Mabel Release 010
Software Change and Release Note

Version 1.0, 11/05/2014

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MABEL 2.0.1 Software Changes

Updated: 2014-11-05

The initial 2014 MABEL campaign data were processed with MABEL 2.0 software in order to quickly assess MABEL performance during the 2014 summer campaign. Since the release of that data, errors were found and improvements were made to MABEL software. The updated software is MABEL v2.0.1. The reprocessing strategy is now to reprocess the entire dataset with the MABEL 2.0.1 software and create Release 010 data. No additional Release 009 data will be processed and the existing Release 009 data will be replaced.

The following changes were made between MABEL software 2.0 and 2.0.1:

> [MABEL-308] – Made continuing improvements to the surface classification algorithm. These include: fixing errors detected during code review with algorithm lead; fixing an issue where the integration time was not being correctly incremented; making the slant histogramming an iterative process; fixing the slant histogram range window; better handling of the case where there are insufficient photons to determine the atmosphere background. (mabel_l2a)

> [MABEL-309] - Fixed a problem where the photonID (ph_id) was not reset for each shot. The photonID is assigned before the range-window filtering, so values will not necessarily be consecutive. Changed the HDF5 datatype of ph_id to INTEGER_2. (mabel_l2a)

> [MABEL-310] - Fixed an L0 file-seaming problem that caused a bad delta_time to get into the data stream. The previous startshot & shottag information were not being retained when transitioning between L0 input files. This has been corrected. (mabel_l1a)

> [MABEL-311] - Fixed an issue where the last photon seen was not being copied from the unfiltered photon array to the filtered photon array. This caused a photon with latitude & longitude = 0.0 to creep into the data. Also fixed an averaging problem that caused an inaccuracy in the ATL & ATM segment latitude & longitude values. (mabel_l2a)

> [MABEL-315] – Fixed an issue where the L1A stopshot statistics had the values for "skipped" and "used" reversed. (mabel_l1a)

> [MABEL-317] – Fixed an issue that caused the atmosphere delay correction to shift the photon height by an incorrect value when the DEM was near 0.0. (mabel_l2a)

> [MABEL-318] – Fixed an interpolation issue when the INS heading toggles between 0 and 360 degrees. (mabel_l2a)

The remainder of this release note reflects changes and improvements made in the MABEL 2.0 and MABEL 2.0.1 software.

Introduction

MABEL Release 010 is a major release that provides new versions of all L1A, L1B and L2A data. This release contains significant improvements. Several improvements are implemented specifically to give data users an advanced look at ICESat-2-like data features. Features the

software development team intends to incorporate within ICESat-2 processing are labeled with (ICESat-2).

Release 010 Improvements include:

- "/ancillary_data/gps_sec_offset" was renamed to "/ancillary_data/granule_gps_epoch" to better identify the purpose of the parameter.

- Implemented a larger L2A photon range window to avoid cut-off when the DEM is inaccurate or when attitude drives the photons significantly off the reference track.

- Higher fidelity between the MABEL L2A and ATLAS ATL03 product structures. (ICESat-2)

- Implementation of the ATL03 Signal Classification algorithm. (ICESat-2)

- Implementation of the ATL03 Atmosphere Delay algorithm. (ICESat-2)

- Removal of the legacy GLAS troposphere correction.

- Improved EGM96 geoid interpolations (ICESat-2).

- Addition of EGM2008 geoid values (ICESat-2).

- Improved DEMs including better interpolations and an updated GIMP DEM. DEMs are primarily used for constructing the range masks (ICESat-2).

- Removal of the DEM and DEM flag from the L2A product. (ICESat-2)

- Inclusion of ICESat-2 surface mask and inland water mask (ICESat-2).

- Adoption of the H5-ES product development strategy (ICESat-2).

- Replacement of NCEP meteorological data with GEOS5-FP IT model data (ICESat-2).

- Incorporation of GOES5-FP IT meteorological data on the L2A product (ICESat-2).

- Higher-rate altimetry data segments (50hz, ICESat-2).

- Additional INS parameters on the L1B and L2A products that can be used to improve geolocation.

- Inclusion of all INS parameters from the L1B product onto the L2A product.

- Change of ancillary data from HDF5 attributes to HDF5 compact datasets. (This allows the ancillary data to be more fully described.)

- Improved NetCDF-4 compliance. Products can now be used with ncdump and other NetCDF-4 utilities.

- Improved CF/ACDD metadata compliance.

- Improved browse products.

Known Issues:

- The surface classification implementation does not exactly match the results provided by the ATBD lead. The ellipsoidal histogramming matched fairly well with sample test data. A simplified algorithm was used for slant histogramming. Instead of rotating the photons in distance space, the implemented algorithm rotates the photons in time space using the slant of the fitted signal photons. Most of the differences in results are the confidence level classification of the photons identified as signal. This is an area of continuing research.

- The GEOS5 FPIT algorithm uses a nearest-neighbor retrieval to return values at a specified coordinate to the interpolation routine. Since GEOS5 uses dynamic

pressure/height levels, coordinate-level interpolations cannot be done without regridding the data. Coordinate values are returned for the two times surrounding the interpolation time. Data are linearly interpolated to give results at an interpolated time, but nearest-neighbor coordinates. It is unclear is this will be sufficient for ICESat-2.

- This is the first MABEL release whose products are usable by NetCDF4-Extended based tools. Feedback regarding the success and value of NetCDF4 compatibility is requested.

