MABEL_L2A Product Data Dictionary

Group: /		
h5es_id	(Attribute)	3
granule_type	(Attribute)	mabel_l2a
short_name	(Attribute)	mabel_l2a
level	(Attribute)	L2A
description	(Attribute)	Geolocated photons.
citation	(Attribute)	The data used in this study were produced by the ICESat-2 Science Project Office (PSO) at NASA/GSFC. The data archive site is the PSO.
comment	(Attribute)	Data granules consist of approximately 1 minute of HDF5 data and include corrected and geolocated MABEL elevation data (in meters) measuring the elevation of each detected photon within a range window about the DEM. All measured parameters are in science units.
contributor_name	(Attribute)	William B Cook (william.b.cook@nasa.gov), Thomas E Neumann (thomas.neumann@nasa.gov), Thorsten Markus (thorsten.markus@nasa.gov), David W Hancock III (david.w.hancock@nasa.gov), Jeffrey E Lee (jeffrey.e.lee@nasa.gov)
contributor_role	(Attribute)	Instrument Engineer, Investigator, Principle Investigator, Data Producer, Data Producer
Conventions	(Attribute)	CF-1.6
creator_email	(Attribute)	David.W.Hancock@nasa.gov
creator_name	(Attribute)	ICESat-2 Science Investigator-led Processing System (ISIPS)
date_created	(Attribute)	SET_BY_PGE
date_type	(Attribute)	J2000
dtu10_mss_citation	(Attribute)	Andersen O. B, Knudsen P (2009) The DNSC08 mean sea surface and mean dynamic topography. J. Geophys. Res., 114, C11, doi:10.1029/2008JC005179, 2009. Andersen, O. B., The DTU10 Gravity field and Mean sea surface (2010) Second international symposium of the gravity field of the Earth (IGFS2), Fairbanks, Alaska.
dtu10_mss_source	(Attribute)	DTU10MSS_1min.mss; downloaded June 22, 2012 from http://www.space.dtu.dk/English/Research/Scientific_data_and_models/downloaddata.aspx
egm2008_citation	(Attribute)	Pavlis, N.K., S.A. Holmes, S.C. Kenyon, and J.K. Factor, An Earth Gravitational Model to Degree 2160: EGM2008, presented at the 2008 General Assembly of the European Geosciences Union, Vienna, Austria, April 13-18, 2008.
egm2008_source	(Attribute)	Und_min1x1_egm2008_isw=82_WGS84_TideFree.gz downloaded from http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm2008/egm08_wgs84.html This file contains POINT values of geoid undulations with respect to WGS 84 in meters, on a 1x1 min global grid (equi-angular spacing in terms of WGS 84 geodetic coordinates), computed from EGM2008 to degree 2190 and using the conversion expansion to degree 2160. The file is global, and contains valid values for ALL 1x1 cells, regardless whether they are located over land or over ocean. The geoid undulations refer to the Tide-Free system, as far as the Permanent Tide is concerned.
egm96_citation	(Attribute)	The Development of the Joint NASA GSFC and NIMA Geopotential Model EGM96, F. G. Lemoine, S. C. Kenyon, J. K. Factor, R.G. Trimmer, N. K. Pavlis, D. S. Chinn, C. M. Cox, S. M. Klosko, S. B. Luthcke, M. H. Torrence, Y. M. Wang, R. G. Williamson, E. C. Pavlis, R. H. Rapp and T. R. Olson, NASA Goddard Space Flight Center, Greenbelt, Maryland, 20771 USA, July 1998.
egm96_source	(Attribute)	June 15, 2005; downloaded from http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm96/egm96.html
featureType	(Attribute)	trajectory
flight_location	(Attribute)	SET_BY_PGE
flight_number	(Attribute)	SET_BY_PGE
geos5_fp_it_citation	(Attribute)	Lucchesi, R., 2013: File Specification for GEOS-5 FP-IT. GMAO Office Note No. 2 (Version 1.2), 60 pp, available from http://gmao.gsfc.nasa.gov/pubs/office_notes.
geos5_fp_it_source	(Attribute)	Global Modeling and Assimilation Office (GMAO) at NASA Goddard Space Flight Center
geospatial_lat_max	(Attribute)	0.0000000000000000
geospatial_lat_min	(Attribute)	0.0000000000000000
geospatial_lat_units	(Attribute)	degrees_north
geospatial_lon_max	(Attribute)	0.0000000000000000
geospatial_lon_min	(Attribute)	0.0000000000000000
geospatial_lon_units	(Attribute)	degrees_east
gimp_dem_citation	(Attribute)	Howat, I.M., A. Negrete, B.E. Smith, 2014, The Greenland Ice Mapping Project (GIMP) land classification and surface elevation datasets, The Cryosphere, 8, 1509-1518, doi:10.5194/tc-8-1509-2014
gimp_dem_source	(Attribute)	Version 2.1 (January 3, 2014), downloaded from link at http://bprc.osu.edu/GDG/gimpdem.php
gmted_dem_citation	(Attribute)	Danielson, J.J., and Gesch, D.B., 2011, Global multi-resolution terrain elevation data 2010 (GMTED2010): U.S. Geological Survey Open-File Report 2011 1073, 26 p. http://pubs.usgs.gov/of/2011/1073/
gmted_dem_source	(Attribute)	GMTED 7.5 arc-second GEOTIFFs; downloaded from http://http://topotools.cr.usgs.gov/GMTED_viewer.
hdfversion	(Attribute)	SET_BY_PGE
history	(Attribute)	SET_BY_PGE
identifier_file_uuid	(Attribute)	SET_BY_PGE
identifier_product_doi	(Attribute)	TBD
identifier_product_doi_authority	(Attribute)	http://dx.doi.org
identifier_product_format_version	(Attribute)	SET_BY_PGE
identifier_product_type	(Attribute)	MABEL_L2A
institution	(Attribute)	National Aeronautics and Space Administration (NASA)
instrument	(Attribute)	Multiple Altimeter Beam Experimental Lidar (MABEL)

keywords	(Attribute)	Earth Science > Spectral/Engineering > Infrared Wavelengths > Sensor Counts > Photons		
keywords_vocabulary	(Attribute)	GCMD Science Keywords Version 6.0		
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_PGE		
processing_level	(Attribute)	L2A		
project	(Attribute)	Multiple Altimeter Beam Experimental Lidar (MABEL)		
publisher_email	(Attribute)	thomas.neumann@nasa.gov		
publisher_name	(Attribute)	ICESat-2 Project Science Office (PSO) at NASA/GSFC.		
publisher_url	(Attribute)	http://icesat.gsfc.nasa.gov/icesat2/data/mabel/data/browse/index.html		
references	(Attribute)	http://icesat.gsfc.nasa.gov/icesat2/data/mabel/mabel_docs.php (Documentation set for this product at the ICESat-2 Website), http://icesat.gsfc.nasa.gov/icesat2/data/mabel/data/browse/index.html (Browse data for MABEL at the ICESat-2 Website)		
source	(Attribute)	Aircraft measurements		
spatial_coverage_type	(Attribute)	Horizontal		
standard_name_vocabulary	(Attribute)	CF-1.6		
summary	(Attribute)	The PGE converts L1B ranges to geolocated photons. Each MABEL_L2A file was created from a corresponding MABEL_L1B file. The provenance metadata shows the history that created the granule.		
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)	MABEL L2A Geolocated Photons (HDF5)		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ds_alt_histogram_bins (Contiguous Dataset)	INTEGER_4 (200)	Histogram dimension scale (not_set)	counts not_set	Altimetry histogram bin index. The histogram bins increment from the top of the range window to the bottom of the range window.
ds_atm_histogram_bins (Contiguous Dataset)	INTEGER_4 (500)	Histogram dimension scale (not_set)	counts not_set	Atmosphere histogram bin index. The histogram bins increment from the top of the range window to the bottom of the range window.
ds_statistics (Contiguous Dataset)	INTEGER_4 (5)	Dimension scale for QA statistics (not_set)	counts Derived (QA)	QA statistics array index flag_values: 1, 2, 3, 4, 5 flag_meanings : number_of_points minimum maximum average standard_deviation
Group: /ancillary_data				
h5es_id	(Attribute)	2		
Description	(Attribute)	Contains information ancillary to the data product. This may include product characteristics, instrument characteristics and/or processing constants.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
control (Compact Dataset)	STRING:4096 (1)	Control File (not_set)	not_set Operations	PGE-specific control file used to generate this granule. To re-use, replace breaks (BR) with linefeeds.
data_end_gpssow (Compact Dataset)	DOUBLE (1)	Ending GPS Seconds-of-Week (not_set)	seconds Derived	GPS seconds-of-week for the last data point in the granule. (not referenced to granule_gps_epoch)
data_end_gpsweek (Compact Dataset)	INTEGER_4 (1)	Ending GPSWeek (not_set)	weeks Derived	GPS week number for the last data point in the granule. (not referenced to granule_gps_epoch)
data_end_utc (Compact Dataset)	STRING:27 (1)	End UTC (not_set)	not_set Derived	UTC (in CCSDS-A format) of the last data point within the granule. (not referenced to granule_gps_epoch)
data_start_gpssow (Compact Dataset)	DOUBLE (1)	Starting GPS Seconds-of-Week (not_set)	seconds Derived	GPS seconds-of-week for the first data point in the granule. (not referenced to granule_gps_epoch)
data_start_gpsweek (Compact Dataset)	INTEGER_4 (1)	Starting GPSWeek (not_set)	weeks since 1980-01-06T00:00:00Z Derived	GPS week number for the first data point in the granule. (not referenced to granule_gps_epoch)
data_start_utc (Compact Dataset)	STRING:27 (1)	Actual Start UTC of Granule (not_set)	not_set Derived	UTC (in CCSDS-A format) of the first data point within the granule. (not referenced to granule_gps_epoch)
end_latitude (Compact Dataset)	DOUBLE (1)	Ending Latitude (not_set)	degrees_north Derived	Best-available latitude (product-specific) in degrees at last data point within the granule.
end_longitude (Compact Dataset)	DOUBLE (1)	Ending Longitude (not_set)	degrees_east Derived	Best-available longitude (product-specific) in degrees at last data point within the granule.
granule_end_utc (Compact Dataset)	STRING:27 (1)	Ending Time of Granule (not_set)	not_set Derived	Requested end time (UTC CCSDS-A) of this granule.
granule_gps_epoch (Contiguous Dataset)	DOUBLE (1)	Elapsed GPS Seconds (not_set)	seconds since 1980-01-06T00:00:00.000000Z Derived	Number of GPS seconds since GPS epoch (1980-01-06T00:00:00.000000Z UTC) corresponding to the requested start time of the granule. Add this value to the data [delta_time] parameter to compute [gps_seconds] for each data point.
granule_start_utc	STRING:27	Requested Start Time of Granule	not_set	Requested start time (UTC CCSDS-A) of this

