1.0 DATA DICTIONARY

The following subsections list the data content of ATL13. Each subsection corresponds to a HDF5 group on the data product. The ATLAS Standard Data Products are designed to be self-documenting and contain additional descriptive information not presented here. The descriptive information within the data dictionary is limited to preserve readability.

1.1.1 Attributes

short_name	ATL13
title	SET_BY_META
level	L3A
description	This data set (ATL13) contains along track surface heights of inland water bodies, including lakes, estuaries and rivers. Water surface slope and descriptive statistics are also provided. The data were acquired by the Advanced Topographic Laser Altimeter S
Conventions	CF-1.6
citation	SET_BY_META
contributor_name	Thomas A 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	Instrument Engineer, Investigator, Principle Investigator, Data Producer, Data Producer
creator_name	SET_BY_META
date_created	SET_BY_PGE
date_type	UTC
featureType	trajectory
geospatial_lat_max	0.0
geospatial_lat_min	0.0
geospatial_lat_units	degrees_north
geospatial_lon_max	0.0

geospatial_lon_min	0.0
geospatial_lon_units	degrees_east
granule_type	ATL13
hdfversion	SET_BY_PGE
history	SET_BY_PGE
identifier_file_uuid	SET_BY_PGE
identifier_product_doi	10.5067/ATLAS/ATL13.001
identifier_product_doi_authority	http://dx.doi.org
identifier_product_format_version	SET_BY_PGE
identifier_product_type	ATL13
institution	SET_BY_META
instrument	SET_BY_META
keywords	SET_BY_META
keywords_vocabulary	SET_BY_META
license	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	http://dx.doi.org
platform	SET_BY_META
processing_level	L3A
project	SET_BY_META
publisher_email	SET_BY_META
publisher_name	SET_BY_META
publisher_url	SET_BY_META
references	SET_BY_META
source	SET_BY_META
spatial_coverage_type	Horizontal

standard_name_vocabulary	CF-1.6
summary	SET_BY_META
time_coverage_duration	SET_BY_PGE
time_coverage_end	SET_BY_PGE
time_coverage_start	SET_BY_PGE
time_type	CCSDS UTC-A

1.1.2 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
ds_anom_trigger	INTEGER(9) -	1	Dimension scale indexing the short segment anomaly trigger array having nine elements. Index = 1 corresponds to coarse ht difference; Index = 2 corresponds to abnormal length; Index = 3 corresponds to histogram mode spread; Index = 4 corresponds to histogram mode count; Index = 5 corresponds to histogram mode intensity; Index = 6 corresponds to invalid long segment; Index = 7 corresponds to shore buffer designation; Index = 8 corresponds to insufficient signal phs; Index = 9 corresponds to unavailability of coarse water height against which to test. Source: dim_scale Flags: 1()=coarse_ht_difference, 2()=abnormal_length, 3()=histogram_mode_spread, 4()=histogram_mode_count, 5()=histogram_mode_intensity, 6()=invalid_long_segment, 7()=shore_buffer_designation, 8()=insufficient_signal_phs, 9()=coarse_water_height_unavailable
ds_sseg_quality	INTEGER(4) -	1	Dimension scale indexing the short segment quality array. Index = 1 corresponds to nominal; Index = 2 corresponds to possible afterpulse; Index = 3 corresponds to possible impulse response; Index = 4 corresponds to possible TEP Source: dim_scale Flags: 1()=nominal, 2()=possible_afterpulse, 3()=possible_impulse_response, 4()=possible_TEP

1.2 Group: /ancillary_data

Contains information ancillary to the data product. This may include product characteristics, instrument characteristics and/or processing constants.

1.2.1 Attributes

data_rate	Data within this group pertain to the granule in its entirety.

1.2.2 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
atlas_sdp_gps_epoch	DOUBLE(1) -	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	STRING(1) -	1	PGE-specific control file used to generate this granule. To re-use, replace breaks (BR) with linefeeds. Source: Operations
data_end_utc	STRING(1) -	1	UTC (in CCSDS-A format) of the last data point within the granule. Source: Derived
data_start_utc	STRING(1) -	1	UTC (in CCSDS-A format) of the first data point within the granule. Source: Derived
end_cycle	INTEGER(1) -	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 time	DOUBLE(1) -	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	INTEGER(1) -	1	The ending geolocation segment number associated with the data contained within

Name Standard Name	Type(Dims) FillValue	Units	Description
			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	DOUBLE(1) -	seconds	GPS seconds-of-week of the last data point in the granule. Source: Derived
end_gpsweek	INTEGER(1) -	weeks from 1980-01-06	GPS week number of the last data point in the granule. Source: Derived
end_orbit	INTEGER(1) -	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	INTEGER(1) -	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	INTEGER(1) -	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

Name Standard Name	Type(Dims) FillValue	Units	Description
granule_end_utc	STRING(1) -	1	Requested end time (in UTC CCSDS-A) of this granule. Source: Derived
granule_start_utc	STRING(1) -	1	Requested start time (in UTC CCSDS-A) of this granule. Source: Derived
release	STRING(1) -	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	INTEGER(1) -	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 time	DOUBLE(1) -	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	INTEGER(1) -	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

Name Standard Name	Type(Dims) FillValue	Units	Description
start_gpssow	DOUBLE(1) -	seconds	GPS seconds-of-week of the first data point in the granule. Source: Derived
start_gpsweek	INTEGER(1) -	weeks from 1980-01-06	GPS week number of the first data point in the granule. Source: Derived
start_orbit	INTEGER(1) -	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	INTEGER(1) -	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	INTEGER(1) -	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	STRING(1) -	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

1.3 Group: /ancillary_data/inland_water

Contains general ancillary parameters.

1.3.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
aggregate_ratio	FLOAT(9) INVALID_R4B	1	Based on water body type, the required bin counts that must exist above and inclusive of a subsurface bin relative to the count of the entire column in order to qualify as possible bottom. Source: ATL13 ATBD, Section 5.2, Table 5-2
amp_mean_sig_incr	FLOAT(3) INVALID_R4B	1	Iteration loop amplitude, mean, and sigma step increments used in deconvolution described in section 5.3.4(B) Source: ATBD Table 5-2
amp_mean_sig_max	FLOAT(3) INVALID_R4B	1	Amplitude, mean, and sigma maximum values of iteration loops used in deconvolution described in section 5.3.4(B) Source: ATBD Table 5-2
amp_mean_sig_min	FLOAT(3) INVALID_R4B	1	Amplitude, mean, and sigma minimum values of iteration loops used in deconvolution described in section 5.3.4(B) Source: ATBD Table 5-2
amp_mean_sig_nskip	INTEGER_1(3, 9) INVALID_I1B	1	Number of amplitude, mean height and standard deviation values skipped based on body type, within coarse iteration loops of amplitude, HM_unit and sigma_unit used in deconvolution described in section 5.3.4 (B), to determine an approximate error minimum location over the surface profile range. Source: ATBD Table 5-2
anmly_test	FLOAT(12, 9) -	meters	Array containing threshold values against which to test segments for heights that are anomalous to the rest of the water surface. The anmly_test value is selected based on the corresponding length of the water body crossing, calculated in the code as iw_bdy_xlen_flag. The mode of each segment histogram will be tested against ht_water_coarse and marked as anomalous if the difference is greater than the anomaly test value associated with the segment crossing length. Source: ATBD Table 5-2
apply_mirror	UINT_1_LE(9) -	1	By water body type, designation as to whether or not to apply the multi-step mirroring scheme for surface estimation, where 0= do not apply mirroring and 1=process water body through mirroring steps. Source: ATL13 ATBD, Section 5.2, Table 5-2 Flags: 0()=do_not_apply_mirroring, 1()=process_through_mirroring

