ICESat (GLAS) Science Processing
Software Document Series
Volume #
GLAS Standard Data Products
Specification - Level 2
Version 8

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Foreword

This document defines the Level Two GLAS standard data products. This Standard Data Products Specification is developed under the structure of the NASA STD-2100-91, a NASA standard defining a four-volume set of documents to cover an entire software life cycle. Under this standard a section of any volume may, if necessary, be rolled out to its own separate document. This document is a roll out of the GLAS ESDIS Software Detailed Design Specification under the Product Specification Volume.

The GEOSCIENCE LASER ALTIMETER SYSTEM (GLAS) is a part of the EOS program. This laser altimetry mission will be carried on the spacecraft designated EOS ICESat (Ice, Cloud and Land Elevation Satellite). The GLAS laser is a frequency-doubled, cavity-pumped, solid state Nd:YAG laser.

This document addresses the data flow, interfaces, record and data formats associated with the GLAS Level 2 standard data products. The term “standard data products” refers to those EOS instrument data products listed in the Earth Science Data and Information System (ESDIS) Project data base that are routinely generated within the ESDIS Distributed Active Archive Center (DAAC) or Science Computing Facilities (SCFs). Each data product has a unique Product Identification code assigned by the EOS Senior Project Scientist.

The Level 2 Standard Data Products specifically include those derived geophysical data values (i.e., ice sheet elevation, cloud height, vegetation height, etc.). Additionally, the appropriate correction elements used to transform the Level 1A and Level 1B Data Products into Level 2 Data Products are included. The data are packaged with time tags, precision orbit location coordinates, and data quality and usage flags.

This document was prepared by the Cryospheric Sciences Branch at NASA GSFC/WFF, Wallops Island, VA, in support of B. E. Schutz, GLAS Science Team Leader for the GLAS Investigation. This work was performed under the direction of David W. Hancock, III, who may be contacted at (757) 824-1238, David.W.Hancock@nasa.gov (e-mail), or (757) 824-1036 (FAX).

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# Table of Contents

Foreword ................................................................. iii
Table of Contents ....................................................... v
List of Figures ............................................................. vii
List of Tables ............................................................... ix

## Section 1 Introduction

1.1 Identification of Document ........................................ 1-1
1.2 Scope of Document .................................................. 1-1
1.3 Purpose and Objectives of Document .............................. 1-1
1.4 Document Organization ............................................ 1-1
1.5 Document Status and Schedule ................................... 1-1

## Section 2 Related Documentation

2.1 Parent Documents .................................................. 2-1
2.2 Applicable Documents ............................................ 2-1
2.3 Information Documents ........................................... 2-2

## Section 3 Purpose and Description of the Data Products

3.1 Purpose of the Data Products ..................................... 3-1
3.2 Description of the Data Product .................................. 3-1

## Section 4 Environment

4.1 Hardware Characteristics and Limitations ...................... 4-1
4.2 Data Product Medium and Characteristics ..................... 4-1
4.3 Protocol and Conventions ......................................... 4-1
4.4 Failure Protection, Detection, and Recovery Features ...... 4-2

## Section 5 Data Flow Characteristics

5.1 Volume, Size, and Frequency Estimates ......................... 5-1
5.2 Data Transfer and Transmission ................................ 5-1
5.3 Timing and Sequencing Characteristics ........................ 5-1
5.4 Recipients and Utilization ...................................... 5-1
5.5 Access ............................................................... 5-2

## Section 6 Data Products Definitions

6.1 Data Products Structure .......................................... 6-1
6.2 Labeling and Identification ..................................... 6-1
6.3 Data Products Substructure Descriptions ....................... 6-2
6.4 Detailed Data Descriptions ..................................... 6-3
6.5 GLAS Data Dictionary ............................................ 6-4
6.6 GLAS Flag Description ........................................... 6-4
<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appendix A</strong></td>
<td>Level 2 Data Products - Standard Label Contents &amp; Description</td>
</tr>
<tr>
<td><strong>Appendix B</strong></td>
<td>Level 2 Data Products Description</td>
</tr>
<tr>
<td>B.1</td>
<td>Data Product Description</td>
</tr>
<tr>
<td>B.2</td>
<td>Data Coverage</td>
</tr>
<tr>
<td>B.3</td>
<td>Data Volume</td>
</tr>
<tr>
<td><strong>Appendix C</strong></td>
<td>Level 2 Data Product Formats</td>
</tr>
<tr>
<td>C.1</td>
<td>Record Formats</td>
</tr>
<tr>
<td><strong>Appendix D</strong></td>
<td>Data Dictionary</td>
</tr>
<tr>
<td>D.1</td>
<td>Data Dictionary</td>
</tr>
<tr>
<td><strong>Appendix E</strong></td>
<td>Flags</td>
</tr>
<tr>
<td>E.1</td>
<td>Design Philosophy</td>
</tr>
<tr>
<td>E.2</td>
<td>Flag Descriptions</td>
</tr>
<tr>
<td>Abbreviations &amp; Acronyms</td>
<td>AB-1</td>
</tr>
<tr>
<td>Glossary</td>
<td>GL-1</td>
</tr>
</tbody>
</table>
List of Figures

Figure 3-1  GLAS Level 2 Products Within The Data Product Hierarchy . . . 3-3
Figure 4-1  Data Representation ......................................................... 4-2
Figure E-1  Layer Flag for 1064 Aerosol ........................................... E-2
Figure E-2  Layer Height Flag ............................................................. E-2
Figure E-3  Full Resolution Cloud Layer Flag ................................. E-4
Figure E-4  Full Resolution 1064 Quality Flag ................................. E-8
Figure E-5  High Resolution Cloud Layer Flag ................................. E-9
Figure E-6  Low Resolution Cloud Layer Flag ................................. E-15
Figure E-7  Low Resolution 1064 Quality Flag ................................. E-16
Figure E-8  Medium Resolution Cloud Layer Flag ............................. E-17
Figure E-9  Medium Resolution 1064 Quality Flag ......................... E-19
Figure E-10 Aerosol Backscatter Flag .............................................. E-20
Figure E-11 Aerosol Extinction Flag .............................................. E-20
Figure E-12 Cloud Backscatter Flag .............................................. E-21
Figure E-13 Cloud Extinction Flag ............................................... E-23
Figure E-14 Aerosol True S Values Use Flag ..................................... E-24
Figure E-15 Cloud True S Values Use Flag ..................................... E-25
Figure E-16 Aerosol Optical Depth ............................................... E-26
Figure E-17 Cloud Optical Depth .................................................... E-27
Figure E-18 Multiple Scattering Warning Flag ................................. E-30
Figure E-19 PBL Optical Depth ....................................................... E-31
Figure E-20 Sea Ice Roughness Quality Flag .................................... E-32
Figure E-21 Ocean RMS Roughness Quality Flag ............................ E-33
Figure E-22 APID Data Availability Flag ....................................... E-34
Figure E-23 Orbit Flag ................................................................. E-36
Figure E-24 Correction Status Flag ............................................... E-37
Figure E-25 Atmosphere Flag .......................................................... E-38
Figure E-26 Attitude Flag 1 .............................................................. E-39
Figure E-27 Attitude Flag 2 .............................................................. E-40
Figure E-28 Attitude Flag 3 .............................................................. E-40
| Figure E-29 | Elevation Definition Flag | E-41 |
| Figure E-30 | Elevation Use Flag       | E-41 |
| Figure E-31 | Altimeter Quality Flag   | E-42 |
| Figure E-32 | Range Correction Flag    | E-43 |
| Figure E-33 | Atmosphere Availability Flag | E-43 |
| Figure E-34 | Multiple Scattering Warning Flag | E-44 |
| Figure E-35 | Correction Status Flag   | E-45 |
| Figure E-36 | High Resolution Source Flag | E-45 |
| Figure E-37 | Medium Resolution Cloud Availability Flag | E-45 |
| Figure E-38 | Range Increment Quality/Use Flag | E-46 |
| Figure E-39 | Surface Roughness and Slope Quality Flag | E-47 |
| Figure E-40 | Region Type              | E-48 |
| Figure E-41 | Lidar Frame Quality Flag | E-48 |
List of Tables

Table 3-1  GLAS Level 2 Standard Data Products .......................... 3-1
Table 6-1  GLAS File Naming Keys .......................................... 6-1
Table 6-2  GLAS Data Product Description Fields ....................... 6-2
Table 6-3  GLAS Data Coverage Description Fields ...................... 6-2
Table 6-5  GLAS Detailed Data Description Fields ....................... 6-3
Table 6-4  GLAS Data Volume Description of Fields ..................... 6-3
Table 6-6  GLAS Data Dictionary ............................................. 6-4
Table A-1  Product Header Elements ........................................ A-1
Table A-2  Product Specific Elements ...................................... A-4
Table B-1  Data Product Description ....................................... B-1
Table B-2  Data Coverage .................................................. B-2
Table B-3  Data Volume ..................................................... B-3
Table C-1  GLA08 Record Format ............................................. C-1
Table C-2  GLA09 Record Format ............................................. C-4
Table C-3  GLA10 Record Format ............................................. C-6
Table C-4  GLA11 Record Format ............................................. C-8
Table C-5  GLA12 Record Format ............................................. C-11
Table C-6  GLA13 Record Format ............................................. C-14
Table C-7  GLA14 Record Format ............................................. C-16
Table C-8  GLA15 Record Format ............................................. C-19
Section 1

Introduction

1.1 Identification of Document

This document is identified as the GLAS Level 2 Standard Data Products Specification. The unique document identification number within the GLAS Standard Data Software documentation numbering scheme is GLAS-DPS-2641. Progressive editions of this document will be uniquely identified by the cover and page date marks.

1.2 Scope of Document

This document addresses the purpose, usage, and description of the GLAS Level 2 Standard Data Products. The intended audience for this document is the GLAS Science and Instrument Teams, the ESDIS Project and related focus teams, the community of EOS data users and investigators, and the GLAS Standard Data Software Development Team. This document will not address the procedures for obtaining the GLAS Level 2 Standard Data Products from the EOSDIS DAAC.

1.3 Purpose and Objectives of Document

The purpose of the GLAS Level 2 Standard Data Products Specification is to provide a high-level descriptive document for the data products. This document describes the purpose, usage, content, and format of the GLAS Level 2 Data Products. It describes the representation and definition of the GLAS data elements constituting the data product. It further describes the structure, physical storage, organization, and access characteristics of the GLAS Level 2 Data Products. The document additionally describes file transfer methods to support product access, the data flow associated with the data product, and the data storage and generation characteristics of the data product.

1.4 Document Organization

This document outline is assembled in a form similar to those presented in the NASA Software Engineering Program [Applicable Document 2.3a].

1.5 Document Status and Schedule

This document will be updated and released as required.
## 1.5.1 Document Change History

<table>
<thead>
<tr>
<th>Version Number</th>
<th>Date</th>
<th>Nature of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary</td>
<td>December 31, 1995</td>
<td>Original Version</td>
</tr>
<tr>
<td>Version 1.2</td>
<td>March 1998</td>
<td>Text, Figures, and Tables updated for Level 2 data updates, for the change to GLAS standard data product generation being performed at the GLAS SCF, and change of the spacecraft name to ICESAT.</td>
</tr>
<tr>
<td>Version 2.0</td>
<td>January 1999</td>
<td>Updates to the data product contents.</td>
</tr>
<tr>
<td>Version 3.0</td>
<td>November 2000</td>
<td>Updated Data Product Contents coincident with the GLAS Science Algorithm Software V1 release.</td>
</tr>
<tr>
<td>Version 4.0</td>
<td>November 2001</td>
<td>Updated Data Product Contents coincident with the GLAS Science Algorithm Software V2 release.</td>
</tr>
<tr>
<td>Version 5.0</td>
<td>July 2002</td>
<td>Updated Data Product Contents coincident with the GLAS Science Algorithm Software V2.2 release.</td>
</tr>
<tr>
<td>Version 6.0</td>
<td>October 2002</td>
<td>Revised for Version 3.0 software.</td>
</tr>
<tr>
<td>Version 7.0</td>
<td>August 2004</td>
<td>Revised for Version 4.0 software.</td>
</tr>
<tr>
<td>Version 8.0</td>
<td>November 2005</td>
<td>Revised for Version 5.0 software.</td>
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Section 2
Related Documentation

2.1 Parent Documents

The GLAS Level 2 Standard Data Products Specification is considered a "roll-out" from the Product Specification as the parent document or volume. Specific topics pertaining to data descriptions are located in the External Interface sections under the Detailed Design document template.

This document is subordinate to any top-level mission or instrument management plan documents, and as such, recognizes these documents as external parent documents in lineage. The recognized external EOSDIS and GLAS parent documents superior to the GLAS Level 2 Standard Data Products Specification are listed below.

a) NASA Earth Observing System Geoscience Laser Altimeter System GLAS Science Requirements Document, Version 2.01, October 1997, Center for Space Research, University of Texas at Austin.


2.2 Applicable Documents

The following documents are applicable to, or contain policies or references pertinent to the contents of the GLAS Level 2 Standard Data Products Specification.


g) Precision Orbit Determination (POD), Algorithm Theoretical Basis Document, Version 2.2, October 2002, Center for Space Research, The University of Texas at Austin.


### 2.3 Information Documents

The following documents are provided as sources of information that provide background or supplemental information that may clarify or amplify material in the GLAS Level 2 Standard Data Products Specification.


- d) *Memorandum: GLAS Data Products*, December 23, 1993, Center for Space Research, University of Texas at Austin.

Section 3

Purpose and Description of the Data Products

3.1 Purpose of the Data Products

The purpose of the GLAS Level 2 Standard Data Products is to provide time-ordered, processed GLAS data, acceptable for science applications. This GLAS derived data consists of calibrated laser altimeter data supplemented with precision orbit determination, earth-location and precision attitude data from the ancillary data sources. The GLAS Level 2 Standard Data Products are intended for use by the GLAS Science Team, and by the EOSDIS data user community.

3.2 Description of the Data Product

Table 3-1 identifies the Level 2 Data Products and shows the composition of each. The data products are integer-binary format files containing fixed-length records of data. Each data record consists of several data elements. An element is either an Item or an Array of Items. The elements are measurements and associated correction values obtained from specific GLAS science algorithm sets. The data products will be formatted in scaled integer binary format with both attached and unattached metadata containing identification, processing history, and data descriptive information.

<table>
<thead>
<tr>
<th>Product ID (Identification)</th>
<th>Product Name</th>
<th>Product Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLA08</td>
<td>Boundary Layer and Elevated Aerosol Layer Heights File</td>
<td>2</td>
</tr>
<tr>
<td>GLA09</td>
<td>Cloud Height for Multiple Layers File</td>
<td>2</td>
</tr>
<tr>
<td>GLA10</td>
<td>Aerosol Vertical Structure File</td>
<td>2</td>
</tr>
<tr>
<td>GLA11</td>
<td>Thin Cloud/Aerosol Optical Depth File</td>
<td>2</td>
</tr>
<tr>
<td>GLA12</td>
<td>Ice Sheet Products File</td>
<td>2</td>
</tr>
<tr>
<td>GLA13</td>
<td>Sea Ice Products File</td>
<td>2</td>
</tr>
<tr>
<td>GLA14</td>
<td>Land Products File</td>
<td>2</td>
</tr>
<tr>
<td>GLA15</td>
<td>Ocean Products File</td>
<td>2</td>
</tr>
</tbody>
</table>

The GLAS Level 2 Standard Data Products are generated as product aggregates or files (i.e., nominally a pass, a half orbit) of GLAS derived geophysical data. The data parameters represent derived geophysical data and associated correction values obtained from specific GLAS science algorithms. These data parameter groups include time tags, data use and quality flags, and precision orbit location data. In
addition to the data products, metadata including identification, processing history, and data content descriptive information is produced for archival.

The GLAS Level 2 Standard Data Products are produced by the GLAS science data processing software which is based on the GLAS Algorithm Theoretical Basis Documents [Applicable Documents 2.2b - 2.2h]. These data products are produced by processing the GLAS Level 1 Data Products to form the Level 2 data. Figure 3-1 illustrates the source data products being processed to generate the Level 2 Data Products.

The specific details of the data product structure, content, format, and data element details will be presented in Section 6. Data sizing and burden, and physical media details are provided in Section 5.
Figure 3-1  GLAS Level 2 Products Within The Data Product Hierarchy
Section 4

Environment

4.1 Hardware Characteristics and Limitations

The GLAS Level 2 Standard Data Products will be generated on the UNIX host processors within the I-SIPS. The input GLAS Level 1 Data Products and ancillary data reside in the I-SIPS storage facilities. Newly-generated Level 2 Data Products are accessed for quality assurance (QA) monitoring through the I-SIPS.

The I-SIPS consists of distributed UNIX operating system-based computers operating under the standard UNIX environment that support the GLAS Science Team operations including the quality monitoring. The GLAS Level 2 Data Products and their metadata (including the QA monitoring data) are delivered to the EOSDIS DAAC archive. The Level 2 metadata (associated data description and support information) are stored in the EOSDIS DAAC to facilitate EOS client inquiry and retrieval activities. The distribution management function of the EOSDIS DAAC allows clients to perform direct search and access of the Level 2 data or to request preparation of Level 2 Data Products.

4.2 Data Product Medium and Characteristics

The Data Products will be archived within the EOSDIS DAAC. The storage system will contain not only the Level 2 Data Products, but will also contain data descriptions and data advertisements (i.e., textual descriptive and abstract information also called metadata). The Level 2 Data Products and their metadata will be part of the Earth Sciences Data Types collection.

The Earth Science data are implemented in the current EOSDIS system through a hierarchical storage manager interface. Physical media supported by the storage system interface will include the disk storage subsystems, magnetic or optical media subsystems, and tiered archive robotics storage subsystems. EOSDIS clients can directly access the GLAS Level 2 data from the DAAC and can copy the data products to their host processors across the EOSDIS Networks.

The Level 2 Data Products will be available to the GLAS Science Team through the GLAS SCF. See Information Document 2.3e for a detailed description of the GLAS SCF.

4.3 Protocol and Conventions

Specific protocols and convention applying to the GLAS SCF will be specified in the SCF Plan [Information Document 2.3e]. When interfacing to the EOSDIS DAAC, the I-SIPS will comply with procedures, conventions, and protocols as defined by the EOSDIS.
Data definition terminology specific to the GLAS Level 2 Data Products and this document is presented in the Glossary at the end of this document. Figure 4-1 “Data Representation” depicts a schematic of the standard data representations used in GLAS Level 2 Data Products. These data structures will be used in the Section 6.0 generic data description and in the Appendix C detailed data description of the GLAS Level 2 Data Product contents.

**Data Types, Sizes, and Representations**

Conventions: byte 0 is the most significant byte (MSB)
bit 0 is the least significant bit (lsb)
S = the sign bit

![Figure 4-1 Data Representation](image)

**4.4 Failure Protection, Detection, and Recovery Features**

The team supporting operations at the I-SIPS will be responsible for failure protection, detection, and recovery of the generated GLAS Level 2 Data Products stored on the I-SIPS. Initial GLAS Level 2 Data Products error detection is performed during product generation as part of the product and processing quality assurance activity. The GLAS Level 2 Data Products will be “backed up” under the routine operational functions performed at the I-SIPS. In the event of failure or error detection in the active working or archive storage, recovery would be performed from backup media or from the EOSDIS DAAC archive.

The EOSDIS will be responsible for failure protection, detection, and recovery of the GLAS Level 2 Data Products archived at the EOSDIS DAAC.
Section 5

Data Flow Characteristics

5.1 Volume, Size, and Frequency Estimates

The expected daily data burdens for the GLAS Level 2 Standard Data Products are listed in Appendix B. These estimates are based on the following EOS ICESat (Ice, Cloud, and Land Elevation Satellite) operational assumptions. The spacecraft will orbit the Earth at an inclination of 94 degrees and a nominal altitude of 600 kilometers in a circular orbit. The orbit (groundtrack) repeat cycle is approximately 91 days based on a frozen orbit. The EOS ICESat orbit period is approximately 100 minutes, with a pass period duration of approximately 50 minutes resulting in just under 15 orbits per day.

The daily volumes shown in Appendix B are assuming 24 hours of global coverage for each product. However, the contents of the GLA12, GLA13, GLA14, and GLA15 products will be edited based on location. Therefore the actual daily volume of these products may vary from what is shown in the table.

5.2 Data Transfer and Transmission

The GLAS Science Team will have access to the GLAS Level 2 Data Products through the GLAS SCF using TCP/IP and standard UNIX command operations. GLAS Level 2 Data Products generated within the I-SIPS will be transferred to the DAAC through the EOS Science Network or off-line via storage media.

Data access procedures to retrieve GLAS Level 2 Standard Data Products from the DAAC will be provided by the EOSDIS DAAC.

5.3 Timing and Sequencing Characteristics

The GLAS Level 2 Standard Data Products are generated as product files consisting of processed GLAS Level 1A and Level 1B Standard Data Products data. The basic aggregation of the GLAS Level 2 Data Products is the descriptive information in the header records and GLAS Data Elements in the data record. All data records within the GLAS Level 2 Data Products will be in ascending time order based on the height vector or aerosol measurement time tag. All parameters contained within the record are synchronous. The GLAS instrument and the EOS ICESat spacecraft are expected to operate for at least three years with a goal of five years.

5.4 Recipients and Utilization

The initial recipients of the GLAS Level 2 Data Products will be the GLAS Science Team and the EOSDIS. At the I-SIPS, the GLAS Level 2 Data Products will be used to produce the metadata quantifying and qualifying the products for EOS community usage. The GLAS Science Team will use the Level 2 Data Products for analysis and
research. The subsequent recipients for the GLAS Level 2 Data Products are the scientific, governmental, and educational community sectors which will obtain the data products from the EOSDIS DAAC.

5.5 Access

The GLAS Level 2 Data Products are available to the GLAS Science Team from the GLAS SCF. Access to the GLAS SCF is controlled by the GLAS Science Team.

While EOS is intended to be a globally available and utilized mission program, access to the data is still operated under a security and integrity program to protect the data and data system resources from unauthorized or destructive use. Procedures for data access are provided by the EOSDIS DAAC.
Section 6
Data Products Definitions

6.1 Data Products Structure

The GLAS Level 2 Standard Data Products will be generated as scaled integer binary files. Each file will include appropriate header, labelling, and metadata information.

6.2 Labeling and Identification

Each of the GLAS Level 2 Data Products is uniquely identified by a GLAS standard file name. The form of this file name is

GLAxx_mmm_prkk_ccc_tttt_s_nn_ffff.eee

Specific elements within the file name are described in Table 6-1.

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>xx</td>
<td>The GLAS Product ID (01-15)</td>
</tr>
<tr>
<td>mmm</td>
<td>release number for process that created the produce (CCB assigned-combination of software and data)</td>
</tr>
<tr>
<td>p</td>
<td>repeat ground track phase</td>
</tr>
<tr>
<td>r</td>
<td>reference orbit number</td>
</tr>
<tr>
<td>kk</td>
<td>instance # incremented every time GLAS enters a different reference orbit</td>
</tr>
<tr>
<td>ccc</td>
<td>cycle of reference orbit for this phase</td>
</tr>
<tr>
<td>tttt</td>
<td>track within reference orbit</td>
</tr>
<tr>
<td>s</td>
<td>segment of orbit. This is 0 on files that contain multiple segments (GLA02, GLA03, GLA04, GLA07-GLA15) and 1,2,3,or 4 on GLA01, GLA05, and GLA06.</td>
</tr>
<tr>
<td>nn</td>
<td>granule version number (the number of times this granule is created for a specific release)</td>
</tr>
<tr>
<td>ffff</td>
<td>file type (numerical, CCB assigned for multiple files as needed for data of same time period for a specific ANCxx or GLAxx, i.e. multi-file granule)</td>
</tr>
</tbody>
</table>

The structure and contents of the GLAS Level 2 Data Product headers and labels are contained in Appendix A.
6.3 Data Products Substructure Descriptions

Full data product descriptions are provided in Appendix B and online in a hyperlinked format at the WFF GLAS website. The URL for product descriptions is: http://wffglas.wff.nasa.gov/v50_products/

Table 6-2 lists the fields shown in each data product description entry.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product ID</td>
<td>GLAS File ID (GLA01, GLA02, etc).</td>
</tr>
<tr>
<td>Name</td>
<td>Descriptive name.</td>
</tr>
<tr>
<td>Product Level</td>
<td>Product Level (L0,L1A,L1B,L2,L3).</td>
</tr>
<tr>
<td>Science Discipline</td>
<td>Primary associated science discipline.</td>
</tr>
<tr>
<td>Investigator</td>
<td>Primary investigator.</td>
</tr>
<tr>
<td>Archive Site</td>
<td>Location at which this file will be permanently archived.</td>
</tr>
<tr>
<td>Source</td>
<td>A flag giving source data system of this file.</td>
</tr>
</tbody>
</table>

Table 6-3 lists the data coverage description fields.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporal Resolution</td>
<td>Nominal time span, in seconds, of each record of data within a file.</td>
</tr>
<tr>
<td>Temporal Coverage</td>
<td>Nominal time span, in minutes, of data contained within a file.</td>
</tr>
<tr>
<td>Horiz Res Coverage</td>
<td>Horizontal coverage, in meters, over Earth's surface for each instrument measurement.</td>
</tr>
<tr>
<td>Vert Res Coverage</td>
<td>Vertical coverage, in meters, over the Earth's surface for each instrument measurement.</td>
</tr>
<tr>
<td>Root/External Flag</td>
<td>A flag signifying whether this file is:</td>
</tr>
<tr>
<td></td>
<td>0: neither of the following.</td>
</tr>
<tr>
<td></td>
<td>1: the head-of-chain (Level 0 data) of an instrument's data stream.</td>
</tr>
<tr>
<td></td>
<td>2: a file from an external source.</td>
</tr>
</tbody>
</table>

Table 6-4 lists the data volume description fields.
6.4 Detailed Data Descriptions

Full detailed data descriptions are available in Appendix C. These descriptions provide details for each value within a product file. Table 6-5 lists the fields shown in each detailed data description entry.

Table 6-4  GLAS Data Volume Description of Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product ID</td>
<td>GLAS File ID (GLA01, GLA02, etc).</td>
</tr>
<tr>
<td>Frequency (per day)</td>
<td>Number of times processing PGE is executed.</td>
</tr>
<tr>
<td>Files per Granule</td>
<td>Number of physical files per each granule.</td>
</tr>
<tr>
<td>CPU (min)</td>
<td>Number of processing minutes required to produce a granule of this data.</td>
</tr>
<tr>
<td>MB per Day</td>
<td>Estimated amount of this data processed each day.</td>
</tr>
<tr>
<td>Record Size (bytes, 0=variable)</td>
<td>Size, in bytes, of a single record of data. 0 indicates a variable sized record.</td>
</tr>
<tr>
<td>Granule Size (MB)</td>
<td>Size, in megabytes, of a granule.</td>
</tr>
<tr>
<td>Granules per Day</td>
<td>Number of granules normally processed per day.</td>
</tr>
<tr>
<td>Revs per Granule</td>
<td>Number of earth revolutions contained in one granule.</td>
</tr>
</tbody>
</table>

Table 6-5  GLAS Detailed Data Description Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Var Name</td>
<td>Unique identifying name of the product variable.</td>
</tr>
<tr>
<td>Offset (bytes)</td>
<td>Offset in bytes from start of data record (start=0).</td>
</tr>
<tr>
<td>Prod Data Type</td>
<td>Product (Unscaled) Variable Type and dimensions (in parens).</td>
</tr>
<tr>
<td></td>
<td>i1b = Integer, 1 byte</td>
</tr>
<tr>
<td></td>
<td>i2b = Integer, 2 bytes</td>
</tr>
<tr>
<td></td>
<td>i4b = Integer, 4 bytes</td>
</tr>
<tr>
<td></td>
<td>r4b = Real, 4 bytes</td>
</tr>
<tr>
<td></td>
<td>r8b = Real, 8 bytes</td>
</tr>
<tr>
<td></td>
<td>etc...</td>
</tr>
<tr>
<td>Total Bytes</td>
<td>Total number of bytes used by variable.</td>
</tr>
<tr>
<td>Is Unsigned?</td>
<td>Flag indicating if variable should be treated as unsigned.</td>
</tr>
<tr>
<td>Invalid Value/Flag</td>
<td>Indicates what identifies the filed as being invalid.</td>
</tr>
<tr>
<td></td>
<td>None = variable cannot be invalid.</td>
</tr>
<tr>
<td></td>
<td>gd_invalid_xxx = datatype-specific value which indicates the variable is not valid.</td>
</tr>
<tr>
<td></td>
<td>[variable name] = name of the flag to check in order to determine validity of the variable.</td>
</tr>
</tbody>
</table>
6.5 GLAS Data Dictionary

Detailed variable descriptions are provided in Appendix D. These descriptions provide details for each variable within a product file. Table 6-6 lists the fields shown in each detailed data dictionary entry.

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product Var Name</td>
<td>Unique identifying name of the product variable.</td>
</tr>
<tr>
<td>Is element of:</td>
<td>Corresponding record where variable is located.</td>
</tr>
<tr>
<td>Short Description</td>
<td>Descriptive name of the product variable.</td>
</tr>
<tr>
<td>Prod Data Type</td>
<td>Product (Unscaled) Variable Type and dimensions (in parens).</td>
</tr>
<tr>
<td>i1b</td>
<td>Integer, 1 byte</td>
</tr>
<tr>
<td>i2b</td>
<td>Integer, 2 bytes</td>
</tr>
<tr>
<td>i4b</td>
<td>Integer, 4 bytes</td>
</tr>
<tr>
<td>r4b</td>
<td>Real, 4 bytes</td>
</tr>
<tr>
<td>r8b</td>
<td>Real, 8 bytes</td>
</tr>
<tr>
<td>etc</td>
<td></td>
</tr>
<tr>
<td>Total Bytes</td>
<td>Total number of bytes used by variable.</td>
</tr>
<tr>
<td>Product Units</td>
<td>Units in which variable is stored on product file.</td>
</tr>
<tr>
<td>Total Bytes</td>
<td>Total number of bytes used by variable.</td>
</tr>
<tr>
<td>Product Units</td>
<td>Units in which variable is stored on product file.</td>
</tr>
<tr>
<td>Invalid Value/Flag</td>
<td>Indicates what identifies the filed as being invalid.</td>
</tr>
<tr>
<td>None</td>
<td>variable cannot be invalid.</td>
</tr>
<tr>
<td>gd_invalid_xxx</td>
<td>datatype-specific value which indicates the variable is not valid.</td>
</tr>
<tr>
<td>[variable name]</td>
<td>name of the flag to check in order to determine validity of the variable.</td>
</tr>
<tr>
<td>Is Correction Flag</td>
<td>Flag indicating if the variable is a correction flag.</td>
</tr>
<tr>
<td>Is Unsigned?</td>
<td>Flag indicating if variable should be treated as unsigned.</td>
</tr>
<tr>
<td>Product Minimum</td>
<td>Minimum value supported in product variable.</td>
</tr>
<tr>
<td>Product Maximum</td>
<td>Maximum value supported in product variable.</td>
</tr>
<tr>
<td>Description</td>
<td>Text description.</td>
</tr>
<tr>
<td>Comments</td>
<td>Text comments.</td>
</tr>
</tbody>
</table>

6.6 GLAS Flag Description

A detailed description of the flags is available in Appendix E.
Appendix A
Level 2 Data Products - Standard Label
Contents & Description

GLAS Products begin with ASCII header records containing information regarding the processing which created the Product and the data contained within. These header records are exactly the same size as a Product data record and contain ASCII information in a slightly modified KEYWORD=VALUE format. In order to conserve space on the product, the header records contain multiple KEYWORD=VALUE entries and entries are delimited by a semi-colon (;) and linefeed (ASCII 10).

By design, the first two header entries are the record length and number of header records. This allows product readers to verify the record length and jump directly to the first data record, if necessary. Most of the remaining information within the headers is directly applicable to the generation of metadata files for EOS ingest.