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
granule_start_utc (Compact Dataset)	STRING:27 (1)	Requested Start Time of Granule (not_set)	not_set Derived	Requested start time (UTC CCSDS-A) of this granule.
release (Compact Dataset)	STRING:80 (1)	Release Number (not_set)	not_set Operations	This identifies the 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_latitude (Compact Dataset)	DOUBLE (1)	Starting Latitude (not_set)	degrees_north Derived	Best-available latitude (product-specific) in degrees at first data point within the granule (corresponds to data_start_utc).
start_longitude (Compact Dataset)	DOUBLE (1)	Starting Longitude (not_set)	degrees_east Derived	Best-available longitude (product-specific) in degrees at first data point within the granule (corresponds to data_start_utc).
version (Compact Dataset)	STRING:80 (1)	Version (not_set)	counts Operations	This identifies the 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/general

h5es_id	(Attribute)	3		
Description	(Attribute)	Contains general ancillary parameters.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
apply_atm_delay (Compact Dataset)	INTEGER_4 (1)	Apply Atmosphere Delay Flag (not_set)	counts MABEL Detailed Design Doc	Indicates application of atmosphere delay correction to photon heights; 0=not applied, 1=applied. flag_values: 0, 1 flag_meanings : atm_delay_not_applied atm_delay_applied
mab_clock_freq (Compact Dataset)	FLOAT (1)	Clock Frequency (not_set)	hertz MABEL Engineering Docs	Nominal MABEL clock frequency.
mab_fcell_conv (Compact Dataset)	FLOAT (1)	Fractional Cell Conversion Factor (not_set)	ns MABEL Engineering Docs	MABEL fractional cell conversion factor.
mab_range_conv (Compact Dataset)	FLOAT (1)	Range Conversion Factor (not_set)	ns MABEL Engineering Docs	MABEL range conversion factor.

Group: /ancillary_data/histograms

h5es_id	(Attribute)	43		
Description	(Attribute)	Contains ancillary data used during the derivation of histogram data.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
alt_hist_bin_bot_off (Compact Dataset)	FLOAT (1)	Altimetry histogram Bin Bottom offset (not_set)	meters MABEL Detailed Design Doc	Meters subtracted from the DEM height to define the bottom of the noise computation range window.
alt_hist_bin_size (Compact Dataset)	FLOAT (1)	Altimery histogram Bin Size (not_set)	meters MABEL Detailed Design Doc	Size is meters of the altimetry histogram bins.
alt_hist_bin_top_off (Compact Dataset)	FLOAT (1)	Altimetry histogram Bin Top Offset (not_set)	meters MABEL Detailed Design Doc	Meters added to the DEM height to define the top of the altimetry histogram range window.
atm_hist_bin_bot_off (Compact Dataset)	FLOAT (1)	Atmosphere histogram Bin Bottom Offset (not_set)	meters MABEL Detailed Design Doc	Meters subtracted from the DEM height to define the bottom of the atmosphere histogram range window.
atm_hist_bin_size (Compact Dataset)	FLOAT (1)	Atmosphere histogram Bin Size (not_set)	meters MABEL Detailed Design Doc	Size in meters of the atmosphere histogram bins.
atm_hist_bin_top_off (Compact Dataset)	FLOAT (1)	Atmosphere histogram Bin Top Offset (not_set)	meters MABEL Detailed Design Doc	Meters added to the DEM height to define the top of the atmosphere histogram range window.

Group: /ancillary_data/photon_range_window

h5es_id	(Attribute)	44		
Description	(Attribute)	Contains ancillary data used to define the range windows for photons, noise, DEM and mean sea surface.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
dem_range_bot_off (Compact Dataset)	FLOAT (1)	DEM Range bottom offset (not_set)	meters MABEL Detailed Design Doc	Meters subtracted from the DEM height to define the bottom of the photon range window.
dem_range_top_off (Compact Dataset)	FLOAT (1)	DEM Range top offset (not_set)	meters MABEL Detailed Design Doc	Meters added to the DEM height to define the top of the photon range window.
mss_range_bot_off (Compact Dataset)	FLOAT (1)	MSS Range bottom offset (not_set)	meters MABEL Detailed Design Doc	Meters subtracted from the MSS height to define the bottom of the photon range window.
mss_range_top_off (Compact Dataset)	FLOAT (1)	MSS Range top offset (not_set)	meters MABEL Detailed Design Doc	Meters added to the MSS height to define the top of the photon range window.
noise_range_bot_off (Compact Dataset)	FLOAT (1)	Noise Range bottom offset (not_set)	meters MABEL Detailed Design Doc	Meters subtracted from the DEM height to define the bottom of the noise computation range window.
noise_range_top_off (Compact Dataset)	FLOAT (1)	Noise Range top offset (not_set)	meters MABEL Detailed Design Doc	Meters added to the DEM height to define the top of the noise computation range window.

Group: /ancillary_data/segment_sizes

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
h5es_id	(Attribute)	45		
Description	(Attribute)	Contains ancillary data used to define altimetry, atmosphere and meteorological segment sizes.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
alt_seg_shots (Compact Dataset)	INTEGER_4 (1)	Altimetry segment size (not_set)	counts MABEL Detailed Design Doc	Number of laser shots defining an altimetry segment.
atm_seg_shots (Compact Dataset)	INTEGER_4 (1)	Atmosphere segment size (not_set)	counts MABEL Detailed Design Doc	Number of laser shots defining an atmosphere segment.