Name Standard Name	Type(Dims) FillValue	Units	Description
atm_window1	FLOAT(1) -	meters	Lower limit of height above coarse water surface height for atmospheric background count calculation. Source: ATBD Table 5-2
atm_window2	FLOAT(1) -	meters	Upper limit of height above coarse water surface height for atmospheric background count calculation. Source: ATBD Table 5-2
b1_sseg1	FLOAT(1) -	meters	Bin size to be used for histogramming of each small segment. Source: ATBD Table 5-2
b2_sseg1	FLOAT(1) -	meters	Bin size to be used for histogramming of small segment heights. Source: ATBD Table 5-2
b_long	FLOAT(1) -	meters	Bin size to be used by which to establish a histogram of long segments. Source: ATBD Table 5-2
bckgrd_threshold	FLOAT(2) -	counts/sec	Thresholds outside of which computed background is flagged (High, Low). Source: ATBD Table 5-2
bin_detrend	FLOAT(1) -	meters	Bin size used to establish a band of heights over which to determine the detrending equation. Source: ATBD Table 5-2
bottom_find_method	INTEGER_1(9) INVALID_I1B	1	Based on water body type, the method by which to identify bathymetry in the subsurface. Source: ATL13 ATBD, Section 5.2, Table 5-2 Flags: 0()=do_not_search_for_bathymetry, 1()=do_not_apply_density_threshold_coupling, 2()=apply_density_threshold_coupling
bottom_sseg_mean_min	INTEGER_1(1) -	1	Minimum number of photons required to calculate a valid mean while downscaling a found bottom into short segment rate output. Source: ATBD Table 5-2
btm_lower_range_bins	INTEGER_1(1) -	1	Number of bins below the long segment derived apparent bottom height over which to include member photons in short segment scale bottom finding adjustment. Source: ATBD Table 5-2
btm_upper_range_bins	INTEGER_1(1) -	1	Number of bins above the long segment derived apparent bottom height over which to include member photons in short segment scale bottom finding adjustment. Source: ATBD Table 5-2

Name Standard Name	Type(Dims) FillValue	Units	Description
c_fresnel	FLOAT(1) -	1	Fresnel specular reflection coefficient @ 532 nm Source: ATBD Table 5-2
detection_ratio	FLOAT(9) INVALID_R4B	1	Based on water body type, an adjustment to the threshold tests that must be passed in order to be identified as subsurface. Source: ATL13 ATBD, Section 5.2, Table 5-2
detrend_width	FLOAT(1) -	1	Number of standard deviations +/- mode to include in detrend band. Source: ATBD Table 5-2
f2_d_min	FLOAT(1) -	meters	Minimum distance threshold between photons required for inclusion in algorithm. Source: ATBD Table 5-2
gauss_pk_thres	FLOAT(1) -	1	Fraction of the peak amplitude above which Gaussian fit error analysis is executed (ie, calculate error on Gaussian only between the peak amplitude and gauss_pk_thres * peak) Source: ATBD Table 5-2
geoseg_edge_buffer	INTEGER_1(9, 9) INVALID_I1B	1	Number of geosegments to include in the water surface calculation that are outside of both water body edges, as identified by reference photon location comparison to water body shapes. Source: ATL13 ATBD, Section 5.2, Table 5-2 Flags: 0()=buffer_0, 1()=buffer_1, 2()=buffer_2, 3()=buffer_3, 4()=buffer_4, 5()=buffer_5
h_mavg_a	INTEGER(1) -	meters	Number of depth bins over which to compute H_mavg_a Source: ATBD Table 5-2
h_mavg_b	INTEGER(1) -	meters	Number of depth bins over which to compute H_mavg_b Source: ATBD Table 5-2
h_mavg_c	INTEGER(1) -	meters	Number of bins over which to calculate moving average Source: ATBD Table 5-2
l_sub	INTEGER(9) INVALID_I4B	1	Long segment size, operationally used as unit length over which to characterize the subsurface, and deconvolve the instrument pulse and subsurface effects from the water surface response. Source: ATBD Table 5-2
l_surf	INTEGER(9) INVALID_I4B	1	Long segment size, operationally used as unit length over which to detrend the water surface, characterize the surface, and deconvolve the instrument pulse and subsurface effects from the water surface response. Source: ATBD Table 5-2

Name Standard Name	Type(Dims) FillValue	Units	Description
lidar_coeff_alpha_unit_incr	FLOAT(2, 9) -	1	Iteration loop coefficient multiplier of unit exponential distribution and subsurface alpha_unit step increments used in deconvolution, described in section 5.3.4 (A), based on water body type. Source: ATBD Table 5-2
lidar_coeff_alpha_unit_max	FLOAT(2, 9) -	1	Coefficient multiplier of unit exponential distribution and subsurface alpha_unit maximum values of iteration loops used in deconvolution, described in section 5.3.4 (A), based on water body type. Source: ATBD Table 5-2
lidar_coeff_alpha_unit_min	FLOAT(2, 9) -	1	Coefficient multiplier of unit exponential distribution and subsurface alpha_unit minimum values of iteration loops used in deconvolution, described in section 5.3.4 (A), based on water body type. Source: ATBD Table 5-2
limit_hist_depth	UINT_1_LE(9) -	1	By water body type, designation as to whether or not to limit the initial short segment histogram depth analysis by range_hist_depth, where 0= do not limit depth range and 1= limit the depth range consideration by range_hist_depth. Source: ATL13 ATBD, Section 5.2, Table 5-2 Flags: 0()=do_not_limit_depth_range, 1()=limit_depth_range
lsbr_threshold	FLOAT(1) -	1	Threshold at which the LSBR indicates a significant transition from signal photon richness to noise. Source: ATBD Table 5-2
m_avg_d	INTEGER(1) -	meters	Number of depth bins over which to compute P_ht_long_subsurf_mavg Source: ATBD Table 5-2
max_gseg_search	INTEGER(1) -	1	Maximum number of geosegments in either direction to search for reported water surface heights Source: ATBD Table 5-2
min_mirror_cnt	UINT_2_LE(5, 9) -	1	Minimum number of signal photons required in a fully-filled long or very segment (consisting of only full member short segments) in each step of mirroring approach to estimating observed surface mean and standard deviation, designated by water body type. Source: ATL13 ATBD, Section 5.2, Table 5-1
n2	FLOAT(9) -	1	Refractive index of water for a processed water body. Source: ATL13 ATBD Section 5.3.2 C

