PhoREAL v1.0
Geospatial Analysis Toolbox

User Manual

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PhoREAL v1.0

- PhoREAL is a geospatial analysis toolbox that allows users to read in IceSat-2 ATL03 .h5 data files, process the data, and output the data into several different file formats for further analysis, such as:
    - .las file
    - .kml file
    - .csv file

- On Windows systems, the PhoREAL toolbox can be run as a Graphical User Interface (GUI) executable (.exe)

- On Linux systems, the PhoREAL toolbox can be run as a Python GUI or as a series of Python function commands via the Linux command line

- PhoREAL also has the ability to classify ATL03 data points from the classifications in the ATL08 data product, trim IceSat-2 ground track data by latitude or time, plot the resulting ATL03 data, and save any figures created
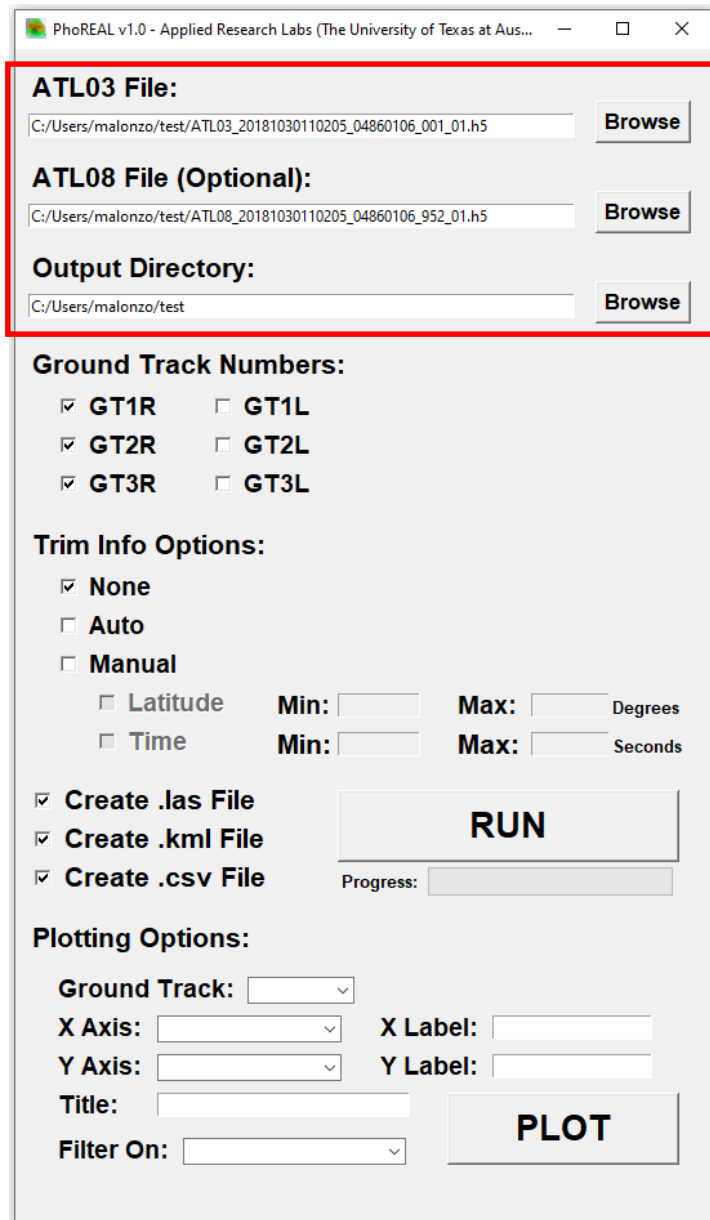
PhoREAL v1.0 GUI Overview (Windows)

- To run PhoReal v1.0 on a Windows system, place the PhoReal_v1.0.exe somewhere on the host computer and double-click the file name or icon
- After a moment, the GUI and terminal window will open as pictured to the left and below, respectively
- Users will input all information to the GUI shown at left
- Any messages from the GUI will appear in the terminal window shown below
- By default, certain GUI inputs are prepopulated

