



## Alvin Imagenex Scanning Sonar Data Processing Protocol

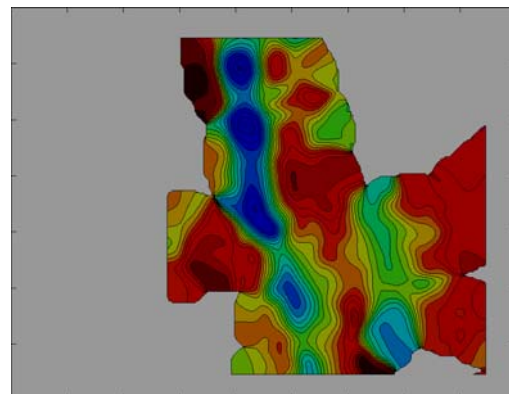
### 1.0 Guidelines for collecting Imagenex data with Alvin:



- 1.) Use LBL with a well-surveyed net. Be sure that the sound velocity profile that is used for surveying the net is appropriate for both *location* and *time of year*.
- 2.) Because of navigation errors, it is better to have more Imagenex survey lines that are short (< 100 m) than a couple of long lines.
- 3.) It is important to include a known prominent bathymetric feature in each survey that can be used to perform feature-matching to create composite grids. This could include axis walls, fissures, or large vent structures. For example, at least one cross-axis transect (at EPR) helps to constrain the bathymetric data.
- 4.) If the dive is primarily a long transect, try to include small areas with a few short lines, to ensure coverage that can be used composite grid generation. Given the width of the swath and the magnitude of features (and variability of bottom), a single swath is often difficult to use in feature-matching.
- 5.) Effective swath width is approximately twice the altitude. Flying 5-6 meters above the bottom (at 0.25 knots) provides reasonable swath width and resolution (< 1-m grids) while also allowing for visual confirmation of seabed features.
- 6.) To aid mapping efforts at R2K Integrated Study Sites, existing high-resolution bathymetry data can be downloaded from the Ridge 2000 data portal: [www.marine-geo.org](http://www.marine-geo.org).
- 7.) Image files can be used as underlays in the DVLNAV system used in the sub. These images should be provided as \*.bmp files to the Expedition Leader no later than the evening before the dive, and should be trimmed to include only the map area (no border around the plot). The coordinates of the corners of the plot (in local XY) should also be provided. Decreasing the image brightness by ~30% will prevent the underlay from obscuring live nav data display.

For example:

N: 3890  
S: 3820  
E: 4500  
W: 4590



## 1.1 Imagenex Processing Software Setup:

- 1) Copy the contents of imagenex-1.1 to your local computer. 

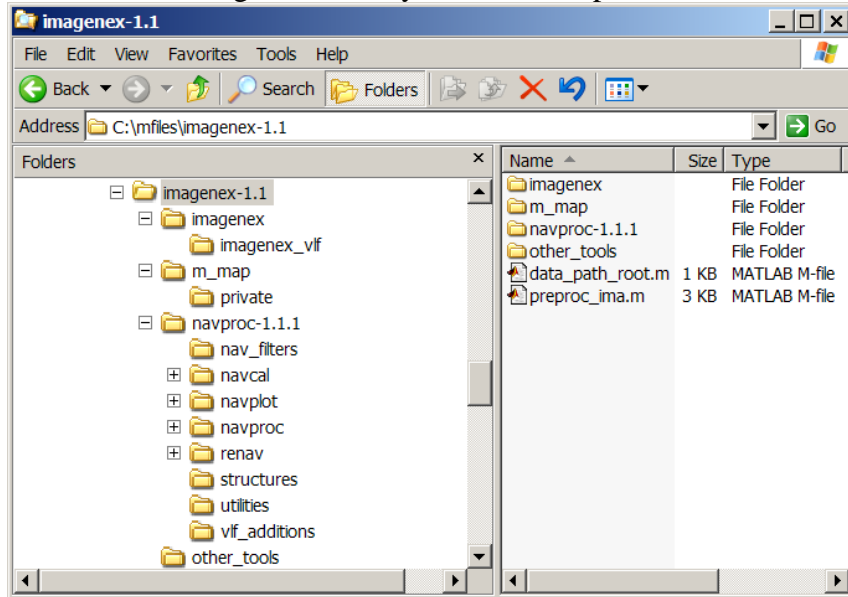


Figure 1: Imagenex processing code directory structure.