Name Standard Name	Type(Dims) FillValue	Units	Description
n_coarse_iter	INTEGER_1(3, 9) INVALID_I1B	1	Number of coarse iteration steps for amplitude, mean height and standard deviation for surface iterated convolution. Source: ATBD Table 5-2
range_hist_depth	FLOAT(9) -	1	Depth at which to limit the initial short segment histogram analysis, if utilized for the body type as designated by limit_hist_depth. Source: ATL13 ATBD, Section 5.2, Table 5-2
ref_dist_iw_bdy	FLOAT(1) -	meters	Maximum distance from a water body that a geosegment reference photon indicates the need for overlap testing each individual photon in the geosegment Source: ATBD Table 5-2
refr_idx_type	INTEGER_1(9) -	1	Array indices denoting refractive index of water for a processed water body. Source: ATL13 ATBD Section 5.3.2 C
s_seg1	INTEGER(9) INVALID_I4B	1	Short segment size, indicating the number of along track signal photons per segment, operationally used as unit length over which to identify water surface height anomalies such as islands, bridges, etc. Source: ATBD Table 5-2
shore_buff_sseg_length	INTEGER(1) -	1	Maximum length of a short segment that can be marked as anomalous due to shore buffering. Source: ATL13 ATBD, Section 5.2, Table 5-2
shore_buffer	INTEGER_1(9, 9) INVALID_I1B	1	Number of near-shore short segments to ignore in analysis due to near-shore influences. Source: ATL13 ATBD, Section 5.2, Table 5-2 Flags: 0()=buffer_0, 1()=buffer_1
sig_threshold	INTEGER(1) -	1	Minimum signal confidence required for photon to be included in analysis Source: ATBD Table 5-2
signal_window_bottom	FLOAT(1) -	meters	Lower limit below coarse water surface to include photons for analysis. Source: ATBD Table 5-2
signal_window_top	FLOAT(1) -	meters	Upper limit above coarse water surface to include photons for analysis. Source: ATBD Table 5-2
size_to_process	INTEGER_1(9, 9) INVALID_I1B	1	Water body sizes that are to be processed by the ATL13 algorithm for each water body type. This parameter is a rank 2 array of size 9x9, where array subscripts 1 through 9, coincide with body type digits along columns, and body size digits along rows. Array elements are binary values, if 0 then process body size for that type, 1 otherwise. Water body sizes are described in ATL13 chapter

Name Standard Name	Type(Dims) FillValue	Units	Description
			4.7.1.2 and in Table 5-4. Source: ATL13 ATBD, Section 4.7.1.2, Table 5-4 Flags: 0()=process_size, 1()=otherwise
sseg_length_test	FLOAT(9) INVALID_R4B	meters	Threshold by which to test the length of a short segment to determine anomalous or not anomalous, varying by water body type. Source: ATBD Table 5-2
sseg_mode_cnt_test	INTEGER_1(6) INVALID_I1B	1	Threshold to test number of values contained in short segment histogram multimodes against for inclusion or exclusion of short segment Source: ATBD Table 5-2 Flags: 10()=sseg_stdev_thres_1, 10()=sseg_stdev_thres_2, 7()=sseg_stdev_thres_3, 7()=sseg_stdev_thres_4, 7()=sseg_stdev_thres_5, 7()=sseg_stdev_thres_6
sseg_mode_freq_test	INTEGER(1) -	1	Threshold to test number of short segment histogram modes against for inclusion or exclusion of short segment. Source: ATBD Table 5-2
sseg_mode_spread_test	FLOAT(1) -	meters	Threshold to test distance between short segment histogram multimodes against for inclusion or exclusion of short segment. Source: ATBD Table 5-2
sub_max	FLOAT(1) -	meters	Maximum vertical profile of water subsurface to include in estimation of subsurface characteristics Source: ATBD Table 5-2
type_to_process	INTEGER_1(9) INVALID_I1B	1	Water body types that are to be processed by the ATL13 algorithm. This parameter is a rank 1 array of extent 9, with the body type digits coinciding with the array subscripts 1 through 9. Array elements are binary values, if 0 then process body type, 1 otherwise. Water body types are described in ATL13 chapter 4.7.1.2 and in Table 5-4. Source: ATL13 ATBD, Section 4.7.1.2, Table 5-4 Flags: 0()=process_type, 1()=otherwise

1.4 Group: /gtx

Contains per-beam data products.

1.4.1 Attributes

data_rate	Data within this group are stored at the inland water short segment rate (/ancillary_data/inland_water/s_seg2).

1.4.2 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
alpha_mle	FLOAT(:) INVALID_R4B	m^-1	Alpha calculated by maximum likelihood analysis of the subsurface profile range. Source: Section 5.3.4 (A)
atl13refid	INTEGER_8(:) 0	1	Unique aggregate reference number for each shape in the ATL13 Inland Water Body Mask, where digit 1 = type, digit 2 = size, digit 3 = source, and digits 4-10 = shape id Source: ATL13 ATBD, Section 5.3.1 (C)
bottom_lat latitude	DOUBLE(:) INVALID_R8B	degrees	Latitude of actual bottom location, based on the apparent bottom sseg_mean_lat / sseg_mean_lon location corrected for refraction effects. Source: ATL13 ATBD, Section 5.3.5 (A)
bottom_lon longitude	DOUBLE(:) INVALID_R8B	degrees	Longitude of actual bottom location, based on the apparent bottom sseg_mean_lat / sseg_mean_lon location corrected for refraction effects. Source: ATL13 ATBD, Section 5.3.5 (A)
cloud_flag_asr_atl09	INTEGER_1(:) INVALID_I1B	1	Cloud probability from ASR. Source: ATL13 ATBD, Section 5.3.5 (A) Flags: 0()=clear_with_high_confidence, 1()=clear_with_medium_confidence, 2()=clear_with_low_confidence, 3()=cloudy_with_low_confidence, 4()=cloudy_with_medium_confidence, 5()=cloudy_with_high_confidence
cloud_flag_atm_atl09	INTEGER_1(:) INVALID_I1B	1	Cloud flag from backscatter profile. Source: ATL13 ATBD, Section 5.3.5 (A)
cycle_number	INTEGER_1(:) -	counts	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 1,387 and adding the RGT value. Source: ATL03
delta_time time	DOUBLE(:) -	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