PhoREAL v1.0 GUI Input/Output File Location Section (Windows)

- To begin, the GUI needs the locations of certain input/output files
- The first input is the ATL03 .h5 file, which can be located using the 'Browse' button or typed or pasted directly into the entry box
- An optional ATL08 file can be input in the same manner in the second entry box
  - If an ATL08 file is included, the ATL03 points will be classified based on the classifications from the ATL08 file
    - Unclassified (class 0)
    - Ground (class 1)
    - Low vegetation (class 2)
    - High vegetation (class 3)
  - If an ATL08 file is not included, the ATL03 points will not be classified (all points labeled Class 0)
- The last entry in this section is the location of an output directory to store any output files created by the GUI
- User Note:
  - The 'Browse' button will input forward slashes " / " in the path names to files and directories
  - Users can input forward or backward slashes in any these entry boxes
  - The GUI can handle either case accordingly

PhoREAL v1.0 GUI Ground Tracks Section (Windows)

- The user can select to process any of the ground tracks listed

- The GUI is defaulted to use ground tracks GT1R, GT2R, and GT3R

PhoREAL v1.0 GUI Trim Info Section (Windows)

- Users have the option to trim the IceSat-2 data if desired

- The trim options are:
    - 'None' – does not trim any data
    - 'Auto' – trims data based on the bounds of known airborne lidar regions (not a capability in external release, will use 'None')
    - 'Manual' – trims data based on the provided min/max latitude or time bounds

- This example uses a Manual trim option between 322 and 338 seconds

PhoREAL v1.0 GUI Output File Section (Windows)

- Users have the option to create any of 3 output file types:
  - .las File – point cloud file that can be opened with QT Modeler, ArcGIS, or any other .las file viewer
  - .kml File – markup file that can be opened with Google Earth
  - .csv File – comma delimited file that can be opened with any text editor or Microsoft Excel

- User Note:
  - .csv files take a long time to create for full IceSat-2 granules that have not been trimmed in any manner
  - It is suggested to create a .kml file first and inspect the ground track in Google Earth, then trim the file down to the region of interest and create any output files from there

PhoREAL v1.0 GUI Run Section (Windows)

- Once all inputs have been entered, the 'Run' button can be clicked
- While the GUI is executing, the progress bar below the 'Run' button will update with the status of the execution
- Also, the GUI terminal window will update during GUI execution with status messages like those shown above
- Once execution is complete, some entries in the Plotting Options section below the 'Run' button will populate

PhoREAL v1.0 GUI Plotting Section (Windows)

- Once GUI execution is complete, the Plotting Options section will populate

- Any ground track in the pull-down menu can be plotted

- Any value in the X and Y Axis pull-down menus can be plotted

- Fields in the X and Y Axis pull-down menu are:
  - Time (sec)
  - Latitude (deg)
  - Longitude (deg)
  - UTM easting (m)
  - UTM northing (m)
  - Cross-track distance (m)
  - Along-track distance (m)
  - Height (m)
  - Classification
  - Signal confidence

PhoREAL v1.0 GUI Plotting Section (Windows)

- The X Label, Y Label, and Title entry boxes auto-populate based on the selections in the pull-down menus for each entry

- These entry boxes can also be edited

- These text labels will appear on the plot when it is created

PhoREAL v1.0 GUI Plotting Section (Windows)

PhoREAL v1.0 GUI Plotting Section (Windows)

- Plots can also be filtered by:
  - None – no filtering (default)
  - Classification – filter by ATL08 classifications
    - Unclassified
    - Ground
    - Low Vegetation
    - High Vegetation
  - Signal Confidence – filter by ATL03 signal confidence
    - 0 – lowest confidence
    - 1
    - 2
    - 3
    - 4 – highest confidence

PhoREAL v1.0 GUI Plotting Section (Windows)

