



ICESat (GLAS) Science Computing Facility Document Series

Volume 4a SCF Data Visualization Software User's Guide Version 201103.0

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Summary of Changes since Version 200105.0

- p. 1 The data visualization Graphical User Interface (GUI) can be run from anywhere using the command `/SCF/bin/V2_prelim/run_visualizer.ksh`.

Figures were updated as appropriate.

Summary of Changes since Version 200110.0

- p.2 Updated pictures for the front end of visualizer. (Figures 2-1, 2-2)
- p.6 Added the description of the pass option button.
- p.8 Most of the following windows have "Print..." buttons, allowing postscript files to be created for printing. However, the user must have write privilege to the current directory for this feature so work, since the postscript files are created there.

The decimated backscatter image has been updated to show the groundtrack without initiating plotset selection by right clicking on an image, and the pass ID for that image is now displayed.

- p.9 The Groundtracks GUI (see Figure 2-7) has been updated to appear similar to the SCF-visualizer map help display (see Figure 2-4). The map may be zoomed by selecting a region (World, Antarctica, or Greenland), or by specifying the minimum and maximum latitudes and longitudes. If the user selects the DEM option, the groundtracks are displayed over a high resolution DEM (GSFC Greenland and Antarctic 5km, or USGS 30 second for all other regions).

The decimated elevation profile has been updated to show the groundtrack without initiating plotset selection by right clicking on a profile.

The decimated elevation profile has been updated to display all of the regional products (GLA12, GLA13, GLA14, and/or GLA15) if a non-regional product (GLA06, GLA05, or GLA01) has not been requested.

- p.10 The plotset "Backscatter (GLA07)" may be selected, but does not have full functionality.

All plotsets with an enabled "Curves" button now have a "Clear All Curves" button.

The "Curves" option now allows one to choose the color, line style, and line thickness for each curve.

The data for each curve may also be written to an ASCII file by selecting the data option within the Curves menu.

- p.19 More lidar plotsets have been added: “1064nm Normalized Lidar”, “Lidar Energy”, and “Backscatter (GLA07)”. The GLA07 bacscatter image does not have zoom capabilities.

Summary of Changes since Version 200112.0

- p.2 Updated pictures for the front end of visualizer. (Figure 2-1)

Summary of Changes since Version 200208.0

- p.3 If there are no files in the directory the visualizer will automatically exit.
- p.4 “Processed Products List” button added
- p.5 Updated the select product window (Figure 2-3)
- p.6 “Apply Time” button added
- p.8 Updated the front end GUI. (Figure 2-2)
- p.8 On the map display, the user can now select low or high resolution maps (Figure 2-4).
- p.10 Added the visualizer/browser window (Figure 2-5)
- p.10 Added the browse product listing window (Figure 2-6)
- p.11 Added the browse product display (Figures 2-7, 2-8)
- p.13 Added “Select from Specific Data Set” Figure 2-9
- p.16 Updated Figure 2-12
- p.18 The “Print Data” button allows one to display the data values to the screen (see Figure 2-14) or output them to an ASCII file.
- p.19 Updated Figure 2-15
- p.20 Updated Figure 2-16
- p.28 Updated Figures 2-24, 2-25

Summary of Changes since Version 200212.0

- p.2 Updated Figure 2-1.
- p.3 Can now select the data directory by using the pick button or by editing the data directory field.
- p.5 Can now visualize GLA03 and GLA04 using “Select from Data Base” button.
- p.5 Updated Figure 2-3.
- p.6 Added Figure 2-4: Display of the region masks
- p.10 Updated Figures 2-6 and 2-7.
- p.28 Updated Figures 2-23 and 2-24.
- p.31 Updated Figures 2-25 and 2-28.
- p.34 Added “Engineering Plotsets” section and Figure 2-29: Laser Profiling Array

Summary of Changes since Version 200302.0

Updated figures as necessary

- p.36 Added Figure 2-31: Waveform Intensity Series Image

Summary of Changes since Version 200304.0

Added commentary as needed

- p.14 Added description of pass ID

Summary of Changes since Version 200306.0

Replaced 183 day tracks with 91 day tracks.

- p. 3 Added Scroll bars.
- p.20 Note that waveform elevations are from GLA05.
- p.36 Warning about zooming ground track too far.

Summary of Changes since Version 200308.0

- p. 3 Using release now instead of version to view old data.
- p. 6 Removed the Yes/No option for the 8-day and 91-day repeats in the visualizer/data_request GUI's. Therefore, to request or visualize data, the user must specify the tracks. If no tracks are selected a warning window pops up.
- p. 6 Added minutes to the visualizer/data_request time span.
- p. 9 Described "Upload Lat/Lon to Main Window" button in map window.
- p.12 Added a "create subset files" button to the visualizer/browse display. Selecting this option will create subsetted products along with the corresponding UR, PS, BN, and GR files in the directory the user selects.
- p.12 Now when pressing the "Exit program" button on the visualizer, instead of exiting back to the unix prompt, it only exits to the visualizer/browse/subset display.
- p.15 Mention clicking on image or profile to continue, and simultaneous visualizations.
- p.19 Note on overlapping tick labels.
- p.31 Updated lidar color scale ranges.
- p.37 Limit on groundtrack zooming.

Summary of Changes since Version 200311.0

- p. 5 Removed the Available PassID button from the front-end GUI.
- p. 6 Added a warning message when the user selects only GLA04 and not GLA01 with it.
- p.13 After the user chooses the file name, the code adds 8 zeros in the end of the selected subset file name in the visualizer. The zeros extension is to accommodate the naming convention that the data select software assumes

Summary of Changes since Version 200401.0

- p.37 Description of flags plotset added

Summary of Changes since Version 200405.0

Updated figures as necessary

- p.22 Added “Save/Restore” button to plot and image screens

Summary of Changes since Version 200405.1

- p.6 GLA01 is now automatically selected if GLA03 or 04 are.
- p.11 Updated Select Browse Product window.
- p.21 Updated Plotset Selection Window figure.
- p.31 Added mention of the new GLA11 Est. Range Delay and Particle Size plotset.
- p.37 Updated LPA image thumbnails plotset figure, and added mention of its new (top down) orientation.

Summary of Changes since Version 200408.0

- p.2 Updated the GLAS visualizer main window figure. The data directory and the data release number moved from the main window to the products, region and the time selection window.
- p.4 Updated the visualizer products, region and the time selection window figure. Also added the data directory and data release number to the parameters list so they can be saved and loaded.

- p.14 New Manual Data Set Selector screenshot. It now uses Release instead of Version. Also, mention data release field in the text.
- pp.21-22 Mention NaNs in latitude and longitude fields.
- p.22 X-axis range no longer a saved property.
- p.22 Dump Field feature.
- p.23 Mention Print button for thumbnails.
- p.23 “Print data rec of 1st tn” dropped, and workaround.
- p.40 Updated (relaxed) window close instructions.
- p.40 Meaning of “NaN”.

Summary of Changes since Version 200501.0

- Removed “Target of Opportunity” button since never implemented.
- p.22: Field Dumps now available on GLA06,12,13,14,15. Retitled paragraph “Field Dumps”. Note about keeping field dump range in mind when comparing with plot.
- p.40: Clicking “Done” to escape from a thumbnail paging loop.

Summary of Changes since Version 200502.0

- p. 5: Only data from the release specified will be selected.
- p. 16: Added note about 5800-second pass division in Select from Specific Data Set mode.
- pp. 18-21: Added a full description of the groundtrack window and updated its screenshots. New option to delete and reopen the PS file before the DEM map with map projections and groundtracks is created. This way the unprojected image wouldn't be included in the PS file. This is a good option if the PS file doesn't have old images that were saved previously.
- p. 23: Added description of Curves -> Print Data buttons.
- p. 23: Field Dump now available for Flags and Corrections plotsets.

- p. 33: Updated zoomed waveform thumbnail screenshot, and added a new thumbnail with a different x-axis range.

Summary of Changes since Version 200505.0

- p. 15: Description of new PostScript plot fonts, character sizes, and line widths.
- p. 22: Removed mention of zooming by entering values into the text boxes. This feature is not yet implemented.
- p. 24: Separate print buttons for printing data, data+difference plots.
- p. 24: Added information on plot aspect ratios.
- p. 24: Caution about IDL reducing title and tick label sizes.
- p. 42: Mention that NaNs cause the “Floating illegal operand” messages.

Summary of Changes since Version 200506.0

- Updated many screenshots, using Laser 2A Release 24 data.
- Screenshots of the Range Increments, Angles, Corrections, and Waveform Characteristics plotsets have been removed. They are all very similar to the Elevations plotset. Many other screenshots have been renumbered.
- p. 8: Removed description of old Target of Opportunity button, no longer available.
- pp. 10, 18-19: Plotting User Data on Map sections: Target of Opportunity files; user locations plot as asterisks.
- p. 10: DEM-grayscale.
- p. 22: “Display...”, not “launch selected plotsets”. Also adding/subtracting displayed plotsets.
- p. 22: Plotset type and range across top of window.
- p. 23: Zoom bars: Descriptions of selection with one visible zoom bar, zoom range boxes, “<”/”>”, new sync button, and ganging of zoom bars.
- pp. 27-28: List of other altimetry plotsets, including new meteorology parameters plotset.

- p. 35: Improved list of other lidar plotsets, with mention of meteorology parameters.
- p. 37: Flags T/F labels are now correct even for zoom plots. Mention the “All T”, “All F” notations.
- pp. 38-39: “Some notes...” is now its own section. Notes added on unresponsive groundtrack windows, need for waveform/lidar thumbnails for positioning location cursor, and why we can’t plot by latitude or longitude.

Summary of Changes since Version 200510.0

- p. 22: Updated the plotset selection window screenshot, Fig. 2-15.
- p. 24: Field Dumps now available for Meteorology and Range Increments plotsets.
- p. 25: Added note about problems restoring plot properties from older files.
- p. 28: New GLA08/9 Rel 26 features in the Meteorology plotset.
- p. 37: Mention for which products the Visualizer does not yet have complete flag-plotting capability.

Summary of Changes since Version 200603.0

- p. 37: All flags for all products are now available, except for GLA02 and GLA07 saturation flag profiles.

Summary of Changes since Version 200605.0

- p. 4: Updated Figure 2.2: SCF-visualizer product, region, and time selection window and subsequent descriptions
- p. 5: Use of dialog_pickfile.
- pp. 5, 14: Note that GLA03 is not supported by the Visualizer.
- p. 15: Visualizer launched from visualizer/browser window.
- p. 15: Added note concerning GLA01 profiles.
- p. 22: Updated Figure 2.15: Plotset Selection window.

- p. 22: Added paragraph describing difference plot.
- pp. 24,28: Tide, Trop, GPS Corrections plotset is now Range Corrections.
- p. 25: WF Characteristics incorrect KIND property.
- p. 35: Particle Size Estimates plotset replaces PSE/ERD because range delays have been moved to Range Corrections plotset.

Summary of Changes since Version 200609.0

- p. 9, 19-20: When plotting user locations on the map, can add optional station names after the lat/lon pairs to be displayed next to the plotted points on the map.
- p. 10: Added Figure 2.6: Displaying User Locations on Map.
- p. 22: Updated Figure 2-15: Ground Track Plot (DEM style)

Summary of Changes since Version 200701.0

- Updated many of the screen shots, especially of the time series plots. Extra copies of some screen shots were removed.
- p. 5: Clarified pick file description and mentioned new help button.
- p. 10: Mentioned returning from map window, to clarify the sequence of actions.
- p. 11: Added description of Reset button; fixed Load button name (not Reload); reworded window name.
- p. 16: Mentioned compliance with AGU standards.
- p. 24: Series windows now show unique index and product. Amplified description of positioning of the red cursor.
- p. 27: Unique index in series window.
- p. 36: Fixed products for lidar plotsets.
- p. 39: Noted that waveform intensity y-axis is not time
- p. 41: Added some more acronyms we use.

Summary of Changes since Version 200901.0

- p. 4: Reorganized the “Select from Data Base” Section.
- p. 4: Added “?” button.
- p. 7: New “Data Product Menu” section added.
- p. 9: New “Map Display” section added. New features added:
 - Select or unselect a track by directly clicking on it on the map
 - Select an area on the map and then click one of the following buttons:

- Select Tracks - to select all tracks within the selected area
- Unselect Tracks - to unselect all tracks within the selected area
- Zoom Map – to zoom the area on the map
- Multiple areas can be selected
- Selected tracks are saved among maps
- p. 13: New “Visualizer/Browse/Subset Window” section added.
- p.17: Section 2.3 “Visualizing the Data”, has been extensively rewritten and updated. It is now organized in a more reference-oriented manner and somewhat less of a tutorial, and we think all of the buttons and menus are now described.
- Nearly all of the screenshots have been updated, and some new ones added.
- “Waveform Thumbnails” and “LIDAR Backscatter Profiles” are now described in their own sections.
- Appendix A: Added UIX and UTC.

Summary of Changes since Version 200909.0

- p. 5: “World”, “Antarctica”, and “Greenland” buttons have been added to the main selection window so users can easily select those regions.
- p. 27: Added Figure 2-18: Difference plot curve menu
- p. 28: Updated section on Curve Menus to describe new tabbed curve menus.
- p. 29: Added Figure 2-20: Tabbed Curve Menus
- Updated some figures since curve menus have changed

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1.0 Related Documentation

- *SCF Architectural Design Document*
- *SCF Data Request Software Detailed Design Document*
- *SCF Data Request Software User's Guide*
- *SCF Data Visualization Software User's Guide*
- *SCF Interface Control Document*
- *SCF Interface Software Update Document*
- *SCF Interface Software Installation Guide*
- *SCF Interface Software Detailed Design Document*
- *SCF Interface Software Operator's Guide for rSCF*
- *SCF Interface Software Operator's Guide for mSCF*
- *I-SIPS Interface Software Operator's Guide for ISF*
- *I-SIPS Interface Software Operator's Guide for UTCSR*
- *Interface Control Document Between I-SIPS/ISF and CSR*
- *SCF File Naming Conventions Document*

2.0 Running the Data Visualization GUI

The data visualization Graphical User Interface (GUI) can be run from anywhere using the command `/SCF/bin/ops/run_visualizer.ksh` or by typing `glas_visualizer` as long as `/opt/bin` is in your path. One does not need to be under a specific account or in a specific directory to run the software.

This GUI allows the user to visualize parameters from any of the GLAS standard data products that reside on the local machine. Since the software uses the SCF data management system, the user can input a specific region and time, and/or set of passes and the software will only select files and records within those files that satisfy the region and time/pass criteria. This allows the user to very quickly visualize many passes over a small region from multiple data sets in one run and compare them with each other. The most restrictive information will be used - for example, if the user selects a time span or region and a set of passes, he or she will receive only the subset of the passes that are within the time span or the region.

The main window is shown in Figure 2-1.



Figure 2-1: SCF visualizer main window

To allow for maximum flexibility, the user can either choose to select from all files in that directory by pushing the “Select from Data Base” button or input specific files by pushing the “Select from Specific Data Set” button.

Important note about multiple data files for the same product in the same directory: The Visualizer filters data for the requested time span and geographic region from all files matching the requested products in the selected directory. The visualization software visualizes data from the most recent product file if older ones exist. Therefore, if the user wants to look at data from a specific file, he may either put the file in a separate directory and select that directory in the Visualizer (see next section), or he may use the “Select from Specific Data Set” button on the main window to visualize a particular file.

Throughout the Visualizer, the larger windows now provide scroll bars on the right and bottom, if the window would exceed the screen size. To see the rest of the window’s contents, just drag the scroll bar with the mouse. Windows may still need to be moved from their initial locations to entirely fit on the screen, however.

2.1 Select from Data Base

Figure 2-2 shows the data selection window that appears after one chooses “Select from Data Base”. The user uses this window to define the directory where the data will be visualized and the data release. The user also defines which types of products to look at (any or all of GLA01-GLA15), the region of interest, the time period of interest, and if any specific passes are of interest. The most stringent of all the criteria is used to select which files and which records of data within the data directory to visualize. This gives the user a very quick response to visualizing small portions of data over specific regions.

Pick Data Directory (Required): Pick ? Data Release (Editable)

Choose Product (Required)
Data Product MENU Processed Products List (For Selected Release)

Choose Time Span (Optional)
Start Time End Time
year (xxxx) month (xx) day (xx) hour (xx) minute (xx) year (xxxx) month (xx) day (xx) hour (xx) minute (xx) Apply Time ?

Choose Region (Required)
Start Latitude (°N) End Latitude (°N) Start Longitude (°E) End Longitude (°E) ? Show GLAS Coverage on Map

Select Passes for Selected Region (Required)

8 Day Repeat
Choose Cycle # (Optional) ?
 ?
Push to List Tracks w/ Region
None ?

91 Day Repeat
Choose Cycle # (Optional) ?
 ?
Push to List Tracks w/ Region
1 ?
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

Save Parameters ? Load Parameters
Summarize Selection
? Continue
Reset Help Exit

Figure 2-2: SCF visualizer data selection window

? – The question mark buttons pop-up windows with brief help text for the adjacent button or field. Dismiss by clicking the popup’s File menu, then “Done with...”.

Data Release – Required - This should be selected first. Enter the I-SIPS data release you want to see data for. **It is crucial that this field be correct for the data files to be visualized properly.** You will find the data release in the last 2 digits of the first number

segment after the GLAXX in the mSCF product name (i.e. GLA06_428... is release 28). The default release is the latest one, so it is particularly important to change the release if you wish to view older data. For example, if you wish to visualize release 26 data, enter 26 in the box. Please note that you may only visualize older releases if the data are still available in the specified directory. **Only data from the release specified will be selected.**

Pick Data Directory – **Required** - The user can change the data directory to whatever he/she desires by using the pick button that will bring up a window with a directory tree to choose from. A new help button describes how to use the “Pick” button to select the data directory. **The Visualizer will only look for data products in this data directory.** If there are no files in this directory with the specified release, a warning window will pop up.

The standard IDL dialog_pickfile() function, which is used here, is unfortunately not completely intuitive. Choose each *intermediate* subdirectory in turn from the list labeled “Directories”, or type directly into the “Directory” box, pushing the “Filter” button each time. The *final* subdirectory, however, should be selected from the list labeled “Files”. Then push the “OK” button to dismiss the dialog and continue.

Processed Products List (For Selected Release) – **Optional** - Pushing this button gives a list of products for the specified release that are available in the selected directory. This is handy for determining available products before selecting them. **You must push this button if you changed the release after selecting the data directory.**

Choose Product – **Required** - See “Data Product Menu” section – allows users to select data products.