Name Standard Name	Type(Dims) FillValue	Units	Description
err_ht_water_surf	FLOAT(:) INVALID_R4B	1	Error included in heights reported in ht_water_surf. Source: section 5.3.3 (C)
err_slope_trk	FLOAT(:) INVALID_R4B	1	Error included in segment_slope_trk_local. Source: section 5.3.3 (C)
ht_ortho	FLOAT(:) INVALID_R4B	meters	Orthometric height EGM2008 converted from ellipsoidal height. Source: ATL13 ATBD, Section 5.3.5 (A)
ht_water_surf	FLOAT(:) INVALID_R4B	meters	Water surface height, reported for each short segment (default length = approximately 100 signal photons) with reference to WGS84 ellipsoid Source: ATL13 ATBD, Section 5.3.5 (A)
ice_flag	INTEGER_1(:) INVALID_I1B	1	Describes likelihood of ice on water surface short segment. Source: ATL13 ATBD, section 5.2 Flags: 0()=no_ice, 1()=ice
inland_water_body_id	INTEGER(:) INVALID_I4B	1	Identifying signature of an individual inland water body. Each body of water is represented by a unique numeric value. Source: ATL13 ATBD, Section 5.3.1 (C)
inland_water_body_region	INTEGER(:) INVALID_I4B	1	ATL13-created shapefile representing relevant bodies of water over which to implement the ATL13 water surface finding algorithm only within a region of processing interest. Source: ATL13 ATBD, Section 5.3.1 (A)
inland_water_body_size	INTEGER_1(:) INVALID_I1B	1	Size of Inland Water Body, A=area, where 0=Not_Assigned, 1=A>10,000 sq km, 2=10,000>A>=1,000, 3=1,000>A>=100, 4=100>A>=10, 5=10>A>=1, 6=1>A>=0.1, 7=0.01>A, 8=Reserved, 9=Reserved Source: ATL13 ATBD, Section 5.3.1 (C) Flags: 0()=not_assigned, 1()=area_gt_10000, 2()=10000_gt_area_ge_1000, 3()=1000_gt_area_ge_100, 4()=100_gt_area_ge_10, 5()=10_gt_area_ge_1, 6()=1_gt_area_ge_0.1, 7()=0.01_gt_area, 8()=Reserved, 9()=Reserved
inland_water_body_source	INTEGER_1(:) INVALID_I1B	1	Source of Inland Water Body shape, where 1=HydroLAKES, 2=Global Lakes and Wetlands Database, 3=Named Marine Water Bodies, 4=GSHHG Shoreline, 5=Global River Widths from Landsat, 6=Reserved, 7=Reserved, 8=Reserved, 9=Reserved Source: ATL13 ATBD, Section 5.3.1 (C) Flags: 1()=HydroLAKES, 2()=Global_Lakes_and_Wetlands_Database, 3()=Named_Marine_Water_Bodies,

Name Standard Name	Type(Dims) FillValue	Units	Description
			4()=GSHHG_Shoreline, 5()=Global_River_Widths_from_Landsat, 6()=Reserved, 7()=Reserved, 8()=Reserved, 9()=Reserved
inland_water_body_type	INTEGER_1(:) INVALID_I1B	1	Type of Inland Water Body, where 1=Lake, 2=Known Reservoir, 3=(Reserved for future use), 4=Ephemeral Water, 5=River, 6=Estuary or Bay, 7=Coastal Water, 8=Reserved, 9=Reserved Source: ATL13 ATBD, Section 5.3.1 (C) Flags: 1()=Lake, 2()=Known_Reservoir, 3()=Reserved_for_future_use, 4()=Ephemeral_Water, 5()=River, 6()=Estuary_or_Bay, 7()=Coastal_Water, 8()=Reserved, 9()=Reserved
layer_flag_atl09	INTEGER_1(:) INVALID_I1B	1	Consolidated cloud flag. Source: ATL13 ATBD, Section 5.3.5 (A) Flags: 0()=likely_clear, 1()=likely_cloudy
met_ts_atl09 temperature	FLOAT(:) INVALID_R4B	K	Surface (skin) temperature from ATL09. Source: ATL13 ATBD, Section 5.3.5 (A)
met_wind10_atl09 Wind speed	FLOAT(:) INVALID_R4B	m/s	Wind speed magnitude at 10m height from ATL09 input. Source: ATL13 ATBD, Section 5.3.5 (A)
met_wind10_atl13 Wind speed	FLOAT(:) INVALID_R4B	m/s	Wind speed magnitude at 10m height, based on derived water surface wave height. Source: ATL13 ATBD, Section 5.3.5 (A)
qf_bckgrd	INTEGER_1(:) INVALID_I1B	1	Describes the degree of background photons present in each short segment. bckgrd_dnsty_threshold1= 0.001 (counts per bi per Lseg); bckgrd_dnsty_threshold2= 0.01 (counts per bin per Lseg); bckgrd_dnsty_threshold3= 0.05 (counts per bin per Lseg); bckgrd_dnsty_threshold4= 0.1 (counts per bin per Lseg); bckgrd_dnsty_threshold5= 0.3 (counts per bin per Lseg); bckgrd_dnsty_threshold6= 0.5 (counts per bin per Lseg) Source: Inland Water ATBD Flags: 0()=equal_to_or_below_threshold1, 1()=equal_to_or_below_threshold2, 2()=equal_to_or_below_threshold3, 3()=equal_to_or_below_threshold4, 4()=equal_to_or_below_threshold5, 5()=equal_to_or_below_threshold6, 6()=above_threshold6
qf_bias_em	INTEGER_1(:) INVALID_I1B	1	The Electromagnetic Bias flag is set based on threshold checks for the estimated electromagnetic height bias. The flag is set as follows: -3 if H_bias_EM < -0.10 (m); -2 if -0.10 < H_bias_EM < -0.05; -1 if -0.05 <= H_bias_EM

