GSAS v5.4 Release Notes

GSAS Team

June 25, 2008

Introduction

GSAS 5.4 is a significant release with extensive changes to the atmosphere processing, additions and corrections to the waveform and elevation processing and the incorporation of new tide models. The format of several products has changed, but those changes were incorporated using unused variables and spares to minimize impact on pre-GSAS 5.4 product code. Significant improvements were made to the data product format documentation and this release will be accompanied with releases of the "Altimetry Data Products User Guide" and "Atmosphere Data Products User Guide".

L1A Changes (GLA01, 02, 03 and 04)

Changes/Improvements

Changed a GPS-time interval limit on GLAS_L0proc to improve the quality and quantity of ANC32 records produced during GPS "boundary condition" periods.

Altimetry Changes (GLA05, 06, 12, 13, 14, and 15)

Additions

A blowing snow range delay estimate and confidence flag from atmosphere processing has been added to GLA06, GLA12 to 14.

40Hz transmit pulse energy was added to GLA05, GLA06 and GLA012 -15.

Long period (equilibrium) tides are now being applied and are available at 2Hz on the record

Changes/Improvements

The ocean tide model was changed from the GOT99.2 model to the TPX07.1 model on GLA06, and 12 to 15.

The reflectivity estimate is now calibrated for several instrument effects. These values are passed on to GLA06, GLA12 to 15. Previous versions contained errors and were not calibrated.

Bug Fixes

An error was fixed in the use of the compression index in waveform processing in the computation of received energy.

The saturation range correction for gain equal to 13 was fixed to a maximum of 2.2m. A software bug in v 5.3 had limited it to 1.5m.

Solar angle and azimuth is now calculated after a pre-geolocation process in the elevation manager. In earlier versions, it was before the pre-geolocation, and would use pass-

through values from GLA05 that were not always updated based on latest pointing information.

Atmosphere changes (GLA07, 08, 09, 10 and 11)

There are many changes, additions and bug fixes incorporated into the version 5.4 GSAS atmospheric data products.

Additions

Blowing snow has been added to the GLA09 data product. The following are stored at the 5 Hz rate on GLA09: blowing snow layer height, optical depth, range delay and confidence flag. The latter two parameters are also stored on the GLA11 product at the 1 Hz rate.

1064 Total Column Optical Depth (over oceans only at 40 Hz and 1 Hz) has been added to GLA11. This is based on the measured (from altimetry channel) surface reflectance over ocean and the computed surface reflectance value (from the Cox-Munk model) as a function of surface wind speed. The computed (from the surface wind) surface reflectance value is also stored on GLA11.

Diurnal Cloud Flag added to GLA09. This new parameter identifies when a given cloud layer detected at night could have been detected during daytime. A space existed in the GLA09 data product for this parameter in prior releases, but its value was not computed until now.

Browse Products are now available for GLA07-11.

GLA08 now contains a fairly reliable aerosol layer height product. This provides top and bottom height of at most 2 aerosol layers detected from the 1064 channel at a 4 second resolution.

Changes/Improvements

Improved 532 calibration during daytime – affects laser 2 and 3 GLA07 532 backscatter profiles

Changed (improved) calibration for 1064 laser 3 operation periods – affects GLA07 1064 backscatter profiles

Changed the extinction retrieval method from one that operated only within detected cloud and aerosol layers to a method that computes extinction for the entire vertical profile (20 km to the top of the first cloud) – affects GLA10

Incorporated GMAO (Goddard Modeling and Assimilation Office) GEOS-5 aerosol transport model calculations of aerosol type as a function of geographic location and time to improve aerosol optical depth calculation – affects GLA11.

Improved multiple scattering correction and multiple scattering range delay calculation – affects GLA10 and GLA11

Added 532 total column aerosol optical depth and use flag to GLA11 and the bottom height of cloud free troposphere to GLA10

No longer use a calculated extinction to backscatter value for cirrus optical depth during daytime (affects some cloud optical depths on GLA11).

When the 1064 laser energy is less than 25 mJ, then the following occurs: 1) 40 Hz 1064 cloud search is not executed – the 40 Hz cloud top value is set to 0.0 and the quality flag set to 15. 2) the 1 and 4 second resolution 1064 cloud layer quality flag is set to one to indicate lowest quality

When the 532 laser energy falls below 1.5 mJ, 532 processing is halted. All 532 data products will be invalid for both day and night.

Bug Fixes

Fixed 532 calibration error induced by altimetry ocean scans and around the world scans

Corrected a bug in the 532 extinction retrieval that caused an incomplete computation of extinction profiles and an error in optical depth.

Fixed a bug in cloud/aerosol discrimination that caused a step-decrease in retrieved aerosol amount poleward of 60 degrees.

Utility Changes

QA-associated metadata values are now available in the GLAS .MET files. These data will be available for use by customers selecting data from NSIDC.

Created a new utility (ANC32_QA) to perform post-L0 processing QA on ANC32 files. This utility provides improved sanity checking on time calibration during the production of Level 1 data products.

Product Format/Definition Change Summary

Significant product changes were made in this release. Products changed include GLA05, GLA06, GLA09, GLA10, GLA11, GLA12, GLA13, GLA14, and GLA15. No changes were made to any product record sizes. A summary of the product changes is listed in the "Table of Data Product Changes" near end of this document.

Known Problems

L1A

None.

Altimetry

Reflectivity, not corrected for atmospheric effects, is calculated as Refl = R/T, where R is the received energy after it has been scaled for range, and T is the transmitted energy. i_reflctUncorr has also been calibrated for gain non-linearity (only for non-saturated waveforms), ground truth calibration and boresight shift shadowing (BSS). It is not corrected for saturation effects. If the shot is saturated (satindex above 2) then to correct for saturation the reflectivity estimate needs to be multiplied by the ratio of the corrected energy to the uncorrected energy (sat corrected reflectivity = i_reflctUncorr * (i_RecNrgAll + i_satNrgCorr)/i_RecNrgAll)

The atmospheric corrected reflectivity may be calculated from this uncorrected reflectivity by multiplying it by d_reflCor_atm.

The saturation energy correction has not be applied to the received energy before the computation of reflectance. The saturation energy corrections have not been fully verified and need additional investigation. A few of concenrs are:

1) If the saturation energy correction is very large compared to the received energy the data is questionable and often a large correction will cause reflectivity values greater than 1 to be computed.

2) The saturation energy corrections were determined using narrow waveforms and may not be valid for wide over-land waveforms.

3) For about 20% of land data there is saturation for which the current saturation energy correction does not provide a valid correction.

Atmosphere

Background correction for (some) 532 daytime data is still problematic. After being hit with a large amount of background light, the 532 detector has a time dependent response which is a non-linear function of the background level. This will result in the GLA07 attenuated backscatter profiles to be miss-calibrated especially in areas of very bright or rapidly changing background.

The 1064 cloud heights (all resolutions, but especially the 40 Hz cloud heights) suffer from false positives (especially) in daytime for operation periods after L3E. This becomes very noticeable when the 1064 laser energy falls below 30 mJ. It also affects the nighttime data as laser energy continues to fall.

Utility

None.

Release Information

The ClearCase label for this release is RELEASE_5.4.

Products generated by this software will be labeled as Release 29 by SDMS.

The release date is June 25, 2008.

Version numbers have been updated to “V5.4 May 2008".

This should be verified during operation by checking the version information in the appropriate ANC06 files.

SMDS Impact

The distribution tarfile is on glasdev.wff.nasa.gov at the following location:

/glasdev1/v5/dist/gsas_v5.4.tar.Z.

