ATL08 Product Data Dictionary

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description	(Attribute)	This data set (ATL08) contains along-track heights above the WGS84 ellipsoid (ITRF2014 reference frame) for the ground and canopy surfaces. The canopy and ground surfaces are processed in fixed 100 m data segments, which typically contain more than 100 sig
level	(Attribute)	L3A
short_name	(Attribute)	ATL08
title	(Attribute)	SET_BY_META
Group: /		This data set (ATL08) contains along-track heights above the WGS84 ellipsoid (ITRF2014 reference frame) for the ground and canopy surfaces. The canopy and ground surfaces are processed in fixed 100 m data segments, which typically contain more than 100 sig
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
date_created	(Attribute)	SET_BY_PGE
date_type	(Attribute)	UTC
featureType	(Attribute)	trajectory
geospatial_lat_max	(Attribute)	0.0
geospatial_lat_min	(Attribute)	0.0
geospatial_lat_units	(Attribute)	degrees_north
geospatial_lon_max	(Attribute)	0.0
geospatial_lon_min	(Attribute)	0.0
geospatial_lon_units	(Attribute)	degrees_east
granule_type	(Attribute)	ATL08
hdfversion	(Attribute)	SET_BY_PGE
history	(Attribute)	SET_BY_PGE
identifier_file_uuid	(Attribute)	SET_BY_PGE
identifier_product_doi	(Attribute)	10.5067/ATLAS/ATL08.001
identifier_product_doi_authority	(Attribute)	http://dx.doi.org
identifier_product_format_version	(Attribute)	SET_BY_PGE
identifier_product_type	(Attribute)	ATL08
institution	(Attribute)	SET_BY_META
instrument	(Attribute)	SET_BY_META
keywords	(Attribute)	SET_BY_META
keywords_vocabulary	(Attribute)	SET_BY_META
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		
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		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
ds_geosegments CONTIGUOUS	INTEGER_1([5])	Geosegments None	1	Dimension scale for geosegments within land segments. (Source: Dim Scale); (Meanings: [1 2 3 4 5]) (Values: ['geosegments1' 'geosegments2' 'geosegments3' 'geosegments4' 'geosegments5'])
ds_metrics CONTIGUOUS	INTEGER_1([18])	Metrics None	1	Dimension scale for metrics. (Source: Dim Scale); (Meanings: [1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18]) (Values: ['metrics1' 'metrics2' 'metrics3' 'metrics4' 'metrics5' 'metrics6' 'metrics7' 'metrics8' 'metrics9' 'metrics10' 'metrics11' 'metrics12' 'metrics13' 'metrics14' 'metrics15' 'metrics16' 'metrics17' 'metrics18'])
ds_surf_type COMPACT	INTEGER([5])	Surface Type Dimension Scale None	1	Dimension scale indexing the surface type array. Index=1 corresponds to Land; index = 2 corresponds to Ocean; Index = 3 corresponds to SeaIce; Index=4 corresponds to LandIce; Index=5 corresponds to InlandWater (Source: Dim Scale); (Meanings: [1 2 3 4 5]) (Values: ['land' 'ocean' 'seaice' 'landice' 'inland_water'])
Group: /ancillary_data		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(Dims) Fillvalue	long_name standard_name	units	description
atlas_sdp_gps_epoch COMPACT	DOUBLE([1])	ATLAS Epoch Offset None	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 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. (Source: Operations)
control CONTIGUOUS	STRING([1])	Control File None	1	PGE-specific control file used to generate this granule. To re-use, replace breaks (BR) with linefeeds.

				(Source: Operations)
data_end_utc COMPACT	STRING([1])	End UTC Time of Granule (CCSDS-A, Actual) None	1	UTC (in CCSDS-A format) of the last data point within the granule. (Source: Derived)
data_start_utc COMPACT	STRING([1])	Start UTC Time of Granule (CCSDS-A, Actual) None	1	UTC (in CCSDS-A format) of the first data point within the granule. (Source: Derived)
end_cycle COMPACT	INTEGER([1])	Ending Cycle None	1	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. (Source: Derived)
end_delta_time COMPACT	DOUBLE([1])	ATLAS End Time (Actual) time	seconds since 2018-01-01	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. (Source: Derived)
end_geoseg COMPACT	INTEGER([1])	Ending Geolocation Segment None	1	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. (Source: Derived)
end_gpssow COMPACT	DOUBLE([1])	Ending GPS SOW of Granule (Actual) None	seconds	GPS seconds-of-week of the last data point in the granule. (Source: Derived)
end_gpsweek COMPACT	INTEGER([1])	Ending GPSWeek of Granule (Actual) None	weeks from 1980-01-06	GPS week number of the last data point in the granule. (Source: Derived)
end_orbit COMPACT	INTEGER([1])	Ending Orbit Number None	1	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. (Source: Derived)
end_region COMPACT	INTEGER([1])	Ending Region None	1	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. (Source: Derived)
end_rgt COMPACT	INTEGER([1])	Ending Reference Groundtrack None	1	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. (Source: Derived)
granule_end_utc COMPACT	STRING([1])	End UTC Time of Granule (CCSDS-A, Requested) None	1	Requested end time (in UTC CCSDS-A) of this granule. (Source: Derived)
granule_start_utc COMPACT	STRING([1])	Start UTC Time of Granule (CCSDS-A, Requested) None	1	Requested start time (in UTC CCSDS-A) of this granule. (Source: Derived)
qa_at_interval COMPACT	DOUBLE([1])	QA Along-Track Interval None	1	Statistics time interval for along-track QA data. (Source: control)
release COMPACT	STRING([1])	Release Number None	1	Release number of the granule. The release number is incremented when the software or ancillary data used to create the granule has been changed. (Source: Operations)
start_cycle COMPACT	INTEGER([1])	Starting Cycle None	1	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. (Source: Derived)
start_delta_time COMPACT	DOUBLE([1])	ATLAS Start Time (Actual) time	seconds since 2018-01-01	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. (Source: Derived)
start_geoseg COMPACT	INTEGER([1])	Starting Geolocation Segment None	1	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. (Source: Derived)

