including geolocation-induced error
signal_selection_source (Chunked Dataset)	INTEGER_1 (:)	Signal Selection Source (not_set)	1 section 3.3.3	Indicates the last algorithm attempted to select the signal for ATL06 fitting. 0=Signal selection succeeded using ATL03 detected PE; 1=Signal selection failed using ATL03 detected PE but succeeded using all flagged ATL03 PE; 2=Signal selection failed using all flagged ATL03 PE, but succeeded using the backup algorithm; 3=All signal-finding strategies failed. flag_values: 0, 1, 2, 3 flag_meanings : succeeded_using_pe succeeded_using_flagged_pe succeeded_using_backup failed
signal_selection_source_status (Chunked Dataset)	INTEGER_1 (:)	Signal Selection Source Status (not_set)	1 section 3.3.3	Indicates the status of the last signal selection algorithm attempted (see signal_selection_source). The definition of flag is different for each source and are defined in each of the signal_selection_status flags. (See Land Ice ATBD Table 3-2).
snr (Chunked Dataset)	FLOAT (:)	SNR (not_set)	1 section 3.6.2	Signal-to-noise ratio in the final refined window
snr_significance (Chunked Dataset)	FLOAT (:)	SNR Significance (not_set)	1 section 3.6.2	Probability that signal-finding routine would converge to at least the observed SNR for a random-noise input. Small values indicate a small likelihood of a surface-detection blunder.
w_surface_window_final (Chunked Dataset)	FLOAT (:)	Surface Window Width (not_set)	meters section 3.3.5.2	Width of the surface window, top to bottom
<b>Group: /gtx/land_ice_segments/geophysical</b>				
Description	(Attribute)	The sun_and_clouds group contains parameters related to solar background and parameters indicative of the presence or absence of clouds.		
data_rate	(Attribute)	Data within this group are stored at the land_ice_height segment rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
bckgrd (Chunked Dataset)	FLOAT (:)	Background count rate (not_set)	hz section 3.6.1	Background count rate, derived from the ATL03 50-shot-average, interpolated to the segment center.
bsnow_conf (Chunked Dataset)	INTEGER_1 (:)	Blowing Snow confidence (not_set)	1 ATL09	Confidence flag for presence of blowing snow
bsnow_h (Chunked Dataset)	FLOAT (:)	Blowing Snow Layer Top Height (not_set)	meters ATL09	Blowing snow layer top height
bsnow_od (Chunked Dataset)	FLOAT (:)	Blowing snow OD (not_set)	1 ATL09	Optical thickness of blowing snow layer.
cloud_flg_asr (Chunked Dataset)	INTEGER_1 (:)	cloud flag confidence (not_set)	1 ATL09	Indicates cloud attenuation as calculated from the apparent surface reflectance, assuming a white snow surface flag_values: 0, 1, 2, 3, 4, 5 flag_meanings : clear_with_high_confidence clear_with_medium_confidence clear_with_low_confidence cloudy_with_low_confidence cloudy_with_medium_confidence cloudy_with_high_confidence
cloud_flg_atm (Chunked Dataset)	INTEGER_1 (:)	Cloud flag (not_set)	1 ATL09	Indicates the probability of clouds based on backscatter measurements flag_values: 0, 1 flag_meanings : no yes
dac (Chunked Dataset)	FLOAT (:)	Dynamic Atmosphere Correction (not_set)	meters ATL03, 6.3.2	Dynamic Atmospheric Correction (DAC) includes inverted barometer (IB) effect.
e_bckgrd (Chunked Dataset)	FLOAT (:)	Expected background count rate (not_set)	hz section 3.6.1	Expected background count rate based on sun angle, surface slope, for unit surface reflectance
msw_flag (Chunked Dataset)	INTEGER_1 (:)	Multiple Scattering Warning Flag (not_set)	1 ATL09	Combined flag indicating the risks of severe multiple scattering. The multiple scattering warning flag (ATL09 parameter msw_flag) has values from -1 to 5 where zero means no multiple scattering and 5 the greatest. If no layers were detected, then msw_flag = 0. If blowing snow is detected and its estimated optical depth is greater than or equal to 0.5, then msw_flag = 5. If the blowing snow optical depth is less than 0.5, then msw_flag = 4. If no blowing snow is detected but there are cloud or aerosol layers detected, the msw_flag assumes values of 1 to 3 based on the height of the bottom of the lowest layer: < 1 km, msw_flag = 3; 1-3 km, msw_flag = 2; > 3km, msw_flag = 1. A value of -1 indicates that the signal to noise of the data was too low to reliably ascertain the presence of cloud or blowing snow. We expect values of -1 to occur only during daylight.

