ATL17 Product Data Dictionary

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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)	The ICESat-2 ATL17 standard data product reports monthly global cloud fraction, total column optical depth over the oceans, polar cloud fraction, blowing snow frequency, apparent surface reflectivity, and ground detection frequency.
featureType	(Attribute)	gridded
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)	ATL17
hdfversion	(Attribute)	SET_BY_PGE
history	(Attribute)	SET_BY_PGE
identifier_file_uuid	(Attribute)	SET_BY_PGE
identifier_product_doi	(Attribute)	10.5067/ATLAS/ATL17.001
identifier_product_doi_authority	(Attribute)	http://dx.doi.org
identifier_product_format_version	(Attribute)	SET_BY_PGE
identifier_product_type	(Attribute)	ATL17
institution	(Attribute)	SET_BY_META
instrument	(Attribute)	SET_BY_META
keywords	(Attribute)	SET_BY_META
keywords_vocabulary	(Attribute)	SET_BY_META
level	(Attribute)	L3B
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)	L3B
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)	ATL17		
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
asr_obs_grid CHUNKED	FLOAT (: x :)	Global apparent surface reflectance observation grid	1 ATM L3B ATBD, Section 3.9	Global apparent surface reflectance (ASR) observation grid. The number of observations used to compute the average Global apparent surface reflectance (ASR). Only surface signal detected ASR 25Hz observations (apparent_surf_reflec > 0.0) in each grid cell are used to compute the cell global ASR (global_asr).
data_qa_flag COMPACT	INTEGER_1 (1)	data quality flag 1	auxiliaryInformation L3B ATM ATBD, Section 5.0	Data quality flag. TBD flag that may be used to indicate data quality.
delta_time_beg COMPACT	DOUBLE (1)	time seconds since 2018-01-01	physicalMeasurement L3B ATM ATBD, Section 5.0, Tables 2, 3	Start time parameter. The start time/date of the data used to make the product. Number of GPS seconds since the ATLAS SDP epoch at the beginning of the data collection. 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.
delta_time_end COMPACT	DOUBLE (1)	time seconds since 2018-01-01	physicalMeasurement L3B ATM ATBD, Section 5.0, Tables 2, 3	End time parameter. The end time/date of the data used to make the product. Number of GPS seconds since the ATLAS SDP epoch at the end of the data collection. 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.
global_aerosol_frac CHUNKED	FLOAT (: x :)	Global Aerosol Fraction	1 ATM L3B ATBD, Section 3.1.1	Global aerosol fraction atmospheric parameter. For each global grid cell this represents the ratio of the number of 25Hz observations with at least one aerosol layer (layer_attr() = 2 within cloud_flag_atm layers) to the number of all 25Hz observations (global_cloud_aerosol_obs_grid) in the cell. The gridded global aerosol fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (global_cloud_aerosol_obs_grid => obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.

global_asr CHUNKED	FLOAT (: x :)	Global Apparent Surface Reflectance (0-1)	1 ATM L3B ATBD, Section 3.5	Global apparent surface reflectance (ASR) atmospheric parameter. For each global grid cell this represents the ratio of the summation of the detected surface signal apparent surface reflectivity 25Hz observations (apparent_surf_reflec > 0.0) to the number of detected surface signal ASR 25Hz observations (asr_obs_grid) in the cell. The gridded average global ASR values are produced when the number of detected surface signal ASR 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (asr_obs_grid => obs_minimum); otherwise set to invalid. ASR represents the true surface reflectivity modified by the two-way atmospheric transmission. Generally a number between 0 and 1. ASR is related to the ratio of the received energy to the transmitted energy, assuming a Lambertian surface reflectance. The required surface signal apparent surface reflectance (apparent_surf_reflec) values are determined in the L3A ATM processing.
