

1.0 DATA DICTIONARY

The following subsections list the data content of ATL15. 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	ATL15
title	ATLAS/ICESat-2 L3B Gridded Antarctic and Arctic Land Ice Height Change
level	L3B
description	The ICESat-2 ATL15 standard data product reports a land ice elevation change as compared to an ice sheet digital elevation model (DEM).
Conventions	CF-1.7
GDAL_AREA_OR_POINT	Area
_NCProperties	version=2,netcdf=4.10.0,hdf5=1.14.6
citation	Cite these data in publications as follows: The data used in this study were produced by the ICESat-2 Science Project Office at NASA/GSFC. The data archive site is the NASA National Snow and Ice Data Center Distributed Active Archive Center.
contributor_name	Benjamin Smith (besmith@uw.edu), Tyler Sutterley (tsutterl@uw.edu), Suzanne Dickinson (sdickins@uw.edu), Benjamin Jelley (benjamin.p.jelley@nasa.gov), Denis Felikson (denis.felikson@nasa.gov), Thomas A Neumann (thomas.neumann@nasa.gov), Helen Fricker (hfricker@ucsd.edu), Aimee Gibbons (aimee.c.gibbons@nasa.gov), Christine Sadlik (christine.c.sadlik@nasa.gov), Laurence Padman (padman@esr.org), Thorsten Markus (thorsten.markus@nasa.gov), Nathan Kurtz (nathan.t.kurtz@nasa.gov), Suneel Bhardwaj (suneel.bhardwaj@nasa.gov), David W Hancock III (david.w.hancock@nasa.gov), Jeffrey Lee (jeffrey.e.lee@nasa.gov)
contributor_role	Investigator, Investigator, Algorithm Developer, Algorithm Developer, Investigator, Investigator, Investigator,

	Investigator, Investigator, Investigator, Investigator, Investigator, Investigator, Investigator, Algorithm Developer
creator_name	GSFC I-SIPS > ICESat-2 Science Investigator-led Processing System
date_created	SET_BY_PGE
date_type	UTC
fileName	SET_BY_PGE
geospatial_lat_max	SET_BY_PGE
geospatial_lat_min	SET_BY_PGE
geospatial_lat_units	degrees_north
geospatial_lon_max	SET_BY_PGE
geospatial_lon_min	SET_BY_PGE
geospatial_lon_units	degrees_east
granule_type	ATL15
history	SET_BY_PGE
identifier_file_uuid	SET_BY_PGE
identifier_product_doi	doi:10.5067/ATLAS/ATL15.005
identifier_product_doi_authority	http://dx.doi.org
identifier_product_format_version	3.0
identifier_product_type	ATL15
institution	National Aeronautics and Space Administration (NASA)
instrument	ATLAS > Advanced Topographic Laser Altimeter System
keywords	EARTH SCIENCE > CRYOSPHERE > GLACIERS/ICE SHEETS > GLACIER ELEVATION/ICE SHEET ELEVATION > NONE > NONE > NONE
keywords_vocabulary	NASA/GCMD Science Keywords
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
netcdfversion	4.10.0
platform	ICESat-2 > Ice, Cloud, and land Elevation Satellite-2
processing_level	3B
project	ICESat-2 > Ice, Cloud, and land Elevation Satellite-2
publisher_email	nsidc@nsidc.org
publisher_name	NSIDC DAAC > NASA National Snow and Ice Data Center Distributed Active Archive Center
publisher_url	http://nsidc.org/daac/
reference_frame	ITRF2014
references	http://nsidc.org/data/icesat2/data.html
shortName	ATL15_META
source	Spacecraft
spatial_coverage_type	Horizontal
standard_name_vocabulary	CF-1.6
summary	The purpose of ATL15 is to provide an IceSat-2 gridded satellite summary of height changes of land-based ice.
time_coverage_duration	SET_BY_PGE
time_coverage_end	SET_BY_PGE
time_coverage_start	SET_BY_PGE
time_type	CCSDS UTC-A
vertical_datum	WGS84

1.2 Group: /METADATA

ISO19115 Structured Metadata Represented within HDF5

1.2.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
iso_19139_dataset_xml	STRING(1) -		ISO 19139 Dataset XML
iso_19139_series_xml	STRING(1) -		ISO 19139 Series XML