				flag_values: -1, 0, 1, 2, 3, 4, 5 flag_meanings: cannot_determine_no_layers layer_gt_3km layer_between_1_and_3_km layer_lt_1km blow_snow_od_ft_0.5 blow_snow_od_gt_0.5
neutat_delay_total (Chunked Dataset)	FLOAT (:)	Total Neutral Atmospheric Delay (not_set)	meters ATL03a ATBD	Total neutral atmosphere delay correction (wet+dry).
r_eff (Chunked Dataset)	FLOAT (:)	Effective uncorrected reflectance (not_set)	1 section 3.1.5.4	Effective reflectance, uncorrected for atmospheric effects.
solar_azimuth (Chunked Dataset)	FLOAT (:)	solar azimuth (not_set)	degrees_east ATL03	The direction, eastwards from north, of the sun vector as seen by an observer at the laser ground spot.
solar_elevation (Chunked Dataset)	FLOAT (:)	solar elevation (not_set)	degrees ATL03	Solar Angle above or below the plane tangent to the ellipsoid surface at the laser spot. Positive values mean the sun is above the horizon, while negative values mean it is below the horizon. The effect of atmospheric refraction is not included. This is a low-precision value, with approximately TBD degree accuracy.
tide_earth (Chunked Dataset)	FLOAT (:)	Earth Tide (not_set)	meters ATL03 ATBD, Section 6.3.3	Solid Earth Tides
tide_load (Chunked Dataset)	FLOAT (:)	Load Tide (not_set)	meters ATL03 ATBD, Section 6.3.4	Load Tide - Local displacement due to Ocean Loading (-6 to 0 cm).
tide_ocean (Chunked Dataset)	FLOAT (:)	Ocean Tide (not_set)	meters ATL03 ATBD, Section 6.3.1	Ocean Tides including diurnal and semi-diurnal (harmonic analysis), and longer period tides (dynamic and self-consistent equilibrium).
tide_pole (Chunked Dataset)	FLOAT (:)	Solid Earth Pole Tide (not_set)	meters ATL03 ATBD, Section 6.3.5	Solid Earth Pole Tide -Rotational deformation due to polar motion (-1.5 to 1.5 cm).
<b>Group: /gtx/land_ice_segments/ground_track</b>				
Description	(Attribute)	The ground_track group contains parameters describing the GT and RGT for each land ice segment, as well as angular information about the beams.		
data_rate	(Attribute)	Data within this group are stored at the land_ice_height segment rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ref_azimuth (Chunked Dataset)	FLOAT (:)	Azimuth (not_set)	radians ATL03g, Section 3.3	The direction, eastwards from north, of the laser beam vector as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the vector from the ground to the spacecraft).
ref_coelv (Chunked Dataset)	FLOAT (:)	Co-elevation (not_set)	radians ATL03g, Section 3.3	Coelevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.
seg_azimuth (Chunked Dataset)	FLOAT (:)	Segment Azimuth (not_set)	degrees section 3.1.2.2	Azimuth of the pair-track, east of local north.
sigma_geo_at (Chunked Dataset)	FLOAT (:)	Across Track Geolocation Error (not_set)	meters section 3.10	Along-track component of the geolocation error.
sigma_geo_xt (Chunked Dataset)	FLOAT (:)	Along Track Geolocation Error (not_set)	meters section 3.10	Across-track component of the geolocation error.
x_atc (Chunked Dataset)	DOUBLE (:)	X Along Track (not_set)	meters section 3.1.2.2	The along-track x-coordinate of the segment, measured parallel to the RGT, measured from the ascending node of the equatorial crossing of a given RGT.
y_atc (Chunked Dataset)	FLOAT (:)	Y Along Track (not_set)	meters section 3.1.2.2	Along-track y coordinate of the segment, relative to the RGT, measured along the perpendicular to the RGT, positive to the right of the RGT.