Group: /ancillary_data/signal_finding

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
h5es_id	(Attribute)	65		
Description	(Attribute)	Contains ancillary data used by the signal finding routine described in the ICESat-2 Global Geolocated Photons ATBD.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
alpha_max (Compact Dataset)	FLOAT (1)	Maximum Slope (not_set)	radians ICESat 2 Global Geolocated Photons ATBD	Maximum slope allowed for slant histogram; if larger than this then dont attempt to fill gap. ATBD label [alpha]max
deslw (Compact Dataset)	FLOAT (1)	Height Window (not_set)	meters ICESat 2 Global Geolocated Photons ATBD	Half the value of the height window used for slant histogramming relative to the surface defined by the linear fit to the surrounding photons at slope, [alpha]. ATBD label: [delta]Eslw
dt_max (Compact Dataset)	FLOAT (1)	Max Time Interval (not_set)	seconds ICESat 2 Global Geolocated Photons ATBD	Maximum time interval over which to select photons to histogram. ATBD label: [delta]t[sub]max
dt_min (Compact Dataset)	FLOAT (1)	Min Time Interval (not_set)	seconds ICESat 2 Global Geolocated Photons ATBD	Minimum time interval over which to select photons to histogram. ATBD label: [delta]t[sub]min
dtime (Chunked Dataset)	FLOAT (UNLIMITED)	time increment (not_set)	seconds GblGeoPhotons ATBD	Time increment at which to step through the photon cloud in a granule. Histograms will be formed at each time interval to identify signal photon events.
dz_max1 (Compact Dataset)	FLOAT (1)	Max Binsize1 (not_set)	meters ICESat 2 Global Geolocated Photons ATBD	Maximum height bin size for histogramming for first sweep . ATBD label: [delta]z[sub]max1
dz_max2 (Compact Dataset)	FLOAT (1)	Max Binsize2 (not_set)	meters ICESat 2 Global Geolocated Photons ATBD	Maximum height bin size for histogramming for second sweep. ATBD label: [delta]z[sub]max2
dz_min (Compact Dataset)	FLOAT (1)	Min Binsize (not_set)	meters ICESat 2 Global Geolocated Photons ATBD	Minimum height bin size for histogramming for first sweep. ATBD label: [delta]z[sub]min
e_gap (Compact Dataset)	FLOAT (1)	Gapfit Multiplier (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Multiplier of [sigma]gapfit, the standard deviation of the residuals between the actual photon events used to estimate the surface across a gap, Egap, and the estimate, Egap. All photons with height > egap _ [sigma]gapfit are edited from the next iteration of calculating Egap. ATBD label: e[sub]gap
ea (Compact Dataset)	FLOAT (1)	EA Multiplier (not_set)	meters ICESat 2 Global Geolocated Photons ATBD	Multiplier of Ha_[sigma] used to determine which bins in Ha may contain signal photon events. ATBD label: e[sub]a
el (Compact Dataset)	FLOAT (1)	Stdev Multiplier for Fit (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Multiplier of standard deviation of linear fit to signal photons used to edit out noise during running linear fit edit. ATBD label: e[sub]l
em (Compact Dataset)	FLOAT (1)	Stdev Multiplier for Signal (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Multiplier of standard deviation of the number of background photon events per bin used in determining if signal photons exist. ATBD label: e[sub]m
em_multi (Compact Dataset)	FLOAT (1)	Multiplier for EM (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Multiplier of em used to determine Thsig2, threshold for singular bins. ATBD label: e[sub]m_multi
hspan_min (Compact Dataset)	FLOAT (1)	Min Height Span (not_set)	meters ICESat 2 Global Geolocated Photons ATBD	Minimum height span for each time interval of photons with confidence flag > 0. If the height span is < htspanmin then all photons not previously selected within +/- htspanmin/2 of the median height of the signal photons selected are marked with a confidence flag of 1. ATBD label: Htspanmin
maxiter_gap (Compact Dataset)	INTEGER_4 (1)	Max Gap Iterations (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	The maximum number of iterations for calculation of Egap. ATBD label: maxiter[sub]gapfit
min_bins (Compact Dataset)	INTEGER_4 (1)	Minimum Bins (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Minimum number of bins in a histogram required for the algorithm to be able to process the histogram. ATBD label: Nbin[sub]min
n_dz1 (Compact Dataset)	INTEGER_4 (1)	Num Binsize1 Increments (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	The number of [delta]z values used for first [delta]z interval [delta]zmin and [delta]zmax1. ATBD label: n[delta]z1
n_dz2 (Compact Dataset)	INTEGER_4 (1)	Num Binsize2 increments (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	The number of [delta]z values used for second [delta]z interval [delta]zmax1 and [delta]zmax2. ATBD label: n[delta]z2
n_p_min (Compact Dataset)	INTEGER_4 (1)	Min Photons (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	The minimum number of photons over which to perform a linear fit to estimate the surface profile across a gap. ATBD label:Nphot[sub]min
r (Compact Dataset)	FLOAT	Ratio for Signal	counts ICESat 2 Global Geolocated Photons ATBD	Minimum ratio of max number of photons in

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
(Compact Dataset)	(1)	(not_set)	ICESat 2 Global Geolocated Photons ATBD	histogram bin to mean noise value that must exist to consider a bin a signal bin. ATBD label: R
r2 (Compact Dataset)	FLOAT (1)	Ratio of Signal to Total (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Minimum ratio of (maximum number of photons in any one bin of contiguous signal bins)/(Maximum number of photons in largest bin) in order to accept a group of signal bins as real signal. ATBD label: R2
seg_time_len (Compact Dataset)	FLOAT (1)	Segment Time Interval (not_set)	seconds ICESat 2 Global Geolocated Photons ATBD	Time increment at which to step through the photon cloud Histograms will be formed at each [delta]time to identify signal photon events. ATBD label: [delta]time
snr_low (Compact Dataset)	FLOAT (1)	SNR Low (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Signal to noise ratio below which all selected signal has low confidence. ATBD label: snrlow
snr_med (Compact Dataset)	FLOAT (1)	SNR Med (not_set)	counts ICESat 2 Global Geolocated Photons ATBD	Signal to noise ratio above which all selected signal has high confidence. Selected signal with signal to noise ratio between snrlow and snrmed is marked as medium confidence. ATBD label: snrmed

Group: /ancillary_data/streak_removal

h5es_id	(Attribute)	46		
Description	(Attribute)	Contains ancillary data used by the streak-removal algorithm.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
remove_streaks_1064 (Compact Dataset)	INTEGER_4 (1)	1064 streak removal flag (not_set)	counts MABEL Detailed Design Doc	Indicates activation of streak removal algorithm.
remove_streaks_532 (Compact Dataset)	INTEGER_4 (1)	532 streak removal flag (not_set)	counts MABEL Detailed Design Doc	Indicates activation of streak removal algorithm.
streak_m (Compact Dataset)	FLOAT (1)	Streak M (not_set)	meters MABEL Detailed Design Doc	Minimum distance in meters between start and end photons to consider consecutive photons a streak.
streak_n (Compact Dataset)	FLOAT (1)	Streak N (not_set)	meters MABEL Detailed Design Doc	Distance in meters between consecutive photons adequate to consider those photons not part of a streak.

Group: /channel

h5es_id	(Attribute)	64
Description	(Attribute)	Contains per-channel data.
data_rate	(Attribute)	Parameters in this group at the data rate of each respective subgroup.

Group: /channel/altimetry

h5es_id	(Attribute)	37
Description	(Attribute)	Contains per-channel channel altimetry data.
data_rate	(Attribute)	Parameters in this group at the altimetry segment rate (defined in /ancillary_data/segment_sizes/alt_seg_shots).

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ch_latitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Channel Latitude (latitude)	degrees_north Derived (Geolocation ATBD)	Latitude at midpoint of the segment. Derived from geolocated photons, WGS84, North=+
ch_longitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Channel Longitude (longitude)	degrees_east Derived (Geolocation ATBD)	Channel Longitude at the midpoint of the segment. Derived from geolocated photons, WGS84, North=+
delta_time_end (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time End (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Exclusive elapsed time at the end of each (or the) data segment, referenced to granule_gps_epoch.
delta_time_start (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time Start (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Inclusive elapsed time at the start of each (or the) data segment, referenced to granule_gps_epoch.
noise_rate (Chunked Dataset)	FLOAT (UNLIMITED)	noise_rate (not_set)	hertz Derived	Noise Rate. Number of photons in the noise range window divided by segment time duration.

Group: /channel/altimetry/histogram

h5es_id	(Attribute)	40
Description	(Attribute)	Contains altimetry histograms for this channel derived from the number of photons detected within a region defined by the altimetry histogram range window (/ancillary_data/histograms) and the altimetry segment length (/ancillary_data/segment_sizes/alt_seg_shots).
data_rate	(Attribute)	Parameters in this group at the altimetry segment rate (defined in /ancillary_data/segment_sizes/alt_seg_shots).

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
alt_hist_ht_top (Chunked Dataset)	FLOAT (UNLIMITED)	Histogram Height (height)	meters Derived	Height to the top bin of the altimetry histogram
alt_hist_n_shots (Chunked Dataset)	INTEGER_4 (UNLIMITED)	n_hist_shots (not_set)	counts Derived	The n_hist_shots parameter is the number of unique shots, with at least one photon detection, found within the histogram time segment and histogram range window
alt_histogram (Chunked Dataset)	INTEGER_4 (200, UNLIMITED)	altimetry_histogram (not_set)	counts Derived	altimetry histogram - count of the number of photons in each defined height bin. Dimensions are time and bin_number. The first element of the bin dimension corresponds to the highest bin.