Chose Time Span – **Optional** – The user selects a start time and end time. The program will process only the passes in the time span. If the user changes the time selection, he needs to push the “Apply Time” button.

Choose Region – **Required** - The user can select start and end latitude and longitude in either this window or the map window as a rectangle in latitude and longitude. The latitude range is from -90 to 90 North, and the longitude range is from -180 west to 180 East of Greenwich in units in units of East longitude. The user can press the “World”, “Antarctica”, or “Greenland” button to select that region. The default is the entire world. To select an even more specific region or see the selected region on a map, press the “Show GLAS Coverage on Map” button.

Show GLAS Coverage on Map – **Optional** - See “Map Display” section - allows users to display and select ground tracks on a map.

Select Passes for Selected Region – **Required** – The program will process only selected tracks.

If tracks were already selected and loaded through the map interface, they should be highlighted in black in the track window. If nothing is highlighted, then tracks must be selected.

Passes are defined by reference orbit (8 or 91 day), cycle number, and track number.

The user must select tracks for either the 8-day or 91-day repeat track reference orbit (or both). The selection of cycles is optional.

To select a specific cycle, merely type it in the appropriate box. More than one cycle can be selected by separating the cycle numbers with commas (,) or dashes (-).

Push to List Tracks w/i Region – Required if tracks were not selected via the map display - Press to display the list of tracks available for the selected region and time span, for the 8 or 91 day repeat. Note that these tracks are based upon GLA01 granules received at the mSCF and therefore other products may not be available for a specific pass. Clicking the "Select All" button highlights all the tracks. Clicking the "Select Subset" button allows the user to select discrete tracks or sets of tracks within that list. To select multiple discrete tracks, hold down the Ctrl key while selecting the tracks individually with the left mouse button. To select a set of tracks hold down the shift key, use the left mouse button to sweep out the set of tracks.

Save Parameters – Optional - Push this button to save all the current selected parameters into a file designated by the user. Very convenient when visualizing similar parameters multiple times.

Load Parameters – Optional - Push this button to load a previously saved parameter file.

Summarize Selection – Optional - Push this button to see your selected parameters before you submit them.

Continue – Required - Pushing this button submits the data for visualization. If there is not enough information to submit, an error message will be displayed that prompts for the missing information. Only when all required information is selected will the request be submitted. The data selection window will exit when the data have been submitted.

Reset – Optional – This button will clear the time span, region, product, and pass selections.

Help – Optional – This button will bring up help documentation.

Exit – Optional – Exits from the GUI so no visualization is done.

2.1.1 Data Product Menu

Pushing the “**Data Product Menu**” button opens a new window, depicted in Figure 2-3, which gives a menu of GLAS products. You must select one or more products from this list.

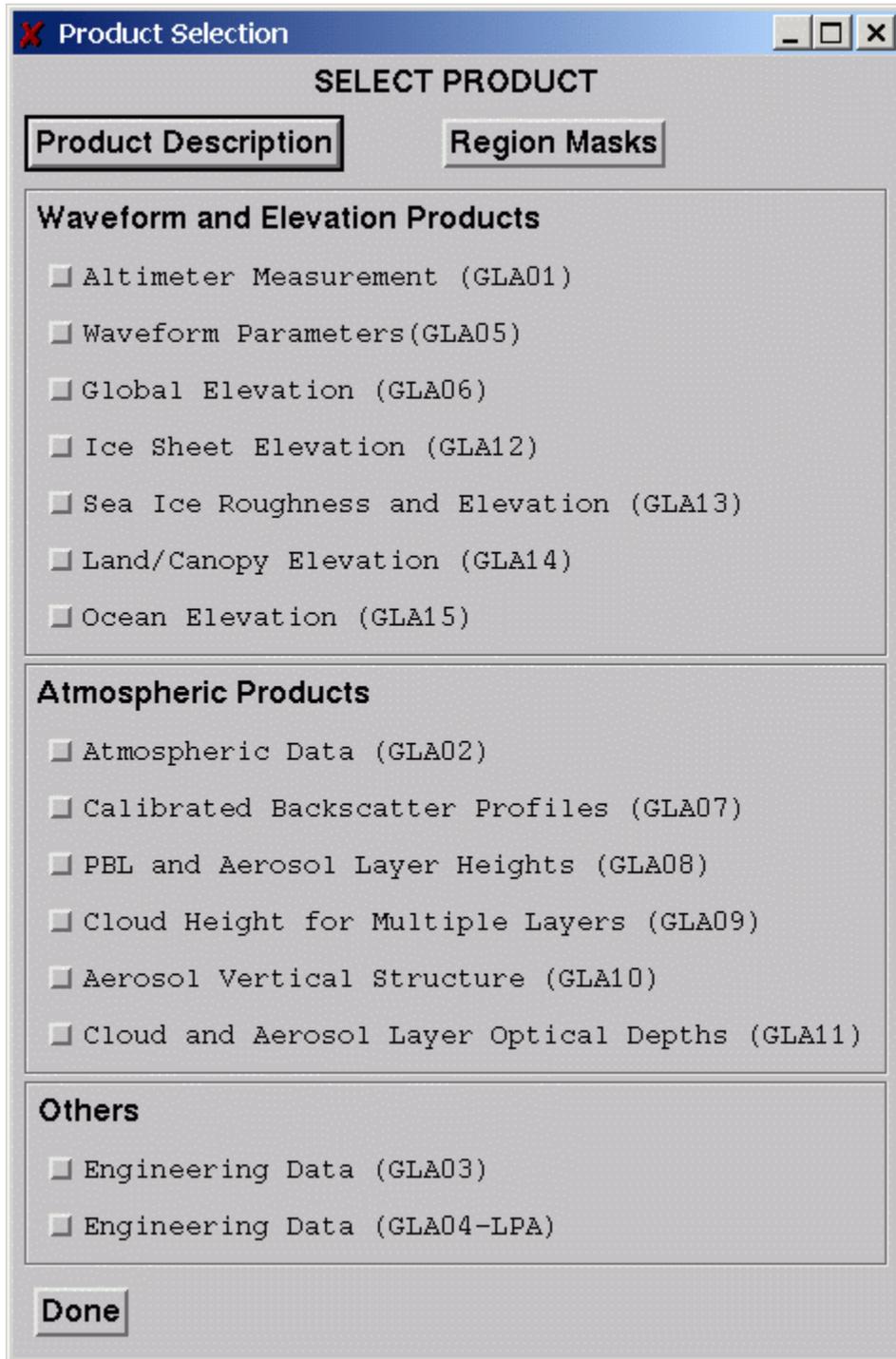


Figure 2-3: Product selection window

The products are grouped by type and if one pushes the “**Product Description**” button a short description of each product is displayed.

NOTE: The user must select another product file that overlaps in time along with GLA03 or 04. If the user selects only GLA03 or 04, GLA01 will automatically be selected also. This requirement is necessary because GLA03 and 04 lack the location information required by some parts of the Visualizer.

GLA03 files can be selected, but are not currently supported in the Visualizer. If GLA03 is selected, a popup window will warn the user when the Visualizer is entered.

Region Masks – A display of the region masks is shown in Figure 2-4.

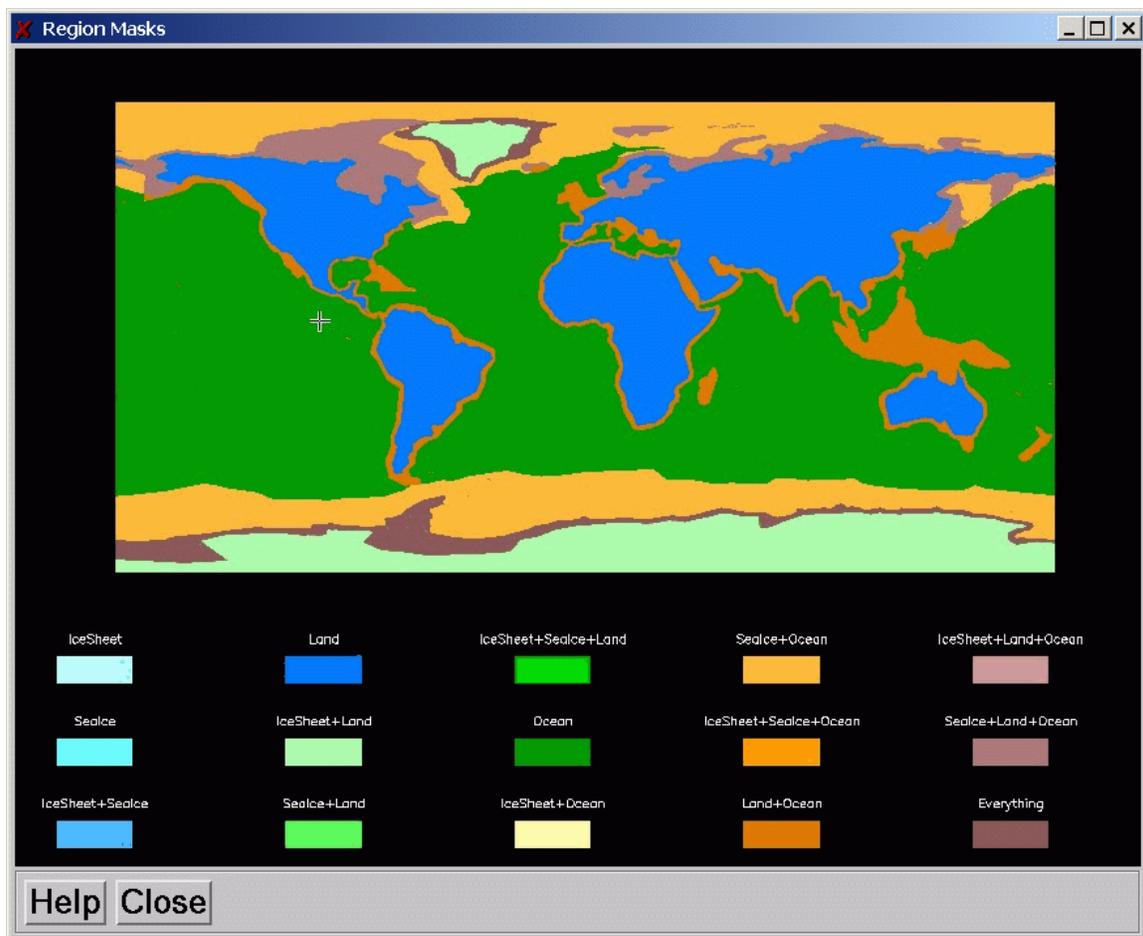


Figure 2-4: Region masks display

2.1.2 Map Display

The “**Show GLAS Coverage on Map**” button brings up the map and ground track display window shown in Figure 2-5. This is a tool to help the user select the proper tracks over his area of interest. The user can display a region map or zoom a region and display the tracks over this region to see the coverage. Only tracks for which the user has data in his/her selected data directory are displayed, however they will be displayed as if data exists for the whole pass, whereas the product may only contain a small portion of the pass.

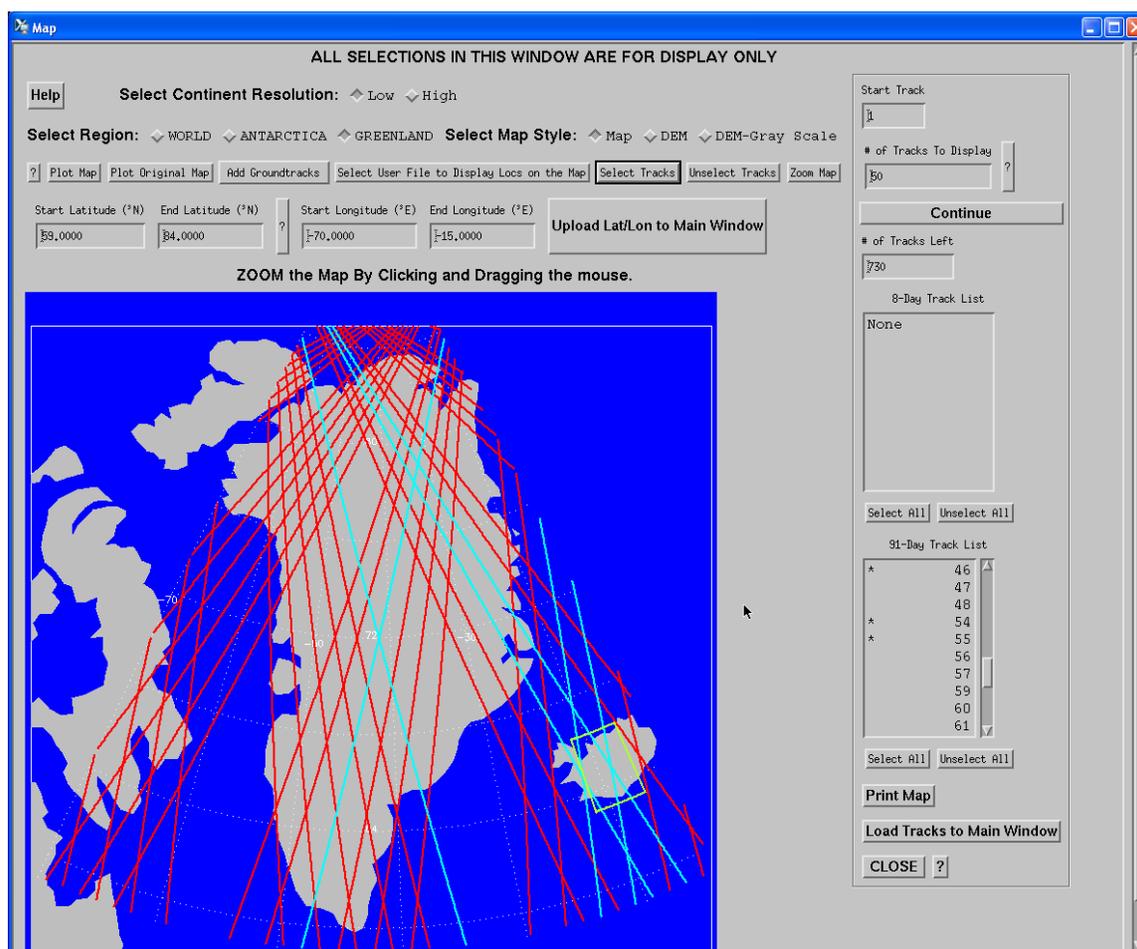


Figure 2-5: GLAS coverage on map display

Select Continent Resolution – Select low or high resolution, for map display only.

Select Region – The user can display Greenland, Antarctica, or the whole world. Press the “**Plot Map**” button after making your selection. Further refinement of the region is accomplished by using the left mouse button to click and drag to select an area outlined in green. Clicking the “**Zoom Map**” button will then zoom that area. To get back to the

original map you started from before zooming, press the “**Plot Original Map**” button. The user may also just type in the desired starting and ending latitudes and longitudes in the appropriate boxes. To transfer these new lat/lon values to the main window, the user must press the “**Upload Lat/Lon to Main Window**” button.

Select Map Style – Map is the default. Pressing the DEM button will plot a shaded-relief Digital Elevation Model instead of the continental outlines. A high resolution DEM is used: GSFC Greenland and Antarctic 5km, or USGS 30 second for all other regions. Tracks can then be displayed on top of this DEM model. The resolution of the DEM is chosen based on the area displayed. The smaller the area, the finer the resolution will be, down to the finest resolution of the DEM. **DEM-Gray Scale** plots elevation in shades of gray.

Add Ground Tracks – Press this button and select either the 8-day or 91-day repeat from the pull down menu to add ICESat ground tracks on the map display. You can only display tracks from either the 8-day or 91-day reference orbit, but not both at the same time. By default, only 50 tracks are displayed at a time. Pushing the “Continue” button will display the next 50 tracks. If you wish to display more or less than 50 tracks at a time just change the number in the text box. Once the next batch of tracks has been displayed, if you want to see the first batch again, you have to press the “Add Groundtracks” button again. A list of the displayed tracks is shown in a list box to the right of the map. Only tracks that have data in the selected data directory are displayed. (See section below, “How to Select Ground Tracks” for methods of selecting ground tracks.) After selecting tracks, the user can load them to the track list of the submittal window by pushing the “Load Tracks to Main Window” button. Select “Close” when done to be brought back to the main menu.

How to Select Ground Tracks

- Unselected tracks are red on the map, and have nothing beside their numbers in the track list window.
- Selected tracks are cyan on the map and have asterisks (*) beside their numbers in the track list window.
- For reference, selected tracks are saved among maps!

There are several ways to select tracks:

Select tracks from list – In the track list window, click on a track number with the left mouse button. Unselect the track number by re-clicking on it.

- Click the “**Select All**” button under the track list window to select all the tracks in the track list.
- Click the “**Unselect All**” button under the track list window to unselect all the tracks in the track list.

Select tracks from map – In the map window, click on a track with the left mouse button. This may take some practice! Since the track lines on the map are actually interpolations of data points, sometimes clicking on a track will not work, if you are not hitting the actual data point. Unselect the track by re-clicking on it.

Select tracks from map within selected area - In the map window, select an area by clicking and dragging with the left mouse button. The selected area will be green on the map. If it is not correct, reselect it. Once the area is selected, there are three things you can do:

- Click the “**Select Tracks**” button to select all the tracks within the selected area.
- Click the “**Unselect Tracks**” button to unselect all the tracks within the selected area.
- Click the “**Zoom Map**” button to zoom the selected area on the map.

When you’re done with an area, you may select another area. If you’re having trouble clicking on a track (especially in a zoomed region), select an area around the track then click the “Select Tracks” or “Unselect Tracks” button.

Remember that to retrieve data for the selected tracks, you must load them to the main window by pushing the "Load Tracks to Main Window" button.

Plotting User Locations on the Map – Push the “Select User File to Display Locs on the Map” button to bring up a window that allows the user to select an existing user location file or Target of Opportunity (TOO) file. User location files should be ASCII text with the following structure:

- The first line is 1 or 0:
1: Connect the points
0: Don't connect the points (plotted as asterisks).
- The second line is the number of location pairs (latitude, longitude) that follow.
- Subsequent lines are the location pairs: north latitude, east longitude (-180 to 180).
- If station names are included after the lat/lon pairs, they will be displayed next to the plotted points on the map. You can mix lines with and without station names.

Example:

```
0
3
64, -60, Station A
75, -50, Station B
80, -20, Station C
```

The automatically generated TOO files can also be displayed. TOOs will normally plot as thick cyan lines. However, they may cover a very short range and not be easily seen until zoomed in.