start_gpssow COMPACT	DOUBLE([1])	Start GPS SOW of Granule (Actual) None	seconds	GPS seconds-of-week of the first data point in the granule. (Source: Derived)
start_gpsweek COMPACT	INTEGER([1])	Start GPSWeek of Granule (Actual) None	weeks from 1980-01-06	GPS week number of the first data point in the granule. (Source: Derived)
start_orbit COMPACT	INTEGER([1])	Starting Orbit Number None	1	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. (Source: Derived)
start_region COMPACT	INTEGER([1])	Starting Region None	1	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. (Source: Derived)
start_rgt COMPACT	INTEGER([1])	Starting Reference Groundtrack None	1	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. (Source: Derived)
version COMPACT	STRING([1])	Version None	1	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. (Source: Operations)
Group: /ancillary_data/land		Constants used in the land_vegetation ATBD		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
atl08_region CHUNKED	INTEGER(['Unlimited'])	atl08 region atl08_region	1	ATL08 region(s) encompassed by ATL03 granule being processed (Source: Land ATBD 29March2019, Table 2.4)
bin_size_h COMPACT	FLOAT([1])	neighbor histogram bin size None	1	Histogram bin size for the alternative DRAGANN algorithm. (Default = 1.0) (Source: ATBD (section 4.2.1 step 3))
bin_size_n COMPACT	INTEGER([1])	neighbor histogram bin size None	1	Size of neighbor histogram bins in number of neighbors in DRAGANN. (Default = 1) (Source: ATBD (section 4.2 step 4))
bright_thresh COMPACT	FLOAT([1])	brightness flag average ph per shot None	1	Threshold to set brightness_flag, average ground photons per shot. (Default = 3.0) (Source: ATBD section 2.4.21)
ca_class COMPACT	INTEGER([1])	Canopy class value None	1	Canopy classification flag value. (Default = 2) (Source: ATBD section 4.12 step 1)
can_noise_thresh COMPACT	INTEGER([1])	Threshold for reclassification of canopy as noise None	1	Threshold, as a number of canopy photons in the CAN_FILT_SEG, used for the reclassification of canopy signal photons. (Default = 75) (Source: ATBD section 4.11 step 6)

can_stat_thresh COMPACT	FLOAT([1])	Threshold for canopy statistics None	1	Minimum percentage of canopy photons to compute statistics upon. (Default =0.05) (Source: ATBD section 4.14.1 step 1)
canopy_flag_switch COMPACT	INTEGER([1])	canopy_flag switch None	1	Controls entrance to the canopy flag subroutine . (Default = 1) (Source: ATBD section 4.3)
canopy_seg COMPACT	INTEGER([1])	segment size in canopy filter None	1	Segment in number of signal photons for filtering sparse canopy cover. (Default = 500) (Source: ATBD section 4.11 step 6)
class_thresh COMPACT	INTEGER([1])	Threshold flag value for classification of photons as signal via input from ATL03 None	1	Threshold flag value for classification of photons as signal via input from ATL03. (Default =3) (Source: ATBD section 4.2 step 17)
cloud_filter_switch COMPACT	INTEGER([1])	cloud_filter switch None	1	Controls entrance to the cloud_filter subroutine. (Default = 0) (Source: ATBD section 4.1.1)
del_amp COMPACT	FLOAT([1])	Step Gaussian Amplitude optimization None	1	Step size for optimizing the amplitude variable of Gaussian function. (Default = 1.0) (Source: ATBD section 4.2 step 7)
del_mu COMPACT	FLOAT([1])	Step size for optimizing the mean parameter of Gaussian function. None	1	Step size for optimizing the mean parameter of Gaussian function. (Default = 0.2) (Source: ATBD section 4.2 step 7)
del_sigma COMPACT	FLOAT([1])	Step size for optimizing the standard deviation parameter of Gaussian function. None	1	Step size for optimizing the standard deviation parameter of Gaussian function. (Default = 0.5) (Source: ATBD section 4.2 step 7)
dem_filter_switch COMPACT	INTEGER([1])	dem_filter switch None	1	Controls filtering based on DEM. (Default = 1) (Source: ATBD section 4.5 step 5)
dem_removal_percent_limit COMPACT	FLOAT([1])	dem_removal_flag set threshold None	percent	Percent of photons in land segment failing DEM test to set dem_removal_flag. (default = 20.0) (Source: ATBD section 2.4.11)
dragann_switch COMPACT	INTEGER([1])	DRAGANN switch None	1	Controls entrance to the DRAGANN subroutine. (Default =1) (Source: ATBD section 4.2)
dseg COMPACT	INTEGER([1])	DRAGANN segment size None	1	DRAGANN segment length in 20m geolocated segments along ground track. (Default=170) (Source: ATBD section 4.2.1 step 1)
dseg_buf COMPACT	INTEGER([1])	DRAGANN segment buffer size None	1	DRAGANN segment buffer length in 20m geolocated segments along ground track. (Default=10) (Source: ATBD section 4.2.1 step 1)
fnlgnd_filter_switch COMPACT	INTEGER([1])	finalground filter switch None	1	Controls filtering based on FINALGROUND. (Default = 1) (Source: ATBD section 4.13 step 2)
gnd_stat_thresh COMPACT	FLOAT([1])	Threshold for terrain statistics None	1	Minimum percentage of terrain photons to compute statistics upon. (Default =0.05) (Source: ATBD section 4.13 step 2)
gthresh_factor COMPACT	FLOAT([1])	threshold for Gaussian	1	Controls threshold for Gaussian Elimination. (Default = 0.1)