Bundle Changes

ANC53 is a new time-dependent input to the Atmosphere processing.

Atmosphere jobs need to be run after waveform jobs due to changes that need data from the GLA05 products. Atmosphere jobs still need to be run before elevation jobs.

QADATA metadata information should be included in GLAS_Meta control files.

ANC32_QA should be run after GLAS_L0proc and before GLAS_L1A. GLAS_L1A should not be run if this program returns a FATAL error unless the reason for the failure is understood to be acceptable.

ANC File Changes

New ANC07 files should be ingested.

New ANC45/ANC46 files should be ingested.

ANC52 (file 1) has been replaced

ANC38 now consists of 4 files.

ANC53 is a new time-dependent input to the Atmosphere processing.

ANC53 files should be ingested. Files have changed for this release.

Detailed Change Notes

(Numbers are the change control system tracking item number)

Documentation Changes

0002704: 0002672: 0002653: 0002647: 0002641: 0002644 0002634: 0002614: 0002606: 0002600: 0002586. 0002544: 0002541: 0002531: 0002493: 0002489: 0002503: 0002438: 0002437: 0002457: 0002424: 0002421: 0002408: 0002407: 0002402: 0002399: 0002393: 0002391: 0002374: 0002310:

The documentation changes to the parameter descriptions were extensive. These changes include making clearer definitions for data, fixing errors and defining parameters newly added to the products on the release. A number of product formats were changed. These are presented in the "Table of Data Product Changes" near the end of this release note.

Major Algorithm Changes

0002629: 0002640: Added an estimate of blowing snow range delay and a confidence flag to altimeter products

Added i_bs_conf to GLA11 and set it by taking the worst case of five values of i_blow_snow_conf on GLA09 with the following order of preference: [13,12,...,2,1,14,0,15]. Added blowing snow confidence (i_bs_conf) and blowing snow rande delay (d_bs_erd) to gla06 & 12-14 at 1Hz. It has not been applied to the range.

0002598: Corrected Computation of C_CalcrNrg to Use the Waveform Compression index properly.

In C_CalcrNrg, the compressions P & Q were being used in the correct order, but the index of compression change was not being used correctly. For wide waveforms with compression, this resulted in a received energy that was too large. In waveforms, applied the energy calibration to gla01%d_RecNrgAll_EU before using it to calculate gla05%d_reflctAllUnc.

0002591: Replace old ocean tide model with GOT99.2 model

Changed the existing GOT99.2 ocean tide model to the TPX07.1 model on GLA06, and 12-15. Changed _ocElv(2) to _ocElv(40), and added_eqElv(2) on GLA06, and 12-15.

The Equilibrium tides are now being calculated and stored in GLA06, 12-15 at 2Hz. The Ocean tides and Load tides are now being calculated using the TPX07.1 and TPX07.0 models respectively. The Ocean tides are now reported at 40Hz on the GLA06,12-15 products.

0002547: New Calibration Factor for Surface Reflectance

Based on the analysis of ICESat/GLAS surface reflectance data over the ocean, and surface reflectance over White Sands vs in-situ measurement, it appeared that the computation of surface reflectance was producing values that are appx 16% too large. The likely cause for this is in the system parameters (system transmission) that are used in the computation of received energy. Until that can be finalized, this factor was added in the code that computes the surface reflectance to provide an improved calibrated estimate and this value is used in the computation of optical depth.

0002543: 0002698: 0002703: Changes in computation of reflectance to correct for boresight and detector

Applied the non-linear gain energy calibration (only to non-saturated waveforms), the boresight shift shadowing (BSS) calibration factor, and the overall calibration to the reflectance values in gla05. Changed GLA06%d_reflCor_atm from a corrected reflectance to the atmospheric correction for reflectance. Defined another bit in GLA06%i_corrStatFlg to indicate if there is no 532 data. Added the first and last times of the data set in ns, the BSS factors and their effective times, and the overall calibration values to the gla05 header.

Reflectivity has not been corrected for saturation or atmospheric effects. If the shot is saturated (satindex above 2 or some other rule) then to correct for saturation the reflectivity estimate needs to be multiplied by the ratio of the corrected energy to the uncorrected energy (sat corrected reflectivity = i_reflctUncorr * (i_RecNrgAll + i_satNrgCorr)/i_RecNrgAll)

The atmospheric corrected reflectivity may be calculated from this uncorrected reflectivity by multiplying it by d_reflCor_atm.

0002530: Aerosol Optical Depth Problem

Prior releases exhibited a large and sudden decrease in aerosol amount poleward of 60 degrees north that was not realistic. This was caused by a tuning of the cloud-aerosol discrimination routine that took effect exactly at 60N and 60S. The tuning is intended to keep very low thin, cirrus-like clouds that occur in these latitudes from being classified as aerosol. The current version does this tuning now as continuous function of latitude starting at 55N and S.

0002529: Diurnal Cloud Flag Constant

The diurnal flag on GLA09 (found in the cloud flag for all resolutions) tells the user whether or not a given cloud layer could likely be detected during the day. The nighttime data has higher sensitivity than daytime data and the diurnal flag tells whether a given cloud layer detected at night would likely have been detected during the day. Prior to release 29, the diurnal flag was not operational.

0002518: Add 40Hz transmit pulse energy to GLA05, GLA06, and GLA12-15

Added the transmitted pulse energy at forty hertz to GLA05, GLA06, GLA12, GLA13, GLA14, & GLA15. Removed the area of the transmitted pulse from GLA05.

0002535: Addition of Blowing Snow Range Delay to GLA11

The blowing snow range delay has been added to product GLA11 as parameter bs_erd. This quantity is similar to a quantity already existing on GLA09, but is provided at a different data rate.

0002470: Fix Errors in Computation of Cloud Optical Depth

Prior to this release, the surface reflectance corrected for atmospheric attenuation (i_reflCor_atm), was incorrect. The atmospheric attenuation due to clouds was not computed correctly. This has been fixed in this release. The i_reflCor_atm parameter appears on GLA06 and GLA12-15.

0002461: Cloud/Aerosol Discrimination

The V28 atmosphere products had a problem with cloud/aerosol discrimination that pertained to cases where cirrus clouds lie directly above and are in contact with stratus clouds (as happens often in high latitudes). In these instances, the layer is broken in two and reported as aerosol (the cirrus) and cloud (the stratus). Also, in cases of multiple cloud layers, often the lower layer(s) are erroneously reported as aerosol. These problems did not occur in prior versions. This version (29) has corrected the problems inherent in the V28 release.

0002443: 1064 Aerosol Optical Depth

Five new product variables have been added to the GLA11 product. The altimetry channel surface reflectance parameter obtained from the GLA05 product is utilized to compute atmospheric total column 1064 nm optical depth at 40 Hz and 1 Hz over the oceans. The surface reflectance over water is a function of windspeed. If the wind speed is known, the actual reflectance of the ocean surface can be computed from theory. The GLAS measured reflectance would differ from this calculated reflectance only by the two-way transmission loss through the atmosphere. The total column atmospheric optical depth is computed from a ratio of the measured GLAS reflectance to the calculated reflectance (based on NCEP local surface wind speed). A multiple scattering correction is applied to the optical depth retrieval and is based on the height of the lowest scattering layer (if one is not detected, a 2000 m default height of the marine PBL is used), an assumed particle size, and geometrical and optical depth of the layer. The optical depth stored on the product has been corrected for multiple scattering. The multiple scattering correction factor (a number ranging from 0 to 1.0) is also stored on the product. One can obtain the non-multiple-scattering corrected optical depth by multiplying the optical depth by the multiple scattering correction factor. The new variables begin at byte offset 2288. See the GLA11 product format description for more information.