This release note focuses on changes to the MABEL software. For more information about the data products themselves, please refer to the appropriate MABEL Standard Data Product documents (HTML-data dictionaries are provided in the pre-release).

Send comments and report any issues to David Hancock (David.W.Hancock@nasa.gov).

Repository

The MABEL data, documentation and example code are available at the following URL:

http://icesat.gsfc.nasa.gov/icesat2/data/mabel/mabel_docs.php

Please read the Standard Data Product Document for each product you will be using.

MABEL Product Release Summary

Release 010 of the MABEL products is created by Version 2.0.1 of the MABEL processing software. All products were re-created for this release. The following table summarizes the correspondence between versions of the software and releases of the MABEL products.

Table 1: MABEL Product Release Summary

Release	Software Version	L1A	L1B	L2A
000	1.0	Initial	No Release	No Release
001	1.1	No Change	Initial	No Release
002	1.2	Updated	Updated	No Release
003	1.3	No Release	No Release	Initial
004	1.3.1	Updated	Updated	Updated
005	1.4	Updated	Updated	Updated
006	1.4+	Not Released	Not Released	Not Released
007	1.5	Updated	Updated	Updated
008	1.6	Updated	Updated	Updated
009	2.0	2014 data only	2014 data only	2014 data only
010	2.0.1	Updated (Latest)	Updated (Latest)	Updated (Latest)

Software Description

The MABEL HDF5 L1A software (mabel_l1a) reads the Level-0 MABEL TOF files and stores the original data and derived parameters into a Level-1A HDF5 file.

The MABEL HDF5 L1B software (mabel_l1b) reads Level-1A MABEL HDF5 and Novatel INS text files, and writes the range calibrated for instrument effects and INS parameters and into a Level-1B HDF5 file.

The MABEL HDF5 L2A software (mabel_l2a) reads Level-1B MABEL HDF5 files, and writes the geolocated photons, histograms, ancillary data, meteorological and atmosphere delay information into a Level-2A HDF5 file.

HDF products require version 1.8.11+ of the HDF5 library.

Browse products require IDL version 8.1+.

All primary processing code is written in Fortran and tested with gfortran 4.7.0+ and the 1.8.11+ version of the HDF5 library. The development and production environments are little-endian x86_64 platforms (MacOSX/Ubuntu Linux).

Release Overview

Significant changes have been made to both the format and content of the MABEL data products.

Product Format Changes

A major driver of the product format changes was to improve correlation between the design of the MABEL L2A and ATLAS ATL03 products. As such, parameters were reorganized into groups that are more closely aligned with the ATL03 groups.

The attribute "/identifier_product_format_version" has been set to "2.0" for Release 010 MABEL L1A and L1B products so that the user can programmatically identify each product's format. The attribute "/identifier_product_format_version" has been set to "2.0.1" for Release 010 MABEL L2A products to reflect the change in "ph_id" datatype. Users can query this attribute to determine the format of the products, even if a release number is changed without the product formats changing.

Version 2.0.1 of the MABEL software incorporates lessons-learned from the process of designing and implementing ICESat-2 standard data products. For ICESat-2, the team developed a database-driven product design and implementation strategy (H5-ES). This strategy uses a web-based interface to design HDF5 data products and instantiate that design into HDF5 template files. There are several benefits to this strategy:

- Template files can be quickly and easily updated to fix descriptive information or re-organize datasets without updating any code.

- No code is required to instantiate the basic HDF5 structure and metadata. That infrastructure is pre-defined within the template files.

- The only coding necessary is that required to fill the HDF5 product with actual data values.

- H5-ES includes an API that provides a standard interface to HDF5 products.

The ICESat-2 lexicon uses "height" instead of "elevation". All relevant references to "elevation" have been replaced with "height". This includes the labeling of parameters and groups.

A significant overall design change is the use of compact datasets (rather than attributes) for non-science (ancillary) data parameters. The use of compact datasets allows the ancillary data parameters to be self-describing. This is not possible when using attributes. The development team realizes this (again) imposes the burden of changing existing software upon the user community, but ICESat-2 standard data products will be designed this way.

Other specific changes include:

- Reorganized the channel data into ATL03-like GT groups. Channel-specific data are now grouped under top-level "channelxx" groups. Data are not specific to a channel (range windows, reference track lat/lon, surface type, mean sea surface, etc) are grouped under a "reference track" group since those values are derived from locations on the reference track and are not channel-specific.

- Renamed "gps_sec_offset" to "granule_gps_epoch" to more accurately identify that value as a per-granule epoch. For ICESat-2, there will be a single "ICESat-2 Epoch" to which all time values within all granules are referenced.

- Added additional "flight_parameters" information, including geolocation-related biases and placeholders for TBD laboratory-measured transmit efficiency and pulse shape information. Due to the way the HDF5 file is designed, the channel-associated arrays have dimensions of 50. The datasets "num_channels_532" and "num_channels_1064" identify the number of values filled within each array (L1B/L2A).

- Added platform information under the "flight_parameters" to identify the platform (aircraft) to which MABEL is attached. Made the geolocation bias parameters flight-specific and moved the datasets from "ancillary_data" to "flight_parameters."

- Improved the descriptions of the flights within "flight_parameters".

- Added a placeholder, within "flight_parameters" for a per-channel pulse shape. This is not currently filled with valid information.

