GSAS V6.1 Release Notes
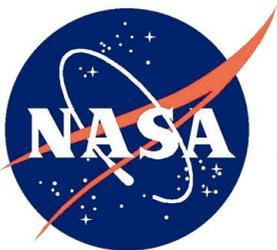# GSAS Team

Effective Date: May 2014

Goddard Space Flight Center

**National Aeronautics and
Space Administration**

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1.0   INTRODUCTION

Release 6.1 is minor release of GSAS. This release incorporates fixes for several data issues that were determined to exist in the GLAS Release 633 data products. The following are important points to note.

1. Correction to the ICESat Data Product Surface Elevation due to an Error in the Range Determination from Transmit-Pulse Reference-Point Selection (Centroid vs Gaussian)

   It was determined that an important correction to the surface elevations on the ICESat products was not applied. The range from which the surface elevation should have been calculated is from the midpoint of the Gaussian peak on the transmit pulse to the midpoint of the Gaussian peak on the received pulse. However the location of the centroid of the transmit pulse was inadvertently used and the difference (defined as G-C) between the transmitted pulse centroid and Gaussian peak was never applied.   The effect of this error of omission varies on a shot-to-shot basis and for the calibration passes over the Salar de Uyuni in Bolivia varied from +/- 6cm over the mission. Similar results were found when tabulating the track-averaged corrections (G-C) over Antarctica.   Note that the (G-C) values are fairly constant within a campaign, so any elevation-data adjustments made to data release 633 or older for "campaign-level" biases that were determined to an independent reference surface would eliminate the G-C error from the elevation data on an average basis.

   The surface elevations on GLA06 (global elevation product), GLA12 (ice sheet), GLA13 (sea ice), and GLA15(ocean) are affected. The GLA14 (land) elevations are computed using the centroid of the received pulse, as well as the centroid of the transmit pulse, and therefore the elevation calculation on GLA14 is correct as intended. However, GLA14 data users who use the range Increment for the up to six Gaussian-fitted peaks may want to use the G-C correction also.

2. Dry Troposphere Correction Jitter

   It was reported that at times the dry troposphere range correction contained several centimeters of jitter. The issue was traced to the threshold range being used to determine the dry troposphere correction in regions of rapidly changing shape of the return signal waveforms. This was normally in poor signal areas or very rough terrain. At times the threshold range relative to the standard fit would jump tens of meters and induce several centimeter changes in the dry troposphere correction. Changes were made to use the centroid range to determine the troposphere correction. The centroid closely follows the standard fit range.

   During the investigation it was determined that the GSAS code was using only one of the 6 hour met files for the pressure inputs. Code was modified to properly interpolate between the two 6 hour met files.'

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3. The GLAS product high resolution DEM was determined to have issues in the Southern Latitude when the source was SRTM data. It was reported to have wrong values that showed as banding.

   It was determine there was an interpolation error in the southern latitudes during the creation of the SRTM track files (ANC51). The code error caused the DEM values to be correct at the mid point latitude between the interpolation points, with increasing errors on either side. This resulted in the banding error seen when comparing GLAS SRTM DEM values with the source SRTM DEM. The higher the DEM gradient the larger the error so they were significant over Australia. The code was fixed and track files were recreated.

4. The order of preference for which values are used when the SRTM and CDED overlap was changed. Starting with this release the SRTM is always used in the overlap region.

5. Some parameters on GLA14 were invalid when i_elev was valid.

   It was determined that if any standard fit for a one second was invalid, checks were not made to determine if GLA14 had valid elevations during that second. Changes were made to provide the parameters based on a valid alternate fit if the standard fit was invalid for a shot.

6. GLA12, 13, 14 and 15 atmosphere character confidence flag was always zero.

   It was determined that the atmosphere confidence flag from GLA09 was not being placed on GLA12, 13, 14, and 15. Changes were made to correctly put the confidence flags on the products.

7. Occasional mismatch of GLA09 atmosphere characteristic flag value and the value reported on GLA06 and 14.

   On occasion the atmosphere characteristic flag was zero on GLA06 and 14 when a non-zero value was on GLA09. It was determined that the time tolerance check for the one second GLA06 time to the GLA09 time tag did not allow for sufficient jitter between the time tags. This caused a GLA09 record not to be selected as the source for the values. Several other parameters, enumerated under section 2.2 Detail Changes GLA06, were also found to be invalid.

2.0   SOFTWARE CHANGES

2.1   General Changes

GSAS modifications to correct of the Transmit pulse centroid being used for the icesheet (standard fit) elevations to being based on the gaussian fit to the Transmit pulse.

Reference range, defined as from the centroid of the TX to the last received waveform sample, did not change.

GmC defined as the additive correction to an elevation relative to Tx centroid to make the elevation relative to the Tx Gaussian

The SRTM track files (ANC51) were recreated to correct the issue with southern latitudes and provided for use in the reprocessing.