Name Standard Name	Type(Dims) FillValue	Units	Description
			< -0.01; 0 if -0.01 <= H_bias_EM < 0.01 (m); 1 if 0.01 <= H_bias_EM < 0.05; 2 if 0.05 <= H_bias_EM < 0.10; 3 if 0.10 < H_bias_EM; 4 if H_bias_EM is invalid. Source: Inland Water ATBD Flags: -3()=below_threshold1, -2()=below_threshold2, -1()=below_threshold3, 0()=below_threshold4, 1()=below_threshold5, 2()=below_threshold6, 3()=above_threshold6, 4()=invalid
qf_bias_fit	INTEGER_1(:) INVALID_I1B	1	The height bias fit flag is set based on the value of the goodness of fit bias estimated as the difference between the centroid elevations of the observed surface water histogram and fitted integrated water surface model histogram. The flag values are set as follows: = -3 if H_bias_fit < -0.10 (m); -2 if -0.10 <= H_bias_fit < -0.05;-1 when -0.05 <= H_bias_fit < -0.01; 0 if -0.01 <= H_bias_fit < 0.01 (m); 1 if 0.01 <= H_bias_fit < 0.05; 2 if 0.05 < H_bias_fit < 0.10; 3 if 0.10 <= H_bias_fit; 4 if H_bias_fit is invalid. Source: Inland Water ATBD Flags: -3()=below_threshold1, -2()=below_threshold2, -1()=below_threshold3, 0()=below_threshold4, 1()=below_threshold5, 2()=below_threshold6, 3()=equal_to_or_above_threshold6, 4()=invalid
qf_cloud	INTEGER_1(:) INVALID_I1B	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. From the ATL09 data closest to the segment time. Source: ATL09 Flags: 0()=likely_clear, 1()=likely_cloudy
qf_ht_adj	INTEGER_1(:) INVALID_I1B	1	Flag representing the range of height, defined in 5.3.5 (C), which has been added to the apparent surface height due to frame of reference scaling during deconvolution analysis. Source: ATL13 ATBD, Section 5.3.5 (C) Flags: -4()=below_threshold1, -3()=below_threshold2, -2()=below_threshold3, -1()=below_threshold4, 0()=below_threshold5, 1()=below_threshold6, 2()=below_threshold7, 3()=below_threshold8, 4()=equal_to_or_above_threshold8, 5()=invalid
qf_ice	INTEGER_1(:) INVALID_I1B	1	The quality flag for ice describes the likelihood of ice on the short water body surface segment. 0 for QF_Bckgrd<= 2; 1 for 2 < QF_Bckgrd<= 4; 2 for 4 < QF_Bckgrd; 3 for (4 < QF_Bckgrd and QF_Cloud=1) Source: Inland Water ATBD

Name Standard Name	Type(Dims) FillValue	Units	Description
			Flags: 0()=qf_bckgrd_le_2, 1()=qf_bckgrd_le_4, 2()=qf_bckgrd_gt_4, 3()=qf_bckgrd_w_cloud
qf_iwp	INTEGER_1(:) INVALID_I1B	1	Describes the level of processing the inland water algorithm was able to perform based on the data available, ranging from one to 7. Source: Inland Water ATBD Flags: 1()=1_short_segment, 2()=2_short_segments, 3()=3_to_5_short_segments, 4()=6_to_7_short_segments, 5()=8_to_9_short_segments, 6()=10_to_29_short_segments, 7()=at_least_30_short_segments
qf_lseg_length	INTEGER_1(:) INVALID_I1B	1	The Long Segment Length flag is set based on the length of the long segment. The flag is set as follows: 0 if Lseg_length < 500 (meters); 1 if 50 <= Lseg_length < 1500 (meters); 2 if 150 <= Lseg_length < 3000 (meters); 3 if 3000 <= Lseg_length Source: Inland Water ATBD Flags: 0()=below_threshold1, 1()=below_threshold2, 2()=below_threshold3, 3()=above_threshold4
qf_spec_width	INTEGER_1(:) INVALID_I1B	1	Spectral moments width flag. The flag is set as follows: 0 when spec_width is invalid; 1 when 0 <= spec_width <= 0.2; 2 when 0.2 < spec_width <= 0.3; 3 when 0.3 < spec_width <= 0.4; 4 when 0.4 < spec_width <= 0.5; 5 when 0.5 < spec_width <= 0.6; 6 when 0.6 < spec_width <= 0.7; 7 when 0.7 < spec_width <= 0.8; 8 when 0.8 < spec_width <= 0.9; 9 when 0.9 < spec_width. Source: ATL13 ATBD, Section 4.8.8 Flags: 0()=invalid, 1()=0<=spec_width<=0.2, 2()=0.2<spec_width<=0.3, 3()=0.3<spec_width<=0.4, 4()=0.4<spec_width<=0.5, 5()=0.5<spec_width<=0.6, 6()=0.6<spec_width<=0.7, 7()=0.7<spec_width<=0.8, 8()=0.8<spec_width<=0.9, 9()=0.9<spec_width
qf_sseg_length	INTEGER_1(:) INVALID_I1B	1	Length of short segments flag. The flag is set as follows: 0 if sseg_length < 10 (meters); 1 if 10 <= sseg_length < 20 (meters); 2 if 20 <= sseg_length < 30 (meters); 3 if 30 <= sseg_length < 50 (meters); 4 if 50 <= sseg_length < 75 (meters); 5 if 75 <= sseg_length < 100 (meters); 6 if 100 <= sseg_length < 150 (meters); 7 if 150 <= sseg_length < 200 (meters); 8 if 200 <= sseg_length < 300 (meters); 9 if 300 <= sseg_length. Source: Inland Water ATBD Flags: 0()=below_threshold1,

Name Standard Name	Type(Dims) FillValue	Units	Description
			1()=below_threshold2, 2()=below_threshold3, 3()=below_threshold4, 4()=below_threshold5, 5()=below_threshold6, 6()=below_threshold7, 7()=below_threshold8, 8()=below_threshold9, 9()=equal_to_or_above_threshold9
qf_stdev_lseg	INTEGER_1(:) INVALID_I1B	1	Quality flag indicating the magnitude of standard deviation (SD) of observed detrended heights of the long segment to which the short segment belongs, where 0: SD < 0.5 (meters), 1: 0.5 <= SD < 1.5, 2: 1.5 <= SD < 2.5, 3: 2.5 <= SD < 3.5, 4: 3.5 <= SD < 4.5, 5: 4.5 <= SD < 5.5, 6: 5.5 <= SD < 6.5, 7: 6.5 <= SD < 7.5, 8: 7.5 <= SD < 8.5, 9: 8.5 <= SD. It is recommended that a user consider this flag in conjunction with the water body type and size to best determine if the observed surface standard deviation is reasonable or whether results should be considered questionable. Source: ATL13 ATBD, Section 5.3.5 Flags: 0()=SD_below_0.5, 1()=SD_below_1.5, 2()=SD_below_2.5, 3()=SD_below_3.5, 4()=SD_below_4.5, 5()=SD_below_5.5, 6()=SD_below_6.5, 7()=SD_below_7.5, 8()=SD_below_8.5, 9()=SD_greater_or_equal_to_8.5
qf_stdev_vlseg	INTEGER_1(:) INVALID_I1B	1	Quality flag indicating the magnitude of standard deviation (SD) of observed detrended heights of the very long segment to which the short segment belongs, where 0: SD < 0.5 (meters), 1: 0.5 <= SD < 1.5, 2: 1.5 <= SD < 2.5, 3: 2.5 <= SD < 3.5, 4: 3.5 <= SD < 4.5, 5: 4.5 <= SD < 5.5, 6: 5.5 <= SD < 6.5, 7: 6.5 <= SD < 7.5, 8: 7.5 <= SD < 8.5, 9: 8.5 <= SD. It is recommended that a user consider this flag in conjunction with the water body type and size to best determine if the observed surface standard deviation is reasonable or whether results should be considered questionable. Source: ATL13 ATBD, Section 5.3.5 Flags: 0()=SD_below_0.5, 1()=SD_below_1.5, 2()=SD_below_2.5, 3()=SD_below_3.5, 4()=SD_below_4.5, 5()=SD_below_5.5, 6()=SD_below_6.5, 7()=SD_below_7.5, 8()=SD_below_8.5, 9()=SD_greater_or_equal_to_8.5
qf_subsurf_anomaly	INTEGER_1(:) INVALID_I1B	1	Describes the likelihood that the bottom or other subsurface anomaly is bottom based on the threshold value at which an anomaly was found. 1 = Subsurface anomaly due to bottom likely; 2 = Subsurface signal may indicate bottom or other anomaly; 3 = Possible subsurface anomaly; invalid = No subsurface anomaly detected Source: Inland Water ATBD 5.3.4(A) Flags: 1()=bottom_likely,