- Added additional "novatel_ins" parameters used to improve geolocation. In addition, since the format of the input Novatel INS file has changed several times over the course of MABEL operations, invalid values are used to indicate when certain data are not available. Check the "FillValue" attribute of each parameter to determine the "invalid value". (L1B/L2A)

- Included all L1B "novatel_ins" parameters on L2A. (L2A)

- Added "/reference_track/geophysical /surf_type". This is an array of 5 flags that indicate the type of surface and presence of inland water. These values are derived from the ICESat-2 surface type and inland water masks at each point on the reference track. (L2A)

- Renamed latitude and longitude within the "/reference_track" group to "rt_latitude" and "rt_longitude". This more clearly indicates that these are the locations of the reference track. (L2A)

- Renamed of the latitude, longitude and height within "/channel/photon" groups to "ph_latitude", "ph_longitude" and "ph_h". This more clearly indicates that these are the photon-related. (L2A)

- Added ph_class and ph_class_src within "/channel/photon". ph_class is the photon classification value from the signal classification algorithm; ph_class_src indicates from which part of the signal classification algorithm the photon was classified highest. The ph_class_src parameter is used for evaluating the signal classification code and will not be present on ATL03. (L2A)

- Added "/reference_track/geophysical/emg2008_geoid". This is the EGM2008 geoid value interpolated at each point on the reference track. (L2A)

- Added the "/atmosphere/meteorology" group. This group contains GEOS5-FP IT meteorological information interpolated to each point on the reference track at the atmosphere histogram data rate (/ancillary_data/segment_sizes/atm_seg_shots). The 48 bottom-most GEOS5-FPIT layers are put on the product. The layers range from the geoid height to about 30km. (L2A)

- Added ch_latitude and ch_longitude to the "/channelxx/altimetry" and "/channelxx/atmosphere/" groups. In prior releases, there was no (easy) way of assigning a geolocated per-channel position to histograms or other segment-based data values.

- Removed the "/met_corr" group. The information within this group has been replaced by the "/reference_track/corrections/atm_delay_xxxx" parameters. In addition the "transtime" parameter has been moved to the "/altimetry/corrections" group. (L2A)

- Added "bg_mean" and "bg_sdev" to the channelxx/atmosphere groups. The values are computed from the atmosphere histograms using the signal removal technique described in the ICESat-2 Global Geolocated Photons ATBD. (Note: These parameters are computed by the same algorithm used in signal classification, but at the atmosphere segment rate.)

- Added a "signal_finding" group to "channelxx/altimetry". This group contains statistics computed by the signal finding routine. In addition to the statistical values, this group also contains indexes into the photon arrays that identify the indices of the first and last photon used within each segment. This is intended to help match the photon data to the segments more precisely.

- Removed the preliminary relative apparent reflectance calculation and parameters. (L2A)

- Added "data_rate" attributes to each group in order to define the data rates of the parameters within each group. (L1A-L2A)

- Improved the descriptions of "delta_time_start" and "delta_time_stop" to indicate that the start times are inclusive and stop times are exclusive. This is consistent throughout the MABEL software.

- Improved the descriptions of the parameters. (L1A-L2A)

- Improved several metadata values. (L1A-L2A)

- Removed non-standard "standard_names" to improve CF-compliance. (L1A-L2A)

MABEL structured metadata is mostly unchanged from Release 008. This is planned to change in future releases once the ICESat-2 ISO-19115 metadata implementation is more fully defined.

Sample Code Fragments

For Release 008, the following code was used to read the gps_sec_offset as an HDF5 attribute:

```
(Fortran)

gps_sec_offset=0.0d0
call H5LTget_attribute_double_f(h5_fileid, "/ancillary_data", &
  "gps_sec_offset", d_8, i_res)
gps_sec_offset=d_8(1)

(IDL)

gps_sec_offset=0.0d0
g_id=H5G_OPEN(h5_fileid, "ancillary_data")
h5_att_id=H5A_OPEN_NAME(g_id, "gps_sec_offset")
gps_sec_offset=H5A_READ(h5_att_id)
H5A_CLOSE, h5_att_id
H5G_CLOSE, g_id
```

The same code modified use Release_010-style compact datasets looks like this:

```
 (Fortran)

granule_gps_epoch=0.0d0
call h5ltread_dataset_f(h5_fileid, "/ancillary_data/granule_gps_epoch ", &
  H5T_NATIVE_DOUBLE, d_8, dims, i_res)
granule_gps_epoch=d_8(1)

(IDL)

granule_gps_epoch=0.0d0
ds_id=H5D_OPEN(h5_fileid, "/ancillary_data/granule_gps_epoch ")
granule_gps_epoch=H5D_READ(ds_id)
H5D_CLOSE, ds_id
```

Processing/Product Content Changes

Improvements have been made to several aspects of the MABEL products and processing software. These changes are categorized as geophysical improvements, Novatel INS improvements, atmosphere improvements, geolocation improvements and general changes/fixes.

Geophysical Improvements

The EGM96 interpolation has been improved. Computed EGM96 values have been compared with 500,000 published reference values and found to be accurate at the millimeter level.

An interpolated EGM2008 value has been added to the L2A product. The EGM2008 values are interpolated using splines within a 6x6 pixel window to each altimetry segment point on the computed reference track. Computed EGM2008 values have been compared with 500,000 published reference values and found to be accurate at the millimeter level.