The following common fields are defined for GLAS Product Headers:

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Content Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional_Attribute</td>
<td>Product-specific additional attributes.</td>
</tr>
<tr>
<td>AutomaticQualityFlagExplan</td>
<td>Automatic Quality flag explanation (per parameter).</td>
</tr>
<tr>
<td>Cycle</td>
<td>A count of the number of exact repeats of this reference orbit.</td>
</tr>
<tr>
<td>EquatorCrossingDate</td>
<td>Date of the equator crossing.</td>
</tr>
<tr>
<td>EquatorCrossingLong</td>
<td>Longitude of equator crossing.</td>
</tr>
<tr>
<td>EquatorCrossingTime</td>
<td>Time of the equator crossing.</td>
</tr>
<tr>
<td>glas_osc_rate</td>
<td>Value that indicates the accuracy rate of the GLAS oscillator.</td>
</tr>
<tr>
<td>glas_osc_rate_date</td>
<td>Valid date of the GLAS oscillator rate. (yyyy-mm-dd)</td>
</tr>
<tr>
<td>glas_osc_rate_time</td>
<td>Valid time of the GLAS oscillator rate. (hh:mm:ss)</td>
</tr>
<tr>
<td>InputPointer</td>
<td>Name of each input product file used to created this product (one instances of this keyword appears in the product header record for each input product file used in creation of this product).</td>
</tr>
<tr>
<td>internal_range_delay</td>
<td>Internal range delay for digitizer in meters (from anc33).</td>
</tr>
<tr>
<td>internal_range_delay_date</td>
<td>Valid date of corresponding internal range delay. (yyyy-mm-dd)</td>
</tr>
<tr>
<td>internal_range_delay_time</td>
<td>Valid time of corresponding internal range delay. (hh:mm:ss)</td>
</tr>
<tr>
<td>internal_time_delay</td>
<td>Time delay for digitizer in seconds (from anc33).</td>
</tr>
<tr>
<td>internal_time_delay_date</td>
<td>Valid date of internal time delay. (yyyy-mm-dd)</td>
</tr>
<tr>
<td>internal_time_delay_time</td>
<td>Valid time of internal time delay. (hh:mm:ss)</td>
</tr>
<tr>
<td><strong>Keyword</strong></td>
<td><strong>Content Description</strong></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Instance</td>
<td>The number of times that a specific reference orbit has been returned to during flight.</td>
</tr>
<tr>
<td>instrument_short_name</td>
<td>Short name of instrument (GLAS).</td>
</tr>
<tr>
<td>Instrument_State</td>
<td>Flag word that indicates which redundant units (laser, detector, oscillator) of the GLAS instrument are in operation.</td>
</tr>
<tr>
<td>Instrument_State_Date</td>
<td>The date that corresponds to the Instrument_State. There are a maximum of two per granule.</td>
</tr>
<tr>
<td>Instrument_State_Time</td>
<td>The time that corresponds to the Instrument_State. There are a maximum of two per granule.</td>
</tr>
<tr>
<td>LocalGranuleID</td>
<td>Filename of the granule.</td>
</tr>
<tr>
<td>LocalVersionID</td>
<td>Granule version number (auto-incrementing, nn in filenaming convention).</td>
</tr>
<tr>
<td>Numhead</td>
<td>Number of header records preceding product data records.</td>
</tr>
<tr>
<td>OperationalQualityFlagExpl</td>
<td>Operational Quality flag explanation (per parameter).</td>
</tr>
<tr>
<td>Orbit Number</td>
<td>Orbit number</td>
</tr>
<tr>
<td>OrbitQuality</td>
<td>Status word that states what type of orbit was used during processing of the data for the granule. It specifies the models used in the orbit determination program. This provides an indication of the quality of the orbits being applied to the data.</td>
</tr>
<tr>
<td>ParameterName</td>
<td>Name of product specific parameters for which additional information follows.</td>
</tr>
<tr>
<td>PercentFullRate</td>
<td>Percent of data for this granule that atmospheric parameters are provided at 40 Hz data rate.</td>
</tr>
<tr>
<td>PercentGroundHit</td>
<td>Percent of data for this granule that had a detected ground return of the transmitted laser pulse.</td>
</tr>
<tr>
<td>PercentHighRate</td>
<td>Percent of data for this granule that atmospheric parameters are provided at 5 Hz data rate.</td>
</tr>
<tr>
<td>PercentLowRate</td>
<td>Percent of data for this granule that atmospheric parameters are provided at 0.25 Hz data rate.</td>
</tr>
<tr>
<td>PercentMediumRate</td>
<td>Percent of data for this granule that atmospheric parameters are provided at 1 Hz data rate.</td>
</tr>
<tr>
<td>Percent1064to532</td>
<td>Percent atmospheric profiles that use the 1064 nm profile data to provide estimated values for the saturated 532nm profiles.</td>
</tr>
<tr>
<td>PGEVersion</td>
<td>Version number of the GSAS software that generated this granule.</td>
</tr>
<tr>
<td>platform_short_name</td>
<td>Short name of spacecraft (Icesat).</td>
</tr>
<tr>
<td>ProductionDateTime</td>
<td>Creation time of granule.</td>
</tr>
<tr>
<td>QAPercentMissingData</td>
<td>Percent of missing data (per parameter)</td>
</tr>
</tbody>
</table>
### Table A-1 Product Header Elements (Continued)

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Content Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>QAPercentOutofBounds</td>
<td>Percent of out-of-bounds data (per parameter)</td>
</tr>
<tr>
<td>RangeBeginningDate</td>
<td>Start date of data on the granule.</td>
</tr>
<tr>
<td>RangeEndingDate</td>
<td>End data of data on the granule.</td>
</tr>
<tr>
<td>RangeBeginningTime</td>
<td>Start time of day for data on this granule.</td>
</tr>
<tr>
<td>Range_Bias</td>
<td>The additive calibration correction in millimeters to apply to range based on the science team cal/val activities.</td>
</tr>
<tr>
<td>Range_Bias_Date</td>
<td>The date that corresponds to the first valid Range_Bias. There are a maximum of two per granule.</td>
</tr>
<tr>
<td>Range_Bias_Time</td>
<td>The time that corresponds to the first valid Range_Bias. There are a maximum of two per granule.</td>
</tr>
<tr>
<td>RangeEndingTime</td>
<td>End time of day for data on this granule.</td>
</tr>
<tr>
<td>Recl</td>
<td>Record length in bytes.</td>
</tr>
<tr>
<td>ReferenceOrbit</td>
<td>Assigned number for which exact orbital elements describe the exact repeat orbit pattern.</td>
</tr>
<tr>
<td>ReprocessingPlanned</td>
<td>Planned reprocessing status.</td>
</tr>
<tr>
<td>ReprocessingActual</td>
<td>Actual reprocessing status.</td>
</tr>
<tr>
<td>sc_osc_rate</td>
<td>Value that indicates the accuracy of the spacecraft oscillator.</td>
</tr>
<tr>
<td>sc_osc_rate_date</td>
<td>Valid date of the spacecraft oscillator measurement. (yyyy-mm-dd)</td>
</tr>
<tr>
<td>sc_osc_rate_time</td>
<td>Valid time of the spacecraft oscillator measurement. (hh:mm:ss)</td>
</tr>
<tr>
<td>sensor_short_name</td>
<td>Short name of sensor (LaserALT).</td>
</tr>
<tr>
<td>ScienceQualityFlagExplana</td>
<td>Science Quality flag explanation (per parameter).</td>
</tr>
<tr>
<td>ShortName</td>
<td>GSAS Filetype.</td>
</tr>
<tr>
<td>size_mb_ecs_data_granule</td>
<td>Size (in MB) of the granule.</td>
</tr>
<tr>
<td>SP_ICE_GLAS_EndBlock</td>
<td>Integer SPICE block number within GLAS coverage scheme in which granule data ends.</td>
</tr>
<tr>
<td>SP_ICE_PATH_NO</td>
<td>Number which represents the GLAS SPICE path number.</td>
</tr>
<tr>
<td>SP_ICE_GLAS_StartBlock</td>
<td>Integer SPICE block number within GLAS coverage scheme in which granule data starts.</td>
</tr>
<tr>
<td>time_between_contiguous_records</td>
<td>Time between contiguous data records (in seconds).</td>
</tr>
<tr>
<td>Timing_Bias</td>
<td>The time tag error determined by the calibration team that was added to the time tags to compute the true time of data as provided on the granule.</td>
</tr>
<tr>
<td>Timing_Bias_Date</td>
<td>The date that corresponds to the Timing_Bias. There are a maximum of two per granule.</td>
</tr>
</tbody>
</table>
In addition to the common information contained in its headers, each product may also contain information specific to the type of data it contains. This type of information is called a product-specific attribute (PSA). The PSAs mostly contain information related to product data quality. The PSAs and their attributes are listed in Table A-2.

### Table A-2  Product Specific Elements

<table>
<thead>
<tr>
<th>Product</th>
<th>Parameter Name</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLA08</td>
<td>Aerosol Layer Heights</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA08</td>
<td>Planetary Boundary Layer</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA09</td>
<td>Cloud Layer Heights</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA10</td>
<td>Cloud Backscatter Cross Section Profile</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA10</td>
<td>Cloud Extinction Cross Section Profile</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA10</td>
<td>Aerosol Backscatter Cross Section Profile</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA10</td>
<td>Aerosol Extinction Cross Section Profile</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA11</td>
<td>Cloud Optical Depth</td>
<td>TBD</td>
</tr>
</tbody>
</table>
Table A-2  Product Specific Elements (Continued)

<table>
<thead>
<tr>
<th>Product</th>
<th>Parameter Name</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLA11</td>
<td>Aerosol Optical Depth</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA11</td>
<td>Planetary Boundary Layer Optical Depth</td>
<td>TBD</td>
</tr>
<tr>
<td>GLA12</td>
<td>Surface Elevation</td>
<td>AutomaticQualityFlag&lt;br&gt;Flag, will fail if surface elevation percent out of bounds is greater than 5%.&lt;br&gt;QAPercentOutofBounds&lt;br&gt;Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA12</td>
<td>Surface Roughness</td>
<td>AutomaticQualityFlag&lt;br&gt;Flag, will fail if surface roughness percent out of bounds is greater than 5%.&lt;br&gt;QAPercentOutofBounds&lt;br&gt;Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA12</td>
<td>Surface Reflectance</td>
<td>AutomaticQualityFlag&lt;br&gt;Flag, will fail if surface reflectance percent out of bounds is greater than 5%.&lt;br&gt;QAPercentOutofBounds&lt;br&gt;Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA12</td>
<td>Surface Slope</td>
<td>AutomaticQualityFlag&lt;br&gt;Flag, will fail if surface slope percent out of bounds is greater than 5%.&lt;br&gt;QAPercentOutofBounds&lt;br&gt;Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA13</td>
<td>Surface Elevation</td>
<td>AutomaticQualityFlag&lt;br&gt;Flag, will fail if surface elevation percent out of bounds is greater than 5%.&lt;br&gt;QAPercentOutofBounds&lt;br&gt;Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA13</td>
<td>Surface Roughness</td>
<td>AutomaticQualityFlag&lt;br&gt;Flag, will fail if surface roughness percent out of bounds is greater than 5%.&lt;br&gt;QAPercentOutofBounds&lt;br&gt;Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
</tbody>
</table>
### Table A-2  Product Specific Elements (Continued)

<table>
<thead>
<tr>
<th>Product</th>
<th>Parameter Name</th>
<th>Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLA13</td>
<td>Surface Reflectance</td>
<td>AutomaticQualityFlag Flag, will fail if surface reflectance percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutofBounds Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA14</td>
<td>Surface Elevation</td>
<td>AutomaticQualityFlag Flag, will fail if surface elevation percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutofBounds Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA14</td>
<td>Surface Roughness</td>
<td>AutomaticQualityFlag Flag, will fail if surface roughness percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutofBounds Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA14</td>
<td>Surface Reflectance</td>
<td>AutomaticQualityFlag Flag, will fail if surface reflectance percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutofBounds Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA14</td>
<td>Surface Slope</td>
<td>AutomaticQualityFlag Flag, will fail if surface slope percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutofBounds Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA15</td>
<td>Surface Elevation</td>
<td>AutomaticQualityFlag Flag, will fail if surface elevation percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutofBounds Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>Product</td>
<td>Parameter Name</td>
<td>Attribute</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>GLA15</td>
<td>Surface Roughness</td>
<td>AutomaticQualityFlag, Flag, will fail if surface roughness percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutOfBounds, Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
<tr>
<td>GLA15</td>
<td>Surface Reflectance</td>
<td>AutomaticQualityFlag, Flag, will fail if surface reflectance percent out of bounds is greater than 5%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>QAPercentOutOfBounds, Percent Out of Bounds is the number of invalid divided by number of shots received.</td>
</tr>
</tbody>
</table>
## Appendix B

### Level 2 Data Products Description

#### B.1 Data Product Description

<table>
<thead>
<tr>
<th>Product ID</th>
<th>Name</th>
<th>Level</th>
<th>Science Discipline</th>
<th>Investigator</th>
<th>Archive Site</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLA08</td>
<td>Boundary Layer height</td>
<td>2</td>
<td>Atmosphere</td>
<td>J. Spinhirne</td>
<td>NSIDC</td>
<td>ISIPS</td>
</tr>
<tr>
<td>GLA09</td>
<td>Cloud Height</td>
<td>2</td>
<td>Atmosphere</td>
<td>J. Spinhirne</td>
<td>Icesat SCF</td>
<td>ICESat SCF</td>
</tr>
<tr>
<td>GLA10</td>
<td>Aerosol Vertical Structure</td>
<td>2</td>
<td>Atmosphere</td>
<td>J. Spinhirne</td>
<td>Icesat SCF</td>
<td>Icesat SCF</td>
</tr>
<tr>
<td>GLA11</td>
<td>Thin Cloud/OD</td>
<td>2</td>
<td>Atmosphere</td>
<td>J. Spinhirne</td>
<td>Icesat SCF</td>
<td>ICESat SCF</td>
</tr>
<tr>
<td>GLA12</td>
<td>Ice Sheet Elevation</td>
<td>2</td>
<td>Elevations-Ice Sheet</td>
<td>Jay Zwally</td>
<td>Icesat SCF</td>
<td>ICESat SCF</td>
</tr>
<tr>
<td>GLA13</td>
<td>Sea Ice Roughness</td>
<td>2</td>
<td>Elevations-Sea Ice</td>
<td>Bob Thomas</td>
<td>Icesat SCF</td>
<td>ICESat SCF</td>
</tr>
<tr>
<td>GLA14</td>
<td>Land/Canopy Elev.</td>
<td>2</td>
<td>Elevations-Land</td>
<td>Jack Bufton</td>
<td>Icesat SCF</td>
<td>ICESat SCF</td>
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<td>Ocean Elevation</td>
<td>2</td>
<td>Elevations-Ocean</td>
<td>N/A</td>
<td>Icesat SCF</td>
<td>ICESat SCF</td>
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## B.2 Data Coverage

### Table B-2 Data Coverage

<table>
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<tr>
<th>Product ID</th>
<th>Temporal Resolution (sec)</th>
<th>Temporal Coverage (min)</th>
<th>Horiz Res Coverage (m)</th>
<th>Vert Res Coverage (m)</th>
<th>Root/External Flag</th>
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<tr>
<td>GLA08</td>
<td>8</td>
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<td>-90 to 90</td>
<td>-180 to 180</td>
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<td>GLA09</td>
<td>4</td>
<td>1380</td>
<td>170</td>
<td>76.8</td>
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<td>GLA10</td>
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<td>1380</td>
<td>170</td>
<td>76.8</td>
<td>0</td>
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<td>GLA11</td>
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<td>1380</td>
<td>170</td>
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<td>1380</td>
<td>170</td>
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<td>0</td>
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<td>1380</td>
<td>170</td>
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<td>0</td>
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<tr>
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<td>1</td>
<td>1380</td>
<td>170</td>
<td>0</td>
<td>0</td>
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<tr>
<td>GLA15</td>
<td>1</td>
<td>1380</td>
<td>170</td>
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## B.3 Data Volume

### Table B-3 Data Volume

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<th>Product ID</th>
<th>Freq. (per day)</th>
<th>Files per Gran.</th>
<th>CPU (min)</th>
<th>MB per Day</th>
<th>Record Size (0=variable)</th>
<th>Granule Size (MB)</th>
<th>Gran. per Day</th>
<th>Revs per Gran.</th>
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<td>6944</td>
<td>143.0419922</td>
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<td>1</td>
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<td>308.4960938</td>
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<td>14</td>
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Appendix C
Level 2 Data Product Formats

C.1 Record Formats

C.1.1 Guidelines

The GLAS Data Product record formats were developed under the following guidelines:

1) Record size a multiple of 4.

2) Start elements on a 4 byte boundary; where not possible use pads or group smaller elements together to get to 4 byte boundary. Pad and move elements so that arrays start on 4 byte boundaries.

3) The output structures to build files should be grouped in descending size order, therefore group elements on file logically and in descending size order.

4) Data that occurs occasionally in the file should be put in the header. Specifically, the orbit number and instrument state are changing at a much lower rate than the record rate on the files, therefore the orbit numbers and instrument states encompassed by a file will be put in the header. These elements will not be shown in the record format. Other data in the same category will be put in the header.

5) Add spares.

C.1.2 GLA08

Each record contains 4 seconds of data. Empty aerosol or planetary boundary layers will contain fill data.

<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>Offset (Bytes)</th>
<th>Product Data Type</th>
<th>Total Bytes</th>
<th>Product Units</th>
<th>Is Unsigned?</th>
<th>Invalid Value/Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>i_rec_ndx</td>
<td>0</td>
<td>i4b</td>
<td>4</td>
<td>N/A</td>
<td>No</td>
<td>no</td>
</tr>
<tr>
<td>i_UTCTime</td>
<td>4</td>
<td>i4b (2)</td>
<td>8</td>
<td>seconds, microseconds</td>
<td>No</td>
<td>no</td>
</tr>
<tr>
<td>i_beam_coelev</td>
<td>12</td>
<td>i4b (4)</td>
<td>16</td>
<td>degrees*100</td>
<td>No</td>
<td>i4b</td>
</tr>
<tr>
<td>i_beam_azimuth</td>
<td>28</td>
<td>i4b (4)</td>
<td>16</td>
<td>degrees*100</td>
<td>No</td>
<td>i4b</td>
</tr>
<tr>
<td>i_pad_angle</td>
<td>44</td>
<td>i4b (4)</td>
<td>16</td>
<td>microdegrees</td>
<td>No</td>
<td>i4b</td>
</tr>
<tr>
<td>i_spare0</td>
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<td>null</td>
<td>NA</td>
<td>No</td>
</tr>
<tr>
<td>i_AttFlg1</td>
<td>100</td>
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<td>No</td>
<td>no</td>
</tr>
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<td>i_lat</td>
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<td>i4b</td>
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<td>Product Var Name</td>
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<td>Product Data Type</td>
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<td>Product Units</td>
<td>Is Unsigned?</td>
<td>Invalid Value/Flag</td>
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<td>no</td>
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<td>no</td>
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<td>no</td>
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<td>i4_aer_top</td>
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<td>10</td>
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<tr>
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<td>No</td>
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<tr>
<td>i20_aer_top</td>
<td>202</td>
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<td>6</td>
<td>deka-meters</td>
<td>No</td>
<td>i20_aer_af</td>
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<tr>
<td>i_LRpbHl_ht</td>
<td>208</td>
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<td>No</td>
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<tr>
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<td>i2b</td>
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<tr>
<td>i_HRpbHl_grd</td>
<td>252</td>
<td>i2b (20)</td>
<td>40</td>
<td>deka-meters</td>
<td>No</td>
<td>i2b</td>
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<td>292</td>
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<td>unitless</td>
<td>No</td>
<td>i4_aer_af</td>
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<tr>
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<td>297</td>
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<td>unitless</td>
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<td>NA</td>
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<td>no</td>
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<td>N/A</td>
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<td>No</td>
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<tr>
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<td>458</td>
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<td>4</td>
<td>deka-meters</td>
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<td>i2b</td>
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<td>No</td>
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<tr>
<td>i_Aer_ir_top_temp</td>
<td>464</td>
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<td>4</td>
<td>degrees Celsius * 100</td>
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<td>i2b</td>
</tr>
<tr>
<td>i_Aer_ir_top_pres</td>
<td>468</td>
<td>i2b (2)</td>
<td>4</td>
<td>millibars of mercury * 10</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
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<td>472</td>
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<td>4</td>
<td>percentage * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Aer_ir_bot_temp</td>
<td>476</td>
<td>i2b (2)</td>
<td>4</td>
<td>degrees Celsius * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Aer_ir_bot_pres</td>
<td>480</td>
<td>i2b (2)</td>
<td>4</td>
<td>millibars of mercury * 10</td>
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<tr>
<td>i_Aer_ir_bot_relh</td>
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<td>4</td>
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<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_temp</td>
<td>488</td>
<td>i2b (4)</td>
<td>8</td>
<td>degrees Celsius * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_pres</td>
<td>496</td>
<td>i2b (4)</td>
<td>8</td>
<td>millibars of mercury * 10</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_relh</td>
<td>504</td>
<td>i2b (4)</td>
<td>8</td>
<td>percentage * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_wind</td>
<td>512</td>
<td>i2b (4)</td>
<td>8</td>
<td>meters/second * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_wdir</td>
<td>520</td>
<td>i2b (4)</td>
<td>8</td>
<td>degrees * 10</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_spare2</td>
<td>528</td>
<td>i1b (264)</td>
<td>264</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
</tr>
<tr>
<td>Total Bytes</td>
<td>792</td>
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<td></td>
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</tr>
</tbody>
</table>
C.1.3 GLA09

Each record contains 4 seconds of data. Empty cloud layers will contain fill data.

<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>Offset (Bytes)</th>
<th>Product Data Type</th>
<th>Total Bytes</th>
<th>Product Units</th>
<th>Is Unsigned?</th>
<th>Invalid Value/Flag</th>
</tr>
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<tr>
<td>i_rec_ndx</td>
<td>0</td>
<td>i4b</td>
<td>4</td>
<td>N/A</td>
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Table C-2  GLA09 Record Format (Continued)

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Total Bytes 6944

C.1.4 GLA10

Each record contains 4 seconds of data.

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### Table C-4 GLA11 Record Format

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Table C-4  GLA11 Record Format (Continued)

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C.1.6 GLA12

Each record contains 1 second of data.

Table C-5 GLA12 Record Format

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C.1.7 GLA13

Each record contains 1 second of data.

Table C-6 GLA13 Record Format

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<th>Invalid Value/Flag</th>
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Table C-6  GLA13 Record Format (Continued)

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Total Bytes 6760

C.1.8 GLA14

Each record contains 1 second of data.

Table C-7  GLA14 Record Format

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<th>Product Units</th>
<th>Is Unsigned?</th>
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Record Type:GLA14_MAIN; % of Granule: 30; Record Duration (seconds):1; Repeats: 1

Latest: Last Modified: Mon Sep 19 09:22:56 GMT-0400 (EDT) 2005
### Table C-7  GLA14 Record Format (Continued)

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<th>Product Units</th>
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### Table C-7 GLA14 Record Format (Continued)

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C.1.9 GLA15

Each record contains 1 second of data.

Table C-7  GLA14 Record Format (Continued)

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<th>Invalid Value/Flag</th>
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<td>deka-meters</td>
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Total Bytes 10000

Table C-8  GLA15 Record Format

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<th>Product Units</th>
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## Table C-8 GLA15 Record Format (Continued)

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<td>80</td>
<td>mm</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_satCorrF1g</td>
<td>4956</td>
<td>i1b (40)</td>
<td>40</td>
<td>NA</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>i_satRngCorr</td>
<td>4996</td>
<td>i2b (40)</td>
<td>80</td>
<td>mm</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_satPwdCorr</td>
<td>5076</td>
<td>i2b (40)</td>
<td>80</td>
<td>mm</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_gval_rcv</td>
<td>5156</td>
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<td>80</td>
<td>counts</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_RecRngAll</td>
<td>5236</td>
<td>i2b (40)</td>
<td>80</td>
<td>0.01 fJoules</td>
<td>No</td>
<td>i_APID_AvF1g</td>
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<tr>
<td>i_FRir_cldtop</td>
<td>5316</td>
<td>i2b (40)</td>
<td>80</td>
<td>deka-meters</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_FRir_gaFlag</td>
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<td>i1b (40)</td>
<td>40</td>
<td>NA</td>
<td>No</td>
<td>No</td>
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Table C-8  GLA15 Record Format (Continued)

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<th>Product Var Name</th>
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<th>Product Data Type</th>
<th>Total Bytes</th>
<th>Product Units</th>
<th>Is Unsigned?</th>
<th>Invalid Value/Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>i_FRir_ODflag</td>
<td>5436</td>
<td>i1b (40)</td>
<td>40</td>
<td>NA</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>i_FRir_intsig</td>
<td>5476</td>
<td>i2b (40)</td>
<td>80</td>
<td>e7/(m-sr)</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_msRngCorr</td>
<td>5556</td>
<td>i2b (40)</td>
<td>80</td>
<td>Unknown</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_msCorrFlg</td>
<td>5636</td>
<td>i1b (40)</td>
<td>40</td>
<td>Unknown</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>i_Surface_temp</td>
<td>5676</td>
<td>i2b</td>
<td>2</td>
<td>degrees Celsius * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_pres</td>
<td>5678</td>
<td>i2b</td>
<td>2</td>
<td>millibars of mercury * 10</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_relh</td>
<td>5680</td>
<td>i2b</td>
<td>2</td>
<td>percentage * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_wind</td>
<td>5682</td>
<td>i2b</td>
<td>2</td>
<td>meters/second * 100</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Surface_wdir</td>
<td>5684</td>
<td>i2b</td>
<td>2</td>
<td>degrees * 10</td>
<td>No</td>
<td>i2b</td>
</tr>
<tr>
<td>i_Spare7</td>
<td>5686</td>
<td>i1b (594)</td>
<td>594</td>
<td>N/A</td>
<td>No</td>
<td>No</td>
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<td>Total Bytes</td>
<td>6280</td>
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</table>
Appendix D
Data Dictionary

D.1 Data Dictionary

D.1.1 GLA08 Record

Product Var Name: i_rec_ndx
Is element of: GLA01 Long Waveform Record, GLA01 Main Record,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record,
GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record,
GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record,
GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: GLAS Record Index
Product Data Type: i4b
Total Bytes: 4
Product Units: N/A
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record,
GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record,
GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record,
GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record,
GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_beam_coelev
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Co-elevation
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.
Comments:

Product Var Name: i_beam_azimuth
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Azimuth
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Azimuth (Az) is the direction clockwise from north of the laser beam as seen by an observer at the laser ground spot.

Comments:

Product Var Name: i_pad_angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: PAD Angle
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600000000
Description: Attitude angle calculated from PAD and POD.

Comments:

Product Var Name: i_spare0
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Spares
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: null
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: 0
Product Maximum: 0
Description: Spares

Comments:

Product Var Name: i_AttFlg1
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.

Comments:

Product Var Name: i_lat
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Profile Location, Latitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name: i_lon
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Profile Location, Longitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east
longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name: i_OrbFlg
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Orbit flag
Product Data Type: i1b (2, 4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 128
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name: i_surfType
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Region Type
Product Data Type: i1b (4)
Total Bytes: 4
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_LidarQF
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Lidar Frame quality flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_LidarQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_atm_dem
Is element of: GLA08 Record
Short Description: DEM value at current location from 1 km x 1 km grid
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: meters
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -32768
Product Maximum: 32768
Description: Surface height value for current location from 1 km x 1 km grid
Comments:

Product Var Name: i4_aer_bot
Is element of: GLA08 Record
Short Description: Below 20 KM Aerosol Layer Bottom at 532 nm
Product Data Type: i2b (5)
Total Bytes: 10
Product Units: deka-meters
Invalid Value/Flag: i4_aer_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: The aerosol layer bottoms (below 20 KM in atmosphere) for up to 5 layers at 1 per 4 sec.
Comments:

Product Var Name: i4_aer_top
Is element of: GLA08 Record
Short Description: Below 20 KM Aerosol Layer Top at 532 nm
Product Data Type: i2b (5)
Total Bytes: 10
Product Units: deka-meters
Invalid Value/Flag: i4_aer_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: The aerosol layer tops (below 20 KM in atmosphere) for up to 5 layers at 1 per 4 sec.
Comments:

Product Var Name: i20_aer_bot
Is element of: GLA08 Record
Short Description: 20-40 KM Aerosol Layer Bottom at 532 nm
Product Data Type: i2b (3)
Total Bytes: 6
Product Units: deka-meters
Invalid Value/Flag: i20_aer_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1000
Product Maximum: 4000
Description: The aerosol layer bottoms (20 - 40 KM in atmosphere) for up to 3 layers at 1 per 4 sec.
Comments:

Product Var Name: i20_aer_top
Is element of: GLA08 Record
Short Description: 20-40 KM Aerosol Layer Top at 532 nm
Product Data Type: i2b (3)
Total Bytes: 6
Product Units: deka-meters
Invalid Value/Flag: i20_aer_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1000
Product Maximum: 4000
Description: The aerosol layer tops (20 - 40 KM in atmosphere) for up to 3 layers at 1 per 4 sec.
Comments:

Product Var Name: i_LRpbl_ht
Is element of: GLA08 Record
Short Description: Low Resolution PBL Height at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 700
Description: Low resolution height of the planetary boundary layer, as derived from the aerosol structure; the low resolution data is averaged over 4 seconds.
Comments:

Product Var Name: i_LRpbl_grd
Is element of: GLA08 Record
Short Description: Ground Detection for Low Res PBL at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: The height above the reference ellipsoid of the ground used by the low res PBL processing algorithms.
Comments:

Product Var Name: i_HRpbl_ht
Is element of: GLA08 Record
Short Description: High Resolution PBL Height at 532 nm
Product Data Type: i2b (20)
Total Bytes: 40
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 700
Description: High resolution height of the planetary boundary layer, as derived from the aerosol structure; the high resolution data occurs at the rate of 5 per second.
Comments:

Product Var Name: i_HRpbl_grd
Is element of: GLA08 Record
Short Description: Ground Detection for High Res PBL
Product Data Type: i2b (20)
Total Bytes: 40
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: The height above the reference ellipsoid of the ground used by the high res PBL processing algorithms.
Comments:

Product Var Name: i4_aer_pct
Is element of: GLA08 Record
Short Description: Percentage of Saturated Bins in Below 20 KM Aerosol Layers at 532 nm
Product Data Type: i1b (5)
Total Bytes: 5
Product Units: unitless
Invalid Value/Flag: i4_aer_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description: Percentage of Saturated Bins in Below 20 KM Aerosol Layers at 532 nm
Comments:

Product Var Name: i20_aer_pct
Is element of: GLA08 Record
Short Description: Percentage of Saturated Bins in 20-40 KM Aerosol Layers at 532 nm
Product Data Type: i1b (3)
Total Bytes: 3
Product Units: unitless
Invalid Value/Flag: i20_aer_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description: Percentage of Saturated Bins in 20–40 KM Aerosol Layers at 532 nm
Comments:

Product Var Name: i_LRpb1_pct
Is element of: GLA08 Record
Short Description: Percentage of Saturated Bins in Low Resolution PBL Layer at 532 nm
Product Data Type: i1b
Total Bytes: 1
Product Units: unitless
Invalid Value/Flag: i1b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description: Percentage of Saturated Bins in Low Resolution PBL Layer at 532 nm
Comments:

Product Var Name: i_LayHgt_Flag
Is element of: GLA08 Record
Short Description: Layer Height Flag
Product Data Type: i1b (32)
Total Bytes: 32
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag — see Breakout for details
Comments: Please see <a href='flags/i_LayHgt_Flag.pdf'> the PDF flag description</a> for more details.

Product Var Name: i_AttFlg3
Is element of: GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude Flag 3
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Please see <a href='flags/i_AttFlg3.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Indicates what instrument or bias corrections were applied to the times on this record. Please see <a href='flags/i_timecorflg.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_Solar_Angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Solar Angle
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: micro-degrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: Incident angle of sun from normal.
Comments:

Product Var Name: i_Aer_top_b20_temp
Is element of: GLA08 Record
Short Description: Temperature of Top of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm
Product Data Type: i2b (5)
Total Bytes: 10
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Top of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm
Comments:

Product Var Name: i_Aer_top_b20_pres
Is element of: GLA08 Record
Short Description: Pressure of Top of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm
Product Data Type: i2b (5)
Total Bytes: 10
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Top of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm
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<th>GLA08 Record</th>
</tr>
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<tr>
<td></td>
<td>Relative Humidity of Top of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm</td>
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<table>
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<td>Temperature of Bottom of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm</td>
</tr>
<tr>
<td></td>
<td>i2b (5)</td>
</tr>
<tr>
<td></td>
<td>Degrees Celsius * 100</td>
</tr>
<tr>
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<tr>
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<td>Temperature of Bottom of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm</td>
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<tr>
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<td>Comments:</td>
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<tr>
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</tr>
<tr>
<td></td>
<td>i2b (5)</td>
</tr>
<tr>
<td></td>
<td>Millibars of mercury * 10</td>
</tr>
<tr>
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<tr>
<td></td>
<td>20000</td>
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<tr>
<td></td>
<td>Pressure of Bottom of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm</td>
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<tr>
<td></td>
<td>Comments:</td>
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</table>

<table>
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<th>Product Var Name</th>
<th>GLA08 Record</th>
</tr>
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<tr>
<td>i_Aer_bot_b20_relh</td>
<td>Relative Humidity of Bottom of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm</td>
</tr>
<tr>
<td></td>
<td>i2b (5)</td>
</tr>
<tr>
<td></td>
<td>Percentage * 100</td>
</tr>
<tr>
<td></td>
<td>NA</td>
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</table>

Comments:
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Bottom of Aerosol Layers in Bottom 20km of Atmosphere at 532 nm
Comments:

Product Var Name: i_Aer_top_a20_temp
Is element of: GLA08 Record
Short Description: Temperature of Top of Aerosol Layers Above 20km of Atmosphere at 532 nm
Product Data Type: i2b ( 3)
Total Bytes: 6
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Top of Aerosol Layers Above 20km of Atmosphere at 532 nm
Comments:

Product Var Name: i_Aer_top_a20_pres
Is element of: GLA08 Record
Short Description: Pressure of Top of Aerosol Layers Above 20km of Atmosphere at 532 nm
Product Data Type: i2b ( 3)
Total Bytes: 6
Product Units: millbars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Top of Aerosol Layers Above 20km of Atmosphere at 532 nm
Comments:

Product Var Name: i_Aer_top_a20_relh
Is element of: GLA08 Record
Short Description: Relative Humidity of Top of Aerosol Layers Above 20km of Atmosphere at 532 nm
Product Data Type: i2b ( 3)
Total Bytes: 6
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Top of Aerosol Layers Above 20km of Atmosphere at 532 nm
Comments:

Product Var Name: i_Aer_bot_a20_temp
Is element of: GLA08 Record
Short Description: Temperature of Bottom of Aerosol Layers Above 20km of Atmosphere at 532 nm
Product Data Type: i2b (3)
Total Bytes: 6
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Bottom of Aerosol Layers Above 20km of Atmosphere at 532 nm
Comments:

Product Var Name: \text{i\_Aer\_bot\_a20\_pres}
Is element of: GLA08 Record
Short Description: Pressure of Bottom of Aerosol Layers Above 20km of Atmosphere at 532 nm
Product Data Type: i2b (3)
Total Bytes: 6
Product Units: millbars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Bottom of Aerosol Layers Above 20km of Atmosphere at 532 nm
Comments:

Product Var Name: \text{i\_Aer\_bot\_a20\_relh}
Is element of: GLA08 Record
Short Description: Relative Humidity of Bottom of Aerosol Layers Above 20km of Atmosphere at 532 nm
Product Data Type: i2b (3)
Total Bytes: 6
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Bottom of Aerosol Layers Above 20km of Atmosphere at 532 nm
Comments:

Product Var Name: \text{i\_Aer\_PBL\_LR\_temp}
Is element of: GLA08 Record, GLA11 Record
Short Description: Temperature of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:
Product Var Name: i_Aer_PBL_LR_pres
Is element of: GLA08 Record, GLA11 Record
Short Description: Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:

Product Var Name: i_Aer_PBL_LR_relh
Is element of: GLA08 Record, GLA11 Record
Short Description: Relative Humidity of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:

Product Var Name: i_Aer_ir_top
Is element of: GLA08 Record, GLA11 Record
Short Description: Elevation of Top of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b ( 2)
Total Bytes: 4
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Top of Aerosol Layers detected in 1064 nm
Comments:

Product Var Name: i_Aer_ir_bot
Is element of: GLA08 Record, GLA11 Record
Short Description: Elevation of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b ( 2)
Total Bytes: 4
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Bottom of Aerosol Layers Detected in 1064 nm
Comments:
Product Var Name: i_Aer_ir_layflg
Is element of: GLA08 Record
Short Description: Layer Flag for 1064 Aerosol
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Please see <a href='flags/i_Aer_ir_layflg.pdf'>the PDF flag description</a> for more details.

