# ATL12 Product Data Dictionary

Date Generated : 2020-02-03T22:48:13

| Group: / | | |
|---|---|---|
| Conventions | (Attribute) | CF-1.6 |
| citation | (Attribute) | SET_BY_META |
| contributor_name | (Attribute) | Thomas E Neumann (thomas.neumann@nasa.gov), Thorsten Markus (thorsten.markus@nasa.gov), Suneel Bhardwaj (suneel.bhardwaj@nasa.gov) David W Hancock III (david.w.hancock@nasa.gov) |
| contributor_role | (Attribute) | Instrument Engineer, Investigator, Principle Investigator, Data Producer, Data Producer |
| creator_name | (Attribute) | SET_BY_META |
| date_created | (Attribute) | SET_BY_PGE |
| date_type | (Attribute) | UTC |
| description | (Attribute) | Sea Surface Height (SSH) of the global open ocean including the ice-free seasonal ice zone (SIZ) and near-coast regions. |
| 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) | ATL12 |
| hdfversion | (Attribute) | SET_BY_PGE |
| history | (Attribute) | SET_BY_PGE |
| identifier_file_uuid | (Attribute) | SET_BY_PGE |
| identifier_product_doi | (Attribute) | 10.5067/ATLAS/ATL12.001 |
| identifier_product_doi_authority | (Attribute) | http://dx.doi.org |
| identifier_product_format_version | (Attribute) | SET_BY_PGE |
| identifier_product_type | (Attribute) | ATL12 |
| institution | (Attribute) | SET_BY_META |
| instrument | (Attribute) | SET_BY_META |
| keywords | (Attribute) | SET_BY_META |
| keywords_vocabulary | (Attribute) | SET_BY_META |
| level | (Attribute) | L3A |
| license | (Attribute) | Data may not be reproduced or distributed without including the citation for this product included in this metadata. Data may not be distributed in an altered form without the written permission of the ICESat-2 Science Project Office at NASA/GSFC. |
| naming_authority | (Attribute) | http://dx.doi.org |
| platform | (Attribute) | SET_BY_META |
| processing_level | (Attribute) | L3A |
| project | (Attribute) | SET_BY_META |
| publisher_email | (Attribute) | SET_BY_META |
| publisher_name | (Attribute) | SET_BY_META |

| | | | | |
|---|---|---|---|---|
| publisher_url | (Attribute) | SET_BY_META | | |
| references | (Attribute) | SET_BY_META | | |
| short_name | (Attribute) | ATL12 | | |
| source | (Attribute) | SET_BY_META | | |
| spatial_coverage_type | (Attribute) | Horizontal | | |
| standard_name_vocabulary | (Attribute) | CF-1.6 | | |
| summary | (Attribute) | SET_BY_META | | |
| time_coverage_duration | (Attribute) | SET_BY_PGE | | |
| time_coverage_end | (Attribute) | SET_BY_PGE | | |
| time_coverage_start | (Attribute) | SET_BY_PGE | | |
| time_type | (Attribute) | CCSDS UTC-A | | |
| title | (Attribute) | SET_BY_META | | |

| Label (Layout) | Datatype (Dimensions) | long_name (standard_name) | units source | description |
|---|---|---|---|---|
| ds_surf_type COMPACT | INTEGER (5) | Surface Type Dimension Scale | 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<br><br>Flag Values: ['1', '2', '3', '4', '5']<br>Flag Meanings: ['land', 'ocean', 'seaice', 'landice', 'inland_water'] |
| ds_xbin CHUNKED | FLOAT (:) | 10m bin centers | meters | Bin center values for the 10m bin averaged data from the SSB calculation. |
| ds_y_bincenters CHUNKED | FLOAT (:) | Y bins center | meters | Bin center values for the y histogram. Ranges -14.995 to 14.995 meters in 1 centimeter bin size steps. |