<b>Group: /gtx/residual_histogram</b>				
Description	(Attribute)	This group contains histograms of the residuals between PE heights and the least-squares fit segment heights, at 200-meter along-track resolution.		
data_rate	(Attribute)	Data within this group are stored at the 200-meter along-track rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
bckgrd_per_bin (Chunked Dataset)	FLOAT (:)	Expected background PEs (not_set)	1 Section 4.11	Number of background PE expected for the bins in each column of the histogram based on the observed background rate (bckgrd).
count (Chunked Dataset)	INTEGER_4 (1000, :)	Bin Counts (not_set)	counts Section 4.11	Residual count in 1-cm bins, for PE within 10 (horizontal) m of segment centers for each histogram.
delta_time (Chunked Dataset)	DOUBLE (:)	Elapsed GPS seconds (time)	seconds since 2018-01-01 section 4.4	Number of GPS seconds since the ATLAS SDP epoch. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
dh (Contiguous Dataset)	FLOAT (1000)	Height Differences (not_set)	meters Section 4.11	Height differences between vertical bin centers and the segment height (heights for the histogram)
ds_segment_id (Contiguous Dataset)	INTEGER_1 (10)	Segment ID Index (not_set)	1 Section 4.11	Relative index of each segment_id used in the derivation of the histogram.
lat_mean (Chunked Dataset)	DOUBLE (:)	Latitude Mean (latitude)	degrees_north Section 4.11	Mean latitude of the segments included in the histogram
lon_mean (Chunked Dataset)	DOUBLE (:)	Longitude Mean (longitude)	degrees_east Section 4.11	Mean longitude of the segments included in the histogram
pulse_count (Chunked Dataset)	INTEGER_4 (:)	Number of Histogram Segment Pulses (not_set)	counts Section 4.11	Number of pulses potentially included in the histogram (pulses are counted if they are in the central 20 m of each segment, even if no PE from the pulse are selected).

segment_id_list (Chunked Dataset)	INTEGER_4 (10, :)	Segment ID List (not_set)	1 Section 4.11	Segments ids included in each column of the histogram
x_atc_mean (Chunked Dataset)	DOUBLE (:)	Along Track Coordinate Mean (not_set)	1 Section 4.11	Mean along-track coordinate of the segments included in the histogram.
<b>Group: /gtx/segment_quality</b>				
Description	(Attribute)	The segment_quality group contains a dense record (i.e. for every possible segment in the granule) of the success or failure of the surface-finding strategies, and gives the locations of the reference points on the RPTs. For segments with adequate data quality (i.e. with more than 10 PE) it also contains offsets into the data structures for the other groups that allow each segment to be efficiently located within the file.		
data_rate	(Attribute)	Data within this group are stored at the ICESat-2 20m segment rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
delta_time (Chunked Dataset)	DOUBLE (:)	Elapsed GPS seconds (time)	seconds since 2018-01-01 ATL03	Number of GPS seconds since the ATLAS SDP epoch. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
record_number (Chunked Dataset)	INTEGER_4 (:)	Land Ice Height Index (not_set)	1 section 4.2	For those segments that have adequate signal strength, this parameter gives the record for the pair within the other groups in the granule.