Comments:

Product Var Name: i_Aer_ir_top_temp
Is element of: GLA08 Record, GLA11 Record
Short Description: Temperature of Top of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name: i_Aer_ir_top_pres
Is element of: GLA08 Record, GLA11 Record
Short Description: Pressure of Top of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name: i_Aer_ir_top_relh
Is element of: GLA08 Record, GLA11 Record
Short Description: Relative Humidity of Top of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Top of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name: i_Aer_ir_bot_temp
Is element of: GLA08 Record, GLA11 Record
Short Description: Temperature of Bottom of Aerosol Layers Detected in 1064 nm
<table>
<thead>
<tr>
<th>Product Data Type</th>
<th>Total Bytes</th>
<th>Product Units</th>
<th>Invalid Value/Flag</th>
<th>Is Correction Flag?</th>
<th>Is Unsigned?</th>
<th>Product Minimum</th>
<th>Product Maximum</th>
<th>Description</th>
<th>Comments</th>
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<td>i2b ( 2)</td>
<td>4</td>
<td>degrees Celsius * 100</td>
<td>i2b</td>
<td>NA</td>
<td>No</td>
<td>-10000</td>
<td>10000</td>
<td>Temperature of Bottom of Aerosol Layers Detected in 1064 nm</td>
<td></td>
</tr>
<tr>
<td>i2b ( 2)</td>
<td>4</td>
<td>millibars of mercury * 10</td>
<td>i2b</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>20000</td>
<td>Pressure of Bottom of Aerosol Layers Detected in 1064 nm</td>
<td></td>
</tr>
<tr>
<td>i2b ( 2)</td>
<td>4</td>
<td>percentage * 100</td>
<td>i2b</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>10000</td>
<td>Relative Humidity of Bottom of Aerosol Layers Detected in 1064 nm</td>
<td></td>
</tr>
<tr>
<td>i2b ( 4)</td>
<td>8</td>
<td>degrees Celsius * 100</td>
<td>i2b</td>
<td>NA</td>
<td>No</td>
<td>-10000</td>
<td>10000</td>
<td>Surface Temperature, 4 of 1-second intervals.</td>
<td></td>
</tr>
<tr>
<td>i2b ( 4)</td>
<td>8</td>
<td>millibars of mercury * 10</td>
<td>i2b</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td>Surface Pressure</td>
<td></td>
</tr>
</tbody>
</table>
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Surface Pressure, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_relh
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Relative Humidity
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Surface Relative Humidity, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_wind
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Wind Speed
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: meters/second * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Surface Wind Speed, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_wdir
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Wind Direction Azimuth from North
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: degrees * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600
Description: Surface wind direction azimuth from North, 4 of 1-second intervals.
Comments:

Product Var Name: i_spare2
Is element of: GLA08 Record
Short Description: Spares
Product Data Type: i1b (264)
Total Bytes: 264
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
D.1.2 GLA09 Record

Product Var Name: i_rec_ndx
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: GLAS Record Index
Product Data Type: i4b
Total Bytes: 4
Product Units: N/A
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_beam_coelev
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Co-elevation
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.
Comments:
Product Var Name: i_beam_azimuth
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Azimuth
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Azimuth (Az) is the direction clockwise from north of the laser beam as seen by an observer at the laser ground spot.Comments:

Product Var Name: i_pad_angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: PAD Angle
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600000000
Description: Attitude angle calculated from PAD and POD.Comments:

Product Var Name: i_spare0
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Spares
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: null
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: 0
Product Maximum: 0
Description:
Comments:

Product Var Name: i_AttFlg1
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_lat
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Profile Location, Latitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east longitude and latitude, at the 1 hertz rate.
Comments:

Product Var Name: i_lon
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record

Short Description: Profile Location, Longitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east longitude and latitude, at the 1 hertz rate.
Comments:

Product Var Name: i_OrbFlg
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record

Short Description: Orbit flag
Product Data Type: i1b (2, 4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 128
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details. There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name: i_surfType
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record

Short Description: Region Type
Product Data Type: i1b (4)
Total Bytes: 4
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_LidarQF
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Lidar Frame quality flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_LidarQF.pdf'>the PDF flag description</a> for more details.

Comments:

Product Var Name: i_spare2
Is element of: GLA09 Record
Short Description: Spares
Product Data Type: i1b (8)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: not used

Comments:

Product Var Name: i_topo_elev
Is element of: GLA09 Record
Short Description: Topographic elevation of surface above geoid
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: meters
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -2500
Product Maximum: 32000
Description: Topographic elevation of surface above geoid based upon POD, PAD, and geoid
Comments:

Product Var Name: i_atm_dem
Is element of: GLA09 Record
Short Description: DEM value at current location from 1 km x 1 km grid
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: meters
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -32768
Product Maximum: 32768
Description: Surface height value for current location from 1 km x 1 km grid
Comments:
Product Var Name: i_LRcld_bot
Is element of: GLA09 Record
Short Description: Low Resolution Cloud Bottom at 532 nm
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: deka-meters
Invalid Value/Flag: i_LRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Low resolution height above the reference ellipsoid of the bottom of a cirrus, thin, or dense cloud layer in the atmosphere. There can be up to 10 cloud layers in an atmospheric profile. The low resolution data occurs at the rate of once per 4 seconds.
Comments:

Product Var Name: i_LRcld_top
Is element of: GLA09 Record
Short Description: Low Resolution Cloud Top at 532 nm
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: deka-meters
Invalid Value/Flag: i_LRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Low resolution height above the reference ellipsoid of the top of a cirrus, thin, or dense cloud layer in the atmosphere. There can be up to 10 cloud layers in an atmospheric profile. The low resolution data occurs at the rate of once per 4 seconds.
Comments:

Product Var Name: i_LRcld_grd
Is element of: GLA09 Record
Short Description: Low Resolution Ground Detection at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: The height from the reference ellipsoid of the ground as detected by the low res cloud processing algorithms. A value of -880 indicates that the ground was searched for, but not detected.
Comments:

Product Var Name: i_spare3
Is element of: GLA09 Record
Short Description: Spares
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: not used
Comments:

Product Var Name: i_MRcld_bot
Is element of: GLA09 Record
Short Description: Medium Resolution Cloud Bottom at 532 nm
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i_MRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Medium resolution height above the reference ellipsoid of the bottom of a cirrus, thin, or dense cloud layer in the atmosphere. There can be up to 10 cloud layers in an atmospheric profile. The medium resolution data occurs at the rate of once per second.
Comments:

Product Var Name: i_MRcld_top
Is element of: GLA09 Record
Short Description: Medium Resolution Cloud Top at 532 nm
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i_MRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Medium resolution height above the reference ellipsoid of the top of a cirrus, thin, or dense cloud layer in the atmosphere. There can be up to 10 cloud layers in an atmospheric profile. The medium resolution data occurs at the rate of once per second.
Comments:

Product Var Name: i_MRcld_grd
Is element of: GLA09 Record
Short Description: Medium Resolution Ground Detection at 532 nm
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: The height above the reference ellipsoid of the ground as detected by the med res cloud processing algorithms. A value of -880 indicates that the ground was searched for, but not detected.
Comments:

Product Var Name: i_MRcld_pct
Is element of: GLA09 Record
Short Description: Percentage of Saturated Bins in Medium Resolution Cloud Layers at
532 nm
Product Data Type: i1b (10, 4)
Total Bytes: 40
Product Units: unitless
Invalid Value/Flag: i_MRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description: Percentage of saturated bins in medium resolution cloud layers
Comments:

Product Var Name: i_HRclld_bot
Is element of: GLA09 Record
Short Description: High Resolution Cloud Bottom at 532 nm
Product Data Type: i2b (10, 20)
Total Bytes: 400
Product Units: deka-meters
Invalid Value/Flag: i_HRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: High resolution height above the reference ellipsoid of the bottom of a cirrus, thin, or dense cloud layer below 10KM in the atmosphere. There can be up to 10 cloud layers in an atmospheric profile. The high resolution data occurs at the rate of 5 per second.
Comments:

Product Var Name: i_HRclld_top
Is element of: GLA09 Record
Short Description: High Resolution Cloud Top at 532 nm
Product Data Type: i2b (10, 20)
Total Bytes: 400
Product Units: deka-meters
Invalid Value/Flag: i_HRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: High resolution height above the reference ellipsoid of the top of a cirrus, thin, or dense cloud layer below 10 KM in the atmosphere. There can be up to 10 cloud layers in an atmospheric profile. The high resolution data occurs at the rate of 5 per second.
Comments:

Product Var Name: i_HRclld_grd
Is element of: GLA09 Record
Short Description: High Resolution Ground Detection at 532 nm
Product Data Type: i2b ( 20)
Total Bytes: 40
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: The height above the reference ellipsoid of the ground as detected by the high res cloud processing algorithms. A value of -880 indicates that the ground
was searched for, but not detected.
Comments:

Product Var Name: i_FRcld_bot
Is element of: GLA09 Record
Short Description: Full Resolution Cloud Bottom at 532 nm
Product Data Type: i2b (160)
Total Bytes: 320
Product Units: deka-meters
Invalid Value/Flag: i_FRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 400
Description: The height above the reference ellipsoid to the bottom of the full resolution cloud layer. The full resolution data occurs at the rate of 40 per second, however, the full resolution cloud layer will only be processed from high resolution layers found below 4 KM. If there are no high resolution layers below 4 KM then the full resolution data will be marked as invalid on the product.
Comments:

Product Var Name: i_FRcld_top
Is element of: GLA09 Record
Short Description: Full Resolution Cloud Top at 532 nm
Product Data Type: i2b (160)
Total Bytes: 320
Product Units: deka-meters
Invalid Value/Flag: i_FRC_af
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 400
Description: The height above the reference ellipsoid to the top of the full resolution cloud layer. The full resolution data occurs at the rate of 40 per second, however, the full resolution cloud layer will only be processed from high resolution layers found below 4 KM. If there are no high resolution layers below 4 KM then the full resolution data will be marked as invalid on the product.
Comments:

Product Var Name: i_FRcld_grd
Is element of: GLA09 Record
Short Description: Full Resolution Cloud Ground Detection at 532 nm
Product Data Type: i2b (160)
Total Bytes: 320
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: The height above the reference ellipsoid of the ground as detected by the full resolution cloud processing algorithms. A value of -880 indicates that the ground was searched for, but not detected.
Comments:

Product Var Name: i_FRg_grd_sig
Is element of: GLA09 Record
Short Description: Full Resolution Ground Return Signal at 532 nm
Product Data Type: i4b (160)
Total Bytes: 640
Product Units: e9/(m-sr)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 10000
Product Maximum: 10000000
Description: Ground return signal from the 532 nm backscatter profile at the height that the ground return is detected.
Comments:

Product Var Name: i_FRir_grd_sig
Is element of: GLA09 Record
Short Description: Full Resolution Ground Return Signal at 1064 nm
Product Data Type: i4b (160)
Total Bytes: 640
Product Units: e9/(m-sr)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 100000
Product Maximum: 10000000
Description: Ground return signal from the 1064 nm backscatter profile at the height that the ground return is detected.
Comments:

Product Var Name: i_LRCL_Flag
Is element of: GLA09 Record
Short Description: Low Resolution Cloud Layers Flag for 532 nm
Product Data Type: i1b (11)
Total Bytes: 11
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see <a href='flags/i_LRCL_Flag.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_MRCL_Flag
Is element of: GLA09 Record
Short Description: Medium Resolution Cloud Layers Flag for 532 nm
Product Data Type: i1b (37)
Total Bytes: 37
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see <a href='flags/i_MRCL_Flag.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_HRCL_Flag
Is element of: GLA09 Record
Short Description: High Resolution Cloud Layers Flag for 532 nm
Product Data Type: i1b (185)
Total Bytes: 185
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag – see Breakout for details
Please see <a href='flags/i_HRCL_Flag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_FRCL_Flag
Is element of: GLA09 Record
Short Description: Full Resolution Cloud Layers Flag for 532 nm
Product Data Type: i1b (220)
Total Bytes: 220
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag – see Breakout for details
Please see <a href='flags/i_FRCL_Flag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_AttFlg3
Is element of: GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude Flag 3
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Please see <a href='flags/i_AttFlg3.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Indicates what instrument or bias corrections were applied to the times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_FRir_clldtop
Is element of: GLA09 Record, GLA11 Record
Short Description: Full Resolution 1064 Cloud Top
Product Data Type: i2b (160)
Total Bytes: 320
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1030
Description: Full resolution (40 Hz) cloud top height obtained from the 1064 atmospheric channel. This parameter is for a 4 second record. Also parameter is in GLA06, 12-15.
Comments:

Product Var Name: i_FRir_qaFlag
Is element of: GLA09 Record, GLA11 Record
Short Description: Full Resolution 1064 Quality Flag
Product Data Type: i1b (160)
Total Bytes: 160
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_FRir_intsig
Is element of: GLA09 Record
Short Description: Full Resolution 1064 Integrated Signal
Product Data Type: i2b (160)
Total Bytes: 320
Product Units: e7/(m-sr)
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Though called 'integrated signal' this is actually an average of all bins in the above-ground portion of the 1064 40 Hz profile with values above the threshold of 1.0e-7 (1/(m-sr)). This parameter is for a 4 second record. This parameter is also in GLA06, 12-15.
Comments:

Product Var Name: i_Solar_Angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Solar Angle
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: micro-degrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: Incident angle of sun from normal.
Comments:

Product Var Name: i_LRir_cld_top
Is element of: GLA09 Record
Short Description: Elevation of Top of Cloud Layers Detected in 1064 nm at Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of top of cloud layers detected in 1064 nm at low resolution data rate (1 per 4 sec).
Comments:

Product Var Name: i_LRir_cld_bot
Is element of: GLA09 Record
Short Description: Elevation of Bottom of Cloud Layers Detected in 1064 nm at Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Bottom of Cloud Layers Detected in 1064 nm at Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name: i_LRir_QAflag
Is element of: GLA09 Record
Short Description: Low Resolution 1064 nm Cloud Layer QA Flag
Product Data Type: i1b (10)
Total Bytes: 10
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 256
Description: Low Resolution 1064 nm Cloud Layer QA Flag. Composite Flag - see Breakout for details
Please see <a href='flags/i_LRir_QAflag.pdf'> the PDF flag description</a> for more details.
The data is arranged in 10 bytes. Within the 10 bytes:

- byte 1 leaves bits 4-7 as spare, and stores the availability flag in bits 0-3; it provides the number of cloud layers determined from 1064 nm data, with 0=cloud layers searched for but not detected and 15=cloud layers not searched for
- bytes 2-5 are spares
- bytes 6-10 are 10 flags, each 4 bits in length giving a quality flag; 15=cloud layers were not searched for, 0=cloud layers searched for but not detected, 1=low chance of being a cloud, 2=moderate, 3=high, 4=no doubt

Comments:

Product Var Name: i_LRir_cldtop_temp
Is element of: GLA09 Record
Short Description: Temperature of Top of Cloud Layers Detected in 1064 nm at Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Top of Cloud Layers Detected in 1064 nm at Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name: i_LRir_cldtop_pres
Is element of: GLA09 Record
Short Description: Pressure of Top of Cloud Layers Detected in 1064 nm at Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Top of Cloud Layers Detected in 1064 nm at Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name: i_LRir_cldtop_relh
Is element of: GLA09 Record
Short Description: Relative Humidity of Top of Cloud Layers Detected in 1064 nm at Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Top of Cloud Layers Detected in 1064 nm at
Low Resolution data rate (1 per 4 sec).

Comments:

Product Var Name: i_LRir_cldbot_temp
Is element of: GLA09 Record
Short Description: Temperature of Bottom of Cloud Layers Detected in 1064 nm at Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Bottom of Cloud Layers Detected in 1064 nm at Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name: i_LRir_cldbot_pres
Is element of: GLA09 Record
Short Description: Pressure of Bottom of Cloud Layers Detected in 1064 nm at Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Bottom of Cloud Layers Detected in 1064 nm at Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name: i_LRir_cldbot_relh
Is element of: GLA09 Record
Short Description: Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm Low Resolution
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm Low Resolution data rate (1 per 4 sec).
Comments:

Product Var Name: i_MRir_cld_top
Is element of: GLA09 Record, GLA11 Record
Short Description: Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cld_bot
Is element of: GLA09 Record, GLA11 Record
Short Description: Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_QAflag
Is element of: GLA09 Record, GLA11 Record
Short Description: Medium Resolution 1064 nm Cloud Layer QA Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Medium Resolution 1064 nm Cloud Layer QA Flag. Composite Flag - see Breakout for details
Comments:

The data is arranged in 40 bytes.

bytes 1-18 are spares:
bytes 19-20 are af flags: The 4 ‘af’ flags (4 bits each) are concatenated with the QAflag storage and are contained in bytes 19-20 starting at bit 0 of byte 20.
bytes 21-40 are QAflags: The QAflag portion has been stored such that interval 1 is in bytes 40-36, interval 2 in bytes 35-31, interval 3 in bytes 30-26, and interval 4 in bytes 25-21. Each of the 10 layer flags per interval is 4 bits in length as before, such that interval 1 layer 1 is in bits 0-3 and interval 1 layer 2 is in bits 4-7 of byte 40, interval 1 layer 3 is in bits 0-3 and interval 1 layer 4 is in bits 4-7 of byte 39, etc.

Quality flag value 15=cloud layers were not searched for; 0=cloud layers were searched but not detected; 1-14 indicate increasing confidence of good cloud retrieval (value 1=least confidence, value 14=greatest confidence).
Availability flag value 15=cloud layers not searched for; 0=layers searched for but not detected.
Comments:
Product Var Name: i_MRir_cldtop_temp  
Is element of: GLA09 Record, GLA11 Record  
Short Description: Temperature of Top of Cloud Layers Detected in 1064 nm at Medium Resolution  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: degrees Celsius * 100  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -10000  
Product Maximum: 10000  
Description: Temperature of Top of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.  
Comments:

Product Var Name: i_MRir_cldtop_pres  
Is element of: GLA09 Record, GLA11 Record  
Short Description: Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Resolution  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: millibars of mercury * 10  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 20000  
Description: Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.  
Comments:

Product Var Name: i_MRir_cldtop_relh  
Is element of: GLA09 Record, GLA11 Record  
Short Description: Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Resolution  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: percentage * 100  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 10000  
Description: Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Resolution data rate.  
Comments:

Product Var Name: i_MRir_cldbot_temp  
Is element of: GLA09 Record, GLA11 Record  
Short Description: Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: degrees Celsius * 100  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cldbot_pres
Is element of: GLA09 Record, GLA11 Record
Short Description: Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cldbot_relh
Is element of: GLA09 Record, GLA11 Record
Short Description: Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at MR
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_LRg_cldtop_temp
Is element of: GLA09 Record
Short Description: Low Resolution 532 nm Cloud Top Temperature
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Low Resolution 532 nm Cloud Top Temperature
Comments:

Product Var Name: i_LRg_cldtop_pres
Is element of: GLA09 Record
Short Description: Low Resolution 532 nm Cloud Top Pressure
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned? : No
Product Minimum: 0
Product Maximum: 20000
Description: Low Resolution 532 nm Cloud Top Pressure
Comments:

Product Var Name: i_LRg_cldtop_relh
Is element of: GLA09 Record
Short Description: Low Resolution 532 nm Cloud Top Relative Humidity
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Low Resolution 532 nm Cloud Top Relative Humidity
Comments:

Product Var Name: i_LRg_cldbot_temp
Is element of: GLA09 Record
Short Description: Low Resolution 532 nm Cloud Bottom Temperature
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Low Resolution 532 nm Cloud Bottom Temperature
Comments:

Product Var Name: i_LRg_cldbot_pres
Is element of: GLA09 Record
Short Description: Low Resolution 532 nm Cloud Bottom Pressure
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Low Resolution 532 nm Cloud Bottom Pressure
Comments:

Product Var Name: i_LRg_cldbot_relh
Is element of: GLA09 Record
Short Description: Low Resolution 532 nm Cloud Bottom Relative Humidity
Product Data Type: i2b (10)
Total Bytes: 20
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Low Resolution 532 nm Cloud Bottom Relative Humidity
Comments:

Product Var Name: i_MRg_cldtop_temp
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Top Temperature
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Medium Resolution 532 nm Cloud Top Temperature
Comments:

Product Var Name: i_MRg_cldtop_pres
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Top Pressure
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Medium Resolution 532 nm Cloud Top Pressure
Comments:

Product Var Name: i_MRg_cldtop_relh
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Top Relative Humidity
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Medium Resolution 532 nm Cloud Top Relative Humidity
Comments:

Product Var Name: i_MRg_cldbot_temp
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Bottom Temperature
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Medium Resolution 532 nm Cloud Bottom Temperature
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Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Surface Pressure, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_relh
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Relative Humidity
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Surface Relative Humidity, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_wind
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Wind Speed
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: meters/second * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Surface Wind Speed, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_wdir
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Wind Direction Azimuth from North
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: degrees * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600
Description: Surface wind direction azimuth from North, 4 of 1-second intervals.
Comments:

Product Var Name: i_spare4
Is element of: GLA09 Record
Short Description: Spares
Product Data Type: i1b (590)
Total Bytes: 590
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
D.1.3 GLA10 Record

Product Var Name: i_rec_ndx
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04_GYRO Main Record, GLA04_IST Main Record, GLA04_LPA Main Record, GLA04_LRS Main Record, GLA04_SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: GLAS Record Index
Product Data Type: i4b
Total Bytes: 4
Product Units: N/A
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04_GYRO Main Record, GLA04_IST Main Record, GLA04_LPA Main Record, GLA04_LRS Main Record, GLA04_SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_beam_coelev
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Co-elevation
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.
Comments:
Product Var Name: i_beam_azimuth
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Azimuth
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Azimuth (Az) is the direction clockwise from north of the laser beam as seen by an observer at the laser ground spot.

Product Var Name: i_pad_angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: PAD Angle
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600000000
Description: Attitude angle calculated from PAD and POD.

Product Var Name: i_spare0
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Spares
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: null
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: 0
Product Maximum: 0
Description:

Product Var Name: i_AttFlg1
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.

Product Var Name: i_lat
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Profile Location, Latitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name: i_lon
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record

Short Description: Profile Location, Longitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name: i_OrbFlg
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Orbit flag
Product Data Type: i1b (2, 4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 128
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details. There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name: i_surfType
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Region Type
Product Data Type: i1b (4)
Total Bytes: 4
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_LidarQF
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Lidar Frame quality flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_LidarQF.pdf'>the PDF flag description</a> for more details.

Comments:

Product Var Name: i_cld1_bs_prof
Is element of: GLA10 record
Short Description: Cloud Backscatter Cross Section Profile at 532 nm
Product Data Type: i4b (280, 4)
Total Bytes: 4480
Product Units: e10/(m-sr)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 100000000
Description: 532 nm cloud backscatter cross section corrected for attenuation, from 20 to -1km at 1hz. The first 4*280 bytes refer to the profile at the first second.

Comments:

Product Var Name: i_cld1_ext_prof
Is element of: GLA10 record
Short Description: Cloud Extinction Cross Section Profile at 32 nm
Product Data Type: i4b (280, 4)
Total Bytes: 4480
Product Units: e9/m
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000000
Product Maximum: 1000000000
Description: Cloud extinction cross section profile from 20 to -1km at 1hz calculated from the 532 nm data. The first 4*280 bytes refer to the profile at the first second.

Comments:

Product Var Name: i_aer4_bs_prof
Is element of: GLA10 record
Short Description: Aerosol Backscatter Cross Section Profile at 532nm
Product Data Type: i4b (548)
Total Bytes: 2192
Product Units: e10/(m-sr)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 1000000000
Description: 532 nm aerosol backscatter cross section from 40 to -1km at 0.25hz. The 4\*548 bytes refer to the profile at the four second interval.
Comments:

Product Var Name: i_aer4_ext_prof
Is element of: GLA10 record
Short Description: Aerosol Extinction Cross Section Profile at 532 nm
Product Data Type: i4b (548)
Total Bytes: 2192
Product Units: e9/m
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000000
Product Maximum: 1000000000

Description: Aerosol extinction cross section profile for 40 to -1km calculated from the 532 nm data at 0.25hz. The 4\*548 bytes refer to the profile at the four second interval.
Comments:

Product Var Name: i_cld1_sval1
Is element of: GLA10 record
Short Description: Cloud true S values from table
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: 100*sr
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 100
Product Maximum: 20000

Description: Cloud true extinction to backscatter ratios calculated from meteorological and geographic data. The first set of 2\*10 bytes refers to the 10 possible layers at the first second.
Comments:

Product Var Name: i_cld1_sval2
Is element of: GLA10 record
Short Description: Cloud true S values from equation calc.
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: 100*sr
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 100
Product Maximum: 20000

Description: Cloud true extinction to backscatter ratios calculated from optically thin layer considerations. The first set of 2\*10 bytes refers to the 10 possible layers at the first second.
Comments:

Product Var Name: i_aer4_sval1
Is element of: GLA10 record
Short Description: Aerosol true S Values from table
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: 100*sr
Invalid Value/Flag: i2b
Is Correction Flag?: NA
IsUnsigned?: No
ProductMinimum: 100
ProductMaximum: 20000
Description: Aerosol true extinction tom backscatter ratios calculated from meteorological and geographic data
Comments:

Product Var Name: i_aer4_sval2
Is element of: GLA10 record
Short Description: Aerosol true S Values from equation calc.
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: 100*sr
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 100
Product Maximum: 20000
Description: Aerosol true extinction to backscatter ratios calculated from optically thin layer considerations
Comments:

Product Var Name: i_cld1_bot
Is element of: GLA10 record, GLA11 Record
Short Description: Medium Resolution Cloud Bottom at 532 nm
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Medium resolution cloud bottom heights for layers which were selected for optical processing at 1hz, 1 per layer, 10 layers
Comments:

Product Var Name: i_cld1_top
Is element of: GLA10 record, GLA11 Record
Short Description: Medium Resolution Cloud Top at 532 nm
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Medium resolution cloud top heights for layers which were selected for optical processing at 1hz, 1 per layer, 10 layers
Comments:

Product Var Name: i_cld1_grd_det
Is element of: GLA10 record, GLA11 Record
Short Description: Medium Resolution Ground Detection at 532 nm
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Medium resolution processed ground height at 1hz, 1 per profile
Comments:

Product Var Name: i_aer4_bot
Is element of: GLA10 record
Short Description: Low Resolution Aerosol Layer Bottom at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 4000
Description: Low resolution aerosol layer bottom heights for layers which were selected for optical processing at 0.25hz, 1 per layer, 9 layers including the planetary boundary layer and PSC
Comments:

Product Var Name: i_aer4_top
Is element of: GLA10 record
Short Description: Low Resolution Aerosol Layer Top at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 4000
Description: Low resolution aerosol layer top heights for layers which were selected for optical processing at 0.25hz, 1 per layer, 9 layers including the planetary boundary layer and PSC
Comments:

Product Var Name: i_pbl4_grd_det
Is element of: GLA10 record
Short Description: Low Resolution Aerosol Layer Ground Detection
Product Data Type: i2b
Total Bytes: 2
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: Low resolution processed ground detection height at 0.25hz, 1 per profile
Comments:

Product Var Name: i_spare2
Is element of: GLA10 record
Short Description: Spares
Product Data Type: i1b ( 2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
IsUnsigned?: No
Product Minimum: null
Product Maximum: null
Description: not used
Comments:

Product Var Name: i_cld1_sval uf
Is element of: GLA10 record
Short Description: Cloud true S values use flag
Product Data Type: i1b (20)
Total Bytes: 20
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
IsUnsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Cloud true S values use flag for 10 layers at 1 Hz for 4 sec. First 40 bits are for 10 layers of first second, last 40 bits are for 10 layers of 4th second.
Please see <a href='flags/i_cld1_sval uf.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_aer4_sval uf
Is element of: GLA10 record
Short Description: Aerosol true S Values use flag
Product Data Type: i1b (5)
Total Bytes: 5
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
IsUnsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Aerosol true S values use flag for 9 layers at 1 per 4 sec. First 4 bits are for first layer, last 4 bits are for 9th layer. Bits 36-39 are spares needed to make 5 bytes.
Please see <a href='flags/i_aer4_sval uf.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_spare3
Is element of: GLA10 record
Short Description: Spares
Product Data Type: i1b (3)
Total Bytes: 3
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
IsUnsigned?: No
Product Minimum: null
Product Maximum: null
Description: not used
Comments:
Product Var Name: i_cld1_bs_flag
Is element of: GLA10 record
Short Description: Cloud backscatter flag for 532 nm
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see <a href='flags/i_cld1_bs_flag.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_cld1_ext_flag
Is element of: GLA10 record
Short Description: Cloud extinction flag at 532 nm
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see <a href='flags/i_cld1_ext_flag.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_aer4_bs_flag
Is element of: GLA10 record
Short Description: Aerosol backscatter flag for 532 nm
Product Data Type: i1b (10)
Total Bytes: 10
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see <a href='flags/i_aer4_bs_flag.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_aer4_ext_flag
Is element of: GLA10 record
Short Description: Aerosol extinction flag for 532 nm
Product Data Type: i1b (10)
Total Bytes: 10
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see `<a href='flags/i_aer4_ext_flag.pdf'> the PDF flag description</a>` for more details.

Comments:

Product Var Name: i_spare4
Is element of: GLA10 record
Short Description: Spares
Product Data Type: i1b
Total Bytes: 1
Product Units: null
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: 0
Product Maximum: 0
Description: 

Comments:

Product Var Name: i_AttFlg3
Is element of: GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude Flag 3
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Please see `<a href='flags/i_AttFlg3.pdf'> the PDF flag description</a>` for more details.

Comments:

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Indicates what instrument or bias corrections were applied to the times on this record. Please see `<a href='flags/i_timecorflg.pdf'> the PDF flag description</a>` for more details.