global_cloud_aerosol_obs_grid CHUNKED	FLOAT (: x :)	Global cloud and aerosol fraction observation grid	1 ATM L3B ATBD, Section 3.9	Global cloud fraction and aerosol fraction observation grid. The number of observations used to compute the average Global cloud fraction and the average Global aerosol fraction. This number represents all 25Hz observations in each cell. Only 25Hz observations with at least one cloud layer (layer_attr() = 1) in each grid cell are used to compute the cell global cloud fraction (global_cloud_frac). Only 25Hz observations with at least one aerosol layer (layer_attr() = 2) in each grid cell are used to compute the cell global aerosol fraction (global_aerosol_frac).
global_cloud_frac CHUNKED	FLOAT (: x :)	Global Cloud Fraction	1 ATM L3B ATBD, Section 3.1	Global cloud fraction atmospheric parameter. For each global grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) to the number of all 25Hz observations (global_cloud_aerosol_obs_grid) in the cell. The gridded global cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (global_cloud_aerosol_obs_grid => obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing. A cloud fraction value of 0 represents a totally cloud free grid cell; a cloud fraction value of 1 indicates the grid cell is completely covered with clouds.
global_column_od CHUNKED	FLOAT (: x :)	Global Total Column Optical Depth (0-1.5)	1 ATM L3B ATBD, Section 3.2	Global (over ocean) total column optical depth atmospheric parameter. For each global grid cell this represents the ratio of the summation of the valid over-ocean (column_od_asr_qf = 4 for water) column optical depth 25Hz observations (column_od_asr .ne. INVALID) to the number of valid over-ocean column optical depth 25Hz observations (tcod_obs_grid) in that cell. The average over-ocean global total column optical depth values are produced when the number of valid over-ocean column optical depth 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (tcod_obs_grid => obs_minimum); otherwise set to invalid. The required total column optical depth (column_od_asr) is estimated from the apparent surface reflectance (ASR) and the assumed actual surface reflectance. The required total column optical depth from ASR quality flag (column_od_asr_qf) supplies the reflecting surface type for over-water surface determination. Both ATL09 parameters are supplied from the L3A ATM processing. The 0 to 1.5 value range constraint is applied to the global image, and is not applied to the gridded parameter values.
global_grid_lat CHUNKED	DOUBLE (:)	Global grid latitudes latitude	degrees_north ATM L3B ATBD, Section 2	Latitudes of the global grids; applicable to each grid cell. ATM histogram top latitude derived from the ATM range window geolocation. Based on WGS84 Earth-centered, Earth-fixed terrestrial reference system and geodetic data. Direction:

				North=+ values.
global_grid_lon CHUNKED	DOUBLE (:)	Global grid longitudes longitude	degrees_east ATM L3B ATBD, Section 2	Longitudes of the global grids; applicable to each grid cell. ATM histogram top longitude derived from the ATM range window geolocation. Based on WGS84 Earth-centered, Earth-fixed terrestrial reference system and geodetic data. Direction: East=+ values.
global_grnd_detect CHUNKED	FLOAT (: x :)	Global Ground Detection Frequency (fraction)	fraction ATM L3B ATBD, Section 3.6	Global ground detection frequency atmospheric parameter. For each global grid cell this represents the number of detected surface signal 25Hz observations (surface_sig > 0.0) to the number of all 25Hz observations in the cell. The gridded global ground detection values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The calculation results in a fractional value. The required detected surface signal (surface_sig) is determined from the surface signal count of the number of photons in the detected surface bin in the L3A ATM processing.
npolar_asr CHUNKED	FLOAT (: x :)	North Polar Apparent Surface Reflectance (0-1)	1 ATM L3B ATBD, Section 3.5	North Polar apparent surface reflectance (ASR) atmospheric parameter. For each north polar grid cell this represents the ratio of the summation of the detected surface signal apparent surface reflectivity 25Hz observations (apparent_surf_reflec > 0.0) to the number of detected surface signal ASR 25Hz observations in the cell. The gridded average north polar ASR values are produced when the number of detected surface signal ASR 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. ASR represents the true surface reflectivity modified by the two-way atmospheric transmission. Generally a number between 0 and 1. ASR is related to the ratio of the received energy to the transmitted energy, assuming a Lambertian surface reflectance. The required surface signal apparent surface reflectance (apparent_surf_reflec) values are determined in the L3A ATM processing.