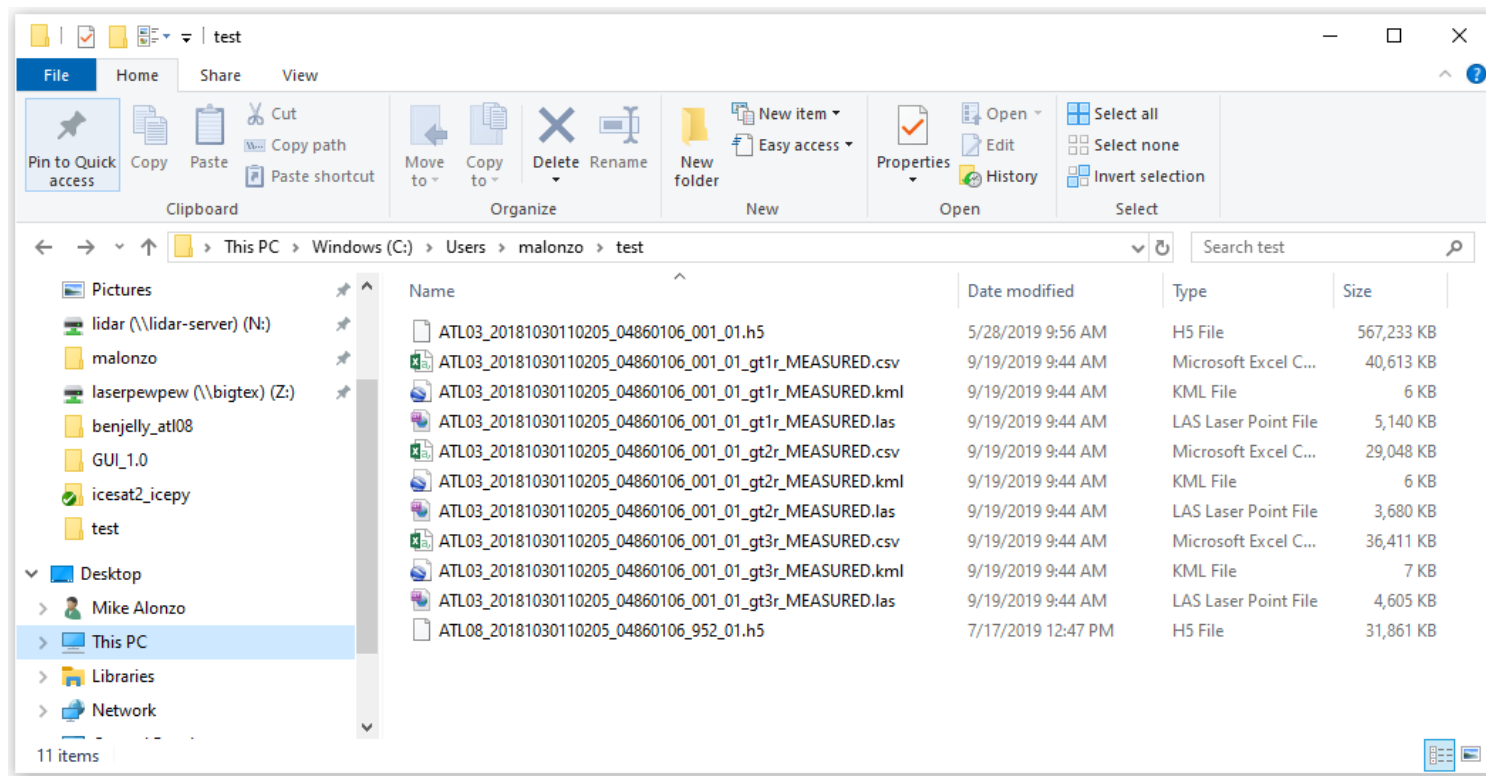- Filtering plot by ATL08 classifications

PhoREAL v1.0 GUI Plotting Section (Windows)