Comments:

Product Var Name: i_Solar_Angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Solar Angle
Product Data Type: i4b (4)
Total Bytes: 16  
Product Units: micro-degrees  
Invalid Value/Flag: i4b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -90000000  
Product Maximum: 90000000  
Description: Incident angle of sun from normal.  
Comments:

Product Var Name: i_MRg_cldtop_temp  
Is element of: GLA09 Record, GLA10 record, GLA11 Record  
Short Description: Medium Resolution 532 nm Cloud Top Temperature  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: degrees Celsius * 100  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -10000  
Product Maximum: 10000  
Description: Medium Resolution 532 nm Cloud Top Temperature  
Comments:

Product Var Name: i_MRg_cldtop_pres  
Is element of: GLA09 Record, GLA10 record, GLA11 Record  
Short Description: Medium Resolution 532 nm Cloud Top Pressure  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: millibars of mercury * 10  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 20000  
Description: Medium Resolution 532 nm Cloud Top Pressure  
Comments:

Product Var Name: i_MRg_cldtop_relh  
Is element of: GLA09 Record, GLA10 record, GLA11 Record  
Short Description: Medium Resolution 532 nm Cloud Top Relative Humidity  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: percentage * 100  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 10000  
Description: Medium Resolution 532 nm Cloud Top Relative Humidity  
Comments:

Product Var Name: i_MRg_cldbot_temp  
Is element of: GLA09 Record, GLA10 record, GLA11 Record  
Short Description: Medium Resolution 532 nm Cloud Bottom Temperature  
Product Data Type: i2b (10, 4)  
Total Bytes: 80  
Product Units: degrees Celsius * 100  
Invalid Value/Flag: i2b
**Medium Resolution 532 nm Cloud Bottom Temperature**

**Product Var Name:** i_MRg_cldbot_pres

**Is element of:** GLA09 Record, GLA10 record, GLA11 Record

**Short Description:** Medium Resolution 532 nm Cloud Bottom Pressure

**Product Data Type:** i2b (10, 4)

**Total Bytes:** 80

**Product Units:** millibars of mercury * 10

**Invalid Value/Flag:** i2b

**Is Correction Flag?:** NA

**Is Unsigned?:** No

**Product Minimum:** 0

**Product Maximum:** 20000

**Description:** Medium Resolution 532 nm Cloud Bottom Pressure

**Comments:**

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**Medium Resolution 532 nm Cloud Bottom Relative Humidity**

**Product Var Name:** i_MRg_cldbot_relh

**Is element of:** GLA09 Record, GLA10 record, GLA11 Record

**Short Description:** Medium Resolution 532 nm Cloud Bottom Relative Humidity

**Product Data Type:** i2b (10, 4)

**Total Bytes:** 80

**Product Units:** percentage * 100

**Invalid Value/Flag:** i2b

**Is Correction Flag?:** NA

**Is Unsigned?:** No

**Product Minimum:** 0

**Product Maximum:** 10000

**Description:** Medium Resolution 532 nm Cloud Bottom Relative Humidity

**Comments:**

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**Aerosol Layers Temperature at Top of Layer at 532 nm**

**Product Var Name:** i_Aer_top_temp

**Is element of:** GLA10 record, GLA11 Record

**Short Description:** Aerosol Layers Temperature at Top of Layer at 532 nm

**Product Data Type:** i2b (9)

**Total Bytes:** 18

**Product Units:** degrees Celsius * 100

**Invalid Value/Flag:** i2b

**Is Correction Flag?:** NA

**Is Unsigned?:** No

**Product Minimum:** -10000

**Product Maximum:** 10000

**Description:** Aerosol Layers Temperature at Top of Layer at 532 nm

**Comments:**

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**Aerosol Layers Pressure at Top of Layer at 532 nm**

**Product Var Name:** i_Aer_top_pres

**Is element of:** GLA10 record, GLA11 Record

**Short Description:** Aerosol Layers Pressure at Top of Layer at 532 nm

**Product Data Type:** i2b (9)

**Total Bytes:** 18

**Product Units:** millibars of mercury * 10

**Invalid Value/Flag:** i2b

**Is Correction Flag?:** NA

**Is Unsigned?:** No

**Product Minimum:** 0

**Product Maximum:** 0

**Description:** Aerosol Layers Pressure at Top of Layer at 532 nm

**Comments:**
Product Maximum: 20000
Description: Aerosol Layers Pressure at Top of Layer at 532 nm
Comments:

Product Var Name: i_Aer_top_relh
Is element of: GLA10 record, GLA11 Record
Short Description: Aerosol Layers Relative Humidity at Top of Layer at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Aerosol Layers Relative Humidity at Top of Layer at 532 nm
Comments:

Product Var Name: i_Aer_bot_temp
Is element of: GLA10 record, GLA11 Record
Short Description: Aerosol Layers Temperature at Bottom of Layer at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Aerosol Layers Temperature at Bottom of Layer at 532 nm
Comments:

Product Var Name: i_Aer_bot_pres
Is element of: GLA10 record, GLA11 Record
Short Description: Aerosol Layers Pressure at Bottom of Layer at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Aerosol Layers Pressure at Bottom of Layer at 532 nm
Comments:

Product Var Name: i_Aer_bot_relh
Is element of: GLA10 record, GLA11 Record
Short Description: Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Comments:
Product Var Name: i_Surface_temp
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Temperature
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Surface Temperature, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_pres
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Pressure
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Surface Pressure, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_relh
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Relative Humidity
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Surface Relative Humidity, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_wind
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Wind Speed
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: meters/second * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Surface Wind Speed, 4 of 1-second intervals.
Comments:

Product Var Name: i_Surface_wdir
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Surface Wind Direction Azimuth from North
Product Data Type: i2b ( 4)
Total Bytes: 8
Product Units: degrees * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600
Description: Surface wind direction azimuth from North, 4 of 1-second intervals.
Comments:

Product Var Name: i_spare5
Is element of: GLA10 record
Short Description: Spares
Product Data Type: i1b (292)
Total Bytes: 292
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: not used
Comments:

D.1.4 GLA11 Record

Product Var Name: i_rec_ndx
Is element of: GLA01 Long Waveform Record, GLA01 Main Record , GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: GLAS Record Index
Product Data Type: i4b
Total Bytes: 4
Product Units: N/A
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record , GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_beam_coelev
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Co-elevation
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.
Comments:

Product Var Name: i_beam_azimuth
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Azimuth
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Azimuth (Az) is the direction clockwise from north of the laser beam as seen by an observer at the laser ground spot.
Comments:

Product Var Name: i_pad_angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: PAD Angle
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600000000
Description: Attitude angle calculated from PAD and POD.
Comments:

Product Var Name: i_spare0
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Spares
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: null
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: 0
Product Maximum: 0
Description:
Comments:

Product Var Name: i_AttFlg1
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Composite Flag - see Common Flag Spreadsheet for details
Please see <a href='flags/i_AttFlg1.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_lat
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Profile Location, Latitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name: i_lon
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Profile Location, Longitude
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: microdegrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: Profile coordinate in the IERS Terrestrial Reference Frame: east longitude and latitude, at the 1 herz rate.
Comments:

Product Var Name: i_OrbFlg
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Orbit flag
Product Data Type: i1b (2, 4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 128
Description: Composite Flag – see Common Flag Spreadsheet for details
Please see `<a href='flags/i_OrbFlg.pdf'> the PDF flag description</a>` for more details.
There are 4 sets of this flag value, 1/sec for each of the 4 sec covered in the record.
Comments:

Product Var Name: i_surfType
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Region Type
Product Data Type: i1b (4)
Total Bytes: 4
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see `<a href='flags/i_surfType.pdf'> the PDF flag description</a>` for more details.
Comments:

Product Var Name: i_LidarQF
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Lidar Frame quality flag
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Composite Flag – see Common Flag Spreadsheet for details
Please see `<a href='flags/i_LidarQF.pdf'> the PDF flag description</a>` for more details.
Comments:

Product Var Name: i_cld1_od
Is element of: GLA11 Record
Short Description: Cloud Optical Depth at 532 nm
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: unitless*1000
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 5000
Description: 532 nm cloud optical depth, corrected for multiple scattering, at 1hz, 1 per layer, 10 layers
Comments:

Product Var Name: i_aer4_od
Is element of: GLA11 Record
Short Description: Aerosol Optical Depth at 532 nm
Product Data Type: i2b (8)
Total Bytes: 16
Product Units: unitless*1000
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 5000
Description: 532 nm elevated aerosol optical depth, corrected for multiple scattering, at 0.25hz, 1 per layer, 8 layers
Comments:

Product Var Name: i_pbl4_od
Is element of: GLA11 Record
Short Description: PBL Optical Depth at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: unitless*1000
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 5000
Description: 532 nm Planetary Boundary Layer aerosol optical depth, corrected for multiple scattering at 0.25hz, 1 per layer, 1 layer
Comments:

Product Var Name: i_aer4_msf
Is element of: GLA11 Record
Short Description: Aerosol Multiple Scattering Factor
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: unitless
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description: Aerosol multiple scattering coefficient used at 0.25hz, 1 per layer, 9 layers (including PSC)
Comments:

Product Var Name: i_cld1_msf
Is element of: GLA11 Record
Short Description: Cloud Multiple Scattering Factor
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: unitless
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description: Cloud multiple scattering coefficient at 1 hz, 1 per layer, 10 layers
Comments:

Product Var Name: i_cld1_bot
Is element of: GLA10 record, GLA11 Record
Short Description: Medium Resolution Cloud Bottom at 532 nm
Product Data Type: i2b (10, 4)
Description: Medium resolution cloud bottom heights for layers which were selected for optical processing at 1hz, 1 per layer, 10 layers

Comments:

Product Var Name: i_cld1_top
Is element of: GLA10 record, GLA11 Record
Short Description: Medium Resolution Cloud Top at 532 nm
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Medium resolution cloud top heights for layers which were selected for optical processing at 1hz, 1 per layer, 10 layers

Comments:

Product Var Name: i_cld1_grd_det
Is element of: GLA10 record, GLA11 Record
Short Description: Medium Resolution Ground Detection at 532 nm
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2000
Description: Medium resolution processed ground height at 1hz, 1 per profile

Comments:

Product Var Name: i_aer4_bot
Is element of: GLA11 Record
Short Description: Low Resolution Aerosol Layer Bottom at 532 nm
Product Data Type: i2b (8)
Total Bytes: 16
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 4000
Description: Low resolution elevated aerosol layer (including PSC) bottom height for layers which were selected for optical processing at 0.25hz, 1 per layer, 8 layers

Comments:

Product Var Name: i_aer4_top
Is element of: GLA11 Record
Short Description: Low Resolution Aerosol Layer Top at 532 nm
Product Data Type: i2b (8)
Total Bytes: 16
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 4000
Description: Low resolution elevated aerosol layer (including PSC) top height for layers which were selected for optical processing at 0.25hz, 1 per layer, 8 layers
Comments:

Product Var Name: i_aer4_ht
Is element of: GLA11 Record
Short Description: Low Resolution PBL Height at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 700
Description: Low resolution Planetary Boundary Layer height at 0.25hz, 1 per profile
Comments:

Product Var Name: i_aer4_grd_det
Is element of: GLA11 Record
Short Description: Low Resolution Ground Detection at 532 nm
Product Data Type: i2b
Total Bytes: 2
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 1000
Description: Low resolution processed ground detection height at 0.25hz, 1 per profile
Comments:

Product Var Name: i_erd
Is element of: GLA11 Record
Short Description: Estimated Range Delay
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description: Estimated Range (Altimetry) Delay 1 per second
Comments:

Product Var Name: i_pse
Is element of: GLA11 Record
Short Description: Particle Size Estimate
Data Dictionary

Product Data Type: i2b (4)
Total Bytes: 8
Product Units: microns
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description: Particle size estimate used to calculate warning flag and range delay, 1 per second
Comments:

Product Var Name: i_cld1_mswf
Is element of: GLA11 Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Cloud Multiple Scattering Warning Flag at 1 Hz for 4 sec. First 4 bits are for first second, last 4 bits are for 4th second.
Comments:

The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailed in the PDF.

A warning flag value of 15 will signify ?invalid?. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically ?thick? cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range.

Comments:

Product Var Name: i_cld1_flag
Is element of: GLA11 Record
Short Description: Cloud optical depth flag for 532 nm
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Comments:

Please see <a href='flags/i_cld1_flag.pdf'> the PDF flag description</a> for more details.

Product Var Name: i_aer4_flag
Is element of: GLA11 Record
Short Description: Aerosol optical depth flag for 532 nm
Product Data Type: i1b (8)
Total Bytes: 8
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see <a href='flags/i_aer4_flag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_pbl4_flag
Is element of: GLA11 Record
Short Description: PBL optical depth flag for 532 nm
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Composite Flag - see Breakout for details
Please see <a href='flags/i_pbl4_flag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_AttFlg3
Is element of: GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Attitude Flag 3
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Please see <a href='flags/i_AttFlg3.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Indicates what instrument or bias corrections were applied to the times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_rdu
Is element of: GLA11 Record
Short Description: Range Delay Uncertainty
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_spare2
Is element of: GLA11 Record
Short Description: Spares
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: not used
Comments:

Product Var Name: i_Solar_Angle
Is element of: GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record
Short Description: Solar Angle
Product Data Type: i4b (4)
Total Bytes: 16
Product Units: micro-degrees
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: Incident angle of sun from normal.
Comments:

Product Var Name: i_MRg_cldtop_temp
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Top Temperature
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Medium Resolution 532 nm Cloud Top Temperature
Comments:

Product Var Name: i_MRg_cldtop_pres
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Top Pressure
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Medium Resolution 532 nm Cloud Top Pressure
Comments:

Product Var Name: i_MRg_cldtop_relh
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Top Relative Humidity
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Medium Resolution 532 nm Cloud Top Relative Humidity
Comments:

Product Var Name: i_MRg_cldbot_temp
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Bottom Temperature
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Medium Resolution 532 nm Cloud Bottom Temperature
Comments:

Product Var Name: i_MRg_cldbot_pres
Is element of: GLA09 Record, GLA10 record, GLA11 Record
Short Description: Medium Resolution 532 nm Cloud Bottom Pressure
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Medium Resolution 532 nm Cloud Bottom Pressure
Comments:
### Product Var Name: i_MRg_cldbot_relh
- **Is element of:** GLA09 Record, GLA10 record, GLA11 Record
- **Short Description:** Medium Resolution 532 nm Cloud Bottom Relative Humidity
- **Product Data Type:** i2b (10, 4)
- **Total Bytes:** 80
- **Product Units:** percentage * 100
- **Invalid Value/Flag:** i2b
- **Is Correction Flag?:** NA
- **Is Unsigned?:** No
- **Product Minimum:** 0
- **Product Maximum:** 10000
- **Description:** Medium Resolution 532 nm Cloud Bottom Relative Humidity
- **Comments:**

### Product Var Name: i_Aer_top_temp
- **Is element of:** GLA10 record, GLA11 Record
- **Short Description:** Aerosol Layers Temperature at Top of Layer at 532 nm
- **Product Data Type:** i2b (9)
- **Total Bytes:** 18
- **Product Units:** degrees Celsius * 100
- **Invalid Value/Flag:** i2b
- **Is Correction Flag?:** NA
- **Is Unsigned?:** No
- **Product Minimum:** -10000
- **Product Maximum:** 10000
- **Description:** Aerosol Layers Temperature at Top of Layer at 532 nm
- **Comments:**

### Product Var Name: i_Aer_top_pres
- **Is element of:** GLA10 record, GLA11 Record
- **Short Description:** Aerosol Layers Pressure at Top of Layer at 532 nm
- **Product Data Type:** i2b (9)
- **Total Bytes:** 18
- **Product Units:** millibars of mercury * 10
- **Invalid Value/Flag:** i2b
- **Is Correction Flag?:** NA
- **Is Unsigned?:** No
- **Product Minimum:** 0
- **Product Maximum:** 20000
- **Description:** Aerosol Layers Pressure at Top of Layer at 532 nm
- **Comments:**

### Product Var Name: i_Aer_top_relh
- **Is element of:** GLA10 record, GLA11 Record
- **Short Description:** Aerosol Layers Relative Humidity at Top of Layer at 532 nm
- **Product Data Type:** i2b (9)
- **Total Bytes:** 18
- **Product Units:** percentage * 100
- **Invalid Value/Flag:** i2b
- **Is Correction Flag?:** NA
- **Is Unsigned?:** No
- **Product Minimum:** 0
- **Product Maximum:** 10000
- **Description:** Aerosol Layers Relative Humidity at Top of Layer at 532 nm
- **Comments:**

### Product Var Name: i_Aer_bot_temp
- **Is element of:** GLA10 record, GLA11 Record
Short Description: Aerosol Layers Temperature at Bottom of Layer at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Aerosol Layers Temperature at Bottom of Layer at 532 nm
Comments:

Product Var Name: i_Aer_bot_pres
Is element of: GLA10 record, GLA11 Record
Short Description: Aerosol Layers Pressure at Bottom of Layer at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Aerosol Layers Pressure at Bottom of Layer at 532 nm
Comments:

Product Var Name: i_Aer_bot_relh
Is element of: GLA10 record, GLA11 Record
Short Description: Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Product Data Type: i2b (9)
Total Bytes: 18
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Aerosol Layers Relative Humidity at Bottom of Layer at 532 nm
Comments:

Product Var Name: i_Aer_ir_top
Is element of: GLA08 Record, GLA11 Record
Short Description: Elevation of Top of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Top of Aerosol Layers detected in 1064 nm
Comments:

Product Var Name: i_Aer_ir_bot
Is element of: GLA08 Record, GLA11 Record
Short Description: Elevation of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b (2)
Total Bytes: 4
**Product Units:** deka-meters

**Invalid Value/Flag:** i2b

**Is Correction Flag?:** NA

**Is Unsigned?:** No

**Product Minimum:** -100

**Product Maximum:** 2200

**Description:** Elevation of Bottom of Aerosol Layers Detected in 1064 nm.

**Comments:**

**Product Var Name:** i_Aer_ir_top_temp

**Is element of:** GLA08 Record, GLA11 Record

**Short Description:** Temperature of Top of Aerosol Layers Detected in 1064 nm

**Product Data Type:** i2b (2)

**Total Bytes:** 4

**Description:** Temperature of Top of Aerosol Layers Detected in 1064 nm

**Comments:**

**Product Var Name:** i_Aer_ir_top_pres

**Is element of:** GLA08 Record, GLA11 Record

**Short Description:** Pressure of Top of Aerosol Layers Detected in 1064 nm

**Product Data Type:** i2b (2)

**Total Bytes:** 4

**Description:** Pressure of Top of Aerosol Layers Detected in 1064 nm

**Comments:**

**Product Var Name:** i_Aer_ir_top_relh

**Is element of:** GLA08 Record, GLA11 Record

**Short Description:** Relative Humidity of Top of Aerosol Layers Detected in 1064 nm

**Product Data Type:** i2b (2)

**Total Bytes:** 4

**Description:** Relative Humidity of Top of Aerosol Layers Detected in 1064 nm

**Comments:**

**Product Var Name:** i_Aer_ir_bot_temp

**Is element of:** GLA08 Record, GLA11 Record

**Short Description:** Temperature of Bottom of Aerosol Layers Detected in 1064 nm

**Product Data Type:** i2b (2)

**Total Bytes:** 4

**Description:** Temperature of Bottom of Aerosol Layers Detected in 1064 nm

**Comments:**
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Bottom of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name: i_Aer_ir_bot_pres
Is element of: GLA08 Record, GLA11 Record
Short Description: Pressure of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b ( 2)
Total Bytes: 4
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Bottom of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name: i_Aer_ir_bot_relh
Is element of: GLA08 Record, GLA11 Record
Short Description: Relative Humidity of Bottom of Aerosol Layers Detected in 1064 nm
Product Data Type: i2b ( 2)
Total Bytes: 4
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Bottom of Aerosol Layers Detected in 1064 nm
Comments:

Product Var Name: i_MRir_cld_top
Is element of: GLA09 Record, GLA11 Record
Short Description: Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Top of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cld_bot
Is element of: GLA09 Record, GLA11 Record
Short Description: Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -100
Product Maximum: 2200
Description: Elevation of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cldtop_temp
Is element of: GLA09 Record, GLA11 Record
Short Description: Temperature of Top of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Temperature of Top of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cldtop_pres
Is element of: GLA09 Record, GLA11 Record
Short Description: Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description: Pressure of Top of Cloud Layers Detected in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cldtop_relh
Is element of: GLA09 Record, GLA11 Record
Short Description: Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
Total Bytes: 80
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Relative Humidity of Top of Cloud Layers in 1064 nm at Medium Resolution data rate.
Comments:

Product Var Name: i_MRir_cldbot_temp
Is element of: GLA09 Record, GLA11 Record
Short Description: Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution
Product Data Type: i2b (10, 4)
| Total Bytes: | 80 |
| Product Units: | degrees Celsius * 100 |
| Invalid Value/Flag: | i2b |
| Is Correction Flag?: | NA |
| Is Unsigned?: | No |
| Product Minimum: | -10000 |
| Product Maximum: | 10000 |
| Description: | Temperature of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate. |

Comments:

| Product Var Name: | i_MRir_cldbot_pres |
| Is element of: | GLA09 Record, GLA11 Record |
| Short Description: | Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution |
| Product Data Type: | i2b (10, 4) |
| Total Bytes: | 80 |
| Product Units: | millibars of mercury * 10 |
| Invalid Value/Flag: | i2b |
| Is Correction Flag?: | NA |
| Is Unsigned?: | No |
| Product Minimum: | 0 |
| Product Maximum: | 20000 |
| Description: | Pressure of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate. |

Comments:

| Product Var Name: | i_MRir_cldbot_relh |
| Is element of: | GLA09 Record, GLA11 Record |
| Short Description: | Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at MR |
| Product Data Type: | i2b (10, 4) |
| Total Bytes: | 80 |
| Product Units: | percentage * 100 |
| Invalid Value/Flag: | i2b |
| Is Correction Flag?: | NA |
| Is Unsigned?: | No |
| Product Minimum: | 0 |
| Product Maximum: | 10000 |
| Description: | Relative Humidity of Bottom of Cloud Layers Detected in 1064 nm at Medium Resolution data rate. |

Comments:

| Product Var Name: | i_MRir_QAflag |
| Is element of: | GLA09 Record, GLA11 Record |
| Short Description: | Medium Resolution 1064 nm Cloud Layer QA Flag |
| Product Data Type: | i1b ( 40) |
| Total Bytes: | 40 |
| Product Units: | NA |
| Invalid Value/Flag: | No |
| Is Correction Flag?: | NA |
| Is Unsigned?: | No |
| Product Minimum: | 0 |
| Product Maximum: | 20000 |
| Description: | Medium Resolution 1064 nm Cloud Layer QA Flag. Composite Flag - see Breakout for details |

Please see <a href='flags/i_MRir_QAflag.pdf'> the PDF flag description</a> for more details.

The data is arranged in 40 bytes.
bytes 1-18 are spares:
bytes 19-20 are af flags: The 4 'af' flags (4 bits each) are concatenated with the QAflag storage and are contained in bytes 19-20 starting at bit 0 of byte 20.
bytes 21-40 are QAflags: The QAflag portion has been stored such that interval 1 is in bytes 40-36, interval 2 in bytes 35-31, interval 3 in bytes 30-26, and interval 4 in bytes 25-21. Each of the 10 layer flags per interval is 4 bits in length as before, such that interval 1 layer 1 is in bits 0-3 and interval 1 layer 2 is in bits 4-7 of byte 40, interval 1 layer 3 is in bits 0-3 and interval 1 layer 4 is in bits 4-7 of byte 39, etc.

Quality flag value 15=cloud layers were not searched for; 0=cloud layers were searched but not detected; 1-14 indicate increasing confidence of good cloud retrieval (value 1=least confidence, value 14=greatest confidence).

Availability flag value 15=cloud layers not searched for; 0=layers searched for but not detected.

Comments:

Product Var Name:  i_Aer_PBL_LR_temp
Is element of:  GLA08 Record, GLA11 Record
Short Description: Temperature of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type:  i2b
Total Bytes:  2
Product Units:  degrees Celsius * 100
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum: -10000
Product Maximum:  10000
Description: Temperature of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:

Product Var Name:  i_Aer_PBL_LR_pres
Is element of:  GLA08 Record, GLA11 Record
Short Description: Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type:  i2b
Total Bytes:  2
Product Units:  millibars of mercury * 10
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  20000
Description: Pressure of Low Resolution Planetary Boundary Layer Top at 532 nm
Comments:

Product Var Name:  i_Aer_PBL_LR_relh
Is element of:  GLA08 Record, GLA11 Record
Short Description: Relative Humidity of Low Resolution Planetary Boundary Layer Top at 532 nm
Product Data Type:  i2b
Total Bytes:  2
Product Units:  percentage * 100
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  10000
<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>Description</th>
<th>Units</th>
<th>Data Type</th>
<th>Total Bytes</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>i_Surface_temp</td>
<td>Relative Humidity of Low Resolution Planetary Boundary Layer Top at 532 nm</td>
<td>degrees Celsius * 100</td>
<td>i2b</td>
<td>8</td>
<td>-10000</td>
<td>10000</td>
</tr>
<tr>
<td>i_Surface_pres</td>
<td>Surface Pressure</td>
<td>millibars of mercury * 10</td>
<td>i2b</td>
<td>8</td>
<td>0</td>
<td>20000</td>
</tr>
<tr>
<td>i_Surface_relh</td>
<td>Surface Relative Humidity</td>
<td>percentage * 100</td>
<td>i2b</td>
<td>8</td>
<td>0</td>
<td>10000</td>
</tr>
<tr>
<td>i_Surface_wind</td>
<td>Surface Wind Speed</td>
<td>meters/second * 100</td>
<td>i2b</td>
<td>8</td>
<td>0</td>
<td>20000</td>
</tr>
<tr>
<td>Product Var Name</td>
<td>Type</td>
<td>Description</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>------</td>
<td>-------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_Surface_wdir</td>
<td>i2b (4)</td>
<td>Surface Wind Direction Azimuth from North</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_Aer_ir_OD</td>
<td>i2b (2)</td>
<td>Aerosol Optical Depth at 1064 nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_cld_ir_OD</td>
<td>i2b (10, 4)</td>
<td>Cloud Optical Depth at 1064 nm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_Aer_ir_ODFlg</td>
<td>i1b (2)</td>
<td>Aerosol Optical Depth at 1064 nm Flag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i_cld_ir_ODFlg</td>
<td>null</td>
<td>Cloud Optical Depth at 1064 nm Flag</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Short Description: Cloud Optical Depth at 1064 nm Flag
Product Data Type: i1b (10, 4)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_FRir_ODflg
Is element of: GLA11 Record
Short Description: Full Resolution 1064 Optical Depth Flag
Product Data Type: i1b (160)
Total Bytes: 160
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: This parameter is for a 4 second record. This parameter is also in GLA06, 12-15.
Comments:

Product Var Name: i_FRir_qaFlag
Is element of: GLA09 Record, GLA11 Record
Short Description: Full Resolution 1064 Quality Flag
Product Data Type: i1b (160)
Total Bytes: 160
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_FRir_cldtop
Is element of: GLA09 Record, GLA11 Record
Short Description: Full Resolution 1064 Cloud Top
Product Data Type: i2b (160)
Total Bytes: 320
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1030
Description: Full resolution (40 Hz) cloud top height obtained from the 1064 atmospheric channel. This parameter is for a 4 second record. Also parameter is in GLA06, 12-15.
Comments:

Product Var Name: i_Aer_b20_prop
<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Is element of:</td>
<td>GLA11 Record</td>
</tr>
<tr>
<td>Short Description:</td>
<td>Aerosol Below 20 Properties</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>i1b (20, 5)</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>100</td>
</tr>
<tr>
<td>Product Units:</td>
<td>Unknown</td>
</tr>
<tr>
<td>Invalid Value/Flag:</td>
<td>i1b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>0</td>
</tr>
<tr>
<td>Product Maximum:</td>
<td>0</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
</tr>
<tr>
<td>Product Var Name:</td>
<td>i_PBL_prop</td>
</tr>
<tr>
<td>Is element of:</td>
<td>GLA11 Record</td>
</tr>
<tr>
<td>Short Description:</td>
<td>Aerosol Properties</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>i1b (20)</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>20</td>
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<tr>
<td>Product Units:</td>
<td>Unknown</td>
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<td>i1b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>0</td>
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<tr>
<td>Product Maximum:</td>
<td>0</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
</tr>
<tr>
<td>Product Var Name:</td>
<td>i_spare3</td>
</tr>
<tr>
<td>Is element of:</td>
<td>GLA11 Record</td>
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<tr>
<td>Short Description:</td>
<td>Spares</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>i1b (144)</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>144</td>
</tr>
<tr>
<td>Product Units:</td>
<td>N/A</td>
</tr>
<tr>
<td>Invalid Value/Flag:</td>
<td>No</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>null</td>
</tr>
<tr>
<td>Product Maximum:</td>
<td>null</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
</tr>
</tbody>
</table>

**D.1.5 GLA12 Record**

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is element of:</td>
<td>GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
</tr>
<tr>
<td>Short Description:</td>
<td>GLAS Record Index</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>i4b</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>4</td>
</tr>
<tr>
<td>Product Units:</td>
<td>N/A</td>
</tr>
<tr>
<td>Invalid Value/Flag:</td>
<td>no</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>0</td>
</tr>
<tr>
<td>Product Maximum:</td>
<td>2147483647</td>
</tr>
<tr>
<td>Description:</td>
<td>Unique index that relates this record to the corresponding</td>
</tr>
</tbody>
</table>
record(s) in each GLAS data product.

Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_transtime
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: One way transit time
Product Data Type: i2b
Total Bytes: 2
Product Units: microseconds
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 4000
Description: One way transit time calculated using the preliminary range offset. This is added to the UTC time tag to get the ground bounce times at which to calculate the orbit.
Comments:

Product Var Name: i_Spare1
Is element of: GLA12 Record
Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_deltagpstmcor
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Delta GPS time correction
Product Data Type: i4b
Total Bytes: 4
Product Units: nanoseconds
Invalid Value/Flag: gi_invalid_i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The high frequency delta GPS time correction calculated during the precision orbit processing step.
Comments:

Product Var Name: i_dShotTime
Is element of: GLA01 Main Record , GLA04 LPA Main Record, GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Laser Shot Time Deltas (shots 2-40)
Product Data Type: i4b (39)
Total Bytes: 156
Product Units: microseconds
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1200000
Description: The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will give the user the time of each individual shot in the frame.
Comments: To calculate the time for shots 2-40, add these deltas to the time of the first shot.

Product Var Name: i_lat
Is element of: GLA12 Record
Short Description: Coordinate Data, Latitude, specific to ice sheet range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The geodetic latitude of the 40 laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and ice sheet-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in degrees North.
Comments:

Product Var Name: i_lon
Is element of: GLA12 Record
Short Description: Coordinate Data, Longitude, specific to ice sheet range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: The longitude of the 40 laser spots in the 1 second time frame,
computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and ice sheet-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in east longitude.

Comments:

Product Var Name: i_elev
Is element of: GLA12 Record
Short Description: Ice Sheet Surface elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: Surface elevation with respect to the ellipsoid at the spot location determined by range using the ice sheet specific algorithm after instrument corrections, atmospheric delays and tides have been applied.

Comments:

Product Var Name: i_PADPoint
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: PAD Pointing unit Vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: Unitless*1000000
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 1000000
Description: Unit vectors giving the pointing direction of the laser with respect to the GLAS optical bench axes in the ICRF reference frame, one vector for each of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte items.

Comments:

Product Var Name: i_PODFixedPos
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Position orbit vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: 3 * (m, mm)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -7.0E+10
Product Maximum: 7.0E+10
Description: Spacecraft position vectors in ICRF of the laser point of reference on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus transit) time. Each element is composed of 2 4-byte items. The first is m and the second is millimeters.

Comments:

Product Var Name: i_sigmaatt
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Record, GLA15 Record

Short Description: Attitude Quality Indicator
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Unitless
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 6000
Description: Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments: This indicator currently has only 3 values: 0, 50, and 100, leaving open the opportunity to use numbers in between for further resolution of the degradation as our knowledge improves.

Product Var Name: i_Azimuth
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

Short Description: Local Azimuth
Product Data Type: i4b
Total Bytes: 4
Product Units: millideg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000
Description: Azimuth of the footprint path.
Comments:

Product Var Name: i_SolAng
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

Short Description: Solar Incidence Angle
Product Data Type: i4b
Total Bytes: 4
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The solar incidence angle determined during Precision Orbit Determination processing; it provides the operational sun angle estimate.
Comments:

Product Var Name: i_tpintensity_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

Short Description: Transmit Pulse intensity - frame avg
Product Data Type: i4b
Total Bytes: 4
Product Units: counts
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 25500
Description:
Comments:

Product Var Name: i_tpazimuth_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Pulse azimuth - frame avg
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees*10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600
Description:

Comments:

Product Var Name: i_tpeccentricity_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Pulse eccentricity - frame avg
Product Data Type: i2b
Total Bytes: 2
Product Units: Unitless*1000
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description:

Comments:

Product Var Name: i_tpmajoraxis_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transit Pulse major axis - frame avg
Product Data Type: i2b
Total Bytes: 2
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:

Comments:

Product Var Name: i_Spare2
Is element of: GLA12 Record
Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: null
Invalid Value/Flag: null
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name:  i_gdHt
Is element of:  GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:  Geoid
Product Data Type:  i2b ( 2)
Total Bytes:  4
Product Units:  cm
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  -20000
Product Maximum:  20000
Description:  The height of the geoid above the ellipsoid for the first and last shot in the record.
Comments:

Product Var Name:  i_erElv
Is element of:  GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:  Solid Earth Tide Elevation (at first & last shot)
Product Data Type:  i2b ( 2)
Total Bytes:  4
Product Units:  mm
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  -10000
Product Maximum:  10000
Description:  The solid earth tide elevation for the first & last shot in the record.
Comments:

Product Var Name:  i_spElv
Is element of:  GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:  Tide Elevations, Specific
Product Data Type:  i2b ( 4)
Total Bytes:  8
Product Units:  mm
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  -10000
Product Maximum:  10000
Description:  A tide elevation calculated from alternate tide models for specific regions for shots 1, 11, 21, and 31.
Comments:

Product Var Name:  i_ldElv
Is element of:  GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:  Load Tide Elevation
Product Data Type:  i2b ( 4)
Total Bytes:  8
Product Units:  mm
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum: -10000
Product Maximum: 10000
Description: The load tide elevation applied to each shot. Elements 1-4 of the load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively. Comments: The load tide is NOT NECESSARILY the load tide for shots 1,11,21,31. It is calculated for the first valid shot in each group of 10 and applied to all valid shots in the group.