- 2) Open data\_path\_root.m and set config.OS to the operating system you are using:

```

1 pthroot='/home/sci0/';
2 config.OS='linux';
3 % pthroot='c:\';
4 % config.OS='windows';


```

- 3) Create a navplot and Imagenex directory on your computer at the same level in the directory structure using the path root defined in step 2 as the path:

*For example (Linux):*

Create a navplot directory in /home/sci0/ → /home/sci0/navplot  
 Create an imagenex directory in /home/sci0/ → /home/sci0/imagenex

*or (Windows):*

Create a navplot directory in: c:\ → c:\navplot   
 Create an imagenex directory in: c:\ → c:\imagenex

## 2.1 Processing Imagenex data when LBL was used:

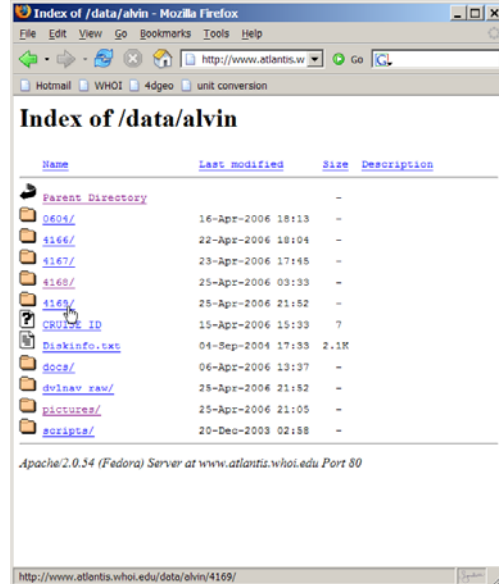
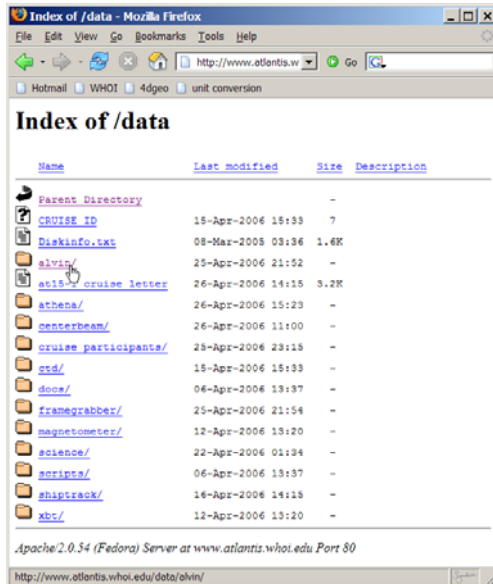
1) Copy Data to Hard Drive either via webpage or mapped drive:

### Copy Data Via Webpage:

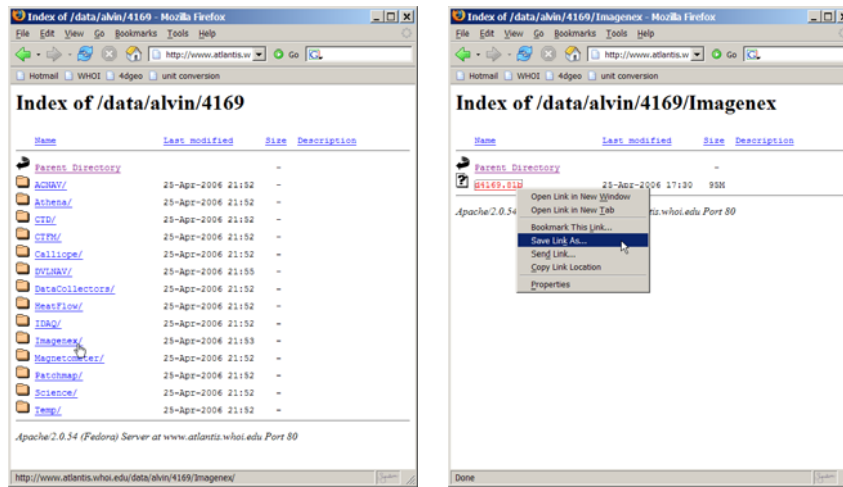
- a. Go to [www.atlantis.who.edu](http://www.atlantis.who.edu)  
Select [All Data For This Cruise](#):



