

IRUAFHF2: IceBridge UAF L2 HF Bed Elevation and Ice Thickness, Version 1

B.S. Tober¹, M.S. Christoffersen², M. Truffer^{2,3}, J.W. Holt^{1,4}, C.F. Larsen²

¹Dept. of Geosciences, University of Arizona, Tucson, AZ 85721

²Geophysical Institute, University of Alaska Fairbanks, Fairbanks, AK 99775

³Dept. of Physics, University of Alaska Fairbanks, Fairbanks, AK 99775

⁴Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721

This dataset (IRUAFHF2) contains glacier bed elevation and ice thickness measurements derived from the IceBridge University of Alaska Fairbanks High-Frequency L1B dataset (IRUAFHF1B)[1], stored in comma delimited ASCII data files. Each IRUAFHF2 data file contains all measurements made from a single IRUAFHF1B observation. When no bed elevation or ice thickness measurements could be made from an IRUAFHF1B observation there is no corresponding file included in the IRUAFHF2 dataset.

A portion of each IRUAFHF2 filename matches the corresponding IRUAFHF1B observation filename, e.g. the IRUAFHF2 file `IRUAFHF2_20150516-010317.csv` contains ice thickness interpretations made from the IRUAFHF1B file `IRUAFHF1B_20150516-010317.h5`.

IRUAFHF1B data were interpreted manually with the Radar Analysis Graphical Utility (RAGU)[2] software to generate the files in the IRUAFHF2 dataset. The fields in each row of an IRUAFHF2 file are defined below. Each row in an IRUAFHF2 file corresponds to a radargram column in an IRUAFHF1B observation. Each IRUAFHF2 file has the same number of rows as the corresponding IRUAFHF1B observation has radargram columns. For IRUAFHF1B radargram traces where no surface elevation information exists or no glacier bed interpretation can be made the corresponding fields in the IRUAFHF2 row (fields 5-7 for surface elevation, fields 8-11 for glacier bed interpretation) are left empty.

The location of the radar provided is generated from a Precise Point Positioning solution for the location of the survey aircraft using a GPS antenna located on the top of the aircraft. No lever-arm correction is applied for the position of the phase center of the radar antenna, which is not well known.

Note, in addition to individual IRUAFHF2 data files, all IRUAFHF2 data were combined into a single comma delimited ASCII data file: `IRUAFHF2.csv`.

trace

Field number: 1
Description: Radargram column in the IRUAFHF1B observation that this interpretation is derived from which corresponds to the row.

lon_deg_e

Field number: 2
Unit: Degrees East
Description: Longitude of the survey aircraft, WGS 84 coordinate system.

lat_deg_n

Field number: 3
Unit: Degrees North
Description: Latitude of the survey aircraft, WGS 84 coordinate system.

height_m

Field number: 4
Unit: Meters
Description: Height of the survey aircraft above the WGS 84 ellipsoid.

<code>surface_sample</code>	
Field number:	5
Description:	Zero-based index of the ice surface in the corresponding IRUAFHF1B radar-gram column.
<code>surface_twtt_s</code>	
Field number:	6
Unit:	Seconds
Description:	Ice surface two way travel time at the speed of light in a vacuum.
<code>surface_height_m</code>	
Field number:	7
Unit:	Meters
Description:	Ice surface height above the WGS 84 ellipsoid. Derived from the on-board laser altimeter[3]. In cases where onboard laser altimetry data was not available, the surface was manually digitized if possible.
<code>bed_sample</code>	
Field number:	8
Description:	Zero-based index of the interpreted glacier bed in the corresponding IRU-AFHF1B radargram column.
<code>bed_twtt_s</code>	
Field number:	9
Unit:	Seconds
Description:	Glacier bed two-way travel time.
<code>bed_height_m</code>	
Field number:	10
Unit:	Meters
Description:	Height of the interpreted glacier bed above the WGS 84 ellipsoid. Englacial two-way travel time delay ($\lfloor \text{bed_twtt_s} \rfloor - \lfloor \text{surface_twtt_s} \rfloor$) is converted to ice thickness assuming a dielectric permittivity of $\epsilon_r = 3.15$ and subtracted from <code>surface_height_m</code> .
<code>ice_thickness_m</code>	
Field number:	11
Unit:	Meters
Description:	Thickness of ice from the interpreted glacier bed. Englacial two-way travel time delay ($\lfloor \text{bed_twtt_s} \rfloor - \lfloor \text{srf_twtt_s} \rfloor$) is converted to ice thickness assuming a dielectric permittivity of $\epsilon_r = 3.15$.

References

- [1] M. Truffer, J. Holt, C. Larsen, M. Christoffersen, and B. S. Tober, *IceBridge UAFHF L1B Geolocated Radar Echo Strength Profiles, version 1*, 2021. DOI: 10.5067/Q0AVPHN3250H. [Online]. Available: <https://nsidc.org/data/IRUAFHF1B/versions/1>.
- [2] B. S. Tober and M. Christoffersen, *Radar Analysis Graphical Utility (RAGU)*, 2022. DOI: 10.5281/ZENODO.3968981. [Online]. Available: <https://zenodo.org/record/3968981>.
- [3] C. Larsen, *IceBridge UAF Lidar Scanner L1B Geolocated Surface Elevation Triplets, version 1*, 2010. DOI: 10.5067/AATE4JJ91EHC. [Online]. Available: <http://nsidc.org/data/ILAKS1B/versions/1>.