Group: /channel/altimetry/signal_finding				
h5es_id	(Attribute)	63		
Description	(Attribute)	Parameters related to the L2A signal finding routine.		
data_rate	(Attribute)	Parameters in this group at the altimetry segment rate (defined in /ancillary_data/segment_sizes/alt_seg_shots).		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
bg_mean (Chunked Dataset)	FLOAT (UNLIMITED)	Background Mean (not_set)	counts Derived (signal finding)	The mean of the number of background counts expected in one elevation bin of the signal finding histogram.
bg_sdev (Chunked Dataset)	FLOAT (UNLIMITED)	Background Standard Deviation (not_set)	counts Derived (signal finding)	The standard deviation of the number of background counts expected in one elevation bin of the signal finding histogram.
delta_time (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Elapsed seconds since granule_gps_epoch.
n_ph_signal (Chunked Dataset)	INTEGER_4 (UNLIMITED)	Number of signal photons (not_set)	counts Derived (signal finding)	The number of photons determined as signal within the segment. This includes padding (ph_class=1).
n_ph_total (Chunked Dataset)	INTEGER_4 (UNLIMITED)	Total Photon count (not_set)	counts Derived (signal finding)	The total number of photons within the segment that fall within the photon range window.
ph_end_index (Chunked Dataset)	INTEGER_8 (UNLIMITED)	Photon End Index (not_set)	counts Derived	Index number into the associated array of photons for the last photon within this segment. The array indexing starts at 1, not 0. This is an index into the range-window-filtered photons stored on this product. It does not represent the photons used in noise and histogram computations since those computations use different range windows.
ph_start_index (Chunked Dataset)	INTEGER_8 (UNLIMITED)	Photon starting index (not_set)	counts Derived	Index number into the associated array of photons for the first photon within this segment. The array indexing starts at 1, not 0. This is an index into the range-window-filtered photons stored on this product. It does not represent the photons used in noise and histogram computations since those computations use different range windows.
sig_dt (Chunked Dataset)	FLOAT (UNLIMITED)	signal finding time interval (not_set)	sec Derived (signal finding)	Integration time over which the majority of the signal photon cloud events within this segment were classified.
sig_dz (Chunked Dataset)	FLOAT (UNLIMITED)	bin size for signal finding (not_set)	m Derived (signal finding)	Histogram size for which the majority of the photon events within this segment were classified.
Group: /channel/atmosphere				
h5es_id	(Attribute)	49		
Description	(Attribute)	Contains atmosphere histograms and related parameters for this channel. Histograms are derived from the number of photons detected within a region defined by the atmosphere histogram range window (/ancillary_data/histograms) and the atmosphere segment length (/ancillary_data/segment_sizes/atm_seg_shots).		
data_rate	(Attribute)	Parameters in this group at the atmosphere segment rate (defined in /ancillary_data/segment_sizes/atm_seg_shots).		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
atm_hist_ht_top (Chunked Dataset)	FLOAT (UNLIMITED)	Histogram Top (height)	meters Derived	Height to the top bin of the atmosphere histogram
atm_hist_n_shots (Chunked Dataset)	INTEGER_4 (UNLIMITED)	n_hist_shots (not_set)	counts Derived	The n_hist_shots parameter is the number of unique shots, with at least one photon detection, found within the histogram time segment and histogram range window
atm_histogram (Chunked Dataset)	INTEGER_4 (500, UNLIMITED)	atmosphere_histogram (not_set)	counts Derived	atmosphere histogram - count of the number of photons in each defined height bin. Dimensions are time and bin_number. The first element of the bin dimension corresponds to the highest bin.
bg_mean (Chunked Dataset)	FLOAT (UNLIMITED)	Atmosphere Background Mean (not_set)	counts Derived (Photon Classification ATBD)	Noise background mean of the atmosphere segment. This value is computed by the signal finding routine using its signal-removing technique to create background-only statistics.
bg_sdev (Chunked Dataset)	FLOAT (UNLIMITED)	Background Standard Deviation (not_set)	counts Derived (Photon Classification ATBD)	Background standard deviation for the Atmosphere segment. This value is computed by the signal finding routine using its signal-removing technique to create background-only statistics.
ch_latitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Channel Latitude (latitude)	degrees_north Derived (Geolocation ATBD)	Latitude at midpoint of the segment. Derived from geolocated photons, WGS84, North=+
ch_longitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Channel Longitude (longitude)	degrees_east Derived (Geolocation ATBD)	Channel Longitude at the midpoint of the segment. Derived from geolocated photons, WGS84, North=+
delta_time_end (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time End (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Exclusive elapsed time at the end of each (or the) data segment, referenced to granule_gps_epoch.
delta_time_start (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time Start (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Inclusive elapsed time at the start of each (or the) data segment, referenced to granule_gps_epoch.
Group: /channel/photon				
h5es_id	(Attribute)	52		
Description	(Attribute)	Contains photon cloud data for this channel.		
data_rate	(Attribute)	Parameters in this group are at the photon detection rate.		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
delta_time (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Elapsed seconds since granule_gps_epoch.
ph_class (Chunked Dataset)	INTEGER_1 (UNLIMITED)	Photon Classification Flag (not_set)	counts Derived (signal finding ATBD)	Photon classification flag. 0=noise, 1=buffer, 2=low, 3=medium, 4=high flag_values: 0, 1, 2, 3, 4 flag_meanings : noise buffer low medium high
ph_class_src (Chunked Dataset)	INTEGER_1 (UNLIMITED)	Photon Classification Source (not_set)	counts Derived (signal finding ATBD)	Source of the Photon classification flag. 0=none or no background, 1=ellipsoidal histogram, 2=slant histogram, 3=padding flag_values: 0, 1, 2, 3, 4 flag_meanings : none ellipsoidal slant pad no_bg
ph_h (Chunked Dataset)	FLOAT (UNLIMITED)	elev (height)	meters Derived (Geolocation ATBD)	Photon height above the WGS84 ellipsoid derived from geolocation.
ph_id (Chunked Dataset)	INTEGER_2 (UNLIMITED)	photon_id (not_set)	counts Derived	Photon-per-shot counter. Increments for each photon detected within a shot. Together with shot_num, forms a unique identifier for each photon. However, be aware of shot_num rollover.
ph_latitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Photon Latitude (latitude)	degrees_north Derived (Geolocation ATBD)	Photon Latitude derived from geolocation, WGS84, North=+
ph_longitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Photon Longitude (longitude)	degrees_east Derived (Geolocation ATBD)	Photon Longitude derived from geolocation, WGS84, North=+
ph_shot (Chunked Dataset)	INTEGER_4 (UNLIMITED)	Photon shot number (not_set)	counts L1A Shottag packet	Shot Number, copied from the L1A shottag packet.
Group: /channel/quality_assessment				
h5es_id	(Attribute)	53		
Description	(Attribute)	Contains per-channel QA statistics.		
data_rate	(Attribute)	Parameters in this group at 0.1Hz.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
delta_time_end (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time End (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Exclusive elapsed time at the end of each (or the) data segment, referenced to granule_gps_epoch.
delta_time_start (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time Start (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Inclusive elapsed time at the start of each (or the) data segment, referenced to granule_gps_epoch.
first_lat (Chunked Dataset)	DOUBLE (UNLIMITED)	Initial latitude (not_set)	degrees_north Derived (QA)	Latitude computed for initial photon.
first_lon (Chunked Dataset)	DOUBLE (UNLIMITED)	Initiallongitude (not_set)	degrees_east Derived (QA)	Longitude computed for initial photon.
last_lat (Chunked Dataset)	DOUBLE (UNLIMITED)	final latitude (not_set)	degrees_north Derived (QA)	Latitude computed for final photon.
last_lon (Chunked Dataset)	DOUBLE (UNLIMITED)	final longitude (not_set)	degrees_east Derived (QA)	Longitude computed for final photon.
n_ht (Chunked Dataset)	INTEGER_4 (UNLIMITED)	number of heights (not_set)	counts Derived (QA)	Number of height measurements computed.
shots_w_streak (Chunked Dataset)	INTEGER_4 (UNLIMITED)	shots with streaks (not_set)	counts Derived (QA)	Number of shots with streaks.
streak_n_del (Chunked Dataset)	INTEGER_4 (UNLIMITED)	streaks deleted (not_set)	counts Derived (QA)	Number of streaks deleted.
streaklen (Chunked Dataset)	DOUBLE (5, UNLIMITED)	streak length (not_set)	meters Derived (QA)	Streak length statistics. Values are in the order number_of_points, minimum, maximum, average, standard_deviation.
Group: /flight_parameters				
h5es_id	(Attribute)	4		
Description	(Attribute)	Contains flight/scenario characteristics derived from information provided by the MABEL instrument team.		
data_rate	(Attribute)	Parameters in this group are single-instances valid for the entire file.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
angle_1064_mrad (Compact Dataset)	FLOAT (50)	1064 Angle (not_set)	mrad Ancillary Scenario File	Angle of each 1064 connector
angle_532_mrad (Compact Dataset)	FLOAT (50)	532 Angle (not_set)	mrad Ancillary Scenario File	Angle of each 532 connector
channel_1064 (Compact Dataset)	INTEGER_4 (50)	1064 Channel Numbers (not_set)	counts Ancillary Scenario File	Channel number for each 1064 channel
channel_1064_flag (Compact Dataset)	INTEGER_4 (50)	1064 Channel Flag (not_set)	counts Ancillary Scenario File	Channel flag (0=processed, 1=skipped)
channel_532 (Compact Dataset)	INTEGER_4 (50)	532 Channel Numbers (not_set)	counts Ancillary Scenario File	Channel number for each 532 channel
channel_532_flag (Compact Dataset)	INTEGER_4 (50)	532 Channel Flag (not_set)	counts Ancillary Scenario File	Channel flag (0=processed, 1=skipped)
comments (Compact Dataset)	STRING:255 (1)	Flight Comments (not_set)	not_set Ancillary Flight File	Comments from the MABEL flight team
connector_1064	INTEGER_4	1064 Connector Numbers	counts	Connector number for each 1064 channel