2.2   Detail Changes

GLA05 Changes:

GmCns = i_parmTr(3) - i_locTr

GmCns in 0.01 ns units was placed on the GLA05 output file taking part of the space from spare43. GmCns is defined as the difference in the transmit pulse gaussian fit and the centroid of the transmit pulse.

The range used to compute i_elev was corrected to be from the Tx gaussian fit peak of the transmit waveform to the standard fit peak of the return waveform.

GmCns* c/2 was subtracted from the range just before computation of GLA05 elevation(i_elev), the computed i_elev and location are now based on the gaussian fit to Tx.

GLA06 Changes:

GmC in millimeter units is on the GLA06 output file taking part of the space from spare42. GmC is defined as the difference in the transmit pulse gaussian fit and the centroid of the transmit pulse.

GmC was subtracted from the range just before computation of GLA06 elevation(i_elev), the computed i_elev and location are now based on the gaussian fit to Tx

Any time either standard fit or alternate fit are valid the atm_char_flag, atm_char_conf, Surface_Temp, Surface_Pres, Sureface_Relh, Surface_wind, Surface_wdir, FRir_cldtop, FRir_qaFlag and FRir_intsig values from GLA09 are placed on GLA06.

GLA12 Changes:

GmC in millimeter units is on the GLA12 output file taking part of the space from spare42. GmC is defined as the difference in the transmit pulse gaussian fit and the centroid of the transmit pulse.

GmC was subtracted from the range just before computation of GLA12 elevation(i_elev), the computed i_elev and location are now based on the gaussian fit to Tx.

Anytime standard fit is valid the atm_char_flag, atm_char_conf, Surface_Temp, Surface_Pres, Sureface_Relh, Surface_wind, Surface_wdir, FRir_cldtop, FRir_qaFlag and FRir_intsig values from GLA09 are placed on GLA12.

GLA13 Changes:

GmC in millimeter units is on the GLA13 output file taking part of the space from spare42. GmC is defined as the difference in the transmit pulse gaussian fit and the centroid of the transmit pulse.

GmC was subtracted from the range just before computation of GLA13 elevation(i_elev), the computed i_elev and location are now based on the gaussian fit to Tx.

Anytime standard fit is valid then the atm_char_flag, atm_char_conf, Surface_Temp, Surface_Pres, Surface_Relh, Surface_wind, Surface_wdir, FRir_cldtop, FRir_qaFlag and FRir_intsig values from GLA09 are placed on GLA13.

Note: I_BergElev is unchanged.

GLA14 Changes:

GmC in millimeter units is on the GLA14 output file taking part of the space from spare42. GmC is defined as the difference in the transmit pulse gaussian fit and the centroid of the transmit pulse.

Anytime standard fit is valid the atm_char_flag, atm_char_conf, Surface_Temp, Surface_Pres, Sureface_Relh, Surface_wind, Surface_wdir, FRir_cldtop, FRir_qaFlag and FRir_intsig values from GLA09 are placed on GLA12.

The i_gpCntRngOff definition is changed to:

i_gpCntRngOff (Centroid Range Increment for Gaussian Fits) is a 6-element array that contains offsets from the reference range to the peak locations of the received waveform alternate Gaussian fits. There are at least one and at most six fits, which can be overlapping. The first offset in the array corresponds to the location of the fit with the lowest elevation (furthest from the spacecraft), and the last to the highest.

GLA15 Changes:

GmC in millimeter units is on the GLA15 output file taking part of the space from spare42. GmC is defined as the difference in the transmit pulse gaussian fit and the centroid of the transmit pulse.

GmC was subtracted from the range just before computation of GLA15 elevation(i_elev, i_lowElev and i_highElev), the computed i_elev and location are now based on the gaussian fit to Tx

Anytime standard fit is valid then the atm_char_flag, atm_char_conf, Surface_Temp, Surface_Pres, Sureface_Relh, Surface_wind, Surface_wdir, FRir_cldtop, FRir_qaFlag and FRir_intsig values from GLA09 are placed on GLA15.

Note:

These changes also necessitated modifying the way the equilibrium tide and pole tides are calculated. The equilibrium tide is a 2Hz and pole tide is a 1Hz variable. The equilibrium tides were part of the above "standard fit" if then else loop. Now if there are standard fits in a record, the equilibrium tide is calculated using those locations if there are valid ocean tides (i.e. non zero tide values), else they are determined using the alternate fit lat/lons (GLA14).

The pole tide is determined further down in the code, and it is has been modified to use a valid ocean tide location. If it was done using a standard fit then the GLA06 location is used, else the GLA14 location is used. We did notice that in some coastal areas, the new code is showing a pole tide where there was none earlier. This is because the alternate fit actually produced a lat/lon that generated a valid ocean tide value.