The DTU10 (mean sea surface) interpolation has been improved by using splines instead of bilinear interpolation.

GIMP and GMTED2010 interpolation has been improved by using bicubic instead of bilinear interpolation. The GIMP DEM was updated to the latest published release (2.1, 2014-01-03). The DEM values are used for range window determination, but have been removed from the L2A product (in order to reflect the current philosophy of ATL03). However, the used DEM values can be recovered by subtracting /ancillary_data/histograms/alt_hist_bit_top_off from /channel/altimetry/histogram/alt_hist_ht_top.

The legacy GLAS correction for troposphere delay was replaced with a version of the ICESat-2 atmosphere delay algorithm. This algorithm uses GEOS5-FP IT modeled atmosphere data to compute an atmosphere delay that is applied to the geolocated photon heights. (The GLAS trop correction was previously applied to the range before geolocation.) In previous MABEL versions, a software error related to the troposphere correction caused a 0.1 – 0.2 meter error in photon heights.

The sampling rate of the altimetry segments was increased to a nominal 50hz (100 shots). This more closely matches the ICESat-2 altimetry data rate. An additional driver for this change was a request from the PSO to increase the rate of the noise parameter.

Support for the ICESat-2 surface and inland water masks was incorporated. The masks were gridded and written as compressed HDF5 files (same technique used for DEM/MSS/Geoids). A nearest-neighbor algorithm is used to retrieve the mask values from the grid for each altimetry segment midpoint on the computed reference track. The surface_mask is a 5-element array where a value of 1 indicates the presence of a particular surface type at the lookup point.

Novatel INS Improvements

Since the format of the Novatel INS input file has changed several times over the course of MABEL operations, the associated code was changed to dynamically determine the content of the input file. Since later INS files contain more information than earlier INS files, there are cases where some parameters on the L1B and L2A products have no information. Whenever, this is the case, the empty parameters are filled with invalid values. The fill values are defined in the "FillValue" attribute of each parameter.

Information requested by the ICESat-2 POD team was added to the Novatel INS file for later flights. This information is mostly used by POD to refine MABEL geolocation parameters and is now available on the L1B and L2A products. If the information is unavailable for a particular flight, the parameters are filled with invalid values (see above).

Updated the code to copy all INS parameters on L1B to L2A (previously, only a subset was copied.)

Atmosphere Improvements

GEOS5-FP IT meteorological data have been added to the L2A product. These data are retrieved from the GEOS5 grids surrounding the target time using a nearest-neighbor algorithm. After retrieval the data are interpolated by linear interpolation to the requested time.

Background mean and standard deviation have been added to the L2A. The values are computed from the atmosphere histograms using the signal removal technique described in the ICESat-2 Global Geolocated Photons ATBD.

The atmosphere browse product, which was retroactively run for Release 008 data, has been incorporated into the MABEL workflow.

Geolocation Improvements

There were no changes to geolocation for pre-2014 data. There are still undetermined range and location errors, but location is generally believed to be within 30 meters.

General Changes/Fixes

The general support library (common_libs) was improved via the ASAS code review/unit testing process. The common_libs unit test infrastructure has been incorporated within the MABEL code. A compiler issue found during common_libs testing has been mitigated, thereby significantly improving the performance of mabel_l2a.

Updated the input flight-scenario files and associated software to support multiple aircraft types and TBD laboratory measurements.

The start time of altimetry and atmosphere segments is now based on the "requested" start time of the entire granule. This guarantees the altimetry and atmosphere segment times start from the exact same point and avoids a potential time shift when using data-driven start times.

Developed IDL-based TOF software for the MABEL flight team. This allows the team to rapidly generate quicklook histograms of the MABEL photons for post-flight analysis. Techniques used within this code were reused to improve the L1A browse data.

Removed "standard_name" placeholders to improve CF-compliance.

Disabled the HDF5 "shuffle" filter for real and double precision datatypes. This should both improved granule access time and decrease file sizes.

Browse generators and example product readers (in Fortran and IDL) have been modified to reflect the switch to back to dataset-based ancillary_data.

Description of Browse Images

The web-based browse images have been updated for the Release 010 products. The L2A browse software no longer attempts crude surface finding, but instead uses the new photon classification information.

Like Release 008 products, there are combined plots of Left/Right/Center channels for each frequency (1064 and 532). Sample Release 008 and 010 channel plots are shown below for comparison.
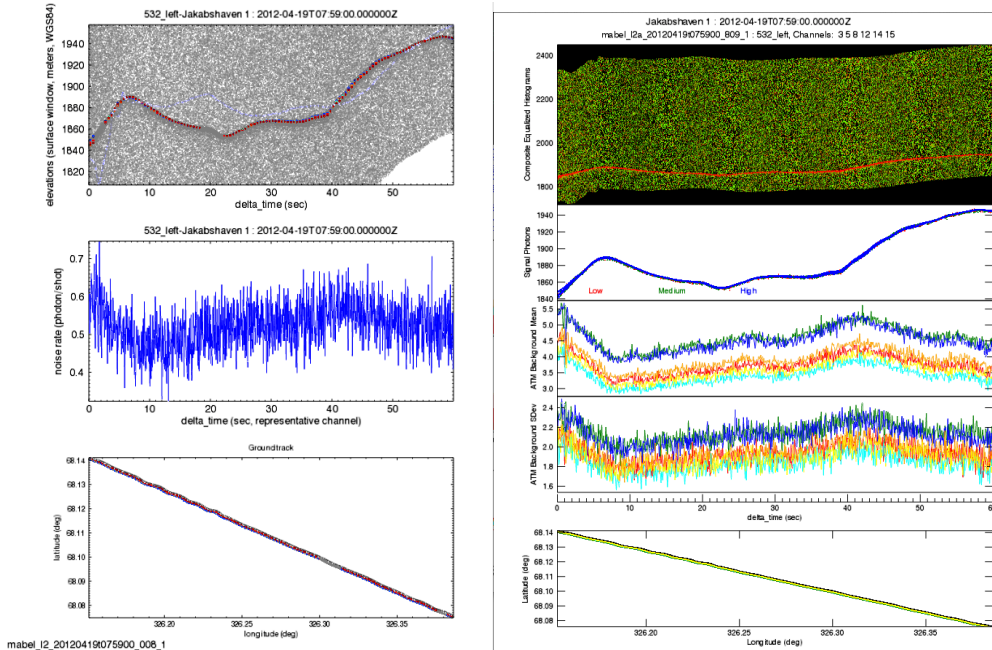
The following paragraphs describe the Release 010 "Channel" images.