reference_pt_lat (Chunked Dataset)	DOUBLE (:)	Latitude (latitude)	degrees_north section 3.1.9	Latitude of the reference segment location on the RPT
reference_pt_lon (Chunked Dataset)	DOUBLE (:)	Longitude (longitude)	degrees_east section 3.1.9	Longitude of the reference segment location on the RPT
segment_id (Chunked Dataset)	INTEGER_4 (:)	Reference Point, m (not_set)	1 section 3.1.2.1	Segment number corresponding to the second of two ATL03 segments in the ATL06 segment, counted from the RGT equator crossing
signal_selection_source (Chunked Dataset)	INTEGER_1 (:)	Signal Selection Source (not_set)	1 section 3.3.3	Indicates the last algorithm attempted to select the signal for ATL06 fitting. 0=Signal selection succeeded using ATL03 detected PE; 1=Signal selection failed using ATL03 detected PE but succeeded using all flagged ATL03 PE; 2=Signal selection failed using all flagged ATL03 PE, but succeeded using the backup algorithm; 3=All signal-finding strategies failed. flag_values: 0, 1, 2, 3 flag_meanings: succeeded_using_pe succeeded_using_flagged_pe succeeded_using_backup failed
<b>Group: /gtx/segment_quality/signal_selection_status</b>				
Description	(Attribute)	The signal selection status subgroup contains the success or failure for each surface-finding strategies		
data_rate	(Attribute)	Data within this group are stored at the ICESat-2 20m segment rate.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
signal_selection_status_all (Chunked Dataset)	INTEGER_1 (:)	Signal Selection Status Flag (not_set)	1 section 3.3.3	Indicates confidence of the signal-selection algorithm using all ATL03-flagged PEs. 0=Signal selection succeeded using all ATL03-flagged PEs (or algorithm not attempted); 1=Signal selection using all ATL03-flagged PEs failed the 20-meter-spread test; 2=Signal selection using all ATL03-flagged PEs failed the 10-photon-count test; 3=Signal selection using all ATL03-flagged PEs failed both tests flag_values: 0, 1, 2, 3 flag_meanings: succeeded failed_20 failed_10 failed_both
signal_selection_status_backup (Chunked Dataset)	INTEGER_1 (:)	Signal Selection Backup Flag (not_set)	1 section 3.3.3	Indicates confidence of the signal-selection algorithm using the backup signal finder. 0=Signal selection succeeded using the backup signal finder after centering the window on flagged PE (or backup signal finder not attempted); 1=Signal selection succeeded using the backup signal finder after searching for the strongest-signal window using four adjacent ATL03 segments; 2=Signal selection using the backup signal finder failed the 20-meter spread test; 3=Signal selection using the backup signal finder failed the 10-photon count test; 4=Signal selection using the backup signal finder failed both tests flag_values: 0, 1, 2, 3, 4 flag_meanings: succeeded failed_widen failed_20 failed_10 failed_both
signal_selection_status_confident (Chunked Dataset)	INTEGER_1 (:)	Signal Selection Confident Flag (not_set)	1 section 3.3.3	Indicates confidence of the signal-selection algorithm using low or better PEs. 0=Signal selection succeeded using ATL03 low-or-better confidence PEs; 1=Signal selection using ATL03 low-or-better confidence PEs failed the 20-meter-spread test; 2=Signal selection using ATL03 low-or-better confidence PEs failed the 10-photon-count test; 3=Signal selection using ATL03 low-or-better confidence PEs failed both tests flag_values: 0, 1, 2, 3 flag_meanings: succeeded failed_20 failed_10 failed_both
<b>Group: /orbit_info</b>				
Description	(Attribute)	Contains data that are common among all beams for the granule. These parameters are constants for a given granule.		
data_rate	(Attribute)	These parameters are constant for a given granule.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
crossing_time (Chunked Dataset)	DOUBLE (:)	Ascending Node Crossing Time (time)	seconds since 2018-01-01 POD/PPD	The time, in seconds since the ATLAS SDP GPS Epoch, at which the ascending node crosses the equator. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS

				seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
cycle_number (Chunked Dataset)	INTEGER_1 (:)	Cycle Number (not_set)	counts POD/PPD	Tracks the number of 91-day cycles in the mission, beginning with 01. A unique orbit number can be determined by subtracting 1 from the cycle_number, multiplying by 1387 and adding the rgt value.
lan (Chunked Dataset)	DOUBLE (:)	Ascending Node Longitude (not_set)	degrees_east POD/PPD	Longitude at the ascending node crossing.
orbit_number (Chunked Dataset)	UINT_2_LE (:)	Orbit Number (not_set)	1 Operations	Unique identifying number for each planned ICESat-2 orbit.