Name	Type	Long Name	Units / Source	Description
connector_1064 (Compact Dataset)	INTEGER_4 (50)	1064 Connector Numbers (not_set)	counts Ancillary Scenario File	Connector number for each 1064 channel
connector_532 (Compact Dataset)	INTEGER_4 (50)	532 Connector Numbers (not_set)	counts Ancillary Scenario File	Connector number for each 532 channel
ds_pulse_shape (Contiguous Dataset)	INTEGER_1 (20)	Pulse Shape Index (not_set)	ns MABEL Flight Team	index of the Transmit Pulse Shape (tx_pulse_shape_x)
ds_tof_port (Contiguous Dataset)	INTEGER_1 (50)	TOF channel port (not_set)	not_set not_set	Dimension scale for TOF channels.
elevation_1064_mrad (Compact Dataset)	FLOAT (50)	1064 Elevation (not_set)	mrad Ancillary Scenario File	Elevation for each 1064 connector (mrad)
elevation_532_mrad (Compact Dataset)	FLOAT (50)	532 Elevation (not_set)	mrad Ancillary Scenario File	Elevation for each 532 connector (mrad)
fiber_1064 (Compact Dataset)	INTEGER_4 (50)	1064 Fiber Numbers (not_set)	counts Ancillary Scenario File	Fiber number for each 1064 channel
fiber_532 (Compact Dataset)	INTEGER_4 (50)	532 Fiber Numbers (not_set)	counts Ancillary Scenario File	Fiber number for each 532 channel
filt_energy_1064_u (Compact Dataset)	FLOAT (50)	1064 Filtered Energy (not_set)	uJ Ancillary Scenario File	Filtered energy for each 1064 channel (uJ)
filter_1064 (Compact Dataset)	FLOAT (50)	1064 Filter per Channel (not_set)	mm Ancillary Scenario File	Filter for each 1064 channel
filter_532 (Compact Dataset)	FLOAT (50)	532 Filter per Channel (not_set)	mm Ancillary Scenario File	Filter for each 532 channel
filter_density_1064 (Compact Dataset)	FLOAT (2)	1064 Filter Density (not_set)	counts Ancillary Scenario File	Density of the 1064 filters
filter_density_532 (Compact Dataset)	FLOAT (2)	532 Filter Density (not_set)	counts Ancillary Scenario File	Density of the 532 filters
filter_size_1064 (Compact Dataset)	FLOAT (2)	1064 Filter Size (not_set)	mm Ancillary Scenario File	Size of 1064 filter(s)
filter_size_532 (Compact Dataset)	FLOAT (2)	532 Filter Size (not_set)	mm Ancillary Scenario File	Size of 532 filter(s)
filtered_energy_532_u (Compact Dataset)	FLOAT (50)	532 Filtered Energy (not_set)	uJ Ancillary Scenario File	Filtered energy for each 532 channel (uJ)
flight_end_utc (Compact Dataset)	STRING:28 (1)	Ending Time of Flight (not_set)	not_set Ancillary Flight File	UTC stop time of the flight in CCSDS-A format
flight_location (Compact Dataset)	STRING:255 (1)	Flight Location (not_set)	counts Ancillary Flight File	Primary location of the flight
flight_number (Contiguous Dataset)	INTEGER_4 (1)	Flight Number (not_set)	counts Ancillary Flight File	Incremental flight number
flight_start_utc (Compact Dataset)	STRING:28 (1)	Start Time of Flight (not_set)	not_set Ancillary Flight File	UTC start time of the flight in CCSDS-A format
flight_version (Compact Dataset)	STRING:80 (1)	Flight File Version (not_set)	counts Ancillary Flight File	Version number of the ancillary flight file.
gps_rate (Compact Dataset)	INTEGER_4 (1)	GPS Rate (not_set)	hertz Ancillary Flight File	Data rate of the GPS (Hz)
imu_bias (Compact Dataset)	DOUBLE (3)	IMU Bias (not_set)	mrad Ancillary Scenario File	IMU bias coefficients (IMU to vehicle frame); roll, pitch, yaw (mrad)
imu_rate (Compact Dataset)	INTEGER_4 (1)	IMU Rate (not_set)	hertz Ancillary Flight File	Data rate of the IMU (Hz)
label (Compact Dataset)	STRING:255 (1)	Flight Label (not_set)	not_set Ancillary Flight File	Unique label associated with the flight
laser_rate (Compact Dataset)	INTEGER_4 (1)	Laser Rate (not_set)	hertz Ancillary Flight File	Data rate of the Laser (Hz)
mab_bias_1064 (Compact Dataset)	DOUBLE (3)	MABEL Bias 1064 (not_set)	mrad Ancillary Scenario File	1064 MABEL bias coefficients (MABEL frame to IMU); roll, pitch, heading (mrad)
mab_bias_532 (Compact Dataset)	DOUBLE (3)	MABEL Bias 532 (not_set)	mrad Ancillary Scenario File	532 MABEL bias coefficients (MABEL frame to IMU); roll, pitch, heading (mrad)
mab_imu_off (Compact Dataset)	DOUBLE (3)	MABEL IMU Offset (not_set)	mrad Ancillary Scenario File	IMU origin ofsets; roll, pitch, heading (mrad)
mab_lrp_off (Compact Dataset)	DOUBLE (3)	MABEL Laser Reference Point Offset (not_set)	mrad Ancillary Scenario File	Laser reference point offsets; roll, pitch, heading (mrad)
num_channels_1064 (Compact Dataset)	INTEGER_4 (1)	Number of 1064 Channels (not_set)	counts Derived	Number of 1064 channels present during the flight.
num_channels_532 (Compact Dataset)	INTEGER_4 (1)	Number of 532 channels (not_set)	counts Derived	Number of 532 channels present during the flight.
num_filter_1064 (Compact Dataset)	INTEGER_4 (1)	Number of 1064 Filters (not_set)	counts Derived	Number of 1064 filters present during the flight.
num_filter_532 (Compact Dataset)	INTEGER_4 (1)	Number of 532 filters (not_set)	counts Derived	Number of 532 filters present during the flight.
num_poi (Compact Dataset)	INTEGER_4 (1)	Number of POIs (not_set)	counts Ancillary Flight File	Number of points-of-interest for the flight
offset2_on_ground_1064_m (Compact Dataset)	FLOAT (50)	1064 Offset 2 (not_set)	m Ancillary Scenario File	Pitch offset on ground for each 1064 channel (m)
offset2_on_ground_532_m (Compact Dataset)	FLOAT (50)	532 Offset 2 (not_set)	m Ancillary Scenario File	Pitch offset on ground for each 532 channel (m)