The first plot (labeled "Composite Equalized Histograms") is a display of composite, stacked altimetry histograms. Histograms for all channels listed at the top are combined into a single composite histogram and then stacked vertically along the time axis to form an image. The IDL 'hist_equal' function is used to improve contrast of the image. The intention is to give some indication of signal strength and background without resorting to plotting each photon.

The second plot (labeled "Signal Photons") is a color-coded display of the signal photons detected by the signal classification algorithm. Only those photons classified as low (red), medium (green) or high (blue) are displayed. This is a composite of signal photons for the channels listed at in the title. In some cases, weak channels can drive the plot scale sufficiently to mask the quality of the higher-signal channels.

The third and fourth plots (labeled "ATM Background Mean/SDev") are the background-only means and standard deviations of the atmosphere data segments computed using the same signal-removal algorithm described in the photon classification section of the ICESat-2 L2A ATBD. Each channel listed in the title is assigned an individual color.

The last plot shows the signal photons plotted by latitude/longitude that can show the distribution of signal photons on the surface. Each channel listed in the title is assigned an individual color.

The Release 010 "INS/DEM" plot (more appropriately named "Reference Track" plot) reflects the removal of the DEM values and the inclusion of EGM2008, atmosphere delay, and surface type values on the L2A product. Release 8 and 010 plots are show for comparison.
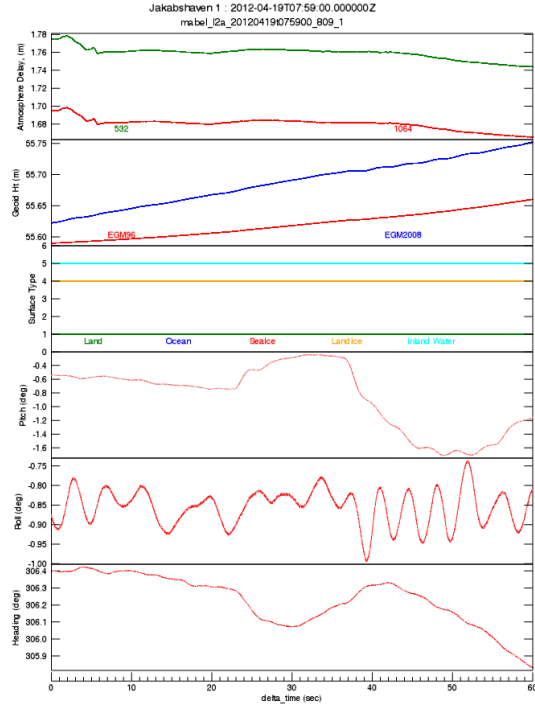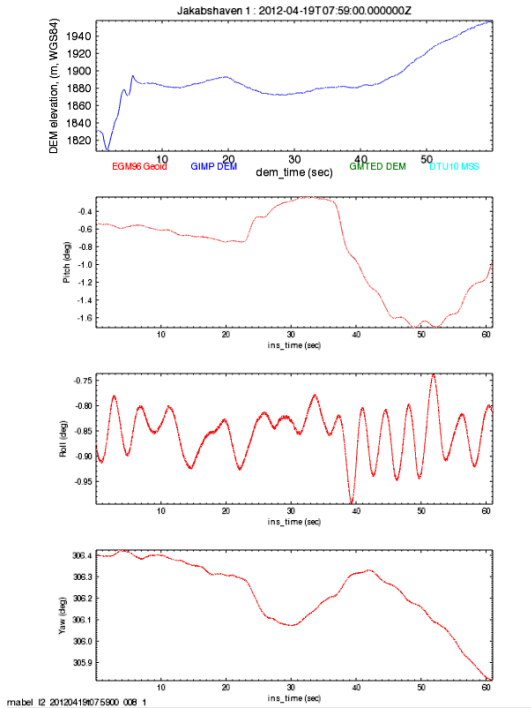
The first plot is the 532 and 1064 atmosphere delay at the reference track values. These values are used to compute the atmosphere delay correction for individual per-channel photons.

The second compares the EGM96 and EGM2008 geoid.

The third is a color-coded plot of the surface type at the reference track, derived from the ICESat-2 land, water, land ice, sea ice and inland water masks.

