Beta 100 m Land Segment ATL08 EGIS Services Technical Specifications

1 INTRODUCTION

1.1 Data Service Overview

Beta 100 m Land Segment ATLAS/ICESat-2 L3A Land and Vegetation Height, Version 7 - December 2025 - March 2026 is a freely accessible GIS-ready data analysis and visualization service for exploring a subset of the satellite laser altimeter data available in the ATL08 data product. It includes three layers: 1) a feature service, 2) an OGC feature service, and 3) a map image service. These layers each provide different pathways to interact with ATL08 data and can be accessed using the NASA Earthdata GIS (EGIS) web platform, ArcGIS Pro, or QGIS.

This is a beta version of the ATL08 EGIS services published for testing purposes. It consists of a 91-day batch of ATL08 data, which represents a single repeat cycle of the ICESat-2 satellite.

1.2 Data Service Information

1.2.1 Key Differences between ATL08 and the 100m Land Segment ATL08 Data Service

The ATL08 data accessible using the EGIS platform is a subset of the complete ATL08 Version 7 data product, allowing for streamlined data access and processing. It differs from the full ATL08 data set in the following ways:

- The point feature class represents 100 m segment locations and does not include the arrays of 20 m information from the source data product.
- A selection of “core” 100 m parameters was chosen from the full suite of parameters available in the complete ATL08 source data. A list of the available is available in Appendix A below.

1.2.2 Methods

ATL08 data are read from the source .h5 files using the open-source icesat2gis Python library developed for this purpose. Under the hood, icesat2gis uses xarray to read the source data and pandas/geopandas to format the data into a GIS-compatible format. Flag values that are stored as byte values in the source h5 file have been converted to their string representations (e.g., the “urban_flag” variable in the h5 data is stored as ubyte, where 0 represents “not_urban”, 1

represents “urban” and 255 represents “Undetermined” - icesat2gis converts the byte values into their human-readable meaning), but otherwise data are not changed.

Data read with icesat2gis are written to GeoPackage format as an intermediate processing step before being handed off to arcpy, which handles ingest into the EGIS Relational Database System (RDS), a postgresql database. The ATL08 service layers made available through the EGIS portal are served from this database.

1.2.3 Source Data

The source data for these services are available from the NASA National Snow and Ice Data Center Distributed Active Archive Center (NSIDC DAAC) as ATLAS/ICESat-2 L3A Land and Vegetation Height, Version 7.

ATL08 data are derived from geolocated, time-tagged photon heights, along with other parameters, passed from the ATLAS/ICESat-2 L2A Global Geolocated Photon Data (ATL03) product. These data were collected from the Advanced Topographic Laser Altimeter System (ATLAS) instrument aboard the Ice, Cloud and land Elevation Satellite-2 (ICESat-2). ATLAS has a single laser split into six beams and arranged in three pairs to better gauge the slope of Earth's surface. The instrument measures heights across Earth's surface by comparing the time it takes for a laser pulse to echo from the ground back to the receiver as it orbits the Earth. Additional information about the ATLAS instrument, the ICESat-2 satellite, and ICESat-2 data products can be found here.

APPENDIX A – AVAILABLE PARAMETERS

Parameter	Definition	Units
objectid	Internal ID	–
ground_track	Ground track ID	–
source_filename	Source ATL08 HDF5 file	–
bm_strength	Beam strength	–
datetime	Date and time	MM/DD/YYYY, HH:MM
cycle_number	A count of the number of exact repeats of this reference orbit.	-
orbit_number	Unique identifying number for each planned ICESat-2 orbit.	-
h_canopy	98% height of all the individual canopy relative heights for the segment above the estimated terrain surface. Relative canopy heights have been computed by differencing the canopy photon	meters
h_canopy_uncertainty	Uncertainty of the relative canopy heights for the segment. Incorporates all systematic uncertainties as well asuncertainty from errors of identified photons. See section 1 and equations 1.4 and 1.5 of the ATL08 ATBD.	meters
h_min_canopy	The minimum of relative individual canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface.	meters
h_max_canopy	Relative maximum of individual canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface. Should be equivalent to RH100 metric reported in the literature.	meters
h_median_canopy	The median of individual relative canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface. This parameter should be equivalent to RH50 reported in the literature	meters
h_mean_canopy	Mean of individual relative canopy heights within segment. Relative canopy heights have been computed by differencing the canopy photon height from the estimated terrain surface.	meters