		Elimination None		(Source: ATBD sGaussian Rejection section of Appendix A)
h_canopy_perc COMPACT	FLOAT([1])	h_canopy percentile None	1	Percentile component of h_canopy parameter. (Default =0.95) (Source: ATBD section 2.2.3)
iter_gnd COMPACT	INTEGER([1])	Iterations of smoothing of interpolated ground surface for ground estimate. None	1	Iterations of smoothing of interpolated ground surface for refinement. (Default = 10) (Source: ATBD section 4.10 step 1)
iter_max COMPACT	INTEGER([1])	Maximum number of iterations for optimizing the Gaussian parameters for fitting of histogram. None	1	Maximum number of iterations for optimizing the Gaussian parameters for fitting of histogram. (Default = 10) (Source: ATBD section 4.2 step 7)
lseg COMPACT	INTEGER([1])	Long segment size None	1	Long segment size in number of 20 meter segments along ground track. (Default=500) (Source: ATBD section 4.1 step 1)
lseg_buf COMPACT	INTEGER([1])	Long segment buffer size None	1	Overlapping long segment buffer size in 20m geosegments along ground track. (Default=10) (Source: ATBD section 4.1 step 2)
lw_filt_bnd COMPACT	INTEGER([1])	Proportionality coefficient for controlling the bounds of the filter window size as a function of number of signal photons. None	1	Lower bound of the filter window size function. (Default = 5) (Source: ATBD section 4.4 step 2)
lw_gnd_bnd COMPACT	FLOAT([1])	Lower bound restricting the search of a ground surface in canopy cases. None	meters	Lower bound restricting the search of a ground surface in canopy cases. (Default = -4.0) (Source: ATBD section 4.7 step 3)
lw_toc_bnd COMPACT	FLOAT([1])	Lower bound restricting the search of a top of canopy surface. None	meters	Lower bound restricting the search of a top of canopy surface. (Default = -4.0) (Source: section 4.7 step 3 entered from section 4.8)
lw_toc_cut COMPACT	FLOAT([1])	Lower cutoff for top of canopy None	meters	Lower cutoff for top of canopy surface. (Default = 2.0) (Source: ATBD section 4.8 step 10)
max_atl03files COMPACT	INTEGER([1])	Maximum number of input ATL03s None	1	Maximum number of input ATL03 files. (Default = 200) (Source: Operations)
max_atl09files COMPACT	INTEGER([1])	Maximum number of input ATL09s None	1	Maximum number of input ATL09 files. (Default = 200) (Source: Operations)
max_peaks COMPACT	INTEGER([1])	Maximum number of Gaussian peaks to fit in the data set None	1	Maximum number of Gaussian peaks to fit in the data set in DRAGANN. (Default =10) (Source: ATBD section 4.2 step 9)
max_try COMPACT	INTEGER([1])	Maximum try count	1	Maximum number of tries to compute a P value in alternative DRAGANN

		None		(Source: ATBD section 4.2.1 step 17)
min_nphs COMPACT	INTEGER([1])	Minimum input photons None	1	Minimum number of input photons from ATL03 to process. (default=1) (Source: Operations)
n_dec_mode COMPACT	INTEGER([1])	Mode decimal parameter None	1	Number of decimal places to consider in mode computation. (Default =1) (Source: ATBD needed for section 4.13 step 3(h_te_mode))
night_thresh COMPACT	FLOAT([1])	Threshold for night None	1	Solar elevation threshold for determining night time conditions. (Default =0.0) (Source: ATBD section 2.4.9)
noise_class COMPACT	INTEGER([1])	Noise class value None	1	Noise classification flag value. (Default = 0) (Source: ATBD section 4.12 step 1)
outlier_filter_switch COMPACT	INTEGER([1])	outlier_filter switch None	1	Controls entrance to the outlier filter subroutine. (Default = 1) (Source: ATBD section 4.6)
p_static COMPACT	FLOAT([1])	Dragann Parameter None	1	Parameter for controlling the search radius in nearest neighbor search in DRAGANN. (Default = 20) (Source: ATBD section 4.2 step 1)
ph_removal_percent_limit COMPACT	FLOAT([1])	ph_removal_flag set threshold None	percent	Percent of photons in land segment removed to set ph_removal_flag. (default = 50.0) (Source: ATBD section 4.13 step 4)
proc_geoseg COMPACT	INTEGER([1])	Geosegment process interval length None	1	Geosegment process interval length. This controls the amount read from ATL03 and ATL09 at a time. (Default = 500000). (Source: Operations)
psf COMPACT	FLOAT([1])	Point Spread Function None	meters	Parameter controlling identification of photons around an interpolated surface. (Default = 0.5) (Source: ATBD section 4.7 step 12)
ref_dem_limit COMPACT	FLOAT([1])	DEM threshold None	meters	Reference DEM limit used to reclassify signal as noise. (default = 120.0) (Source: ATBD section 4.5 step 4)
ref_finalground_limit COMPACT	FLOAT([1])	finalground threshold None	meters	Reference finalground limit used to reclassify signal as noise. (default = 150.0) (Source: ATBD section 4.13 step 2)
relief_hbot COMPACT	FLOAT([1])	lower relief percentile None	meters	The approximate relief of the L-km segment uses the percentile height values, relief_htop and relief_hbot. (Default=0.05) (Source: ATBD (section 4.5 step 6))
relief_htop COMPACT	FLOAT([1])	Upper relief percentile None	meters	The approximate relief of the L-km segment uses the percentile height values, relief_htop and relief_hbot. (Default=0.95) (Source: ATBD (section 4.5 step 6))
shp_param COMPACT	FLOAT([1])	Exponential coefficient for controlling the exponential decay of the filter window size as a function of number of signal photons. None	1	Exponential coefficient of the filter window size as a function. (Default = 21.0E-06) (Source: ATBD section 4.4 step 2)
sig_rsq_search COMPACT	FLOAT([1])	Square Radius of filter for canopy None	meters^2	Top of canopy refinement square search radius. (Default = 225.0) (Source: ATBD section 4.8 step 6)
sseg COMPACT	FLOAT([1])	Short Segment Length	meters	Short segment length in meters. (Default = 100.0)