Name Standard Name	Type(Dims) FillValue	Units	Description
			2()=bottom_or_other_anomaly, 3()=possible_subsurface_anomaly
qf_subsurface_attenuation	INTEGER_1(:) INVALID_I1B	1	Quality flag indicating whether or not the reported subsurface attenuation was constrained during deconvolution by the minimum (initial) limit in the possible range (QF=-1), the maximum limit in the possible range (QF = 1), or was allowed to settle on a solution within the possible range (QF=0). For analysis prior to deconvolution of the subsurface attenuation fit to the observations, the flag indicates whether the value determined by attempting to fit the observations was below (QF= -2), above (QF= 2), or within (QF=0) the possible range of expected values. When the default value for subsurface attenuation is chosen due to any condition other than those defined by an existing quality flag, QF=invalid. Source: ATL13 ATBD, Section 5.3.4 (A) Flags: -2()=obs_fit_below_range, -1()=initial_limit, 0()=within_range, 1()=maximum_limit, 2()=obs_fit_above_range
qf_subsurface_backscat_ampltd	INTEGER_1(:) INVALID_I1B	1	Quality flag indicating whether or not the reported subsurface backscatter amplitude was constrained during deconvolution by the minimum limit in the possible range (QF=-1), the maximum limit in the possible range (QF = 1), or was allowed to settle on a solution within the possible range (QF=0). For analysis prior to deconvolution of the backscatter amplitude fit to the observations, the flag indicates whether the value determined by attempting to fit the observations was below (QF= -2), above (QF= 2), or within (QF=0) the possible range of expected values. When the default value for backscatter amplitude is chosen due to any condition other than those defined by an existing quality flag, QF=invalid. Source: ATL13 ATBD, Section 5.3.4 (A) Flags: -2()=obs_fit_below_range, -1()=initial_limit, 0()=within_range, 1()=maximum_limit, 2()=obs_fit_above_range
rgt	INTEGER_2(:) -	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 GT2L and GT2R. During slews or off-pointing, it is possible that ground tracks may intersect the RGT. The ICESat-2 mission has 1,387 RGTs. Source: ATL03

Name Standard Name	Type(Dims) FillValue	Units	Description
segment_apparent_ht	FLOAT(:) INVALID_R4B	meters	Apparent height of the short segment, before adjustments are made by the algorithm, based on an average of heights within a designated range of the short segment mode. Source: ATL13 ATBD, Section 5.3.5 (A)
segment_apparent_stdev	FLOAT(:) INVALID_R4B	meters	Standard deviation of short segment photon height in the short segment with signal classification >= sig_threshold. Source: section 5.3.2 (C)
segment_azimuth azimuth	FLOAT(:) INVALID_R4B	radians	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). When the spacecraft is precisely at the geodetic zenith, the value will be 99999 degrees. Source: ATL13 ATBD, Section 5.3.5 (A)
segment_bias_em	DOUBLE(:) INVALID_R8B	meters	Electromagnetic bias. (Has been applied to ht_ortho and _ht_water_surf products) Source: ATL13 ATBD, Section 5.3.5 (A)
segment_bias_fit	FLOAT(:) INVALID_R4B	meters	Bias contribution from goodness of observation/system response fit. (Has been applied to ht_ortho and _ht_water_surf products) Source: ATL13 ATBD, Section 5.3.5 (A)
segment_dac	FLOAT(:) INVALID_R4B	meters	Dynamic atmospheric correction (DAC) includes inverted barometer (IB) effect (+- 5 cm). Although available at short segment rate for all water body types, value is provided mainly for transitional tidal and coastal water (types 6 and 7) and the largest lakes of Type 1 (~> 10,000 km2) for user's discretion. Source: ATBD Section 5.3.5A
segment_dem_ht	FLOAT(:) INVALID_R4B	meters	DEM height relative to WGS-84 ellipsoid, reported at the short segment rate. Source: ATL13 ATBD, Section 5.3.5
segment_dem_source	INTEGER(:) INVALID_I4B	1	Flag equal to the source of the selected photon (in hierarchy of Arctic/Global/MSS/Antarctic). Values: 0=None, 1=Arctic, 2=Global, 3=MSS, 4=Antarctic. Source: ATL13 ATBD, Section 5.3.5 Flags: 0()=none, 1()=arctic, 2()=global, 3()=mss, 4()=antarctic
segment_fpb_correction	DOUBLE(:) INVALID_R8B	meters	First photon bias correction. May be applied at user disrection by subtracting from mean height produts ht_ortho and ht_water_surf. Source: ATL13 ATBD, Section 5.3.5 (A)

Name Standard Name	Type(Dims) FillValue	Units	Description
segment_full_sat_fract	FLOAT(:) INVALID_R4B	1	The fraction of pulses within the short segment determined to be fully saturated based on ATL03 geosegment rate input. Source: ATL13 ATBD, Section 5.2
segment_geoid	FLOAT(:) INVALID_R4B	meters	Applicable mean-tide system geoid value at reporting location for all short segment statistics. (see geoid_free2mean to convert to the tide-free system.) Source: ATL03 ATBD, Section 6.3.8
segment_geoid_free2mean	FLOAT(:) INVALID_R4B	meters	Value to convert segment geoid heights from the mean-tide system to the tide-free system. Subtract this value from mean-tide system segment_geoid (on ATL13) to get geoid heights in the tide-free system. Applicable value at reporting location for all short segment statistics. Source: ATL03 ATBD, Section 6.3.8
segment_id_beg	INTEGER(:) -	1	First ATL03 segment_id associated with the photons within this inland water segment. Source: ATL03
segment_id_end	INTEGER(:) -	1	Last ATL03 segment_id associated with the photons within this inland water segment. Source: ATL03
segment_lat latitude	DOUBLE(:) -	degrees	Latitude of reporting location for all short segment statistics. Source: ATL13 ATBD, Section 5.3.5 (A)
segment_lon longitude	DOUBLE(:) INVALID_R8B	degrees	Longitude of reporting location for all short segment statistics. Source: ATL13 ATBD, Section 5.3.5 (A)
segment_near_sat_fract	FLOAT(:) INVALID_R4B	1	The fraction of pulses within the short segment determined to be nearly saturated based on ATL03 geosegment rate input. Source: ATL13 ATBD, Section 5.2
segment_podppd_flag	INTEGER_1(:) 0	1	Composite POD/PPD flag that indicates the quality of input geolocation products for the utilized ATL03 segments on an ATL13 short segment output basis. A non-zero value may indicate that geolocation solutions are degraded or that ATLAS is within a calibration scan period (CAL). The ATL03 sigma values should indicate the degree of uncertainty associated with the degradation. Possible non-CAL values are: 0=NOMINAL; 1=POD_DEGRADE; 2=PPD_DEGRADE; 3=PODPPD_DEGRADE; possible CAL values are: 4=CAL_NOMINAL; 5=CAL_POD_DEGRADE; 6=CAL_PPD_DEGRADE; 7=CAL_PODPPD_DEGRADE;