h_canopy_abs	The 98% height of all the absolute individual canopy heights referenced above the WGS84 ellipsoid.	meters
h_min_canopy_abs	The minimum of absolute individual canopy heights within segment referenced above the WGS84 Ellipsoid.	meters
h_max_canopy_abs	Maximum of individual absolute canopy heights within segment referenced above the WGS84 ellipsoid.	meters
h_median_canopy_abs	The median of individual absolute canopy heights within segment referenced above the WGS84 Ellipsoid.	meters
h_mean_canopy_abs	Mean of the individual absolute canopy heights within segment referenced above the WGS84 Ellipsoid.	meters
canopy_openness	Standard Deviation of all photons classified as canopy photons within the segment to provide inference of canopy openness.	-
h_dif_canopy	Difference between h_canopy and h_median_canopy	meters
photon_rate_can	Calculated photon rate of canopy photons within each 100m segment	s^{-1}
canopy_h_metrics10	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 10th percentile.	meters
canopy_h_metrics15	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 15th percentile.	meters
canopy_h_metrics20	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 20th percentile.	meters
canopy_h_metrics25	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 25th percentile.	meters
canopy_h_metrics30	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 30th percentile.	meters
canopy_h_metrics35	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 35th percentile.	meters
canopy_h_metrics40	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 40th percentile.	meters

canopy_h_metrics45	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 45th percentile.	meters
canopy_h_metrics50	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 50th percentile.	meters
canopy_h_metrics55	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 55th percentile.	meters
canopy_h_metrics60	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 60th percentile.	meters
canopy_h_metrics65	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 65th percentile.	meters
canopy_h_metrics70	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 70th percentile.	meters
canopy_h_metrics75	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 75th percentile.	meters
canopy_h_metrics80	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 80th percentile.	meters
canopy_h_metrics85	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 85th percentile.	meters
canopy_h_metrics90	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 90th percentile.	meters
canopy_h_metrics95	Height metrics based on the cumulative distribution of relative canopy heights above the interpolated ground surface, calculated at the 95th percentile.	meters
h_te_best_fit	The best fit terrain elevation at the the mid-point location of each 100m segment. The mid-segment terrain elevation is determined by selecting the best of three fits- linear, 3rd order and 4th order polynomials - to the terrain photons and interpolating the elevation at the mid-point location of the 100 m segment. For the linear fit, a slope correction and weighting is applied to each ground photon based on the distance to the slope height at the center of the segment.	meters

h_te_uncertainty	Uncertainty of the mean terrain height for the segment. This uncertainty incorporates all systematic uncertainties(e.g. timing orbits, geolocation,etc.) as well as uncertainty from errors of identified photons. This parameter is described in section 1, equation 1.4 in ATL08 ATBD.	meters
terrain_slope	The along-track slope of terrain, within each segment;computed by a linear fit of terrain classified photons. Slope is in units of delta height over delta along track distance.	-
h_te_min	The minimum of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment.	meters
h_te_max	The maximum of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment.	meters
h_te_median	The median of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment.	meters
h_te_mean	The mean of the photon heights above the WGS84 Ellipsoid, classified as terrain within the segment.	meters
photon_rate_te	Calculated photon rate of terrain photons within each 100m segment	s^-1
solar_elevation	Solar Angle above or below the plane tangent to the ellipsoid surface at the laser spot. Positive values mean the sun is above the horizon, while negative values mean it is below the horizon. The effect of atmospheric refraction is not included. This is a low precision value, with approximately TBD degree accuracy.	degrees
brightness_flag	Flag indicating that the ground surface is bright (e.g. snow-covered or other bright surfaces).	-
urban_flag	The urban flag indicates that a segment is likely located over an urban area as determined by coincident pixels in the Global Urban Footprint (GUF) 0.4 arcsecond product.	-
rgt	The reference ground track (RGT) is the track on the earth at which a specified unit vector within the observatory is pointed. Under nominal operating conditions, there will be no data collected along the RGT, as the RGT is spanned by GT3 and GT4. During slews or off-pointing, it is possible that ground tracks may intersect the RGT. The ICESat-2 mission has 1387 RGTs.	-
layer_flag	This flag is a combination of multiple flags (cloud_flag_atm, cloud_flag_asr, and bsnow_con) and takes daytime/nighttime into consideration.	-
msw_flag	Multiple Scattering Warning flag.	-

dem_h	Best available DEM (in priority of Arctic/Antarctic/Global/MSS) value at the geolocation point. Height is in meters above the WGS84 Ellipsoid.	meters
latitude	Latitude of the center-most signal photon within each segment.	degrees
longitude	Longitude of the center-most signal photon within each segment.	degrees
utc_timestamp_string	UTC time stamp	-