		None		(Source: ATBD section 4.13 step 1)
stat_thresh COMPACT	INTEGER([1])	Threshold for land statistics None	1	Minimum number of photons to compute statistics upon. (Default =50) (Source: ATBD section 2 intro paragraph)
tc_thresh COMPACT	FLOAT([1])	Canopy Flag threshold None	1	Percentage threshold for average L-km segment tree cover to be considered canopy. (Default = 5.0) (Source: ATBD section 4.3 steps 6 and 7)
te_class COMPACT	INTEGER([1])	Terrain class value None	1	Terrain classification flag value. (Default = 1) (Source: ATBD section 4.12 step 1)
toc_class COMPACT	INTEGER([1])	Top of canopy class value None	1	Top of canopy classification flag value. (Default = 3) (Source: ATBD section 4.12 step 1)
up_filt_bnd COMPACT	INTEGER([1])	Proportionality coefficient for controlling the bounds of the filter window size as a function of number of signal photons. None	1	Lower bound of the filter window size function. (Default = 46) (Source: ATBD section 4.4 step 2)
up_gnd_bnd COMPACT	FLOAT([1])	Upper bound restricting the search of a ground surface in canopy cases. None	meters	Upper bound restricting the search of a ground surface in canopy cases. (Default = 1.0) (Source: ATBD (section 4.7 step 3))
up_toc_bnd COMPACT	FLOAT([1])	Upper bound restricting the search of a top of canopy surface. None	meters	Upper bound restricting the search of a top of canopy surface. (Default=1.0) (Source: ATBD section 4.7 step 3 entered from section 4.8)
up_toc_cut COMPACT	FLOAT([1])	upper cutoff of top of canopy surface. None	meters	Upper cutoff for top of canopy surface. (Default = 150.0) (Source: ATBD section 4.8 step 10)
Group: /gtx		Each group contains the segments for one Ground Track. As ICESat-2 orbits the earth, sequential transmit pulses illuminate six ground tracks on the surface of the earth. The track width is approximately 14m. Each ground track is numbered, according to the laser spot number that generates a given ground track. Ground tracks are numbered from the left to the right in the direction of spacecraft travel as: 1L, 1R in the left-most pair of beams; 2L, 2R for the center pair of beams; and 3L, 3R for the right-most pair of beams.		
Group: /gtx/land_segments		Contains data categorized as land at 100 meter intervals.		
data_rate	(Attribute)	Data are stored as aggregates of 100 meters.		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
asr CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	apparent surface reflectance None	1	Apparent surface reflectance (Source: ATL09)
atlas_pa CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	atlas pointing angle None	radians	Off nadir pointing angle (in radians) of the satellite to increase spatial sampling in the non-polar regions. ATLAS_PA =90degs-beam_coelev. (Source: ATL03)
beam_azimuth CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	beam azimuth None	radians	Azimuth(in radians) of the unit pointing vector for the reference photon in the local ENU frame in radians. The angle is measured from north and positive towards East.

				(Source: ATL03)
beam_coelev CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	beam co-elevation None	radians	Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot. (Source: ATL03)
brightness_flag CHUNKED	INTEGER_1(['Unlimited']) INVALID_I1B	brightness flag None	1	Flag indicating that the ground surface is bright (e.g. snow-covered or other bright surfaces) (Source: Land ATBD section 2.4.21); (Meanings: [0 1]) (Values: ['not_bright_surface' 'bright_surface'])
cloud_flag_atm CHUNKED	INTEGER_1(['Unlimited']) INVALID_I1B	cloud flag atm None	1	Cloud confidence flag from ATL09 that indicates the number of cloud or aerosol layers identified in each 25Hz atmospheric profile. If the flag is greater than 0, aerosols or clouds could be present. Valid range is 0 - 10. (Source: ATL09)
cloud_fold_flag CHUNKED	INTEGER_1(['Unlimited']) INVALID_I1B	cloud folding flag None	1	Flag that indicates this profile likely contains cloud signal folded down from above 15 km to the last 2-3 km of the profile. See ATL09 ATBD Table 3.9 for detailed flag value meanings. (Source: ATL09); (Meanings: [0 1 2 3]) (Values: ['no_folding' 'goes5_indicates' 'profile_indicates' 'both_indicate'])
delta_time CHUNKED	DOUBLE(['Unlimited'])	mean_pass_time time	seconds since 2018-01-01	Mean time for the segment in 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. (Source: Land ATBD section 2.4)
delta_time_beg CHUNKED	DOUBLE(['Unlimited'])	delta time begin None	seconds since 2018-01-01	Time of the first photon contained within the data segment, in seconds since the ATLAS SDP GPS 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. (Source: Derived (gps_seconds-gps_sec_offset))
delta_time_end CHUNKED	DOUBLE(['Unlimited'])	delta time end None	seconds since 2018-01-01	Time of the last photon contained within the data segment, in 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. (Source: Derived (gps_seconds-gps_sec_offset))
dem_flag CHUNKED	INTEGER_1(['Unlimited']) INVALID_I1B	dem source flag None	1	Indicates source of the DEM height. Values: 0=None, 1=Arctic, 2=Global, 3=MSS, 4=Antarctic.