0002442: Additional anc Files for Aerosol Optical Processing Required

This release incorporates a significant improvement in the computation of extinction to backscatter ratio (S) for aerosol optical depth and extinction retrievals. In prior versions, this value was based only on climatology and obtained via a lookup table based on latitude and longitude. This new version uses the output of the NASA GEOS-4 aerosol transport model extracted along the GLAS track at the GLAS observation time to obtain a better estimate of S. The aerosol model calculates the aerosol type and size distribution

globally as a function of time. The S value is then computed from the aerosol type mixture knowing the percentage of each aerosol type and its corresponding S ratio.

At present, the generation of these files (called anc53) has only been done for the laser 2A operating period (Sep 25 - Nov 18, 2003). If they are not available for a given run, then the code will default back to the original global, non-time dependent table (anc31). For operational considerations, both anc31 and anc53 files can be defined in the run control file. But if anc53 files are not available, then the anc31 file must be present. The anc53 files are of length one calendar day starting at 00:00:00 GMT and ending at 23:59:59 GMT.

This release also incorporates a minor change to the pbl quality flag on GLA08. As of version 28, when the quality flag is equal to one, the extinction and optical depth for the PBL is not computed. Version 28 had an error in the computation of the quality flag that set it to one erroneously. This caused the retrievals of PBL extinction and optical depth to be missing in areas where there should have been good PBL optical depth and extinction values. This is now fixed.

0002440: Modifications to Optical Processing Routines (GLA10,11)

In prior releases, the 532 nm aerosol extinction, backscatter, and optical depth were computed only within layers that were found by the aerosol layer search algorithm. This captured most of the aerosol within the atmosphere, but when very tenuous aerosol layers are present, the aerosol search algorithm is sometimes unable to detect them. In order to capture all aerosol present, we now perform (for night data only) the extinction and backscatter retrieval beginning at 20 km altitude down to the top of the first cloud layer or the top of the PBL, whichever comes first. The resulting extinction and backscatter profiles are reported and stored on GLA10 exactly like any other aerosol layer was reported in prior versions. The top of the layer will always be 20 km and the bottom of the layer will be top of the highest cloud (if any) or the PBL top (if any). If no cloud or PBL were detected, the bottom would then be the bin above the ground height. This bottom height (d_aod_botht_4s) is stored on GLA10. In cases where there is an elevated aerosol layer detected, it is still reported separately as an individual layer as before, but the new column extinction layer would include it as well. For example, consider a cloud-free nighttime profile with an elevated aerosol layer between 6 and 3 km, and a PBL top at 1 km. In prior versions, the aerosol extinction profile would begin at 6 km and end at 3 km and then start up again at 1 km. In the new version, the aerosol extinction profile would begin at 20 km and extend down to the PBL top at 1 km. The aerosol optical depth of the elevated aerosol layer between 6 and 3 km is still reported as before on GLA11. New to GLA11 is the total column aerosol optical depth (d_aod_4s) which is the sum of the optical depth of all elevated aerosol layers plus the free troposphere plus the PBL (if PBL is aerosol, not cloud) and the total column AOD use flag (i_aod_flg_4s) which is described below.

total column AOD use flag (i_aod_flg_4s):
Note: in the below "full column" means the extinction retrieval from 20 km to d_aod_botht_4s. "Bad layer" means a layer for which extinction could not be computed.

0 - night, full column good, ground detected - highest quality
1 - day, no full column, sum of all detected layers, no bad layers, ground detected - highest daytime quality
2 - night, full column good, sum of detected layers, with a bad layer
3 - night, full column good
4 - night, full column bad, includes only detected lower layers.
5 - day, no full column, sum of all good layers, but bad layer present
6 - night, full column good, but no ground detected
7 - day, good or no layers, but no ground detected

0002433: Fix The Saturation Range Correction for Gain=13 to allow a larger maximum estimate then other gains.

Fixed a problem with the saturation elevation correction that caused the maximum corrector for gain 13 to be 1.5m instead of 2.2m. The saturation elevation correction remains the same for all other gain values.

0002375: 0002517: Blowing Snow Detection Algorithm

The incorporation of blowing snow detection is a major addition to this release. The algorithm looks at the bins immediately above the ground return to see if there is enhanced scattering present. If so, and the surface wind speed is in excess of 5 m/s, then blowing snow is assumed present. The top of the blowing snow layer is then found when two consecutive bins have a backscatter value less than 3.0e-6 (working from the ground upward). The optical depth of the layer is computed from the integral of the backscatter coefficient through the layer times an assumed extinction to backscatter ratio (25). The effect on altimetry is estimated from the optical depth of the layer, the layer top height and an assumed blowing snow particle size of 10 microns. The algorithm searches for blowing snow only if pole-ward of 60 degrees latitude and the observation is over land or sea ice. The algorithm is designed to use the 532 channel data if it is present and has a high enough quality, but will use the 1064 channel when 532 channel data are not available. To determine which channel was used, see the explanation of the blowing snow confidence flag below.

A blowing snow confidence flag is also included which ranges from 0 - 15 and has the following meaning:

0: profile tested, but no blowing snow detected.

1 - 6: Good blowing snow detection using the 1064 channel. 1 is the lowest confidence that layer is blowing snow, 6 is the highest confidence.

6: Layer suspected of being low cloud (such as fog), or seemingly too thick to be blowing snow (> 1.0 km thick) as determined from 1064 channel.

7 - 12: Good blowing snow detection using the 532 channel. 7 lowest confidence that layer is blowing snow, 12 highest confidence.

13: Layer suspected of being low cloud (such as fog), or seemingly too thick to be blowing snow (> 1.0 km thick) as determined from 532 channel.

14: Wind speed < 5 m/s or ground-stroke not detected (the latter case indicating overlying thick cloud).

15: Signal not examined for blowing snow (could be because equator-ward of 60 digress, or not over sea ice or land).

Minor Changes

0002642: Correct Errors In Reported GLA05%d_wfFitSDev_1

An error that occationally reported d_wfFitSDev_1 in non-normalized units has been fixed. d_maxGoodsDev (a threshold value used to set gwi_poorFit1 in GLA05%l_WFqual) is no longer normalized before using it to set the poor fit flag for alt fit.

0002635: Fix Received Pulse Energy Correction For Saturation So It Can Not Be Negative

Changed c_calcSatCorr_mod so that d_satNrgCorr is never negative. A few small negative values were detected on the release 28 products. If correction is computed as negative it is set to zero.

0002612: Remove Saturation Correction For Pulse Width

Removed the saturation correction for pulse width from GLA05, GLA06, and GLA12-15.

0002593: Atmosphere Calibration error during ocean scans and off nadir pointing

All prior versions of the atmospheric codes had a calibration problem during off-nadir pointing sequences (this includes off-nadir pointing to ground targets and ocean scans). The derived calibration constant during these periods was too large. This then caused the retrieved extinction and optical depth to be too low. This problem was greatest in the central Pacific Ocean, in the regions of daily ocean scans. Here the 532 extinction and optical depth are too low. For version 29, this problem has been corrected.

Additional work performed under this Mantis:

Affecting GLA09:

Tweaked the cloud/aerosol discrimination for 1064 cloud detection. Prior versions of the 1064 cloud layer product were often reporting low boundary layer aerosol layers as cloud. This skewed the cloud statistics especially below 3-4 km. V29 will show less low cloud than prior versions.