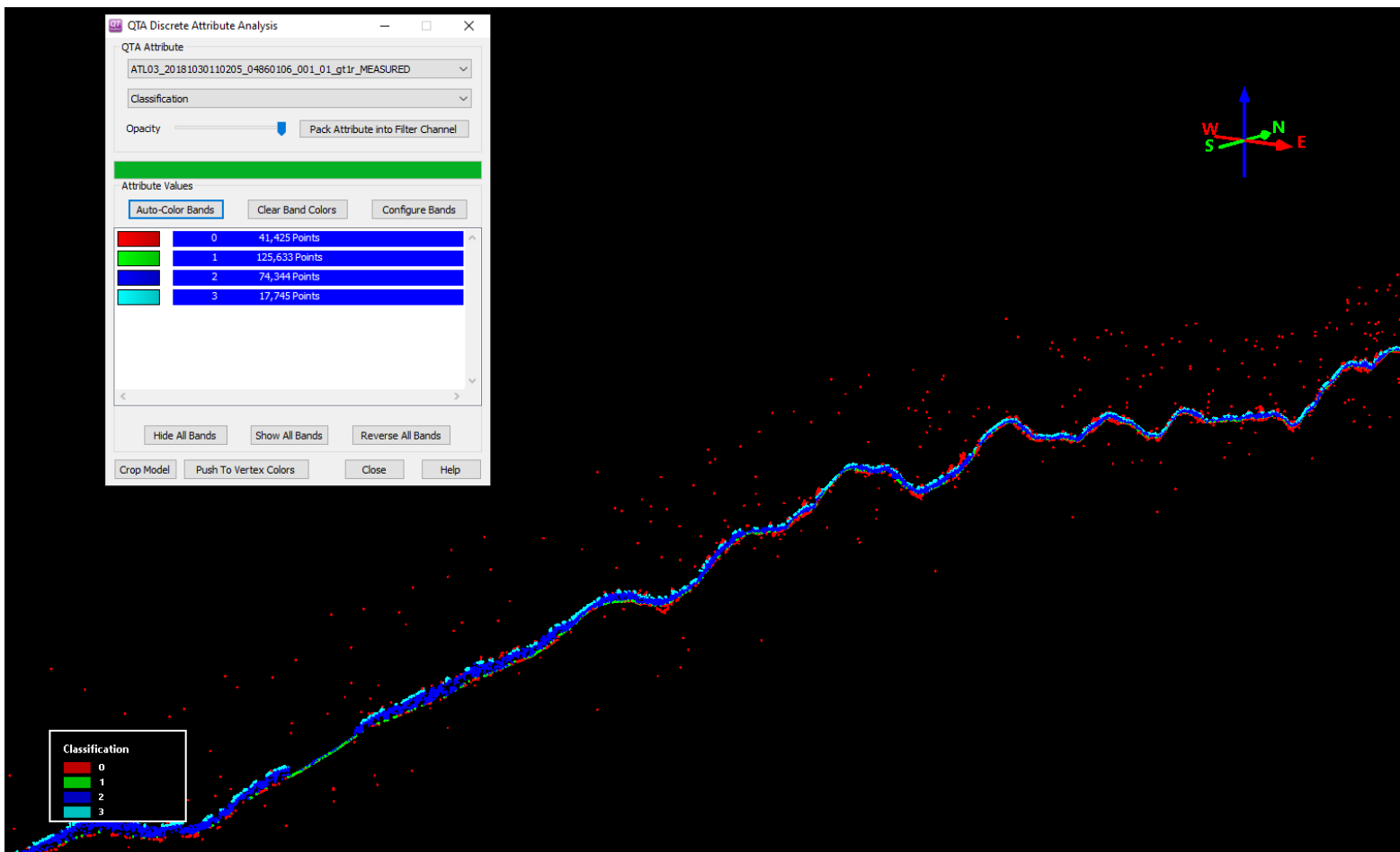- Filtering plot by signal confidence values