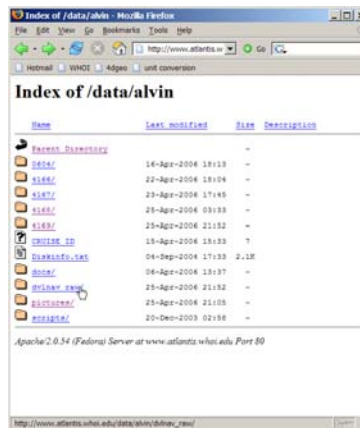
- b. Choose [alvin](#) from the data directory list and then choose the dive of interest:



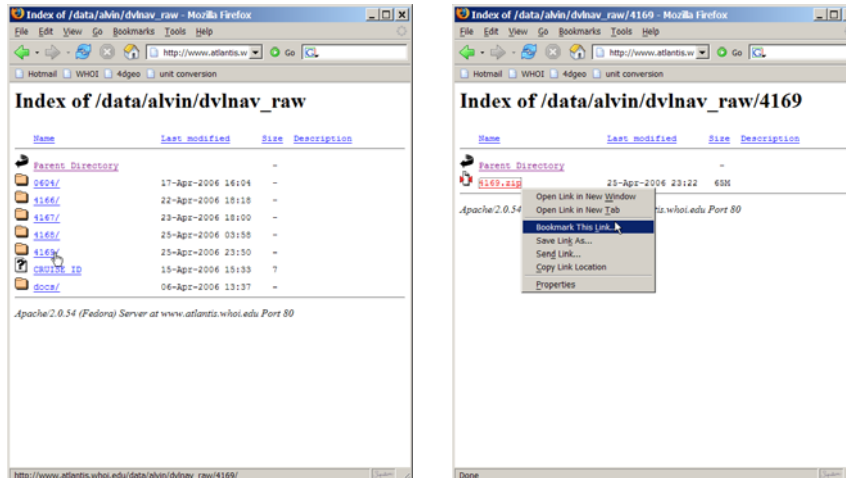
- c. Go to the folder entitled [Imagenex](#) and then right-click on the [\\*81b](#) file and save it to your local hard drive (e.g. c:\imagenex\4169) or /usr/sci0/imagenex/4169):



- d. Return to the alvin data index page and select [dvlnav\\_raw](#):

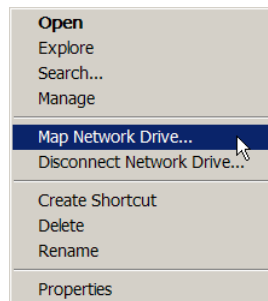


- e. Choose the dive of interest and then right click to save the zip file to your local hard drive (e.g. c:\navplot\4169) or /usr/sci0/navplot/4169):