1.3 Group: /METADATA/AcquisitionInformation

Describe the group

1.4 Group: /METADATA/AcquisitionInformation/lidar

ATLAS on ICESat-2 determines the range between the satellite and the Earth's surface by measuring the two-way time delay of short pulses of laser light that it transmits in six beams. It is different from previous operational ice-sheet altimeters in that it is a photon-counting LIDAR. ATLAS records a set of arrival times for individual photons, which are then analyzed to derive surface, vegetation, and cloud properties. ATLAS has six beams arranged in three pairs, so that it samples each of three reference pair tracks with a pair of beams; ATLAS transmits pulses at 10 kHz, giving approximately one pulse every 0.7 m along track; ATLAS's expected pointing control will be better than 90 m RMS.

1.4.1 Attributes

identifier	ATLAS
pulse_rate	10000 pps
type	Laser Altimeter
wavelength	532 nm

1.5 Group: /METADATA/AcquisitionInformation/lidarDocument

Describe the group

1.5.1 Attributes

edition	Pre-Release
publicationDate	12/31/17
title	A document describing the ATLAS instrument will be provided by the ICESat-2 Project Science Office.

1.6 Group: /METADATA/AcquisitionInformation/platform

Ice, Cloud, and land Elevation Satellite-2

1.6.1 Attributes

identifier	ICESat-2
type	Spacecraft

1.7 Group: /METADATA/AcquisitionInformation/platformDocument

Describe the group

1.7.1 Attributes

edition	31-Dec-16
publicationDate	31-Dec-16
title	The Ice, Cloud, and land Elevation Satellite-2 (ICESat-2): Science requirements, concept, and implementation. Thorsten Markus, Tom Neumann, Anthony Martino, Waleed Abdalati, Kelly Brunt, Beata Csatho, Sinead Farrell, Helen Fricker, Alex Gardner, David Harding, Michael Jasinski, Ron Kwok, Lori Magruder, Dan Lubin, Scott Luthcke, James Morison, Ross Nelson, Amy Neuenschwander, Stephen Palm, Sorin Popescu, CK Shum, Bob E. Schutz, Benjamin Smith, Yuekui Yang, Jay Zwally. http://dx.doi.org/10.1016/j.rse.2016.12.029

1.8 Group: /METADATA/DataQuality

Describe the group

1.8.1 Attributes

scope	NOT_SET
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1.9 Group: /METADATA/DataQuality/CompletenessOmission

Describe the group

1.9.1 Attributes

evaluationMethodType	directInternal
measureDescription	TBD

nameOfMeasure	TBD
unitofMeasure	TBD
value	NOT_SET

1.10 Group: /METADATA/DataQuality/DomainConsistency

Describe the group

1.10.1 Attributes

evaluationMethodType	directInternal
measureDescription	TBD
nameOfMeasure	TBD
unitofMeasure	TBD
value	NOT_SET

1.11 Group: /METADATA/DatasetIdentification

Describe the group

1.11.1 Attributes

RevisionID	00
VersionID	10km
abstract	The ICESat-2 ATL15 standard data product reports a land ice elevation change as compared to an ice sheet digital elevation model (DEM).
characterSet	utf8
creationDate	SET_BY_PGE
credit	The software that generates the ATL15 product was designed and implemented within the ICESat-2 Science Investigator-led Processing System at the NASA Goddard Space Flight Center in Greenbelt, Maryland.
fileName	SET_BY_PGE
language	eng

originatorOrganizationName	GSFC I-SIPS > ICESat-2 Science Investigator-led Processing System
purpose	The purpose of ATL15 is to provide an IceSat-2 gridded satellite summary of height changes of land-based ice.
shortName	ATL15
spatialRepresentationType	gridded
status	onGoing
topicCategory	geoscientificInformation
uuid	SET_BY_PGE

1.12 Group: /METADATA/Extent

Describe the group

1.12.1 Attributes

eastBoundLongitude	SET_BY_PGE
northBoundLatitude	SET_BY_PGE
rangeBeginningDateTime	SET_BY_PGE
rangeEndingDateTime	SET_BY_PGE
southBoundLatitude	SET_BY_PGE
westBoundLongitude	SET_BY_PGE

1.13 Group: /METADATA/Lineage

Describe the group

1.14 Group: /METADATA/Lineage/ANC19

TAI to UTC leapsecond file retrieved from <ftp://maia.usno.navy.mil/ser7/tai-utc.dat>

1.14.1 Attributes

fileName	SET_BY_PGE
shortName	SET_BY_PGE
uuid	SET_BY_PGE

version	SET_BY_PGE
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1.15 Group: /METADATA/Lineage/ANC36-15

ISO 19139 XML file containing Series-level metadata information.