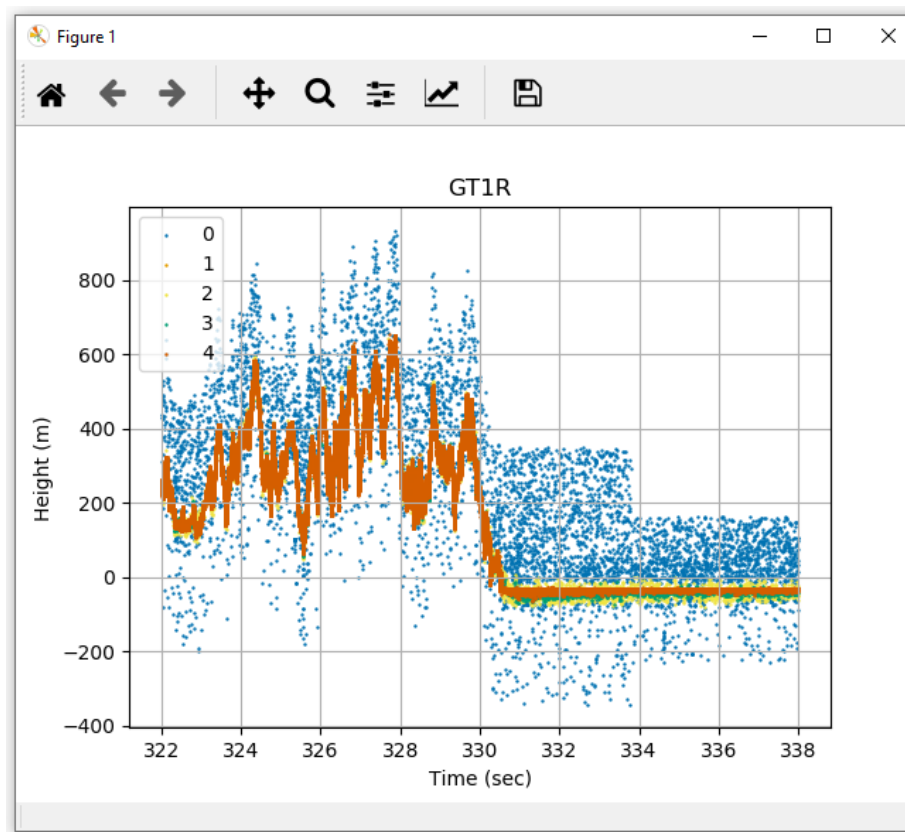
# PhoREAL v1.0 GUI Output Files (Windows)