**Group: /ancillary_data**

| | | | | |
|---|---|---|---|---|
| Description | (Attribute) | Contains information ancillary to the data product. This may include product characteristics, instrument characteristics and/or processing constants. | | |
| data_rate | (Attribute) | Data within this group pertain to the granule in its entirety. | | |

| Label (Layout) | Datatype (Dimensions) | long_name (standard_name) | units source | description |
|---|---|---|---|---|
| atlas_sdp_gps_epoch COMPACT | DOUBLE (1) | ATLAS Epoch Offset | seconds since 1980-01-06T00:00:00.000000Z Operations | 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. |
| control CONTIGUOUS | STRING (1) | Control File | 1 Operations | PGE-specific control file used to generate this granule. To re-use, replace breaks (BR) with linefeeds. |
| data_end_utc COMPACT | STRING (1) | End UTC Time of Granule (CCSDS-A, Actual) | 1 Derived | UTC (in CCSDS-A format) of the last data point within the granule. |
| data_start_utc COMPACT | STRING (1) | Start UTC Time of Granule (CCSDS-A, Actual) | 1 Derived | UTC (in CCSDS-A format) of the first data point within the granule. |
| end_cycle COMPACT | INTEGER (1) | Ending Cycle | 1 Derived | The ending cycle number associated with the data contained within this granule. The cycle number is |

| | | | | |
|---|---|---|---|---|
| | | | | the counter of the number of 91-day repeat cycles completed by the mission. |
| end_delta_time COMPACT | DOUBLE (1) | ATLAS End Time (Actual) time | seconds since 2018-01-01 Derived | Number of GPS seconds since the ATLAS SDP epoch at the last data point in the file. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed. |
| end_geoseg COMPACT | INTEGER (1) | Ending Geolocation Segment | 1 Derived | The ending geolocation segment number associated with the data contained within this granule. ICESat granule geographic regions are further refined by geolocation segments. During the geolocation process, a geolocation segment is created approximately every 20m from the start of the orbit to the end. The geolocation segments help align the ATLAS strong a weak beams and provide a common segment length for the L2 and higher products. The geolocation segment indices differ slightly from orbit-to-orbit because of the irregular shape of the Earth. The geolocation segment indices on ATL01 and ATL02 are only approximate because beams have not been aligned at the time of their creation. |
| end_gpssow COMPACT | DOUBLE (1) | Ending GPS SOW of Granule (Actual) | seconds Derived | GPS seconds-of-week of the last data point in the granule. |
| end_gpsweek COMPACT | INTEGER (1) | Ending GPSWeek of Granule (Actual) | weeks from 1980-01-06 Derived | GPS week number of the last data point in the granule. |
| end_orbit COMPACT | INTEGER (1) | Ending Orbit Number | 1 Derived | The ending orbit number associated with the data contained within this granule. The orbit number increments each time the spacecraft completes a full orbit of the Earth. |
| end_region COMPACT | INTEGER (1) | Ending Region | 1 Derived | The ending product-specific region number associated with the data contained within this granule. ICESat-2 data products are separated by geographic regions. The data contained within a specific region are the same for ATL01 and ATL02. ATL03 regions differ slightly because of different geolocation segment locations caused by the irregular shape of the Earth. The region indices for other products are completely independent. |
| end_rgt COMPACT | INTEGER (1) | Ending Reference Groundtrack | 1 Derived | The ending reference groundtrack (RGT) number associated with the data contained within this granule. There are 1387 reference groundtrack in the ICESat-2 repeat orbit. The reference groundtrack increments each time the spacecraft completes a full orbit of the Earth and resets to 1 each time the spacecraft completes a full cycle. |
| granule_end_utc COMPACT | STRING (1) | End UTC Time of Granule (CCSDS-A, Requested) | 1 Derived | Requested end time (in UTC CCSDS-A) of this granule. |
| granule_start_utc COMPACT | STRING (1) | Start UTC Time of Granule (CCSDS-A, Requested) | 1 Derived | Requested start time (in UTC CCSDS-A) of this granule. |