Also, when the above fixes were incorporated, it was noticed that the values of the rngCorrFlg may change because there might be valid tide values which have been determined using the alt fits.

3.0   PRODUCT FORMAT/DEFINITION CHANGE SUMMARY

3.1   Product Format Changes

Although record sizes of the products did not change, this release incorporated changes to the products.

GLA05

Integer (kind_i4b) ::i_spare43(12,40) to:

Integer (kind_i4b) ::i_GmCns(40)

Integer (kind_i4b) ::i_spare43(11,40)

GLA06

Integer (kind_i2b) ::i_spare42(4,40) to:

Integer (kind_i2b) ::i_GmC (40)

Integer (kind_i2b) ::i_spare42(3,40)

GLA12

Integer (kind_i2b) ::i_spare42(4,40) to:

Integer (kind_i2b) ::i_GmC (40)

Integer (kind_i2b) ::i_spare42(3,40)

GLA13

Integer (kind_i2b) ::i_spare42(4,40) to:

Integer (kind_i2b) ::i_GmC (40)

Integer (kind_i2b) ::i_spare42(3,40)

GLA14

Integer (kind_i2b) ::i_spare42(4,40) to:

Integer (kind_i2b) ::i_GmC (40)

Integer (kind_i2b) ::i_spare42(3,40)

GLA15

Integer (kind_i2b) ::i_spare42(4,40) to:

Integer (kind_i2b) ::i_GmC (40)

Integer (kind_i2b) ::i_spare42(3,40)

3.2   GLAS Binary Data Dictionaries Changes

1. comment field of i_Surface_pres for GLA06, 12,13,14 and 15 from Null to "This surface pressure is computed in the atmospheric processing and is not the pressure used for the troposphere delay correction."
2. for GLA14 change   the i_gpCntRngOff definition is changed to -   "(Centroid Range Increment for Gaussian Fits) is a 6-element array that contains offsets from the reference range to the peak locations of the received waveform alternate Gaussian fits. There are at least one and at most six fits, which can be overlapping. The first offset in the array corresponds to the location of the fit with the lowest elevation (furthest from the spacecraft), and the last to the highest."
3. hi res source flag is set as value 6 the change for rel634 to use SRTM in the overlap region means we always know what value is being reported. flag 6 needs the definition to changed to: "6 = Data in overlap area of SRTM and CDED. Value reported is from _finished_ SRTM C-band 90 m DEM."
4. See detailed changes under in section 2 for the dictionary changes to specific products for the placement of the Gaussian minus centroid parameter on a number of products.

4.0   KNOWN ISSUES

4.1   Known Induced Issue

It was determined that a few valid Release 633 elevations are now invalid on Rel 634. This is the result of an invalid centroid for the TX therefore these elevations should be invalid.

4.2   Known Remaining Issue

At times GLA14 (land product) has an invalid distance to reference track when alternate fit is valid. The problem was traced to a code issue, however, the fix was considered to have too much risk of inducing other errors. Extensive testing is out of scope for this delivery. The utility of having a valid value on every shot is not clear. Normally within a few seconds there are values from valid standard fit.

i_ElevBiasCorr is not computed.

5.0   RELEASE INFORMATION

The AccuRev label for this release is RELEASE_6.1.

Products generated by this software will be labeled as Release 34 by SDMS.

The release date is January, 2014.

Version numbers have been updated to "V6.1 January 2014. This should be verified during operation by checking the version information in the appropriate ANC06 files.

6.0   SDMS IMPACT

ANC45 (metadata template) files have changed and need to be ingested.

ANC51 (SRTM track files) files have changed and need to be ingested

7.0   JIRA CHANGE ITEMS

GSAS-1110   Hi Res Source Flag Definition Update

The change for rel634 to use SRTM in the overlap region means we always know what value is being reported. flag 6 definition was changed to:

"6 = Data in overlap area of SRTM and CDED. Value reported is from finishedSRTM C-band 90 m DEM."

GSAS-1108   Create New SRTM Track Files

Created a new set of SRTM track files for the 91 day and 8 day orbits.

GSAS-1107   Modify WFMgr_mod.f90 so that the GmC correction will always be determined if there is a valid d_parmTr(3) and d_locTr

Modified WFMgr_mod.f90 so that the GmC is always be determined if there is a valid d_parmTr(3) and d_locTr.

GSAS-1104   NSIDC needs to change GLA14 Definition of i_gpCntRngOff

for GLA14

The i_gpCntRngOff definition is changed to:

"(Centroid Range Increment for Gaussian Fits) is a 6-element array that contains offsets from the reference range to the peak locations of the received waveform alternate Gaussian fits. There are at least one and at most six fits, which can be overlapping. The first offset in the array corresponds to the location of the fit with the lowest elevation (furthest from the spacecraft), and the last to the highest."