(Compact Dataset)	(50)	(not_set)	Ancillary Scenario File	
offset_on_ground_1064_m (Compact Dataset)	FLOAT (50)	1064 Offset (not_set)	m Ancillary Scenario File	Roll offset on ground for each 1064 channel (m)
offset_on_ground_532_m (Compact Dataset)	FLOAT (50)	532 Offset (not_set)	m Ancillary Scenario File	Roll offset on ground of each 532 channel (m)
path_length_1064_mm (Compact Dataset)	FLOAT (50)	1064 Path Length (not_set)	mm Ancillary Scenario File	Path length for each 1064 fiber (mm)
path_length_532_mm (Compact Dataset)	FLOAT (50)	532 Path Length (not_set)	mm Ancillary Scenario File	Path length for each 532 fiber (mm)
platform_longname (Compact Dataset)	STRING:255 (1)	Platform Longname (not_set)	not_set Ancillary Scenario File	Long name of platform (aircraft) carrying the MABEL instrument.
platform_shortname (Compact Dataset)	STRING:255 (1)	Platform Shortname (not_set)	not_set Ancillary Scenario File	Short name of platform (aircraft) carrying the MABEL instrument.
point_of_interest (Compact Dataset)	STRING:255 (1)	Point of Interest (not_set)	not_set Ancillary Flight File	Points of interest identified by the mabel flight team
power_1064_mw (Compact Dataset)	FLOAT (50)	1064 Power (not_set)	mW Ancillary Scenario File	Power for each 1064 channel (mW)
power_532_mw (Compact Dataset)	FLOAT (50)	532 Power (not_set)	mW Ancillary Scenario File	Power for each 532 channel (mW)
raw_energy_1064_u (Compact Dataset)	FLOAT (50)	1064 Raw Energy (not_set)	uJ Ancillary Scenario File	Raw energy for each 1064 channel (uJ)
raw_energy_532_u (Compact Dataset)	FLOAT (50)	532 Raw Energy (not_set)	uJ Ancillary Scenario File	Raw energy for each 532 channel (uJ)
rec_power_1064_mw (Compact Dataset)	FLOAT (50)	1064 Received Power (not_set)	mW Ancillary Scenario File	Received power for each 1064 channel (mW)
rec_power_532_mw (Compact Dataset)	FLOAT (50)	532 Received Power (not_set)	mW Ancillary Scenario File	Received power for each 532 channel (mW)
reference_channel_1064 (Compact Dataset)	INTEGER_4 (1)	1064 Reference Channel (not_set)	counts Ancillary Scenario File	Representative channel for 1064
reference_channel_532 (Compact Dataset)	INTEGER_4 (1)	532 Reference Channel (not_set)	counts Ancillary Scenario File	Representative channel for 532
scenario_number (Contiguous Dataset)	INTEGER_4 (1)	Scenario Number (not_set)	counts Ancillary Flight File	Associated mabel configuration scenario number
scenario_utc_time (Compact Dataset)	STRING:17 (1)	Start Time of Scenario (not_set)	not_set Ancillary Scenario File	UTC start time of the scenario in CCSDS-A format
scenario_version (Compact Dataset)	STRING:80 (1)	Scenario Version (not_set)	not_set Ancillary Scenario File	Version number of the ancillary scenario file
transmit_efficiency_1064 (Compact Dataset)	FLOAT (50)	Transmit Efficiency 532 (not_set)	percent MABEL Flight Team	The laboratory-measured efficiency of the transmit path, for each beam, from the point the transmit power was measured to its output point from MABEL.
transmit_efficiency_532 (Compact Dataset)	FLOAT (50)	Transmit Efficiency 532 (not_set)	percent MABEL Flight Team	The laboratory-measured efficiency of the transmit path, for each beam, from the point the transmit power was measured to its output point from MABEL.
tx_pulse_shape_1064 (Compact Dataset)	FLOAT (20)	Transmit Pulse Shape 1064 (not_set)	ns MABEL Flight Team	The laboratory-measured shape of the 1064 Transmit Pulse. Values are provided every 0.5 ns.
tx_pulse_shape_532 (Compact Dataset)	FLOAT (20)	Transmit Pulse Shape 532 (not_set)	ns MABEL Flight Team	The laboratory-measured shape of the 532 Transmit Pulse. Values are provided every 0.5 ns.
Group: /meteorology				
h5es_id	(Attribute)	59		
Description	(Attribute)	This group contains meteorological information interpolated from GEOS5 FP_IT data produced by the Global Modeling and Assimilation Office (GMAO) at NASA Goddard Space Flight Center. A set of values is stored for each atmosphere segment (defined by /ancillary_data/segment_sizes/atm_seg_shots).		
data_rate	(Attribute)	Parameters in this group at the atmosphere segment rate (defined in /ancillary_data/segment_sizes/atm_seg_shots).		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
cloud (Chunked Dataset)	FLOAT (48, UNLIMITED)	cloud_fraction_for_radiation (cloud_fraction_for_radiation)	1 GEOS5 FP_IT	The horizontal fractional cloud cover for each layer as seen by the radiation. In the vertical, clouds are assumed to fill the layer. This fraction is the combination of the models predicted large-scale and convective fractions that is used for radiative purposes. Interpolated to the midpoint of the atmosphere segment. Reported at the native GEOS5-FPIT levels up to approximately 30Km.
delta_time_end (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time End (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Exclusive elapsed time at the end of each (or the) data segment, referenced to granule_gps_epoch.
delta_time_start (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time Start (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Inclusive elapsed time at the start of each (or the) data segment, referenced to granule_gps_epoch.
ds_met_levels (Contiguous Dataset)	INTEGER_4 (48)	met_levels_dim_scale (not_set)	counts not_set	Dimension scale for native GEOS5 FT-IP levels up to approximately 30Km. Actual height values vary due to the geoid.
h (Chunked Dataset)	FLOAT (48, UNLIMITED)	mid_layer_heights (mid_layer_heights)	m GEOS5 FP_IT	Geopotential height of the layer. Interpolated to the midpoint of the atmosphere segment. Reported at the native GEOS5-FPIT levels up to approximately 30Km.

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
o3 (Chunked Dataset)	FLOAT (48, UNLIMITED)	ozone_mass_mixing_ration (ozone_mass_mixing_ration)	kg kg-1 GEOS5 FP_IT	Ozone mass mixing ratio. Interpolated to the midpoint of the atmosphere segment. Reported at the native GEOS5-FPIT levels up to approximately 30Km.
pl (Chunked Dataset)	FLOAT (48, UNLIMITED)	mid_level_pressure (mid_level_pressure)	Pa GEOS5 FP_IT	The layer pressure defined as the average of the upper and lower edge pressures, PLE, in Pa. Interpolated to the midpoint of the atmosphere segment. Reported at the native GEOS5-FPIT levels up to approximately 30Km.
qv (Chunked Dataset)	FLOAT (48, UNLIMITED)	Specific Humidity (specific_humidity)	kg kg-1 GEOS5 FP-IT	Specific humidity. Interpolated to the midpoint of the atmosphere segment. Reported at native GEOS5 FP-IT levels up to approximately 30Km.
rt_latitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Reference Track Latitude (latitude)	degrees_north Derived (Reference Track)	Latitude of the location on a center-beam, altitude-based reference track used for determining the DEM, geoid, surface_type, and photon/noise windows.
rt_longitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Reference Track Longitude (longitude)	degrees_east Derived (Reference Track)	Longitude of the location on a center-beam, altitude-based reference track used for determining the DEM, geoid, surface_type, and photon/noise windows.
slp (Chunked Dataset)	FLOAT (UNLIMITED)	sea_level_pressure (sea_level_pressure)	Pa GEOS5 FP_IT	The surface pressure reduced to sea level, in Pa. Over topography the reduction is done by assuming a lapse rate of 6.5 K km-1 from a free atmospheric temperature. Interpolated to the midpoint of the atmosphere segment.
t (Chunked Dataset)	FLOAT (48, UNLIMITED)	temperature (air_temperature)	K GOES5_FP_IT	Air temperature in Kelvin. Interpolated to the midpoint of the atmosphere segment. Reported at native GEOS5 FP-IT levels up to approximately 30Km.
u (Chunked Dataset)	FLOAT (48, UNLIMITED)	Eastward Wind Velocity (eastward_wind)	m s-1 GEOS5 FP_IT	Eastward wind velocity Interpolated to the midpoint of the atmosphere segment. Reported at native GEOS5 FP-IT levels up to approximately 30Km.
v (Chunked Dataset)	FLOAT (48, UNLIMITED)	northward_wind (northward_wind)	m s-1 GEOS5 FP_IT	Northward wind velocity. Interpolated to the midpoint of the atmosphere segment. Reported at native GEOS5 FP-IT levels up to approximately 30Km.

Group: /novatel_ins

h5es_id	(Attribute)	22	
Description	(Attribute)	Contains parameters provided within the L1A Novatel INS input file.	
data_rate	(Attribute)	Most parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz). The imu2gps and s2body parameters are single instance values for the whole file.	

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
delta_time (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Elapsed seconds since granule_gps_epoch.
ds_xyz (Contiguous Dataset)	INTEGER_4 (3)	Dimension scale for XYZ axes. (not_set)	counts Geolocation ATBD	Dimension scale for XYZ axes (x, y, z) flag_values: 1, 2, 3 flag_meanings : X Y Z
imu2gps_lever (Compact Dataset)	FLOAT (3)	Lever Arm XYZ (not_set)	m L1A INS Data File	IMU to GNSS Antenna Lever Arm X,Y,Z. This parameter may not be available for early MABEL flights (check FillValue).
s2body_rot (Compact Dataset)	FLOAT (3)	SC to Body XYZ (not_set)	m L1A INS Data File	Sensor-to-Body rotation X, Y, Z. This parameter may not be available for early MABEL flights (check FillValue).