| qa_at_interval COMPACT | DOUBLE (1) | QA Along-Track Interval | 1 control | Statistics time interval for along-track QA data. |
|---|---|---|---|---|
| release COMPACT | STRING (1) | Release Number | 1 Operations | Release number of the granule. The release number is incremented when the software or ancillary data used to create the granule has been changed. |
| start_cycle COMPACT | INTEGER (1) | Starting Cycle | 1 Derived | The starting cycle number associated with the data contained within this granule. The cycle number is the counter of the number of 91-day repeat cycles completed by the mission. |
| start_delta_time COMPACT | DOUBLE (1) | ATLAS Start Time (Actual) time | seconds since 2018-01-01 Derived | Number of GPS seconds since the ATLAS SDP epoch at the first data point in the file. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed. |
| start_geoseg COMPACT | INTEGER (1) | Starting Geolocation Segment | 1 Derived | The starting geolocation segment number associated with the data contained within this granule. ICESat granule geographic regions are further refined by geolocation segments. During the geolocation process, a geolocation segment is created approximately every 20m from the start of the orbit to the end. The geolocation segments help align the ATLAS strong a weak beams and provide a common segment length for the L2 and higher products. The geolocation segment indices differ slightly from orbit-to-orbit because of the irregular shape of the Earth. The geolocation segment indices on ATL01 and ATL02 are only approximate because beams have not been aligned at the time of their creation. |
| start_gpssow COMPACT | DOUBLE (1) | Start GPS SOW of Granule (Actual) | seconds Derived | GPS seconds-of-week of the first data point in the granule. |
| start_gpsweek COMPACT | INTEGER (1) | Start GPSWeek of Granule (Actual) | weeks from 1980-01-06 Derived | GPS week number of the first data point in the granule. |
| start_orbit COMPACT | INTEGER (1) | Starting Orbit Number | 1 Derived | The starting orbit number associated with the data contained within this granule. The orbit number increments each time the spacecraft completes a full orbit of the Earth. |
| start_region COMPACT | INTEGER (1) | Starting Region | 1 Derived | The starting product-specific region number associated with the data contained within this granule. ICESat-2 data products are separated by geographic regions. The data contained within a specific region are the same for ATL01 and ATL02. ATL03 regions differ slightly because of different geolocation segment locations caused by the irregular shape of the Earth. The region indices for other products are completely independent. |
| start_rgt COMPACT | INTEGER (1) | Starting Reference Groundtrack | 1 Derived | The starting reference groundtrack (RGT) number associated with the data contained within this granule. There are 1387 reference groundtrack in the ICESat-2 repeat orbit. The reference groundtrack increments each time the spacecraft completes a full orbit of the Earth and resets to 1 each time the spacecraft completes a full cycle. |

| Label (Layout) | Datatype (Dimensions) | long_name (standard_name) | units source | description |
|---|---|---|---|---|
| version COMPACT | STRING (1) | Version | 1 Operations | Version number of this granule within the release. It is a sequential number corresponding to the number of times the granule has been reprocessed for the current release. |

**Group: /ancillary_data/ocean**

| Description | (Attribute) | Contains general ancillary parameters. | | |
|---|---|---|---|---|
| **Label (Layout)** | **Datatype (Dimensions)** | **long_name (standard_name)** | **units source** | **description** |
| cld_thres COMPACT | FLOAT (1) | Cloud Threshold | percent Operations | Data associated with cloud percentages above this threshold are not processed. |
| coarse_interval COMPACT | DOUBLE (1) | Coarse selection interval | seconds Operations | The number of seconds of data used for coarse selection (normally equivalent to 400 laser pulses). |
| depth_shore COMPACT | FLOAT (1) | Depth Shore | meters Control File Override ( Defined in Ocean ATBD section 4.2.1.2 Coarse selection ) | If ocean depth is less than depth_shore, then the current ocean segment is too close to land for ocean processing. |
| fine_max_secs COMPACT | DOUBLE (1) | Maximum Integration Time | seconds Operations | Maximum fine segment duration of fine selection segment (equivalent to required number of tx pulses). |
| fine_min_sig COMPACT | INTEGER (1) | Minimum Signal Photons | counts Operations | Minimum number of signal photons required to perform fine selection. |
| hist_bin_size COMPACT | FLOAT (1) | Histogram Bin Size | meters Operations | Height histogram and impulse response bin size in meters. |
| hist_bot COMPACT | FLOAT (1) | Histogram Bottom | meters Operations | Bottom (minimum height) of the coarse and fine select histograms. |
| hist_nbins COMPACT | INTEGER (1) | Number of histogram bins. | counts Derived | Number of bins in each histogram. |
| hist_top COMPACT | FLOAT (1) | Histogram Top | meters Operations | Top (maximum height) of the coarse and fine select histograms. |
| layer_switch COMPACT | INTEGER_1 (1) | layer_switch | 1 Control File Override ( Defined in Ocean ATBD section 4.2.1.2 Coarse selection ) | Switch to enable usage of layer_flag from ATL09. 0 - Ignore layer_flag when processing ocean data (default); 1 - Process a 14 geoseg ocean segment only if layer_flag is also 1.<br><br>Flag Values: ['0', '1'] Flag Meanings: ['ignore_layer_flag', 'use_layer_flag'] |
| min_ph_pcnt COMPACT | FLOAT (1) | Minimum Photon Percentage | percent Operations | Minimum percentage of the selected coarse photons being selected in fine_sel to continue processing. |
| oc_region COMPACT | INTEGER (1) | Ocean Region Index | 1 Operations | The ocean region covered within this granule. |
| ocseg_min_sig COMPACT | INTEGER (1) | Ocean Segment Minimum Signal Photons | counts Ocean ATBD Sect. 5.2.6.2 step I.Sect. 5.2.4 step G | Minimum number of signal photons required to process an ocean segment. |
| proc_interval COMPACT | INTEGER (1) | Processing interval | counts Operations | The number of 20 meter segments read at once from ATL03. |
| pts2bin COMPACT | INTEGER (1) | Bins in Boxcar Smoother | 1 Control File Override ( Defined in Ocean ATBD, section 5.3.2 step D and Table 5) | Defines the number of bins used in the boxcar smoother |
| sig_thres COMPACT | FLOAT (1) | Signal Threshold | percent Operations | Threshold for photons to be considered signal. |