GSAS-1102   GLA09 Parameters at times are not being Passed to GLA06, 12 to 15.

The ATM char flag value on GLA06 and 14 now match their GLA09 value.

GSAS-1100   atm_char_conf   Values are not being passed through from GLA06 to GLA12-15.

The atm_char_conf values are now being passed through to GLA12-15.

GSAS-1099   Investigate GLA14 Missing Parameters when std fit is Invalid

Some GLA14 parameters were invalid when alt fit has an elevation but std fit did not. It was found at least d2ref, deltaEllip and ocElv have the issue within the first few shots on the GLA14. Problem was fixed.

GSAS-1098   Change DD for i_Surface_pres

NSIDC needs to change the GLAS binary data dictionaries comment field of i_Surface_pres for GLA06, 12,13,14 and 15 from Null to:

"This surface pressure is computed in the atmospheric processing and is not the pressure used for the troposphere delay correction."

GSAS-1096   Provide ANC45 Files for del 634

New ESDTs were developed and New ANC45 files were created for rel 634 processing of GLA05, GLA06, GLA12 , GLA13, GLA14 and GLA15

GSAS-1093   Atmosphere Character and Confidence Flags

1. char_flag and char_conf appears on GLA09, 6,12 to 15 so all definitions should be changed.
2. On GLA09 the atm_char_flag can not have values 9 and 10. These definitions should be deleted so only 0 to 8 are defined.
3. The atm_char_conf can have a value 10. it should be defined as:

   "10 = data quality insufficient to assign flag "

   for atm_char_conf value zero the ""(for contamination flag values of 9 or 10)"" should be removed.

GSAS-1091   GSAS Code Modifications for GmC

For the standard fit elevations the incorrect fit to the transmit pulse was used. The centroid was used and the Guassian should be used. This has been defined as a correction to elevation to change for an elevation based on Centroid to elevations based on Transmit pulse guassian fit peak location.

GSAS-1090   GSAS Code Modifications for Trop Corrections

The GSAS code was modified for two problems with the use of the met data.

1. The pre geolocation used the threshold range to determine the pressure and trop corrections. The threshold range at times is very noisy causing noisy trop corrections. The code was modified to use the standard centroid if available and if not use the alternate centroid. If neither centroid is available then the trop corrections is invalid.
2. It was determined the dry trop issue was not interpolating between the two 6 hour met files. The code was fixed to properly use both 6 hour met files."

8.0 CHANGED FILES

/./gsas/data/anc07_001_01_0000.dat changed from 262/1 to 54/1
/./gsas/data/anc45_001_01_0005.dat changed from 260/1 to 54/1
/./gsas/data/anc45_001_01_0006.dat changed from 260/1 to 54/1
/./gsas/data/anc45_001_01_0012.dat changed from 260/1 to 54/1
/./gsas/data/anc45_001_01_0013.dat changed from 260/1 to 54/1
/./gsas/data/anc45_001_01_0014.dat changed from 260/1 to 54/1
/./gsas/data/anc45_001_01_0015.dat changed from 260/1 to 54/1
/./gsas/src/common_libs/platform_lib/const_glob_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA05_alg_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA05_print_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA05_prod_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA05_scal_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA06_alg_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA06_Pass_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA06_print_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA06_prod_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA06_scal_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA12_alg_mod.f90 changed from 262/2 to 54/1
/./gsas/src/common_libs/prod_lib/GLA12_print_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA12_prod_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA12_scal_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA13_alg_mod.f90 changed from 262/2 to 54/1
/./gsas/src/common_libs/prod_lib/GLA13_print_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA13_prod_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA13_scal_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA14_alg_mod.f90 changed from 262/2 to 54/1
/./gsas/src/common_libs/prod_lib/GLA14_print_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA14_prod_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA14_scal_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA15_alg_mod.f90 changed from 262/2 to 54/1
/./gsas/src/common_libs/prod_lib/GLA15_print_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA15_prod_mod.f90 changed from 262/1 to 54/1
/./gsas/src/common_libs/prod_lib/GLA15_scal_mod.f90 changed from 262/1 to 54/1
/./gsas/src/create_dem/maker_SRTM_trks/maker.f90 changed from 279/4 to 54/1
/./gsas/src/elevations/c_Retreive_HiRes_DEM_mod.f90 changed from 279/1 to 54/1
/./gsas/src/elevations/e_calctrop_mod.f90 changed from 262/1 to 54/1
/./gsas/src/glas_alt/Elev_Support_mod.f90 changed from 262/2 to 54/1
/./gsas/src/glas_alt/ElevMgr_mod.f90 changed from 262/1 to 54/1
/./gsas/src/glas_alt/WFMgr_mod.f90 changed from 262/2 to 54/1