SCF
Data Management System File Formats Document

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1. Data Management System

The DMS does not use special COTS software but consists of a set of tables that are associated with each data file. The purpose of the data management system is to allow one to create subsets of the GLAS standard data products by directly accessing the records that fall within the temporal span and/or geographic region requested for the subset instead of reading through all the data sequentially. This allows for creating subsets of the original GLAS product granules efficiently, since the entire granule need not be read to determine the specific records required. This design is based on the DMS in use at GSFC for the polar ice radar altimetry data. The only real requirement for this type of system is that the data files must be direct access files. For GLAS we also make use of the fact that each data record in every granule contains the unique record index assigned when processing the level 0 data. This unique record index is assigned for every 1-second frame of data and is a function of the time on the level 0 data. Since it exists on every product, one can use it to correlate data across the products.

To allow geographic subsetting, the world is divided into a set of bins. This georeference bin configuration selected for GLAS is defined in Table 1. Given this information, the bin numbers included in any latitude/longitude defined rectangular region can be analytically calculated.

Beginning Latitude	-90.0°N
Beginning Longitude	0.0°E
Ending Latitude	90.0°N
Ending Longitude	360.0°E
Width of bins in Latitude°	1.0
Width of bins in Longitude°	1.0

Table 1: Georeference Bin Configuration for GLAS

One bin table and one georeference table are created per product granule. The names of the bin tables for the altimetry products GLA01, 3-6, 12-15 start with “BNA” while those for the lidar products GLA02, 7-11 start with “BNL”. Similarly, the names of the georeference tables start with “GRA” for the altimetry products and “GRL” for the lidar products.

2. DMS Table Formats and Creation

The DMS tables are direct access binary files. The beginning of each table contains header records consisting of “keyword=value” strings in ASCII. The header records are followed by the fixed length binary data records.

The first two records of each file are:

RECL=N;
NUMHEAD=M;

Where N is the integer record length and M is the number of header records. Capital letters denote keywords and must be typed as shown; a semicolon terminates lines. Blank lines and spaces before and after the equal sign are irrelevant. Multiple "keyword=value;" headers may be on one header record up to the record length RECL. Each header record is terminated with a new line character.

Each file contains the two header records listed above and more keywords may follow that are table-specific. Following the header records are the data records defined below.

2.1. Bin Table (BN file)

This has a file name that starts with “BN”. This table defines which bins each data set traverses and the unique record numbers within the data set that go through that bin. It is a direct access file that has one record for each instance that a pass enters and leaves a bin. The bin table contains 24 byte records that are described in Table 2.

Bytes	Type of variable	Description
1-4	I*4	Georeference bin number
5-15	Char*11	Pass ID (prkkccctttt)
16	Char*1	Spare byte so next integer will start on 4 byte boundary
17-20	I*4	Unique record index of first record on this pass that traverses this bin
21-24	I*4	Unique record index of the last record on this pass that traverses this bin

Table 2: Bin table data record format

The data records in the bin table file are sorted primarily by bin number, secondarily by pass number, and finally by beginning unique record index.

To create the bin/rev directory table, a Fortran 90 program, mkbinrev, is supplied that reads sequentially all the data in the product set for that specific product. As each data record is read, the geographic bin corresponding to the latitude and longitude on that record is calculated using the geographic bin configuration. The program keeps track of the first unique record number and the last unique record number for each bin and outputs a record to a scratch file every time the bin number changes. This scratch file is then sorted first by bin, then pass ID within the bin and lastly by unique record index within each pass within the bin. The sorted file is then the bin directory table.

2.2. Georeference Table (GR file)

This has a file name that starts with “GR”. This is a directory of the bin table that allows direct access to the start of each bin the bin table. There is one georeference table for each bin table. The georeference directory tables are direct access files of 12 bytes record length consisting of: geographic bin number, beginning data record number within the bin/rev table for this bin, and the ending data record number within the bin/rev table for this bin -each a 4 byte integer field.