- All output files are placed in the path provided in the Output Directory entry box at the top of the GUI

- In this example, all three output files (.las, .kml, and .csv) were created for ground tracks GT1R, GT2R, and GT3R

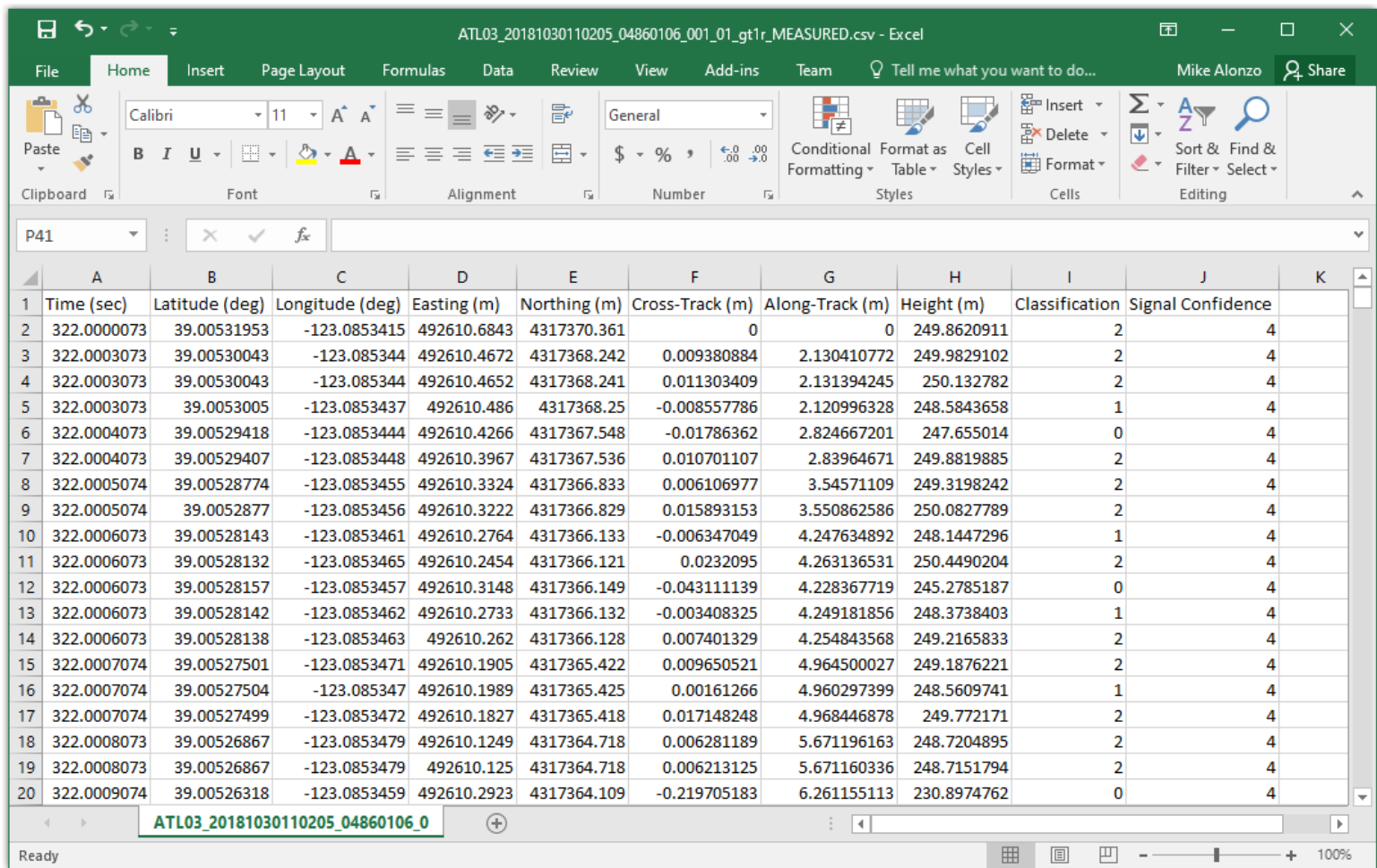# PhoREAL v1.0 GUI Output .las File (Windows)

- Output .las files can be viewed in any .las file viewer

- In this example, QT Modeler is used

- Data can be analyzed in 3D and filtered by classification (if an ATL08 file is used) or signal confidence

- For .las files, the signal confidence data is stored in the Scan Angle field since .las files do not have a pre-allocated field for signal confidence