**Group: /gtx**

| Description | (Attribute) | This ground contains parameters and subgroups related a specific groundtrack. | | |
|---|---|---|---|---|

| data_rate | (Attribute) | Each subgroup identifies its particular data rate. | | |
|---|---|---|---|---|
| **Group: /gtx/ssh_segments** | | | | |
| Description | (Attribute) | Contains parameters relating to the calculated surface height. | | |
| data_rate | (Attribute) | Data within this group are stored at the variable ocean processing segment rate. | | |
| Label<br>(Layout) | Datatype<br>(Dimensions) | long_name<br>(standard_name) | units<br>source | description |
| delt_seg<br>CHUNKED | DOUBLE<br>(:) | Ocean Segment Duration | seconds<br>Ocean ATBD Sect. 5.2.4 step N. | Time duration segment |
| delta_time<br>CHUNKED | DOUBLE<br>(:) | Elapsed GPS seconds time | seconds since 2018-01-01<br>telemetry | Mean time for the ocean surface 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. |
| latitude<br>CHUNKED | DOUBLE<br>(:) | Mean latitude of surface segment latitude | degrees_north<br>Ocean ATBD | Mean latitude of surface photons in segment |
| longitude<br>CHUNKED | DOUBLE<br>(:) | Mean longitude of surface segment longitude | degrees_east<br>Ocean ATBD | Mean longitude of surface photons in segment |
| **Group: /gtx/ssh_segments/heights** | | | | |
| Description | (Attribute) | Contains parameters including and relating to the calculated sea surface height. | | |
| data_rate | (Attribute) | Data within this group are stored at the variable ocean processing segment rate. | | |
| Label<br>(Layout) | Datatype<br>(Dimensions) | long_name<br>(standard_name) | units<br>source | description |
| bin_ssbias<br>CHUNKED | FLOAT<br>(:) | Sea State Bias | meters<br>Ocean ATBD | Mean of linear fit removed from surface photon height (4.3.1) |
| h<br>CHUNKED | FLOAT<br>(:) | mean sea surface height | meters<br>Ocean ATBD Sect. 5.2.6.2 step I, equation 21 | Mean sea surface height in meters computed as the mean of the distribution represented as an optimum 2-Gaussian mixture fit to the DOT plus the geoid and the mean removed in detrending the surface photon heights for analysis. |
| h_kurtosis<br>CHUNKED | FLOAT<br>(:) | kurtosis of sea surface height | 1<br>Ocean ATBD Sect. 5.2.6.2 step I, equation 24. | Excess kurtosis of sea surface height of the distribution represented as an optimum 2-Gaussian mixture fit to the DOT. |
| h_skewness<br>CHUNKED | FLOAT<br>(:) | Skewness of sea surface height | 1<br>Ocean ATBD Sect. 5.2.6.2 step I, equation 23 | Skewness of photon sea surface height of the distribution represented as an optimum 2-Gaussian mixture fit to the DOT. |
| h_var<br>CHUNKED | FLOAT<br>(:) | Variance of fit | meters^2<br>Ocean ATBD Sect. 5.2.6.2 step I, equation 22. | Variance in meters squared of the distribution represented as an optimum 2-Gaussian mixture fit to the DOT. |
| htybin<br>CHUNKED | FLOAT<br>(: x :) | Average 10m height | meters<br>Ocean ATBD | The 10-m bin averaged heights from the SSB calculation for each ocean segment. |
| length_seg<br>CHUNKED | DOUBLE<br>(:) | Length of segment | meters<br>Ocean ATBD Sect. 5.2.4 step N. | Length of segment (m) |
| meanoffit2<br>CHUNKED | FLOAT<br>(:) | coarse Sea surface height of segment | meters<br>Ocean ATBD Sect. 5.2.4 step G | Average of the linear fit, P0+P1*X, where P0 and P1 are the coefficients of the linear fit to the initial choice of surface photons and X is the array of along-track positions of the final choice of surface photons |