The remaining plots are the INS pitch, roll and heading, unchanged from Release 8.

The 3D plots simply display the signal photons instead of the entire photon cloud. Release 8 and 010 plots are show for comparison.
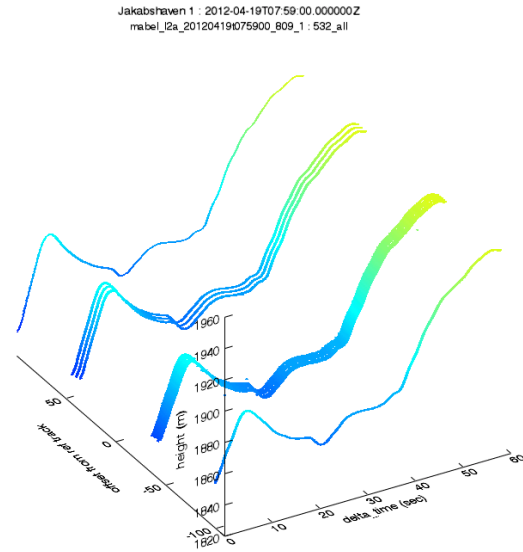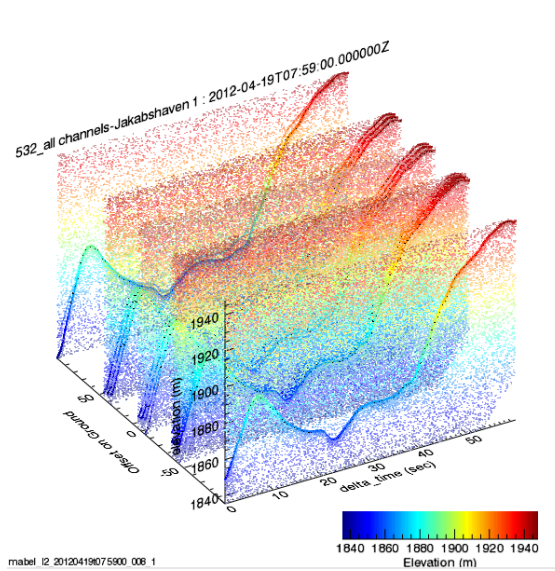
Software Change Notes

Release 010 data products were created with V2.0.1 of the MABEL processing software. Differences between the Release 009 and 010 products were described at the top of this document. The following change requests were implemented in version V2.0 of the MABEL software.

[MABEL-179] - Work with EOSDIS to get DOIs for MABEL products.

[MABEL-182] - Update the mabel_flights.txt file to reflect actual times of INS granules.

[MABEL-187] - Create software to inventory MABEL data.

[MABEL-190] - Investigate error: geo_mod>geo_lin_intrp | Cannot interpolate between two equal times.

[MABEL-191] - Investigate error: Channels in data do not match flightparams

[MABEL-192] - investigate error: Too many IN_ANC_MET_HDR files specified

[MABEL-198] - Add WFF flight POIs provided by Kelly to mabel_flights.txt

[MABEL-209] - Implement ancillary_data and flight_parameters as AdditionalAttributes

[MABEL-211] - In /ancillary_data, granule_beginning_time, granule_beginning_date are not set

[MABEL-213] - Additional flight notes regarding MABEL removal

[MABEL-216] - Create a test build that fixes the noise_rate issues

[MABEL-217] - Add ISO19115 classification attribute to each dataset.

[MABEL-219] - Update Makefile infrastructure to support optimization

[MABEL-220] - Atmosphere browse

[MABEL-222] - Update mabel code to use new H5ES strategy

[MABEL-223] - noise rate definition update

[MABEL-224] - MABEL geolocation biases move to scenario file

[MABEL-226] - Add flight platform info to scenario file

[MABEL-227] - change MABEL profiletype to trajectory

[MABEL-228] - Update definition of n_hist_shots

[MABEL-229] - Remove relative_apparent_reflectivity

[MABEL-230] - Troposphere correction rate

[MABEL-231] - Initial evaluation of MABEL L2A v2.0

[MABEL-232] - ancillary_data Issues

[MABEL-233] - flight_parameters issues

[MABEL-234] - altimettry issues

[MABEL-235] - atmosphere issues

[MABEL-236] - met_corr comparison

[MABEL-237] - General Issues

[MABEL-238] - METADATA issues

[MABEL-239] - Create TOF browse for MABEL flight team

[MABEL-240] - Update L1A Browse to use new histogram settings

[MABEL-241] - Improve MABEL Geoid/DEM

[MABEL-242] - Initial test of Rel 9 L1A and L1B

[MABEL-243] - MABEL Atmosphere Browse

[MABEL-244] - Segment times should be relative to requested start time of the granule

[MABEL-245] - Include all L1B INS parameters on L2A

[MABEL-246] - Update the MABEL L2A Browse software for V2.0

[MABEL-247] - FLIGHT_PARAMETERS.ELEVATION_532_MRAD on Release 809

[MABEL-248] - Documentation updates

[MABEL-249] - MABEL Noise rate at 100 shots

[MABEL-251] - update Citation For External Publication

[MABEL-261] - Make MABEL angle biases and platform a file input

[MABEL-262] - Incorporate changes made in GSAS Trop software

[MABEL-263] - Change MABEL INS processor to dynamically determine content of INS file.