The 1 second and 5 Hz 532 cloud availability (af) flag within i_MRCL_Flag and i_HRCL_Flag, respectively are now set to zero whenever no cloud is found at 4 seconds. Prior version the af flag would be 15 (meaning not searched for) in this case.

The 1064 40 Hz cloud detection is turned off (and quality flag set to 15) if the 1064 laser energy is less than 25 mJ. Also, the 1064 40 Hz quality flag is set to 1 for laser energy < 35 mJ and > 25 mJ

Affecting GLA08-11:

Prior versions turned off the daytime 532 channel processing (cloud and aerosol layer height, PBL height, cloud and aerosol optical depth ie. all products in GLA08-11 that were derived from the 532 channel) when the 532 laser energy was less than 5 mJ. For V29, A check was added so that this 532 processing is turned off both day and night when the 532 laser energy is less than 1.5 mJ.

0002584: Need fsize.c for qap04_mod.f90

Fixed a problem where a (currently) unsupported compiler had a problem linking l1a_lib.

0002583: Need to use GLA00_print_mod in GLA00_cols_mod.f90

Fixed a problem where a required module was not referenced in GLA00_cols_mod.f90

0002582: Change The Scales For GLA12%d_IceSVar, GLA14%d_LandVar, and GLA15%d_OceanVar

Changed the scale for GLA12%i_IceSVar, GLA14%i_LandVar, & GLA15%i_OceanVar from 1.0d-3 to 1.0d-5.

0002578: Fix the code order for The i_podFlg being passed through to the GLA12-15 products.

The i_podFlg variable is now passed through to GLA12-15 as soon as it is determined for GLA06. This allows it to be properly updated during new geolocation processing.

0002577: The dateinterface_linux.c needs to be removed

Removed unused module (Dateinterface_linux.c) from date/time library. It was not referenced in any makefiles, so no other changes were necessary.

0002576: The calculation of solar angle/azimuth should be done after the first geolocation in the elevation manager

Solar angle and azimuth is now calculated after a pre-geolocation process in the elevation manager. In earlier versions, it was before the pre-geolocation, and would use pass-through values from GLA05.

0002540: Replacement ANC53 Files

These files are new to version 29 and give a more accurate estimate of the aerosol backscatter to extinction ratio (S) for aerosol. The GEOS-4 aerosol transport model is used to obtain an S value along the GLAS track and as a function of time. This is currently limited to the L2A period. Thus, the 2nd version of these files use the GLAS measured PBL height instead of the GEOS-4 model PBL height to separate PBL from free troposphere aerosol.

0002511: Multiple Scattering Table Indexing

For V29, the atmospheric multiple scattering factor (eta), the altimetry range delay due to cloud and aerosol multiple scattering and the global particle size table have been updated. The monte-carlo simulations used to compute eta and the range delay were run using many more photons that produced a more stable result. The user will see less variance in

the eta and range delay values for this release.

0002495: 0002662: 2697 532 Calibration Problem

The daytime calibration for the 532 nm channel has at certain times been a problem. This is especially true when the satellite passes from night to day and then again form day to night. For this release, the integration period used to compute the calibration constants was reduced from 10 minutes to 4 minutes, thereby providing more time resolution to the calibration changes that are occurring in these transition periods. In past versions, the 532 calibration was not performed during the day. The daytime calibration values were obtained by interpolating from the last night calibration to the next night calibration point. Thus, calibration changes occurring as the satellite passed from night to day and during the day portion of the orbit could not be accounted for.

The laser 3 532 channel calibration is now set to a constant value of 5.00e12 for nighttime data and a constant value of 2.0e13 for daytime data. The switch between the night value and the day value occurs when the 532 background exceeds 0.10 photons/bin. The laser 2 calibration remains as it has been for prior versions - computed from the data using the molecular scattering in the height range 22-26 km.

The low 532 laser energy of laser 3 makes the calibration of the 532 channel unreliable using the standard automated calibration utility. The data was analyzed off line and it was found that the calibration is fairly constant but depends on background conditions. A nighttime and separate daytime calibration constant is implemented for release 29 as follows:

L3C:

Night: 2.1d12

Day: 2.0d13

All other L3 Obs periods:

Night: 4.1d12

Day: 1.0d13

0002488: ANC32 Processing Sometimes Pairs GPS Latch Times Wrong when crossing a 6 Hour time Boundary

Created a new utility program, ANC32_QA. Required inputs are at least two ANC32 files. ANC07 is required, as well. The program checks for consistency among data in the ANC32 files by looking at changes in relationships of time-relevant parameters. If a change is detected which indicates a bad ANC32 file, the program exits with a FATAL result code. Otherwise, the program exists with a NO_ERROR result code. The only output is an ANC06 file. This program should be run after GLAS_L0proc and before GLAS_L1A. GLAS_L1A should not run if this program returns a FATAL error.

A related code change was made in the subroutine that reads ANC32. This subroutine was supposed to skip the first ANC32 record of EACH ANC32 file. However, testing determined it was only skipping the first record of the COMBINED ANC32 data set. The program was fixed to skip the first record of EACH ANC32 file.

0002486: Fix print_anc52 to use the Correct Scale factors

Fixed print_anc52 so that it would print gd_nrgCorrTbl in fJ. Added comments to the print for gd_rngCorrTbl and gd_pwdCorrTbl to list units.

0002485: Modify the pop_granule_mod.f90 to Increase the Array Size of the Number of Reference Orbit Variables

The arrays for the reference orbit instance in the pop_granule_mod.f90 file have been increased from 20 to 50.

0002479: Anc07 Change Affecting atm anc

This release will implement two changes to the computation of the 532 calibration constant (C). The averaging length used to compute C is increased from 600 seconds to 1000 seconds. Second, the calibration constant will now be calculated using daytime data as well as night data. Prior versions only used nighttime data to compute C. This change is implemented in an effort to increase the accuracy of the daytime calibration. It should not affect the calibration of the nighttime data.

0002458: Spurious Values in GLA14 d_gpCntRngOff

Fixed a problem where values of GLA14%d_gpCntRngOff from previous shots within a one-second frame were retained until replaced by a correct value. For example, if the first shot had six valid peaks, then all forty shots in that one second frame would have six values for GLA14%d_gpCntRngOff, independent of the actual number of peaks in each of the next 39 shots.

0002441: Fix the Error in GLA10 Extinction Retrieval

This release fixes a problem in the cloud and aerosol extinction retrieval that caused the inaccurate retrieval of optical depth and extinction for some (normally optically thick) layers. This resulted in a lower optical depth for the layer than reality. This problem was present in all prior releases of the atmospheric GSAS codes and affected GLA10 and GLA11.

0002428: Add The Utility that Creates anc52 file (Saturation Elevation, Energy, and pw Corrections) to the VOB

Added programs used to generate the anc52 files to the vob.

0002420: Increase The Alternate Fit Convergence Threshold To allow faster exit from the iteration loop.

Changed d_maxGoodSDev1 from 0.04 to 0.06

0002417: Add Bits to tell if Second Iteration was Performed

Flags gwi_2ndFit1 (bit 22, 0 based) & gwi_2ndFit2 (bit 23, 0 based) were added to i_WFqual to indicate that a second fit was tried.

0002416: Maximum Standard Deviation needs Value for alt and std Fit

Changed the maximum good standard deviation of fit (maxGoodSDev) from one value to two values - one for alternate parameters and one for standard parameters.

0002406: Wrong Invalid Value Used for i_SolarAngle on GLA11, GLA09

Corrects an error in setting the invalid value of i_SolarAngle on GLA11 and corrects a minor internal processing error on checking for invalids.