Product Var Name: i_ocElv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Ocean Tide Elevation (at first & last shot)
Product Data Type: i2b ( 2)
Total Bytes: 4
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: The ocean tide elevation at first & last shot
Comments:

Product Var Name: i_wTrop
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Correction_Wet Troposphere
Product Data Type: i2b ( 2)
Total Bytes: 4
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000
Product Maximum: 0
Description: The range correction due to the wet troposphere at first & last shot.
Comments:

Product Var Name: i_dTrop
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record
Short Description: Range Correction, Dry Troposphere
Product Data Type: i2b ( 40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -2500
Product Maximum: 0
Description: The range correction due to the dry troposphere; one correction for each shot.
Comments:

Product Var Name: i_surfType
Is element of: GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Region Type
Product Data Type: ilb
Total Bytes: 1
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see `<a href='flags/i_surfType.pdf'> the PDF flag description</a>` for more details.
Comments:

Product Var Name: i_Spare3
Is element of: GLA12 Record
Short Description: Spare
Product Data Type: i1b (3)
Total Bytes: 3
Product Units: N/A
Invalid Value/Flag: null
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_DEM_elv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: DEM Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: cm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -50000
Product Maximum: 1000000
Description: Elevation with respect to sea level as interpolated from a Digital Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name: i_refRng
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Reference Range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 400000000
Product Maximum: 1000000000
Description: Range in distance calculated from the time between the peak of the transmit pulse and the farthest gate from the spacecraft of the received pulse. See the rngcorrflg to determine any corrections that have been applied.
Comments:
Product Var Name: i_TrshRngOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Threshold Retracker Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the threshold retracker location on the received echo using standard parameters.
Comments:

Product Var Name: i_isRngOff
Is element of: GLA06 record, GLA12 Record
Short Description: Ice Sheet Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range offset to be added to i_refRng to calculate the range using the algorithm deemed appropriate for ice sheets.
Comments:

Product Var Name: i_SigEndOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Signal End Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the location on the received echo calculated as the end of signal (farthest from the spacecraft) using standard parameters.
Comments:

Product Var Name: i_cntRngOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Centroid Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the location of the centroid of the received echo from signal begin through signal end defined by the standard parameters.
Comments:

Product Var Name: i_reflctUncorr
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Reflectivity not corrected for Atmospheric Effects
Product Data Type: i4b ( 40)
Total Bytes: 160
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The reflectance (not corrected for atmospheric effects) is calculated as the ratio of the received energy after it has been scaled for range, and the transmitted energy. The corrected reflectance may be calculated from this uncorrected reflectance by dividing by \( e^{-2(tc+ta+tm)} \), where \( tc \) is the cloud (column) integrated optical depth, \( ta \) is the aerosol (column) integrated optical depth, and \( tm \) is the molecular optical depth.
Comments: This uses all signal between signal begin and signal end.

Product Var Name: i_reflCor_atm
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Reflectivity Corrected Atmospheric Effects
Product Data Type: i4b
Total Bytes: 4
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: This corrected reflectance is calculated from the uncorrected reflectance by dividing by \( e^{-2(tc+ta+tm)} \), where \( tc \) is the cloud (column) integrated optical depth, \( ta \) is the aerosol (column) integrated optical depth, and \( tm \) is the molecular optical depth.
Comments:

Product Var Name: i_maxSmAmp
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Peak Amplitude of Smoothed Received Echo
Product Data Type: i2b ( 40)
Total Bytes: 80
Product Units: Tenth of millivolts
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -300
Product Maximum: 30000
Description: The peak amplitude of the received echo after it has been smoothed to remove high frequency noise (see ATBD).
Comments: This is calculated after converting the return to voltage.

Product Var Name: i_SigmaElv
Is element of: GLA06 record, GLA12 Record
Short Description: Sigma of Elevation
<table>
<thead>
<tr>
<th>Product Data Type:</th>
<th>i2b (40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Bytes:</td>
<td>80</td>
</tr>
<tr>
<td>Product Units:</td>
<td>mm</td>
</tr>
<tr>
<td>Invalid Value/Flag:</td>
<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>0</td>
</tr>
<tr>
<td>Product Maximum:</td>
<td>32000</td>
</tr>
<tr>
<td>Description:</td>
<td>Elevation error estimates, the error from the Gaussian fit to the received echo associated with the centroid of the last peak using standard parameters. Comments:</td>
</tr>
<tr>
<td>Product Var Name:</td>
<td>i_numPk</td>
</tr>
<tr>
<td>Is element of:</td>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record</td>
</tr>
<tr>
<td>Short Description:</td>
<td>Number of Peaks found in the Return</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>i1b (40)</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>40</td>
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<tr>
<td>Product Units:</td>
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<tr>
<td>Invalid Value/Flag:</td>
<td>No</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>0</td>
</tr>
<tr>
<td>Product Maximum:</td>
<td>6</td>
</tr>
<tr>
<td>Description:</td>
<td>The number of peaks in the return echo found by the Gaussian fitting procedure, using standard parameters. Comments:</td>
</tr>
<tr>
<td>Product Var Name:</td>
<td>i_kurt2</td>
</tr>
<tr>
<td>Is element of:</td>
<td>GLA05 record, GLA06 record, GLA12 Record</td>
</tr>
<tr>
<td>Short Description:</td>
<td>Kurtosis of the Received Echo (standard)</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>i2b (40)</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>80</td>
</tr>
<tr>
<td>Product Units:</td>
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</tr>
<tr>
<td>Invalid Value/Flag:</td>
<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>-1000</td>
</tr>
<tr>
<td>Product Maximum:</td>
<td>1000</td>
</tr>
<tr>
<td>Description:</td>
<td>Kurtosis of the received echo from signal begin to signal end using standard parameters. Comments: Note that the received echo was calibrated and converted to voltage before calculation.</td>
</tr>
<tr>
<td>Product Var Name:</td>
<td>i_skew2</td>
</tr>
<tr>
<td>Is element of:</td>
<td>GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record</td>
</tr>
<tr>
<td>Short Description:</td>
<td>Skewness</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>i2b (40)</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>80</td>
</tr>
<tr>
<td>Product Units:</td>
<td>unitless * 100</td>
</tr>
<tr>
<td>Invalid Value/Flag:</td>
<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>-10000</td>
</tr>
<tr>
<td>Product Maximum:</td>
<td>10000</td>
</tr>
<tr>
<td>Description:</td>
<td>The skewness of the received echo from signal begin to signal end using standard parameters. Comments: Note that the received echo was calibrated and converted to voltage before calculation.</td>
</tr>
</tbody>
</table>
Product Var Name: i_IceSheetRuf
Is element of: GLA12 Record
Short Description: Ice Sheet Roughness
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 12000
Description: The surface roughness over the footprint calculated empirically from the transmitted pulse and received echo assuming no slope.
Comments:

Product Var Name: i_IsSlopeEmp
Is element of: GLA12 Record
Short Description: Ice Sheet Slope - echo
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: millideg
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32000
Description: The surface slope over the footprint calculated empirically from the transmitted pulse and received echo assuming no roughness.
Comments:

Product Var Name: i_IsRngLast
Is element of: GLA12 Record
Short Description: Ice Sheet Range offset using last peak
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range offset to be added to i_refRng to calculate ice sheet specific range from centroid of last peak in standard Gaussian fit.
Comments:

Product Var Name: i_IsRngFst
Is element of: GLA12 Record
Short Description: Ice Sheet Range Offset using first peak
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range offset to be added to i_refRng to calculate ice sheet specific range from centroid of first peak in standard Gaussian fit.
Comments:

Product Var Name: i_IceSVar
Is element of: GLA12 Record
Short Description: Standard Deviation of the ice sheet Gaussian Fit
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: millivolts
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 25500
Description: The Standard deviation of the difference between the functional fit and the received echo using standard parameters. It is directly taken from GLA05 parameter d_wfFitSDev_2 (standard).
Comments:

Product Var Name: i_ElvuseFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation use flag
Product Data Type: i1b (5)
Total Bytes: 5
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -127
Product Maximum: 127
Description: Flag indicating whether the elevations on this record should be used or not (1 bit set/shot). See the <a href='flags/i_ElvuseFlg.pdf'>PDF file</a> for more information.
Comments:

Product Var Name: i_atm_avail
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_atm_avail.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_erd
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Estimated Range Delay
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description:
Comments:

Product Var Name: i_rdu
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Delay Uncertainty
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_cld1_mswf
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailed in the PDF. A warning flag value of 15 will signify "invalid". An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically "thick" cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range. Please see <a href="flags/i_cld1_mswf_elv.pdf">the PDF flag description</a> for more details.
Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_MRC_af.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_SurfRuf_slpQF
Is element of: GLA06 record, GLA12 Record, GLA14 Record
Short Description: Surface Roughness & Slope Quality Flag
Product Data Type: i1b ( 40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 127
Description: Per-shot data quality flags indicating quality of i_srf_slope and i_srf_ruf on this record.
Please see <a href='flags/i_SurfRuf_slpQF.pdf'> the PDF flag description</a> for more details. For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set to reflect Alternate Fitting. Although defined as a pass-thru, the values are different on GLA06/12-15 and GLA14.
Comments:

Product Var Name: i_ElvFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation Definition Flag
Product Data Type: i1b ( 40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 127
Description: Indicates which location on the received echo was used to calculate the elevation on the record.
Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details. For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set to reflect Alternate Fitting. Although defined as a pass-thru, the values are different on GLA06/12-15 and GLA14.
Comments:

Product Var Name: i_rng_UQF
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Offset Quality/Use Flag
Product Data Type: i2b ( 40)
Total Bytes: 80
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Data quality flag for the range offsets on this record.
Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_atmQF
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Flag
Product Data Type: i1b (10)
Total Bytes: 10
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Indicates from LIDAR channel if conditions for forward scattering were favorable.
Please see <a href='flags/i_atmQF.pdf'>the PDF flag description</a> for more details.
Comments: If forward scattering occurs, it may map to an error in the elevation measurement. Users may want to delete data with forward scattering.

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Indicates what instrument or bias corrections were applied to the times on this record. Please see <a href='flags/i_timecorflg.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_APID_AvFlg
Is element of: GLA01 Main Record, GLA02 Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: APID Data Availability Flag
Product Data Type: i1b (8)
Total Bytes: 8
Product Units: n/a
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -127
Product Maximum: 127
Description: Flag indicating which packets (APIDs) for each second are available missing, or filled. APID 19 is broken down further into Altimeter Digitizer, Photon Counter, Cloud Digitizer, GPS/DEM, and C&T sections.
Please see <a href='flags/i_APID_AvFlg.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_AttFlg2
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Attitude Flag 2
Product Data Type: i1b (20)
Total Bytes: 20
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Denotes at 40/sec rate whether precision attitude was used to determine spot location, and if problems with LPA, etc.
Please see <a href='flags/i_AttFlg2.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_spare5
Is element of: GLA12 Record
Short Description: Spares
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description:
Comments:

Product Var Name: i_FrameQF
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Altimeter Frame Quality Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Denotes all bad data (no signal in whole frame), or all data good and all science team recommended corrections applied
Please see <a href='flags/i_FrameQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_OrbFlg
Is element of: GLA01 Main Record, GLA02 Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: POD flag (Orbit Flag)
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 128
Description: Denotes quality of orbit, whether predicted or precision, loss of GPS data, maneuver-degraded, etc. Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_rngCorrFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Correction Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Denotes which geophysical or instrument corrections have been applied to the range in the calculation of the elevation on this record. Please see <a href='flags/i_rngCorrFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_CorrStatFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Correction Status Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: For each geophysical correction that has multiple values denotes which algorithm or model was used. Please see <a href='flags/i_CorrStatFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_beam_coelev
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Co-elevation
Product Data Type: i4b
Total Bytes: 4
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot. Comments:
Product Var Name:  i_beam_azimuth
Is element of:  GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:  Azimuth
Product Data Type:  i4b
Total Bytes:  4
Product Units:  degrees*100
Invalid Value/Flag:  i4b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  36000
Description:  Az is the direction clockwise from north of the laser beam vector
as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the
vector from the ground to the spacecraft).
Comments:

Product Var Name:  i_AttFlg1
Is element of:  GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13
Record, GLA14 Record, GLA15 Record
Short Description:  Attitude Flag 1
Product Data Type:  i2b
Total Bytes:  2
Product Units:  N/A
Invalid Value/Flag:  No
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  32767
Description:  At 1/sec denotes large off-nadir angle, ocn sweep, target of op-
portunity, steering to reference track.
Please see <a href='flags/i_AttFlg1.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name:  i_Spare6
Is element of:  GLA12 Record
Short Description:  Spare
Product Data Type:  i1b ( 2)
Total Bytes:  2
Product Units:  N/A
Invalid Value/Flag:  null
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  null
Product Maximum:  null
Description:  
Comments:  

Product Var Name:  i_DEM_hires_src
Is element of:  GLA06 record, GLA12 Record, GLA13 Record
Short Description:  High Resolution Source Flag
Product Data Type:  i1b ( 40)
Total Bytes:  40
Product Units:  NA
Invalid Value/Flag:  No
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  128
Description:  Please see <a href='flags/i_DEM_hires_src.pdf'> the PDF flag de-
<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>i_DEM_hires_elv</td>
<td>High Resolution Elevation</td>
</tr>
<tr>
<td>i_satNdx</td>
<td>Saturation Index</td>
</tr>
<tr>
<td>i_satRngCorr</td>
<td>Saturation Range Correction</td>
</tr>
<tr>
<td>i_satCorrFlg</td>
<td>Saturation Correction Flag</td>
</tr>
</tbody>
</table>

**Comments**

- Product Var Name: i_DEM_hires_elv
  - Is element of: GLA06 record, GLA12 Record, GLA13 Record
  - Short Description: High Resolution Elevation
  - Product Data Type: i2b (40)
  - Total Bytes: 80
  - Product Units: meters
  - Invalid Value/Flag: i2b
  - Is Correction Flag?: NA
  - Is Unsigned?: No
  - Product Minimum: -500
  - Product Maximum: 13000

- Product Var Name: i_satNdx
  - Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
  - Short Description: Saturation Index
  - Product Data Type: i1b (40)
  - Total Bytes: 40
  - Product Units: ns
  - Invalid Value/Flag: i1b
  - Is Correction Flag?: NA
  - Is Unsigned?: Yes
  - Product Minimum: 0
  - Product Maximum: 255

- Product Var Name: i_satRngCorr
  - Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
  - Short Description: Saturation Range Correction
  - Product Data Type: i2b (40)
  - Total Bytes: 80
  - Product Units: mm
  - Invalid Value/Flag: i2b
  - Is Correction Flag?: No
  - Is Unsigned?: No
  - Product Minimum: 0
  - Product Maximum: 100

- Product Var Name: i_satCorrFlg
  - Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
  - Short Description: Saturation Correction Flag
  - Product Data Type: i1b (40)
  - Total Bytes: 40
  - Product Units: NA
  - Invalid Value/Flag: No
  - Is Correction Flag?: NA
  - Is Unsigned?: NA
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<tr>
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<tbody>
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<tr>
<td>Short Description</td>
<td>Saturation Energy Correction</td>
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<td>i2b (40)</td>
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<td>Total Bytes</td>
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<tr>
<td>Product Units</td>
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<tr>
<td>Invalid Value/Flag</td>
<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?: NA</td>
<td></td>
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<tr>
<td>Is Unsigned?: No</td>
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<tr>
<td>Product Minimum</td>
<td>0</td>
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<tr>
<td>Product Maximum</td>
<td>100</td>
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<tr>
<th>Product Var Name</th>
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<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
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<tr>
<td>Short Description</td>
<td>Saturation Pulse Width Correction</td>
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<tr>
<td>Product Data Type</td>
<td>i2b (40)</td>
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<td>Total Bytes</td>
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<td>Product Units</td>
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</tr>
<tr>
<td>Is Correction Flag?: NA</td>
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<td>Comments:</td>
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<td>GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
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<tr>
<td>Short Description</td>
<td>Gain Value used for Received Pulse</td>
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<tr>
<td>Product Data Type</td>
<td>i2b (40)</td>
</tr>
<tr>
<td>Total Bytes</td>
<td>80</td>
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<tr>
<td>Product Units</td>
<td>counts</td>
</tr>
<tr>
<td>Invalid Value/Flag</td>
<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?: NA</td>
<td></td>
</tr>
<tr>
<td>Is Unsigned?: No</td>
<td></td>
</tr>
<tr>
<td>Product Minimum</td>
<td>0</td>
</tr>
<tr>
<td>Product Maximum</td>
<td>200</td>
</tr>
<tr>
<td>Description</td>
<td>Gain value used for received pulse - uncalibrated.</td>
</tr>
<tr>
<td>Comments:</td>
<td>This value is in counts and needs to be calibrated before calculating energy from it. Same as variable in GLA01_Long/i_gainSet1064.</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>i_RecNrgAll</th>
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</thead>
<tbody>
<tr>
<td>Is element of</td>
<td>GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
</tr>
<tr>
<td>Short Description</td>
<td>Received Energy signal begin to signal end</td>
</tr>
<tr>
<td>Product Data Type</td>
<td>i2b (40)</td>
</tr>
<tr>
<td>Total Bytes</td>
<td>80</td>
</tr>
<tr>
<td>Product Units</td>
<td>0.01 fJoules</td>
</tr>
<tr>
<td>Invalid Value/Flag</td>
<td>i_APID_AvFlg</td>
</tr>
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</table>
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32000
Description:
Comments:

Product Var Name: i_FRir_cldtop
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Cloud Top
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1030
Description: Full resolution (40 Hz) cloud top height obtained from the 1064 atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name: i_FRir_qaFlag
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_FRir_ODflg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Optical Depth Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: This parameter is for a 1 second record. This parameter is also in GLA11.
Comments:

Product Var Name: i_FRir_intsig
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Integrated Signal
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: e7/(m-sr)
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Though called 'integrated signal' this is actually an average of all bins in the above-ground portion of the 1064 40 Hz profile with values above the threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This parameter is also in GLA09.

Comments:

Product Var Name: i_msRngCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Multi-Scatter Range Correction
Product Data Type: i2b ( 40)
Total Bytes: 80
Product Units: Unknown
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description:

Comments:

Product Var Name: i_msCorrFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Multi-Scatter Range Correction
Product Data Type: i1b ( 40)
Total Bytes: 40
Product Units: Unknown
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description:

Comments:

Product Var Name: i_Surface_temp
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Temperature
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description:

Comments:

Product Var Name: i_Surface_pres
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Pressure
Product Data Type: i2b
Total Bytes: 2
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description:
Comments:

Product Var Name: i_Surface_relh
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Relative Humidity
Product Data Type: i2b
Total Bytes: 2
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_spare7
Is element of: GLA12 Record
Short Description: Spares
Product Data Type: i1b ( 566)
Total Bytes: 566
Product Units: NA
Invalid Value/Flag: null
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

D.1.6 GLA13 Record

Product Var Name: i_rec_ndx
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: GLAS Record Index
Product Data Type: i4b
Total Bytes: 4
Product Units: N/A
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description:
Comments:
Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_transtime
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: One way transit time
Product Data Type: i2b
Total Bytes: 2
Product Units: microseconds
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 4000
Description: One way transit time calculated using the preliminary range offset. This is added to the UTC time tag to get the ground bounce times at which to calculate the orbit.
Comments:

Product Var Name: i_Spare1
Is element of: GLA13 Record
Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_deltagpstmcor
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Delta GPS time correction
Product Data Type: i4b
Total Bytes: 4
Product Units: nanoseconds
Invalid Value/Flag: gi_invalid_i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The high frequency delta GPS time correction calculated during the precision orbit processing step.
Comments:

Product Var Name: i_dShotTime
Is element of: GLA01 Main Record, GLA04 LPA Main Record, GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Laser Shot Time Deltas (shots 2-40)
Product Data Type: i4b (39)
Total Bytes: 156
Product Units: microseconds
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1200000
Description: The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will give the user the time of each individual shot in the frame.
Comments: To calculate the time for shots 2-40, add these deltas to the time of the first shot.

Product Var Name: i_lat
Is element of: GLA13 Record
Short Description: Coordinate Data, Latitude, specific to sea ice range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The geodetic latitude of the 40 laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, PAD, and sea ice specific range after all atmospheric corrections and tides have been applied.
Comments:

Product Var Name: i_lon
Is element of: GLA13 Record
Short Description: Coordinate Data, Longitude, specific to sea ice range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: The longitude of the 40 laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, PAD, and sea ice specific range after all atmospheric corrections and tides have been applied. The values are in east longitude.

Comments:

Product Var Name: i_elev
Is element of: GLA13 Record
Short Description: Sea Ice Surface Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 1000000
Description: Surface elevation wrt ellipsoid at the spot location determined by range using the sea ice specific fitting procedure after atmospheric delays and tides have been applied.

Comments:

Product Var Name: i_PADPoint
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: PAD Pointing unit Vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: Unitless*1000000
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 1000000
Description: Unit vectors giving the pointing direction of the laser with respect to the GLAS optical bench axes in the ICRF reference frame, one vector for each of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte items.

Comments:

Product Var Name: i_PODFixedPos
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Position orbit vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: 3 * (m, mm)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -7.0E+10
Product Maximum: 7.0E+10
Description: Spacecraft position vectors in ICRF of the laser point of reference on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus transit) time. Each element is composed of 2 4-byte items. The first is m and the second is millimeters.

Comments:
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Attitude Quality Indicator
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Unitless
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 6000
Description: Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments: This indicator currently has only 3 values: 0, 50, and 100, leaving open the opportunity to use numbers in between for further resolution of the degradation as our knowledge improves.

Product Var Name: i_Azimuth

Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Local Azimuth
Product Data Type: i4b
Total Bytes: 4
Product Units: millideg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000
Description: Azimuth of the footprint path.
Comments:

Product Var Name: i_SolAng

Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Solar Incidence Angle
Product Data Type: i4b
Total Bytes: 4
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The solar incidence angle determined during Precision Orbit Determination processing; it provides the operational sun angle estimate.
Comments:

Product Var Name: i_tpintensity_avg

Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Pulse intensity - frame avg
Product Data Type: i4b
Total Bytes: 4
Product Units: counts
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 25500
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<th>Product Var Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>i_tpazimuth_avg</td>
<td>Transmit Pulse azimuth - frame avg</td>
</tr>
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<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
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<tr>
<td>i_tpeccentricity_avg</td>
<td>Transmit Pulse eccentricity - frame avg</td>
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<tr>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
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<tr>
<td>i_tpmajoraxis_avg</td>
<td>Transit Pulse major axis - frame avg</td>
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<td>i_Spare2</td>
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<tr>
<td>i_tpazimuth_avg</td>
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<tr>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
<td></td>
</tr>
<tr>
<td>i_tpeccentricity_avg</td>
<td></td>
</tr>
<tr>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
<td></td>
</tr>
<tr>
<td>i_tpmajoraxis_avg</td>
<td></td>
</tr>
<tr>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
<td></td>
</tr>
<tr>
<td>i_Spare2</td>
<td></td>
</tr>
<tr>
<td>GLA13 Record</td>
<td></td>
</tr>
</tbody>
</table>
Description:

Comments:

Product Var Name: i_gdHt
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Geoid
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -20000
Product Maximum: 20000
Description: The height of the geoid above the ellipsoid for the first and last shot in the record.
Comments:

Product Var Name: i_erElv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Solid Earth Tide Elevation (at first & last shot)
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: The solid earth tide elevation for the first & last shot in the record.
Comments:

Product Var Name: i_spElv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Tide Elevations, Specific
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: A tide elevation calculated from alternate tide models for specific regions for shots 1, 11, 21, and 31.
Comments:

Product Var Name: i_ldElv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Load Tide Elevation
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No  
Product Minimum: -10000  
Product Maximum: 10000  
Description: The load tide elevation applied to each shot. Elements 1-4 of the load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively. Comments: The load tide is NOT NECESSARILY the load tide for shots 1,11,21,31. It is calculated for the first valid shot in each group of 10 and applied to all valid shots in the group.  
Product Var Name: i_ocElv  
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
Short Description: Ocean Tide Elevation (at first & last shot)  
Product Data Type: i2b (2)  
Total Bytes: 4  
Product Units: mm  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -10000  
Product Maximum: 10000  
Description: The ocean tide elevation at first & last shot.  
Comments:  
Product Var Name: i_wTrop  
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
Short Description: Range Correction_Wet Troposphere  
Product Data Type: i2b (2)  
Total Bytes: 4  
Product Units: mm  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -1000  
Product Maximum: 0  
Description: The range correction due to the wet troposphere at first & last shot.  
Comments:  
Product Var Name: i_dTrop  
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
Short Description: Range Correction, Dry Troposphere  
Product Data Type: i2b (40)  
Total Bytes: 80  
Product Units: mm  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -2500  
Product Maximum: 0  
Description: The range correction due to the dry troposphere; one correction for each shot.  
Comments:  
Product Var Name: i_surfType  
Is element of: GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
Short Description: Region Type  
Product Data Type: ilb
Total Bytes: 1
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_Spare3
Is element of: GLA13 Record
Short Description: Spare
Product Data Type: i1b (3)
Total Bytes: 3
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: Comments:

Product Var Name: i_DEM_elv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: DEM Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: cm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -50000
Product Maximum: 1000000
Description: Elevation with respect to sea level as interpolated from a Digital Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name: i_refRng
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Reference Range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 400000000
Product Maximum: 1000000000
Description: Range in distance calculated from the time between the peak of the transmit pulse and the farthest gate from the spacecraft of the received pulse. See the rngcorrflg to determine any corrections that have been applied.
Comments:
Product Var Name: i_TrshRngOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Threshold Retracker Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the threshold retracker location on the received echo using standard parameters.
Comments:

Product Var Name: i_siRngOff
Is element of: GLA06 record, GLA13 Record
Short Description: Sea Ice Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range offset to be added to i_refRng to calculate the range using the algorithm deemed appropriate for sea ice.
Comments:

Product Var Name: i_SigEndOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Signal End Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the location on the received echo calculated as the end of signal (farthest from the spacecraft) using standard parameters.
Comments:

Product Var Name: i_cntRngOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Centroid Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the location of the centroid of the received echo from signal begin through signal end defined by the standard parameters.
Comments:

Product Var Name: i_reflctUncorr
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record
Short Description: Reflectivity not corrected for Atmospheric Effects
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The reflectance (not corrected for atmospheric effects) is calculated as the ratio of the received energy after it has been scaled for range, and the transmitted energy. The corrected reflectance may be calculated from this uncorrected reflectance by dividing by \( e^{-2(tc+ta+tm)} \), where \( tc \) is the cloud (column) integrated optical depth, \( ta \) is the aerosol (column) integrated optical depth, and \( tm \) is the molecular optical depth.
Comments: This uses all signal between signal begin and signal end.

Product Var Name: i_reflCor_atm
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Reflectivity Corrected Atmospheric Effects
Product Data Type: i4b
Total Bytes: 4
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: This corrected reflectance is calculated from the uncorrected reflectance by dividing by \( e^{-2(tc+ta+tm)} \), where \( tc \) is the cloud (column) integrated optical depth, \( ta \) is the aerosol (column) integrated optical depth, and \( tm \) is the molecular optical depth.
Comments:

Product Var Name: i_maxSmAmp
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record
Short Description: Peak Amplitude of Smoothed Received Echo
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Tenth of millivolts
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -300
Product Maximum: 30000
Description: The peak amplitude of the received echo after it has been smoothed to remove high frequency noise (see ATBD).
Comments: This is calculated after converting the return to voltage.

Product Var Name: i_SigmaElv
Is element of: GLA13 Record
Short Description: Sigma of Elevation
Product Data Type:  i2b ( 40)
Total Bytes:  80
Product Units:  mm
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  32000
Description:  Elevation error estimates, the error from the Gaussian fit to the received echo associated with the centroid of the last peak using standard parameters.
Comments:

Product Var Name:  i_numPk
Is element of:  GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:  Number of Peaks found in the Return
Product Data Type:  i1b ( 40)
Total Bytes:  40
Product Units:  N/A
Invalid Value/Flag:  No
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  6
Description:  The number of peaks in the return echo found by the Gaussian fitting procedure, using standard parameters.
Comments:

Product Var Name:  i_RufSeaIce
Is element of:  GLA13 Record
Short Description:  Sea Ice Surface Roughness
Product Data Type:  i2b ( 40)
Total Bytes:  80
Product Units:  cm
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  0
Product Maximum:  12400
Description:  The surface slope over the footprint calculated empirically from the transmitted and received waveforms using the RMS width of the entire waveform
Comments:

Product Var Name:  i_skew2
Is element of:  GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description:  Skewness
Product Data Type:  i2b ( 40)
Total Bytes:  80
Product Units:  unitless * 100
Invalid Value/Flag:  i2b
Is Correction Flag?:  NA
Is Unsigned?:  No
Product Minimum:  -10000
Product Maximum:  10000
Description:  The skewness of the received echo from signal begin to signal end using standard parameters.
Comments:  Note that the received echo was calibrated and converted to voltage before calculation.
Product Var Name: i_SiRufLstPk  
Is element of: GLA13 Record  
Short Description: Surface Roughness - last peak  
Product Data Type: i2b ( 40)  
Total Bytes: 80  
Product Units: cm  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 12400  
Description: The surface roughness over the footprint calculated empirically from the transmitted and received waveforms using the RMS width of the last peak.

Comments:

Product Var Name: I_AvgRuf  
Is element of: GLA13 Record  
Short Description: Avg Roughness  
Product Data Type: i2b ( 40)  
Total Bytes: 80  
Product Units: cm  
Invalid Value/Flag: i4b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 12000  
Description: The surface roughness of the entire footprint calculated from the RMS width of the entire waveform.

Comments:

Product Var Name: i_BergElev  
Is element of: GLA13 Record  
Short Description: Iceberg Elevation  
Product Data Type: i4b ( 40)  
Total Bytes: 160  
Product Units: mm  
Invalid Value/Flag: i4b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 200000  
Description: For waveforms with more than 1 peak, ‘iceberg’ elevation is calculated using the difference between the range offset of the maximum amplitude peak and the range offset of the first peak. Computations are made after atmospheric and tide corrections have been applied. The elevation computed is relative to the ellipsoid.

Comments: Users should be wary that this parameter is computed for all multiple-peak GLA13 records, even if the elevation is too high to be sea-ice.

Product Var Name: i_Spare7  
Is element of: GLA13 Record  
Short Description: Spares  
Product Data Type: i2b ( 40)  
Total Bytes: 80  
Product Units: N/A  
Invalid Value/Flag: No  
Is Correction Flag?: NA  
Is Unsigned?: NA  
Product Minimum: null  
Product Maximum: null
Description:

Comments:

Product Var Name: i_SiRufMaxPk
Is element of: GLA13 Record
Short Description: Maximum Amplitutde Peak Sea Ice Surface Roughness
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 12400
Description: The surface slope over the footprint calculated empirically from the transmitted and received waveforms using the gaussian width of the maximum amplitude peak.

Comments:

Product Var Name: i_SiRngFst
Is element of: GLA13 Record
Short Description: Sea ice range increment to first peak
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range increment to be added to reference range to compute the sea ice specific range. This was determined from centroid of first peak in sea ice Gaussian fit.

Comments:

Product Var Name: i_SeaIceVar
Is element of: GLA13 Record
Short Description: Standard Deviation of the sea ice Gaussian fit
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: millivolts
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 25500
Description: The Standard deviation of the difference between the functional fit and the received echo using standard parameters. It is directly taken from GLA05 parameter d_wfFitSDev_2 (standard).

Comments:

Product Var Name: i_ElvuseFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation use flag
Product Data Type: i1b (5)
Total Bytes: 5
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -127
Product Maximum: 127
Description: Flag indicating whether the elevations on this record should be used or not (1 bit set/shot). See the PDF file for more information.
Comments:

Product Var Name: i_atm_avail
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see the PDF flag description for more details.
Comments:

Product Var Name: i_erd
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Estimated Range Delay
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description: 
Comments:

Product Var Name: i_rdu
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Delay Uncertainty
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: 
Comments:

Product Var Name: i_cld1_mswf
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b
The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailed in the PDF.

A warning flag value of 15 will signify ‘invalid’. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically ‘thick’ cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range. Please see <a href='flags/i_cldl_mswf_elv.pdf'> the PDF flag description</a> for more details.

Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_MRC_af.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_SiRufQF
Is element of: GLA13 Record
Short Description: Sea ice Roughness Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Data quality flag for the sea ice roughness indicates quality based on good vs. bad criteria. Please see <a href='flags/i_SiRufQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_ElvFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation Definition Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 127
Description: Indicates which location on the received echo was used to calculate the elevation on the record.
Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details.
'For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set to reflect Alternate Fitting. Although defined as a pass-thru, the values are different on GLA06/12-15 and GLA14.’
Comments:

Product Var Name: i_rng_UQF
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Offset Quality/Use Flag
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Data quality flag for the range offsets on this record.
Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_atmQF
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Flag
Product Data Type: i1b (10)
Total Bytes: 10
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Indicates from LIDAR channel if conditions for forward scattering were favorable.
Please see <a href='flags/i_atmQF.pdf'> the PDF flag description</a> for more details.
Comments: If forward scattering occurs, it may map to an error in the elevation measurement. Users may want to delete data with forward scattering.