				(Source: Atmosphere ATBD); (Meanings: [0 1 2 3 4]) (Values: ['none' 'arctic' 'global' 'mss' 'antarctic'])
dem_h CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	dem height None	meters	Best available DEM (in priority of Arctic/Antarctic/Global/MSS) value at the geolocation point. Height is in meters above the WGS84 Ellipsoid. (Source: Arctic, Antarctic, Global, MSS DEM)
dem_removal_flag CHUNKED	INTEGER_1(['Unlimited'])	dem removal flag None	1	Flag indicating more than dem_removal_percent_limit (default 20.0) removed from land segment due to failing DEM-QA tests (Source: ATBD section 2.4.11); (Meanings: [0 1]) (Values: ['below_threshold' 'above_threshold'])
h_dif_ref CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	h dif from reference None	meters	Difference between h_te_median and ref_DEM (Source: Land ATBD section 2.4)
last_seg_extend CHUNKED	FLOAT(['Unlimited'])	last segment extended last_seg_extend	kilometers	The distance (km) that the last ATL08 processing segment in a file is either extended or overlapped with the previous ATL08 processing segment. (Source: Land ATBD 13March2019, Section 2.4.20)
latitude CHUNKED	FLOAT(['Unlimited'])	latitude latitude	degrees	Latitude of the center-most signal photon within each segment. (Source: Land ATBD section 2.4)
layer_flag CHUNKED	INTEGER_1(['Unlimited'])	consolidated cloud flag None	1	This flag is a combination of multiple flags (cloud_flag_atm, cloud_flag_asr, and bsnow_con) and takes daytime/nighttime into consideration. A value of 1 means clouds or blowing snow are likely present. A value of 0 indicates the likely absence of clouds or blowing snow. (Source: ATL09); (Meanings: [0 1]) (Values: ['likely_clear' 'likely_cloudy'])
longitude CHUNKED	FLOAT(['Unlimited'])	longitude longitude	degrees	Longitude of the center-most signal photon within each segment. (Source: Land ATBD section 2.4)
msw_flag CHUNKED	INTEGER_1(['Unlimited']) INVALID_I1B	multiple scattering warning flag None	1	Multiple Scattering warning flag. 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. (Source: ATL09); (Meanings: [-1 0 1 2 3 4 5]) (Values: ['cannot_determine' 'no_layers' 'layer_gt_3km' 'layer_between_1_and_3_km' 'layer_lt_1km' 'blow_snow_od_lt_0.5' 'blow_snow_od_gt_0.5'])
n_seg_ph CHUNKED	INTEGER(['Unlimited'])	number of photons	1	Number of photons within each land segment. (Source: Derived)

		None		
night_flag CHUNKED	INTEGER(['Unlimited']) INVALID_I4B	night flag None	1	Flag indicating the data were acquired in night conditions: 0=day, 1=night. Flag is derived from solar elevation at the geolocated segment. IF solar elevation is above threshold it is day, if not then it is night. Threshold is set in atlas_l3a_const_mod. (Source: Land ATBD section 2.4.8); (Meanings: [0 1]) (Values: ['day' 'night'])
ph_ndx_beg CHUNKED	INTEGER_8(['Unlimited'])	photon index begin None	1	Index (1-based) within the photon-rate data (/land_segments/photons) of the first photon within this each land segment. (Source: Derived)
ph_removal_flag CHUNKED	INTEGER_1(['Unlimited'])	ph removal flag None	1	Flag indicating more than ph_removal_percent_limit (default 50.0) removed from land segment due to failing QA tests (Source: ATBD section 4.13); (Meanings: [0 1]) (Values: ['below_threshold' 'above_threshold'])
psf_flag CHUNKED	INTEGER_1(['Unlimited'])	point spread function flag None	1	Flag is set to 1 if the point spread function (computed as sigma_atlas_land) has exceeded the threshold (1 m) (Source: Land/Veg ATBD); (Meanings: [0 1]) (Values: ['below_threshold' 'above_threshold'])
rgt CHUNKED	INTEGER_2(['Unlimited'])	reference ground track None	1	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 GT3 and GT4. During slews or off-pointing, it is possible that ground tracks may intersect the RGT. The ICESat-2 mission has 1387 RGTs. (Source: Operations)
sat_flag CHUNKED	INTEGER_1(['Unlimited']) INVALID_I1B	saturation flag None	1	Flag derived from full_sat_fract on the ATL03 data product, averaged over 5 geosegments in 100m land segment (Source: ATL03, Land ATBD 15Apr2020, section 2.5.23); (Meanings: [0 1 -1]) (Values: ['no_saturation_detected' 'saturation_detected' 'not_enough_valid_data'])
segment_id_beg CHUNKED	INTEGER(['Unlimited'])	begin geolocation segment bin None	1	Geolocation segment number of the first photon in the land segment. (Source: ATL03)
segment_id_end CHUNKED	INTEGER(['Unlimited'])	end geolocation segment bin None	1	Geolocation segment number of the last photon in the land segment. (Source: ATL03)
segment_landcover CHUNKED	INTEGER(['Unlimited']) 255	segment landcover None	1	IGBP Land Cover Surface type classification as reference from MODIS Land Cover(ANC18) at the 0.5 arcsecond resolution. (Source: ATBD section 2.4.14); (Meanings: [0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16]) (Values: ['Water' 'Evergreen_Needleleaf_Forest' 'Evergreen_Broadleaf_Forest' 'Deciduous_Needleleaf_Forest' 'Deciduous_Broadleaf_Forest' 'Mixed_Forest' 'Closed_Shrublands' 'Open_Shrubland' 'Woody_Savanna' 'Savanna' 'Grassland' 'Wetland' 'Croplands' 'Urban' 'Crop_Mosaic' 'Permanent_Snow' 'Barren'])
segment_snowcover CHUNKED	INTEGER_1(['Unlimited']) INVALID_I1B	segment snowcover None	1	Daily snow/ice cover from ATL09 at the 25 Hz rate(275m) indicating likely presence of snow and ice within each segment. 0=ice free water; 1=snow free land; 2=snow; 3=ice.