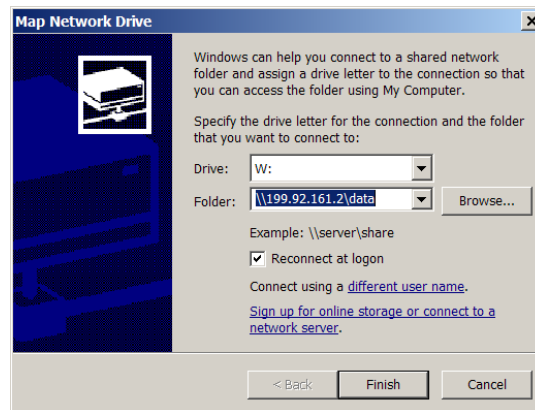


## Copy Data Via Mapped Drive:

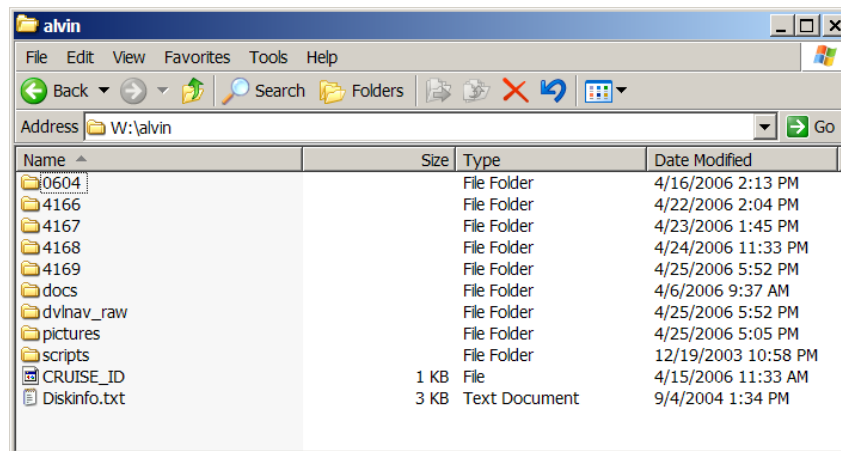
- a) Right click on My Computer and select Map Network Drive:



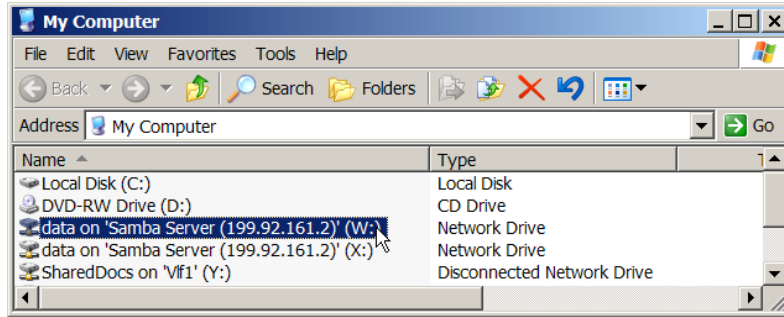
- b) Choose a Drive Letter and enter [\\199.92.161.2\data](#) as the folder. Check Reconnect at logon. Then press Finish. Once the drive is mapped, it should be accessible through My Computer whenever connected to the ship's network.



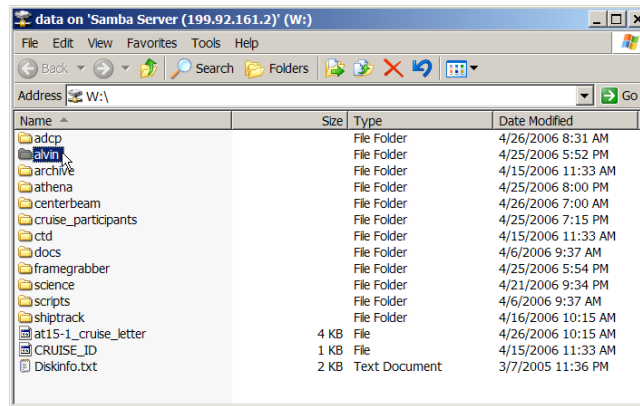
- c) A window should automatically appear with the contents of the data directory.