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Indicates what instrument or bias corrections were applied to the times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_APID_AvFlg
Is element of: GLA01 Main Record, GLA02 Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: APID Data Availability Flag
Product Data Type: i1b (8)
Total Bytes: 8
Product Units: n/a
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -127
Product Maximum: 127
Description: Flag indicating which packets (APIDs) for each second are available missing, or filled. APID 19 is broken down further into Altimeter Digitizer, Photon Counter, Cloud Digitizer, GPS/DEM, and C&T sections.
Please see <a href='flags/i_APID_AvFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_AttFlg2
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Attitude Flag 2
Product Data Type: i1b (20)
Total Bytes: 20
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Denotes at 40/sec rate whether precision attitude was used to determine spot location, and if problems with LPA, etc.
Please see <a href='flags/i_AttFlg2.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_spare5
Is element of: GLA13 Record
Short Description: Spares
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: NA
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description:
Comments:

Product Var Name: i_FrameQF
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Altimeter Frame Quality Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Denotes all bad data (no signal in whole frame), or all data good and all science team recommended corrections applied
Please see <a href='flags/i_FrameQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_OrbFlg
Is element of: GLA01 Main Record, GLA02 Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: POD flag (Orbit Flag)
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 128
Description: Denotes quality of orbit, whether predicted or precision, loss of GPS data, maneuver-degraded, etc.
Please see <a href='flags/i_OrbFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_rngCorrFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Correction Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Denotes which geophysical or instrument corrections have been applied to the range in the calculation of the elevation on this record.
Please see <a href='flags/i_rngCorrFlg.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_CorrStatFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Correction Status Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: For each geophysical correction that has multiple values denotes which algorithm or model was used.
Please see <a href="flags/i_CorrStatFlg.pdf">the PDF flag description</a> for more details.
Comments:

Product Var Name: i_beam_coelev
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Co-elevation
Product Data Type: i4b
Total Bytes: 4
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.
Comments:

Product Var Name: i_beam_azimuth
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Azimuth
Product Data Type: i4b
Total Bytes: 4
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Az is the direction clockwise from north of the laser beam vector as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the vector from the ground to the spacecraft).
Comments:

Product Var Name: i_AttFlg1
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Attitude Flag 1
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: At 1/sec denotes large off-nadir angle, ocn sweep, target of opportunity, steering to reference track.
Product Var Name: i_Spare6  
Is element of: GLA13 Record  
Short Description: Spares  
Product Data Type: i1b (2)  
Total Bytes: 2  
Product Units: N/A  
Invalid Value/Flag: No  
Is Correction Flag?: NA  
Is Unsigned?: NA  
Product Minimum: null  
Product Maximum: null  

Comments:

Product Var Name: i_DEM_hires_src  
Is element of: GLA06 record, GLA12 Record, GLA13 Record  
Short Description: High Resolution Source Flag  
Product Data Type: i1b (40)  
Total Bytes: 40  
Product Units: NA  
Invalid Value/Flag: No  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: 0  
Product Maximum: 128  

Description: Please see <a href='flags/i_DEM_hires_src.pdf'> the PDF flag description</a> for more details.  
Comments:

Product Var Name: i_DEM_hires_elv  
Is element of: GLA06 record, GLA12 Record, GLA13 Record  
Short Description: High Resolution Elevation  
Product Data Type: i2b (40)  
Total Bytes: 80  
Product Units: meters  
Invalid Value/Flag: i2b  
Is Correction Flag?: NA  
Is Unsigned?: No  
Product Minimum: -500  
Product Maximum: 13000  

Description: Please see <a href='flags/i_DEM_hires_elv.pdf'> the PDF flag description</a> for more details.  
Comments:

Product Var Name: i_satNdx  
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
Short Description: Saturation Index  
Product Data Type: i1b (40)  
Total Bytes: 40  
Product Units: ns  
Invalid Value/Flag: i1b  
Is Correction Flag?: NA  
Is Unsigned?: Yes  
Product Minimum: 0  
Product Maximum: 255  

Description: The count of the number of gates in a waveform which have an am-
plitude greater than or equal to \( i_{\text{satNdxTh}} \) (set in \textit{anc07_0004}). The value 255 means 255 or more gates are above the saturation index threshold \( (i_{\text{satNdxTh}}) \).

**Comments:**

<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>i_satRngCorr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is element of</td>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
</tr>
<tr>
<td>Short Description</td>
<td>Saturation Range Correction</td>
</tr>
<tr>
<td>Product Data Type</td>
<td>i2b (40)</td>
</tr>
<tr>
<td>Total Bytes</td>
<td>80</td>
</tr>
<tr>
<td>Product Units</td>
<td>mm</td>
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<tr>
<td>Invalid Value/Flag</td>
<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>No</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum</td>
<td>0</td>
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<tr>
<td>Product Maximum</td>
<td>100</td>
</tr>
<tr>
<td>Description:</td>
<td>This is a flag for i_satRngCorr, i_satNrgCorr &amp; i_satPwdCorr.</td>
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<td>Comments:</td>
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<td>Short Description</td>
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<td>Invalid Value/Flag</td>
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<tr>
<td>Is Correction Flag?:</td>
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<tr>
<td>Is Unsigned?:</td>
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<td>Product Maximum</td>
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<tr>
<td>Short Description</td>
<td>Saturation Energy Correction</td>
</tr>
<tr>
<td>Product Data Type</td>
<td>i2b (40)</td>
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<tr>
<td>Total Bytes</td>
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<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
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<tr>
<td>Is Unsigned?:</td>
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</tr>
<tr>
<td>Product Minimum</td>
<td>0</td>
</tr>
<tr>
<td>Product Maximum</td>
<td>100</td>
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<tr>
<td>Short Description</td>
<td>Saturation Pulse Width Correction</td>
</tr>
<tr>
<td>Product Data Type</td>
<td>i2b (40)</td>
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<tr>
<td>Total Bytes</td>
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<tr>
<td>Product Units</td>
<td>mm</td>
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<tr>
<td>Invalid Value/Flag</td>
<td>i2b</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
</tbody>
</table>
Product Minimum: 0
Product Maximum: 100
Description:
Comments:

Product Var Name: i_gval_rcv
Is element of: GLA05 record, GLA06 record, GLA12 record, GLA13 record, GLA14
Record, GLA15 Record
Short Description: Gain Value used for Received Pulse
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: counts
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 200
Description: Gain value used for received pulse - uncalibrated.
Comments: This value is in counts and needs to be calibrated before calculating energy from it. Same as variable in GLA01_Long/i_gainSet1064.

Product Var Name: i_RecNrgAll
Is element of: GLA05 record, GLA06 record, GLA12 record, GLA13 record, GLA14
Record, GLA15 Record
Short Description: Received Energy signal begin to signal end
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: 0.01 fJoules
Invalid Value/Flag: i_APID_AvFlg
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32000
Description:
Comments:

Product Var Name: i_FRir_cldtop
Is element of: GLA06 record, GLA12 record, GLA13 record, GLA14 record, GLA15
Record
Short Description: Full Resolution 1064 Cloud Top
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1030
Description: Full resolution (40 Hz) cloud top height obtained from the 1064 atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name: i_FRir_qaFlag
Is element of: GLA06 record, GLA12 record, GLA13 record, GLA14 record, GLA15
Record
Short Description: Full Resolution 1064 Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: **No**
Is Correction Flag?: **NA**
Is Unsigned?: **No**
Product Minimum: **0**
Product Maximum: **15**
Description: Please see `<a href='flags/i_FRir_qaFlag.pdf'> the PDF flag description</a>` for more details.
Comments:

Product Var Name: **i_FRir_ODflg**
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Optical Depth Flag
Product Data Type: **i1b ( 40)**
Total Bytes: **40**
Product Units: **NA**
Invalid Value/Flag: **No**
Is Correction Flag?: **NA**
Is Unsigned?: **No**
Product Minimum: **0**
Product Maximum: **0**
Description: This parameter is for a 1 second record. This parameter is also in GLA11.
Comments:

Product Var Name: **i_FRir_intsig**
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Integrated Signal
Product Data Type: **i2b ( 40)**
Total Bytes: **80**
Product Units: **e7/(m-sr)**
Invalid Value/Flag: **i2b**
Is Correction Flag?: **NA**
Is Unsigned?: **No**
Product Minimum: **0**
Product Maximum: **10000**
Description: Though called ‘integrated signal’ this is actually an average of all bins in the above-ground portion of the 1064 40 Hz profile with values above the threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This parameter is also in GLA09.
Comments:

Product Var Name: **i_msRngCorr**
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Multi-Scatter Range Correction
Product Data Type: **i2b ( 40)**
Total Bytes: **80**
Product Units: **Unknown**
Invalid Value/Flag: **i2b**
Is Correction Flag?: **NA**
Is Unsigned?: **No**
Product Minimum: **0**
Product Maximum: **0**
Description: Comments:

Product Var Name: **i_msCorrFlg**
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Record
Short Description: Multi-Scatter Range Correction
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: Unknown
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description:
Comments:

Product Var Name: i_Surface_temp
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Temperature
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_Surface_pres
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Pressure
Product Data Type: i2b
Total Bytes: 2
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description:
Comments:

Product Var Name: i_Surface_relh
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Relative Humidity
Product Data Type: i2b
Total Bytes: 2
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_spare8
Is element of: GLA13 Record
Short Description: Spares
Product Data Type: i1b (566)
Total Bytes: 566
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: null
Product Maximum: null
Description:
Comments:

D.1.7 GLA14 Record

Product Var Name: _rec_ndx
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: GLAS Record Index
Product Data Type: i4b
Total Bytes: 4
Product Units: N/A
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: _UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: _transtime
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: One way transit time
Product Data Type: i2b
<table>
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<tr>
<th>Variable Name</th>
<th>Data Type</th>
<th>Total Bytes</th>
<th>Units</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>i_Spare1</td>
<td>i1b</td>
<td>2</td>
<td>microseconds</td>
<td>0</td>
<td>4000</td>
<td>One way transit time calculated using the preliminary range offset. This is added to the UTC time tag to get the ground bounce times at which to calculate the orbit.</td>
</tr>
<tr>
<td>i_deltagpstmcor</td>
<td>i4b</td>
<td>4</td>
<td>nanoseconds</td>
<td>0</td>
<td>1000000</td>
<td>The high frequency delta GPS time correction calculated during the precision orbit processing step.</td>
</tr>
<tr>
<td>i_dShotTime</td>
<td>i4b</td>
<td>156</td>
<td>microseconds</td>
<td>0</td>
<td>1200000</td>
<td>The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will give the user the time of each individual shot in the frame.</td>
</tr>
</tbody>
</table>
Product Var Name: i_lat
Is element of: GLA14 Record
Short Description: Coordinate Data, Latitude, specific to land range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The geodetic latitude of the forty laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and land-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in degrees North.
Comments:

Product Var Name: i_lon
Is element of: GLA14 Record
Short Description: Coordinate Data, Longitude, specific to land range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: The longitude of the forty laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and land-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in east longitude.
Comments:

Product Var Name: i_elev
Is element of: GLA14 Record
Short Description: Land surface Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: Surface elevation with respect to the ellipsoid at the spot location determined by range using the land-specific fitting procedure after all instrument corrections, atmospheric delays and tides have been applied.
Comments:

Product Var Name: i_PADPoint
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: PAD Pointing unit Vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: Unitless*1000000
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 1000000
Description: Unit vectors giving the pointing direction of the laser with respect to the GLAS optical bench axes in the ICRF reference frame, one vector for each of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte items.
Comments:

Product Var Name: i_PODFixedPos
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Position orbit vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: 3 * (m, mm)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -7.0E+10
Product Maximum: 7.0E+10
Description: Spacecraft position vectors in ICRF of the laser point of reference on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus transit) time. Each element is composed of 2 4-byte items. The first is m and the second is millimeters.
Comments:

Product Var Name: i_sigmaatt
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Attitude Quality Indicator
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Unitless
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 6000
Description: Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments: This indicator currently has only 3 values: 0, 50, and 100, leaving open the opportunity to use numbers in between for further resolution of the degradation as our knowledge improves.

Product Var Name: i_Azimuth
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Local Azimuth
Product Data Type: i4b
Total Bytes: 4
Product Units: millideg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000
Description: Azimuth of the footprint path.
Comments:
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<tr>
<td><strong>Short Description:</strong></td>
<td>Solar Incidence Angle</td>
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<td>i4b</td>
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<td><strong>Product Units:</strong></td>
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<td><strong>Is Correction Flag?:</strong></td>
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<td><strong>Is Unsigned?:</strong></td>
<td>No</td>
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<tr>
<td><strong>Product Minimum:</strong></td>
<td>-90000000</td>
</tr>
<tr>
<td><strong>Product Maximum:</strong></td>
<td>90000000</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td>The solar incidence angle determined during Precision Orbit Determination processing; it provides the operational sun angle estimate.</td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
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<tr>
<td><strong>Short Description:</strong></td>
<td>Transmit Pulse intensity - frame avg</td>
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<tr>
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<td>i4b</td>
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<tr>
<td><strong>Is Unsigned?:</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Product Minimum:</strong></td>
<td>0</td>
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<td><strong>Product Maximum:</strong></td>
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<tr>
<td><strong>Short Description:</strong></td>
<td>Transmit Pulse azimuth - frame avg</td>
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<tr>
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<td>i2b</td>
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<td><strong>Product Units:</strong></td>
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<td>i2b</td>
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<tr>
<td><strong>Is Unsigned?:</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Product Minimum:</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>Product Maximum:</strong></td>
<td>3600</td>
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<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>i_tpeccentricity_avg</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Is element of:</strong></td>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
</tr>
<tr>
<td><strong>Short Description:</strong></td>
<td>Transmit Pulse eccentricity - frame avg</td>
</tr>
<tr>
<td><strong>Product Data Type:</strong></td>
<td>i2b</td>
</tr>
<tr>
<td><strong>Total Bytes:</strong></td>
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</tr>
<tr>
<td><strong>Product Units:</strong></td>
<td>Unitless*1000</td>
</tr>
<tr>
<td><strong>Invalid Value/Flag:</strong></td>
<td>i2b</td>
</tr>
<tr>
<td><strong>Is Correction Flag?:</strong></td>
<td>NA</td>
</tr>
<tr>
<td><strong>Is Unsigned?:</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Product Minimum:</strong></td>
<td>0</td>
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<tr>
<td><strong>Product Maximum:</strong></td>
<td>1000</td>
</tr>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Comments:</strong></td>
<td></td>
</tr>
</tbody>
</table>
Product Var Name: i_tpmajoraxis_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transit Pulse major axis - frame avg
Product Data Type: i2b
Total Bytes: 2
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: The height of the geoid above the ellipsoid for the first and last shot in the record.

Product Var Name: i_Spare2
Is element of: GLA14 Record
Short Description: Spares
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:

Product Var Name: i_gdHt
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Geoid
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -20000
Product Maximum: 20000
Description: The height of the geoid above the ellipsoid for the first and last shot in the record.

Product Var Name: i_erElv
Is element of: GLA14 Record
Short Description: Earth Tide Elevation
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Solid earth tide elevation (first and last shot)

Comments:

Product Var Name: i_spElv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Tide Elevations, Specific
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: A tide elevation calculated from alternate tide models for specific regions for shots 1, 11, 21, and 31.
Comments:

Product Var Name: i_ldElv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Load Tide Elevation
Product Data Type: i2b (4)
Total Bytes: 8
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: The load tide elevation applied to each shot. Elements 1-4 of the load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively.
Comments: The load tide is NOT NECESSARILY the load tide for shots 1, 11, 21, 31. It is calculated for the first valid shot in each group of 10 and applied to all valid shots in the group.

Product Var Name: i_ocElv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Ocean Tide Elevation (at first & last shot)
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: The ocean tide elevation at first & last shot
Comments:

Product Var Name: i_wTrop
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Correction_Wet Troposphere
Product Data Type: i2b (2)
Total Bytes: 4
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000
Product Maximum: 0
Description: The range correction due to the wet troposphere at first & last shot.
Comments:

Product Var Name: i_dTrop
Is element of: GLA14 Record
Short Description: Range Correction, Dry Troposphere
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -2500
Product Maximum: 0
Description: Atmospheric dry tropospheric delay correction added to the elevation
Comments:

Product Var Name: i_surfType
Is element of: GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Region Type
Product Data Type: i1b
Total Bytes: 1
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see <a href='flags/i_surfType.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_Spare3
Is element of: GLA14 Record
Short Description: Spare
Product Data Type: i1b (3)
Total Bytes: 3
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description: 
Comments:

Product Var Name: i_DEM_elv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: DEM Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: cm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -50000
Product Maximum: 1000000
Description: Elevation with respect to sea level as interpolated from a Digital Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name: i_refRng
Is element of: GLA14 Record
Short Description: Reference Range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 400000000
Product Maximum: 1000000000
Description: Range calculated from the time between the peak of the transmit pulse and the farthest gate from the spacecraft of the received pulse.
Comments:

Product Var Name: i_SigBegOff
Is element of: GLA14 Record
Short Description: Signal Begin Range Increment
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range increment to be added to reference range to obtain signal begin as computed in ground process using the alternate parameterization.
Comments:

Product Var Name: i_ldRngOff
Is element of: GLA06 record, GLA14 Record
Short Description: Land Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range offset to be added to i_refRng to calculate the range using the algorithm deemed appropriate for land.
Comments:

Product Var Name: i_SigEndOff
Is element of: GLA14 Record
Short Description: Signal End Range Increment
Product Data Type: i4b ( 40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range increment to be added to reference range to signal end as computed in ground process using the alternate parameterization.

Comments:

Product Var Name: i_gpCntRngOff
Is element of: GLA14 Record
Short Description: Centroid Range Increment for all 6 peaks
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: 

Comments:

Product Var Name: i_reflctUncorr
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Reflectivity not corrected for Atmospheric Effects
Product Data Type: i4b ( 40)
Total Bytes: 160
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The reflectance (not corrected for atmospheric effects) is calculated as the ratio of the received energy after it has been scaled for range, and the transmitted energy. The corrected reflectance may be calculated from this uncorrected reflectance by dividing by $e^{(-2(tc+ta+tm))}$, where tc is the cloud (column) integrated optical depth, ta is the aerosol (column) integrated optical depth, and tm is the molecular optical depth.
Comments: This uses all signal between signal begin and signal end.

Product Var Name: i_reflCor_atm
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Reflectivity Corrected Atmospheric Effects
Product Data Type: i4b
Total Bytes: 4
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: This corrected reflectance is calculated from the uncorrected reflectance by dividing by $e^{-2(tc+ta+tm)}$, where $tc$ is the cloud (column) integrated optical depth, $ta$ is the aerosol (column) integrated optical depth, and $tm$ is the molecular optical depth.

Comments:

Product Var Name: i_maxSmAmp
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Peak Amplitude of Smoothed Received Echo
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Tenth of millivolts
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -300
Product Maximum: 30000
Description: The peak amplitude of the received echo after it has been smoothed to remove high frequency noise (see ATBD).
Comments: This is calculated after converting the return to voltage.

Product Var Name: i_SigmaElv
Is element of: GLA14 Record
Short Description: Sigma of Elevation - TBD
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32000
Description: The algorithm for calculating this is TBD.
Comments: The peak amplitude of the received echo after it has been smoothed to remove high frequency noise (see ATBD).

Product Var Name: i_numPk
Is element of: GLA14 Record
Short Description: Number of Peaks found in the Return
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 6
Description: The number of peaks in the waveform produced by the Gaussian filtering, using alternate parameters.
Comments: The number of peaks in the waveform produced by the Gaussian filtering, using alternate parameters.

Product Var Name: i_kurt1
Is element of: GLA05 record, GLA14 Record
Short Description: Kurtosis of Received Echo (alternative)
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: unitless * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000
Product Maximum: 1000
Description: Kurtosis of the received echo from signal begin to signal end using alternative parameters
Comments: Note that the received echo was calibrated and converted to voltage before calculation.

Product Var Name: i_skew1
Is element of: GLA05 record, GLA14 Record
Short Description: Skewness of Received Echo (alternative)
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: unitless * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Skewness of the received echo from signal begin to signal end using alternative parameters
Comments: Note that the received echo was calibrated and converted to voltage before calculation.

Product Var Name: i_LdRufLstPk
Is element of: GLA14 Record
Short Description: Land Roughness - last
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 12000
Description: The surface roughness over the footprint calculated empirically from the transmitted pulse and received echo assuming no slope using alternate parameters.
Comments:

Product Var Name: i_LandSlopeLast
Is element of: GLA14 Record
Short Description: Land Slope - echo - last
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: millideg
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32000
Description: The surface slope over the footprint calculated empirically from the transmitted pulse and received echo assuming no slope using alternate parameters.
Comments:

Product Var Name: i_Gamp
Is element of: GLA14 Record
Short Description: Amplitudes of Gaussians
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Var Name:   i_Garea
Is element of:   GLA14 Record
Short Description:   Area under Gaussian
Product Data Type:   i4b (6, 40)
Total Bytes:   960
Product Units:   0.01 volts * ns
Invalid Value/Flag:   i4b
Is Correction Flag?:   NA
Is Unsigned?:   No
Product Minimum:   0
Product Maximum:   348457
Description:   Area under each of the Gaussians solved for (up to six), using alternate parameters.
Comments:

Product Var Name:   i_Gsigma
Is element of:   GLA14 Record
Short Description:   Sigma of Gaussians
Product Data Type:   i4b (6, 40)
Total Bytes:   960
Product Units:   0.001 ns
Invalid Value/Flag:   i4b
Is Correction Flag?:   NA
Is Unsigned?:   No
Product Minimum:   0
Product Maximum:   327660
Description:   Width (sigma) of each Gaussian solved for (up to six), using alternate parameters.
Comments:

Product Var Name:   i_nPeaks1
Is element of:   GLA05 record, GLA06 record, GLA14 Record
Short Description:   Initial Number of Peaks in received echo (alternate)
Product Data Type:   i1b (40)
Total Bytes:   40
Product Units:   NA
Invalid Value/Flag:   no
Is Correction Flag?:   NA
Is Unsigned?:   No
Product Minimum:   0
Product Maximum:   50
Description:   The initial number of peaks of the received echo; determined from the smoothed waveform, using alternative parameters.
Comments:

Product Var Name:   i_LandVar
Is element of:   GLA14 Record
Short Description:   Standard Deviation of the land Gaussian Fit
Product Data Type:   i2b ( 40)
Total Bytes: 80
Product Units: millivolts
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 25500
Description: The Standard deviation of the difference between the functional fit and the received echo using alternative parameters. It is directly taken from GLA05 parameter d_wFFitSDev_1 (alternative).
Comments:

Product Var Name: i_ElvuseFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation use flag
Product Data Type: i1b (5)
Total Bytes: 5
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -127
Product Maximum: 127
Description: Flag indicating whether the elevations on this record should be used or not (1 bit set/shot). See the <a href='flags/i_ElvuseFlg.pdf'>PDF file</a> for more information.
Comments:

Product Var Name: i_atm_avail
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_atm_avail.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_erd
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Estimated Range Delay
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description: Comments:
Product Var Name: i_rdu
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description: Range Delay Uncertainty
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_cld1_mswf
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailed in the PDF.
A warning flag value of 15 will signify invalid. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically thick cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range. Please see <a href='flags/i_cld1_mswf_elv.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_MRC_af.pdf'>the PDF flag description</a> for more details.
Comments:
Product Var Name: i_SurfRuf_slpQF
Is element of: GLA06 record, GLA12 Record, GLA14 Record
Short Description: Surface Roughness & Slope Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 127
Description: Per-shot data quality flags indicating quality of i_srf_slope and i_srf_ruf on this record.
Please see <a href='flags/i_SurfRuf_slpQF.pdf'> the PDF flag description</a> for more details. For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set to reflect Alternate Fitting. Although defined as a pass-thru, the values are different on GLA06/12-15 and GLA14.

Comments:

Product Var Name: i_ElvFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation Definition Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 127
Description: Indicates which location on the received echo was used to calculate the elevation on the record.
Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details. For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set to reflect Alternate Fitting. Although defined as a pass-thru, the values are different on GLA06/12-15 and GLA14.

Comments:

Product Var Name: i_rng_UQF
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Offset Quality/Use Flag
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Data quality flag for the range offsets on this record.
Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.

Comments:

Product Var Name: i_atmQF
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Flag
**Product Data Type:** i1b (10)  
**Total Bytes:** 10  
**Product Units:** N/A  
**Invalid Value/Flag:** No  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** 0  
**Product Maximum:** 1  
**Description:** Indicates from LIDAR channel if conditions for forward scattering were favorable. Please see <a href='flags/i_atmQF.pdf'> the PDF flag description</a> for more details.  
**Comments:** If forward scattering occurs, it may map to an error in the elevation measurement. Users may want to delete data with forward scattering.

**Product Var Name:** i_timecorflg  
**Is element of:** GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** time correction flag  
**Product Data Type:** i2b  
**Total Bytes:** 2  
**Product Units:** N/A  
**Invalid Value/Flag:** No  
**Is Correction Flag?:** No  
**Is Unsigned?:** No  
**Product Minimum:** 0  
**Product Maximum:** 32767  
**Description:** Indicates what instrument or bias corrections were applied to the times on this record. Please see <a href='flags/i_timecorflg.pdf'> the PDF flag description</a> for more details.  
**Comments:**

**Product Var Name:** i_APID_AvFlg  
**Is element of:** GLA01 Main Record, GLA02 Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** APID Data Availability Flag  
**Product Data Type:** i1b (8)  
**Total Bytes:** 8  
**Product Units:** n/a  
**Invalid Value/Flag:** No  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -127  
**Product Maximum:** 127  
**Description:** Flag indicating which packets (APIDs) for each second are available missing, or filled. APID 19 is broken down further into Altimeter Digitizer, Photon Counter, Cloud Digitizer, GPS/DEM, and C&T sections. Please see <a href='flags/i_APID_AvFlg.pdf'> the PDF flag description</a> for more details.  
**Comments:**

**Product Var Name:** i_AttFlg2  
**Is element of:** GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Attitude Flag 2
**Product Data Type:** ilb (20)  
**Total Bytes:** 20  
**Product Units:** NA  
**Invalid Value/Flag:** no  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** 0  
**Product Maximum:** 15  
**Description:** Denotes at 40/sec rate whether precision attitude was used to determine spot location, and if problems with LPA, etc.  
Please see `<a href='flags/i_AttFlg2.pdf'> the PDF flag description</a>` for more details.  

**Comments:**

**Product Var Name:** i_spare5  
**Is element of:** GLA14 Record  
**Short Description:** Spares  
**Product Data Type:** ilb  
**Total Bytes:** 1  
**Product Units:** NA  
**Invalid Value/Flag:** NA  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** 0  
**Product Maximum:** 0  
**Description:**

**Comments:**

**Product Var Name:** i_FrameQF  
**Is element of:** GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Altimeter Frame Quality Flag  
**Product Data Type:** ilb  
**Total Bytes:** 1  
**Product Units:** N/A  
**Invalid Value/Flag:** No  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** 0  
**Product Maximum:** 1  
**Description:** Denotes all bad data (no signal in whole frame), or all data good and all science team recommended corrections applied  
Please see `<a href='flags/i_FrameQF.pdf'> the PDF flag description</a>` for more details.  

**Comments:**

**Product Var Name:** i_OrbFlg  
**Is element of:** GLA01 Main Record, GLA02 Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** POD flag (Orbit Flag)  
**Product Data Type:** ilb (2)  
**Total Bytes:** 2  
**Product Units:** NA  
**Invalid Value/Flag:** no  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** 0  
**Product Maximum:** 128  
**Description:** Denotes quality of orbit, whether predicted or precision, loss of GPS data, maneuver-degraded, etc.  
Please see `<a href='flags/i_OrbFlg.pdf'> the PDF flag description</a>` for more details.
Comments:

Product Var Name: i_rngCorrFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Correction Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Denotes which geophysical or instrument corrections have been applied to the range in the calculation of the elevation on this record.
Please see <a href='flags/i_rngCorrFlg.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_CorrStatFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Correction Status Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: For each geophysical correction that has multiple values denotes which algorithm or model was used.
Please see <a href='flags/i_CorrStatFlg.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_beam_coelev
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Co-elevation
Product Data Type: i4b
Total Bytes: 4
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.
Comments:

Product Var Name: i_beam_azimuth
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Azimuth
Product Data Type: i4b
Total Bytes: 4
<table>
<thead>
<tr>
<th>Product Var Name</th>
<th>Is element of</th>
<th>Short Description</th>
<th>Product Data Type</th>
<th>Total Bytes</th>
<th>Product Units</th>
<th>Invalid Value/Flag</th>
<th>Is Correction Flag?</th>
<th>Is Unsigned?</th>
<th>Product Minimum</th>
<th>Product Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>i_AttFlg1</td>
<td>GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
<td>Attitude Flag 1</td>
<td>i2b</td>
<td>2</td>
<td>N/A</td>
<td>No</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>32767</td>
</tr>
<tr>
<td>i_Spare6</td>
<td>GLA14 Record</td>
<td>Spares</td>
<td>i1b (2)</td>
<td>2</td>
<td>N/A</td>
<td>No</td>
<td>NA</td>
<td>No</td>
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</tr>
<tr>
<td>i_DEM_hires_src</td>
<td>GLA14 Record</td>
<td>High Resolution Source Flag</td>
<td>i1b (40)</td>
<td>40</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>127</td>
</tr>
<tr>
<td>i_DEM_hires_elv</td>
<td>GLA14 Record</td>
<td>High Resolution Elevation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Description:
- **Az** is the direction clockwise from north of the laser beam vector as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the vector from the ground to the spacecraft).

Comments:
- Please see `<a href="flags/i_AttFlg1.pdf"> the PDF flag description</a>` for more details.

Description:
- At 1/sec denotes large off-nadir angle, ocn sweep, target of opportunity, steering to reference track.

Comments:
- Please see `<a href="flags/i_DEM_hires_src.pdf"> the PDF flag description</a>` for more details.
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500
Product Maximum: 13000
Description:
Comments:

Product Var Name: i_satNdx
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Index
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: ns
Invalid Value/Flag: i1b
Is Correction Flag?: NA
Is Unsigned?: Yes
Product Minimum: 0
Product Maximum: 255
Description: The count of the number of gates in a waveform which have an amplitude greater than or equal to i_satNdxTh (set in anc07_0004). The value 255 means 255 or more gates are above the saturation index threshold (i_satNdxTh).
Comments:

Product Var Name: i_satRngCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Range Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description:
Comments:

Product Var Name: i_satCorrFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Correction Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: NA
Product Minimum: NA
Product Maximum: NA
Description: This is a flag for i_satRngCorr, i_satNrgCorr & i_satPwdCorr.
Comments:

Product Var Name: i_satNrgCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Energy Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description:
Comments:

Product Var Name: i_satPwdCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Pulse Width Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description:
Comments:

Product Var Name: i_gval_rcv
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Gain Value used for Received Pulse
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: counts
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 200
Description: Gain value used for received pulse - uncalibrated.
Comments: This value is in counts and needs to be calibrated before calculating energy from it. Same as variable in GLA01_Long/i_gainSet1064.

Product Var Name: i_RecNrgfl
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Received Energy signal begin to signal end
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: 0.01 fJoules
Invalid Value/Flag: i_APID_AvFlg
Is Correction Flag?: i_APID_AVFlg
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32000
Description:
Comments:
Product Var Name: i_FRir_cldtop
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Cloud Top
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1030
Description: Full resolution (40 Hz) cloud top height obtained from the 1064 atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name: i_FRir_qaFlag
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_FRir_qaFlag.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_FRir_ODflg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Optical Depth Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: This parameter is for a 1 second record. This parameter is also in GLA11.
Comments:

Product Var Name: i_FRir_intsig
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Integrated Signal
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: e7/(m-sr)
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Though called ‘integrated signal’ this is actually an average of all bins in the above-ground portion of the 1064 40 Hz profile with values above the threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This parameter is also in GLA09.

Comments:

Product Var Name: i_msRngCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Multi-Scatter Range Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Unknown
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: Multi-Scatter Range Correction
Comments:

Product Var Name: i_msCorrFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Multi-Scatter Range Correction
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: Unknown
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: Multi-Scatter Range Correction
Comments:

Product Var Name: i_Surface_temp
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Temperature
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description: Surface Temperature
Comments:

Product Var Name: i_Surface_pres
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Pressure
Product Data Type: i2b
Total Bytes: 2
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description:
Comments:

Product Var Name: i_Surface_relh
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Relative Humidity
Product Data Type: i2b
Total Bytes: 2
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_Spare7
Is element of: GLA14 Record
Short Description: spares
Product Data Type: i1b (566)
Total Bytes: 566
Product Units: NA
Invalid Value/Flag: null
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

D.1.8 GLA15 Record

Product Var Name: i_rec_ndx
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04_GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04_SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: GLAS Record Index
Product Data Type: i4b
Total Bytes: 4
Product Units: N/A
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: Unique index that relates this record to the corresponding record(s) in each GLAS data product.
Comments:

Product Var Name: i_UTCTime
Is element of: GLA01 Long Waveform Record, GLA01 Main Record, GLA01_Short_Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08 Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

Short Description: Transmit Time of First Shot in frame in J2000
Product Data Type: i4b (2)
Total Bytes: 8
Product Units: seconds, microseconds
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 2147483647
Description: The transmit time in UTC of the 1st shot in the 1 second frame referenced to noon on Jan 1, 2000. The first item is the whole number of seconds; the second item is the fractional part in microseconds.
Comments: This is not the ground bounce time, but the transmit time.

Product Var Name: i_transtime
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

Short Description: One way transit time
Product Data Type: i2b
Total Bytes: 2
Product Units: microseconds
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 4000
Description: One way transit time calculated using the preliminary range offset. This is added to the UTC time tag to get the ground bounce times at which to calculate the orbit.
Comments:

Product Var Name: i_Spare1
Is element of: GLA15 Record

Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_deltagpstmcor
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record

Short Description: Delta GPS time correction
Product Data Type: i4b
Total Bytes: 4
Product Units: nanoseconds
Invalid Value/Flag: gi_invalid_i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The high frequency delta GPS time correction calculated during the precision orbit processing step.
Comments:

Product Var Name: _dShotTime
Is element of: GLA01 Main Record, GLA04 LPA Main Record, GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Laser Shot Time Deltas (shots 2-40)
Product Data Type: i4b (39)
Total Bytes: 156
Product Units: microseconds
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1200000
Description: The time deltas of pulses 2 through 40 to i_UTCTime, the UTC time tag of the first pulse in the 1-second data frame. Adding the deltas to i_UTCTime will give the user the time of each individual shot in the frame.
Comments: To calculate the time for shots 2-40, add these deltas to the time of the first shot.