				(Source: ATBD section 4.2.16); (Meanings: [0 1 2 3]) (Values: ['ice_free_water' 'snow_free_land' 'snow' 'ice'])
segment_watermask CHUNKED	INTEGER(['Unlimited']) 255	segment watermask None	1	Water mask(i.e. flag) indicating inland water as referenced from the Global Raster Water Mask(ANC33) at 250 m spatial resolution. (Source: ATBD section 2.4.15); (Meanings: [0 1]) (Values: ['no_water' 'water'])
sigma_across CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	sigma atlas y None	1	Total cross-track uncertainty due to PPD and POD knowledge. Read from ATL03 product gtx/geolocation/sigma_across. Sigma_atlas_y is reported on ATL08 as the uncertainty of the center-most reference photon of the 100m ATL08 segment. (Source: ATL03)
sigma_along CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	sigma atlas x None	1	Total along-track uncertainty due to PPD and POD knowledge. Read from ATL03 product gtx/geolocation/sigma_along. Sigma_atlas_x is reported on ATL08 as the uncertainty of the center-most reference photon of the 100m ATL08 segment. (Source: ATL03)
sigma_atlas_land CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	sigma atlas land None	1	Total vertical geolocation error due to ranging and local surface slope. The parameter is computed for ATL08 as described in equation 1.2. (Source: Land ATBD section 2.5.13)
sigma_h CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	height uncertainty None	1	Estimated uncertainty for the reference photon bounce point ellipsoid height: 1- sigma (m) provided at the geolocation segment rate on ATL03. Sigma_h is reported on ATL08 as the uncertainty of the center-most reference photon of the 100m ATL08 segment. (Source: ATL03)
sigma_topo CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	sigma atlas topo None	1	Total uncertainty that include sigma_h plus geolocation uncertainty due to local slope (equation 1.3). The local slope is multiplied by the geolocation uncertainty factor. This will be used to determine the total vertical geolocation error due to ranging and local slope. (Source: Land ATBD section 2.5.12)
snr CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	signal to noise ratio None	1	The signal to noise ratio of geolocated photons as determined by the ratio of the superset of ATL03 signal and DRAGANN found signal photons used for processing the ATL08 segments to the background photons (i.e. noise) within the same ATL08 segments. (Source: ATBD section 2.5.14)
solar_azimuth CHUNKED	FLOAT(['Unlimited'])	solar azimuth None	degrees_east	The direction, eastwards from north, of the sun vector as seen by an observer at the laser ground spot. (Source: ATL03g ATBD)
solar_elevation CHUNKED	FLOAT(['Unlimited'])	solar elevation None	degrees	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. (Source: ATL03g ATBD)
surf_type CHUNKED	INTEGER_1(['Unlimited', 5])	surface type None	1	Flags describing which surface types this interval is associated with. 0=not type, 1=is type. Order of array is land, ocean, sea ice, land ice,

				inland water. (Source: ATL03 ATBD, Section 4); (Meanings: [0 1]) (Values: ['not_type' 'is_type'])
terrain_flg CHUNKED	INTEGER(['Unlimited']) INVALID_I4B	terrain flag None	1	Terrain flag quality check to indicate a deviation above a threshold from the reference DEM height reported on the product. (Source: Land ATBD section 2.4.8); (Meanings: [0 1]) (Values: ['below_threshold' 'above_threshold'])
urban_flag CHUNKED	INTEGER(['Unlimited']) INVALID_I4B	segment urban flag None	1	The urban flag indicates that a segment is likely located over an urban area. (Source: Land ATBD section 2.4.17); (Meanings: [0 1]) (Values: ['not_urban' 'urban'])
Group: /gtx/land_segments/canopy		Contains height parameters based on the land algorithm.		
data_rate	(Attribute)	Data are stored as aggregates of 100 meters.		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
canopy_flag CHUNKED	INTEGER(['Unlimited']) INVALID_I4B	canopy flag None	1	Flag indicating that canopy was detected using the Landsat Tree Cover Continuous Fields data product. If percent of canopy cover along the L-km segment is greater than 5%, then canopy is assumed to be present; else, no canopy is assumed present. (Source: Land ATBD section 2.2.22); (Meanings: [0 1]) (Values: ['no_canopy_present' 'canopy_present'])
canopy_h_metrics CHUNKED	FLOAT(['Unlimited', 18]) INVALID_R4B	canopy height metrics None	meters	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface. The height metrics are calculated at the following percentiles: 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95%. (Source: Land ATBD 15May2020 section 2.2.4)
canopy_h_metrics_abs CHUNKED	FLOAT(['Unlimited', 18]) INVALID_R4B	canopy absolute height metrics None	meters	Height metrics based on the cumulative distribution of absolute canopy heights above the WGS84 Ellipsoid. The height metrics are calculated at the following percentiles: 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95%. (Source: Land ATBD section 2.2.3)
canopy_openness CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	canopy openness None	1	Standard Deviation of all photons classified as canopy photons within the segment to provide inference of canopy openness. (Source: Land ATBD section 4.12)
canopy_rh_conf CHUNKED	INTEGER_1(['Unlimited'])	canopy relative height confidence None	1	Canopy relative height confidence flag based on percentage of ground and canopy photons within a segment: 0 (<5% canopy), 1 (>5% canopy, <5% ground), 2 (>5% canopy, >5% ground). (Source: Land/Veg ATBD 13March2019, Section 2.2.21); (Meanings: [0 1 2]) (Values: ['<5%_canopy' '>=5%_canopy_<5%_ground' '>=5%_canopy_>=5%_ground'])
centroid_height CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	centroid height None	meters	Optical centroid of all photons classified as either canopy or ground points within the segment. The heights used in this calculation are absolute heights above the reference ellipsoid. This parameter is equivalent to the centroid height produced ICESat GLA14. (Source: Land ATBD section 2.2.22)
h_canopy CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	height canopy None	meters	98% height of all the individual canopy relative heights for the segment above the estimated