These are shown in Table 3. The georeference table is created from the bin table using the Fortran 90 program, mkgeo. Note that the size of both these tables is dependent on the geographic bin resolution and not on the resolution of the data.

Bytes	Type of variable	Description
1-4	I*4	Georeference bin number
5-8	I*4	beginning data record number within the bin/ table for this bin,
9-12	I*4	ending data record number within the bin table for this bin

Table 3: Georeference table data record format

2.3. Unique Record Index Table (UR file)

This has a file name that starts with "UR". This is a table that allows one to calculate the data records within a file that correspond to specific unique record index numbers. One of these is required for each GLAS standard product file (GLA01-GLA15) in the product set. This is a direct access file of either 20 or 24 byte records. The extra 4 bytes are required for the table for GLA01 in order to specify waveform record mode. Data records are defined in Table 4.

Bytes	Type of variable	Description
1-4	I*4	Beginning unique record number
5-8	I*4	Ending unique record number,
9-16	R*8	UTC time of the beginning unique record number in seconds relative to noon, January 1, 2000
17-20	I*4	The data record number within this file that corresponds to the beginning unique record number – the first data record is number 1 (header records do not affect this number)
21-24	I*4	Waveform record mode (for GLA01 only)

Table 4: Unique Record Index table data record format

One data record is written every time there is a break in unique record index in the file or for GLA01, a record also has to be written every time the waveform record mode changes. Note that for the granules with a record time span of 1 second, the unique record index will change by approximately 10 between contiguous records, for the granules with a record time span of 4 seconds; the unique record index will change by approximately 40 between contiguous records. Therefore, if the difference between unique record indices is more than the nominal value of 10 or 40, then a new data record is written to the unique record index table.

In addition to the two header records described in section 2 above, the UR file contains a third header record:

UIXDELTA=uix_delta;

where uix_delta is the is difference in unique index records between two consecutive product records. This changed at release 31 (GSAS v5.6) and therefore the header was added. For releases 30 and lower, this difference is 10 between 1 sec records and 40 between 4 sec records (GLA08-11). For releases 31 and higher, this difference is 5 between 1 sec records and 20 between 4 sec records (GLA08-11).

2.4. Pass Table (PS file)

This has a file name that starts with "PS". This table defines the passes present in the product set. One pass table is required for each GLAS Standard Product file (GLA01-GLA15) in the product set. The pass table is a direct access file of 20 byte records. The format of the data records is given in Table 5.

Bytes	Type of variable	Description
1-4	I*4	Reference orbit designator - prkk
5-8	I*4	Cycle number -ccc
9-12	I*4	Track number - tttt
13-16	I*4	Beginning unique record number of a contiguous span of data
17-20	I*4	Ending unique record number of a contiguous span of data

Table 5: Pass table data record format

The pass table will have one record for every contiguous set of data for a specific pass.

2.5. Rev Table

This table correlates pass ID's and rev numbers with start times for all reference orbits. The rev table is a direct access file with 28 byte records described in table 6.

Bytes	Type of variable	Description
1-8	R*8	UTC time
9-12	I*4	Longitude of the ascending node
11-23	Char*11	Pass ID (prkkccctttt)
24	Char*1	Spare byte so next integer will start on 4 byte boundary
25-28	I*4	Rev number

Table 6: Rev table data record format

UTC time is the time in seconds relative to noon January 1, 2000. In the rev file, the time is the time of the ascending node. The ascending node is the point where the track crosses the equator and continues towards the north. The longitude of the ascending node is in micro degrees.

The rev number is determinate by TBD. The revs are numbered consecutively in time from rev 1.

In addition to the two header records described in section 2 above, the rev file contains a third header record:

REF_ID=prkk

where p is the repeat ground track phase, r is the reference orbit number, and kk is the instance incremented every time we enter a different reference orbit. This header was included when there used to be separate rev files for each reference orbit. Since there is now only one rev file containing all reference orbits, it is no longer used.