rgt (Chunked Dataset)	INTEGER_2 (:)	Reference Ground track (not_set)	counts POD/PPD	The reference ground track (RGT) is the track on the earth at which a specified unit vector within the observatory is pointed. Under nominal operating conditions, there will be no data collected along the RGT, as the RGT is spanned by GT2L and GT2R. During slews or off-pointing, it is possible that ground tracks may intersect the RGT. The ICESat-2 mission has 1387 RGTs.
sc_orient (Chunked Dataset)	INTEGER_1 (:)	Spacecraft Orientation (not_set)	1 POD/PPD	This parameter tracks the spacecraft orientation between forward, backward and transitional flight modes. ICESat-2 is considered to be flying forward when the weak beams are leading the strong beams; and backward when the strong beams are leading the weak beams. ICESat-2 is considered to be in transition while it is maneuvering between the two orientations. Science quality is potentially degraded while in transition mode. flag_values: 0, 1, 2 flag_meanings : backward forward transition
sc_orient_time (Chunked Dataset)	DOUBLE (:)	Time of Last Spacecraft Orientation Change (time)	seconds since 2018-01-01 POD/PPD	The time of the last spacecraft orientation change between forward, backward and transitional flight modes, expressed in seconds since the ATLAS SDP GPS Epoch. ICESat-2 is considered to be flying forward when the weak beams are leading the strong beams; and backward when the strong beams are leading the weak beams. ICESat-2 is considered to be in transition while it is maneuvering between the two orientations. Science quality is potentially degraded while in transition mode. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.

**Group: /quality\_assessment**

Description	(Attribute)	Contains quality assessment data. This may include QA counters, QA long-track data and/or QA summary data.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
qa_granule_fail_reason (Compact Dataset)	INTEGER_4 (1)	Granule Failure Reason (not_set)	1 Operations	Flag indicating granule failure reason. 0=no failure; 1=processing error; 2=insufficient output data was generated; 3=TBD Failure; 4=TBD_Failure; 5=other failure. flag_values: 0, 1, 2, 3, 4, 5 flag_meanings : no_failure PROCESS_ERROR INSUFFICIENT_OUTPUT failure_3 failure_4 OTHER_FAILURE
qa_granule_pass_fail (Compact Dataset)	INTEGER_4 (1)	Granule Pass Flag (not_set)	1 Operations	Flag indicating granule quality. 0=granule passes automatic QA. 1=granule fails automatic QA. flag_values: 0, 1 flag_meanings : PASS FAIL

**Group: /quality\_assessment/gtx**

Description	(Attribute)	Contains quality assessment data. This may include QA counters, QA long-track data and/or QA summary data.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
delta_time (Chunked Dataset)	DOUBLE (:)	Elapsed GPS seconds (time)	seconds since 2018-01-01 ATL03	Mean number of GPS seconds since the ATLAS SDP epoch for the 10km segment. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
lat_mean (Chunked Dataset)	DOUBLE (:)	Latitude Mean (latitude)	degrees_north Section 4.11	Mean latitude of the 10km segment.
lon_mean (Chunked Dataset)	DOUBLE (:)	Longitude Mean (longitude)	degrees_east Section 4.11	Mean longitude of the 10km segment.
signal_selection_source_fraction_0 (Chunked Dataset)	FLOAT (:)	Signal Selection Source Fraction 0 (not_set)	1 section 7.2	The fraction of 20m segments with signal_selection_source equal to zero.
signal_selection_source_fraction_1 (Chunked Dataset)	FLOAT (:)	Signal Selection Source Fraction 1 (not_set)	1 section 7.2	The fraction of 20m segments with signal_selection_source equal to 1.
signal_selection_source_fraction_2 (Chunked Dataset)	FLOAT (:)	Signal Selection Source Fraction 2 (not_set)	1 section 7.2	The fraction of 20m segments with signal_selection_source equal to 2.
signal_selection_source_fraction_3 (Chunked Dataset)	FLOAT (:)	Signal Selection Source Fraction 3 (not_set)	1 section 7.2	The fraction of 20m segments with signal_selection_source equal to 3.