Name Standard Name	Type(Dims) FillValue	Units	Description
			Source: ATL02, ANC04, ANC05 Flags: 0()=nominal, 1()=pod_degrade, 2()=ppd_degrade, 3()=podppd_degrade, 4()=cal_nominal, 5()=cal_pod_degrade, 6()=cal_ppd_degrade, 7()=cal_podppd_degrade
segment_quality	INTEGER(4, :) INVALID_I4B	1	Four-element array of describing, for each short segment n, the count of photons qualifying in each quality group. (n,1) = nominal, (n,2) = possible afterpulse, (n,3) = possible impulse response effect, (n,4) = possible TEP Source: ATL13 ATBD, Table 5-4b
segment_ref_elev elevation	FLOAT(:) INVALID_R4B	radians	Elevation of the unit pointing vector for the reference photon in the local ENU frame in radians. The angle is measured from east-north plane and positive towards up. Source: ATL13 ATBD, Section 5.3.5 (A)
segment_slope_trk_bdy	FLOAT(:) INVALID_R4B	m/m	Along track water body surface slope, reported per short segment ID per water body. Source: ATL13 ATBD, Section 5.3.5 (A)
segment_tide_earth_free2mean	FLOAT(:) INVALID_R4B	meters	Segment rate value to convert solid earth tide from the tide-free system that was applied in ATL03 to photon heights to the ht_water_surf to the mean-tide system. Subtract value from ht_water_surf to reference it in the mean-tide system. Applicable value at reporting location for all short segment statistics. Source: ATL03 ATBD, Section 6.3.8
segment_tide_equilibrium	FLOAT(:) INVALID_R4B	meters	Long period equilibrium tide self-consistent with ocean tide model (+- 0.04 m). Although available at short segment rate for all water body types, value is provide mainly for transitional tidal and coastal water (types 6 and 7) and the largest lakes of Type 1 (~> 10,000 km2) for user's discretion. Source: ATL03
segment_tide_ocean	FLOAT(:) INVALID_R4B	meters	Ocean tides including diurnal and semi-diurnal (harmonic analysis (+-4 m)). Although available at short segment rate for all water body types, value is provide mainly for transitional tidal and coastal water (types 6 and 7) and the largest lakes of Type 1 (~> 10,000 km2) for user's discretion. Source: ATL03
significant_wave_ht	FLOAT(:) INVALID_R4B	meters	Significant wave height Source: section 5.3.3 (C)
snow_ice_atl09	INTEGER(:) INVALID_I4B	1	NOAA snow/ice flag scaled by ATL09 (0=ice-free water, 1=snow-free land, 2=snow, 3=ice, 127=invalid) Source: ATL13 ATBD, Section 5.3.5 (A)

Name Standard Name	Type(Dims) FillValue	Units	Description
			Flags: 0()=ice_free_water, 1()=snow_free_land, 2()=snow, 3()=ice, 127()=invalid
sseg_dist_from_eq Along-track distance	DOUBLE(:) INVALID_R8B	meters	Along-track distance from the equator to the first photon in the short segment. Source: ATL13 ATBD, Section 5.3.2 (C)
sseg_end_lat latitude	DOUBLE(:) -	degrees	Latitude at which the short segment ends. May be a signal or non-signal photon. Source: ATL13 ATBD, Section 5.3.2 (C)
sseg_end_lon longitude	DOUBLE(:) -	degrees	Longitude at which the short segment ends. May be a signal or non-signal photon. Source: ATL13 ATBD, Section 5.3.2 (C)
sseg_length Length	DOUBLE(:) INVALID_R8B	meters	Distance from the first to the last photon in the short segment. Source: ATL13 ATBD, Section 5.3.2 (C)
sseg_mean_lat latitude	DOUBLE(:) INVALID_R8B	degrees	Mean latitude of the signal-qualified photons in a short segment. Source: ATL13 ATBD, Section 5.3.5 (A)
sseg_mean_lon longitude	DOUBLE(:) INVALID_R8B	degrees	Mean longitude of the signal-qualified photons in a short segment. Source: ATL13 ATBD, Section 5.3.5 (A)
sseg_mean_time time	DOUBLE(:) INVALID_R8B	Seconds since 2018-01-01	Mean time of the signal-qualified photons in a short segment. Source: ATL13 ATBD, Section 5.3.5 (A)
sseg_sig_ph_cnt	INTEGER_8(:) INVALID_I8B	1	Count of signal photons in short segment, full or partial. Source: ATL13 ATBD, Section 5
sseg_start_lat latitude	DOUBLE(:) -	degrees	Latitude at which the short segment begins. May be a signal or non-signal photon. Source: ATL13 ATBD, Section 5.3.2 (C)
sseg_start_lon longitude	DOUBLE(:) -	degrees	Longitude at which the short segment begins. May be a signal or non-signal photon. Source: ATL13 ATBD, Section 5.3.2 (C)
stdev_water_surf	FLOAT(:) INVALID_R4B	meters	Derived standard deviation of water surface, calculated over long segments (when available) with result reported at each short segment location tag contained within. Source: section 5.3.3 (C)
subsurface_attenuation	FLOAT(:) INVALID_R4B	m^-1	Subsurface attenuation coefficient. Source: Section 5.3.4 (A)
subsurface_backscat_ampltd	FLOAT(:) INVALID_R4B	1	Subsurface backscatter amplitude, described in section 4.5.3, reported per long segment (default length = 10 short segments =

Name Standard Name	Type(Dims) FillValue	Units	Description
			approximately 1000 signal photons). Source: Section 5.3.4 (A)
transect_id	INTEGER_1(:) INVALID_I1B	1	Transect within a water body to which the short segment rate output belongs. Source: ATL13 ATBD, Section 5.3.2 (C)
water_depth	FLOAT(:) INVALID_R4B	meters	Depth from the mean water surface to detected bottom. Source: ATL13 ATBD, Section 5.3.4 (A)

1.5 Group: /gtx/anom_ssegs

Contains per-beam anomalous short segment output parameters.

