IceBridge 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. *IceBridge 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/GW4Q1SXIZAJC. [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/IOLVIS1A

National Snow and Ice Data Center

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1 DATA DESCRIPTION

The images in this Level-1A product were collected by the NASA Digital Mapping Camera, which was mounted alongside the Land, Vegetation, and Ice Sensor (LVIS), as part of Operation IceBridge campaigns. Related data sets include *IceBridge LVIS L1B Geolocated Return Energy Waveforms*, which contains the geolocated laser waveform data for each laser footprint collected by the LVIS instrumentation, and *IceBridge LVIS L2 Geolocated Surface Elevation Product*, which contains canopy top elevations, ground elevations, and relative heights derived from the Level-1B data.

1.1 Parameters

The data files include images of various terrains, such as sea ice, ocean surface, and glaciers.

1.2 File Information

1.2.1 Format

The data files are provided in JPEG format (.JPG). 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 image from the file `IOLVIS1A_CAM1_GL2017_0920_R1803_043816.JPG`.

Figure 1. Sample image of snowy and icy terrain.

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

Command line example:

exiftool -config ATT68716.ExifTool_config IOLVIS1A_CAM1_GL2017_0920_R1803_043816.JPG

1.2.3 Naming Convention

The files are named according to the following convention, which is described in more detail in Table 1.

```
IOLVIS1A_CAM#_LOYYYY_MMDD_RYYMM_nnnnnn.ext
```

Table 1. File Naming Convention

Variable	Description
IOLVIS1A	Data set ID
CAM#	CAM1 = LVIS-Camera1, CAM2 = LVIS-Camera2
LLYYYY	Campaign identifier • LL = location (GL = Greenland, AQ = Antarctica) • YYYY = four-digit year of campaign
MMDD	Two-digit month, two-digit day of start of data collection
RYYMM	Date (two-digit year, two-digit month) of data release
nnnnnn	Number of seconds since UTC midnight of the day on which data collection started
ext	File type: .JPG (JPG data file) or .xml (metadata)

Example file names:

```
IOLVIS1A_CAM1_GL2017_0920_R1803_043816.JPG
IOLVIS1A_CAM1_GL2017_0920_R1803_043816.JPG.xml
```

1.2.4 Browse Files

The Antarctica campaign includes .JPG browse files with "_reduced" appended to the file names. For example, IOLVIS1A_CAM1_AQ2015_1102_R2105_085812_reduced.JPG.

1.3 Spatial Information

1.3.1 Coverage

Coverage for this data set includes parts of the Arctic, Greenland, Antarctica, surrounding ocean areas, and transit flights:

Southernmost latitude: 82° S
Northernmost latitude: 90° N
Westernmost longitude: 180° W
Easternmost longitude: 180° E

1.3.2 Resolution

Spatial resolution varies with aircraft altitude. The nominal spatial resolution is 3.1 km by 2.0 km (0.35 m per pixel) at a nominal flight altitude of 27,000 ft.

1.3.3 Geolocation

For data up to and including 2015, LVIS used ITRF 2000 / WGS 84. Starting in 2017, LVIS used ITRF 2008 / WGS-84. See the following tables for geolocation details.

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	WGS 84
Ellipsoid/spheroid	WGS 84
Units	degree
EPSG code	4326
PROJ4 string	+proj=longlat +datum=WGS84 +no_defs +type=crs
Reference	https://epsg.io/4326

Table 2. ITRF Details*

Geographic coordinate system	WGS 84	WGS 84
Prime Meridian	0°	0°
Datum	ITRF 2000	ITRF 2008
Ellipsoid/spheroid	GRS 1980	GRS 1980
Units	meters	meters
False easting	0	0
False northing	0	0
EPSG code	4919	5332
PROJ4 string	+proj=geocent +ellps=GRS80 +units=m +no_defs +type=crs	+proj=geocent +ellps=GRS80 +units=m +no_defs +type=crs
Reference	https://epsg.io/4919	https://epsg.io/5332

*For data up to and including 2015, LVIS used ITRF 2000. Starting in 2017, LVIS used ITRF 2008.

1.4 Temporal Information

1.4.1 Coverage

17 September 2015 to 20 September 2017

1.4.2 Resolution

IceBridge campaigns were conducted on an annually repeating basis. Arctic, Greenland, and Alaska campaigns were typically conducted during March, April, and May; Antarctic campaigns were typically conducted during October and November.

2 DATA ACQUISITION AND PROCESSING

2.1 Instrumentation

The images provided in this data set were taken with a downward-facing (nadir) Canon EOS 5DS R camera with an image resolution of 50.3 Megapixels (8896 px by 5920 px). The lens model is a Carl Zeiss Makro-Planar T* 100mm f/2 ZE. Frame overlap is approximately 75%.

2.2 Acquisition and Processing

Imagery is stored via Ethernet on a supporting computer running the Canon EOS camera utility software to monitor and control image exposure. Frame capture is controlled using an external

intervalometer. The intervalometer provides a Transistor-Transistor-Logic (TTL) pulse to the navigation system, which enables precise timing, positioning, and attitude for each image capture.

Images are acquired at 5-second intervals. The image name contains the acquisition time in number of seconds since UTC midnight of the day on which data collection started. Each image is tagged with data regarding the precise time of the acquisition, as well as position and orientation of the camera at time of acquisition; this includes latitude, longitude, altitude, roll, pitch, and yaw.

2.3 Quality, Errors, and Limitations

Currently, there are no known errors or limitations in this data set.

3 RELATED DATA SETS

- IceBridge LVIS L0 Raw Ranges
- IceBridge LVIS L1B Geolocated Return Energy Waveforms
- IceBridge LVIS L2 Geolocated Surface Elevation Product

4 RELATED WEBSITES

- LVIS data product website at NSIDC
- LVIS website at NASA Goddard Space Flight Center
- ABoVE website at NASA

4.1 Acknowledgments

This work was supported through funding from Hank Margolis (NASA - SMD - ESD Terrestrial Ecology).

5 DOCUMENT INFORMATION

5.1 Publication Date

December 2019

5.2 Date Last Updated

February 2024