Example of a TOO file: 2006-06-11_stations.txt_chk:
 Haughton_NWT,2006-06-11,07:52,75.867,74.867,270.96315,269.77685,1
 Gr_030515_01,2006-06-11,15:47,75.96641,79.47025,300.61213,294.54386,1

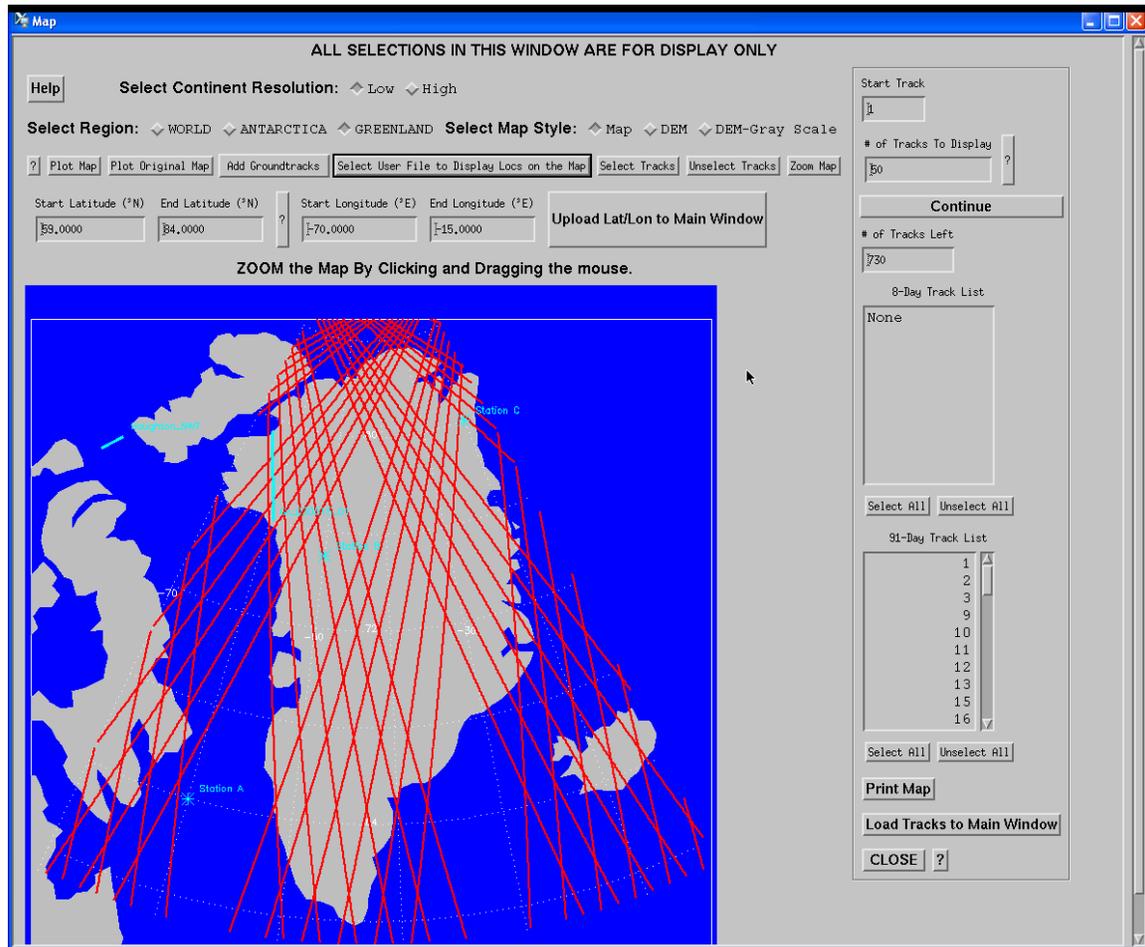


Figure 2-6: Displaying User Locations on Map

Print Map – Pressing this button creates a PostScript file of the map. “Create File” must be pressed to create the file. Subsequent plots will overwrite the first one unless a different file name is created.

Load Tracks to Main Window – Loads selected tracks to main data selection window. Only the selected (*) tracks listed in the track window are loaded. If you need to press the “Continue” button to select more tracks, then you need to load those tracks as well.

Close - Upon closing the map display window, the user returns to the main data selection window.

2.1.3 Visualizer/Browse/Subset Window

Once the request is submitted, the data selection GUI disappears and a script starts that runs the data subsetting software to determine which individual files and which records in those files are within the requested data selection criteria. Only files in the selected data directory will be considered. A set of request files, referred to as REQ files, will be created (one for each product type requested) listing the product files required and the records within those files that meet the data selection criteria. If no data are available, an error will appear in the IDL window. Otherwise, a Visualizer/Browse Products/Subset window pops-up. (Figure 2-7)



Figure 2-7: The Visualizer/Browse Products/Subset window

It has three options to select: the visualizer software, the browse product display, and the create subset products command. The user can go back and forth between displaying the browse products or the visualization. Selecting the “**VISUALIZER**” option causes the visualization software to read the REQ files, the product files, and the data management tables to find the data. Details on the visualizer software are in section 2-3.

Selecting the “**VIEW BROWSE PRODUCTS**” option brings a new window with a list of all the browse product files that cover the user selection in the visualizer GUI.

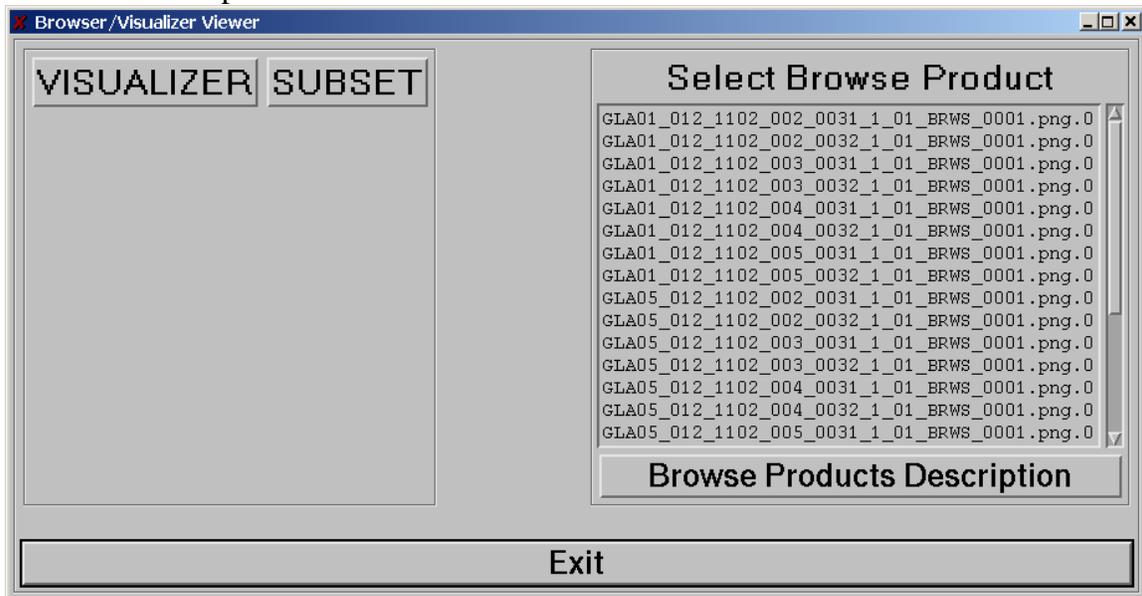


Figure 2-8: Select browse product window

Selecting any file in the list will display the browse product. The description of the different browse products is in the browse product description button.

An example of GLA05 browse product displays are in Figure 2-9 and Figure 2-10.

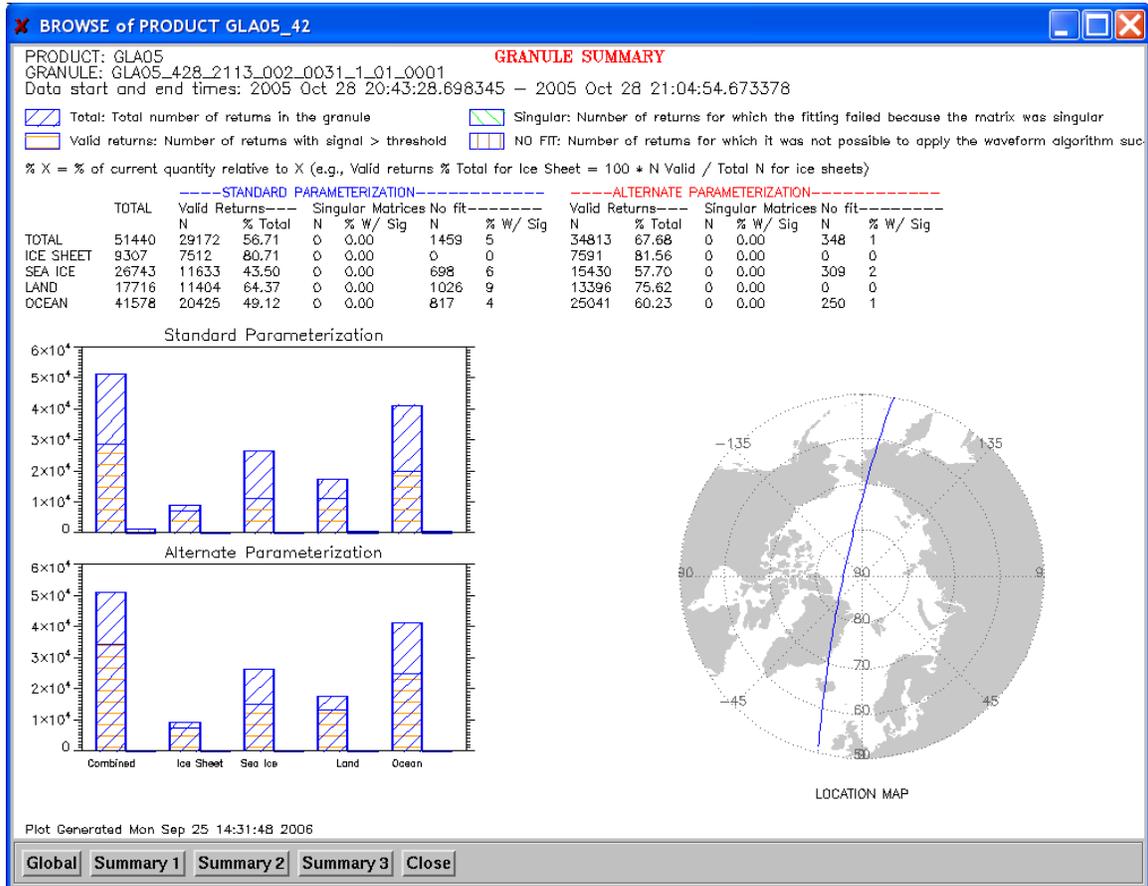


Figure 2-9: GLA05 browse product, main page

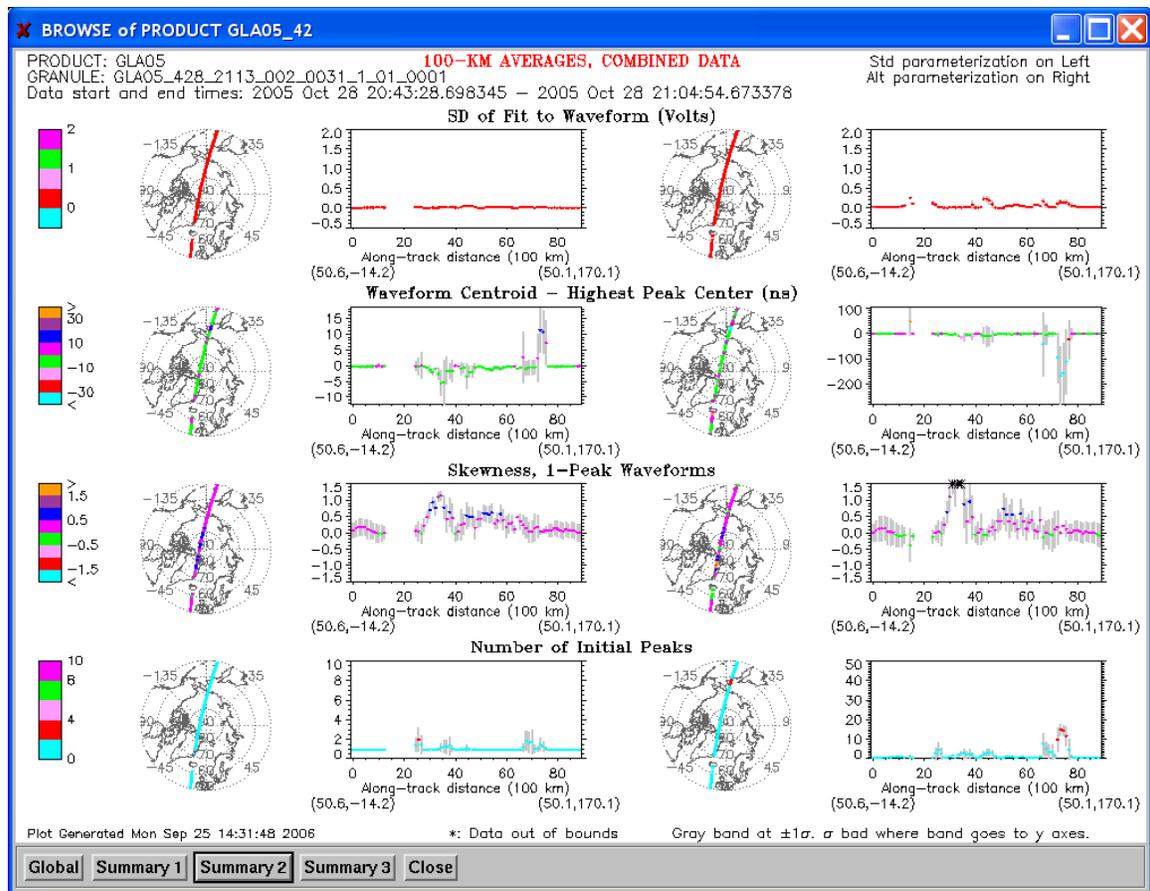


Figure 2-10: GLA05 browse product, secondary page

Selecting “**Create Subset Products**” will create subsetted products along with the corresponding UR, PS, BN and GR files. The files will be created in the directory chosen by the user. After the user chooses the file name, the code adds 8 zeros on the end of the selected subset file name in the visualizer. This extension is to accommodate the naming convention that the data select software assumes.

2.2 Select from Specific Data Set Option

If this button is selected, a window will appear allowing the user to input specific product files (one per product type) to visualize as in Figure 2-11. There is no further region or temporal selection. To use this option, the unique record index table for each file must exist in the same directory as the file; if it is missing, it will be created automatically. The first five characters of product file names must be “GLAnn” where nn is the number 01 through 15 indicating the GLAS product type of the file. The unique record index file name must be the same name as the corresponding file name with “GLA” replaced with “UR”. Care should be taken to only select files that have data with overlapping time spans. Also, be sure that you specify the correct Data Release for your data.

When you have selected all of the product files desired, press the “**Display Data**” button to continue.

GLAS Manual Data Set Selector

Data Release:

You may select one file for each product. Click a Pick button to browse. (If you pick GLA04, please choose GLA01 product also)

Default Directory:

GLA01: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA09: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA09: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>
GLA02: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA10: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA10: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>
GLA03: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA11: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA11: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>
GLA04: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA12: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA12: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>
GLA05: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA13: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA13: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>
GLA06: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA14: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA14: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>
GLA07: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA15: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA15: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>
GLA08: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/> <td>GLA16: <input type="text"/></td> <td><input type="button" value="pick"/> <input <="" td="" type="button" value="?"/></td>	GLA16: <input type="text"/>	<input type="button" value="pick"/> <input <="" td="" type="button" value="?"/>

Figure 2-11: Select from Specific Data Set window

Note: GLA04 files must be accompanied by another product, because GLA04 lacks the location information required by some parts of the Visualizer. If you select only a GLA04 file, you will receive a popup warning to select another product also. GLA03 files are not currently supported by the Visualizer.

2.3 Visualizing the Data

After pushing “**VISUALIZER**” from the visualizer/browser window or “**Display Data**” from the specific data set window, the following windows will appear to give you a snapshot of the data you have selected. Most of the windows have “**Print...**” buttons, allowing PostScript files to be created for printing. However, the user must be sure to specify a directory for which they have write privileges for this feature so work, since the PostScript files are created there; the default is the current directory. It is possible to add more than one plot to a PostScript file; be sure to click on the “**Close PS File**” option when you have completed a file, otherwise it will not be properly terminated and may be unusable. (Adding further plots to a file that has already been closed will overwrite the previous ones.)

The PostScript files plot all text in the PostScript Helvetica font with a unit character size of 12 points (ie, when charsize=1.0), and lines are plotted with a unit (thickness=1.0) line width of 0.5 point (1 pt = 1/72”). These comply with the AGU standards for manuscript figures. The user can scale both character sizes and line widths using the Plot Properties (axis title/tick label sizes, curve label/annotation sizes, and axis line widths) and Curve Properties dialogs (individual curve widths). Keep in mind that text will look very different on your screen and in PostScript, relative to the size of the plot. IDL is not WYSIWYG! Be prepared to make test files and iterate. IDL always plots the main plot title at 125% of the axis title size. Also, when printing the 20-pane thumbnail windows (waveforms, lidar profiles, and LPA images), IDL will automatically reduce the axis title and tick labels by 50% (ITTVIS considers this to be a “feature”).

If GLA02 or GLA07 is selected, then a set of thumbnails (one for each pass) of images created from the backscatter profiles is displayed as shown in Figure 2-12. These images are created from a decimated selection of the data and only give an idea of what is available. If GLA08-11 were selected without GLA02 or 07, profile images are not available; a similar window is displayed, but the individual thumbnails only show the passid.

If any of GLA01, GLA05, GLA06, or GLA12 – GLA15 are chosen then a set of thumbnails (one for each pass) of decimated elevation profiles is displayed, as in Figure 2-13. (GLA01 profiles are calculated estimates, and are very inaccurate.)

Use these decimated profiles to select the pass to visualize. Right-clicking on one of the backscatter images or elevation profiles will highlight that pass on the ground track window. If more than four passes are present in the selected data, then pushing the “**next**” and “**previous**” buttons show the additional passes. The “**<<page**” and “**page>>**” buttons skip backward and forward by four passes. To continue, left-click on the backscatter image or elevation profile of the pass you want to view. You can view multiple passes simultaneously, but there is no communication between the visualizations (and it’s easy to get the windows mixed up). The “**Exit This Window**”, “**Exit Program**”, or “**Return to GLAS Manual Data Set Selector**” button terminates the child

visualizations and returns to the Visualize/Browse/Subset window (Figure 2-7) or the Manual Data Set Selector window (Figure 2-11).