1.15.1 Attributes

fileName	DsESDTAtATL15.001.series.xml
shortName	ANC36-15
uuid	SET_BY_PGE
version	001

1.16 Group: /METADATA/Lineage/ANC38-15

ISO 19139 XML file containing DataSet-level metadata information.

1.16.1 Attributes

fileName	DsESDTAtATL15.001.dataset.xml
shortName	ANC38-15
uuid	SET_BY_PGE
version	001

1.17 Group: /METADATA/Lineage/ATL11

ATLAS/L3B Land Ice Height

1.17.1 Attributes

end_cycle	SET_BY_PGE
end_geoseg	SET_BY_PGE
end_orbit	SET_BY_PGE
end_region	SET_BY_PGE
end_rgt	SET_BY_PGE
fileName	SET_BY_PGE

release	SET_BY_PGE
shortName	SET_BY_PGE
start_cycle	SET_BY_PGE
start_geoseg	SET_BY_PGE
start_orbit	SET_BY_PGE
start_region	SET_BY_PGE
start_rgt	SET_BY_PGE
uuid	SET_BY_PGE
version	SET_BY_PGE

1.18 Group: /METADATA/Lineage/Control

Text-based keyword=value file generated automatically within the ICESat-2 data system that specifies all of the conditions required for each individual run of the software.

1.18.1 Attributes

fileName	SET_BY_PGE
shortName	SET_BY_PGE
version	SET_BY_PGE

1.19 Group: /METADATA/ProcessStep

Describe the group

1.20 Group: /METADATA/ProcessStep/Browse

Describe the group

1.20.1 Attributes

identifier	SET_BY_PGE
processDescription	Browse processing is performed for each granule SIPS produces. The browse utility reads data from the granule and produces browse images as defined in the respective product ATBD. The utility then embeds each browse image into the product within the /Browse group.

runTimeParameters	SET_BY_PGE
softwareDate	SET_BY_PGE
softwareTitle	SET_BY_PGE
softwareVersion	SET_BY_PGE
stepDateTime	SET_BY_PGE

1.21 Group: /METADATA/ProcessStep/Metadata

Describe the group

1.21.1 Attributes

identifier	atlas_meta
processDescription	Metadata information is processed by the metadata utility for each granule produced by SIPS. During PGE processing, dynamic metadata are written to the product. Additional static information is provided with the metadata template. The metadata utility reads ISO Dataset and Series metadata files and updates the product with static information from within those files. The utility then merges the static and dynamic metadata to creates output ISO19139 Dataset and Series XML files. Finally the utility reads the ISO19139 Dataset and Series XML files into memory and stores the textual representations as attributes attached to the /METADATA group.
runTimeParameters	SET_BY_PGE
softwareDate	Sep 3 2025
softwareTitle	Creates ATLAS XML metadata files
softwareVersion	Version 5.1.3
stepDateTime	SET_BY_PGE

1.22 Group: /METADATA/ProcessStep/PGE

Describe the group

1.22.1 Attributes

ATBDDate	10/22/2025
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ATBDTitle	Algorithm Theoretical Basis Document (ATBD) for Land-ice DEM (ATL14) and Land-ice height change (ATL15)
ATBDVersion	5.0
documentDate	Feb 2020
documentation	ATLAS Science Algorithm Software Design Description (SDD) - Volume 14 (atlas_l3b_is)
identifier	SET_BY_PGE
processDescription	Computes gridded estimates of seasonal, annual and multi-annual land ice height change.
runTimeParameters	SET_BY_PGE
softwareDate	May 01 2024
softwareTitle	ASAS L3B Land Ice PGE
softwareVersion	3.0
stepDateTime	SET_BY_PGE