| mix_m1 CHUNKED | FLOAT (:) | Fraction of component 1 Gaussian mixture | 1 Ocean ATBD Sect. 5.2.6.2 step I. | Fraction of component 1 in 2-component Gaussian mixture |
|---|---|---|---|---|
| mix_m2 CHUNKED | FLOAT (:) | Fraction of component 2 Gaussian mixture | 1 Ocean ATBD Sect. 5.2.6.2 step I. | Fraction of component 2 in 2-component Gaussian mixture |
| mix_mu1 CHUNKED | FLOAT (:) | Mean of component 1 Gaussian mixture | meters Ocean ATBD Sect. 5.2.6.2 step I. | Mean of component 1 in 2-component Gaussian mixture |
| mix_mu2 CHUNKED | FLOAT (:) | Mean of component 2 Gaussian mixture | meters Ocean ATBD Sect. 5.2.6.2 step I. | Mean of component 2 in 2-component Gaussian mixture |
| mix_sig1 CHUNKED | FLOAT (:) | Standard deviation of component 1 Gaussian mixture | meters Ocean ATBD Sect. 5.2.6.2 step I. | Standard deviation of component 1 in 2-component Gaussian mixture |
| mix_sig2 CHUNKED | FLOAT (:) | Standard deviation of component 2 Gaussian mixture | meters Ocean ATBD Sect. 5.2.6.2 step I. | Standard deviation of component 2 in 2-component Gaussian mixture |
| n_pulse_seg CHUNKED | FLOAT (:) | Number laser pulses segment | counts Ocean ATBD | Number of laser pulses in segment |
| p0 CHUNKED | FLOAT (:) | Intercept of Linear Fit | meters Ocean ATBD | Zero intercept of the linear fit used to detrend the photon heights before going into the second round of surface finding |
| p1 CHUNKED | FLOAT (:) | Slope of Linear Fit | meters/meter Ocean ATBD | Slope of linear fit versus along-track distance to surface photon height |
| slope_seg CHUNKED | DOUBLE (:) | Sea surface slope of segment | meters/meters Ocean ATBD Sect. 5.2.6.2 step I.Sect. 5.2.4 step G | Sea surface slope equal to the linear coefficient , P1, of the linear fit used to detrend the photon heights before going into the second round of surface finding. |
| swh CHUNKED | FLOAT (:) | swh | meters Ocean ATBD | Significant wave height estimated as 4 times the standard deviation of along track 10-m bin averaged surface height |
| xbind CHUNKED | FLOAT (: x :) | Average distance for each 10m bin | meters Ocean ATBD | Averages of along-track distance in each 10-meter bin |
| xrbin CHUNKED | FLOAT (: x :) | Average 10m photon rate | photons/meter Ocean ATBD | The 10-m bin averaged photon rate from the SSB calculation for each ocean segment. |
| y CHUNKED | FLOAT (: x :) | PDF of Height | 1/meter Ocean ATBD | Probability density function of photon surface height |
| ykurt CHUNKED | FLOAT (:) | ykurt | 1 Ocean ATBD | Excess Kurtosis = (fourth moment of Y)/ Yvar squared, all -3. The fourth moment of Y is calculated as the integral of Y(z) times z to the fourth, all divided by the integral of Y(z). |
| ymean CHUNKED | FLOAT (:) | ymean | meters Ocean ATBD | Mean=first moment of Y calculated as the integral of Y(z) times z all divided by the integral of Y(z). This, should be ~0 = h -meanoffit2 |
| yskew CHUNKED | FLOAT (:) | yskew | 1 Ocean ATBD | Skewness = (third moment of Y)/ Yvar to the 3/2 power. The third moment of Y is calculated as the integral of Y(z) times z cubed, all divided by the integral of Y(z). |

