LVIS L1A Geotagged Images, Version 1

USER GUIDE

How to Cite These Data

As a condition of using these data, you must include a citation:

Blair, J. B. and M. Hofton. 2020. *LVIS L1A Geotagged Images, Version 1*. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/NE5KKKBAQG44. [Date Accessed].

FOR QUESTIONS ABOUT THESE DATA, CONTACT NSIDC@NSIDC.ORG

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/OLVIS1A

National Snow and Ice Data Center

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1 DATA DESCRIPTION

NOTE: This user guide refers to NASA's Land, Vegetation, and Ice Sensor (LVIS) Facility Technical Reference Document (LVIS Technical Reference), which contains a full list and descriptions of missions to date. This document can be found on the data set landing page under Documentation.

This Level-1A data set contains high-resolution color digital camera imagery obtained during NASA LVIS aircraft flight campaigns. The LVIS cameras are units manufactured by Canon and Phase One, which are typically mounted adjacent to the LVIS lidar instrument and face downward during each flight. Camera location and attitude at acquisition are added to each image file.

Related Level-1B data sets include *LVIS Classic L1B Geolocated Return Energy Waveforms* and *LVIS Facility L1B Geolocated Return Energy Waveforms*, which contain the geolocated laser waveform data for each laser footprint collected by the LVIS instrumentation; related Level-2 data sets include *LVIS Classic L2 Geolocated Surface Elevation and Canopy Height Product* and *LVIS Facility L2 Geolocated Surface Elevation and Canopy Height Product*, which contain canopy top elevations, ground elevations, and relative heights derived from the Level-1B data.

1.1 Parameters

The data files include down-looking images of various overflown terrains, such as forests, glaciers, tundra, ocean, lakes, fields, and volcanoes.

1.2 File Information

1.2.1 Format

The data files are provided in JPEG (`.JPG`) format. Some images are also captured in the native Canon Raw Version 2 (`.CR2`) format. Each data file is paired with an associated XML file (`.xml`), which contains additional metadata.

1.2.2 File Contents

Figure 1 shows an example data set image from a Canon camera.

Figure 1. Sample image of coastline.

Note the image metadata for the Canon cameras can be extracted using the ExifTool by Phil Harvey.

Command line example:

exiftool -config ATT68716.ExifTool_config OLVIS1A_CAM050MP_GL2022_0721_R2210_042247.JPG

1.2.3 Naming Convention

The files are named according to the following conventions, depending on the camera used and data release date (see Table 1).

Canon (before November 2024):

`OLVIS1A_CAMERA_CAMPAIGNYYYY_MMDD_RYYMM_nnnnnn.ext`

Phase One (before November 2024):

`OLVIS1A_CAMERA_CAMPAIGNYYYY_MMDD_RYYMM_hh-mm-ss.sss.ext`

All cameras since November 2024:

`OLVIS1A_CAMERA_CAMPAIGNYYYY_MMDD_RYYMM_nnnnnn_p.ext`

Table 1. File Naming Convention

Variable	Description
OLVIS1A	LVIS L1A Geotagged Images, Version 1 data set
CAMERA	Indicates the camera system used: • CAM1 or CAM2 = Canon EOS 5DS R or Canon EOS 5D Mk II (see LVIS Technical Reference for specific model and lens) • CAM020MP = Canon EOS 5D Mk II (lens may vary; see LVIS Technical Reference) • CAM050MP = Canon EOS 5DS R (lens may vary; see LVIS Technical Reference) • CAM150MP = Phase One iXM-RS150F
CAMPAIGNYYYY	Campaign identifier or primary location. Examples: ABoVE = Arctic-Boreal Vulnerability Experiment; GEDI = Global Ecosystem Dynamics Investigation; US = USA; GL = Greenland (see "Section 3 File Naming Convention" of the LVIS Technical Reference for a full list) YYYY = four-digit year of campaign
MMDD	Two-digit month and two-digit day of start of data collection
RYYMM	Date (two-digit year, two-digit month) of data production
nnnnnn or nnnnnn_p	• nnnnnn = Number of seconds since GPS midnight of the day the data collection started (Canon before November 2024) • nnnnnn_p = Number of seconds since GPS midnight of the day the data collection started, where p is a decimal second (all cameras since November 2024)
hh-mm-ss.sss	Number of hours, minutes, seconds, and fractional seconds since UTC midnight of the day the data collection started (Phase One before November 2024)
ext	File type: • .JPG (JPEG data file) or .CR2 (Canon Raw Version 2 data file) • .JPG.xml (XML metadata file)

Example file names (before November 2024):

OLVIS1A_CAM2_GEDI2021_0727_R2111_073613.JPG

OLVIS1A_CAM050MP_GL2022_0721_R2210_042247.JPG

OLVIS1A_CAM150MP_IS2LakeIce2024_0226_R2407_18-48-50.997.JPG

Example file name (since November 2024):

OLVIS1A_CAM150MP_ARCSIX2024_0517_R2411_81971_4.JPG

1.3 Spatial Information

1.3.1 Coverage

The data set covers various regions within the spatial extents below:

Northernmost latitude: 88° N
Southernmost latitude: 35° S
Westernmost longitude: 168° W
Easternmost longitude: 27° E

1.3.2 Resolution

Varies

See the LVIS Technical Reference for campaign- and instrument-specific resolution information.