1.23 Group: /METADATA/ProcessStep/QA

Describe the group

1.23.1 Attributes

identifier	atl15_qa_util
processDescription	QA processing is performed by an external utility on each granule produced by SIPS. The utility reads the granule, performs both generic and product-specific quality-assessment calculations, and writes a text-based quality assessment report. The name and creation data of this report are identified within the QADatasetIdentification metadata
runTimeParameters	SET_BY_PGE
softwareDate	SET_BY_PGE
softwareTitle	ATL15 QA Utility
softwareVersion	Version 1.0
stepDateTime	SET_BY_PGE

1.24 Group: /METADATA/ProductSpecificationDocument

Describe the group

1.24.1 Attributes

ShortName	ATL15_SDP
characterSet	utf8
edition	v1.0
language	eng
publicationDate	Feb 2020
title	ICESat-2-SIPS-SPEC-4269 - ATLAS Science Algorithm Standard Data Product (SDP) Volume 14 (ATL15). Revision -.

1.25 Group: /METADATA/QADatasetIdentification

Describe the group

1.25.1 Attributes

abstract	An ASCII product that contains statistical information on data product results. These statistics enable data producers and users to assess the quality of the data in the data product granule
creationDate	SET_BY_PGE
fileName	SET_BY_PGE

1.26 Group: /METADATA/SeriesIdentification

Describe the group

1.26.1 Attributes

VersionID	3.0
abstract	The ICESat-2 ATL15 standard data product reports a land ice elevation change as compared to an ice sheet digital elevation model (DEM).
characterSet	utf8
credit	The software that generates the ATL15 product was designed and implemented within the ICESat-2 Science Investigator-led

	Processing System at the NASA Goddard Space Flight Center in Greenbelt, Maryland.
format	HDF
formatVersion	5
identifier_product_DOI	doi:10.5067/ATLAS/ATL15.005
language	eng
longName	ATLAS/ICESat-2 L3B Gridded Antarctic and Arctic Land Ice Height Change
maintenanceAndUpdateFrequency	asNeeded
maintenanceDate	SET_BY_META
mission	ICESat-2 > Ice, Cloud, and land Elevation Satellite-2
pointOfContact	NSIDC DAAC > NASA National Snow and Ice Data Center Distributed Active Archive Center
purpose	The purpose of ATL15 is to provide an IceSat-2 gridded satellite summary of height changes of land-based ice.
resourceProviderOrganizationName	National Aeronautics and Space Administration (NASA)
revisionDate	2024-05-15
shortName	ATL15
status	onGoing
topicCategory	geoscientificInformation

1.27 Group: /delta_h

delta_h group includes variables describing height differences between the model surface at any time and the DEM surface at a resolution of X km.

1.27.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
Polar_Stereographic Polar_Stereographic	INTEGER_1 -127		
delta_h	FLOAT(:, :, :) INVALID_R4B	meters	X x X km average height change relative to the datum (Jan 1, 2020) surface Source: ATBD section 3.4

Name Standard Name	Type(Dims) FillValue	Units	Description
delta_h_sigma	FLOAT(:, :, :) INVALID_R4B	meters	Uncertainty in the X x X km average height change relative to the datum (Jan 1, 2020) surface Source: ATBD section 3.4
ice_area	FLOAT(:, :, :) INVALID_R4B	meters^2	Ice-covered area of each X x X km grid cell, accounting for the area distortion in the polar-stereographic projections Source: ATBD section 3.4
time	DOUBLE(:) INVALID_R8B	days since 2018-01-01	Time for each node, in days since 2018-01-01:T00.00.00 UTC Source: ATBD section 4.2
x projection_x_coordinate	DOUBLE(:) INVALID_R8B	meters	x coordinate of the X-km cell centers, in projected coordinates Source: ATBD section 3.2
y projection_y_coordinate	DOUBLE(:) INVALID_R8B	meters	y coordinate of the X-km cell centers, in projected coordinates Source: ATBD section 3.2

1.28 Group: /dhdt_XXXmo

dhdt_XXXmo group includes variables describing height difference rates, at a resolution of X km, between subsequent quarterly (3-monthly) or monthly height-difference surfaces.