				terrain surface. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface. (Source: Land ATBD section 4.12)
h_canopy_abs CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	absolute segment canopy height None	meters	The 98% height of all the absolute individual canopy heights referenced above the WGS84 ellipsoid. (Source: Land ATBD section 2.2.2)
h_canopy_quad CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	canopy quadratic mean None	meters	The quadratic mean height of individual classified relative canopy photon heights above the estimated terrain surface. (Source: Land ATBD section 4.12)
h_canopy_uncertainty CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	segment canopy height uncertainty None	meters	Uncertainty of the relative canopy heights for the segment. Incorporates all systematic uncertainties as well as uncertainty from errors of identified photons. See section 1 and equations 1.4 and 1.5 in the Land ATBD (Source: Land ATBD section 1.5)
h_dif_canopy CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	canopy diff to median height None	meters	Difference between h_canopy and h_median_canopy (Source: Land ATBD section 4.12)
h_max_canopy CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	maximum canopy height None	meters	Relative maximum of individual canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface. Should be equivalent to RH100 metric reported in the literature. (Source: Land ATBD section 2.2.12)
h_max_canopy_abs CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	absolute maximum canopy height None	meters	Maximum of individual absolute canopy heights within segment referenced above the WGS84 ellipsoid. (Source: Land ATBD section 2.2.11)
h_mean_canopy CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	mean canopy height None	meters	Mean of individual relative canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface. (Source: Land ATBD section 4.12)
h_mean_canopy_abs CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	absolute mean canopy height None	meters	Mean of the individual absolute canopy heights within segment referenced above the WGS84 Ellipsoid. (Source: Land ATBD section 2.2.4)
h_median_canopy CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	median canopy height None	meters	The median of individual relative canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface. This parameter should be equivalent to RH50 reported in the literature. (Source: Land ATBD section 2.2.8)
h_median_canopy_abs CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	absolute segment median canopy height None	meters	The median of individual absolute canopy heights within segment referenced above the WGS84 Ellipsoid. (Source: Land ATBD section 2.2.6)
h_min_canopy CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	minimum canopy height None	meters	The minimum of relative individual canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface. (Source: Land ATBD section 2.2.10)
h_min_canopy_abs CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	absolute minimum canopy height None	meters	The minimum of absolute individual canopy heights within segment referenced above the WGS84 Ellipsoid. (Source: Land ATBD section 2.2.9)

landsat_flag CHUNKED	INTEGER(['Unlimited']) INVALID_I4B	landsat flag None	1	Flag indicating that more than 50% of the Landsat Continuous Cover product have values > 100 for the L-Km segment. Canopy is assumed present along the L-km segment if landsat_flag is 1. (Source: Land ATBD section 2.2.25); (Meanings: [0 1]) (Values: ['canopy_not_assumed_present' 'canopy_assumed_present'])
landsat_perc CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	landsat percentage canopy None	1	Average percentage value of the valid (value <= 100) Landsat Tree Cover Continuous Fields product for each 100 m segment (Source: Land ATBD section 2.2.24)
n_ca_photons CHUNKED	INTEGER(['Unlimited'])	number canopy photons None	1	The number of photons classified as canopy within the segment. (Source: Land ATBD section 4.12)
n_toc_photons CHUNKED	INTEGER(['Unlimited'])	number top of canopy photons None	1	The number of photons classified as top of canopy within the segment. (Source: Land ATBD section 4.12)
photon_rate_can CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	Canopy photon rate None	s^-1	Calculated photon rate of canopy photons within each 100m segment (Source: Land/Veg ATBD July 2020)
subset_can_flag CHUNKED	INTEGER_1(['Unlimited', 5]) INVALID_I1B	subset canopy flag None	1	Quality flag indicating the canopy photons populating the 100 m segment statistics are derived from less than 100 m worth of photons and/or less than 5 20m ATL03 segments. (Source: Land/Veg ATBD 15 Novemebr 2019, Section 2.2.25); (Meanings: [-1 0 1]) (Values: ['no_photon_data_within_geosegment' 'no_canopy_photons_within_geosegment' 'canopy_photons_present_within_geosegment'])
toc_roughness CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	top of canopy roughness None	meters	Standard deviation of the relative heights of all photons classified as top of canopy within the segment (Source: Land ATBD section 4.12)
Group: /gtx/land_segments/terrain		Contains terrain parameters at a 100m aggregation.		
data_rate	(Attribute)	Data are stored as aggregates of 100 meters.		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
h_te_best_fit CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	segment terrain height best fit None	meters	The best fit terrain elevation at the the mid-point location of each 100m segment. The mid-segment terrain elevation is determined by selecting the best of three fits- linear, 3rd order and 4th order polynomials - to the terrain photons and interpolating the elevation at the mid-point location of the 100 m segment. For the linear fit, a slope correction and weighting is applied to each ground photon based on the distance to the slope height at the center of the segment. (Source: Land ATBD section 2.1.15)
h_te_interp CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	interpolated terrain surface height None	meters	Interpolated terrain surface height above the WGS84 Ellipsoid at the midpoint of the segment. (Source: Land ATBD section 4.9)
h_te_max CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	maximum terrain height None	meters	The maximum of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment. (Source: Land ATBD section 4.11)
h_te_mean CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	mean terrain height None	meters	The mean of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment.

				(Source: Land ATBD section 4.11)
h_te_median CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	median terrain height None	meters	The median of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment. (Source: Land ATBD section 4.11)
h_te_min CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	minimum terrain height None	meters	The minimum of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment. (Source: Land ATBD section 4.11)
h_te_mode CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	mode of terrain heights None	meters	The mode of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment. (Source: Land ATBD section 4.11)
h_te_rh25 CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	Terrain height 25% percentile None	meters	The terrain elevation from the 25% height. The classified ground photons are sorted into a cumulative distribution and the height associated with the 25% height for that segment is reported. (Source: Land/veg ATBD, September 2020)
h_te_skew CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	skew of terrain heights None	meters	The skewness of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment. (Source: Land ATBD section 4.11)
h_te_std CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	segment terrain roughness None	meters	The standard deviation of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment. (Source: Land ATBD section 4.11)
h_te_uncertainty CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	uncertainty of h_te_mean None	meters	Uncertainty of the mean terrain height for the segment. This uncertainty incorporates all systematic uncertainties(e.g. timing orbits, geolocation,etc.) as well as uncertainty from errors of identified photons. This parameter is described in section 1, equation 1.4 (Source: Land ATBD section 4.11)
n_te_photons CHUNKED	INTEGER(['Unlimited'])	number of ground photons None	1	The number of the photons classified as terrain within the segment. (Source: Land ATBD section 4.11)
photon_rate_te CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	Terrain photon rate None	s^-1	Calculated photon rate of terrain photons within each 100m segment (Source: July 2020 Land/Veg ATBD)
subset_te_flag CHUNKED	INTEGER_1(['Unlimited', 5]) INVALID_I1B	subset terrain flag None	1	Quality flag indicating the terrain photons populating the 100 m segment statistics are derived from less than 100 m worth of photons and/or less than 5 20m ATL03 segments. (Source: Land/Veg ATBD 15 Novemebr 2019, Section 2.1.15); (Meanings: [-1 0 1]) (Values: ['no_photon_data_within_geosegment' 'no_terrain_photons_within_geosegment' 'terrain_photons_present_within_geosegment'])
terrain_slope CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	segment terrain slope None	1	The along-track slope of terrain, within each segment;computed by a linear fit of terrain classified photons. Slope is in units of delta height over delta along track distance. (Source: Land ATBD section 4.11)
Group: /gtx/signal_photons		Contains parameters related to individual photons.		
data_rate	(Attribute)	Data are stored at the signal-photon classification rate.		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
classed_pc_flag CHUNKED	INTEGER_1(['Unlimited'])	photon land atbd classification	1	Land Vegetation ATBD classification flag for each photon as either noise, ground, canopy,