0002395: Remove Surface Slope and Roughness from Level 2 Products

Removed slope, roughness and slope & roughness QA from level 2 products.

0002389: Parameters should be Set to Invalid for waveforms with No Fit

Changed W_FunctionalFt so that if there is no fit, the fit parameters are set to invalid.

0002377: ANC07 Vars for Waveforms should be Renamed

The filter width used to start the smoothing process is no longer the minimum filter width. The variable names for the beginning filter widths were changed to prevent confusing them with the minimum and maximum filter widths. Removed anc07 variables that were associated with saturation flags that were removed from wfQual, and are no longer used.

0002265: ANC38 File Refinements

This release incorporates improvements to the multiple scattering correction (eta) applied to aerosol and cloud backscatter. This will improve the extinction and optical depth retrievals for 532. Also, we are now producing column optical depth over oceans from the 1064 channel and a separate 1064 eta is applied to that calculation. An improvement to the range delay calculation was made for this release by increasing the number of photons used in the montecarlo calculations and updating the particle size table. This will help to reduce the large variance seen in prior versions.

0002233: GLA09 i_MRC_qf is Packed/Unpacked Inconsistently

An error was corrected in the packing software for the GLA09 i_MRC_qf flag. This is a quality flag that is part of the composite i_MRCL_Flag product flag (medium resolution cloud layer flag). Previous flag values did not conform to the documentation. Flags are now reported as they were previously documented.

0002231: GLA09 Diurnal Cloud Flag

Up until this software release, the diurnal cloud flag has not been operational. The diurnal cloud flag is contained in the 532 nm cloud layer flag for all resolutions (i_LRCL_Flag, i_MRCL_Flag, i_FRCL_Flag, i_HRCL_Flag). It indicates whether a given cloud layer that was detected during night conditions could in fact be detected during the day. The sensitivity of the 5 32 channel is significantly better at night than during the day and this flag is used to tell whether the layer could have been detected under typical daytime background conditions. The use of the flag is important if one is studying the daytime cloud amount versus the nighttime amount. The amount of cloud detected at night will always be greater than during the day just because of the increased sensitivity of the nighttime data. Using this flag with the nighttime data and eliminating those layers that could not be detected during the day, will render a more equitable comparison of the

cloud amount during day versus night. The diurnal flag is stored as part of the general cloud flag for the various resolutions on GLA09 starting at byte offset 3532.

0002038: GLA01%main%i_TxFlg at times could be Incorrectly Set

The code was updated to correct the setting of the GLA01 i_txflg for each shot. In previous versions the flag was set to "no telemetered transmit pulse" based on the pulse width being out of range. However, there are cases when there is a valid transmit pulse with its pulse width out of normal bounds. The code was updated to perform an additional check to set the flag correctly.

0000976: Remove d_sigmaElv from GLA12-15

Changed i_sigmaElv to i_spare12 on the elevation products. The Precision Range Determination (PRD) team decided there was not a universal (for all returns and surface types) algorithm to provide a meaningful estimate on the elevation error.

Browse, Metadata and QA Changes

0002645: 0002397: 0001979: Generation of GLA07-11 metadata and related browse product changes

Added metadata for GLA07-11. Metadata and Browse products are now available for GLA07-11.

0002595: GLA06 QA histogram problems

Changed the elevation QA histogram range for the distance from the maximum amplitude peak to the centroid from [-50,50] to [-5,5].

Changed the elevation QA histogram range for skewness to be the same as in QAP05 ([-1.5,1.5]) and changed the number of histogram bins for both from 102 to 62 (the QAP05 and QAP06 structures have been left the same). Changed the elevation QA histogram range for kurtosis to be the same as in QAP05 ([-2.5,2.5]).

0002580: QAP readers do not work on icesat5

Changed code so it will work on little-endian machines.

0002579: Incorrect map on GLA05 browse products

For GSAS/ISIPS processing, the code was modified to use file names rather than latitudes in the qap file to determine the segment. For the equatorial segments, the longitude range is now set using same algorithm as used for SCF files.

0002539: Change the failure triggers on some QA parameters

QAPCompare failure levels for several parameters were modified. For GLA01 and GLA05 this was done to avoid FAIL status due to cloud returns. For GLA03 this was done to avoid FAIL status caused by checks of portions of the instrument that are turned off. I do not know why the change was needed for GLA04.

QAPCompare was modified so all output metadata files will have show the limits used.

Slope and roughness metadata parameters were removed from all elevation product metadata.

0002538: 0002646: 0002679: 0002673: 0002674: ANC45 changes for Release 29 GSAS 5.4

The GSAS version was updated to 5.4 and release was updated to 29 for all ANC45's.

Removed the Surface_Slope and Surface_Roughness from GLA06, GLA12-15.

Removed QAPercentCloudCover from all products.

Removed QAPercentMissing from the Surface_Reflectance parameter on GLA06, GLA 12-15.

Removed QAPercentOutofBounds from the Data parameter on GLA03.

Removed QAPercentMissing from the Voltage and Temperature parameters on GLA03.

Removed QAPercentOutofBounds from all parameters on GLA04.

0002536: Fix Bug in qapc_metadat02

Corrected errors in calculation of OPERQA_PCProfile_Flag and OPERQA_CDProfile_Flag.

0002533: QA Metadata Fixes

Modified GLAS_Meta so that met files would not contain parameter values for those items that (1) do not appear in the ANC45 file and (2) have zero or null values in the respective control file line.

0002532: Remove slope and roughness qa parameters from all ANC45s

Removed QAPercentCloudCover from all ANC45 files.

Removed QAPercentMissing from the Surface_Reflectance parameter on ANC45-06, ANC45-12-15.

Removed QAPercentOutofBounds from the Data parameter on ANC45-03.

Removed QAPercentMissing from the Voltage and Temperature paremeters on ANC45-03.

Removed QAPercentOutofBounds from all parameters on ANC45-04.

0002460: Change in QAP05 record structure

Code was changed to work with modified QAP data structures for GLA05, 6, 12, 13, 14, and 15.

0002459: Slope and Roughness should be Removed from Elevations QA

Restored QA structure to previous format with removed variables replaced with spares.

0002432: GLA06 Metadata File has the SP_ICE_GLAS_StartBlock and SP_ICE_GLAS_EndBlock Values Set to "NOT SET"

Updated GLAS_Meta to produce an error message when control file has unequal inputs and outputs.

0002383: There is an End-Of-File Problem in Waveforms

Changed the value of a variable (eps) to insure that last frame is always used in QA processing.

0002356: Fix Saturation QA For GLA05 & GLA06

Changed gla05 QA for saturation to include a set of totals for along-track QA and histograms for i_satNdx.

Added along-track and summary totals for saturated waveforms (i_satNdx >= anc07_0004%iMinSatNdx) to gla05 QA.

Added summary totals for i_satCorrFlg (to be displayed as %), histograms and summary averages for d_satElevCorr and d_satNrgCorr to gla06 QA.

Corrected an error in the calculation of qap12 & qap14.

Corrected the use of gi_satNdxTh - it is a table of 256 values and should use (gain+1) as its index.

No changes - investigation provided clarification that processing was correct.

0002625: Adjustment of 1064 Calibration Constant for Laser 3

Confirmed that the 1064 calibration did not change for this data.

0002636: Transmitted Pulse Needs To Be Reversed In Waveforms

The Transmit pulse does not need to be reversed. No code was changed. Clarification was written in the altimeter user guide. The received waveform is stored on gla01 in latest to earliest order because of the compression processing on the spacecraft. The transmitted pulse is not compressed and is stored on gla01 in earliest to latest order. For waveform processing, the received waveform is flipped to make it earliest to latest order. The transmitted pulse is already in that order and does not need to be reversed.

