IceBridge Riegl Laser Altimeter L2 Geolocated Surface Elevation Triplets, Version 1

USER GUIDE

How to Cite These Data

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

Blankenship, D. D., Kempf, S. D., Young, D. A., Roberts, J. L., van Ommen, T., Forsberg, R., Siegert, M. J., Palmer, S. J., & Dowdeswell, J. A. (2012, updated 2013). *IceBridge Riegl Laser Altimeter L2 Geolocated Surface Elevation Triplets* (ILUTP2, Version 1). [Data set]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. https://doi.org/10.5067/JV9DENETK13E [Date Accessed].

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

FOR CURRENT INFORMATION, VISIT https://nsidc.org/data/ILUTP2

National Snow and Ice Data Center

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1 DATA DESCRIPTION

1.1 Summary

This data set contains surface range values for Antarctica and Greenland derived from measurements captured by the Riegl Laser Altimeter. The data were collected by scientists working on the Investigating the Cryospheric Evolution of the Central Antarctic Plate (ICECAP)

project, which is funded by the National Science Foundation (NSF) and the Natural Environment Research Council (NERC) with additional support from NASA Operation IceBridge.

1.2 File Information

1.2.1 Format

The data files are in space-delimited ASCII text format. Each data file is paired with an associated XML file, which contains additional metadata.

1.2.2 File Naming Convention

The data files are named according to the following convention and as described in Table 1:

`ILUTP2_YYYYDOY_AAAN_JKBna_Xnna_srfelv.xxx`

File name examples:

`ILUTP2_2013022_ICP5_JKB2h_F26T04a_srfelv.txt`
`ILUTP2_2013022_ICP5_JKB2h_F26T04a_srfelv.txt.xml`

Table 1. File Naming Convention

Variable	Description
ILUTP2	Data set ID
YYYY	Four-digit year of survey
DOY	Day of year of survey
AAAN	Geographic area
JKBna	Host platform
Xnna	Geographic track line
srfelv	Surface range
xxx	Indicates ASCII text file (.txt), or or XML file (.xml)

1.3 Spatial Information

1.3.1 Coverage

Spatial coverage for the Riegl Laser Altimeter data includes Greenland and Antarctica. This represents the coverage noted below.

Greenland:

Southernmost Latitude 59° N

Northernmost Latitude: 83° N

Westernmost Longitude: 74° W

Easternmost Longitude: 12° W

Antarctica:

Southernmost Latitude: 90° S

Northernmost Latitude: 53° S

Westernmost Longitude: 180° W

Easternmost Longitude: 180° E

Figure one shows spatial coverages for Antarctica by campaign year.

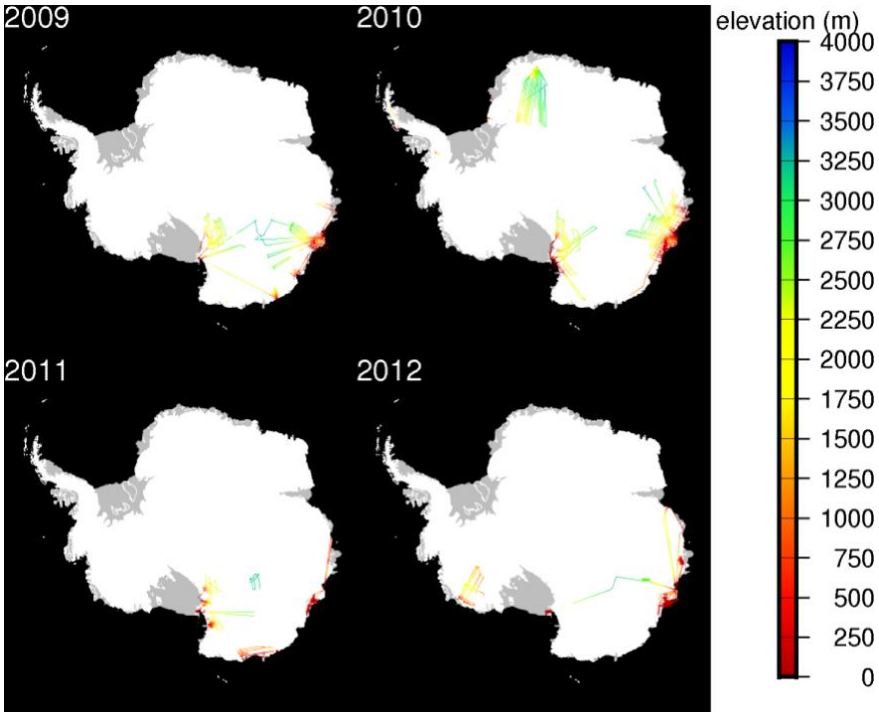

Figure 1**.** Antarctic Temporal and Spatial Coverage

1.3.2 Resolution

The effective footprint of the laser data is 25 m along track by 1 meter across track.