[MABEL-264] - Consolidate utest infrastructure

[MABEL-265] - Incorporate ICESat-2 Surface and IW Mask

[MABEL-266] - Update GIMP to v2.1 2014-01-03

[MABEL-267] - Implement basic support for GEOS5_FPIT meteorological data

[MABEL-268] - Removed unsupported standard_names from MABEL products.

[MABEL-269] - Replace the trop correction with the ICESat-2 atmosphere delay

[MABEL-270] - Update the new flight/scenario files with the latest geolocation information

[MABEL-271] - Update L2A Browse to include surface mask info

[MABEL-272] - Incorporate the GEOS5-FP IT data on the MABEL atmosphere browse

[MABEL-273] - Verify CF-compliance of Rel 009 MABEL products.

[MABEL-274] - Shuffle filter should be disabled for floats

[MABEL-275] - flag_meanings, flag_masks, flag_values, coordinates should be arrays

[MABEL-277] - Problem with MABEL 2.0 GIMP DEM Interpolation

[MABEL-278] - Typo in Inventory Meta Data

[MABEL-279] - Delta Time on mabel_l2a_20120222t010500_809_1.h5

[MABEL-280] - MABEL webpage words truncations

[MABEL-281] - Deliver preview of MABEL 2.0 to SDMS for testing

[MABEL-282] - Implement the ASAS L2A signal finding algorithm into MABEL L2A

[MABEL-283] - CLONE - Add a chmod to template files after copy

[MABEL-284] - gps_sec_offset should be based on the requested start time of the granule

[MABEL-285] - Update ICESat-2 inland water mask to May 2014 version.

[MABEL-286] - Change gps_sec_offset to granule_gps_epoch

[MABEL-287] - Determine why we have excessive ingest failures

[MABEL-288] - Update the ATM browse code for new ATL03-like format.

[MABEL-289] - Deliver MABEL 2.0 rc1 for testing

Software Change History

The change history is a summary of changes implemented in prior versions of the MABEL software.

MABEL v1.6 10/24/2012

[MABEL-18] - Make l1a hdf files netcdf-friendly

[MABEL-33] - Implement dimension scales on the MABEL products

[MABEL-76] - Implement computation of relative apparent reflectance for MABEL L2A

[MABEL-91] - Replace existing MABEL DEM with ICESat-2 DEM/DRM

[MABEL-114] - Add geoid to mabel_l2a

[MABEL-125] - Redesign the flightparams update method.

[MABEL-126] - Merge the common_library routine updated in GLAS_HDF with MABEL codebase

[MABEL-131] - Write critical MABEL coefficients to an ANCILLARY_DATA group

[MABEL-133] - Add filetype to Metadata

[MABEL-136] - Change project_scientist field in the Metadata

[MABEL-138] - The flight_parameters flight_number is off by 1 which causes the flight location and other label info to be incorrect

[MABEL-139] - no channel 14 in early mabel data makes browse fail

[MABEL-140] - Add reference track to the MABEL L2 products

[MABEL-141] - Add a Noise sample to the MABEL L2 products

[MABEL-142] - Reduce the window of elevations output on MABEL L2 products

[MABEL-144] - Implement HDF5 shuffle filter on MABEL data

[MABEL-145] - Retrieve new TAU-UTC file for MABEL/GLAS_HDF

[MABEL-146] - Revamp MABEL metadata to incorporate lessons-learned during glas_hdf

[MABEL-147] - Improvements to MABEL infrastructure

[MABEL-148] - Add code to verify channels in data correspond to channels in flightparams

[MABEL-149] - Web distribution changes - Level 1 not necessary and whole flight access for L2

[MABEL-150] - Jumps in elevation

[MABEL-151] - Fix errors found in initial 1.6 testing

[MABEL-152] - Select representative channels for all flights

[MABEL-153] - Improve L1A browse

[MABEL-154] - Update L2A browse generation code to reflect V1.6 file formats.

[MABEL-155] - MABEL Angles and elevations actually applied to channels need to be in HDF file

[MABEL-156] - Scott Calibrations for Greenland configuration

[MABEL-157] - Updated mabel_scenarios with unscrambled values provided by DH

[MABEL-159] - Data dictionary is getting garbage in the attribute names

[MABEL-160] - Update sample Fortran reader for Release 008

[MABEL-161] - Make gps_sec_offset/gps_seconds_offset consistent throughout all code

[MABEL-162] - Logic error prevents using GIMP DEM

[MABEL-163] - Split shottags at end of file are giving bad times to scan_tof.

[MABEL-164] - Update MABEL SAS/SDMS ICD for Version 1.6

[MABEL-165] - Provide proper citations for GIMP, GMTED and DTU10 in the L2A products

[MABEL-166] - MABEL bias angles

[MABEL-172] - L2A QA crashes when no photons are available.

[MABEL-173] - Updated flight/scenarios for 2012-09 missions

[MABEL-174] - Update the flight/scenario files for Scott runs with his cals 03-27-2012 and10-19-2012 campaign.

[MABEL-175] - Updated PGE/Lib versions for release 1.6

MABEL v1.5 05/31/2012

[MABEL-75] - Compute the true surface range for 10khz MABEL data

[MABEL-87] - Test MABEL geolocation code

[MABEL-92] - Make sure constants are initialized/overridden like matlas

[MABEL-94] - Add an "all channels" 3d plot to standard browse

[MABEL-95] - Add channel angle and elevation corrections to geolocation

[MABEL-96] - Fix error found in step 1 of the MABEL geolocation ATBD

[MABEL-97] - Ingest/Adopt MABEL Flight Parameters Spreadsheet V7.