PhoREAL v1.0 GUI Output .kml File (Windows)
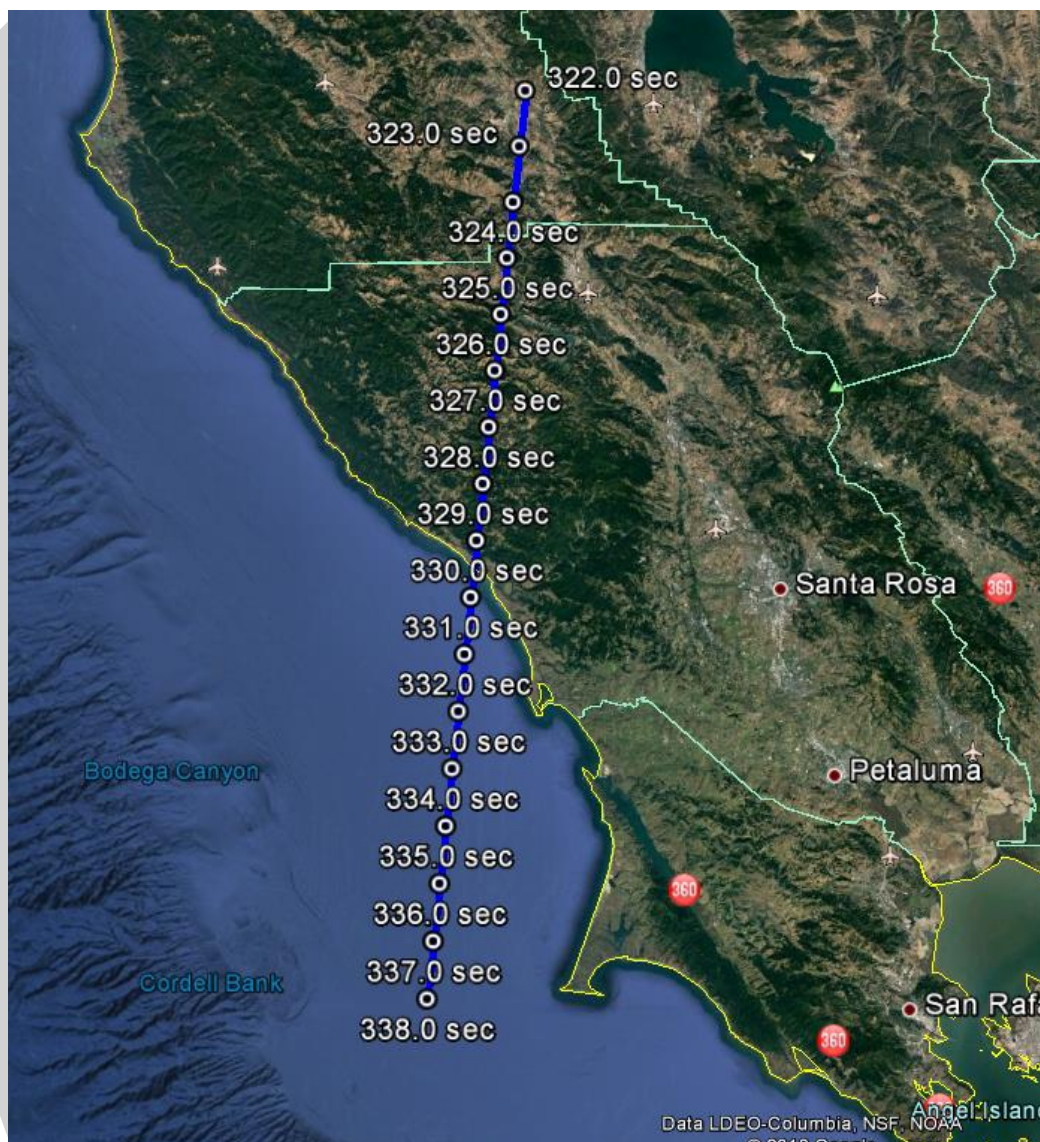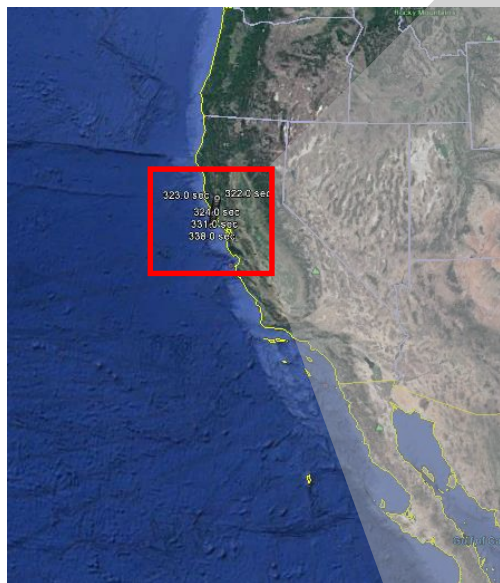
- Output .kml files can be viewed in Google Earth

- In this example, the segment of ground track GT1R from 322 to 338 seconds goes over Sonoma county in California

- Discrete ATL03 points are saved in one second time increments in the .kml file

PhoREAL v1.0 GUI Output .csv File (Windows)

- Output .csv files can be opened with any text editor or Microsoft Excel

- Ensure that .csv files with the same name are closed before writing new .csv files (or this may create an error)

- For all .csv files, the fields printed for each ATL03 point are:
  - Time (sec)
  - Latitude (deg)
  - Longitude (deg)
  - UTM easting (m)
  - UTM northing (m)
  - Cross-track distance (m)
  - Along-track distance (m)
  - Height (m)
  - Classification
  - Signal confidence