1.3.3 Projection and Grid Description

Referenced to WGS-84 Ellipsoid, ITRF-2008.

1.4 Temporal Coverage

29 December 2008 to 22 January 2013

1.4.1 Temporal Resolution

IceBridge campaigns were conducted on an annual repeating basis. Arctic and Greenland campaigns were typically conducted during March, April, and May; Antarctic campaigns were typically conducted between October and February.

1.5 Parameter or Variable

1.5.1 Parameter Description

The Riegl Laser Altimeter L2 files contain fields as described in Table 2.

Table 2. Parameter Description

Parameter	Units
Year	UTC
Day of Year	UTC
Second of day	UTC
Longitude Angle, WGS-84	Degrees
Latitude Angle, WGS-84	Degrees
Laser Derived Surface Range (WGS-84, ITRF2005)	Meters

Missing values have been replaced by NANs.

Horizontal positions represent aircraft location at the time of the observation.

2 DATA ACQUISITION AND PROCESSING

2.1 Trajectory and Attitude Data

Except for the 2010 field season, trajectory information was derived using Waypoint Inertial Explorer loosely coupled PPP/IMU processing. See the IceBridge GPS/IMU L1B Primary Position and Attitude Solution data set and Young et al. (2014) for details.

2.2 Processing Steps

Cloud filtering was performed by passing only continuous sections 20 meters long, with jumps between samples of 2 meters rejected. Ranges of less than 150 meters were also rejected. Default ranges where a surface was not detected by the laser ranger were -1 meters. Range vectors were transformed into elevations through the vector algebra reviewed in Koks (2008).

2.3 Quality, Errors, and Limitations

The primary sources of errors are:

- the pointing biases, in particular a coupling between the pitch bias and the range bias
- the limitation on the along track resolution, especially in rough areas
- interflight biases due to unmodelled tropospheric delays in the PPP GPS solutions

The net error is approximately 12 cm.

2.4 Instrumentation

2.4.1 Description

The instrument has been used and validated in previous field campaigns (Young et al., 2014). The instrument is a Riegl LD90-3800-HiP-LR distance meter, with a 3.5 mW diode laser operating at 905 nm. The Laser Altimeter System (LAS) acquires measurements at 2000 Hz, with a range resolution of 2 mm and ground spot width of approximately 1 m. For each block of 575 pulses, the greatest range is recorded, along with the standard deviation and maximum amplitude of the detected pulse echoes. Samples were time stamped using a 100 kHz counter timer, along with a precise timing signal from GPS clock. Typical point separation on the ground was 21–23 m, as expected for a target ground speed of 90 m-s-1. The maximum range of the system is 1500 m over ice.

3 VERSION HISTORY

On 05 July 2013, the Version 1 2009, 2010, and 2011 Antarctica data were replaced by Version 1.1. Version 1.1 data files were revised in the Seconds field and the Laser Derived Surface field.

4 RELATED DATA SETS

- IceBridge Riegl Laser Altimeter L0 Raw Ranges
- IceBridge Riegl Laser Altimeter L1B Time-Tagged Laser Ranges

- Airborne Laser Altimetry of the Thwaites Glacier Catchment, West Antarctica

5 ACKNOWLEDGMENTS

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6 REFERENCES

Koks, D. 2006. Using Rotations to Build Aerospace Coordinate Systems, Australian Government Department of Defence, Defence Science and Technology Organization, DSTO-TN-0640.

Young, D. A., S. D. Kempf, D. D. Blankenship, J. W. Holt, and D. L. Morse. 2008. New airborne laser altimetry over the Thwaites Glacier Catchment, West Antarctica, Geochemistry, Geophysics, Geosystems 9(6):Q06006, doi:10.1029/2007GC001935.

Young, D. A., L. E. Lindzey, D. D. Blankenship, J. S. Greenbaum, A. G. de Gorordo, S. D. Kempf, J. L. Roberts, R. C. Warner, T. van Ommen, M. J. Siegert, and E. Le Meur. 2014. Land-ice elevation changes from photon counting swath altimetry: First applications over the Antarctic ice sheet, Journal Of Glaciology 61(225):17-28, doi:10.3189/2015JoG14J048.

7 DOCUMENT INFORMATION

7.1 Publication Date

August 2012

7.2 Date Last Updated

April 2025