1.5.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
anom_sseg_end_lat latitude	DOUBLE(:) -	degrees	End latitude of the anomalous short segment, based on the average latitude of the last sseg_endpoint_avg_n signal photons in the segment. Source: ATL13 ATBD, Table 5-4b
anom_sseg_end_lon longitude	DOUBLE(:) -	degrees	End longitude of the anomalous short segment, based on the average longitude of the last sseg_endpoint_avg_n signal photons in the segment. Source: ATL13 ATBD, Table 5-4b
anom_sseg_ht_delta	FLOAT(:) INVALID_R4B	meters	Height difference between anom_sseg_mode of the anomalous short segment and the transect coarse_transect_ht. Source: ATL13 ATBD, Table 5-4b
anom_sseg_lat latitude	DOUBLE(:) -	degrees	Latitude of the short segment (mean of signal class >=2 ph Lats). Source: ATL13 ATBD, Section 5.3.5 (A)
anom_sseg_length	DOUBLE(:) INVALID_R8B	meters	Length of the short segment, based on end points computed by the average of sseg_endpoint_avg_n signal photons. Source: ATL13 ATBD, Table 5-4b
anom_sseg_lon longitude	DOUBLE(:) -	degrees	Longitude of the short segment (mean of signal class >=2 ph Lons). Source: ATL13 ATBD, Section 5.3.5 (A)
anom_sseg_mean_ht_ortho	FLOAT(:) INVALID_R4B	meters	Orthometric height of anomalous short segment as determined by the mean of photon orthometric heights in the anomalous short segment with

Name Standard Name	Type(Dims) FillValue	Units	Description
			signal classification >2 Source: ATL13 ATBD, Section 5.3.5 (A)
anom_sseg_mode	FLOAT(:) INVALID_R4B	meters	Height of anomalous short segment as determined by histogram bin mode. Source: ATL13 ATBD, Table 5-4b
anom_sseg_quality	INTEGER(4, :) INVALID_I4B	1	Four-element array of describing, for each anomalous short segment n, the count of photons qualifying in each quality group. (n,1) = nominal, (n,2) = possible afterpulse, (n,3) = possible impulse response effect, (n,4) = possible TEP Source: ATL13 ATBD, Table 5-4b
anom_sseg_sig_ph_cnt	INTEGER_8(:) INVALID_I8B	1	Count of signal photons in short segment, full or partial. Source: ATL13 ATBD, Section 5
anom_sseg_start_lat latitude	DOUBLE(:) -	degrees	Start latitude of the anomalous short segment, based on the average latitude of the first sseg_endpoint_avg_n signal photons in the segment. Source: ATL13 ATBD, Table 5-4b
anom_sseg_start_lon longitude	DOUBLE(:) -	degrees	Start longitude of the anomalous short segment, based on the average longitude of the first sseg_endpoint_avg_n signal photons in the segment. Source: ATL13 ATBD, Table 5-4b
anom_sseg_stdev	FLOAT(:) INVALID_R4B	meters	Standard deviation of anomalous short segment photon height in the anomalous short segment with signal classification >= 2. Source: ATL13 ATBD, Table 5-4b
anom_sseg_time time	DOUBLE(:) -	sec	Time of the short segment (mean of signal class >=2 ph time). Source: ATL13 ATBD, Table 5-4b
anom_sseg_trigger_flag	INTEGER_1(9, :) INVALID_I1B	1	Nine element array describing justification for short segment classification as anomalous, where for each element 0 = not triggered as anomalous and 1 = triggered as anomalous due to any of the following causes: [element 1=coarse ht difference, element 2=abnormal length, element 3= histogram mode spread, element 4=histogram mode count, element 5=histogram mode intensity, element 6=invalid long segment, element 7=shore buffer designation, element 8=insufficient signal phs, element 9=transect coarse water height unavailable against which to test short segment height] Source: ATL13 ATBD, Table 5-4b Flags: 0()=not_triggered_as_anomalous, 1()=triggered_as_anomalous

Name Standard Name	Type(Dims) FillValue	Units	Description
atl13refid	INTEGER_8(:) 0	1	Unique aggregate reference number for each shape in the ATL13 Inland Water Body Mask, where digit 1 = type, digit 2 = size, digit 3 = source, and digits 4-10 = shape id. Source: ATL13 ATBD, Section 5.3.1 (C)
coarse_transect_ht	FLOAT(:) INVALID_R4B	meters	Coarse water height of transect. Source: ATL13 ATBD, Table 5-4b
cycle_number	INTEGER_1(:) -	counts	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 1,387 and adding the RGT value. Source: ATL03
rgt	INTEGER_2(:) -	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 GT2L and GT2R. During slews or off-pointing, it is possible that ground tracks may intersect the RGT. The ICESat-2 mission has 1,387 RGTs. Source: ATL03
transect_id	INTEGER_1(:) INVALID_I1B	1	Transect within a water body to which the short segment rate output belongs. Source: ATL13 ATBD, Section 5.3.2 (C)

1.6 Group: /orbit_info

Contains orbit information.

1.6.1 Attributes

data_rate	Varies. Data are only provided when one of the stored values (besides time) changes.

1.6.2 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
crossing_time time	DOUBLE(:) -	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

Name Standard Name	Type(Dims) FillValue	Units	Description
			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	INTEGER_1(:) -	1	A count of the number of exact repeats of this reference orbit. Source: Operations
lan	DOUBLE(:) -	degrees_east	Longitude at the ascending node crossing. Source: POD/PPD
orbit_number	UINT_2_LE(:) -	1	Unique identifying number for each planned ICESat-2 orbit. Source: Operations
rgt	INTEGER_2(:) -	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	INTEGER_1(:) -	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 Flags: 0()=backward, 1()=forward, 2()=transition
sc_orient_time time	DOUBLE(:) -	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

Name Standard Name	Type(Dims) FillValue	Units	Description
			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

1.7 Group: /orbit_info/bounding_polygons

Contains the bounding polygons associated with the input ATL03s.

1.7.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
lat	DOUBLE(:) -	degrees_north	Latitude values for a bounding polygon. Source: geo_poly
lon	DOUBLE(:) -	degrees_east	Longitude values for a bounding polygon. Source: geo_poly

1.8 Group: /quality_assessment

Contains quality assessment data. This may include QA counters, QA along-track data and/or QA summary data.

1.8.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
qa_granule_fail_reason	INTEGER(1) -	1	Flag indicating granule failure reason. 0=no failure; 1=processing failure; 2=insufficient data; 3=TBD3; 4=TBD4; 5=TBD5 Source: Operations Flags: 0()=no_failure, 1()=processing_failure, 2()=insufficient_data, 3()=TBD3, 4()=TBD4, 5()=TBD5
qa_granule_pass_fail	INTEGER(1) -	1	Flag indicating granule quality. 0=granule passes automatic QA. 1=granule fails automatic QA. Source: Operations Flags: 0()=PASS, 1()=FAIL