npolar_blowing_snow_freq CHUNKED	FLOAT (: x :)	North Polar Blowing Snow Frequency (percent)	percent ATM L3B ATBD, Section 3.4	North Polar blowing snow frequency atmospheric parameter. For the northern hemisphere polar region. For each north polar grid cell this represents the ratio of the number of the valid detected blowing snow layer top height 1Hz observations (bsnow_h > 0.0) to the number of valid 1Hz blowing snow confidence flag (exceeds the surface not detected value, i.e., bsnow_con > -3, implemented as bsnow_con => -2) observations (npolar_bsnow_obs_grid); the ratio is multiplied by 100 to obtain percent. The gridded north polar blowing snow frequency values are produced when the number of valid 1Hz blowing snow confidence flag observations is equal to or greater than the minimum number of observations required for each grid cell (npolar_bsnow_obs_grid => obs_minimum).
npolar_bsnow_obs_grid CHUNKED	FLOAT (: x :)	North polar blowing snow frequency observation grid	1 ATM L3B ATBD, Section 3.9	North Polar blowing snow observation count. The number of blowing snow observations used in the computation of blowing snow frequency for the Arctic. For each north polar grid cell this represents the number of valid blowing snow confidence 1Hz observations (bsnow_con .ne. INVALID) where the blowing snow confidence value exceeds the surface not detected value (bsnow_con > -3, actually implemented as bsnow_con => -2). Only valid detected blowing snow layer top height 1Hz observations (bsnow_h .ne. INVALID and bsnow_h > 0.0) and only valid blowing snow confidence 1Hz observations (bsnow_con .ne. INVALID) where the blowing snow confidence value exceeds the surface not detected value (bsnow_con > -3, implemented as bsnow_con => -2) in each grid cell are used to compute the cell north polar blowing snow frequency (npolar_blowing_snow_freq).
npolar_grid_lat	DOUBLE	North Polar grid	degrees_north	Latitudes of the North Polar grids; applicable to each grid cell.

CHUNKED	(:)	latitudes latitude	ATM L3B ATBD, Section 2	ATM histogram top latitude derived from the ATM range window geolocation. Based on WGS84 Earth-centered, Earth-fixed terrestrial reference system and geodetic data. Direction: North=+ values.
npolar_grid_lon CHUNKED	DOUBLE (:)	North Polar grid longitudes longitude	degrees_east ATM L3B ATBD, Section 2	Longitudes of the North Polar grids; applicable to each grid cell. ATM histogram top longitude derived from the ATM range window geolocation. Based on WGS84 Earth-centered, Earth-fixed terrestrial reference system and geodetic data. Direction: East=+ values.
npolar_grnd_detect CHUNKED	FLOAT (: x :)	North Polar Ground Detection Frequency (fraction)	fraction ATM L3B ATBD, Section 3.6	North Polar ground detection frequency atmospheric parameter. For each north polar grid cell this represents the number of detected surface signal 25Hz observations (surface_sig > 0.0) to the number of all 25Hz observations in the cell. The gridded north polar ground detection values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The calculation results in a fractional value. The required detected surface signal (surface_sig) is determined from the surface signal count of the number of photons in the detected surface bin in the L3A ATM processing.
npolar_highcloud_frac CHUNKED	FLOAT (: x :)	North Polar High Cloud Fraction (> 8km)	1 ATM L3B ATBD, Section 3.3.1	North Polar high (> 8km) cloud fraction atmospheric parameter. For each north polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) that occurs above 8 km from the layer top (layer_top() > 8 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded north polar high cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm), the layer attribute flag (layer_attr), and the height of the detected layers (layer_top) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.
npolar_lowcloud_frac CHUNKED	FLOAT (: x :)	North Polar Low Cloud Fraction (<= 4km)	1 ATM L3B ATBD, Section 3.3.1	North Polar low (<= 4km) cloud fraction atmospheric parameter. For each north polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) that occurs below and up to and including 4 km from the layer top (layer_top() <= 4 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded north polar low cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm), the layer attribute flag (layer_attr), and the height of the detected layers (layer_top) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.
npolar_midcloud_frac CHUNKED	FLOAT (: x :)	North Polar Mid Cloud Fraction (> 4km and <= 8km)	1 ATM L3B ATBD, Section 3.3.1	North Polar mid (> 4km and <= 8km) cloud fraction atmospheric parameter. For each north polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) that occurs above 4 km and up to and including 8 km from the layer top (layer_top() > 4 and <= 8 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded north polar middle cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm), the layer attribute flag (layer_attr), and the height of the detected layers (layer_top) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.