1.28.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
Polar_Stereographic Polar_Stereographic	INTEGER_1 -127		
dhdt	FLOAT(:, :, :) INVALID_R4B	meters years^-1	X x X km average monthly or quarterly height change rate Source: ATBD section 3.4
dhdt_sigma	FLOAT(:, :, :) INVALID_R4B	meters years^-1	Uncertainty in the X x X km average quarterly height change rate Source: ATBD section 3.4
ice_area	FLOAT(:, :, :) INVALID_R4B	meters^2	Ice-covered area of each X x X km grid cell for quarterly change in height, accounting for the area distortion in the polar-stereographic projections Source: ATBD section 3.4
time	DOUBLE(:) INVALID_R8B	days since	Time for the midpoint of each quarterly height-change rate, in days since 2018-01-

Name Standard Name	Type(Dims) FillValue	Units	Description
		2018-01-01	01:T00.00.00 UTC Source: ATBD section 4.2
x projection_x_coordinate	DOUBLE(:) INVALID_R8B	meters	x coordinate of the X-km cell centers, in projected coordinates Source: ATBD section 3.2
y projection_y_coordinate	DOUBLE(:) INVALID_R8B	meters	y coordinate of the X-km cell centers, in projected coordinates Source: ATBD section 3.2

1.29 Group: /orbit_info

Contains orbit information.

1.29.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
bounding_polygon_dim1	INTEGER(:) -2147483647	1	Polygon extent vertex count Source: model
bounding_polygon_lat1	FLOAT(:) 9.969209968386869e+36	degrees North	Polygon extent vertex latitude Source: model
bounding_polygon_lon1	FLOAT(:) 9.969209968386869e+36	degrees East	Polygon extent vertex longitude Source: model

1.30 Group: /quality_assessment

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

1.30.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
qa_granule_fail_reason	INTEGER(1) -2147483647	1	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. Source: Operations Flags: 0()=no_failure, 1()=PROCESS_ERROR, 2()=INSUFFICIENT_OUTPUT, 3()=failure_3, 4()=failure_4, 5()=OTHER_FAILURE
qa_granule_pass_fail	INTEGER(1) -2147483647	1	Flag indicating granule quality. 0=granule passes automatic QA. 1=granule fails automatic QA.

Name Standard Name	Type(Dims) FillValue	Units	Description
			Source: Operations Flags: 0(=PASS, 1(=FAIL

1.31 Group: /tile_stats

1.31.1 Datasets

Name Standard Name	Type(Dims) FillValue	Units	Description
N_bias	INTEGER(:, :) INVALID_I4B	counts	number of bias values solved for Source: 4.1.2.1
N_data	INTEGER(:, :) INVALID_I4B	counts	number of data used in fit Source: 4.1.2.1
Polar_Stereographic Polar_Stereographic	INTEGER_1 -127		
RMS_bias	FLOAT(:, :) INVALID_R4B	meters	root mean of squared, scaled bias values Source: 4.1.2.1
RMS_d2z0dx2	FLOAT(:, :) INVALID_R4B	meters^-1	root mean square of the constraint equation residuals for the second spatial derivative of z0 Source: 4.1.2.1
RMS_d2zdt2	FLOAT(:, :) INVALID_R4B	meters years^2	root mean square of the constraint equation residuals for the second temporal derivative of dz Source: 4.1.2.1
RMS_d2zdx2dt	FLOAT(:, :) INVALID_R4B	meters^-1 years^-1	root mean square of the constraint equation residuals for the second temporal derivative of dz/dt Source: 4.1.2.1
RMS_data	FLOAT(:, :) INVALID_R4B	meters	root mean of squared, scaled data misfits Source: 4.1.2.1
sigma_tt	FLOAT(:, :) INVALID_R4B	meters years^-2	weighting values for the constraint equations on the second temporal derivatives of the surface height Source: 4.1.2.1
sigma_xx0	FLOAT(:, :) INVALID_R4B	meters^-1	weighting values for the constraint equations on the second spatial derivatives of the DEM Source: 4.1.2.1
sigma_xxt	FLOAT(:, :) INVALID_R4B	meters^-1 years^-1	weighting values for the constraint equations on the second spatial derivatives of the height-change rate Source: 4.1.2.1

Name Standard Name	Type(Dims) FillValue	Units	Description
x projection_x_coordinate	DOUBLE(:) INVALID_R8B	meters	tile-center x-coordinate, in projected coordinates Source: 4.1.2.1
y projection_y_coordinate	DOUBLE(:) INVALID_R8B	meters	tile-center y-coordinate, in projected coordinates Source: 4.1.2.1