| yvar<br>CHUNKED | FLOAT<br>(:) | yvar | meter^2<br>Ocean ATBD | Variance= second moment of Y calculated as the integral of Y(z) times z squared, all divided by the integral of Y(z). |
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| **Group: /gtx/ssh_segments/stats** | | | | |
|---|---|---|---|---|
| Description | (Attribute) | Contains parameters related to quality and corrections on the sea surface height parameters | | |
| data_rate | (Attribute) | Data within this group are stored at the variable ocean processing segment rate. | | |
| Label<br>(Layout) | Datatype<br>(Dimensions) | long_name<br>(standard_name) | units<br>source | description |
| backgr_seg<br>CHUNKED | FLOAT<br>(:) | ATL03 background | 1/meters<br>Ocean ATBD | backgrd_atlas/bckgrd_rate from ATL03 averaged over the segment |
| dac_seg<br>CHUNKED | FLOAT<br>(:) | Dynamic Atmosphere Correction | meters<br>ATL03 | Ocean segment average of dynamic atmospheric correction (DAC) includes inverted barometer (IB) affect |
| depth_ocn_seg<br>CHUNKED | FLOAT<br>(:) | Ocean depth | meters<br>Ocean ATBD | The average of depth_ocn of geo-segments used in the ocean segment |
| first_geoseg<br>CHUNKED | INTEGER<br>(:) | ATL03 Geolocation Segment | 1<br>Ocean ATBD | The first of the geosegment ids (segment_id) for each ocean segment |
| first_pce_mframe_cnt<br>CHUNKED | UINT_4_LE<br>(:) | First PCE Major frame ID | counts<br>l1a/atlas/pcex/altimeter/photons_s and photons_w | First Major Frame ID in the SSH segment |
| first_tx_pulse<br>CHUNKED | INTEGER<br>(:) | First Transmit Pulse | counts<br>Ocean ATBD | First Transmit pulse in along-track segment |
| fpb_corr<br>CHUNKED | FLOAT<br>(:) | first photon bias correction | meters<br>Ocean ATBD | Estimated first-photon bias correction to mean segment height = 0 pending findings to the contrary for the ocean |
| fpb_corr_stdev<br>CHUNKED | FLOAT<br>(:) | fpb_corr_stdev | meters<br>Ocean ATBD | Estimated error in fpb_corr = 0 pending findings to the contrary |
| geoid_seg<br>CHUNKED | FLOAT<br>(:) | Geoid | meters<br>ATL03 | Ocean segment average of geoid height above the WGS 84 reference ellipsoid (range -107 to 86 m) |
| last_pce_mframe_cnt<br>CHUNKED | UINT_4_LE<br>(:) | Last PCE Major frame ID | counts<br>l1a/atlas/pcex/altimeter/photons_s and photons_w | Last Major Frame ID in the SSH segment |
| last_tx_pulse<br>CHUNKED | INTEGER<br>(:) | Last Transmit Pulse | counts<br>Ocean ATBD | Last Transmit pulse in along-track segment |
| layer_flag_seg<br>CHUNKED | INTEGER<br>(:) | Layer Flag | 1<br>Ocean ATBD | The layer flag from ATL09 that is in effect over 50% of the ocean segment, 0 indicating absence of clouds and forward scattering, and 1 indicating possibility of forward scattering as in ATL09 |
| n_photons<br>CHUNKED | INTEGER_8<br>(:) | Number surface photons segment | counts<br>Ocean ATBD | Number of surface photons found for the segment |
| n_ttl_photon<br>CHUNKED | INTEGER_8<br>(:) | Number photons segment | counts<br>Ocean ATBD Sect. 5.2.4 step N. | Number of photons in the 15-m ocean downlink band |
| neutat_delay_total_seg<br>CHUNKED | FLOAT<br>(:) | Total Neutral Atmospheric Delay | meters<br>ATL03 | Ocean segment average of total neutral atmosphere delay correction (wet + dry) |
| orbit_number<br>CHUNKED | INTEGER_2<br>(:) | Orbit Number | 1<br>ATL03 | Unique identifying number for each planned ICESat-2 orbit |
| photon_rate<br>CHUNKED | FLOAT<br>(:) | Photon count rate, averaged over the segment | 1/meters<br>Ocean ATBD Sect. 5.2.4 step N. | Photon count rate, averaged over the segment |
| photonns_rate | FLOAT | Noise photon | 1/meters | Noise photon count rate, averaged over the |