npolar_opaquecloud_frac CHUNKED	FLOAT (: x :)	North Polar Opaque Cloud Fraction	1 ATM L3B ATBD, Section 3.3.2	North Polar opaque cloud fraction atmospheric parameter. For each north polar cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) without surface signal detection (surface_sig = 0.0) to the number of all 25Hz observations in the cell. The gridded north polar opaque cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The fraction of opaque clouds covering the entire grid cell. Opaque clouds are clouds that inhibit or absorb transmission of downward radiation through the cloud. The cloud layer with opaque characteristics exhibits no surface signal count return (=0.0), indicating that no transmitted photons reached the surface. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder, and the required surface signal (surface_sig) is determined from the surface signal count of the number of photons in the detected surface bin, all in the L3A ATM processing.
npolar_totalcloud_frac CHUNKED	FLOAT (: x :)	North Polar Total Cloud Fraction	1 ATM L3B ATBD, Section 3.3.1	North Polar total cloud fraction atmospheric parameter. For each north polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded north polar total cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.
npolar_transcloud_frac CHUNKED	FLOAT (: x :)	North Polar Transmissive Cloud Fraction	1 ATM L3B ATBD, Section 3.3.2	North Polar transmissive cloud fraction atmospheric parameter. For each north polar cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) with surface signal detection (surface_sig > 0.0) to the number of all 25Hz observations in the cell. The gridded north polar transmissive cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The fraction of transmissive clouds covering the entire grid cell. Transmissive clouds are clouds that permit or allow transmission of downward radiation through the cloud. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder, and the required detected surface signal (surface_sig) is determined from the surface signal count of the number of photons in the detected surface bin, all in the L3A ATM processing.
spolar_asr CHUNKED	FLOAT (: x :)	South Polar Apparent Surface Reflectance (0-1)	1 ATM L3B ATBD, Section 3.5	South Polar apparent surface reflectance (ASR) atmospheric parameter. For each south polar grid cell this represents the ratio of the summation of the detected surface signal apparent surface reflectivity 25Hz observations (apparent_surf_reflec > 0.0) to the number of detected surface signal ASR 25Hz observations in the cell. The gridded average south polar ASR values are produced when the number of detected surface signal ASR 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. ASR represents the true surface reflectivity modified by the two-way atmospheric transmission. Generally a number between 0 and 1. ASR is related to the ratio of the received energy to the transmitted energy, assuming a Lambertian surface reflectance. The required surface signal apparent surface

				reflectance (apparent_surf_reflec) values are determined in the L3A ATM processing.
spolar_blowing_snow_freq CHUNKED	FLOAT (: x :)	South Polar Blowing Snow Frequency (percent)	percent ATM L3B ATBD, Section 3.4	South Polar blowing snow frequency atmospheric parameter. For the southern hemisphere polar region. For each south polar grid cell this represents the ratio of the number of the valid detected blowing snow layer top height 1Hz observations (bsnow_h .ne. INVALID and bsnow_h > 0.0) to the number of valid blowing snow confidence 1Hz observations (spolar_bsnow_obs_grid) in the cell, where the blowing snow confidence 1Hz observation is not invalid (i.e., bsnow_con .ne. INVALID) and exceeds the surface not detected value (i.e., bsnow_con > -3, implemented as bsnow_con => -2); the ratio is multiplied by 100 to obtain percent. The gridded south polar blowing snow frequency values are produced when the number of valid 1Hz blowing snow confidence flag observations is equal to or greater than the minimum number of observations required for each grid cell (spolar_bsnow_obs_grid => obs_minimum); otherwise set to invalid. The required blowing snow layer top height (bsnow_h) values and blowing snow confidence (bsnow_con) values are determined in the L3A ATM processing.