1.3.3 Geolocation

Table 2. Geolocation Details

Geographic coordinate system	WGS 84
Projected coordinate system	N/A
Longitude of true origin	Prime Meridian, Greenwich
Latitude of true origin	N/A
Scale factor at longitude of true origin	N/A
Datum	World Geodetic System 1984 ensemble
Ellipsoid/spheroid	WGS 84
Units	degree
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs +type=crs
Reference	https://epsg.io/4326

1.4 Temporal Information

1.4.1 Coverage

7 November 2018 to present

For information on campaign dates, see the LVIS Technical Reference.

1.4.2 Resolution

Varies

2 DATA ACQUISITION AND PROCESSING

2.1 Instrumentation

Images were taken with one or two downward-facing (nadir) cameras. Up until 2021, the cameras used were exclusively Canon EOS. In 2022, the Phase One iXM-RS150F camera system was added to the instrument suite and primarily operated on high-altitude portions of flights. See the LVIS Technical Reference for campaign- and instrument-specific information.

2.1.1 Canon

Imagery is captured from the camera via the Canon EOS camera utility software, also used to control image exposure. The rate at which imagery is collected is controlled using an external intervalometer and varies depending on the altitude and ground speed of the airplane and desired overlap between images. The intervalometer provides a transistor-transistor-logic (TTL) pulse to an Applanix Postion and Orientation system to allow precise timing, positioning, and attitude for each image to be added during post processing. Information added to the header of each image includes GPS Time Stamp, GPS Date Stamp, GPS Latitude, GPS Longitude, GPS Altitude, GPSRoll, GPSPitch, and GPS Img Direction. The image name is amended to include the acquisition time of the image relative to GPS midnight of the day on which data collection started.

2.1.2 Phase One

Camera imagery is controlled and captured using the Phase One iX Capture software and acquired at a rate determined by the desired nominal overlap, depending on the altitude and ground speed of the aircraft. Using positioning and attitude information provided by the Applanix Position and Orientation system, the Phase One Capture software writes camera location and pointing information into the header of each image in real time, including GPS Latitude, GPS Longitude, GPS Altitude, GPSIMU Roll, GPSIMU Pitch, and GPSIMU Yaw. During post-mission processing, pointing and positioning information is updated with more precise data. The image name contains the acquisition time of the image relative to UTC midnight of the day on which data collection started.

2.2 Quality, Errors, and Limitations

2.2.1 Canon

For all LVIS Camera images, the time stamp information is available in the file name as well as in the Exif data for each file under the “GPS Date/Time” field. Due to a formatting error, a 1-second offset may exist in the image collection time contained in the Exif “GPS Date/Time” field. The

affected flights are listed in the Known Issues sections of the LVIS Technical Reference. For images from these flights, the collection time contained in the file name should be used, or one second should be added to the time contained in the Exif “GPS Date/Time” field.

2.2.2 Phase One

None

3 VERSION HISTORY

Table 3. Version History Summary

Version	Date Implemented	Impacted Temporal Coverage	Description of Changes
1.0	12 May 2025	12 Apr to 27 Apr 2022	Added CReSIS 2022 Canon camera data
1.0	8 Apr 2025	17 May to 16 Aug 2024	Added SARP 2024 and ARCSIX 2024 Canon camera data
1.0	17 Mar 2025	17 May to 16 Aug 2024	Added SARP 2024 and ARCSIX 2024 Phase One camera data
1.0	23 Dec 2024	21 and 25 Apr 2022	Added Greenland Spring 2022 Phase One camera data
1.0	20 Nov 2024	26 Feb and 1 Mar 2024	Added ICESat-2 Lake Ice campaign data
1.0	12 Nov 2020		Initial release

4 RELATED DATA SETS

LVIS Classic L1B Geolocated Return Energy Waveforms (LVISC1B)

LVIS Classic L2 Geolocated Surface Elevation and Canopy Height Product (LVISC2)

LVIS Facility L1B Geolocated Return Energy Waveforms (LVISF1B)

LVIS Facility L2 Geolocated Surface Elevation and Canopy Height Product (LVISF2)

5 RELATED WEBSITES

LVIS at NSIDC

LVIS at NASA Goddard Space Flight Center

6 ACKNOWLEDGMENTS

For acknowledgments, see the LVIS Technical Reference.

7 DOCUMENT INFORMATION

7.1 Publication Date

November 2020

7.2 Date Last Updated

September 2025