

NASA Land, Vegetation, and Ice Sensor (LVIS)

<http://lvis.gsfc.nasa.gov>

Contact:

Dr. Michelle Hofton, Univ. of Maryland College Park (MHofton@umd.edu)

Bryan Blair, NASA/GSFC (James.B.Blair@nasa.gov)

AfriSAR Gabon 2016 Data Release Oct 2016

In February and March of 2016, NASA's LVIS system was flown over sites in Gabon for the AfriSAR project, a joint campaign between NASA, ESA, DLR and AGEOS. LVIS was mounted on the NASA Langley B200 aircraft and flown at ~24,000' over selected target areas and lines. Flight dates and primary targets for each flight are listed below (Table 1).

Flight trajectories can be found at <http://lvis.gsfc.nasa.gov/Gabon2016Map.html>

This October 2016 data release includes Level1b and Level2 data products from the Lope flight. The Level1B product contains the geolocated laser return waveforms. The Level2 product contains elevation (ground and canopy top) and Relative Height (RH) products derived from the Level1B file. Level2 files are much smaller and more manageable. For those users not familiar with waveform lidar data, we recommend that you start with the Level2 data. The Gabon data were much more complex (and taller and more varied and interesting...) than we initially estimated and, because of this, processing and filtering took longer than we had planned as we had to develop some new algorithms. We will continue to refine the ground finding and error identification algorithms for future releases. For this initial release, we have filtered out laser data shots that we believe did not penetrate through to the ground (e.g., mostly due to clouds or fog) as well as shots where our interpretation algorithm returned an erroneous location. We are continuing to work to improve the Level2 products and welcome all feedback.

Interpreting waveforms is partially a statistical process as we are setting thresholds above electronic and optical noise to detect weak signals. As such, there will be some (small) percentage of the data that we have misinterpreted. We have attempted to do an initial Quality Check of the data to remove obvious errors, but there will be some small percentage of the data that have some error in the ground elevation or the canopy top height. We highly recommend that end users contact us about any idiosyncrasies or unexpected results. We also recommend that users review the Level1B waveforms for their specific areas of study to verify that ground return and canopy top identification seem reasonable.

In terms of horizontal geolocation knowledge, initial crossover comparisons indicate that the data are consistent at the meter level horizontally and that the vertical accuracy of the geolocated waveforms is at the 5-10 cm level.

Level1B Geolocated LVIS Waveforms

The Version 2 LVIS Level1B Geolocated Return Energy Waveforms data files are in HDF5 format. Parameters contained in the Level1B file are described below:

LFID		LVIS file identification
		LVIS shot number assigned during collection.
shotnumber		Together with LFID these are a unique identifier for every LVIS laser shot. Format is XXYYYYYYZZZ where XX identifies instrument version, YYYYYY is the Modified Julian Date of the flight departure day, ZZZ represents file number.
azimuth	degrees	Azimuth angle of laser beam
incidentangle	degrees	Off-nadir incident angle of laser beam
range	meters	Distance between the instrument and the ground
time	seconds	UTC decimal seconds of the day
lon0	degrees	Longitude of the highest sample of the waveform (degrees East)
lat0	degrees	Latitude of the highest sample of the waveform (degrees North)
z0	meters	Elevation of the highest sample of the waveform
lon1023	degrees	Longitude of the lowest sample of the waveform (degrees East)
Lat1023	degrees	Latitude of the lowest sample of the waveform (degrees North)
z1023	meters	Elevation of the lowest sample of the waveform
sigmean	counts	Signal mean noise level, calculated in-flight
txwave	counts	Transmitted waveform (128 samples long)
rxwave	counts	Return waveform (1024 samples long)

Data are in the ITRF05 reference frame using the WGS-84 ellipsoid.

Table 1: Flight dates and names

Flight Date	Primary Targets
2/20/16	Mabounie site
2/22/16	TanDEM-X and GEDI lines
2/23/16	Biomass transect 1
2/25/16	Mondah site
3/2/16	Lope site
3/3/16	Mondah site -2
3/4/16	Pongara site
3/7/16	RABI site
3/8/16	Fill in: Biomass, Mondah, Pongara sites

Level2 Geolocated Surface Elevation and Height Product

The LVIS Level-2 Geolocated Surface Elevation Product data files are in ASCII text (.TXT) format. Parameters contained in the Level2 file are described below:

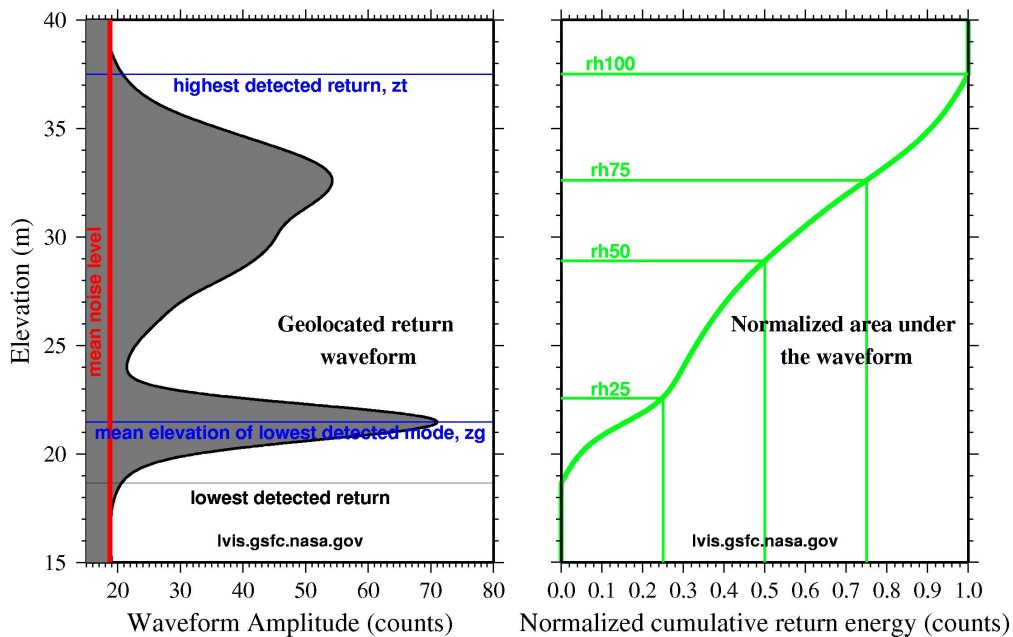
Item	Units	Item Description
LFID		LVIS file identification
shotnumber		laser shot number assigned during collection
time	seconds	UTC decimal seconds of the day
glon	degrees	Longitude of the lowest detected mode within the waveform (degrees East)
glat	degrees	Latitude of the lowest detected mode within the waveform (degrees North)
zg	meters	mean elevation of the lowest detected mode within the waveform
tlon	degrees	Longitude of the highest detected signal (degrees East)
tlat	degrees	Latitude of the highest detected signal (degrees North)
zt	meters	Elevation of the highest detected signal
RH10	meters	height (relative to zg) at which 10% of the waveform energy occurs
RH15	meters	height (relative to zg) at which 15% of the waveform energy occurs
RH20	meters	height (relative to zg) at which 20% of the waveform energy occurs
RH25	meters	height (relative to zg) at which 25% of the waveform energy occurs
RH30	meters	height (relative to zg) at which 30% of the waveform energy occurs
RH35	meters	height (relative to zg) at which 35% of the waveform energy occurs
RH40	meters	height (relative to zg) at which 40% of the waveform energy occurs
RH45	meters	height (relative to zg) at which 45% of the waveform energy occurs
RH50	meters	height (relative to zg) at which 50% of the waveform energy occurs
RH55	meters	height (relative to zg) at which 55% of the waveform energy occurs
RH60	meters	height (relative to zg) at which 60% of the waveform energy occurs
RH65	meters	height (relative to zg) at which 65% of the waveform energy occurs
RH70	meters	height (relative to zg) at which 70% of the waveform energy occurs
RH75	meters	height (relative to zg) at which 75% of the waveform energy occurs
RH80	meters	height (relative to zg) at which 80% of the waveform energy occurs
RH85	meters	height (relative to zg) at which 85% of the waveform energy occurs
RH90	meters	height (relative to zg) at which 90% of the waveform energy occurs
RH95	meters	height (relative to zg) at which 95% of the waveform energy occurs
RH96	meters	height (relative to zg) at which 96% of the waveform energy occurs
RH97	meters	height (relative to zg) at which 97% of the waveform energy occurs
RH98	meters	height (relative to zg) at which 98% of the waveform energy occurs

Item	Units	Item Description
RH99	meters	height (relative to zg) at which 99% of the waveform energy occurs
RH100	meters	height (relative to zg) at which 100% of the waveform energy occurs
azimuth	degrees	Azimuth angle of laser beam
incidentangle	degrees	Off-nadir incident angle of laser beam
range	meters	Distance between the instrument and the ground
Flag1		Flag indicating LVIS channel used to locate zg
Flag2		Flag indicating LVIS channel used to calculate RH metrics
Flag3		Flag indicating LVIS channel waveform contained in Level1B file

Data are in the ITRF05 reference frame using the WGS-84 ellipsoid.

Flag(1-3) – Channel A (1) is LVIS’s most sensitive optical channel and the vast majority of shots will use Channel A. When Channel A is saturated (i.e. the return signal is so strong that it overwhelms the detector), then Channel B (2) is used.

Overview of LVIS data products



LVIS Level1B and Level2 File Naming Convention

Level1B and Level2 files are named according to the following conventions:

ILVIS1B_GB2016_1114_R1405_063767.h5

Or

ILVIS2_GB2016_1114_R1406_043900.TXT

Where:

File Naming Convention	
Variable	Description
ILVIS1B or ILVIS2	Short name for LVIS L1B Geolocated LVIS Waveforms data or LVIS L2 Geolocated Elevation and Height Data products
LOYYYY	Campaign identifier. LO = location, where GB=Gabon. YYYY= four-digit year of campaign
MMDD	Two digit month, two-digit day of campaign
RYYMM	Date (YY year/ MM month) of the data release
nnnnnn	Number of seconds since UTC midnight of the day the data collection started
NN	Indicates file type: .h5 (HDF5) or .TXT (ascii)