spolar_bsnow_obs_grid CHUNKED	FLOAT (: x :)	South Polar blowing snow frequency observation grid	1 ATM L3B ATBD, Section 3.9	South Polar blowing snow observation count. The number of blowing snow observations used in the computation of blowing snow frequency for the Antarctic. For each south polar grid cell this represents the number of valid blowing snow confidence 1Hz observations (bsnow_con ? INVALID) where the blowing snow confidence value exceeds the surface not detected value (bsnow_con > -3, actually implemented as bsnow_con => -2). Only valid detected blowing snow layer top height 1Hz observations (bsnow_h ? INVALID and bsnow_h > 0.0) and only valid blowing snow confidence 1Hz observations (bsnow_con ? INVALID) where the blowing snow confidence value exceeds the surface not detected value (bsnow_con > -3, implemented as bsnow_con => -2) in each grid cell are used to compute the cell south polar blowing snow frequency (spolar_blowing_snow_freq).
spolar_grid_lat CHUNKED	DOUBLE (:)	South Polar grid latitude latitude	degrees_north ATM L3B ATBD, Section 2	Latitudes of the South Polar grids; applicable to each grid cell. ATM histogram top latitude derived from the ATM range window geolocation. Based on WGS84 Earth-centered, Earth-fixed terrestrial reference system and geodetic data. Direction: South=- values.
spolar_grid_lon CHUNKED	DOUBLE (:)	South Polar grid longitudes longitude	degrees_east ATM L3B ATBD, Section 2	Longitudes of the South Polar grids; applicable to each grid cell. ATM histogram top longitude derived from the ATM range window geolocation. Based on WGS84 Earth-centered, Earth-fixed terrestrial reference system and geodetic data. Direction: East=+ values.
spolar_grnd_detect CHUNKED	FLOAT (: x :)	South Polar Ground Detection Frequency (fraction)	1 ATM L3B ATBD, Section 3.6	South Polar ground detection frequency atmospheric parameter. For each south polar grid cell this represents the number of detected surface signal 25Hz observations (surface_sig > 0.0) to the number of all 25Hz observations in the cell. The gridded south polar ground detection values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The calculation results in a fractional value. The required detected surface signal (surface_sig) is determined from the surface signal count of the number of photons in the detected surface bin in the L3A ATM processing.
spolar_highcloud_frac CHUNKED	FLOAT (: x :)	South Polar High Cloud Fraction (> 8km)	1 ATM L3B ATBD, Section 3.3.1	South Polar high (> 8km) cloud fraction atmospheric parameter. For each south polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) that occurs above 8 km from the layer top (layer_top() > 8 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded south polar high cloud fraction values

				are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm), the layer attribute flag (layer_attr), and the height of the detected layers (layer_top) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.
spolar_lowcloud_frac CHUNKED	FLOAT (: x :)	South Polar Low Cloud Fraction (<= 4km)	1 ATM L3B ATBD, Section 3.3.1	South Polar low (<= 4km) cloud fraction atmospheric parameter. For each south polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) that occurs below and up to and including 4 km from the layer top (layer_top() <= 4 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded south polar low cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm), the layer attribute flag (layer_attr), and the height of the detected layers (layer_top) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.
spolar_midcloud_frac CHUNKED	FLOAT (: x :)	South Polar Mid Cloud Fraction (> 4km and <= 8km)	1 ATM L3B ATBD, Section 3.3.1	South Polar mid (> 4km and <= 8km) cloud fraction atmospheric parameter. For each south polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) that occurs above 4 km and up to and including 8 km from the layer top (layer_top() > 4 and <= 8 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded south polar middle cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm), the layer attribute flag (layer_attr), and the height of the detected layers (layer_top) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.