0002590: Investigate "track error" messages

Problem has been diagnosed not as an error message, but rather as an imprecisely stated status message. This message is a normal part of the transition process when cycling between track files covering an expanse of data.

Branches cr2590 and wcr2590 have been used to make modifications to track_reader_mod.f90 and anc07_001_01_0000.dat in order to make the message appear more informational and less likely to be perceived as an error.

002474: The GLA05_428__2103_002_0286_4_01_0001.DAT File has Incorrect

Equator Crossing Time and Date in its Header

Problem was a bad PASSID control line so no GSAS change is needed.

0002376: IST Time Computation Change

After investigation, it was determined that no correction is to be implemented for the IST time tags.

0002361: Change W_CombinePeaks

After investigation for alternate fit peaks that are far apart are not combined. No software change is required.

0001496: Investigate Leading Edge Fit of Saturated Waveforms Additional Information

It has been determined from engineering that when saturated, there is an instrument stretching of the front edge as well as the back. So fitting only the front does not really provide the true surface location. Since this mantis was opened Xiaoli has determined, from lab work, a set of saturation range corrections. These were implemented as elevation corrections in rel 28 (i_satElevCorr). So any code related to this mantis should not be put in the production code.

Additional Information

The GSAS User Guide

Altimeter Data Product User Guide (Updated)

Atmosphere Data Product User Guide (Updated)

Table of Data Product Changes

PRODUCT	VARIABLE CHANGES
GLA01	None
GLA02	None
GLA03	None
GLA04	None
GLA05	Replaced integer (kind=i2b) :: i_areaTrWF (40) with integer (kind=i2b) :: i_TxNrg (40)
GLA06	Replaced integer (kind=i2b) :: i_ocElv (2) with integer (kind=i2b) :: i_spare12 (2)
	Replaced integer (kind=i2b) :: i_SigmaElv (40) with integer (kind=i2b) :: i_ocElv (40)
	Replaced integer (kind=i2b) :: i_srf_ruf (40) integer (kind=i2b) :: i_srf_slope (40) with

	integer (kind=i1b) :: i_spare4 (160)
	Replaced integer (kind=i1b) :: i_SurfRuf_slpQF (40) with integer (kind=i1b) :: i_spare9 (40)
	Replaced integer (kind=i2b) :: i_satPwdCorr(40) with integer (kind=i2b) :: i_spare13(40)
	Replaced integer (kind=i1b) :: i_spare7(366) with integer (kind=i2b) :: i_TxNrg (40) integer (kind=i2b) :: i_eqElv(2) integer (kind=i1b) :: i_spare7(282)
	Replaced integer (kind=i1b) :: i_spare3 (3) with integer (kind=i1b) :: i_bs_conf integer (kind=i2b) :: i_bs_erd
GLA07	None
GLA08	None
GLA09	Replaced integer (kind=i1b) :: i_spare4 (558) with integer (kind=i2b) :: i_blow_snow_ht (20) integer (kind=i2b) :: i_blow_snow_od (20) integer (kind=i2b) :: i_blow_snow_erd (20) integer (kind=i1b) :: i_blow_snow_conf (20) integer (kind=i1b) :: i_spare4 (418)
GLA10	Replaced integer (kind=i1b) :: i_spare5 (292) with integer (kind=i2b) :: i_aod_botht_4s integer (kind=i1b) :: i_spare5 (290)
GLA11	Replaced integer (kind=i1b) :: i_FRir_qaFlag (160) integer (kind=i2b) :: i_FRir_cldtop (160) integer (kind=i1b) :: i_Aer_b20_prop (20,5) integer (kind=i1b) :: i_PBL_prop (20) integer (kind=i1b) :: i_Aer_ir_layflg (2) integer (kind=i1b) :: i_spare3 (142) with integer (kind=i2b) :: i_reflct_1064od_40hz_cor (40,4) integer (kind=i1b) :: i_reflct_1064msf_40hz (40,4) integer (kind=i2b) :: i_reflct_1064od_1hz_cor (4) integer (kind=i1b) :: i_reflct_1064msf_1hz (4) integer (kind=i2b) :: i_reflct_pristine_1hz (4) integer (kind=i2b) :: i_aod_4s integer (kind=i1b) :: i_aod_flg_4s integer (kind=i1b) :: i_spare3 integer (kind=i2b) :: i_bs_erd (4) integer (kind=i1b) :: i_bs_conf(4) integer (kind=i1b) :: i_spare4 (228)
GLA12	Replaced

	integer (kind=i2b) :: i_ocElv (2) with integer (kind=i2b) :: i_spare12 (2)
	Replaced integer (kind=i2b) :: i_SigmaElv (40) with integer (kind=i2b) :: i_ocElv (40)
	Replaced integer (kind=i2b) :: i_IceSheetRuf (40) integer (kind=i2b) :: i_IsSlopeEmp (40) with integer (kind=i1b) :: i_spare4 (160)
	Replaced integer (kind=i1b) :: i_SurfRuf_slpQF (40) with integer (kind=i1b) :: i_spare9 (40)
	Replaced integer (kind=i2b) :: i_satPwdCorr(40) with integer (kind=i2b) :: i_spare13(40)
	Replaced integer (kind=i1b) :: i_spare7 (366) with integer (kind=i2b) :: i_TxNrg (40) integer (kind=i2b) :: i_eqElv (2) integer (kind=i1b) :: i_spare7 (282)
	Replaced integer (kind=i1b) :: i_spare3 (3) with integer (kind=i1b) :: i_bs_conf integer (kind=i2b) :: i_bs_erd
GLA13	Replaced integer (kind=i2b) :: i_ocElv (2) with integer (kind=i2b) :: i_spare12 (2)
	Replaced integer (kind=i2b) :: i_SigmaElv (40) with integer (kind=i2b) :: i_ocElv (40)
	Replaced integer (kind=i2b) :: i_RufSeaIce (40) with integer (kind=i1b) :: i_spare11 (80)
	Replaced integer (kind=i2b) :: i_SiRufLstPk (40) integer (kind=i2b) :: i_AvgRuf (40) with integer (kind=i1b) :: i_spare4 (160)
	Replaced integer (kind=i2b) :: i_spare7 (40) integer (kind=i2b) :: i_SiRufMaxPk (40) with integer (kind=i1b) :: i_spare10 (160)
	replaced integer (kind=i1b) :: i_SiRufQF (40)

	with integer (kind=i1b) :: i_spare9 (40)
	Replaced integer (kind=i2b) :: i_satPwdCorr(40) with integer (kind=i2b) :: i_spare13(40)
	Replaced integer (kind=i1b) :: i_spare8 (366) with integer (kind=i2b) :: i_TxNrg (40) integer (kind=i2b) :: i_eqElv (2) integer (kind=i1b) :: i_spare7 (282)
	Replaced integer (kind=i1b) :: i_spare3 (3) with integer (kind=i1b) :: i_bs_conf integer (kind=i2b) :: i_bs_erd
GLA14	Replaced integer (kind=i2b) :: i_ocElv (2) with integer (kind=i2b) :: i_spare12 (2)
	Replaced integer (kind=i2b) :: i_SigmaElv (40) with integer (kind=i2b) :: i_ocElv (40)
	Replaced integer (kind=i2b) :: i_LdRufLstPk (40) integer (kind=i2b) :: i_LandSlopeLast (40) with integer (kind=i1b) :: i_spare4 (160)
	Replaced integer (kind=i1b) :: i_SurfRuf_slpQF (40) with integer (kind=i1b) :: i_spare9 (40)
	Replaced integer (kind=i2b) :: i_satPwdCorr(40) with integer (kind=i2b) :: i_spare13(40)
	Replaced integer (kind=i1b) :: i_spare7 (204) with integer (kind=i2b) :: i_TxNrg (40) integer (kind=i2b) :: i_eqElv (2) integer (kind=i1b) :: i_spare7 (120)
	Replaced integer (kind=i1b) :: i_spare3 (3) with integer (kind=i1b) :: i_bs_conf integer (kind=i2b) :: i_bs_erd
GLA15	Replaced integer (kind=i2b) :: i_ocElv (2) with integer (kind=i2b) :: i_spare12 (2)
	Replaced integer (kind=i2b) :: i_SigmaElv (40)