Group: /novatel_ins/attitude

h5es_id	(Attribute)	23	
Description	(Attribute)	Contains aircraft orientation parameters from the Novatel INS instrument.	
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)	

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_heading (Chunked Dataset)	DOUBLE (UNLIMITED)	heading (not_set)	degrees L1A INS Data	Heading angle computed by GPS/INS routines
ins_heading_sd (Chunked Dataset)	FLOAT (UNLIMITED)	heading_sd (not_set)	degrees L1A INS Data	standard deviation of heading
ins_pitch (Chunked Dataset)	DOUBLE (UNLIMITED)	pitch (not_set)	degrees L1A INS Data	Pitch angle computed by GPS/INS routines
ins_pitch_sd (Chunked Dataset)	FLOAT (UNLIMITED)	pitch_sd (not_set)	degrees L1A INS Data	standard deviation of pitch
ins_roll (Chunked Dataset)	DOUBLE (UNLIMITED)	roll (not_set)	degrees L1A INS Data	Roll angle computed by GPS/INS routines
ins_roll_sd (Chunked Dataset)	FLOAT (UNLIMITED)	roll_sd (not_set)	degrees L1A INS Data	standard deviation of roll

Group: /novatel_ins/covariance

h5es_id	(Attribute)	60	
Description	(Attribute)	Contains velocity-related parameters.	
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)	

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_cx11 (Chunked Dataset)	DOUBLE (UNLIMITED)	Position X-X covariance (not_set)	m2 L1A INS Data	Position X-X covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cx21 (Chunked Dataset)	DOUBLE (UNLIMITED)	Position Y-X covariance (not_set)	m2 L1A INS Data	Position Y-X covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cx22 (Chunked Dataset)	DOUBLE (UNLIMITED)	Position Y-Y covariance (not_set)	m2 L1A INS Data	Position Y-Y covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cx31 (Chunked Dataset)	DOUBLE (UNLIMITED)	Position Z-X covariance (not_set)	m2 L1A INS Data	Position Z-X covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cx32 (Chunked Dataset)	DOUBLE (UNLIMITED)	Position Z-Y covariance (not_set)	m2 L1A INS Data	Position Z-Y covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cx33 (Chunked Dataset)	DOUBLE (UNLIMITED)	Position Z-Z covariance (not_set)	m2 L1A INS Data	Position Z-Z covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxee (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxee (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxeh (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxeh (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxen (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxen (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxhh (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxhh (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxnh (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxnh (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxnn (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxnn (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxvee (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxvee (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxveh (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxveh (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxven (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxven (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxvhh (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxvhh (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxvnh (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxvnh (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_cxvnn (Chunked Dataset)	DOUBLE (UNLIMITED)	ins_cxvnn (not_set)	m2 L1A INS Data	cx11 covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_vel_cx11 (Chunked Dataset)	DOUBLE (UNLIMITED)	Velocity X-X covariance (not_set)	m2/s2 L1A INS Data	Velocity X-X covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_vel_cx21 (Chunked Dataset)	DOUBLE (UNLIMITED)	Velocity Y-X covariance. (not_set)	m2/s2 L1A INS Data	Velocity Y-X covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_vel_cx22 (Chunked Dataset)	DOUBLE (UNLIMITED)	Velocity Y-Y covariance (not_set)	m2/s2 L1A INS Data	Velocity Y-Y covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_vel_cx31 (Chunked Dataset)	DOUBLE (UNLIMITED)	Velocity Z-X covariance. (not_set)	m2/s2 L1A INS Data	Velocity Z-X covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_vel_cx32 (Chunked Dataset)	DOUBLE (UNLIMITED)	Velocity Z-Y covariance (not_set)	m2/s2 L1A INS Data	Velocity Z-Y covariance. This parameter may not be available on early MABEL flights. Check FillValue.
ins_vel_cx33 (Chunked Dataset)	DOUBLE (UNLIMITED)	Velocity Z-Z covariance (not_set)	m2/s2 L1A INS Data	elocity Z-Z covariance. This parameter may not be available on early MABEL flights. Check FillValue.
Group: /novatel_ins/ecef				
h5es_id	(Attribute)	24		
Description	(Attribute)	Contains Earth-centered, earth-facing (ECEF) parameters from the Novatel INS instrument.		
data_rate	(Attribute)	Most parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz). The imu2gps and s2body parameters are single instance values for the whole file.		
Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_x_ecef (Chunked Dataset)	DOUBLE (UNLIMITED)	x_ecef (not_set)	meters L1A INS Data	X, earth-centered earth-fixed frame
ins_x_ecef_sd (Chunked Dataset)	FLOAT (UNLIMITED)	x_ecef_sd (not_set)	meters L1A INS Data	standard deviation of x_ecef
ins_y_ecef (Chunked Dataset)	DOUBLE (UNLIMITED)	y_ecef (not_set)	meters L1A INS Data	Y, earth-centered earth-fixed frame
ins_y_ecef_sd (Chunked Dataset)	FLOAT (UNLIMITED)	y_ecef_sd (not_set)	meters L1A INS Data	standard deviation of y_ecef

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_z_ecef (Chunked Dataset)	DOUBLE (UNLIMITED)	z_ecef (not_set)	meters L1A INS Data	Z, earth-centered earth-fixed frame
ins_z_ecef_sd (Chunked Dataset)	FLOAT (UNLIMITED)	z_ecef_sd (not_set)	meters L1A INS Data	standard deviation of z_ecef

Group: /novatel_ins/flags

h5es_id	(Attribute)	25		
Description	(Attribute)	Contains flag data from the Novatel INS instrument.		
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_bad_field_count (Chunked Dataset)	INTEGER_4 (UNLIMITED)	bad_field_count (not_set)	counts L1A INS Data	Number of fields in this INS record that were determined as bad uponinput of the L1A INS data. These fields are generally filled with a value of -9999.99
ins_flag (Chunked Dataset)	INTEGER_4 (UNLIMITED)	imu_flag (not_set)	counts L1A INS Data	IMU Status - (0=ideal), where : 0=GPS position computed and used; 1=GPS range update applied; 2=no update applied (free mode); 3=zero velocity update applied (not moving); 4=phase update applied. flag_values: 0, 1, 2, 3, 4 flag_meanings : position_used position_update free_mode not_moving phase_update
ins_num_gps_sat (Chunked Dataset)	INTEGER_4 (UNLIMITED)	Number of GPS Satellites (not_set)	counts L1A INS Data	Number of GPS satellites in observation
ins_quality_num (Chunked Dataset)	INTEGER_4 (UNLIMITED)	quality_num (not_set)	counts L1A INS Data	Quality factor (integer: 1=best; 6=worst)

Group: /novatel_ins/geolocation

h5es_id	(Attribute)	26		
Description	(Attribute)	Contains geolocation-related parameters from the Novatel INS instrument.		
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_comb_sd (Chunked Dataset)	FLOAT (UNLIMITED)	Combined standard deviation (not_set)	meters L1A INS Data	Combined N, E, and Hgt standard deviation
ins_ht_ell (Chunked Dataset)	DOUBLE (UNLIMITED)	Height above ellipsoid (height)	meters L1A INS Data	Height above WGS84 ellipsoid
ins_latitude (Chunked Dataset)	DOUBLE (UNLIMITED)	latitude (latitude)	degrees_north L1A INS Data	Latitude, WGS84, North=+
ins_longitude (Chunked Dataset)	DOUBLE (UNLIMITED)	longitude (longitude)	degrees_east L1A INS Data	Longitude, WGS84, East=+

Group: /novatel_ins/rms

h5es_id	(Attribute)	28		
Description	(Attribute)	Contains RMS values from the Novatel INS instrument.		
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_ca_rms (Chunked Dataset)	FLOAT (UNLIMITED)	ca_rms (not_set)	counts L1A INS Data	C/A code RMS error
ins_l1_rms (Chunked Dataset)	FLOAT (UNLIMITED)	l1_rms (not_set)	counts L1A INS Data	L1 RMS error

Group: /novatel_ins/solar_angle

h5es_id	(Attribute)	29		
Description	(Attribute)	Contains solar angle parameters from the Novatel INS instrument.		
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_solar_azimuth (Chunked Dataset)	FLOAT (UNLIMITED)	Solar Azimuth (not_set)	degrees L1A INS Data	Azimuth of the sun from true north, at position and time
ins_solar_elevation (Chunked Dataset)	FLOAT (UNLIMITED)	Solar Elevation (not_set)	degrees L1A INS Data	elevation of sun above horizon, at position and time

Group: /novatel_ins/sta

h5es_id	(Attribute)	30		
Description	(Attribute)	Contains status parameters from the Novatel INS instrument.		
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ins_pdop (Chunked Dataset)	FLOAT (UNLIMITED)	position dilution of precision (not_set)	counts L1A INS Data	position dilution of precision (indicator of x, y, z geometry)

Group: /novatel_ins/time

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
h5es_id	(Attribute)	31		
Description	(Attribute)	Contains GPS time parameters from the Novatel INS instrument.		
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)		
ins_gps_sow (Chunked Dataset)	DOUBLE (UNLIMITED)	gps seconds of week (not_set)	seconds L1A INS Data	GPS seconds of week corrected for receiver clock bias
ins_gps_week (Chunked Dataset)	INTEGER_4 (UNLIMITED)	gps week (not_set)	weeks L1A INS Data	GPS week number

Group: /novatel_ins/velocity

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
h5es_id	(Attribute)	27		
Description	(Attribute)	Contains velocity-related parameters.		
data_rate	(Attribute)	Parameters in this group are at the data rate of the L1B Novatel INS data packet (nominally 100hz)		
ins_v_east (Chunked Dataset)	FLOAT (UNLIMITED)	v_east (not_set)	meters per second L1A INS Data	Velocity component in the local level east axis
ins_v_north (Chunked Dataset)	FLOAT (UNLIMITED)	v_north (not_set)	meters per second L1A INS Data	Velocity component in the local level north axis
ins_v_up (Chunked Dataset)	FLOAT (UNLIMITED)	v_up (not_set)	meters per second L1A INS Data	Velocity component in the local level vertical axis

Group: /quality_assessment

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
h5es_id	(Attribute)	6		
Description	(Attribute)	Contains quality assessment data. This may include QA counters, QA along-track data and/or QA summary data.		
data_rate	(Attribute)	Parameters in this group at the data rate defined in each quality_assessment subgroup.		
delta_time_end (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time End (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Exclusive elapsed time at the end of each (or the) data segment, referenced to granule_gps_epoch.
delta_time_start (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time Start (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Inclusive elapsed time at the start of each (or the) data segment, referenced to granule_gps_epoch.