About Passids. A *pass* is identified by its *orbit*, the *cycle* or number of times the same sequence of ground tracks have been repeated for this orbit, and the *track* or single revolution within the current cycle. (Recall that ICESat's orbit is such that a particular ground track repeats every 8 or 91 days.) This information is encoded into the *passid string*. In general, a passid string has the form:

```
                prkkccctttt  
(for example: 11020050029)
```

where p = 1 = ground track repeat phase (1=8-day orbit, 2=91-day orbit, 3=transfer orbit)
r = 1 = reference orbit number (instance number of this reference orbit)
kk = 02 = instance number of any reference orbit
ccc = 005 = cycle number, fifth time through the ground tracks
ttt = 0029 = track number 29 within cycle 5

When using Select from Data Base mode (sec. 2.1), the correct passids are obtained from the request files. However, in Select from Specific Data Set mode (sec. 2.2), this is not available and a substitute passid is derived from the file name. Filenames with the Main SCF convention have all the necessary information, but this will refer to the first pass in the file (which may contain as many as 14 revs, depending on the product). For Remote SCF files, not even this is available and an alternate is created from the date/time and request/subscription-number parts of the filename. In addition, because the product files in Select from Specific Data Set mode may cover such large time spans, the total time of all the files selected is artificially divided every 5800 seconds (approx. one rev), with each piece treated as if it were a separate "pass", and the passid is appended with an underscore and the piece number. For example, one of the resulting "passids" for the rSCF file GLA01_03031719_r0219.P0048_01_01 will be "03031719r0219_00" (2003 March 17 at 19hr, special request #0219, piece 0). For more information on passid strings and the mSCF and rSCF filename conventions, see the *SCF File Naming Conventions Document*.

Please note that the artificial division every 5800 seconds sometimes results in "passes" that have wide gaps, or that include a small piece of the next pass. Also, the last "pass" profile is sometimes an amalgam of the others.

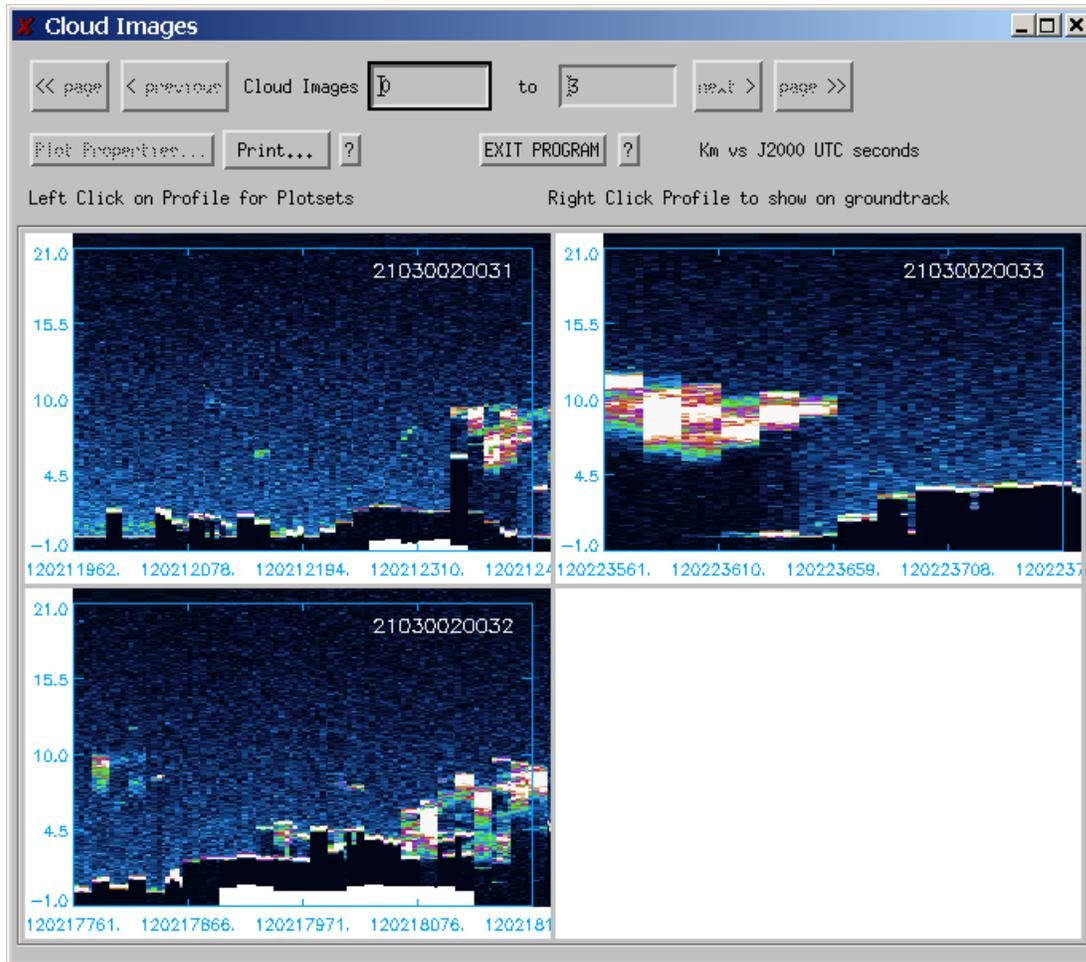


Figure 2-12: Decimated backscatter images of data selected

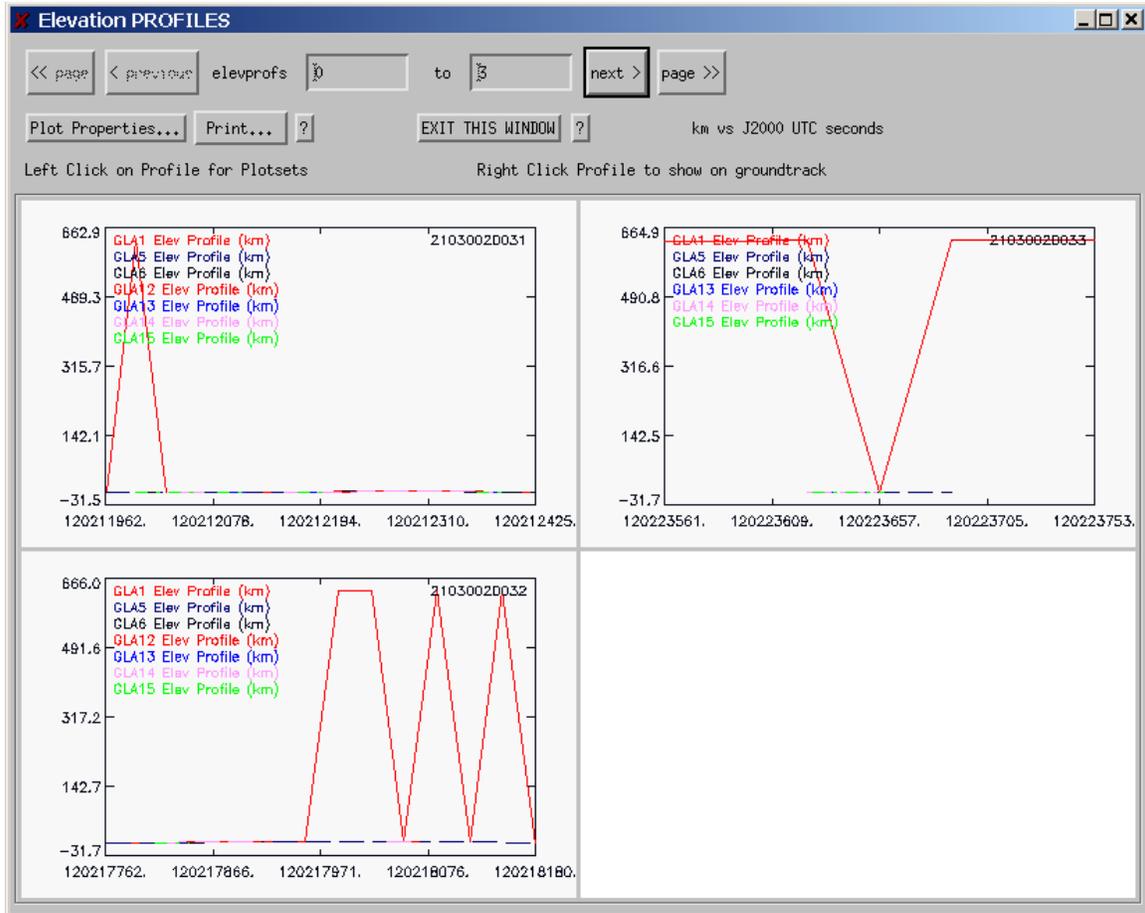


Figure 2-13: Decimated elevation profiles of data selected

The **Groundtracks Window** (Figure 2-14 and Figure 2-15) displays a continental or Digital Elevation Model (DEM) map with all selected ground tracks (blue); the track of the current pass-selection elevation or LIDAR profile (red); track section shown in a zoomed series plotset (cyan); and a diamond-shaped marker showing the location of the series cursor, the current waveform, or current lidar profile, if active. The window also shows the REQ file, the data file of the current elevation or LIDAR profile, and the pass ID of the selected profile. “**World**”, “**Antarctica**”, and “**Greenland**” reset the geographic region to these respective areas. The “**Map**” and “**DEM**” buttons toggle between the two map styles. The user can change the geographic region displayed by clicking and dragging the mouse (note that this always follows latitude/longitude lines, even on polar maps), by choosing one of the predefined region buttons, or by manually entering latitude/longitude ranges. After selecting a new region or map style, click “**Replot Map**” to draw the new map. The “**Clear Map**” button removes the zoomed track section, location marker, and user locations. “**Disable/Enable Zoom**” toggles whether the map can be zoomed. (*Tip: Sometimes the mouse will become locked out of the map plot, preventing zooming. This can usually be fixed by toggling the Disable/Enable Zoom button a couple times.*)

“**Select User File to Display Locs on the Map**” lets the user add either their own file of locations (stations) or paths, or a Target of Opportunity (TOO) file, to the map. Any number of user location and TOO files can be added; all points will be shown (until cleared with “Clear Map”). User location files have the same format as in the “Map Display” section, ASCII text with the following structure:

- The first line is 1 or 0:
1: Connect the points
0: Don't connect the points (plotted as asterisks).
- The second line is the number of location pairs (latitude, longitude) that follow.
- Subsequent lines are the location pairs: north latitude, east longitude (-180 to 180).
- If station names are included after the lat/lon pairs, they will be displayed next to the plotted points on the map. You can mix lines with and without station names.

Example:

```
0
3
64, -60, Station A
75, -50, Station B
80, -20, Station C
```

The automatically generated TOO files can also be displayed. TOOs will normally plot as thick cyan lines. However, they may cover a very short range and not be easily seen until zoomed in.

Example of a TOO file: 2006-06-11_stations.txt_chk:

```
Haughton_NWT,2006-06-11,07:52,75.867,74.867,270.96315,269.77685,1
Gr_030515_01,2006-06-11,15:47,75.96641,79.47025,300.61213,294.54386,1
```

Note: When displaying the groundtracks on a DEM map, IDL actually creates two images: first the unprojected base map, then the projected map with the groundtracks. On the screen, the first image is not visible as the second overwrites it; but in the PostScript file, both images are present. To avoid having two images in the PS file, the user is given the option to delete and reopen the PS file before the DEM map with the projections and groundtracks are created. This is a good option if the PS file doesn't have other images that the user saved previously; but if it does, they will be lost.

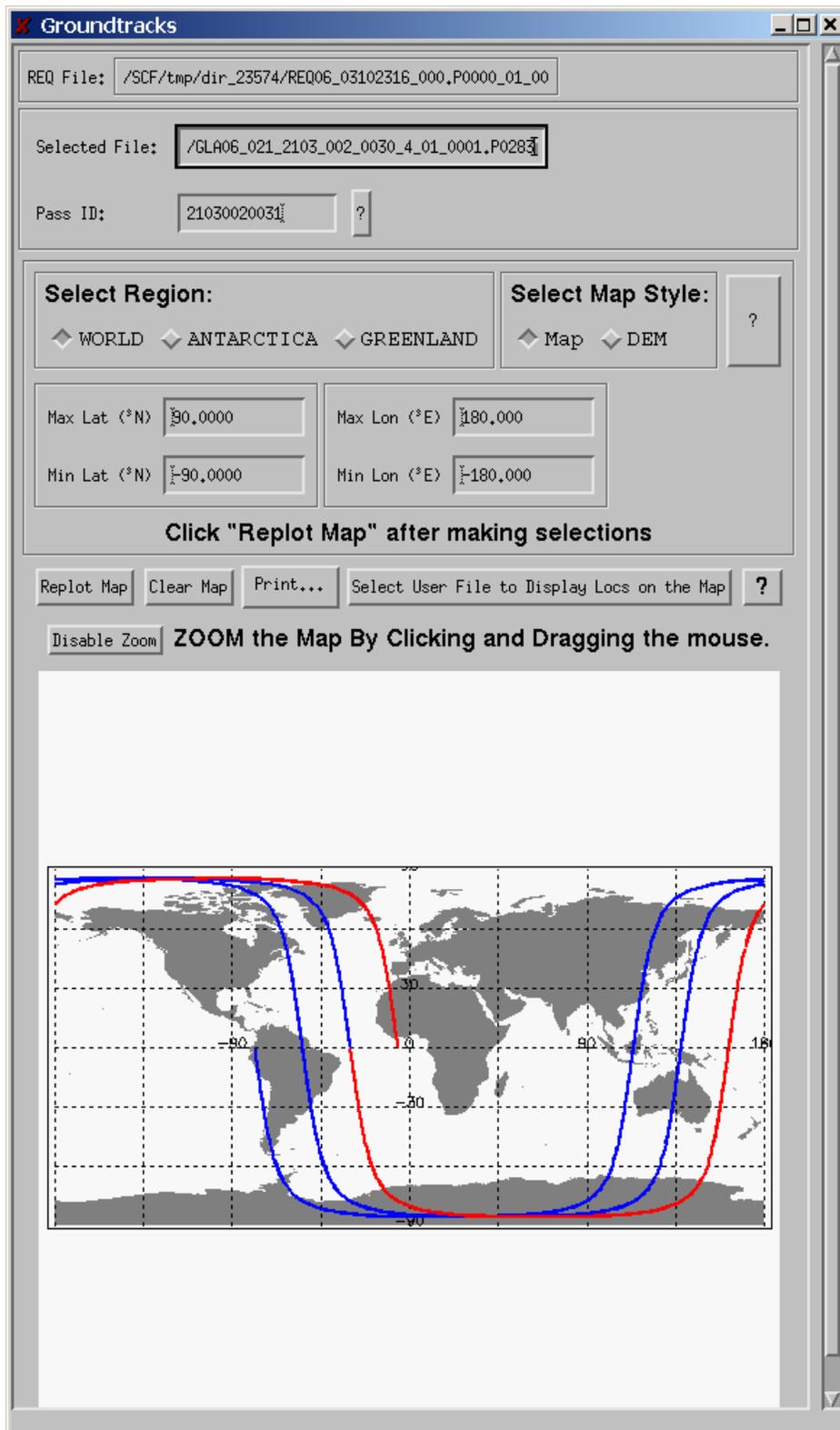


Figure 2-14: Ground tracks of data.

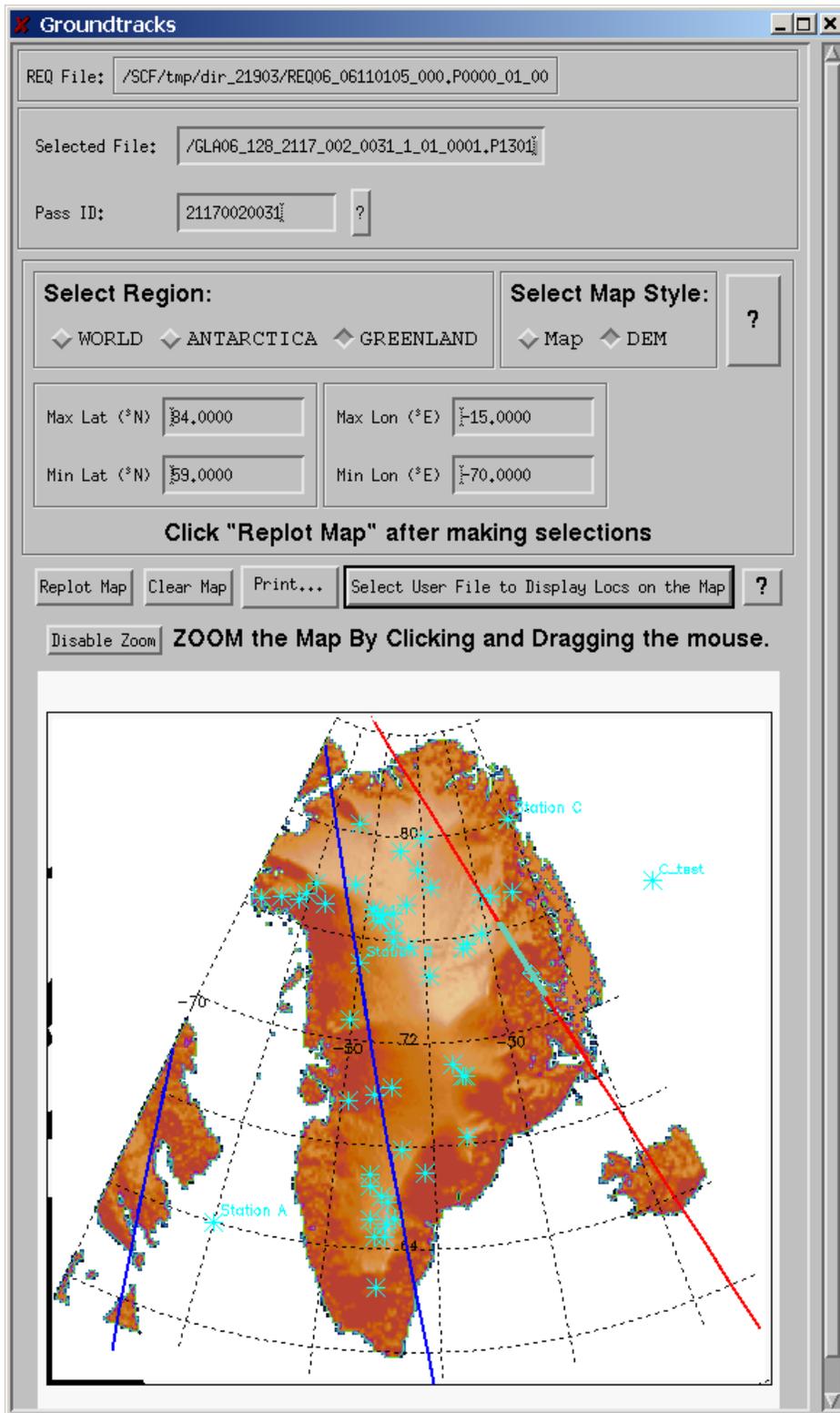


Figure 2-15: Ground track plot (Digital Elevation Model style), showing selected tracks (blue), current track (red), section covered by a zoomed plotset (aqua), location marker (green diamond), and user-supplied stations (cyan asterisks), some with station names.