[MABEL-98] - Add the ability to override embedded flight parameters with values from a new file.

[MABEL-100] - Refactor MABEL codebase to support SIMPL and GLAS_HDF

[MABEL-102] - Error in flight parameters data on product

[MABEL-103] - MABEL Housekeeping data format change Jan-2012

[MABEL-104] - Modify SDMS to process Mabel data.

[MABEL-105] - Create miniSIPS to perform QuickLook processing of MABEL data

[MABEL-106] - Create QuickLook L1A Browse Products

[MABEL-107] - Handle nadir connector (99)

[MABEL-108] - Create utility to extract QA information from L1A.

[MABEL-109] - Ingest 02/22/2012 flightparameters file.

[MABEL-110] - Bad oscillator value

[MABEL-111] - Integrate L1A Quicklook into Web-based Browse

[MABEL-112] - Improve performance of MABEL IDL browse generators

[MABEL-113] - Create utility to create surface-to-dem comparison files to help with geolocation.

[MABEL-115] - mabel_l1b is not respecting the output granule time in regards to INS data

[MABEL-117] - Implement the 2012-03-08 version of the Geolocation ATBD

[MABEL-118] - Flightparams needs better time resolution

[MABEL-119] - INS files are consistently inconsistent

[MABEL-121] - Add set_plot, Z to idl program to avoid Xwindows problems.

[MABEL-122] - Error in time of day assign to MABEL Tx time

[MABEL-123] - Create 1 minute granules instead of the current 30 seconds granules

[MABEL-124] - Streak removal algorithm

[MABEL-128] - Allow for individual channel angle/elevation overrides

[MABEL-130] - Create option for deleting channels at the L1A level

[MABEL-132] - Clean up the MABEL HDF5 readers.

[MABEL-134] - Updated IDL code to handle deleted channels

[MABEL-135] - Final updates for MABEL Release 1.5 code

MABEL v1.4 11/23/2011

[MABEL-68] - Met range corrections wrong sign.

[MABEL-70] - Change Range Conversion Parameter

[MABEL-71] - 532 path length has the wrong units

[MABEL-82] - Update parameter descriptions based on feedback.

[MABEL-88] - Increase precision of INS data

[MABEL-69] - Added selected INS data to the MABEL L2A product

[MABEL-73] - MABEL flight Parameters update to v6

[MABEL-74] - Update the Geolocation module to include beam pitch angles and IMU offset true values

[MABEL-77] - Change self-documenting format from text to html.

[MABEL-78] - Add descriptive attributes for L1A and L1B parameters

[MABEL-79] - Write a code generator for HDF5 parameters.

[MABEL-86] - Implement the photon_id in L2A

[MABEL-47] - Add housekeeping data to L1A HDF5 files

[MABEL-72] - Compute and apply oscillator correction to L1B range.

[MABEL-83] - Remove osc_corr from L1A QA Data

[MABEL-89] - Create Release005 Mabel Products

MABEL v1.3.1 10/19/2011

[MABEL-66] - Fix MET Trop fields in L2A

[MABEL-59] - L1A - Add descriptive attributes to quality_assessment, metadata, and flight_parameters

[MABEL-60] - L1B - Add descriptive attributes to quality_assessment, metadata, and flight_parameters to L1B

[MABEL-63] - Move common metadata fields to global_meta_mod

[MABEL-64] - Add start/end lat/lon fields to metadata

[MABEL-65] - Remove range patch from L2A

[MABEL-67] - Create Release_004 Data Products

MABEL v1.3 08/25/2011

[MABEL-9] - Develop the MABEL L2A processing Requirements

[MABEL-11] - Develop MABEL geo location ATBD

[MABEL-12] - Develop the Mabel Range ATBD

[MABEL-58] - Use actual speed of light for range computation

[MABEL-30] - Add descriptive attributes to quality_assessment, metadata, and flight_parameters

[MABEL-50] - Implement L2A Processing

[MABEL-8] - Define Mabel L2A processing

[MABEL-51] - Integrate geolocation code into mabel_l2a

[MABEL-52] - Integrate trop code into mabel_l2a

[MABEL-53] - Define final format for L2A H5 file

[MABEL-54] - Define QA data for L2A

[MABEL-55] - Integrate DEM code into mabel_l2a

[MABEL-61] - Create L2A Data Description and Release Notes

MABEL v1.2 08/03/2011

[MABEL-32] - Fix the hertz attributes in the L1A data products

[MABEL-38] - mabel_l1a creating huge files

[MABEL-42] - Control files not complete

[MABEL-43] - Wrong flight information

[MABEL-44] - gps_sow_offset is bad value in L1B

[MABEL-45] - gps_rate is inconsistently cast

[MABEL-48] - Implement the new Novatel INS format for L1B

[MABEL-41] - Add requested_start, request_stop times to L1A & L1B granules

[MABEL-46] - write example hdf5 reader

[MABEL-31] - Research time problems found in L0 TOF data

[MABEL-49] - Create Version 002 L1A and L1B files

MABEL v1.1 07/11/2011

Initial Version of L1B processor and first release of MABEL L1B data.

MABEL v1.0 06/24/2011

Initial Version of L1A processor and first release of MABEL L1A data.