| | | | | |
|---|---|---|---|---|
| CHUNKED | (:) | count rate, averaged over the segment | Ocean ATBD Sect. 5.2.4 step N.Sect. 5.2.4 step N | segment |
| ref_azimuth_seg CHUNKED | FLOAT (:) | Azimuth azimuth | radians ATL03 | Ocean segment average of azimuth 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 |
| ref_elev_seg CHUNKED | FLOAT (:) | elevation elevation | radians ATL03 | Ocean segment average of elevation of the unit pointing vector for the reference photon in the local ENU frame in radians. The angle is measured from the East-North plane and positive towards Up |
| seg_dist_x_seg CHUNKED | DOUBLE (:) | Distance along-track | meters Ocean ATBD | Ocean segment average of the along-track distance from the equator crossing to the start of the 20-m geolocation segments included in the ocean segment |
| segment_id CHUNKED | INTEGER (:) | ATL03 geolocation segment ID number. | 1 ATL03 | A 7 digit number identifying the first along-track ATL03 geolocation segment number in the ocean height segment |
| solar_azimuth_seg CHUNKED | FLOAT (:) | solar azimuth | degrees_east ATL03 | Ocean segment average of the azimuth of the sun position vector from the reference photon bounce point position in the local ENU frame. The angle is measured from North and is positive towards East. The average is provided in degrees. |
| solar_elevation_seg CHUNKED | FLOAT (:) | solar elevation | degrees ATL03 | Ocean segment average of the elevation of the sun position vector from the reference photon bounce point position in the local ENU frame. The angle is measured from the East-North plane and is positive towards Up. The average is provided in degrees. |
| ss_corr CHUNKED | FLOAT (:) | subsurface scattering correction | meters Ocean ATBD | Subsurface scattering correction, placeholder = zero pending further findings to the contrary |
| ss_corr_stdev CHUNKED | FLOAT (:) | ss_corr_stdev | meters Ocean ATBD | Estimated error of subsurface scattering correction, placeholder = zero pending further findings to the contrary |
| surf_type_prcnt CHUNKED | FLOAT (: x 5) | Percent Surface Type | 1 ATL03 | Percent of each surface type (land, ocean, sea ice, land ice, inland water from masks) in the ocean segment |
| tide_earth_seg CHUNKED | FLOAT (:) | Earth Tide | meters ATL03 | Ocean segment average of solid earth tides |
| tide_equilibrium_seg CHUNKED | FLOAT (:) | Equilibrium Tide | meters ATL03 | Long period equilibrium tide self-consistent with ocean tide model (+-0.04m). |
| tide_load_seg CHUNKED | FLOAT (:) | Load Tide | meters ATL03 | Ocean segment average of local displacement due to ocean loading (-6 to 0 cm) |
| tide_oc_pole_seg CHUNKED | FLOAT (:) | Ocean Pole Tide | meters ATL03 | Ocean segment average of oceanic surface rotational deformation due to polar motion (-2 to +2 mm) |
| tide_ocean_seg CHUNKED | FLOAT (:) | Ocean Tide | meters ATL03 | Ocean segment average of ocean tides including diurnal and semi-diurnal (harmonic analysis) and longer period tides (dynamic and self-consistent equilibrium) |
| tide_pole_seg CHUNKED | FLOAT (:) | Solid Earth Pole Tide | meters ATL03 | Solid Earth Pole Tide -Rotational deformation due to polar motion (-1.5 to 1.5 cm). |
| **Group: /orbit_info** | | | | |
| Description | (Attribute) | Contains orbit information. | | |
| data_rate | (Attribute) | Varies. Data are only provided when one of the stored values (besides time) changes. | | |