spolar_opaquecloud_frac CHUNKED	FLOAT (: x :)	South Polar Opaque Cloud Fraction	1 ATM L3B ATBD, Section 3.3.2	South Polar opaque cloud fraction atmospheric parameter. For each south polar cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) without surface signal detection (surface_sig = 0.0) to the number of all 25Hz observations in the cell. The gridded south polar opaque cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The fraction of opaque clouds covering the entire grid cell. Opaque clouds are clouds that inhibit or absorb transmission of downward radiation through the cloud. The cloud layer with opaque characteristics exhibits no surface signal count return (=0.0), indicating that no transmitted photons reached the surface. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder, and the required surface signal (surface_sig) is determined from the surface signal count of the number of photons in the detected surface bin, all in the L3A ATM processing.
spolar_totalcloud_frac CHUNKED	FLOAT (: x :)	South Polar Total Cloud Fraction	1 ATM L3B ATBD, Section 3.3.1	South Polar total cloud fraction atmospheric parameter. For each south polar grid cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) to the number of all 25Hz observations in the cell. The gridded south polar total cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=>

				obs_minimum); otherwise set to invalid. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder in the L3A ATM processing.
spolar_transcloud_frac CHUNKED	FLOAT (: x :)	South Polar Transmissive Cloud Fraction	1 ATM L3B ATBD, Section 3.3.2	South Polar transmissive cloud fraction atmospheric parameter. For each south polar cell this represents the ratio of the number of 25Hz observations with at least one cloud layer (layer_attr() = 1 within cloud_flag_atm layers) with surface signal detection (surface_sig > 0.0) to the number of all 25Hz observations in the cell. The gridded south polar transmissive cloud fraction values are produced when the number of all 25Hz observations is equal to or greater than the minimum number of observations required for each grid cell (=> obs_minimum); otherwise set to invalid. The fraction of transmissive clouds covering the entire grid cell. Transmissive clouds are clouds that permit or allow transmission of downward radiation through the cloud. The required number of layers (cloud_flag_atm) and the layer attribute flag (layer_attr) are determined from the backscatter profile using the DDA layer finder, and the required detected surface signal (surface_sig) is determined from the surface signal count of the number of photons in the detected surface bin, all in the L3A ATM processing.
tcod_obs_grid CHUNKED	FLOAT (: x :)	Global total column optical depth observation grid	1 ATM L3B ATBD, Section 3.9	Global total column optical depth observation grid (for over-ocean only). The number of observations used to compute the average Global total column optical depth over the ocean. Only valid surface return over-ocean column optical depth 25Hz observations in each grid cell are used to compute the cell average over-ocean total column optical depth (global_column_od).
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.
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	INTEGER	Starting	1	The starting geolocation segment number associated with the

COMPACT	(1)	Geolocation Segment	Derived	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.
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/atmosphere

Description	(Attribute)	Contains general ancillary parameters.		
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
center_weight COMPACT	FLOAT (1)	gridded image smoothing center weight factor	auxiliaryInformation L3B ATM ATBD, Section 4.0	When the gridded image data parameters are smoothed, the center weight value is used to calculate the weight factor used to scale each cell in the smoothed image production. The nominal [default] center_weight value = 0.6.
data_type_flag COMPACT	INTEGER_1 (1)	data type flag 1	auxiliaryInformation L3B ATM ATBD, Section 1	Data type flag. Flag value =0 [default] indicates both night and day data were used to generate the product; flag value =1 indicates night-only data were used to generate the product. Flag Values: ['0', '1'] Flag Meanings: ['day-night', 'night-only']
lat_scale COMPACT	FLOAT (1)	latitude grid resolution	degrees/cell Atmosphere ATBD, Section 2	Latitude grid resolution, in degrees per cell. Nominal [default] value is 1.0 degrees latitude grid cell size for the monthly ATL17 product.
lon_scale COMPACT	FLOAT (1)	longitude grid resolution	degrees/cell Atmosphere ATBD, Section 2	Longitude grid resolution, in degrees per cell. Nominal [default] value is 1.0 degrees longitude grid cell size for the monthly ATL17 product.