Product Var Name: _lat
Is element of: GLA15 Record
Short Description: Coordinate Data, Latitude, specific to ocean range
Product Data Type: i4b ( 40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The geodetic latitude of the forty laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and ocean-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in degrees North.
Comments:

Product Var Name: _lon
Is element of: GLA15 Record
Short Description: Coordinate Data, Longitude, specific to ocean range
Product Data Type: i4b ( 40)
Total Bytes: 160
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000000
Description: The longitude of the forty laser spots in the 1 second time frame, computed from the Precision orbit determined GLAS laser antenna ground nadir coordinates, precision attitude, and ocean-specific range after all instrument corrections, atmospheric delays and tides have been applied. The values are in east longitude.
Comments:
Product Var Name: i_elev
Is element of: GLA15 Record
Short Description: Ocean Surface Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: Surface elevation with respect to the ellipsoid at the spot location determined by range using the fitting algorithm after instrument corrections, atmospheric delays and tides have been applied.

Comments:

Product Var Name: i_PADPoint
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: PAD Pointing unit Vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: Unitless*1000000
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -1000000
Product Maximum: 10000000
Description: Unit vectors giving the pointing direction of the laser with respect to the GLAS optical bench axes in the ICRF reference frame, one vector for each of the 40 shots, at the shot (transmit) time. Each component is composed of 2 4-byte items.

Comments:

Product Var Name: i_PODFixedPos
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Position orbit vector in ICRF
Product Data Type: i4b (6, 40)
Total Bytes: 960
Product Units: 3 * (m, mm)
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -7.0E+10
Product Maximum: 7.0E+10
Description: Spacecraft position vectors in ICRF of the laser point of reference on the spacecraft, one vector for each of the 40 shots, at the bounce (transmit plus transit) time. Each element is composed of 2 4-byte items. The first is m and the second is millimeters.

Comments:

Product Var Name: i_sigmaatt
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Attitude Quality Indicator
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Unitless
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 6000
Description: Attitude quality indicator. Values: 0=good; 50=warning; 100=bad.
Comments: This indicator currently has only 3 values: 0, 50, and 100, leaving open the opportunity to use numbers in between for further resolution of the degradation as our knowledge improves.

Product Var Name: i_Azimuth
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Local Azimuth
Product Data Type: i4b
Total Bytes: 4
Product Units: millideg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 360000
Description: Azimuth of the footprint path.
Comments:

Product Var Name: i_SolAng
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Solar Incidence Angle
Product Data Type: i4b
Total Bytes: 4
Product Units: microdeg
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -90000000
Product Maximum: 90000000
Description: The solar incidence angle determined during Precision Orbit Determination processing; it provides the operational sun angle estimate.
Comments:

Product Var Name: i_tpintensity_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Pulse intensity - frame avg
Product Data Type: i4b
Total Bytes: 4
Product Units: counts
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 25500
Description:
Comments:

Product Var Name: i_tpazimuth_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Pulse azimuth - frame avg
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees*10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600
Description:
Comments:

Product Var Name: i_tpeccentricity_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Pulse eccentricity - frame avg
Product Data Type: i2b
Total Bytes: 2
Product Units: Unitless*1000
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description:
Comments:

Product Var Name: i_tpmajoraxis_avg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Transmit Pulse major axis - frame avg
Product Data Type: i2b
Total Bytes: 2
Product Units: cm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_Spare2
Is element of: GLA15 Record
Short Description: Spare
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:
Comments:

Product Var Name: i_gdHt
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
**Short Description:** Geoid  
**Product Data Type:** i2b (2)  
**Total Bytes:** 4  
**Product Units:** cm  
**Invalid Value/Flag:** i2b  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -20000  
**Product Maximum:** 20000  
**Description:** The height of the geoid above the ellipsoid for the first and last shot in the record.  
**Comments:**

**Product Var Name:** i_erElv  
**Is element of:** GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record  
**Short Description:** Solid Earth Tide Elevation (at first & last shot)  
**Product Data Type:** i2b (2)  
**Total Bytes:** 4  
**Product Units:** mm  
**Invalid Value/Flag:** i2b  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -10000  
**Product Maximum:** 10000  
**Description:** The solid earth tide elevation for the first & last shot in the record.  
**Comments:**

**Product Var Name:** i_spElv  
**Is element of:** GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Tide Elevations, Specific  
**Product Data Type:** i2b (4)  
**Total Bytes:** 8  
**Product Units:** mm  
**Invalid Value/Flag:** i2b  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -10000  
**Product Maximum:** 10000  
**Description:** A tide elevation calculated from alternate tide models for specific regions for shots 1, 11, 21, and 31.  
**Comments:**

**Product Var Name:** i_ldElv  
**Is element of:** GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Load Tide Elevation  
**Product Data Type:** i2b (4)  
**Total Bytes:** 8  
**Product Units:** mm  
**Invalid Value/Flag:** i2b  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -10000  
**Product Maximum:** 10000  
**Description:** The load tide elevation applied to each shot. Elements 1-4 of the load tide vector are applied to shots 1-10, 11-20, 21-30, and 31-40, respectively.  
**Comments:** The load tide is NOT NECESSARILY the load tide for shots
1,11,21,31. It is calculated for the first valid shot in each group of 10 and applied to all valid shots in the group.

**Product Var Name:** i_ocElv  
**Is element of:** GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Ocean Tide Elevation (at first & last shot)  
**Product Data Type:** i2b (2)  
**Total Bytes:** 4  
**Product Units:** mm  
**Invalid Value/Flag:** i2b  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -10000  
**Product Maximum:** 10000  
**Description:** The ocean tide elevation at first & last shot  

**Comments:**

**Product Var Name:** i_wTrop  
**Is element of:** GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Range Correction_Wet Troposphere  
**Product Data Type:** i2b (2)  
**Total Bytes:** 4  
**Product Units:** mm  
**Invalid Value/Flag:** i2b  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -1000  
**Product Maximum:** 0  
**Description:** The range correction due to the wet troposphere at first & last shot.  

**Comments:**

**Product Var Name:** i_dTrop  
**Is element of:** GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Range Correction, Dry Troposphere  
**Product Data Type:** i2b (40)  
**Total Bytes:** 80  
**Product Units:** mm  
**Invalid Value/Flag:** i2b  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** -2500  
**Product Maximum:** 0  
**Description:** The range correction due to the dry troposphere; one correction for each shot.  

**Comments:**

**Product Var Name:** i_surfType  
**Is element of:** GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record  
**Short Description:** Region Type  
**Product Data Type:** i1b  
**Total Bytes:** 1  
**Product Units:** N/A  
**Invalid Value/Flag:** No  
**Is Correction Flag?:** NA  
**Is Unsigned?:** No  
**Product Minimum:** 1
Product Maximum: 15
Description: Describes the region type or types associated with each shot Ice Sheet, ocean, sea ice, or Land.
Please see `<a href='flags/i_surfType.pdf'> the PDF flag description</a>` for more details.
Comments:

Product Var Name: _i_Spare3
Is element of: GLA15 Record
Short Description: Spares
Product Data Type: i1b (3)
Total Bytes: 3
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:

Product Var Name: _i_DEM_elv
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: DEM Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: cm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -50000
Product Maximum: 1000000
Description: Elevation with respect to sea level as interpolated from a Digital Elevation Map (DEM) at each footprint location.
Comments:

Product Var Name: _i_refRng
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Reference Range
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 400000000
Product Maximum: 1000000000
Description: Range in distance calculated from the time between the peak of the transmit pulse and the farthest gate from the spacecraft of the received pulse. See the rngcorrflg to determine any corrections that have been applied.
Comments:

Product Var Name: _i_TrshRngOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Threshold Retracker Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the threshold retracker location on the received echo using standard parameters.
Comments:

Product Var Name: i_ocRngOff
Is element of: GLA06 record, GLA15 Record
Short Description: Ocean Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Range offset to be added to i_refRng to calculate the range using the algorithm deemed appropriate for oceans.
Comments:

Product Var Name: i_SigEndOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Signal End Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the location on the received echo calculated as the end of signal (farthest from the spacecraft) using standard parameters.
Comments:

Product Var Name: i_cntRngOff
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record
Short Description: Centroid Range Offset
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -150000
Product Maximum: 0
Description: Offset to be added to i_refRng to give the range in distance to the location of the centroid of the received echo from signal begin through signal end defined by the standard parameters.
Comments:

Product Var Name: i_reflctUncorr
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Reflectivity not corrected for Atmospheric Effects
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: The reflectance (not corrected for atmospheric effects) is calculated as the ratio of the received energy after it has been scaled for range, and the transmitted energy. The corrected reflectance may be calculated from this uncorrected reflectance by dividing by $e^{-2(tc+ta+tm)}$, where $tc$ is the cloud (column) integrated optical depth, $ta$ is the aerosol (column) integrated optical depth, and $tm$ is the molecular optical depth.
Comments: This uses all signal between signal begin and signal end.
Product Var Name: i_reflCor_atm
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Reflectivity Corrected Atmospheric Effects

Product Data Type: i4b
Total Bytes: 4
Product Units: Unitless*1E06
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000000
Description: This corrected reflectance is calculated from the uncorrected reflectance by dividing by $e^{-2(tc+ta+tm)}$, where $tc$ is the cloud (column) integrated optical depth, $ta$ is the aerosol (column) integrated optical depth, and $tm$ is the molecular optical depth.
Comments:
Product Var Name: i_maxSmAmp
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Peak Amplitude of Smoothed Received Echo
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: Tenth of millivolts
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -300
Product Maximum: 300000
Description: The peak amplitude of the received echo after it has been smoothed to remove high frequency noise (see ATBD).
Comments: This is calculated after converting the return to voltage.
Product Var Name: i_SigmaElv
Is element of: GLA15 Record
Short Description: Sigma of Elevation
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Data Dictionary

**Product Minimum:** 0
**Product Maximum:** 32000
**Description:** Elevation error estimates, the error from the Gaussian fit to the received echo associated with the centroid of the last peak using standard parameters.

**Comments:**

**Product Var Name:** i_numPk
**Is element of:** GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record

**Short Description:** Number of Peaks found in the Return

**Product Data Type:** i1b ( 40)
**Total Bytes:** 40
**Product Units:** N/A
**Invalid Value/Flag:** No
**Is Correction Flag?:** NA
**Is Unsigned?:** No
**Product Minimum:** 0
**Product Maximum:** 6

**Description:** The number of peaks in the return echo found by the Gaussian fitting procedure, using standard parameters.

**Comments:**

**Product Var Name:** i_skew2
**Is element of:** GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA15 Record

**Short Description:** Skewness

**Product Data Type:** i2b ( 40)
**Total Bytes:** 80
**Product Units:** unitless * 100
**Invalid Value/Flag:** i2b
**Is Correction Flag?:** NA
**Is Unsigned?:** No
**Product Minimum:** -10000
**Product Maximum:** 10000

**Description:** The skewness of the received echo from signal begin to signal end using standard parameters.

**Comments:** Note that the received echo was calibrated and converted to voltage before calculation.

**Product Var Name:** i_OcRufRMS
**Is element of:** GLA15 Record

**Short Description:** RMS of elevations used for 1-sec mean elevation

**Product Data Type:** i4b
**Total Bytes:** 4
**Product Units:** mm
**Invalid Value/Flag:** i4b
**Is Correction Flag?:** NA
**Is Unsigned?:** No
**Product Minimum:** 0
**Product Maximum:** 120000

**Description:**

**Comments:**

**Product Var Name:** i_OcMeanElev
**Is element of:** GLA15 Record

**Short Description:** Mean elevation over 1 sec

**Product Data Type:** i4b
**Total Bytes:** 4
**Product Units:** mm
**Invalid Value/Flag:** i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: 1 -sec mean elevation
Comments:

Product Var Name: i_lowElev
Is element of: GLA15 Record
Short Description: Lowest Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: Lowest elevation in footprint, with all corrections applied (cor-
responds to signal end) using standard parameters.
Comments:

Product Var Name: i_highElev
Is element of: GLA15 Record
Short Description: Highest Elevation
Product Data Type: i4b (40)
Total Bytes: 160
Product Units: mm
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -500000
Product Maximum: 10000000
Description: Highest elevation in footprint, with all corrections applied (cor-
responds to signal begin) using standard parameters.
Comments:

Product Var Name: i_OceanVar
Is element of: GLA15 Record
Short Description: Standard Deviation of the ocean Gaussian Fit
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: millivolts
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 25500
Description: The Standard deviation of the difference between the functional
fit and the received echo using standard parameters. It is directly taken from GLA05
parameter d_wfFitSDev_2 (standard).
Comments:

Product Var Name: i_ElvuseFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description: Elevation use flag
Product Data Type: i1b (5)
Total Bytes: 5
Product Var Name: i_atm_avail
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Atmosphere Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see the PDF flag description for more details.
Comments:

Product Var Name: i_erd
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Estimated Range Delay
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1000
Description:
Comments:

Product Var Name: i_rdu
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Range Delay Uncertainty
Product Data Type: i2b
Total Bytes: 2
Product Units: Millimeters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_cld1_mswf
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description:
Product Data Type:
Total Bytes:
Product Units:
Invalid Value/Flag:
Is Correction Flag?:
Is Unsigned?:
Product Minimum:
Product Maximum:
Description:
Comments:
Record
Short Description: Cloud Multiple Scattering Warning Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: The multiple scattering warning flag (MSWF) is based on the total column optical depth (aerosol plus cloud) calculated in GLA11 using 532nm. It is intended as a way to quickly obtain information about the potential severity of multiple scattering with regards to the range-to-surface calculated by the altimetry processing software. It will be output on the GLA11 product for use by the altimetry group. The multiple scattering warning flag will have values ranging from 0-14, based on the total column optical depth as detailed in the PDF.
A warning flag value of 15 will signify invalid. An invalid will be encoded if an optical depth in any of the layers in the 1-second column could not be calculated. This usually occurs in a very optically thick cloud which extinguishes the signal. It could also occur if the extinction-to-backscatter ratio assignment is set too high, causing the transmission calculations in the lidar inversion to go out-of-range. Please see <a href='flags/i_cld1_mswf_elv.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_MRC_af
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Medium Resolution Cloud Availability Flag
Product Data Type: i1b
Total Bytes: 1
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_MRC_af.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_OcRMSqf
Is element of: GLA15 Record
Short Description: Ocean RMS Roughness Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: null
Invalid Value/Flag: N
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Data quality flag for the ocean roughness.
Please see <a href='flags/i_OcRMSqf.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_ElvFlg
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Elevation Definition Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 127
Description: Indicates which location on the received echo was used to calculate
the elevation on the record. Please see <a href='flags/i_ElvFlg.pdf'> the PDF flag description</a> for more details.
'For GLA06 and 12-15, bits are set to reflect Standard Fitting. For GLA14, bits are set
to reflect Alternate Fitting. Although defined as a pass-thru, the values are different
on GLA06/12-15 and GLA14.'
Comments:

Product Var Name: i_rng_UQF
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15
Record
Short Description: Range Offset Quality/Use Flag
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: Data quality flag for the range offsets on this record. Please see <a href='flags/i_rng_UQF.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_atmQF
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description: Atmosphere Flag
Product Data Type: i1b (10)
Total Bytes: 10
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1
Description: Indicates from LIDAR channel if conditions for forward scattering
were favorable. Please see <a href='flags/i_atmQF.pdf'> the PDF flag description</a> for more details.
Comments: If forward scattering occurs, it may map to an error in the ele-
vation measurement. Users may want to delete data with forward scattering.

Product Var Name: i_timecorflg
Is element of: GLA01 Main Record, GLA02 Record, GLA03 Main Record, GLA04 BST Main
Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS
Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA08
Record, GLA09 Record, GLA10 record, GLA11 Record, GLA12 Record, GLA13 Record, GLA14
Record, GLA15 Record
Short Description: time correction flag
Product Data Type: i2b
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<tr>
<th>Product Var Name:</th>
<th>i_APID_AvFlg</th>
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</thead>
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<tr>
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<td>GLA01 Main Record, GLA02 Record, GLA04 BST Main Record, GLA04 GYRO Main Record, GLA04 IST Main Record, GLA04 LPA Main Record, GLA04 LRS Main Record, GLA04 SCPA Main Record, GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
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<td>Short Description:</td>
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<td>Product Data Type:</td>
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<td>8</td>
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<tr>
<td>Product Units:</td>
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<tr>
<td>Invalid Value/Flag:</td>
<td>No</td>
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<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
</tr>
<tr>
<td>Is Unsigned?:</td>
<td>No</td>
</tr>
<tr>
<td>Product Minimum:</td>
<td>-127</td>
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<tr>
<td>Product Maximum:</td>
<td>127</td>
</tr>
<tr>
<td>Description:</td>
<td>Flag indicating which packets (APIIDs) for each second are available missing, or filled. APID 19 is broken down further into Altimeter Digitizer, Photon Counter, Cloud Digitizer, GPS/DEM, and C&amp;T sections. Please see &lt;a href='flags/i_APID_AvFlg.pdf'&gt; the PDF flag description&lt;/a&gt; for more details.</td>
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<td>Comments:</td>
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<table>
<thead>
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<th>Product Var Name:</th>
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<tr>
<td>Is element of:</td>
<td>GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
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<td>Total Bytes:</td>
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<td>Invalid Value/Flag:</td>
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<tr>
<td>Is Unsigned?:</td>
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<tr>
<td>Product Minimum:</td>
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<tr>
<td>Product Maximum:</td>
<td>15</td>
</tr>
<tr>
<td>Description:</td>
<td>Denotes at 40/sec rate whether precision attitude was used to determine spot location, and if problems with LPA, etc. Please see &lt;a href='flags/i_AttFlg2.pdf'&gt; the PDF flag description&lt;/a&gt; for more details.</td>
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<td>Is Correction Flag?:</td>
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<tr>
<td>Is Unsigned?:</td>
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<tr>
<td>Product Var Name</td>
<td>Description</td>
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<tr>
<td>-----------------</td>
<td>-------------</td>
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<tr>
<td><strong>i_FrameQF</strong></td>
<td>Denotes all bad data (no signal in whole frame), or all data good and all science team recommended corrections applied. Please see the PDF flag description for more details.</td>
</tr>
<tr>
<td><strong>i_OrbFlg</strong></td>
<td>Denotes quality of orbit, whether predicted or precision, loss of GPS data, maneuver-degraded, etc. Please see the PDF flag description for more details.</td>
</tr>
<tr>
<td><strong>i_rngCorrFlg</strong></td>
<td>Denotes which geophysical or instrument corrections have been applied to the range in the calculation of the elevation on this record. Please see the PDF flag description for more details.</td>
</tr>
<tr>
<td><strong>i_CorrStatFlg</strong></td>
<td>Denotes all bad data (no signal in whole frame), or all data good and all science team recommended corrections applied. Please see the PDF flag description for more details.</td>
</tr>
</tbody>
</table>
Record
Short Description: Correction Status Flag
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: NA
Invalid Value/Flag: no
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: For each geophysical correction that has multiple values denotes which algorithm or model was used.
Please see <a href='flags/i_CorrStatFlg.pdf'>the PDF flag description</a> for more details.
Comments:

Product Var Name: i_beam_coelev
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Co-elevation
Product Data Type: i4b
Total Bytes: 4
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Co-elevation (CE) is direction from vertical of the laser beam as seen by an observer located at the laser ground spot.

Comments:

Product Var Name: i_beam_azimuth
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Azimuth
Product Data Type: i4b
Total Bytes: 4
Product Units: degrees*100
Invalid Value/Flag: i4b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 36000
Description: Az is the direction clockwise from north of the laser beam vector as seen by an observer at the laser ground spot viewing toward the spacecraft (i.e., the vector from the ground to the spacecraft).

Comments:

Product Var Name: i_AttFlg1
Is element of: GLA05 record, GLA06 record, GLA07 Record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Attitude Flag 1
Product Data Type: i2b
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32767
Description: At 1/sec denotes large off-nadir angle, ocn sweep, target of opportunity, steering to reference track. Please see a href='flags/i_AttFlg1.pdf' the PDF flag description</a> for more details.

Comments:

Product Var Name: i_Spare6
Is element of: GLA15 Record
Short Description: spares
Product Data Type: i1b (2)
Total Bytes: 2
Product Units: N/A
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: null
Product Maximum: null
Description:

Comments:

Product Var Name: i_satNdx
Is element of: GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Index
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: ns
Invalid Value/Flag: i1b
Is Correction Flag?: NA
Is Unsigned?: Yes
Product Minimum: 0
Product Maximum: 255
Description: The count of the number of gates in a waveform which have an amplitude greater than or equal to i_satNdxTh (set in anc07_0004). The value 255 or more gates are above the saturation index threshold (i_satNdxth).

Comments:

Product Var Name: i_satRngCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Range Correction
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: mm
Invalid Value/Flag: i2b
Is Correction Flag?: No
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 100
Description:

Comments:

Product Var Name: i_satCorrFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Saturation Correction Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
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<thead>
<tr>
<th>Product Var Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>i_satRngCorr</td>
<td>This is a flag for i_satRngCorr, i_satNrgCorr &amp; i_satPwdCorr.</td>
</tr>
<tr>
<td>i_satNrgCorr</td>
<td>Saturation Energy Correction</td>
</tr>
<tr>
<td>i_satPwdCorr</td>
<td>Saturation Pulse Width Correction</td>
</tr>
<tr>
<td>i_gval_rcv</td>
<td>Gain Value used for Received Pulse</td>
</tr>
<tr>
<td>i_RecNrgAll</td>
<td>Received Energy signal begin to signal end</td>
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<tr>
<td>i_satPwdCorr</td>
<td>GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
</tr>
<tr>
<td>i_gval_rcv</td>
<td>GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
</tr>
<tr>
<td>i_RecNrgAll</td>
<td>GLA05 record, GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Product Data Type</th>
<th>Total Bytes</th>
<th>Product Units</th>
<th>Invalid Value/Flag</th>
<th>Is Correction Flag?</th>
<th>Is Unsigned?</th>
<th>Product Minimum</th>
<th>Product Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>i2b (40)</td>
<td>80</td>
<td>mm</td>
<td>i2b</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>i2b (40)</td>
<td>80</td>
<td>mm</td>
<td>i2b</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>i2b (40)</td>
<td>80</td>
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<td>i2b</td>
<td>NA</td>
<td>No</td>
<td>0</td>
<td>200</td>
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<td>80</td>
<td>mm</td>
<td>i2b</td>
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<td>No</td>
<td>0</td>
<td>100</td>
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Product Units: 0.01 fJoules
Invalid Value/Flag: i_APID_AvFlg
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 32000
Description: 
Comments:

Product Var Name: i_FRir_cldtop
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Cloud Top
Product Data Type: i2b (40)
Total Bytes: 80
Product Units: deka-meters
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 1030
Description: Full resolution (40 Hz) cloud top height obtained from the 1064 atmospheric channel. This parameter is for a 1 second record. This parameter is in GLA09.
Comments:

Product Var Name: i_FRir_qaFlag
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Quality Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 15
Description: Please see <a href='flags/i_FRir_qaFlag.pdf'> the PDF flag description</a> for more details.
Comments:

Product Var Name: i_FRir_ODflg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Optical Depth Flag
Product Data Type: i1b (40)
Total Bytes: 40
Product Units: NA
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description: This parameter is for a 1 second record. This parameter is also in GLA11.
Comments:

Product Var Name: i_FRir_intsig
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Full Resolution 1064 Integrated Signal
Product Data Type: i2b ( 40)
Total Bytes: 80
Product Units: e7/(m-sr)
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description: Though called ‘integrated signal’ this is actually an average of all bins in the above-ground portion of the 1064 40 Hz profile with values above the threshold of 1.0e-7 (1/(m-sr) units). This parameter is for a 1 second record. This parameter is also in GLA09.
Comments:

Product Var Name: i_msRngCorr
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Multi-Scatter Range Correction
Product Data Type: i2b ( 40)
Total Bytes: 80
Product Units: Unknown
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description:
Comments:

Product Var Name: i_msCorrFlg
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Multi-Scatter Range Correction
Product Data Type: i1b ( 40)
Total Bytes: 40
Product Units: Unknown
Invalid Value/Flag: No
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 0
Description:
Comments:

Product Var Name: i_Surface_temp
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Temperature
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees Celsius * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: -10000
Product Maximum: 10000
Description:
Comments:
Product Var Name: i_Surface_pres
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Surface Pressure
Product Data Type: i2b
Total Bytes: 2
Product Units: millibars of mercury * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description:
Comments:

Product Var Name: i_Surface_relh
Is element of: GLA06 record, GLA12 Record, GLA13 Record, GLA14 Record, GLA15 Record
Short Description: Relative Humidity
Product Data Type: i2b
Total Bytes: 2
Product Units: percentage * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 10000
Description:
Comments:

Product Var Name: i_Surface_wind
Is element of: GLA07 Record, GLA15 Record
Short Description: Surface Wind Speed
Product Data Type: i2b
Total Bytes: 2
Product Units: meters/second * 100
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 20000
Description:
Comments:

Product Var Name: i_Surface_wdir
Is element of: GLA07 Record, GLA15 Record
Short Description: Surface Wind Direction Azimuth from North
Product Data Type: i2b
Total Bytes: 2
Product Units: degrees * 10
Invalid Value/Flag: i2b
Is Correction Flag?: NA
Is Unsigned?: No
Product Minimum: 0
Product Maximum: 3600
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Comments:
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</thead>
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<td>GLA15 Record</td>
</tr>
<tr>
<td>Short Description:</td>
<td>spares</td>
</tr>
<tr>
<td>Product Data Type:</td>
<td>ilb (594)</td>
</tr>
<tr>
<td>Total Bytes:</td>
<td>594</td>
</tr>
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<td>N/A</td>
</tr>
<tr>
<td>Invalid Value/Flag:</td>
<td>No</td>
</tr>
<tr>
<td>Is Correction Flag?:</td>
<td>NA</td>
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<tr>
<td>Is Unsigned?:</td>
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</tr>
<tr>
<td>Product Minimum:</td>
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<tr>
<td>Product Maximum:</td>
<td>null</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>Comments:</td>
<td></td>
</tr>
</tbody>
</table>
Appendix E

Flags

E.1 Design Philosophy

GSAS flag design is governed by a consistent philosophy. Per HP documentation, bits are numbered right to left starting at 0. Eg, a byte has the following bit numbers:

```
|   |   |   |   |   |   |   |   |
bit:  7  6  5  4  3  2  1  0
```

However, arrays of bytes are numbered left to right starting at 1. The direction from which shots are incremented depend if the flag is a byte flag or bit flag. Byte flags increment from left to right, bit flags increment from right to left. This follows the "natural" big endian ordering scheme. Eg:

BIT flags increment from right to left:

```
|   |   |   |   |   . . . . . . . . |   |   |   |  |
bit:  39  38  37  36                          3  2  1  0
shot: 40  39  38  37                          4  3  2  1
```

BYTE flags increment from left to right:

```
|   |   |   |   |   . . . . . . . . |   |   |   |  |
byte:  01  02  03  04                         37  38  39  40
shot:  01  02  03  04                         37  38  39  40
```

The following section contains detailed descriptions of each flag found in the GSAS Level 2 products. The descriptions are ordered alphabetically.

E.2 Flag Descriptions
i_Aer_ir_layflg [GLA08]: Layer Flag for 1064 Aerosol

<table>
<thead>
<tr>
<th>MSB</th>
<th>LSB</th>
<th>MSB</th>
<th>LSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>spare</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Number of 1064 layers of aerosol saved

Figure E-1  Layer Flag for 1064 Aerosol

i_LayHgt_Flag [GLA08]: Layer Height Flag

i_pscf: value 0 = not a PSC; value 1 = low likely; value 2 = medium likely; value 3 = high likely

i20_aer_qf = quality flag at 1 per sec: value 0 = aerosol layers were searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = upper (>20 km) aerosol layers were not searched for

i20_aer_af = availability flag at 1 per 20 sec: value 0 = aerosol layers were searched for, but not detected; value 15 = aerosol layers were not searched for

i20_aer uf = use flag at 1 per 20 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i4_aer_qf = quality flag at 1 per 4 sec: value 0 = aerosol layers were searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = lower (<20 km) aerosol layers were not searched for

i4_aer_af = availability flag at 1 per 4 sec: value 0 = aerosol layers were searched for, but not detected; value 15 = aerosol layers were not searched for

i4_aer uf = use flag at 1 per 4 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i_HRpbl_qf = quality flag at 5Hz for 4 sec: value 0 = PBL was searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = PBL not searched for

i_HRpbl uf = use flag at 5Hz for 4 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i_HRpbl_ccf = clear/cloudy flag at 5Hz for 4 sec: value 0 = clear; value 1 = cloudy

i_LRpbl_qf = quality flag at 1 per 4 sec: value 0 = PBL was searched for, but not detected; values 1 to 13 = increasing goodness; value 14 = bad; value 15 = PBL not searched for

i_LRpbl uf = use flag at 1 per 4 sec: value 0 = no saturated bins present in layer; value 1 = saturated bins present in layer and replaced with 1064 data; value 2 = saturated bins present in layer and not replaced with 1064 data

i_LRpbl_ccf = clear/cloudy flag at 1 per 4 sec: value 0 = clear; value 1 = cloudy

Figure E-2  Layer Height Flag
### Figure E-2  Layer Height Flag (Continued)

<table>
<thead>
<tr>
<th>Byte 9</th>
<th>Byte 10</th>
<th>Byte 11</th>
<th>Byte 12</th>
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<td>7</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>i_HRpbl_Uf (layers 4-1)</td>
<td>i_HRpbl_Uf (layers 20-15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 13</td>
<td>Byte 14</td>
<td>Byte 15</td>
<td>Byte 16</td>
</tr>
<tr>
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<td>7</td>
<td>0</td>
</tr>
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<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>i_HRpbl_Uf (layers 14-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 17</td>
<td>Byte 18</td>
<td>Byte 19</td>
<td>Byte 20</td>
</tr>
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<td>5</td>
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</tr>
<tr>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>i_HRpbl_Uf (layers 6-1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Byte 21</td>
<td>Byte 22</td>
<td>Byte 23</td>
<td>Byte 24</td>
</tr>
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<td>3</td>
<td>3</td>
</tr>
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<td>i4_aer_Uf</td>
<td>i4_aer_Uf (layers 5-1)</td>
<td></td>
</tr>
<tr>
<td>Byte 25</td>
<td>Byte 26</td>
<td>Byte 27</td>
<td>Byte 28</td>
</tr>
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<td>2</td>
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<td>i20_aer_Uf</td>
<td>i20_aer_Uf (layers 3-1)</td>
<td>BSpare1</td>
</tr>
<tr>
<td>Byte 29</td>
<td>Byte 30</td>
<td>Byte 31</td>
<td>Byte 32</td>
</tr>
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<td>7</td>
<td>6</td>
<td>5</td>
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<td>BSpare1</td>
<td>i_Pscf (layers 8-1)</td>
<td></td>
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</tr>
</tbody>
</table>
i_FRCL_Flag (GLA09): Full Resolution Cloud Layer Flag (4 seconds per record, 40 per second rate)

- **af** = availability flag: Tells how many cloud layers were found (from the 532 channel) at this resolution. Value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected.
- **qf** = quality flag: Value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; value 1 = low chance of being a cloud; value 2 = moderate; value 3 = high; value 4 = no doubt.
- **uf** = use flag: Not used at this time.
- **df** = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. Value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight.

**Figure E-3 Full Resolution Cloud Layer Flag**
<table>
<thead>
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<th>Byte</th>
<th>i_FRC_qf (flags 40-1, second 1)</th>
<th>i_FRC_qf (flags 40-1, second 2)</th>
<th>i_FRC_qf (flags 40-1, second 3)</th>
<th>i_FRC_qf (flags 40-1, second 4)</th>
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<tbody>
<tr>
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<td>40 39 10</td>
<td>40 39 15</td>
<td>40 39 10</td>
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<td>7 2 0</td>
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</table>

Figure E-3  Full Resolution Cloud Layer Flag (Continued)
i_FRCL_Flag [GLA09]: Full Resolution Cloud Layer Flag (4 seconds per record, 40 per second rate)

Figure E-3  Full Resolution Cloud Layer Flag (Continued)
Figure E-3  Full Resolution Cloud Layer Flag (Continued)
### i_FRir_qaFlag [GLA09, 11]: Full Resolution 1064 Quality Flag

(i1b(160): 4 seconds per record, 40 per second rate)

One byte per data quality flag

Value 15 = No clouds.

Value 14 = Indicates the likely presence of low clouds (< 150 m) based on elevated signal from the two bins above the ground return bin that were not detected directly by the cloud search algorithm. When this occurs, the 40 Hz cloud top height (i_FRir_cldtop) is set to a value of 0.10 km.

Value 13 = Indicates the possible presence of a cloud based on the value of the integrated signal parameter (i_FRir_intsig) that was not detected directly by the cloud search algorithm. When this occurs, the 40 Hz cloud top height (i_FRir_cldtop) is set to a value of 10.0 km.

Value 0 - 12 = Cloud detected by cloud search algorithm with higher numbers indicating a stronger average signal from the region starting at cloud top and extending 500 m below cloud top height.