The user may select one pass by left-clicking on one of the elevation or LIDAR thumbnails. The corresponding ground track will be highlighted and the plot set selection window (Figure 2-16) will appear.



Figure 2-16: Plot set selection window

Only the plot set buttons applicable to products that the user has selected will be sensitive. Select any or all of the highlighted plot sets to view time-series of specific parameters from the products by selecting the individual plot set and then pushing the **“Display Selected Plotsets”** button. Pushing **“Display Selected Plotsets”** again will add any plotsets selected in the interim and remove those that have been deselected, but will not launch multiple instances of the same plotsets. **“DONE”** terminates the child visualizations and returns to the pass selection windows.

2.3.1 Altimetry Plotsets (and Time-Series Plots in General)

In the elevation plot set shown in Figure 2-17, which is typical of the time-series plotsets, the surface elevation, DEM, and geoid from the GLA06 product for the pass selected are shown in the upper plot. The plotset type and the total range in unique indices and time are across the top of the window. On the plot itself, by default the plot title gives the data’s starting UTC date and time, ending time, and the pass ID string. Some plotsets automatically show only the first shot of each second until zoomed in sufficiently; this is indicated by the **“(1Hz)”** notation. In the upper right, annotations **“Start”** and **“End”** give the latitude and longitude of the endpoints of the displayed section. **“NaN”** indicates that the location at that endpoint was not valid. The names of the curves plotted are listed in the upper left, typically with units and GLA product number. Many of these may be changed with the Curve Properties or Plot Properties buttons.

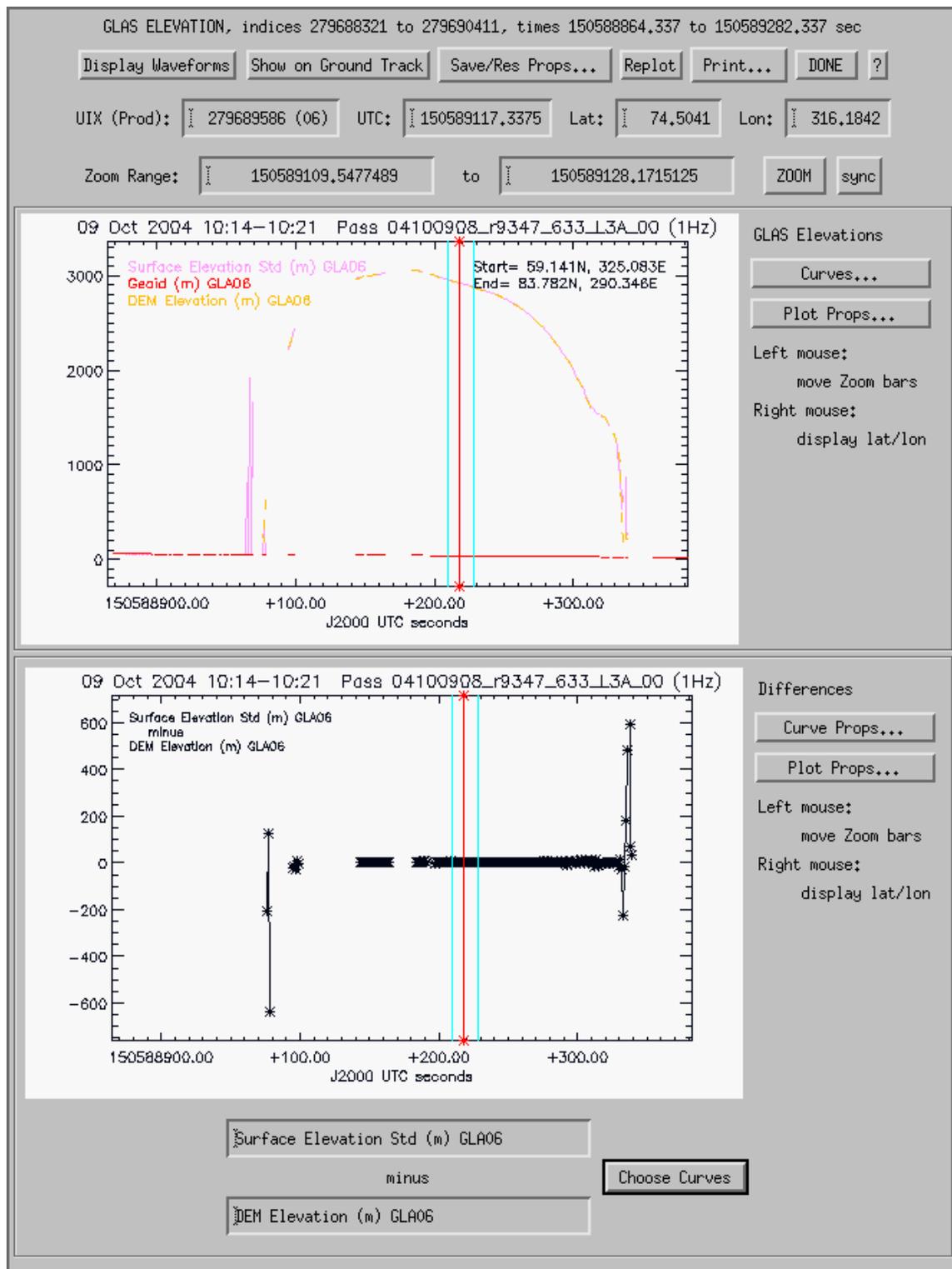


Figure 2-17: Elevation plotset, top shows time-series of specific parameters, bottom shows differences between two selected parameters. The vertical cyan bars indicate the range that a zoomed plot will cover (exact values are shown in the “Zoom Range” boxes), and the vertical red bar indicates which waveforms will be shown when “Display Waveforms” is clicked. The record (unique index, with product used), time, and ground location of the red bar are shown in the “UIX”, “UTC”, “Lat”, and

“Lon” boxes, and is indicated by a marker on the groundtracks plot (see Figure 2-15). “(1Hz)” indicates that only the first shot of each second is plotted.

The X axis of time-series plots is generally in J2000 UTC seconds (seconds since noon, Jan. 1, 2000); this is a proxy for distance along the track. Beginning with the 200909.0 release, by default the time-series X-axis ticks are labeled with the full time only on the first tick, and offsets from that time on subsequent ticks. This is referred to as “Delta Ticks”-style labeling and helps to keep tick labels from overlapping unreadably. You can revert to standard tick labeling, or use delta tick labeling for any other axis, via the Plot Properties dialog. Y axis units differ between individual curves, so by default are shown as part of the label for each curve.

Difference Plots – The lower plot can show differences between any two curves available in this plot set or between a curve and a null curve. Use the **“Choose Curves”** button to select the curves to difference (Figure 2-18). Select the first curve by pressing the button under “1” next to the curve and select the second curve by pressing the button under “2” next to the curve. Press the **“Apply selection”** button to display the difference curve. Press the **“Cancel pending”** button to cancel the selections. Press the **“Dismiss window”** button to exit the window. In Figure 2-17, the difference is between the measured surface elevation and the DEM on GLA06. Not all plot sets include a difference plot.



Figure 2-18: Difference plot curve menu

Zooming (left click/drag) – The turquoise bars on each edge of the plot are **zoom bars**. Click on these bars and drag them left or right to define the zoom range, then push the “**Zoom**” button and a new plot set with only the data in that range will appear as shown in Figure 2-19. (Vertical zooming is not supported, but the vertical axis range can be changed via the “Plot Properties” button.) If you cannot see a zoom bar, click anywhere within the window and the closest zoom bar will appear which you can then drag to the desired location. If only one bar is visible, click closer to the edge of the plot on the appropriate side to select the other. The current locations of the zoom bars are shown in the Zoom Range boxes, which are automatically updated when you move the bars with the mouse. A “<” or a “>” next to a zoom range box indicates that the corresponding bar is left or right of the current range of the plot, respectively. You can also enter a zoom range directly into these boxes, then click the “**Sync**” button to reposition the bars to these locations. Moving or syncing the zoom bars will update the zoom ranges and bars in all other series belonging to the same plotset selection window.

Red Cursor (right click) – Right-clicking on a time-series plot positions a **red cursor** (vertical line). The unique index (followed in parentheses by the product where this information was found), time (in J2000 seconds), and location of the first shot in the record where the line is positioned are shown in the boxes marked “**UIX (prod)**”, “**UTC**”,

“Lat”, and “Lon”. “NaN” indicates the first shot did not have a valid location. If the cursor was positioned in a gap in the data, the information will be shown for the closest record found. If a thumbnail window is shown (eg., Figure 2-24), it will be positioned to the records corresponding to the displayed waveforms or lidar thumbnails. The geographic location of the cursor will be shown in the Groundtracks plot with a diamond-shaped, cyan marker.

Display Waveforms button – Right clicking (to set the red cursor) on any portion of the time-series profile in an altimetry plot set and then clicking on “Display Waveforms” will display the corresponding waveforms if GLA01 has been selected, beginning at the location of the red vertical cursor. See Section 2.3.1.1 Waveform Thumbnails.

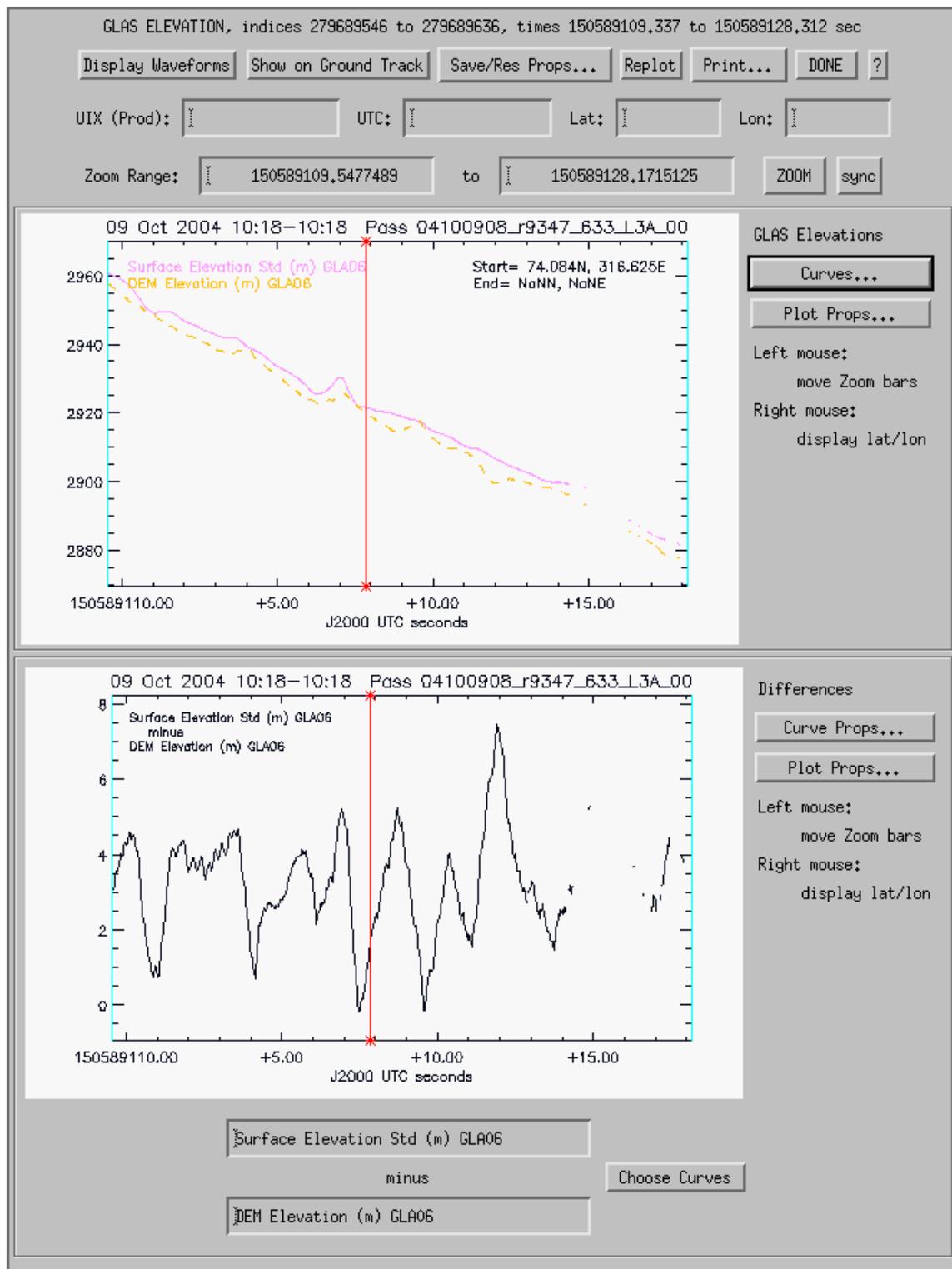


Figure 2-19: Zoomed elevation plotset, top shows time-series of specific parameters, bottom shows differences between two selected parameters. The data is plotted at the full 40Hz rate. Gaps are due to missing data.

Show on Ground Track button – Pushing the “**Show on Ground Track**” button will highlight on the groundtrack window (Figure 2-15) that portion of the pass currently shown in the series plot, in cyan with a diamond-shaped marker at the location of the red cursor. This is drawn using the actual, full rate data from the product, and so will have discontinuities where there are gaps in the data, and may not lie precisely on the nominal track path.

Save/Res Props...button -- The “**Save/Res Props...**” button lets you save the current plot and curve properties, including which curves are plotted, to a file, or restore saved properties from a file. Properties for both the data and difference plots are saved, but the selection of curves differenced is not (we plan to add this in a future release). You can only restore properties to a plot of the same type. When saving properties, be sure to specify a directory for which you have write permission; the default is the one from which you launched the visualizer. *Note:* The X-axis range is no longer included in the properties that are saved; it was considered to be too confusing when applying saved properties to a different region or pass.

Replot button – This button just redraws the plots.

Print...button -- The “**Print...**” menu allows one to create a PostScript file of the plot. There are buttons for making a plot of the data (series) window only, or of both the data and difference windows. Be sure to use the “**Close PS File**” button when finished! Series plots are displayed with a 5:3 (x:y) aspect ratio; to maintain this, in the PostScript setup dialog specify X and Y sizes in this ratio if plotting only the data window, or 5:6 for both. Note that if the user attempts to create either the PostScript or ASCII file in a directory that they do not have write permission to (the default is the directory from which the visualizer was run), the visualizer may crash.

DONE button – Pushing the “**Done**” button will close the window.

Curves button – The “**Curves**” button brings up a window of curves available for this plot (Figure 2-20). Curves are listed in alphabetical order with the product name shown first. Curves for different products are listed separately under tabbed curve menus. Therefore, to see d_elev from GLA05 and GLA06, you must select d_elev from both the GLA05 and GLA06 curve menus. To select a curve, press the button under “**Show**”. Multiple curves may be displayed at the same time. Press the “**Apply Properties**” button to display the curves. If you do not wish to see the curves currently displayed, either unselect the curve buttons under “**Show**” or press the “**Hide all curves**” button. Then press the “**Apply properties**” button. If you have selected curves to display then decide otherwise, press the “**Cancel pending**” button. To exit the curve window, press the “**Dismiss window**” button.

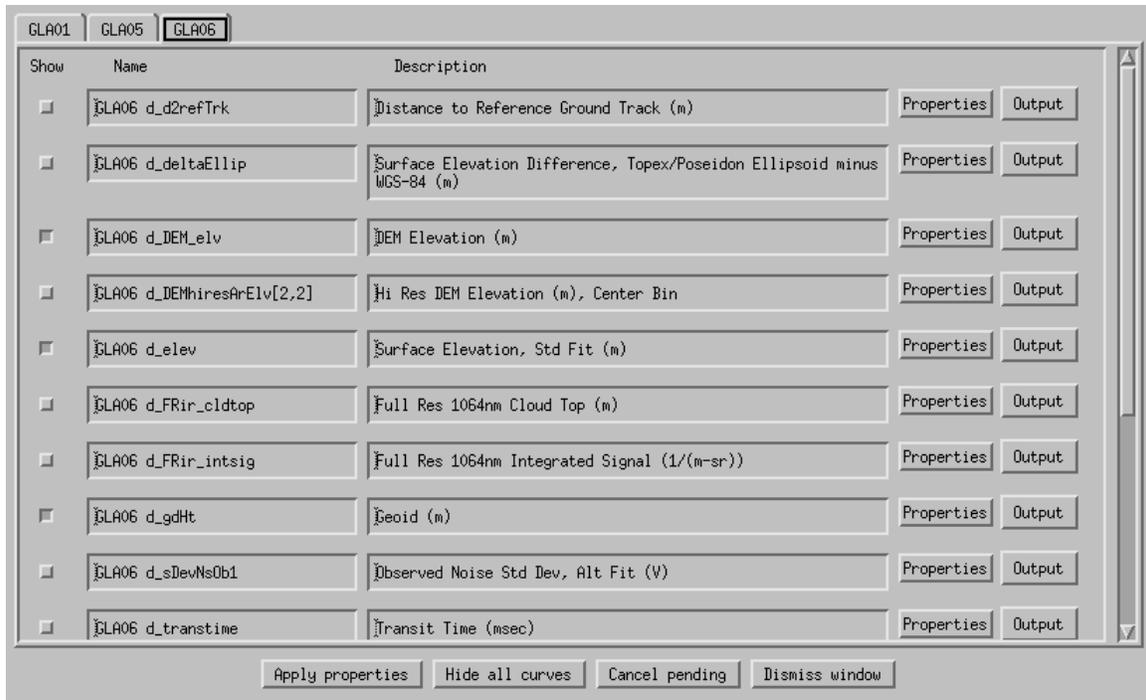


Figure 2-20: Curve window lists curves tabbed by product.

Each curve has the following two buttons:

Properties button -- Pops up a dialog window (Figure 2-21) that allows you to change the curve's label text, visibility, color, line style, point symbol, whether or not to connect the points, and line thickness of the particular curve. A label may be up to 3 lines long. The text in the "Default Label" box cannot be changed, and will be used if the "Curve Label" box is empty. To not use any label, put space characters (only) in the Curve label box. Line thickness is in pixels for screen plots, or units of 0.5 pts for PostScript (1 pt = 1/72"); ie., thickness=2 will produce a PostScript line 1/72" wide. Click OK to accept the changes, redraw the plot, and dismiss the window; or Cancel to dismiss the window without modifying the plot.