| Label<br>(Layout) | Datatype<br>(Dimensions) | long_name<br>(standard_name) | units<br>source | description |
|---|---|---|---|---|
| crossing_time<br>CHUNKED | DOUBLE<br>(:) | Ascending Node<br>Crossing Time<br>time | seconds since 2018-01-01<br>POD/PPD | The time, in seconds since the ATLAS SDP GPS Epoch, at which the ascending node crosses the equator. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed. |
| cycle_number<br>CHUNKED | INTEGER_1<br>(:) | Cycle Number | 1<br>Operations | A count of the number of exact repeats of this reference orbit. |
| lan<br>CHUNKED | DOUBLE<br>(:) | Ascending Node<br>Longitude | degrees_east<br>POD/PPD | Longitude at the ascending node crossing. |
| orbit_number<br>CHUNKED | UINT_2_LE<br>(:) | Orbit Number | 1<br>Operations | Unique identifying number for each planned ICESat-2 orbit. |
| rgt<br>CHUNKED | INTEGER_2<br>(:) | Reference<br>Ground track | 1<br>POD/PPD | The reference ground track (RGT) is the track on the earth at which a specified unit vector within the observatory is pointed. Under nominal operating conditions, there will be no data collected along the RGT, as the RGT is spanned by 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. |
| sc_orient<br>CHUNKED | INTEGER_1<br>(:) | Spacecraft<br>Orientation | 1<br>POD/PPD | This parameter tracks the spacecraft orientation between forward, backward and transitional flight modes. ICESat-2 is considered to be flying forward when the weak beams are leading the strong beams; and backward when the strong beams are leading the weak beams. ICESat-2 is considered to be in transition while it is maneuvering between the two orientations. Science quality is potentially degraded while in transition mode.<br><br>Flag Values: ['0', '1', '2']<br>Flag Meanings: ['backward', 'forward', 'transition'] |
| sc_orient_time<br>CHUNKED | DOUBLE<br>(:) | Time of Last<br>Spacecraft<br>Orientation<br>Change<br>time | seconds since 2018-01-01<br>POD/PPD | The time of the last spacecraft orientation change between forward, backward and transitional flight modes, expressed in seconds since the ATLAS SDP GPS Epoch. ICESat-2 is considered to be flying forward when the weak beams are leading the strong beams; and backward when the strong beams are leading the weak beams. ICESat-2 is considered to be in transition while it is maneuvering between the two orientations. Science quality is potentially degraded while in transition mode. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed. |
| **Group: /quality_assessment** | | | | |
| Description | (Attribute) | Contains quality assessment data. This may include QA counters, QA along-track data and/or QA summary data. | | |

| Label<br>(Layout) | Datatype<br>(Dimensions) | long_name<br>(standard_name) | units<br>source | description |
|---|---|---|---|---|
| qa_granule_fail_reason<br>COMPACT | INTEGER<br>(1) | Granule Failure<br>Reason | 1<br>Operations | Flag indicating granule failure reason. 0=no failure; 1=processing error; 2=Insufficient output data was generated; 3=TBD Failure; 4=TBD_Failure; 5=other failure.<br><br>Flag Values: ['0', '1', '2', '3', '4', '5']<br>Flag Meanings: ['no_failure', 'PROCESS_ERROR', 'INSUFFICIENT_OUTPUT', 'failure_3', 'failure_4', 'OTHER_FAILURE'] |
| qa_granule_pass_fail<br>COMPACT | INTEGER<br>(1) | Granule Pass<br>Flag | 1<br>Operations | Flag indicating granule quality. 0=granule passes automatic QA. 1=granule fails automatic QA.<br><br>Flag Values: ['0', '1']<br>Flag Meanings: ['PASS', 'FAIL'] |
| **Group: /quality_assessment/along_track** | | | | |
| Description | (Attribute) | Along-track statistics | | |

| Label<br>(Layout) | Datatype<br>(Dimensions) | long_name<br>(standard_name) | units<br>source | description |
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