---

### Figure E-4 Full Resolution 1064 Quality Flag

<table>
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<tr>
<th>MSB</th>
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<th>MSB</th>
<th>LSB</th>
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<th>Flags 1-40, Second 3</th>
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<th>LSB</th>
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### i_FRir_qaFlag [GLA06, 12-15]: Full Resolution 1064 Quality Flag

(i1b(40): 40 per second rate)

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**Figure E-4** Full Resolution 1064 Quality Flag
i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

af = availability flag: Tells how many cloud layers were found (from the 532 channel) at this resolution.
value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected

qf = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; value 1 = low chance of being a cloud; value 2 = moderate; value 3 = high; value 4 = no doubt

uf = use flag: not used at this time

df = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight

Figure E-5 High Resolution Cloud Layer Flag
**i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag** (4 seconds per record, 5 per second rate)

**Figure E-5 High Resolution Cloud Layer Flag (Continued)**

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<table>
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**Figure E-5 High Resolution Cloud Layer Flag (Continued)**
Figure E-5  High Resolution Cloud Layer Flag (Continued)
i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

Figure E-5  High Resolution Cloud Layer Flag (Continued)
Figure E-5  High Resolution Cloud Layer Flag (Continued)
Figure E-5  High Resolution Cloud Layer Flag (Continued)
i_HRCL_Flag [GLA09]: High Resolution Cloud Layer Flag (4 seconds per record, 5 per second rate)

i_LRCL_Flag [GLA09]: Low Resolution Cloud Layer Flag (4 seconds per record, at once per 4 second rate)

af = availability flag: Tells how many cloud layers were found at this resolution. The total number of layers found is the sum of those found using the 532 channel and the 1064 channel (thus, this number will generally be larger than the actual number of layers present).

Value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected.

df = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight.
**i_LRirc_QAflag [GLA09]: Low Resolution 1064 Quality Flag** (once per 4 seconds rate)

af = availability flag: It provides the number of cloud layers determined from the 1064 nm data.
value 0 = layers searched for but not detected; value 15 = cloud layers not searched for.

QAflag = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; values 1-14 indicate increasing confidence of good cloud retrieval (value 1 = least confidence, value 14 = greatest confidence).

---

**Figure E-7 Low Resolution 1064 Quality Flag**
i_MRCL_Flag [GLA09]: Medium Resolution Cloud Layer Flag (4 seconds per record, at once per second rate)

- **af** = availability flag: Tells how many cloud layers were found at this resolution. The total number of layers found is the sum of those found using the 532 channel and the 1064 channel (thus, this number will generally be larger than the actual number of layers present). Value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for, but not detected.

- **qf** = quality flag: Value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; value 1 = low chance of being a cloud; value 2 = moderate; value 3 = high; value 4 = no doubt

- **uf** = use flag: Tells which channel was used to detect the layer; value 0 = cloud layer was derived from 532 channel data; value 2 = cloud layer was derived from the 1064 channel data

- **df** = diurnal flag: This tells whether a given layer would be detected during normal daylight conditions. Value 0 = layer would not have been detected in typical daytime background; value 1 = layer would have been detected in daylight.

---

**Figure E-8 Medium Resolution Cloud Layer Flag**

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**Figure E-8 Medium Resolution Cloud Layer Flag (Continued)**
**i_MRIr_QAflag [GLA09, 11]: Medium Resolution 1064 Quality Flag** (4 seconds per record, at once per second rate)

af = availability flag: It provides the number of cloud layers determined from the 1064 nm data. 
value 0 = layers searched for but not detected; value 15 = cloud layers not searched for.

QAflag = quality flag: value 15 = cloud layers were not searched for; value 0 = cloud layers were searched for but not detected; values 1-14 indicate increasing confidence of good cloud retrieval (value 1 = least confidence, value 14 = greatest confidence).

---

**Figure E-9 Medium Resolution 1064 Quality Flag**
Figure E-10 Aerosol Backscatter Flag

Figure E-11 Aerosol Extinction Flag
Figure E-12  Cloud Backscatter Flag
i_clid1_bs_flag [GLA10]: Cloud Backscatter Flag (4 sec/records, up to 10 layers/sec.)
(QF = Quality Flag; UF = Use Flag)

Figure E-12 Cloud Backscatter Flag (Continued)
i_cld1_ext_flag [GLA10]: Cloud Extinction Flag (4 sec/records, up to 10 layers/sec.)

(QF = Quality Flag; UF = Use Flag)

Figure E-13  Cloud Extinction Flag
Figure E-13  Cloud Extinction Flag (Continued)

i_cld1_ext_flag [GLA10]: Cloud Extinction Flag (4 sec/records, up to 10 layers/sec.)
(QF = Quality Flag; UF = Use Flag)

Figure E-14  Aerosol True S Values Use Flag

i_aer4_sval_uf [GLA10]: Aerosol True S Values Use Flag (once per 4 sec., up to 9 layers/record)
**i_cld1_sval uf [GLA10]: Cloud True S Values Use Flag** (4 sec/records, up to 10 layers/sec.)

```
           Byte 1           Byte 2           Byte 3           Byte 4
              7             10            8              7
              9             6             5              4
              0             3              2

UF (second 4, layer 10-1)

           Byte 5           Byte 6           Byte 7           Byte 8
              7             10            8              7
              9             6             5              4
              0             3

UF (second 3, layer 10-1)

           Byte 9           Byte 10          Byte 11          Byte 12
              8             4             7              10
              7             2             1

UF (second 2, layer 10-1)

           Byte 13          Byte 14          Byte 15          Byte 16
              7             6             4             10
              8             5             3

UF (second 1, layer 10-1)

           Byte 17          Byte 18          Byte 19          Byte 20
              8             7             6             5
              4             3             2             1
```

**Figure E-15 Cloud True S Values Use Flag**
Figure E-16  Aerosol Optical Depth
**Figure E-17 Cloud Optical Depth**

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**UF (second 3, layer 10-1)**

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**UF (second 2, layer 10-1)**

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**UF (second 1, layer 10-1)**

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Figure E-17  Cloud Optical Depth (Continued)
Layer Use Flag Values

a) For backscatter cross section, the use flag gives saturation status as follows:

- **Use Flag Saturation Status**
  - 0 = no saturation detected
  - 1 = one or two bins were saturated with 1064 nm conversion performed
  - 2 = at least three bins were saturated with 1064 nm conversion performed
  - 3 = at least one but less than four bins were saturated with no conversion performed
  - 4 = four or more bins were saturated with no conversion performed
  - 15 = invalid

b) For extinction cross section and layer optical depth, the use flag designates layer type category as follows:

- **Use Flag Meaning**
  - Aerosol (based on S ratio default index, PSC flag, and tropopause height)
    - 00 = PBL generic (all PBL indices not mentioned below)
    - 01 = PBL maritime (index 4)
    - 02 = PBL continental ice (index 7)
    - 03 = PBL continental haze (index 11)
    - 04 = PBL Saharan dust (index 12)
    - 05 = PBL desert (index 13)
    - 06 = PBL smoke (indices 15,3)
    - 07 = TROP generic (all TROP indices not mentioned below)
    - 08 = TROP volcanic (index 3)
    - 09 = TROP continental haze (index 11)
    - 10 = TROP Saharan dust (index 12)
    - 11 = TROP smoke (index 15)
    - 12 = STRATO aerosol (any non-PSC layer whose top is > tropopause
    - 13 = PSC type I (PSC with rh less than or equal to 95%)
    - 14 = PSC type II (PSC with rh greater than 95%)
    - 15 = invalid

- Cloud (based on average cloud temperature, water cloud is warmer than –13 C)
  - **Use Flag Meaning**
    - 00 = less than or equal to –75.0 C
    - 01 = –75.0 through –68.5
    - 02 = –68.5 through –62.0
    - 03 = –62.0 through –55.5
    - 04 = –55.5 through –49.0
    - 05 = –49.0 through –32.5
    - 06 = –32.5 through –26.0
    - 07 = –26.0 through –19.5
    - 08 = –19.5 through –13.0
    - 09 = –13.0 through –6.5
    - 10 = –6.5 through 0.0
    - 11 = 0.0 through 6.5
    - 12 = 6.5 through 13.0
    - 13 = 13.0 through 19.5
    - 14 = greater than 19.5 C
    - 15 = invalid

**Figure E-17  Cloud Optical Depth (Continued)**
### i_cld1_mswf [GLA11]: Multiple Scattering Warning Flag (4 sec. per record, at once per second rate)

4 bit set of values:

- 0 = < 0.010
- 1 = 0.010 - 0.030
- 2 = 0.030 - 0.060
- 3 = 0.060 - 0.100
- 4 = 0.100 - 0.150
- 5 = 0.150 - 0.225
- 6 = 0.225 - 0.300
- 7 = 0.300 - 0.400
- 8 = 0.400 - 0.500
- 9 = 0.500 - 0.670
- 10 = 0.670 - 0.900
- 11 = 0.900 - 1.200
- 12 = 1.200 - 1.600
- 13 = 1.600 - 2.000
- 14 = > 2.000
- 15 = Invalid

#### Note:
A warning flag value of 15 will be the default whenever no 532nm signal is available (as when the 532 laser energy is < 4 mJ during daytime). To distinguish this case from that of optically thick clouds, one must check the number of layers. If there were zero layers reported, but the MSWF is 15, then the cause is the lack of useable 532 data. If the number of layers is > 0 and the MSWF is 15, then the cause is total extinction of the lidar beam (this happens for clouds of optical depth > about 3). A warning flag of 0 is a very good indicator of no layers or a layer so thin it won’t cause any altimetry range delays.

#### Figure E-18  Multiple Scattering Warning Flag
### Layer Use Flag Values

#### a) For backscatter cross section, the use flag gives saturation status as follows:

**Use Flag SATURATION STATUS**

- 0 = no saturation detected
- 1 = one or two bins were saturated with 1064 nm conversion performed
- 2 = at least three bins were saturated with 1064 nm conversion performed
- 3 = at least one but less than four bins were saturated with no conversion performed
- 4 = four or more bins were saturated with no conversion performed

15 = invalid

#### b) for extinction cross section and layer optical depth, the use flag designates layer type category as follows:

**Aerosol: (based on S ratio default index, PSC flag, and tropopause height)**

- 00 = PBL generic (all PBL indices not mentioned below)
- 01 = PBL maritime (index 4)
- 02 = PBL continental ice (index 7)
- 03 = PBL continental haze (index 11)
- 04 = PBL Saharan dust (index 12)
- 05 = PBL desert (index 13)
- 06 = PBL smoke (indices 15,3)
- 07 = TROP generic (all TROP indices not mentioned below)
- 08 = TROP volcanic (index 3)
- 09 = TROP continental haze (index 11)
- 10 = TROP Saharan dust (index 12)
- 11 = TROP smoke (index 15)
- 12 = STRATO aerosol (any non-PSC layer whose top is > tropopause)
- 13 = PSC type I (PSC with rh less than or equal to 95%)
- 14 = PSC type II (PSC with rh greater than 95%)

15 = invalid

**Cloud: (based on average cloud temperature, water cloud is warmer than –13°C)**

- 00 = less than or equal to –75.0°C
- 01 = –75.0 through –68.5
- 02 = –68.5 through –62.0
- 03 = –62.0 through –55.5
- 04 = –55.5 through –49.0
- 05 = –49.0 through –32.5
- 06 = –32.5 through –26.0
- 07 = –26.0 through –19.5
- 08 = –19.5 through –13.0
- 09 = –13.0 through –6.5
- 10 = –6.5 through 0.0
- 11 = 0.0 through 6.5
- 12 = 6.5 through 13.0
- 13 = 13.0 through 19.5
- 14 = greater than 19.5°C

15 = invalid

### Quality Flag Values

- 0 = 0-5 % Error
- 1 = 5-10 % Error
- 2 = 10-15 % Error
- 3 = 15-20 % Error
- 4 = 20-25 % Error
- 5 = 25-30 % Error
- 6 = 30-35 % Error
- 7 = 35-40 % Error
- 8 = 40-45 % Error
- 9 = 45-50 % Error
- 10 = 50-55 % Error
- 11 = 55-60 % Error
- 12 = 60-65 % Error
- 13 = 65-70 % Error
- 14 = 70 and greater % Error

15 = Unable to process
**i_SiRufQF [1/sec for GLA13]: Sea Ice Roughness Quality Flag**; One byte per shot data quality flag

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- **0**: Roughness valid (other bits may indicate degradation)
- **1**: Roughness invalid
- **0**: Single peak waveform from standard fit
- **1**: Multi-peak waveform from standard fit - roughness and slope degraded and will not be representative of full footprint
- **0**: Reasonable values for standard deviation of the width of gaussian for received wv
- **1**: High values for standard deviation of the width of gaussian for received wv - may cause degradation of slope and roughness values
- **0**: No problems with received/transmitted pulse widths
- **1**: Valid values do not exist for slope and roughness
- **0**: Roughness calculated from Gaussian fits to transmitted and received wfs
- **1**: Roughness calculated from external source
- **2**: Roughness calculated as rms of 40 surface elevations

**Figure E-20 Sea Ice Roughness Quality Flag**
i_OcRMSqf [1/sec for GLA15]: Ocean RMS Roughness Quality Flag; one byte per shot quality flag

Figure E-21  Ocean RMS Roughness Quality Flag
Figure E-22 APID Data Availability Flag

2 bit sets of values; 0= present, 1= filled at EDOS, 2= never received - ISIPS filled
Figure E-22  APID Data Availability Flag (Continued)

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- Altimeter Digitizer small waveform packet for 4th 10 shots
- Altimeter Digitizer small waveform packet for 3rd 10 shots
- Altimeter Digitizer small waveform packet for 2nd 10 shots
- Altimeter Digitizer small waveform packet for 1st 10 shots
- Altimeter Digitizer large waveform packet for 4th 10 shots
- Altimeter Digitizer large waveform packet for 3rd 10 shots
- Altimeter Digitizer large waveform packet for 2nd 10 shots
- Altimeter Digitizer large waveform packet for 1st 10 shots

C&T board telemetry data in Ancillary science packet
Photon counter telemetry data in Ancillary science packet
Cloud Digitizer telemetry data in Ancillary science packet
Altimeter Digitizer telemetry data in Ancillary science packet
1064 Cloud Digitizer packet
532 Photon counter packet
Altimeter Digitizer small waveform packet for 4th 10 shots
Altimeter Digitizer small waveform packet for 3rd 10 shots
Altimeter Digitizer small waveform packet for 2nd 10 shots
Altimeter Digitizer small waveform packet for 1st 10 shots
Altimeter Digitizer large waveform packet for 4th 10 shots
Altimeter Digitizer large waveform packet for 3rd 10 shots
Altimeter Digitizer large waveform packet for 2nd 10 shots
Altimeter Digitizer large waveform packet for 1st 10 shots

2 bit sets of values; 0= present, 1= filled at EDOS, 2= never received - ISIPS filled

**i_APID_AvFlg** [1/sec for GLA01, 02, 04-07, 12-15], [1/16 sec for GLA03]: APID Data Availability Flag (continued)
**i_OrbFlg [1/sec for GLA01, 02, 05-15]: Orbit Flag**

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<tr>
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</table>

- **Spares**
  - 0: no model problems
  - 1: model problems; orbit RMS > 5 cm; required accuracy not met
- **0** = no maneuvers
  - 1: maneuvers occurred during this record; orbit degraded
- **0** = no maneuvers
  - 1: maneuvers occurred during this record; orbit degraded
- **0** = no GPS data outage
  - 1: GPS data missing from portion of this record, possible degradation
- **0** = precision orbit used
  - 1: predicted orbit used
  - 2: on-board orbit used
- **0** = instrument attitude used for orbit
  - 1: modeled attitude used, possible orbit degradation
- **0** = solar ray orientation used from measurement
  - 1: modeled solar ray orientation, possible orbit degradation

---

**Figure E-23 Orbit Flag**
Figure E-24  Correction Status Flag
i_atmQF [1/sec for GLA05, 06, 12-15]: Atmosphere Flag

2 bit flags, 40/second

### MSB

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Shots 40 - 25

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</tr>
<tr>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Shots 24 - 09

### LSB

<table>
<thead>
<tr>
<th>Byte 9</th>
<th>Byte 10</th>
<th>LSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Shots 08 - 01

- 0=conditions not favorable for forward scattering
- 1=conditions favorable for forward scattering
- 0=atmdf flag has been set using LIDAR products
- 1=atmdf forward scattering flag has not been set - no valid Atmosphere data available for this shot

Figure E-25 Atmosphere Flag
Figure E-26  Attitude Flag 1
i_AttFlg2 [1/sec for GLA05,06,12-15]: Attitude Flag 2

Bytes 1-5, PAD Use Flag: 1 bit/shot values; 0 = PAD used to determine spot location, 1 = PAD not used to determine spot location
Bytes 6-10, Calc PAD Use Flag: 1 bit/shot values; 0 = new PAD used to determine orbit, 1 = pass-thru PAD not used to determine orbit
Bytes 11-20, LPA Problem Flag: 2 bit/shot values; 0 = no problems with LPA, 1 = missing LPA, 2 = noisy LPA

Calc PAD Use Flag (shots 40 - 17)

LPA Problem Flag (for shots 40 - 33)

Figure E-27 Attitude Flag 2

i_AttFlg3 [1/sec for GLA07-11]: Attitude Flag 3

0=PAD used for geolocation
1=PAD not used for geolocation

Figure E-28 Attitude Flag 3
**Figure E-29 Elevation Definition Flag**

i_ElvFlg [1/sec GLA05, 06, 12-15]: Elevation Definition Flag; Indicates which location on the received echo was used to calculate the elevation on the record.

1-byte flags, 40/second.

<table>
<thead>
<tr>
<th>Byte 1</th>
<th>Byte 2</th>
<th>Byte 3</th>
<th>Byte 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

- 1 = centroid of received pulse between signal begin and signal end defined for standard parameterization used to calculate elevation
- 1 = centroid of received pulse between signal begin and signal end defined for alternate parameterization used to calculate elevation
- 1 = location of last Gaussian peak in received pulse for standard parameterization used to calculate elevation
- 1 = location of last Gaussian peak in received pulse for alternate parameterization used to calculate elevation
- 1 = location of threshold retracker used to calculate elevation
- 1 = location associated with Gaussian with largest peak used to calculate elevation
- 1 = "other" algorithm used to calculate elevation - see software release documentation for details
- 1 = Gain > flag value, indicating probable cloud contamination

**Figure E-30 Elevation Use Flag**

i_ElvuseFlg [1/sec for GLA05, 06, 12-15]: Elevation Use Flag; One flag per shot; indicates quality to use based on valid or invalid criteria

1-bit flags, 40/second.

0 = elevation is valid
1 = elevation is invalid

<table>
<thead>
<tr>
<th>Byte 1</th>
<th>Byte 2</th>
<th>Byte 3</th>
<th>Byte 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
</tbody>
</table>
Figure E-31  Altimeter Quality Flag

0=all data in frame is good with appropriate corrections applied
1=some of data is not corrected or has measurement problems
0=there is at least some usable data in the frame
1=all elevations in the frame are bad due to problems with corrections
0=all GLAS measurements are good,
1=there is at least one unusable measurement in the frame
0=there is at least one usable measurement in the frame
1=all GLAS measurements are bad
**i_rngCorrFlg** [1/sec for GLA05, 06, 12-15]: Range Correction Flag

2 byte set of 1 bit values: 0=used, 1=not used

Note: This is a range correction flag. Some of the corrections are applied to the reference range, i_refrng on the data record, and some of them are used in the calculation of the elevation but are not applied to the reference range.

**Figure E-32 Range Correction Flag**

**i_atm_avail** [1/sec for GLA06, 12-15]: Atmosphere Availability Flag

1 = GLA09 data available
0 = GLA09 data not available
1 = GLA11 data available
0 = GLA11 data not available

**Figure E-33 Atmosphere Availability Flag**
### i_cld1_mswf [GLA06, 12-15]: Multiple Scattering Warning Flag

4 bit set of values:

- 0 = < 0.010
- 1 = 0.010 - 0.030
- 2 = 0.030 - 0.060
- 3 = 0.060 - 0.100
- 4 = 0.100 - 0.150
- 5 = 0.150 - 0.225
- 6 = 0.225 - 0.300
- 7 = 0.300 - 0.400
- 8 = 0.400 - 0.500
- 9 = 0.500 - 0.670
- 10 = 0.670 - 0.900
- 11 = 0.900 - 1.200
- 12 = 1.200 - 1.600
- 13 = 1.600 - 2.000
- 14 = > 2.000
- 15 = Invalid

---

Note: A warning flag value of 15 will be the default whenever no 532nm signal is available (as when the 532 laser energy is < 4 mJ during daytime).

To distinguish this case from that of optically thick clouds, one must check the number of layers. If there were zero layers reported, but the MSWF is 15, then the cause is the lack of useable 532 data. If the number of layers is > 0 and the MSWF is 15, then the cause is total extinction of the lidar beam (this happens for clouds of optical depth > about 3).

A warning flag of '0' is a very good indicator of no layers or a layer so thin it won't cause any altimetry range delays.

---

**Figure E-34  Multiple Scattering Warning Flag**
Flags

GLAS Standard Data Products Specification - Level

Figure E-35 Correction Status Flag

<table>
<thead>
<tr>
<th>i_CorrStatFlg</th>
<th>[1/sec for GLA06, 12-15]: Correction Status Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Byte 1</td>
<td>Byte 2</td>
</tr>
<tr>
<td>0 1 2 3 4 5 6</td>
<td>7 6 5 4 3 2 1 0</td>
</tr>
</tbody>
</table>

- 0: Load and ocean tides are from global model.
- 1: Load and ocean tides are from regional model no. 1.
- 2: Load and ocean tides are from regional model no. 2.
- 3: Load and ocean tides are from regional model no. 3.
- 4: Troposphere corrections based on 6hr NCEP grids surrounding data.
- 5: Troposphere corrections based on 6hr NCEP grids but at least one was >6 but <24 hrs away from data.
- 6: Troposphere corrections based on standard clim.
- 7: Troposphere corrections based on reanalyzed met data.
- 8: Computed aerosol and cloud optical depths used to calculate corrected reflectivity.
- 9: Default-null aerosol and cloud optical depths used.
- 10: Computed aerosol and default-null cloud optical depths used.
- 11: Default-null values for aerosol and cloud optical depths used to calculate corrected reflectivity.
- 12: Maximum bound set.

Figure E-36 High Resolution Source Flag

<table>
<thead>
<tr>
<th>i_DEM_hires_src</th>
<th>[1/sec for GLA06,14]: High Resolution Source Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-byte flag, 40/second</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 6 5 4 3 2 1 0</td>
</tr>
</tbody>
</table>

- 0: No high res source available.
- 1: “Unfinished research” Shuttle Radar Topography Mission (SRTM) C-band 90 m DEM produced by JPL.
- 2: “Finished” SRTM C-band 90 m DEM produced by NGA.

Figure E-37 Medium Resolution Cloud Availability Flag

<table>
<thead>
<tr>
<th>i_MRC_av</th>
<th>[GLA06, 12-15]: Medium Resolution Cloud Availability Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tells how many cloud layers were found at this resolution. The total number of layers found is the sum of those found using the 532 channel and the 1064 channel (thus, this number will generally be larger than the actual number of layers present). Value 15 = cloud layers were not searched for, value 0 = cloud layers were searched for, but not detected.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Byte 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 6 5 4 3 2 1 0</td>
</tr>
</tbody>
</table>
i_rng_UQF [1/sec for GLA06, 12-15]: Range Increment Quality/Use Flag; Two bytes per shot. Shot 1 is in first location in array.

<table>
<thead>
<tr>
<th>MSB</th>
<th>Byte 1</th>
<th>Byte 2</th>
<th>Byte 3</th>
<th>Byte 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>98765</td>
<td>43210</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LSB</th>
<th>Byte 77</th>
<th>Byte 78</th>
<th>Byte 79</th>
<th>Byte 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- 0 = signal begin range increment - standard parameterization - valid
- 1 = signal begin range increment - standard parameterization - invalid
- 0 = signal end range increment - standard parameterization - valid
- 1 = signal end range increment - standard parameterization - invalid
- 0 = centroid range increment - standard parameterization - valid
- 1 = centroid range increment - standard parameterization - invalid
- 0 = threshold retracker range increment - standard parameterization - valid
- 1 = threshold retracker range increment - standard parameterization - invalid
- 0 = signal begin range increment - alternate parameterization - valid
- 1 = signal begin range increment - alternate parameterization - invalid
- 0 = signal end range increment - alternate parameterization - valid
- 1 = signal end range increment - alternate parameterization - invalid
- 0 = centroid range increment - alternate parameterization - valid
- 1 = centroid range increment - alternate parameterization - invalid
- 0 = threshold retracker range increment - alternate parameterization - valid
- 1 = threshold retracker range increment - alternate parameterization - invalid
- 0 = ice sheet range increment - valid
- 1 = ice sheet range increment - invalid
- 0 = sea ice range increment - valid
- 1 = sea ice range increment - invalid
- 0 = land range increment - valid
- 1 = land range increment - invalid
- 0 = ocean range increment - valid
- 1 = ocean range increment - invalid

- Saturation flag set - low gain situation - set from bit 22 of i_WFqual flag
- Saturation flag set - high gain situation - set from bit 23 of i_WFqual flag
- Saturation (high gain situation) and forward scattering - set from bit 24 of i_WFqual flag

Figure E-38 Range Increment Quality/Use Flag
i_SurfRuf_slpQF {1/sec for GLA06, 12,14}: Surface Roughness and Slope Quality Flag: One byte per shot data quality flag.

Figure E-39 Surface Roughness and Slope Quality Flag
**I$_{surfType}$** [GLA06, 12-15]: Region Type

1 byte of 1 bit values

![Region Type Diagram]

**I$_{LidarQF}$** [1/1 sec for GLA07], [1/4 sec for GLA08-11]: Lidar Frame Quality Flag

- 0: good data
- 1: data unsuitable for L2 processing due to weak 532 laser energy or high background
- 2: either SPCMs not turned on or bad background

![Lidar Frame Quality Flag Diagram]
# Abbreviations & Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2P</td>
<td>Algorithm-to-Product Conversion</td>
</tr>
<tr>
<td>ALT</td>
<td>Altimeter or Altimetry, also designation for the EOS-Altimeter spacecraft series</td>
</tr>
<tr>
<td>ANCxx</td>
<td>GLAS Ancillary Data Files</td>
</tr>
<tr>
<td>APID</td>
<td>GLAS Level-0 Data file</td>
</tr>
<tr>
<td>ATBD</td>
<td>Algorithm Theoretical Basis Document</td>
</tr>
<tr>
<td>ATM</td>
<td>Atmosphere</td>
</tr>
<tr>
<td>CCB</td>
<td>Change Control Board</td>
</tr>
<tr>
<td>ClearCase</td>
<td>GSAS version tracking software</td>
</tr>
<tr>
<td>CR</td>
<td>Change Request</td>
</tr>
<tr>
<td>DAAC</td>
<td>Distributed Active Archive Center</td>
</tr>
<tr>
<td>DEM</td>
<td>Digital Elevation Model</td>
</tr>
<tr>
<td>DFD</td>
<td>Data Flow Diagram</td>
</tr>
<tr>
<td>DLT</td>
<td>Digital Linear Tape</td>
</tr>
<tr>
<td>EDOS</td>
<td>EOS Data and Operations System</td>
</tr>
<tr>
<td>EDS</td>
<td>Expedited Data Set</td>
</tr>
<tr>
<td>ELEV</td>
<td>Elevation</td>
</tr>
<tr>
<td>EOC</td>
<td>EOS Operating Center</td>
</tr>
<tr>
<td>EOS</td>
<td>NASA Earth Observing System Mission Program</td>
</tr>
<tr>
<td>EOSDIS</td>
<td>Earth Observing System Data and Information System</td>
</tr>
<tr>
<td>GB</td>
<td>Gigabyte</td>
</tr>
<tr>
<td>GDS</td>
<td>GLAS Ground Data System</td>
</tr>
<tr>
<td>GLAS</td>
<td>Geoscience Laser Altimeter System instrument or investigation</td>
</tr>
<tr>
<td>GLAxx</td>
<td>GLAS Science Data Product Files</td>
</tr>
<tr>
<td>GLOP</td>
<td>GLAS Level-0 PGE (correctly called GLAS_L0proc)</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>GSAS</td>
<td>GLAS Science Algorithm Software</td>
</tr>
<tr>
<td>GSFC</td>
<td>NASA Goddard Space Flight Center at Greenbelt, Maryland</td>
</tr>
<tr>
<td>GSFC/WFF</td>
<td>NASA Goddard Space Flight Center/Wallops Flight Facility at Wallops Island, Virginia</td>
</tr>
<tr>
<td>TBD</td>
<td>to be determined, to be done, or to be developed</td>
</tr>
</tbody>
</table>
Glossary

aggregate A collection, assemblage, or grouping of distinct data parts together to make a whole. It is generally used to indicate the grouping of GLAS data items, arrays, elements, and EOS parameters into a data record. For example, the collection of Level 1B EOS Data Parameters gathered to form a one-second Level 1B data record. It could be used to represent groupings of various GLAS data entities such as data items aggregated as an array, data items and arrays aggregated into a GLAS Data Element, GLAS Data Elements aggregated as an EOS Data Parameter, or EOS Data Parameters aggregated into a Data Product record.

array An ordered arrangement of homogenous data items that may either be synchronous or asynchronous. An array of data items usually implies the ability to access individual data items or members of the array by an index. An array of GLAS data items might represent the three coordinates of a georeference location, a collection of values at a rate, or a collection of values describing an altimeter waveform.

file A collection of data stored as records and terminated by a physical or logical end-of-file (EOF) marker. The term usually applies to the collection within a storage device or storage media such as a disk file or a tape file.

header A text and/or binary label or information record, record set, or block, prefacing a data record, record set, or a file. A header usually contains identifying or descriptive information, and may sometimes be embedded within a record rather than attached as a prefix.

item Specifically, a data item. A discrete, non-decomposable unit of data, usually a single word or value in a data record, or a single value from a data array. The representation of a single GLAS data value within a data array or a GLAS Data Element.

label The text and/or binary information records, record set, block, header, or headers prefacing a data file or linked to a data file sufficient to form a labeled data product. A label may consist of a single header as well as multiple headers and markers depending on the defining authority.

Level 0 The level designation applied to an EOS data product that consists of raw instrument data, recorded at the original resolution, in time order, with any duplicate or redundant data packets removed.

Level 1A The level designation applied to an EOS data product that consists of reconstructed, unprocessed Level 0 instrument data, recorded at the full resolution with time referenced data records, in time order. The data are annotated with ancillary information including radiometric and geometric calibration coefficients, and georeferencing parameter data (i.e., ephemeris data). The included, computed coefficients and parameter data have not however been applied to correct the Level 0 instrument data contents.

Level 1B The level designation applied to an EOS data product that consists of Level 1A data that have been radiometrically corrected, processed from raw data into sensor data units, and have been geolocated according to applied georeferencing data.
Level 2 The level designation applied to an EOS data product that consists of derived geophysical data values, recorded at the same resolution, time order, and georeference location as the Level 1A or Level 1B data.

Level 3 The level designation applied to an EOS data product that consists of geophysical data values derived from Level 1 or Level 2 data, recorded at a temporally or spatially resampled resolution.

Level 4 The level designation applied to an EOS data product that consists of data from modeled output or resultant analysis of lower level data that are not directly derived by the GLAS instrument and supplemental sensors.

metadata The textual information supplied as supplemental, descriptive information to a data product. It may consist of fixed or variable length records of ASCII data describing files, records, parameters, elements, items, formats, etc., that may serve as catalog, data base, keyword/value, header, or label data. This data may be parsable and searchable by some tool or utility program.

orbit revolution The passage of time and spacecraft travel signifying a complete journey around a celestial or terrestrial body. For GLAS and the EOS ICESat spacecraft each orbit revolution count starts at the time when the spacecraft is on the equator traveling toward the North Pole, continues through the equator crossing as the spacecraft ground track moves toward the South Pole, and terminates when the spacecraft has reached the equator moving northward from the South Polar region.

parameter Specifically, an EOS Data Parameter. This is a defining, controlling, or constraining data unit associated with a EOS science community approved algorithm. It is identified by an EOS Parameter Number and Parameter Name. An EOS Data Parameter within the GLAS Data Product is composed of one or more GLAS Data Elements.

pass A sub-segment of an orbit, it may consist of the ascending or descending portion of an orbit (e.g., a descending pass would consist of the ground track segment beginning with the northernmost point of travel through the following southernmost point of travel), or the segment above or below the equator (e.g., either the northern or southern hemisphere portion of the ground track on any orbit).

product Specifically, the Data Product or the EOS Data Product. This is implicitly the labeled data product or the data product as produced by software on the DAAC or SCF. A GLAS data product refers to the data file or record collection either preaced with a product label or standard formatted data label or linked to a product label or standard formatted data label file. Loosely used, it may indicate the entire set of product files contained in a data repository.

record A specific organization or aggregate of data items. It represents the collection of EOS Data Parameters within a given time interval, such as a one-second data record. It is the first level decomposition of a product file.

Standard Data Product Specifically, a GLAS Standard Data Product. It represents an EOS ICESat/GLAS Data Product produced on the DAAC or on the SCF. It is routinely produced and is intended to be archived in the EOSDIS data repository for EOS user community-wide access and retrieval.

variable Usually a reference in a computer program to a storage location.