	with integer (kind=i2b) :: i_ocElv (40)
	Replaced integer (kind=i1b) :: i_OcRMSqf (40) with integer (kind=i1b) :: i_spare9 (40)
	replaced integer (kind=i2b) :: i_satPwdCorr(40) with integer (kind=i2b) :: i_spare13(40)
	replaced integer (kind=i2b) :: i_srf_ruf (40) integer (kind=i2b) :: i_srf_slope (40) with integer (kind=i1b) :: i_spare4 (160)
	replaced integer (kind=i1b) :: i_spare7 (234) with integer (kind=i2b) :: i_TxNrg (40) integer (kind=i2b) :: i_eqElv (2) integer (kind=i1b) :: i_spare7 (150)

Changed Files:

```
./data
./data/anc07_001_01_0000.dat
./data/anc07_001_01_0001.dat
./data/anc07_001_01_0002.dat
./data/anc07_001_01_0003.dat
./data/anc07_001_01_0004.dat
./data/anc07_001_01_0005.dat
./data/anc38_001_01_0001.dat
./data/anc38_001_01_0002.dat
./data/anc38_001_01_0003.dat
./data/anc38_001_01_0004.dat
./data/anc45_001_01_0001.dat
./data/anc45_001_01_0002.dat
./data/anc45_001_01_0003.dat
./data/anc45_001_01_0004.dat
./data/anc45_001_01_0005.dat
./data/anc45_001_01_0006.dat
./data/anc45_001_01_0007.dat
./data/anc45_001_01_0008.dat
./data/anc45_001_01_0009.dat
./data/anc45_001_01_0010.dat
./data/anc45_001_01_0011.dat
./data/anc45_001_01_0012.dat
./data/anc45_001_01_0013.dat
./data/anc45_001_01_0014.dat
./data/anc45_001_01_0015.dat
./data/anc52_001_01_0001.dat
./idl/qa_browse/browse/qab_bar__define.pro
./idl/qa_browse/browse/qab_gndtrkmap.pro
./idl/qa_browse/browse/qab_latlonrange.pro
./idl/qa_browse/browse/qab_mapspecs.pro
```