Group: /reference_track

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
h5es_id	(Attribute)	35		
Description	(Attribute)	Contains parameters derived from the location given by the reference track (or at the same data rate as the reference track data) Segment size is defined by /ancillary_data/segment_sizes/alt_seg_shots.		
data_rate	(Attribute)	Parameters in this group are at the altimetry segment rate (defined in /ancillary_data/segment_sizes/alt_seg_shots).		
delta_time_end (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time End (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Exclusive elapsed time at the end of each (or the) data segment, referenced to granule_gps_epoch.
delta_time_start (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time Start (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Inclusive elapsed time at the start of each (or the) data segment, referenced to granule_gps_epoch.
rt_latitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Reference Track Latitude (latitude)	degrees_north Derived (Reference Track)	Latitude of the location on a center-beam, altitude-based reference track used for determining the DEM, geoid, surface_type, and photon/noise windows.
rt_longitude (Chunked Dataset)	DOUBLE (UNLIMITED)	Reference Track Longitude (longitude)	degrees_east Derived (Reference Track)	Longitude of the location on a center-beam, altitude-based reference track used for determining the DEM, geoid, surface_type, and photon/noise windows.

Group: /reference_track/corrections

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
h5es_id	(Attribute)	61		
Description	(Attribute)	Contains corrections derived from the location on the reference track at the altimetry segment rate. (/ancillary_data/segment_sizes/alt_seg_shots). Ancillary data used in the derivations are found in the group /ancillary_data/photon_range_window.		
data_rate	(Attribute)	Parameters in this group at the altimetry segment rate (defined in /ancillary_data/segment_sizes/alt_seg_shots).		
atm_dd_dh1064 (Chunked Dataset)	DOUBLE (UNLIMITED)	Atmosphere Delay Ratio 1064 (not_set)	meters Derived (Atmosphere Delay ATBD)	Ratio of atmosphere delay to height for 1064. Used to compute an additive per-shot atmosphere delay that is applied to 1064 heights after geolocation.
atm_dd_dh532 (Chunked Dataset)	DOUBLE (UNLIMITED)	Atmosphere Delay Ratio 532 (not_set)	meters Derived (Atmosphere Delay ATBD)	Ratio of atmosphere delay to height for 532. Used to compute an additive per-shot atmosphere delay that is applied to 532 heights after geolocation.
atm_delay1064 (Chunked Dataset)	DOUBLE (UNLIMITED)	Atmosphere Delay 1064 (not_set)	meters Derived (Atmosphere Delay ATBD)	1064 delay due to atmosphere, computed from the platform altitude to the the DEM height. Used to compute an additive per-shot atmosphere delay that is applied to 1064 heights after geolocation.

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
atm_delay532 (Chunked Dataset)	DOUBLE (UNLIMITED)	Atmosphere Delay 532 (not_set)	meters Derived (Atmosphere Delay ATBD)	532 delay due to atmosphere, computed from the platform altitude to the the DEM height. Used to compute an additive per-shot atmosphere delay that is applied to 532 heights after geolocation.
transtime (Chunked Dataset)	FLOAT (UNLIMITED)	Transit Time (not_set)	seconds Derived (ht_ell/(speed_light/2.0))	Transit time of the laser light to photon bounce. Not applied to heights.

Group: /reference_track/geophysical

h5es_id	(Attribute)	38		
Description	(Attribute)	Contains geophysical parameters derived from the location on the reference track at the altimetry segment data rate. Includes MSS (mean sea surface), geoids, suface type, and range windows for each altimetry segment. The duration of an altimetry segment is defined by /ancillary_data/segment_sizes/alt_seg_shots.		
data_rate	(Attribute)	Parameters in this group at the altimetry segment rate (defined in /ancillary_data/segment_sizes/alt_seg_shots).		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
ds_surf_type (Contiguous Dataset)	INTEGER_4 (5)	Dimension scale for surf_type (not_set)	counts not_set	Dimension scale for surf_type. Defines the meaning of each surf_type array element. flag_values: 1, 2, 3, 4, 5 flag_meanings : LAND OCEAN SEA_ICE LAND_ICE INLAND_WATER
egm2008_geoid (Chunked Dataset)	FLOAT (UNLIMITED)	egm2008_hgt (not_set)	meters EGM2008 ANC File	Interpolated geoid values from the EGM2008 1min grid.
egm96_geoid (Chunked Dataset)	FLOAT (UNLIMITED)	egm96_geoid (not_set)	meters EGM96 ANC File	Interpolated geoid values from the EGM96 15min grid.
mss_h (Chunked Dataset)	FLOAT (UNLIMITED)	mean_sea_surface (height)	meters DTU10 ANC File	Mean Sea Surface height. Values interpolated from the 1-min DTU10 MSS (global ocean), referenced to T/P ellipsoid. The value is not adjusted since there are only small differences between the WGS84 and TOPEX ellipsoids (about 0.71 meters).
noise_window_bot (Chunked Dataset)	FLOAT (UNLIMITED)	Bottom of the Noise Window (not_set)	meters Derived (dem_h-NOISE_RANGE_BOT_OFF)	Bottom height of the noise window used for noise rate calculation. (ht_dem-NOISE_RANGE_BOT_OFF)
noise_window_top (Chunked Dataset)	FLOAT (UNLIMITED)	noise_top_window (not_set)	meters Derived (dem_h+NOISE_RANGE_TOP_OFF)	Top height of the noise window used for noise rate calculation. (ht_dem+NOISE_RANGE_TOP_OFF)
photon_window_bot (Chunked Dataset)	FLOAT (UNLIMITED)	Photon Window Bottom (not_set)	meters Derived (dem_h-DEM_RANGE_BOT_OFF)	Bottom of the height window for altimeter-reported photons. (dem_ht-DEM_RANGE_BOT_OFF)
photon_window_top (Chunked Dataset)	FLOAT (UNLIMITED)	Top of the photon window (not_set)	meters Derived (h_dem+DEM_RANGE_TOP_OFF)	Top of the height window for altimeter-reported photons. (dem_ht+DEM_RANGE_TOP_OFF)
surf_type (Chunked Dataset)	INTEGER_4 (5, UNLIMITED)	Surface Type Flag (not_set)	counts Derived (ICESat-2 Surface Masks)	The surface type flag indicates the presence of a particular surface type at the coordinates of the reference track (rt_latitude, rt_longitude). Since a particular location may indicate multiple surface types, this flag is an array of 5 values in the order LAND, OCEAN, SEA_ICE, LAND_ICE, INLAND_WATER. 0=surface type not present; 1=surface type present. These values are derived from surface masks provided by the ICESat-2 Project Science Office. flag_values: 0, 1 flag_meanings : NOT_PRESENT PRESENT

Group: /tof

h5es_id	(Attribute)	12		
Description	(Attribute)	Contains Time-of-Flight packet data for each TOF card in use.		
data_rate	(Attribute)	Parameters in this group are at the rate defined in each tof subgroup.		

Group: /tof/osc_corr

h5es_id	(Attribute)	34		
Description	(Attribute)	Contains oscillator correction data for each TOF card in use.		
data_rate	(Attribute)	Parameters in this group are at the oscillator-correction rate (0.1 hz).		

Label (Layout)	Datatype (Dimensions)	long_name (standard_name)	units source	description
delta_time (Chunked Dataset)	DOUBLE (UNLIMITED)	Delta Time (not_set)	seconds since granule_gps_epoch Derived (gps_seconds-granule_gps_epoch)	Elapsed seconds since granule_gps_epoch.
osc_corr (Chunked Dataset)	DOUBLE (UNLIMITED)	oscillator correction (not_set)	hertz Derived: osc_corr= (2.95d8*delta_gps_sow)/(32*delta_PPSTag)	osc_corr is a hardware-dependent frequency-based correction for range. It is derived by computing the deltas of corresponding TOF status gps_sow and PPSTag values and using the equation provided.
osc_flag (Chunked Dataset)	UINT_1_LE (UNLIMITED)	oscillator correction flag (not_set)	counts Derived: set to 1 if 1.05 < osc_corr > 0.95	The osc_corr flag is use to determine if the corresponding osc_corr is within valid bounds. A non-zero value indicates the corresponding osc_corr should not be used as a range correction flag_values: 0, 1 flag_meanings : osc_corr_valid osc_corr_not_valid