		None		and top of canopy. 0 = noise, 1 = ground, 2 = canopy, or 3 = top of canopy. (Source: Land ATBD section 4.10); (Meanings: [0 1 2 3]) (Values: ['noise' 'ground' 'canopy' 'top_of_canopy'])
classed_pc_indx CHUNKED	INTEGER(['Unlimited'])	indicies of classed photons None	1	Index (1-based) of the ATL08 classified signal photon from the start of the ATL03 geolocation segment specified on the ATL08 product at the photon rate in the corresponding parameter, ph_segment_id. This index traces back to specific photon within a 20m segment_id on ATL03. The unique identifier for tracing each ATL08 signal photon to the corresponding photon record on ATL03 is the segment_id, orbit, cycle, and classed_pc_indx. Orbit and cycle intervals for the granule are found in the /ancillary_data. The timestamp of each orbit transition is found in the /orbit_info group. (Source: Retained from prior a_alt_science_ph packet)
d_flag CHUNKED	INTEGER_1(['Unlimited'])	dragann flag None	1	Flag indicating the labeling of DRAGANN noise filtering for a given photon. (Source: Land ATBD section 2.3.5); (Meanings: [0 1]) (Values: ['noise' 'signal'])
delta_time CHUNKED	DOUBLE(['Unlimited'])	delta time time	seconds since 2018-01-01	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. (Source: ATL03)
ph_h CHUNKED	FLOAT(['Unlimited']) INVALID_R4B	relative photon height height	meters	Height of photons above interpolated land surface (Source: land/veg ATBD, 15May2020, Section 2.3.4)
ph_segment_id CHUNKED	INTEGER(['Unlimited'])	segment id of photon None	1	Segment ID of photons tracing back to specific 20m segment_id on ATL03. The unique identifier for tracing each ATL08 signal photon to the photon on ATL03 is the segment_id, orbit, and classed_pc_indx. The unique identifier for tracing each ATL08 signal photon to the corresponding photon record on ATL03 is the segment_id, orbit, cycle, and classed_pc_indx. Orbit and cycle intervals for the granule are found in the /ancillary_data. The timestamp of each orbit transition is found in the /orbit_info group. (Source: Retained from prior a_alt_science_ph packet)
Group: /orbit_info		Contains orbit information.		
data_rate	(Attribute)	Varies. Data are only provided when one of the stored values (besides time) changes.		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
crossing_time CHUNKED	DOUBLE(['Unlimited'])	Ascending Node Crossing Time time	seconds since 2018-01-01	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. (Source: POD/PPD)
cycle_number CHUNKED	INTEGER_1(['Unlimited'])	Cycle Number None	1	A count of the number of exact repeats of this reference orbit. (Source: Operations)
lan CHUNKED	DOUBLE(['Unlimited'])	Ascending Node Longitude None	degrees_east	Longitude at the ascending node crossing. (Source: POD/PPD)
orbit_number CHUNKED	UINT_2_LE(['Unlimited'])	Orbit Number None	1	Unique identifying number for each planned ICESat-2 orbit. (Source: Operations)
rgt CHUNKED	INTEGER_2(['Unlimited'])	Reference Ground track None	1	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 GT3 and GT4. During slews or off-pointing, it is possible that ground tracks may intersect the RGT. The ICESat-2 mission has 1387 RGTs. (Source: POD/PPD)
sc_orient CHUNKED	INTEGER_1(['Unlimited'])	Spacecraft Orientation None	1	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. (Source: POD/PPD); (Meanings: [0 1 2]) (Values: ['backward' 'forward' 'transition'])
sc_orient_time CHUNKED	DOUBLE(['Unlimited'])	Time of Last Spacecraft Orientation Change time	seconds since 2018-01-01	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. (Source: POD/PPD)
Group: /quality_assessment		Contains quality assessment data. This may include QA counters, QA along-track data and/or QA summary data.		
Label (Layout)	Datatype(Dims) Fillvalue	long_name standard_name	units	description
qa_granule_fail_reason COMPACT	INTEGER([1])	Granule Failure Reason	1	Flag indicating granule failure reason. 0=no failure; 1=processing error; 2=Insufficient output

		None		data was generated; 3=TBD Failure; 4=TBD_Failure; 5=other failure. (Source: Operations); (Meanings: [0 1 2 3 4 5]) (Values: ['no_failure' 'PROCESS_ERROR' 'INSUFFICIENT_OUTPUT' 'failure_3' 'failure_4' 'OTHER_FAILURE'])
qa_granule_pass_fail COMPACT	INTEGER([1])	Granule Pass Flag None	1	Flag indicating granule quality. 0=granule passes automatic QA. 1=granule fails automatic QA. (Source: Operations); (Meanings: [0 1]) (Values: ['PASS' 'FAIL'])