obs_minimum	INTEGER_1	observation	auxiliaryInformation	Indicates the minimum acceptable observation count value

COMPACT	(1)	minimum count value 1	L3B ATM ATBD, Section 3.8	required to compute the specific atmosphere parameter grid cell value. Nominal value [default] is: 4=monthly minimum observation cell count for the ATL17 product.
smooth_grid COMPACT	INTEGER_1 (1)	image smoothing control 1	auxiliaryInformation L3B ATM ATBD, Section 4.0	Image smoothing control parameter. Value = 1 [default] indicates to apply the smoothing algorithm to the data used to generate the images; value = 0 indicates do not apply the smoothing algorithm to the data used to generate the images. When image gridded data smoothing is selected the smoothing algorithm is applied to intermediate working data arrays for each parameter, and is NOT applied to the actual product gridded parameter arrays content (i.e., the gridded data parameters remain un-smoothed).
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 (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
crossing_time CHUNKED	DOUBLE (:)	Ascending Node Crossing Time time	seconds since 2018-01-01 POD/PPD	The time, in seconds since the ATLAS SDP GPS Epoch, at which the ascending node crosses the equator. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
cycle_number CHUNKED	INTEGER_1 (:)	Cycle Number	1 Operations	A count of the number of exact repeats of this reference orbit.
lan CHUNKED	DOUBLE (:)	Ascending Node Longitude	degrees_east POD/PPD	Longitude at the ascending node crossing.
orbit_number CHUNKED	UINT_2_LE (:)	Orbit Number	1 Operations	Unique identifying number for each planned ICESat-2 orbit.
rgt CHUNKED	INTEGER_2 (:)	Reference Ground track	1 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 CHUNKED	INTEGER_1 (:)	Spacecraft Orientation	1 POD/PPD	This parameter tracks the spacecraft orientation between forward, backward and transitional flight modes. ICESat-2 is considered to be flying forward when the weak beams are leading the strong beams; and backward when the strong beams are leading the weak beams. ICESat-2 is considered to be in transition while it is maneuvering between the two orientations. Science quality is potentially degraded while in transition mode. Flag Values: ['0', '1', '2'] Flag Meanings: ['backward', 'forward', 'transition']
sc_orient_time CHUNKED	DOUBLE (:)	Time of Last Spacecraft Orientation Change time	seconds since 2018-01-01 POD/PPD	The time of the last spacecraft orientation change between forward, backward and transitional flight modes, expressed in seconds since the ATLAS SDP GPS Epoch. ICESat-2 is considered to be flying forward when the weak beams are leading the strong beams; and backward when the strong beams are leading the weak beams. ICESat-2 is considered to be in transition while it is maneuvering between the two orientations. Science quality is potentially degraded while in transition mode. The ATLAS Standard Data Products (SDP) epoch offset is defined within /ancillary_data/atlas_sdp_gps_epoch as the number of GPS

				seconds between the GPS epoch (1980-01-06T00:00:00.000000Z UTC) and the ATLAS SDP epoch. By adding the offset contained within atlas_sdp_gps_epoch to delta time parameters, the time in gps_seconds relative to the GPS epoch can be computed.
Group: /quality_assessment				
Description	(Attribute)	Contains quality assessment data. This may include QA counters, QA along-track data and/or QA summary data.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
qa_granule_fail_reason COMPACT	INTEGER (1)	Granule Failure Reason	1 Operations	Flag indicating granule failure reason. 0=no failure; 1=processing error; 2=Insufficient output data was generated; 3=TBD Failure; 4=TBD_Failure; 5=other failure. Flag Values: ['0', '1', '2', '3', '4', '5'] Flag Meanings: ['no_failure', 'PROCESS_ERROR', 'INSUFFICIENT_OUTPUT', 'failure_3', 'failure_4', 'OTHER_FAILURE']
qa_granule_pass_fail COMPACT	INTEGER (1)	Granule Pass Flag	1 Operations	Flag indicating granule quality. 0=granule passes automatic QA. 1=granule fails automatic QA. Flag Values: ['0', '1'] Flag Meanings: ['PASS', 'FAIL']