./idl/qa_browse/browse/qab_nonstdlatlonrange.pro
./idl/qa_browse/browse/qab_plotelevadjustments.pro
./idl/qa_browse/browse/qab_tripleplot.pro
./idl/qa_browse/browse/qab_tripleplotpage.pro
./idl/qa_browse/browse/qab01.pro
./idl/qa_browse/browse/qab05_groundtrackmaps.pro
./idl/qa_browse/browse/qab05_histograms.pro
./idl/qa_browse/browse/qab05_writetabletoplot.pro
./idl/qa_browse/browse/qab05.pro
./idl/qa_browse/browse/qab06_lowerlevelplots.pro
./idl/qa_browse/browse/qab06_upperlevelplot.pro
./idl/qa_browse/browse/qab06.pro
./idl/qa_browse/browse/qab07_plot.pro
./idl/qa_browse/browse/qab07.pro
./idl/qa_browse/browse/qab08_plot.pro
./idl/qa_browse/browse/qab08.pro
./idl/qa_browse/browse/qab09_plot.pro
./idl/qa_browse/browse/qab09.pro
./idl/qa_browse/browse/qab10_plot.pro
./idl/qa_browse/browse/qab10.pro
./idl/qa_browse/browse/qab11_plot.pro
./idl/qa_browse/browse/qab11.pro
./idl/qa_browse/browse/qab13and15_lowerlevelplot.pro
./idl/qa_browse/browse/qab13and15_upperlevelplot.pro
./idl/qa_browse/browse/qab13and15.pro
./idl/qa_browse/browse/qabatm_statplot.pro
./idl/qa_browse/browse/qabelev_positions.pro
./idl/qa_browse/compare
./idl/qa_browse/compare/qapc_metadata.pro
./idl/qa_browse/compare/qapc_metadata02.pro
./idl/qa_browse/compare/qapc_metadata03.pro
./idl/qa_browse/compare/qapc_metadata04.pro
./idl/qa_browse/compare/qapc_metadata05.pro
./idl/qa_browse/compare/qapc_metadata07.pro
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./idl/qa_browse/compare/qapc_metadata09.pro
./idl/qa_browse/compare/qapc_metadata10.pro
./idl/qa_browse/compare/qapc_metadata11.pro
./idl/qa_browse/compare/qapc_metadataelev.pro
./idl/qa_browse/read/qapr_readfile.pro
./idl/qa_browse/read/qapr_readheader.pro
./idl/qa_browse/read/qapread.pro
./idl/qa_browse/util
./idl/qa_browse/util/qa_consts.pro
./idl/qa_browse/util/qap05V4_datastruct.pro
./idl/qa_browse/util/qap06V6_datastruct.pro
./idl/qa_browse/util/qap07V4_datastruct.pro
./idl/qa_browse/util/qap08V3_datastruct.pro
./idl/qa_browse/util/qap09V3_datastruct.pro
./idl/qa_browse/util/qap10V3_datastruct.pro
./idl/qa_browse/util/qap11V3_datastruct.pro
./idl/qa_browse/util/qap13V6_datastruct.pro
./idl/qa_browse/util/qapc_faillevel.pro
./Makefile
./src
./src/anc32_qa/ANC32_QA.f90
./src/anc32_qa/GetControl_mod.f90
./src/anc32_qa/Makefile

```
./src/atm_anc/A_sum_lidar_mod.f90
./src/atm_lib
./src/atm_lib/Makefile
./src/atmosphere/backscat/A_cal_cofs_mod.f90
./src/atmosphere/common/A_buff_data_mod.f90
./src/atmosphere/common/A_fetch_met_mod.f90
./src/atmosphere/common/A_types_mod.f90
./src/atmosphere/layers
./src/atmosphere/layers/A_1s_1064_det_mod.f90
./src/atmosphere/layers/A_4s_1064_det_mod.f90
./src/atmosphere/layers/A_aer_lays_mod.f90
./src/atmosphere/layers/A_blow_snow_mod.f90
./src/atmosphere/layers/A_cld_det_mod.f90
./src/atmosphere/layers/A_cld_grd_det_mod.f90
./src/atmosphere/layers/A_cld_lays_mod.f90
./src/atmosphere/layers/A_lays_1064_mod.f90
./src/atmosphere/layers/A_pbl_det_mod.f90
./src/atmosphere/opt_props/A_aer_opt_prop_mod.f90
./src/atmosphere/opt_props/A_cld_opt_prop_mod.f90
./src/atmosphere/opt_props/A_opt_thin_mod.f90
./src/atmosphere/QA/QAP07_mod.f90
./src/atmosphere/QA/QAP08_mod.f90
./src/atmosphere/QA/QAP09_mod.f90
./src/atmosphere/QA/QAP10_mod.f90
./src/atmosphere/QA/QAP11_mod.f90
./src/common_libs/anc_lib
./src/common_libs/anc_lib/anc07_elev_mod.f90
./src/common_libs/anc_lib/anc07_glob_mod.f90
./src/common_libs/anc_lib/anc07_wf_mod.f90
./src/common_libs/anc_lib/anc32_gps_mod.f90
./src/common_libs/anc_lib/anc38_msf_mod.f90
./src/common_libs/anc_lib/anc52_corr_mod.f90
./src/common_libs/anc_lib/anc53_aerosol_mod.f90
./src/common_libs/anc_lib/c_calcSatCorr_mod.f90
./src/common_libs/anc_lib/Makefile
./src/common_libs/exec_lib/C_CalcNrg_mod.f90
./src/common_libs/exec_lib/c_nose_mod.f90
./src/common_libs/exec_lib/fCntl_mod.f90
./src/common_libs/exec_lib/get_fileindex_mod.f90
./src/common_libs/exec_lib/pastendofperiod_mod.f90
./src/common_libs/exec_lib/ReadAnc_mod.f90
./src/common_libs/exec_lib/ReadData_mod.f90
./src/common_libs/platform_lib/const_atm_mod.f90
./src/common_libs/platform_lib/const_elev_mod.f90
./src/common_libs/platform_lib/const_glob_mod.f90
./src/common_libs/platform_lib/const_wf_mod.f90
./src/common_libs/prod_lib/common_flags_mod.f90
./src/common_libs/prod_lib/GLA00_cols_mod.f90
./src/common_libs/prod_lib/GLA05_alg_mod.f90
./src/common_libs/prod_lib/GLA05_hdr_mod.f90
./src/common_libs/prod_lib/GLA05_Pass_mod.f90
./src/common_libs/prod_lib/GLA05_print_mod.f90
./src/common_libs/prod_lib/GLA05_prod_mod.f90
./src/common_libs/prod_lib/GLA05_scal_mod.f90
./src/common_libs/prod_lib/GLA06_alg_mod.f90
./src/common_libs/prod_lib/GLA06_Pass_mod.f90
./src/common_libs/prod_lib/GLA06_print_mod.f90
./src/common_libs/prod_lib/GLA06_prod_mod.f90
```

```
./src/common_libs/prod_lib/GLA06_scal_mod.f90
./src/common_libs/prod_lib/GLA08_scal_mod.f90
./src/common_libs/prod_lib/GLA09_alg_mod.f90
./src/common_libs/prod_lib/GLA09_flags_mod.f90
./src/common_libs/prod_lib/GLA09_print_mod.f90
./src/common_libs/prod_lib/GLA09_prod_mod.f90
./src/common_libs/prod_lib/GLA09_scal_mod.f90
./src/common_libs/prod_lib/GLA10_alg_mod.f90
./src/common_libs/prod_lib/GLA10_print_mod.f90
./src/common_libs/prod_lib/GLA10_prod_mod.f90
./src/common_libs/prod_lib/GLA10_scal_mod.f90
./src/common_libs/prod_lib/GLA11_alg_mod.f90
./src/common_libs/prod_lib/GLA11_print_mod.f90
./src/common_libs/prod_lib/GLA11_prod_mod.f90
./src/common_libs/prod_lib/GLA11_scal_mod.f90
./src/common_libs/prod_lib/GLA12_alg_mod.f90
./src/common_libs/prod_lib/GLA12_flags_mod.f90
./src/common_libs/prod_lib/GLA12_print_mod.f90
./src/common_libs/prod_lib/GLA12_prod_mod.f90
./src/common_libs/prod_lib/GLA12_scal_mod.f90
./src/common_libs/prod_lib/GLA13_alg_mod.f90
./src/common_libs/prod_lib/GLA13_print_mod.f90
./src/common_libs/prod_lib/GLA13_prod_mod.f90
./src/common_libs/prod_lib/GLA13_scal_mod.f90
./src/common_libs/prod_lib/GLA14_alg_mod.f90
./src/common_libs/prod_lib/GLA14_flags_mod.f90
./src/common_libs/prod_lib/GLA14_print_mod.f90
./src/common_libs/prod_lib/GLA14_prod_mod.f90
./src/common_libs/prod_lib/GLA14_scal_mod.f90
./src/common_libs/prod_lib/GLA15_alg_mod.f90
./src/common_libs/prod_lib/GLA15_print_mod.f90
./src/common_libs/prod_lib/GLA15_prod_mod.f90
./src/common_libs/prod_lib/GLA15_scal_mod.f90
./src/common_libs/prod_lib/qap_version_mod.f90
./src/common_libs/time_lib
./src/create_gla16/Create_GLA16.f90
./src/createGran_util/pop_granule_mod.f90
./src/elev_lib
./src/elev_lib/Makefile
./src/elevations
./src/elevations/c_Reflect_Atm_Corr_mod.f90
./src/elevations/e_calcslope_mod.f90
./src/elevations/e_IceSheetParm_mod.f90
./src/elevations/e_LandParm_mod.f90
./src/elevations/e_legacyOcTd_mod.f90
./src/elevations/e_OceanParm_mod.f90
./src/elevations/ElevQA_mod.f90
./src/elevations/qap06_mod.f90
./src/elevations/qap12_mod.f90
./src/elevations/qap13_mod.f90
./src/elevations/qap14_mod.f90
./src/elevations/qap15_mod.f90
./src/elevations/qapelev_rangecorrections_mod.f90
./src/glas_alt/Elev_Support_mod.f90
./src/glas_alt/ElevMgr_mod.f90
./src/glas_atm/AtmMgr_mod.f90
./src/glas_meta/WriteMetaFile_mod.f90
./src/glas_alt/WFMgr_mod.f90
```

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./src/glas_atm/AtmMgr_mod.f90
./src/glas_l0p/GLAS_L0proc.f90
./src/glas_meta/GetControl_mod.f90
./src/glas_meta/GLAS_Meta.f90
./src/glas_meta/MetaQA_mod.f90
./src/glas_meta/ReadMetaTemplate_mod.f90
./src/glas_meta/WriteMetaFile_mod.f90
./src/glas_reader/PrintAnc_mod.f90
./src/glas_reader/PrintData_mod.f90
./src/l1a_lib
./src/l1a_lib/fsize.c
./src/l1a_lib/L_Alt_mod.f90
./src/l1a_lib/Makefile
./src/Makefile
./src/prod_util/product_test/gla05_minmax_mod.f90
./src/prod_util/product_test/gla06_minmax_mod.f90
./src/prod_util/product_test/gla12_minmax_mod.f90
./src/prod_util/product_test/gla13_minmax_mod.f90
./src/prod_util/product_test/gla14_minmax_mod.f90
./src/prod_util/product_test/gla15_minmax_mod.f90
./src/qapg/qapg_consts_mod.f90
./src/qapg/qapg_gla05_at.f90
./src/qapg/qapg_gla05_mod.f90
./src/qapg/qapg_gla05_sum.f90
./src/saturation_util
./src/saturation_util/mk_nrg_corr.f
./src/saturation_util/mk_pwd_corr.f
./src/saturation_util/mk_range_corr.f
./src/track_reader/track_reader_mod.f90
./src/wf_lib/QA_wf_mod.f90
./src/wf_lib/W_Assess_mod.f90
./src/wf_lib/W_CreQAStats_mod.f90
./src/wf_lib/W_FunctionalFt_mod.f90
./src/wf_lib/W_LsqFit_mod.f90
./src/wf_lib/W_Types_mod.f90
```