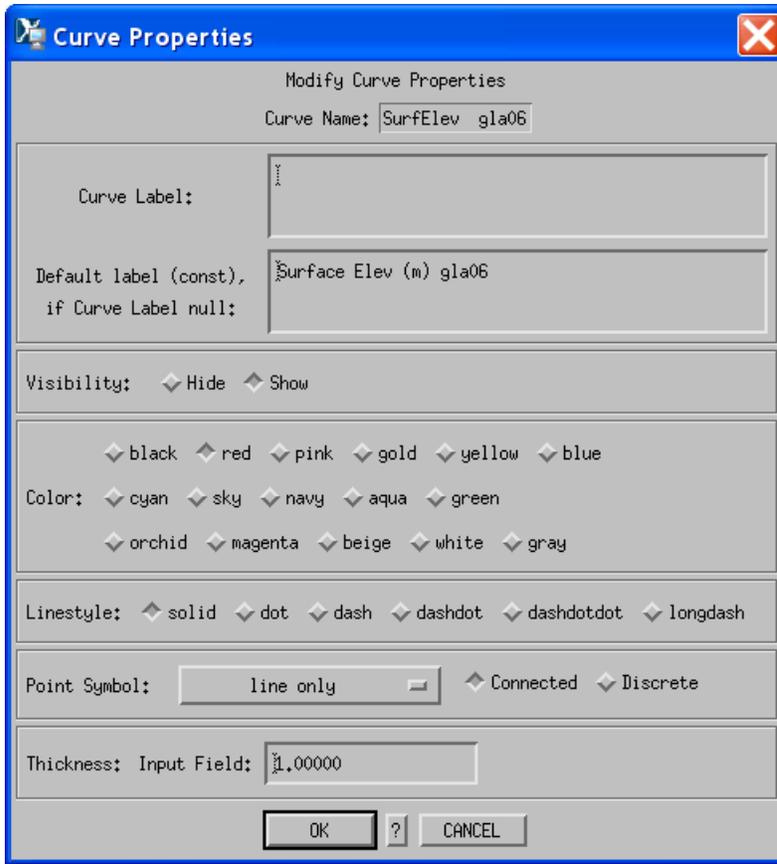


Figure 2-21: Curve Properties dialog.

Output button – This menu allows you to print the curve’s data values to a text file or view them in a screen window. “**Spreadsheet style to file**” prints the data to a text file in X,Y columns, whereas “**Programmer style to file**” outputs all the X values followed by all the Y values, which is easier to read into languages such as Fortran and IDL. Both have headers in *keyword=value* format that give the array dimensions and other information. “**Show (x1, x2, ...) in window**” and “**Show (y1, y2, ...) in window**” let the user view the X or Y data values in screen windows (Figure 2-22). Dismiss the window by clicking “**File**”, then “**Done with...**”. Note that the values shown or written are those plotted; they will not necessarily be the same as what’s in the product files, for instance if the Visualizer applied its own additional scaling.

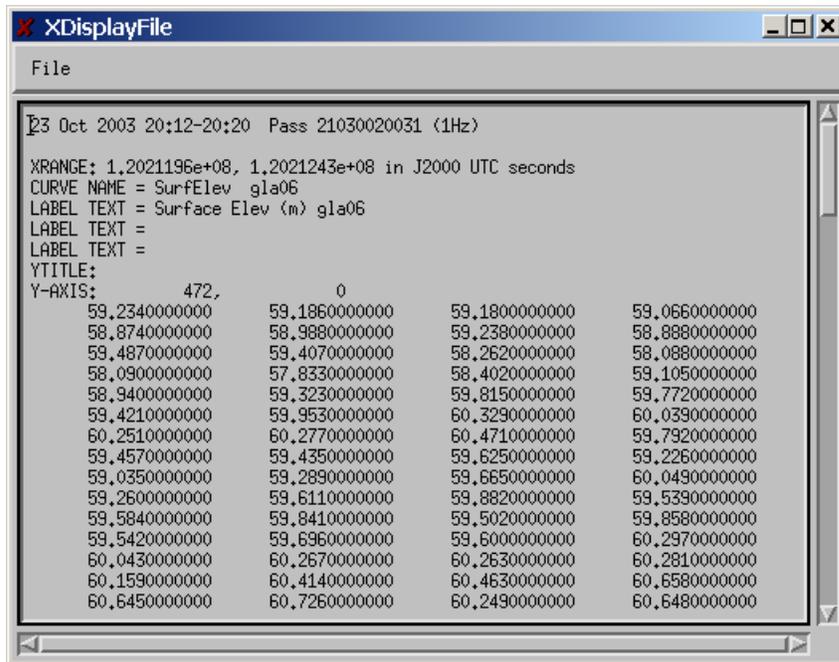


Figure 2-22: Output from “Curves...”, “Print Data”, “Show ... in Window”

Some curves now have an option labeled “**Dump Field...**” under the “**Output**” button. This allows you to dump to an ASCII file the product-file field that was plotted as that curve, along with the unique index, shot number, time (J2000 UTC seconds), latitude, and longitude, for each shot or record. So far this is only available for GLA06, 12, 13, 14, and 15 curves on the Elevations, Range Corrections, Flags, Meteorology, and Range Increments series plotsets, but we plan to implement it for the rest in future releases. Shots are numbered 0-39, in the IDL convention. 1Hz fields are shown as shot 0. Values are reread from the product file and scaled to their natural, “algorithm” units, so may not be precisely the same as plotted: Some curves have an additional scaling applied within the Visualizer, which will not be in the dump; and dumps are always at the product field’s full resolution, even from 1Hz plots. The range of the field dump will be the full range of the data available in the plot (the xrange plot property is not taken into account), rounded to a full record on either end; be sure to keep this in mind if comparing a field dump to the plot! When multiple curves are plotted from the same “algorithm” field, all parts of the field are dumped. For example, GLA14 Gaussian amplitudes (d_Gamp) are plotted separately for each peak, but the field dump includes all peaks; thus, you need not dump each peak separately. (This does not apply to those “product” fields, such as some flags, that are unpacked into multiple “algorithm” fields, only to the components of the same algorithm field.) The first line of the output file will always be “NUMHEAD =...;”, giving the number of header lines; the data will immediately follow the last header line (“END;”). You will have the opportunity to add comments that will be included in the header of the dump output file.

Other buttons on the plot window:

Curve Props... button (Difference pane only) – This button pops up a dialog window to modify the properties of the curve shown in the Difference plot. It's identical to the Properties button for an individual curve in the main plot's Curves menu (Figure 2-21).

Plot Props...button – The “**Plot Props...**” button (Figure 2-23) brings up a dialog box that allows one to change scales, character sizes, line widths, decorations, and other plot properties on the screen or to create publication quality plots. The dialog box has three tabs, for general plot properties, X-axis properties, and Y-axis properties.

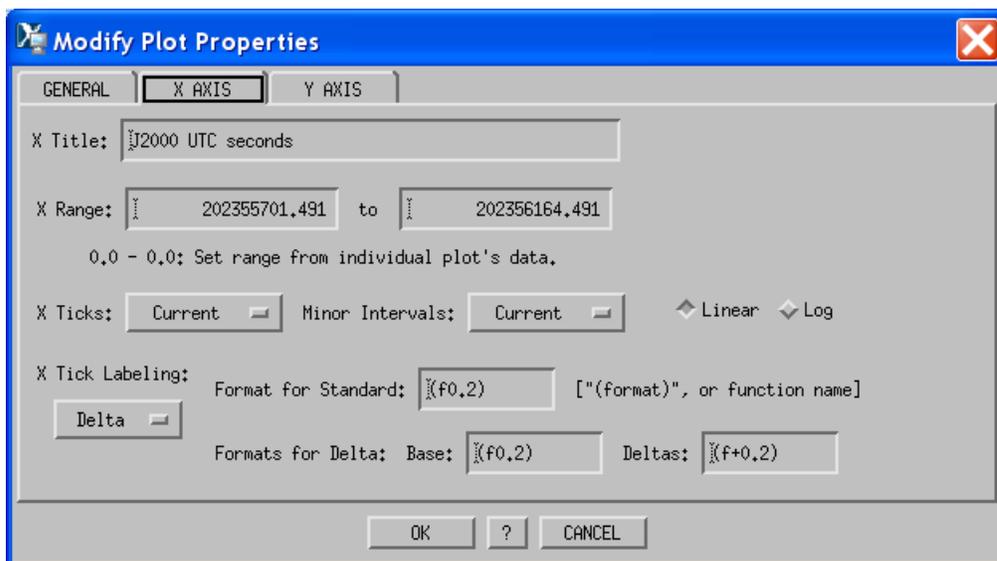
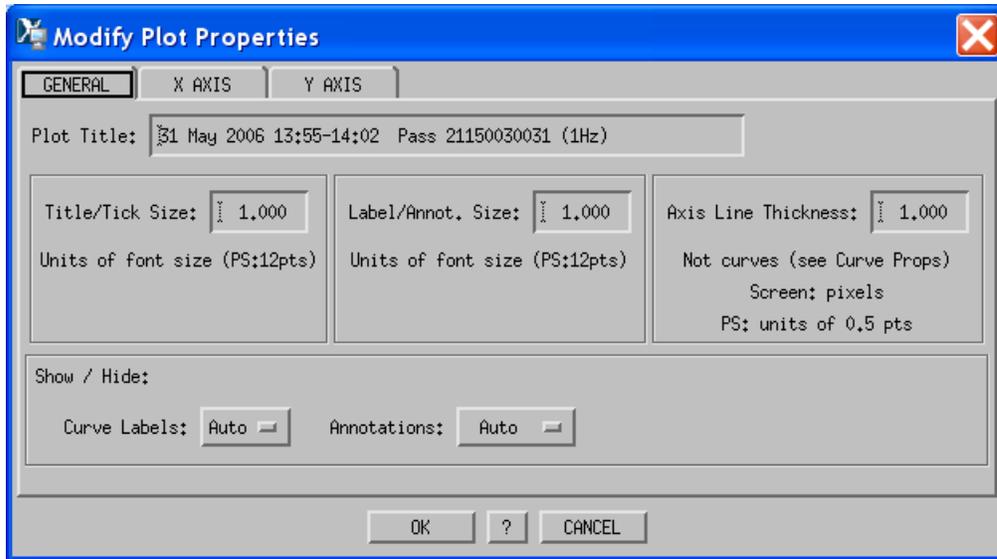


Figure 2-23: Plot Properties dialog. *Top: General plot properties tab. Bottom: X-axis properties tab. The Y axis tab is similar.*

“GENERAL” tab – This tab contains properties that affect the entire plot. “**Plot Title**” is the text for the main title printed across the top of the plot. “**Title/Tick Size**”

specifies the character size to use for the main title, axis titles, and tick labels. IDL automatically increases the main title character size by 25%. “**Label/Annot. Size**” is the character size to use for the curve labels (upper left corner of the plot) and plot annotations (upper right: Start/End, UIX, UTC, location, etc.). Character sizes are specified in multiples of the standard font size, or 12 points for PostScript plots. “**Axis Line Thickness**” is the how thickly to draw the axis lines and characters (but *not* the curves, which are controlled separately by the curve properties). Thickness units are pixels for screen plots, or 0.5 points for PostScript (1 pt = 1/72”). The “**Show/Hide Curve Labels**” drop list allows you to choose whether to show the curve labels on the plot. “Auto” (the default) lets the program select based on the size of the plot. “**Show/Hide Annotations**” chooses whether to hide the annotations, show them in less detail (“Level 1”, in general intended for smaller plots like thumbnails (section 2.3.1.1 Waveform Thumbnails)), show in more detail (“Level 2”, intended for larger plots like time series or zoomed thumbnails), or let the program decide (“Auto”, the default). Not every plot has both Level 1 and Level 2 annotations.

“X AXIS” tab – This tab contains properties of the X axis. “**X Title**” is the title shown under the X axis. “**X Range**” is the data range for the X axis; if given as 0.0 to 0.0, the range will be set automatically from the data. “**X Ticks**” is the number of major ticks on the axis; “current” keeps the current number, “IDL default” lets IDL decide. “**Minor Intervals**” is the number of minor tick *intervals* between each pair of major ticks. “**Linear**” and “**Log**” specify just that. “**X Tick Labeling**” = Standard means to use standard labeling for major ticks, where the label is the actual value. Delta means to use “Delta Tick” labeling, where only the first tick has its actual value and subsequent tick values are deltas (+/-) from the first. “**Format for Standard**” is the IDL format code (*Note*: parentheses required!) to use to format tick labels when using Standard labeling. This can also be the name of a user-defined callback function that given a tick value returns a formatted string; see the IDL documentation for details. “**Formats for Delta: Base**” gives the format code for the first tick label when using Delta Ticks labeling; “**...Deltas**” is the format for the subsequent delta labels.

“Y AXIS” tab – This is just like the X Axis tab, but pertains to the Y axis.

“OK” button – Accepts any changed properties, redraws the plot, and dismisses the dialog.

“?” button – Pops up a window with help text.

“Cancel” button – Dismisses the window without making any changes.

Other available altimetry plotsets include:

- Waveform Characteristics
- Range Increments

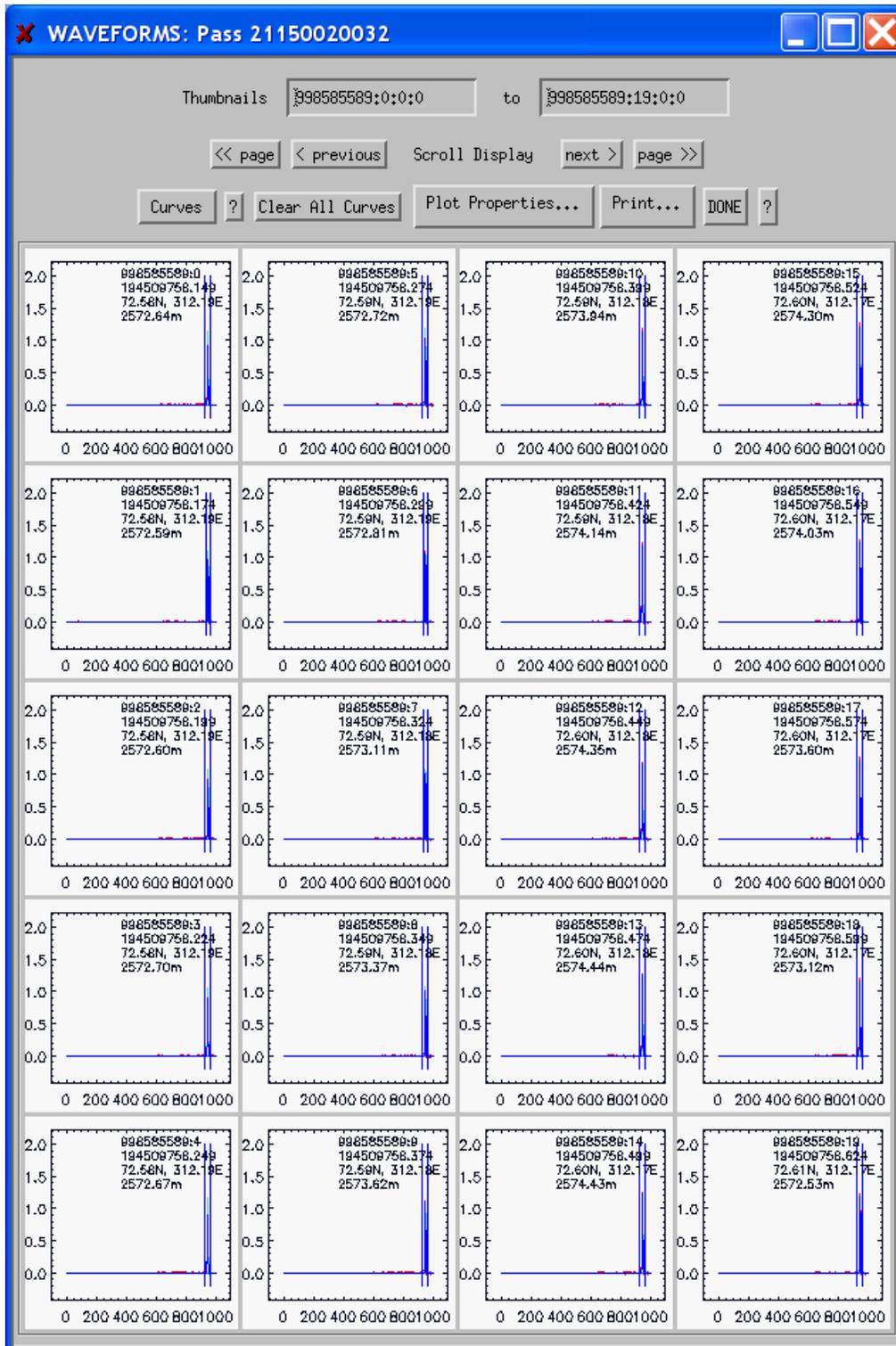
- Range Corrections (called Tide, Troposphere, and GPS Corrections prior to release 200609.0)
- Angles (spacecraft and instrument orientation)
- Meteorology/Cloud/Aerosol Parameters (temperatures, pressures, humidity from GLA06-15, data release 24 and above only; also specific humidity, temperature at 2m altitude, and total cloud cover from GLA08-09 at data release 26 and above.)

2.3.1.1 Waveform Thumbnails

If GLA01 has been selected, right clicking on any portion of the time-series profile in an altimetry plot set and then clicking on “Display Waveforms” will display corresponding waveform thumbnails in a ThumbnailViewer window, as shown in Figure 2-24, beginning at the location of the red vertical cursor, with waveform parameterization results if GLA05 was also selected. Thumbnails are displayed 20 at a time (0.5 second), top to bottom then left to right; ie., the first thumbnail (timewise) is in the upper left corner, the fifth in the lower left, and the twentieth in the lower right. (This ordering was requested by the GLAS Science Team in order to more easily see trends in sequential thumbnails.)

Paging backwards or forwards through the thumbnails will also cause the red vertical line to be plotted on any open plot sets, positioned to the corresponding time on all profiles. Similarly, repositioning the red line on any of the series plots with the right mouse button will move the waveforms window to show waveforms starting at the selected time. Clicking on any one of the thumbnails will bring up a large version of it in a ThumbnailZoom window as shown in Figure 2-25.

Note that if GLA05 data is available for this record, the latitude, longitude, and elevation shown on each waveform are taken from GLA05 even if higher products were also selected, and thus do not include all corrections. On the zoomed thumbnails, this is indicated by “(uncorr)”. Otherwise, the location shown will be the *predicted* location of



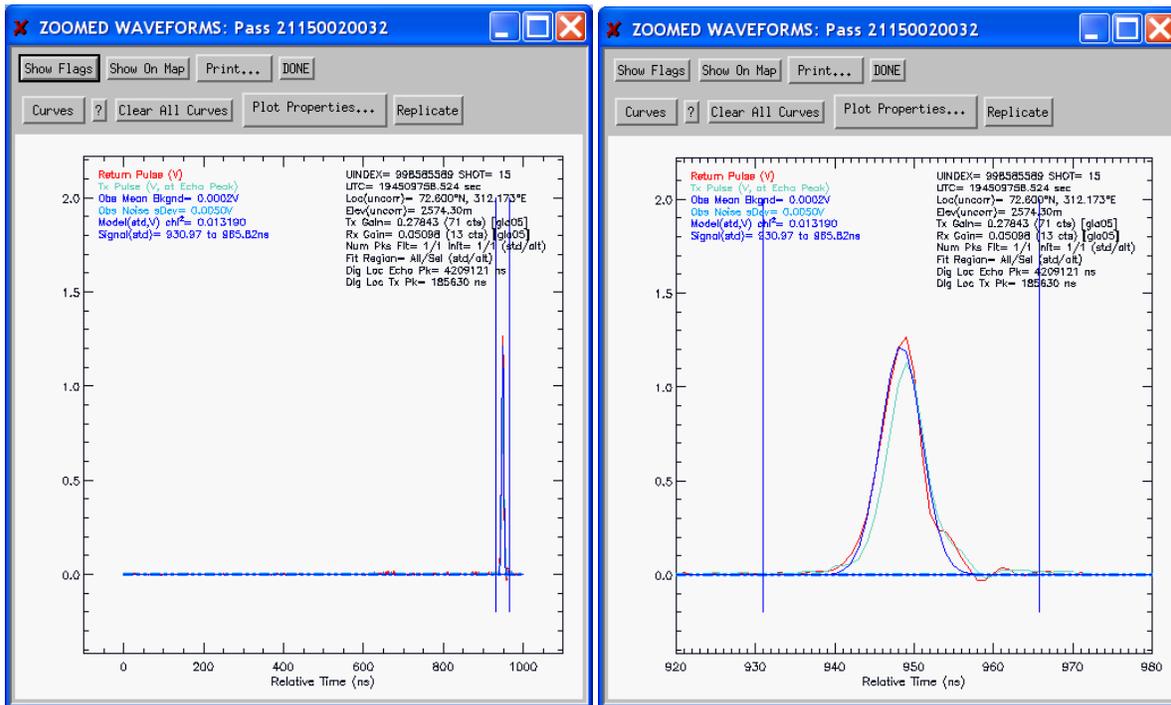


Figure 2-25: Zoomed waveform thumbnails. In the thumbnail on the right, the user has used the “Plot Properties...” button to change the X-axis range, to better show the waveform.

the *first* shot in that 1-second record. This is due to the design of the GLA01 product, and is indicated by “(pred)”.

Scroll Display buttons (ThumbnailViewer only) – These buttons scroll through the available waveforms. “<< page” displays the previous 20 thumbnails. “< previous” brings the preceding thumbnail onto the display in the upper left and slides the rest down. “next >” adds the next thumbnail on the lower right and slides the others up. “page >>” displays the next 20.

Caution: Do not be too quick on the mouse when paging back and forth on the thumbnails or the program may get confused and do weird things. Pushing the “DONE” button in the thumbnail window will usually stop this, after a while.

Curves button – Works in the same manner as for the time-series plots, but applies to all thumbnails in the window.

Clear All Curves button – Clears the plots of all curves.

Plot Properties...button – Works in the same manner as for the time-series plots, but properties apply to all thumbnails in the window. This button also provides options to save the properties to and restore from a file.

Print... button – Allows you to make a PostScript plot that shows all the thumbnails in the window. (**Caution:** IDL will automatically reduce the titles and tick labels, but not curve labels or annotations, by 50%. Make appropriate adjustments to the character size using the “Plot Properties...” button.) Individual thumbnails have a 1:1 aspect ratio, so use 4:5 for printing the entire window. Remember to use the “Close PS File” button when you’ve completed the plot.

Note: The ThumbnailViewer and ThumbnailZoom “Print...” button option “Print data rec of 1st tn” has been removed. It was implemented in a way that precluded use of the IDL Virtual Machine, did not work for most products, and when it did produced voluminous output, most of which was of little use. Instead, we recommend you zoom the thumbnail you want and use the “Print data...” options on the Curve menu for the curve you’re interested in. (We plan to add the Field Dump feature to the ThumbnailViewer and ThumbnailZoom in a future release.)

DONE button – Closes the window.

Show Flags button (ThumbnailZoom only) – This button will only appear if GLA05 data is available. Pops up a window that shows the states of the waveform quality flags for this waveform.

Show On Map button (ThumbnailZoom only) – Clicking this button will position the location marker (green diamond) on the Groundtrack Map window (Figure 2-15) to the location of this waveform (or if GLA01 only, the predicted location of the first waveform in the record).

Replicate button (ThumbnailZoom only) – Makes a clone of this window. Each window has its own set of properties, making this useful for studying the data at different scales, or showing different curves in separate windows.

2.3.2 Lidar Plotsets

LIDAR plotting capabilities are similar to the altimetry ones described in section 2.3.1

Altimetry Plotsets (and Time-Series Plots in General) above. Currently available lidar plotsets are GLA02 Normalized Lidar and GLA07 Attenuated Backscatter profile images at 532nm and 1064nm, GLA02 and 07 Energies and Backgrounds, GLA10 and 11 Cloud and Aerosol Layers, GLA11 Optical Depths, and GLA11 Particle Size Estimates. Clicking on one of the “normalized lidar” or “attenuated backscatter” plot sets brings up a time-series backscatter profile image for the pass as displayed in Figure 2-26. At the request of the ICESat Lidar Science Team, the backscatter image data is averaged

over 1 second. The zoom bars can be dragged from each side of the image to select a zoom region and pushing the “zoom” button will create another plot window of the zoomed region as shown in Figure 2-27. If GLA08 or GLA09 was selected, a variety of cloud, aerosol, and topographic elevations may be superimposed on the backscatter images (these may still be viewed even if GLA02 and GLA07 were not selected). There will be no difference windows with the backscatter images *unless* GLA08 or GLA09 was selected. Note that a Postscript output file of a backscatter image is likely to be very large; some people prefer to simply use screen-capture tools, but these produce lower-resolution prints.

Display Lidar Profiles button – Right clicking on any portion of the image and then clicking on “**Display Lidar Profiles**” will display thumbnails of the corresponding individual backscatter profiles; see Section 2.3.2.1 Lidar Backscatter Profiles.

Other buttons – See Section 2.3.1 Altimetry Plotsets (and Time-Series Plots in General).

The current color scale ranges for the lidar windows are:

532nm Normalized (GLA02): $-2.0e7$ to $1.2e8$
532nm Attenuated (GLA07): 0.0 to $1.0e-5$
1064nm Normalized (GLA02): $1.0e-4$ to $4.0e-4$
1064nm Attenuated (GLA07): 0.0 to $1.0e-4$

Additional lidar plotsets available include:

- GLA02, GLA07 Lidar Energies and Backgrounds
- GLA10, GLA11 Cloud and Aerosol Layers
- GLA11 Optical Depths
- GLA11 Particle Size Estimates

These are all time-series plotsets similar to the altimetry ones, but include a “**Display Lidar Profiles**” button rather than a waveforms one. Meteorology parameters from GLA07-11 are on the altimetry Meteorology plotset.

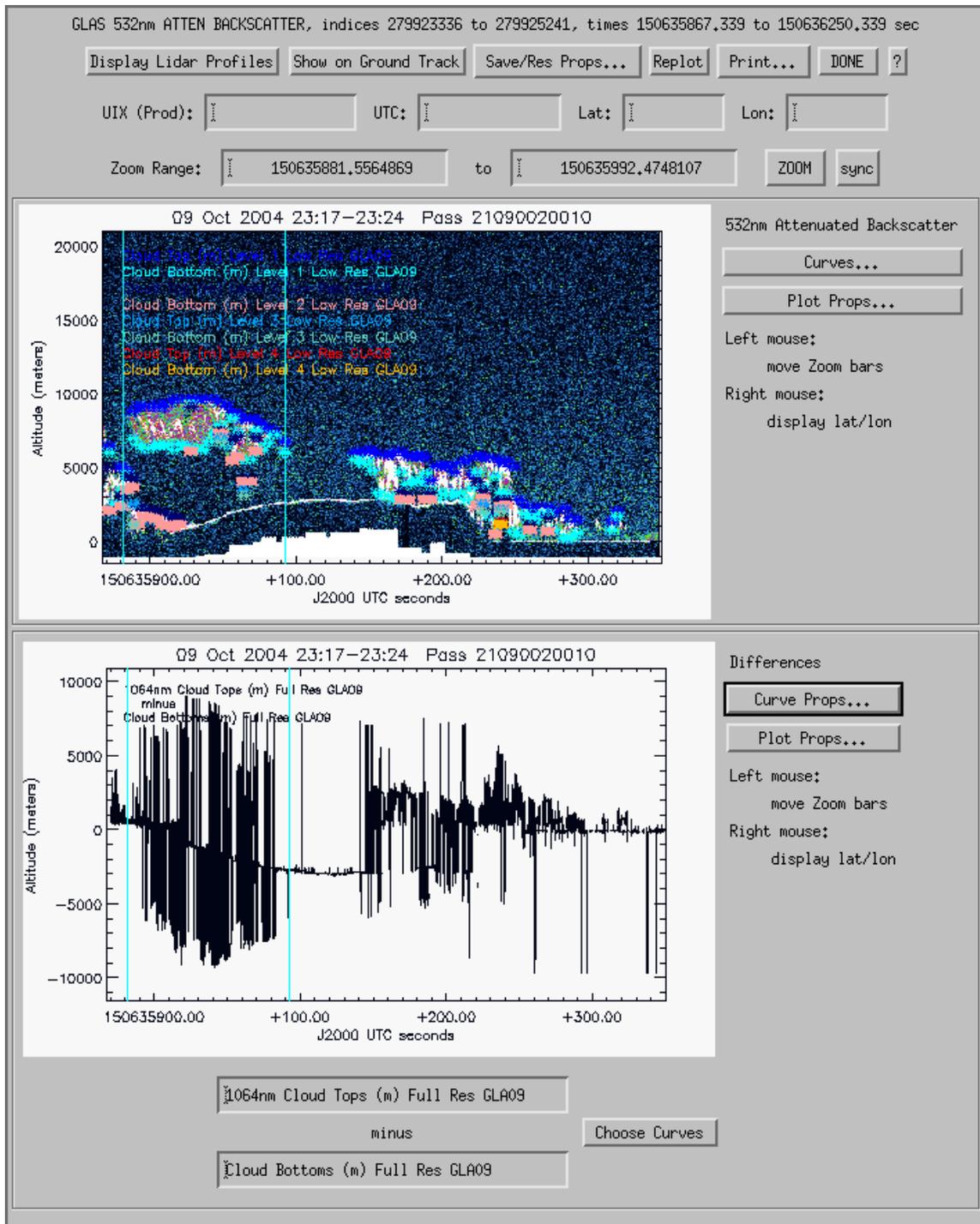


Figure 2-26: LIDAR Image plot set (GLA07 532nm Attenuated Backscatter). The difference plot is showing full-res cloud thickness (cloud top height – cloud bottom height). The difference plot will only appear if GLA08 or GLA09 was selected.

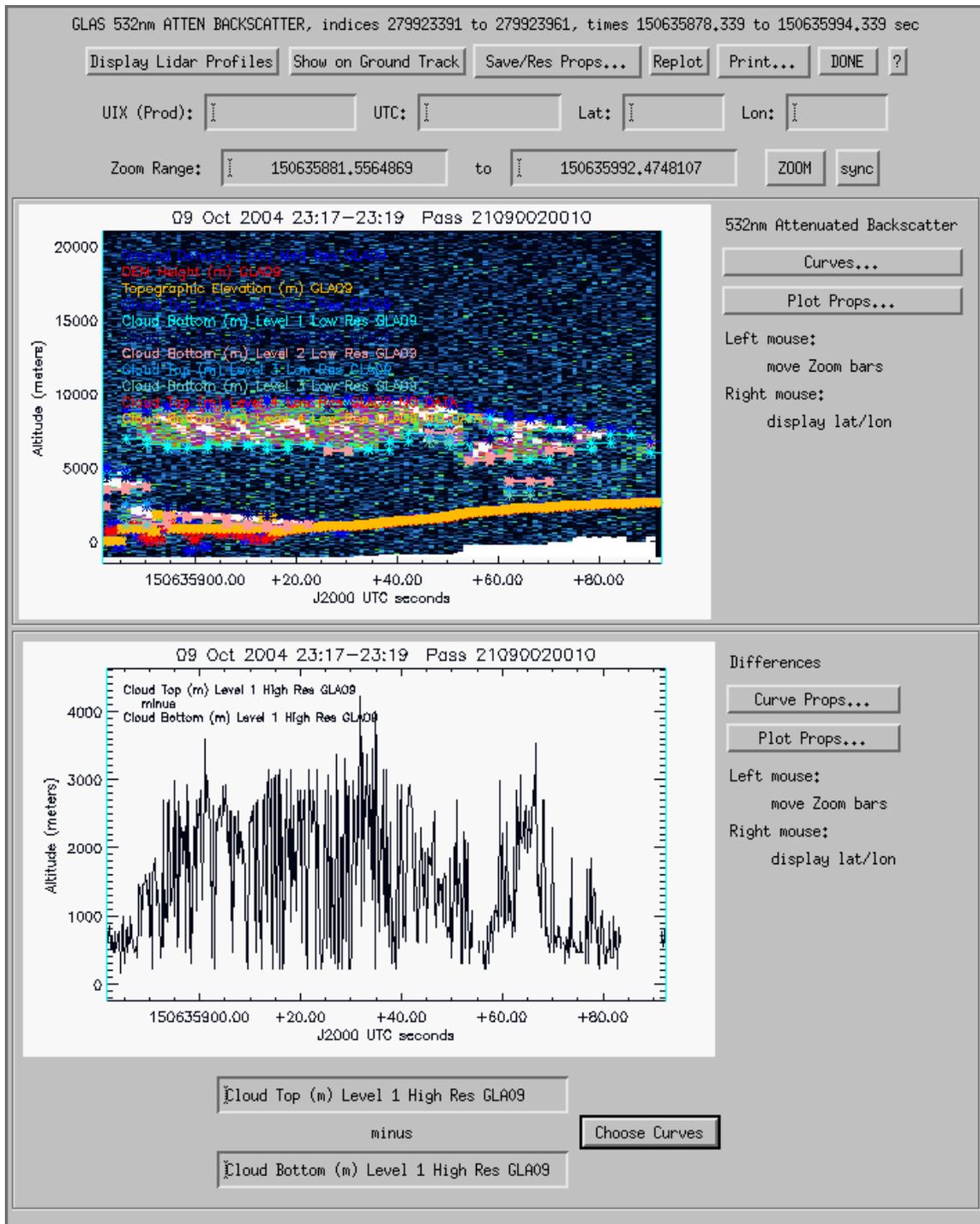


Figure 2-27: Zoomed LIDAR image profile, with cloud layers, elevation, DEM, and ground detection overlays. The difference plot is showing the thickness of the first cloud layer.

2.3.2.1 Lidar Backscatter Profiles

Right clicking on any portion of a lidar plotset and then clicking on “**Display Lidar Profiles**” will display the corresponding individual backscatter profiles as shown in Figure 2-28. (Note: Currently, for GLA02 only the 532nm profiles are initially shown, even when the lidar profiles were launched from a 1064nm image. We plan to rectify this in a future release. For GLA07, both sets of profiles are shown.) These windows work the same as the waveform thumbnails described in Section 2.3.1.1 Waveform Thumbnails. Left clicking on an individual profile will bring up a zoomed window of that profile as displayed in Figure 2-29. If one has both LIDAR and altimetry data and has displayed both the waveform and backscatter thumbnails, paging through one set of thumbnails, causes the other set to also page to the new location. Repositioning the red cursor on any time-series plot will also reposition the LIDAR thumbnails, and scrolling any of the thumbnail windows will also move the red cursors in all the time-series windows and reposition any other thumbnail windows.

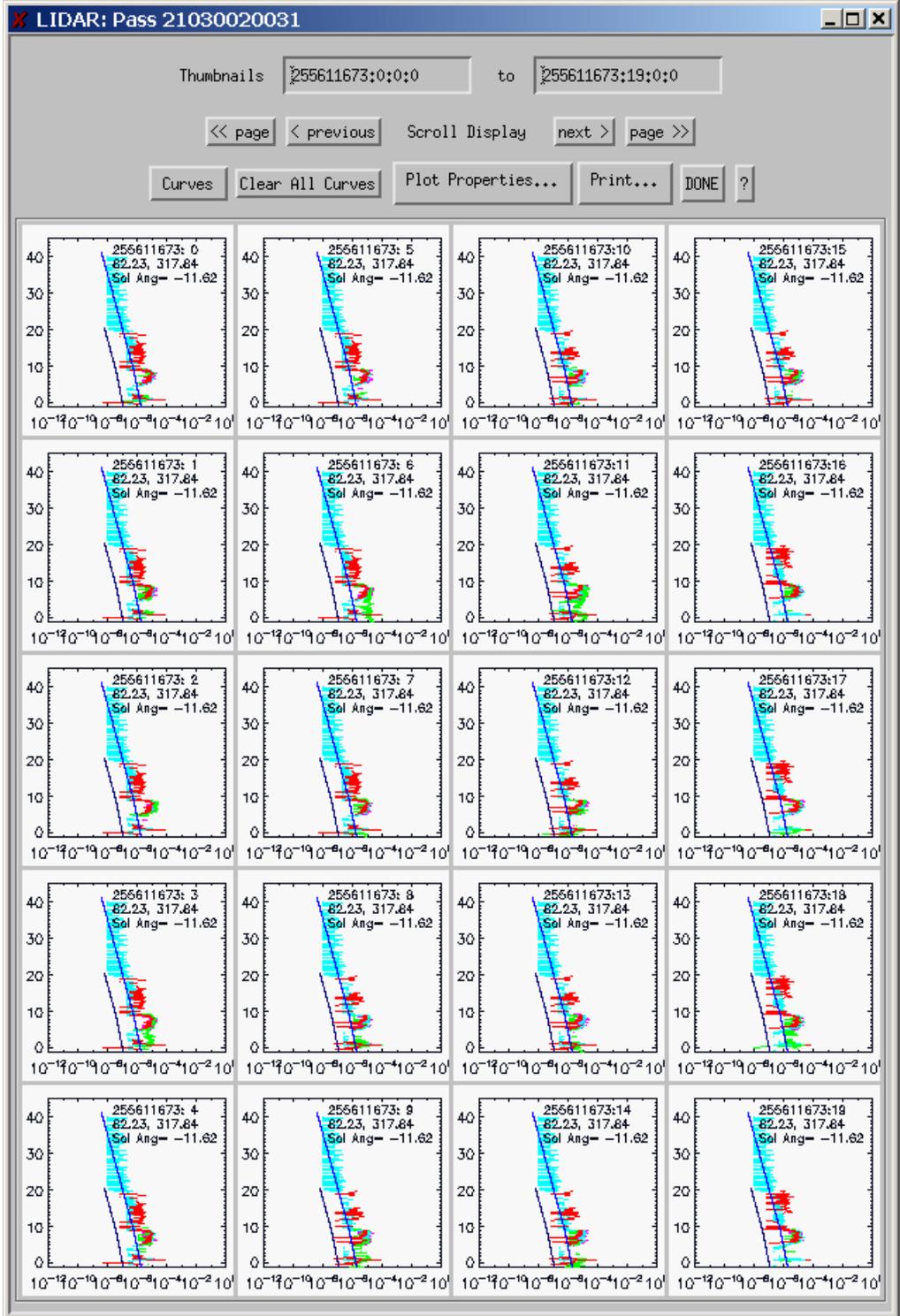


Figure 2-28: Individual backscatter profiles. Annotations: unique record index and shot number; latitude and longitude; sun angle. The X scale is energy; the Y scale is altitude in km.

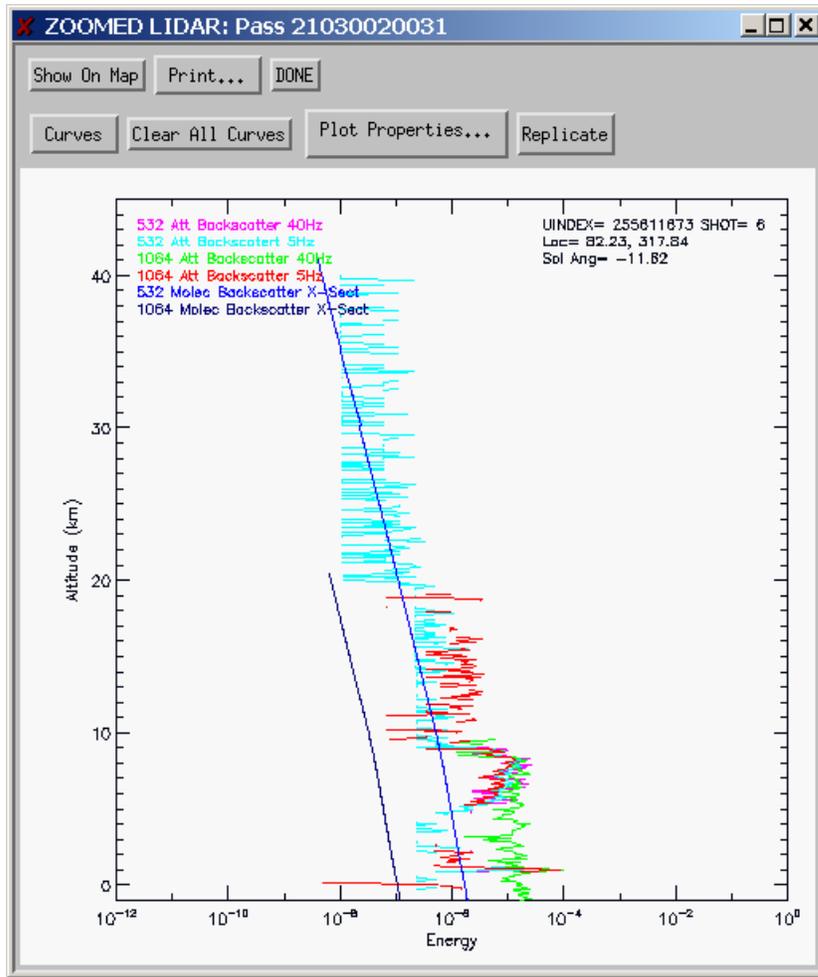


Figure 2-29: Zoomed backscatter profile

2.3.3 Miscellaneous Plotsets

Other available plotsets include Laser Profiling Array (see Figure 2-30), Flags (see Figure 2-31), and Waveform Intensity Image (see Figure 2-32).

Selecting the Laser Profiling Array plotset brings up a window of GLA04 LPA thumbnails, as shown in Figure 2-30. The x and y scales are simply pixel numbers. Each thumbnail shows the unique index and shot number in the upper right corner, with the time (in J2000 seconds) below it. (Note that the origin is now in the upper left, with row numbers increasing downwards. The old orientation may be easily restored by clicking on Plot Properties and reversing the Y-Axis Range.) This window works the same as the Waveform and Lidar thumbnail windows. Clicking one of the thumbnails will bring up a zoomed version of that plot. Repositioning a red cursor on one of the time-series plots, or scrolling or paging a Waveform or Lidar thumbnail window, will replace the thumbnails shown here with those at the new location; likewise, scrolling or paging this window will reposition other thumbnail windows and the red cursors on the time-series plots.

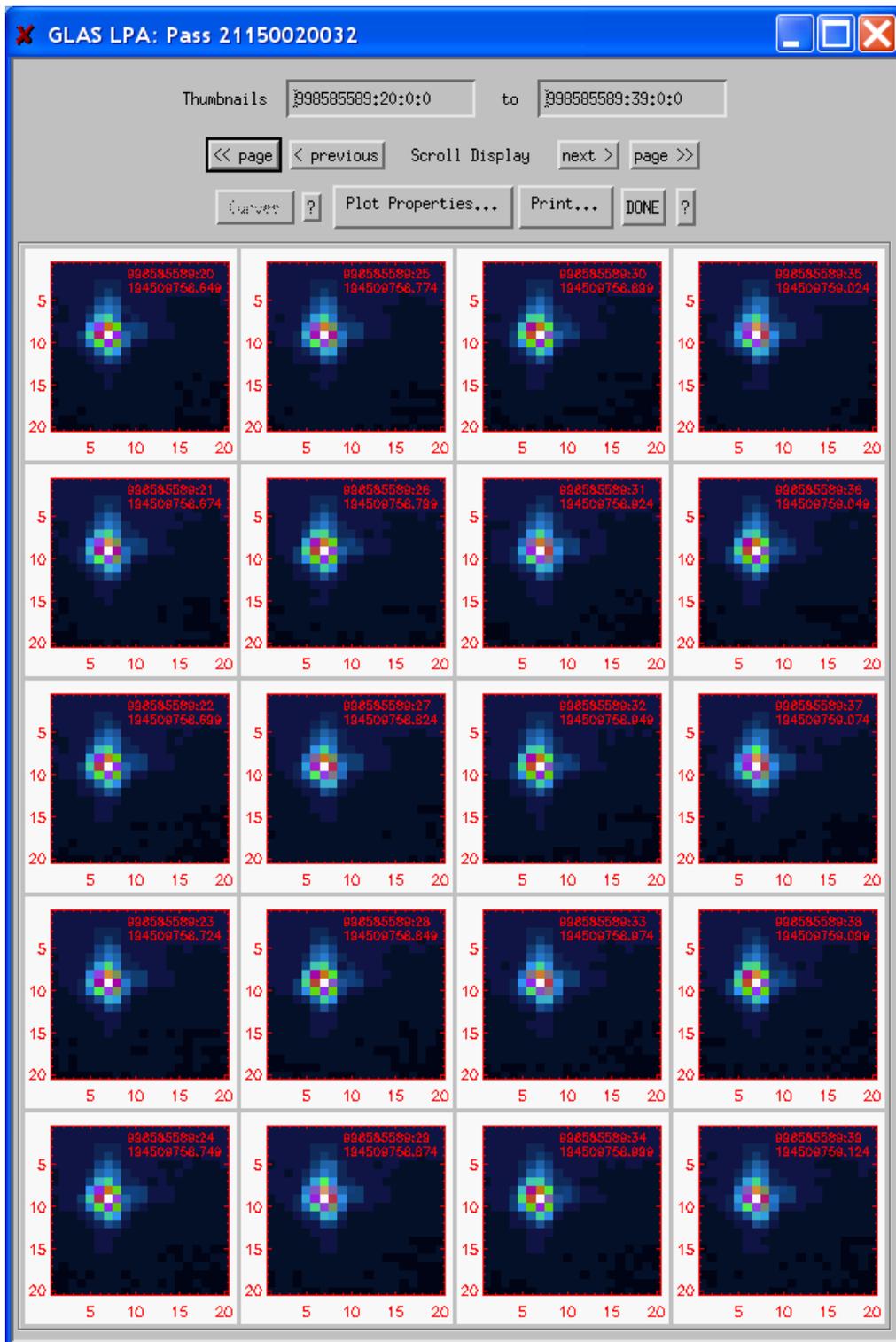


Figure 2-30: Laser Profiling Array

The Flags plotset (see Figure 2-31) is a time series plot that allows monitoring the values of the flag fields in all selected products. All flags from all products are available, except for the vertically-binned saturation flag profiles from GLA02 and GLA07. No difference window is shown.

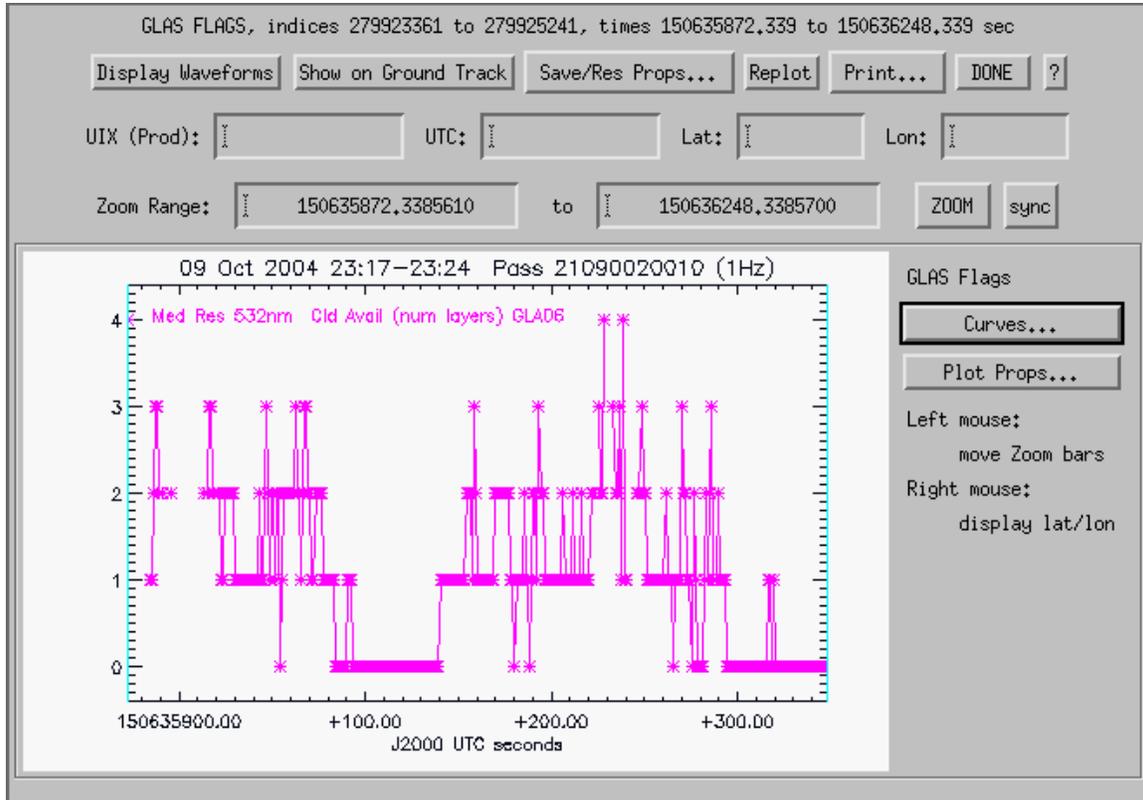


Figure 2-31: Flags plotset, shows time-series of specific parameters

The Waveform Intensity Series plotset (see Figure 2-32) is a time-series image of the intensity of the returned waveforms. The y-axis is gates (note: Not nanoseconds as in the waveform plots!) before end of waveform digitization. The large black areas are due to the use of 544 digitizer gates over land and ice sheets and 200 gates over ocean and sea ice. There is no difference window.

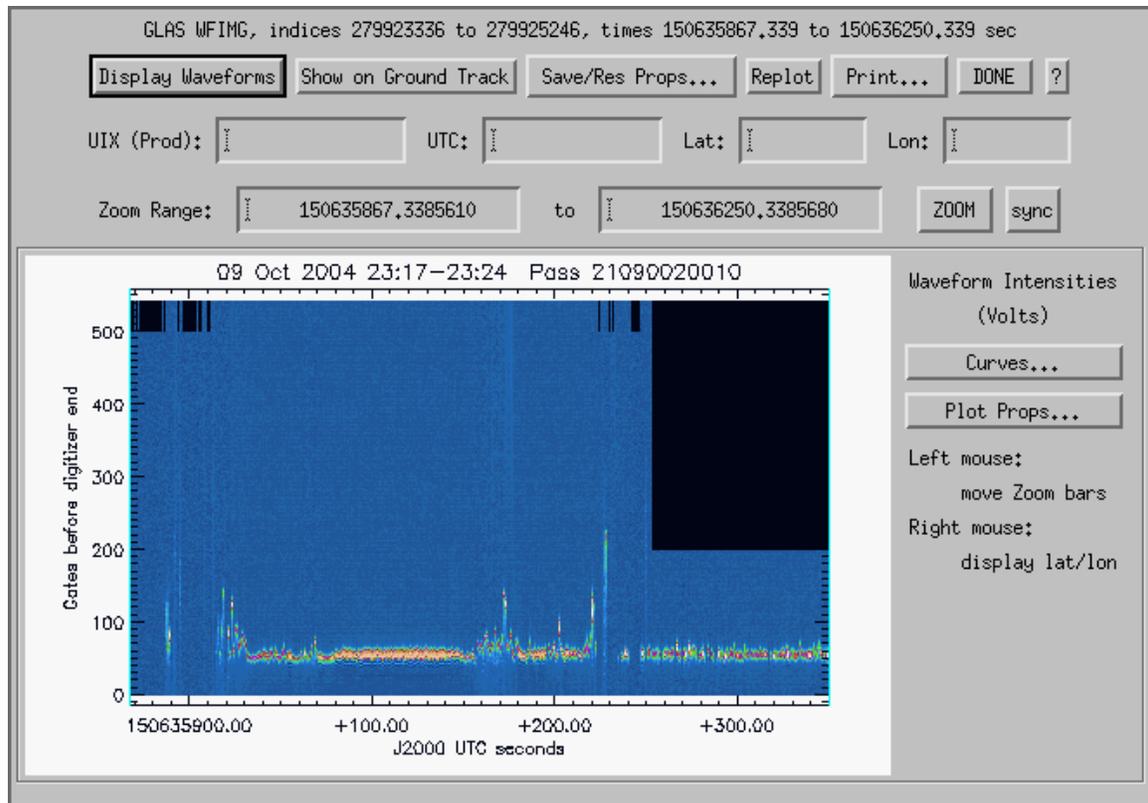


Figure 2-32: Waveform Intensity Image.

2.3.4 Some Notes about this Version

- You can keep going back to the initial elevation and LIDAR thumbnails (pass selection) and select more and more passes without closing any windows and probably eventually cause the program to crash.
- Try to close any windows that are no longer necessary as you continue on your way. It is best to use the buttons within the window labeled “Done” or “Close”; while closing via the X button won’t *usually* crash the program any more, it may still in some cases.
- Paging through the thumbnails too quickly (double clicking, etc) can get you in a loop where the event handlers just keep generating new events. Try to restrain yourself. Sometimes clicking the “Done” button several times will get you out of the loop (and will probably close the thumbnail window).
- There is now a limit on how far the groundtrack window can be zoomed. This avoids an IDL bug that caused crashes when zooming too far.
- Occasionally the groundtrack drawing window will become unresponsive so that you can’t drag out a zoom box. If this happens, clicking the “Replot Map” or “Clear Map” button will usually fix the problem.

- Positioning the location cursor on a time series plot (by right clicking) will only affect the cursors on the other time series if a waveform or lidar profile thumbnail window is displayed.
- The Meaning of “NaN”: Sometimes the string “NaN” will appear in place of a number. This stands for Not-a-Number, which is a feature of IEEE-standard floating-point computer arithmetic. (For example, 0./0. is a NaN.) It’s used in the Visualizer to indicate invalid values. Any particular language or compiler may or may not be able to parse “NaN” as a real number (IDL can); you may need to experiment and possibly edit out any lines containing “NaN”. The use of NaNs is also the cause of the harmless “Program caused arithmetic error: Floating illegal operand” messages you are likely to see.
- Could the Visualizer plot series by latitude or longitude, instead of by time? Sorry. This is a common request, and we can certainly appreciate why you would want to. But while this would work over a short range, remember that the Visualizer must work for GLAS data in the general case: Consider a plot by latitude as the spacecraft passes the pole, or a longitude plot at low latitudes where the track is steep. Keep in mind too that one plot may go all the way around the world! Furthermore, there won’t necessarily be data at the position of any particular tick. We concluded that plotting by time – which corresponds to distance along track – was really the only feasible way.

Appendix A: Abbreviations & Acronyms

GLAS	Geoscience Laser Altimeter System
GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
ICESat	Ice, Cloud, and land Elevation Satellite
IDL	Interactive Data Language
ISF	Instrument Support Facility
I-SIPS	ICESat Science Investigator-led Processing System
ITTVIS	ITT Visual Information Solutions, manufacturer of IDL
LIDAR	Light Detection And Ranging
LPA	Laser Profiling Array
MIT	Massachusetts Institute of Technology
mSCF	Main Science Computing Facility
NaN	Not a Number
NASA	National Aeronautics and Space Administration
OSU	Ohio State University
rSCF	Remote Science Computing Facility
TOO	Target Of Opportunity
UCSD	University of California at San Diego
UIX	Unique Index
UTC	Universal Time, Coordinated
UTCSR	University of Texas Center for Space Research
UW	University of Washington
WFF	Wallops Flight Facility