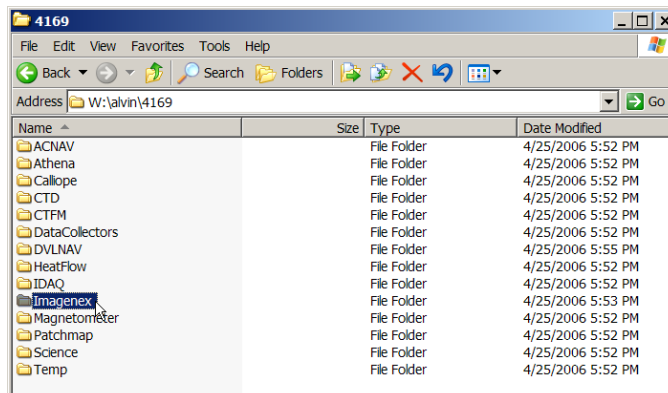
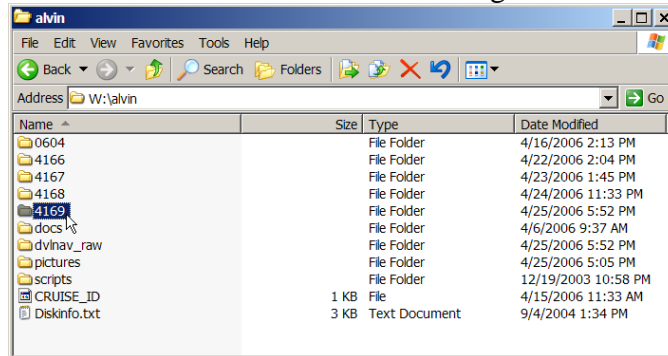
\*If this window doesn't open automatically, double click on My Computer and a link to it will be there. Double click to open.



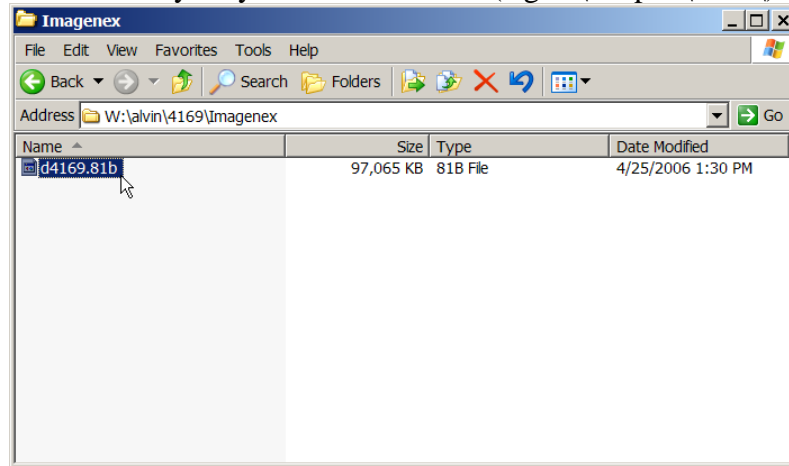
d) Double click on alvin:



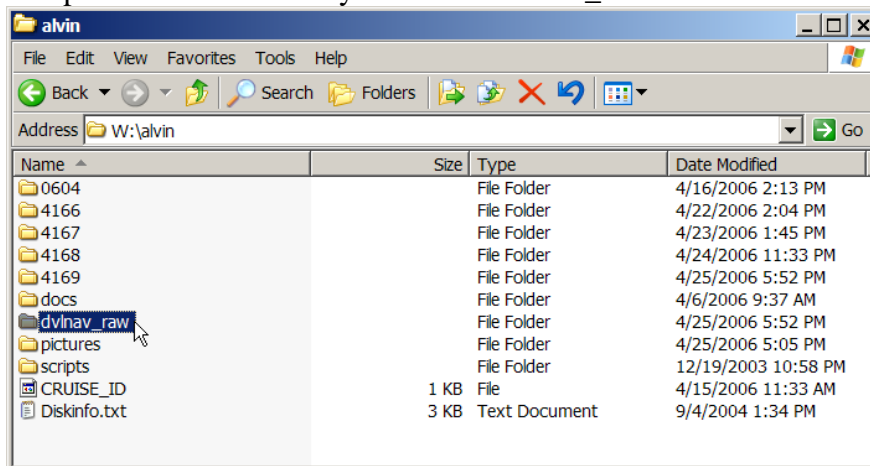
e) Double click on the dive of interest and then Imagenex:



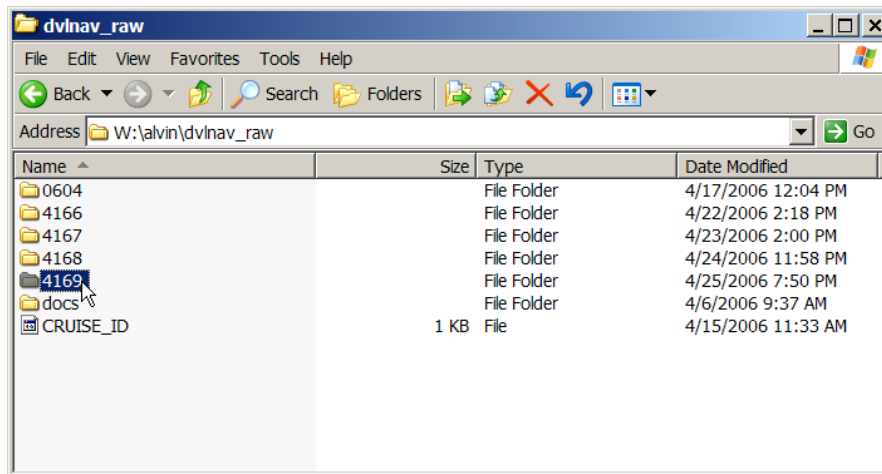
- f) Select and drag (or copy-paste) the \*81b file from this directory into the destination directory on your local machine (e.g. c:\navplot\4169).



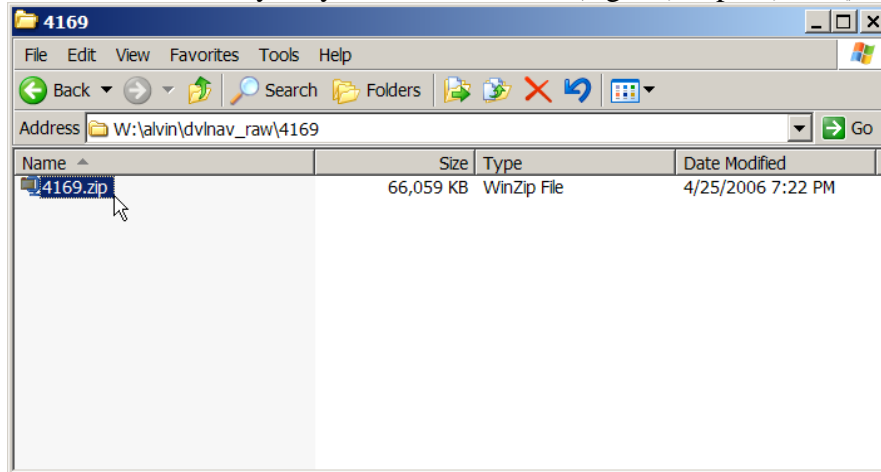
- g) Move up to the alvin directory and select dvlnav\_raw:



- h) Choose the dive of interest:



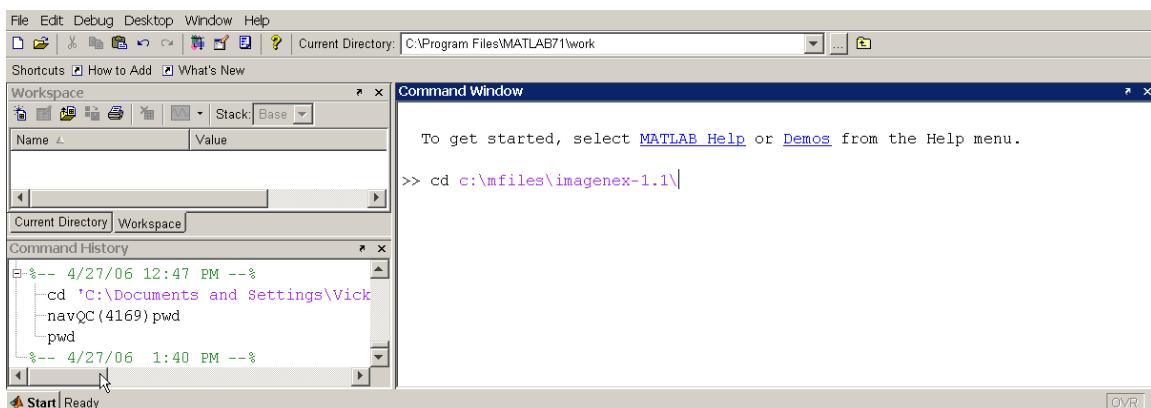
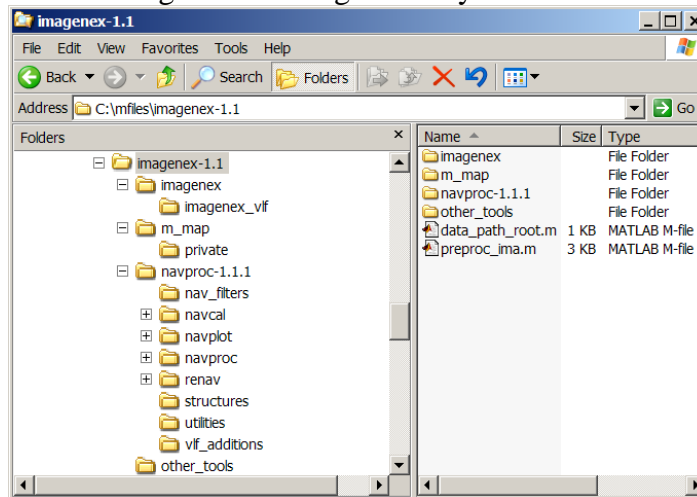
- i) Select and drag (or copy-paste) the \*.zip file from this directory into the destination directory on your local machine (e.g. c:\navplot\4169\).



\*\*If using Windows, unzip this file manually and place the contents in the navplot data directory:

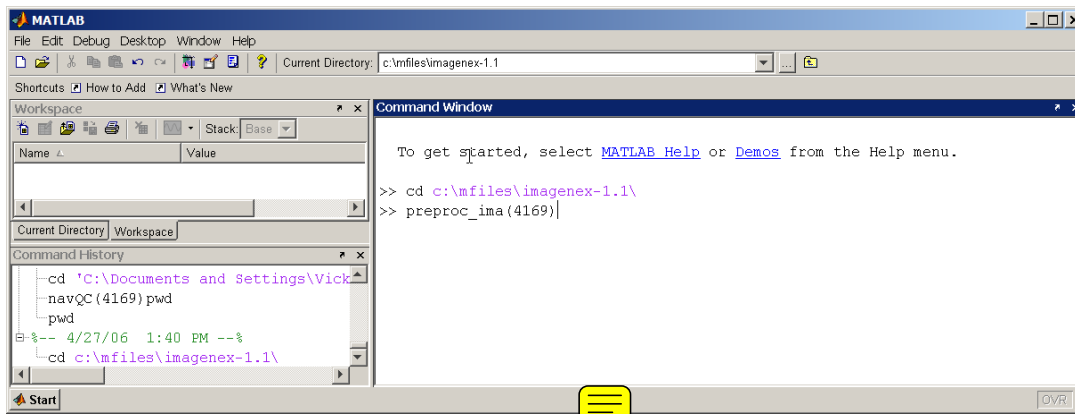
i.e. c:\navplot\4169\4169.zip should be unzipped into c:\navplot\4169\

- 2) Open Matlab and change the working directory to the mfile directory:

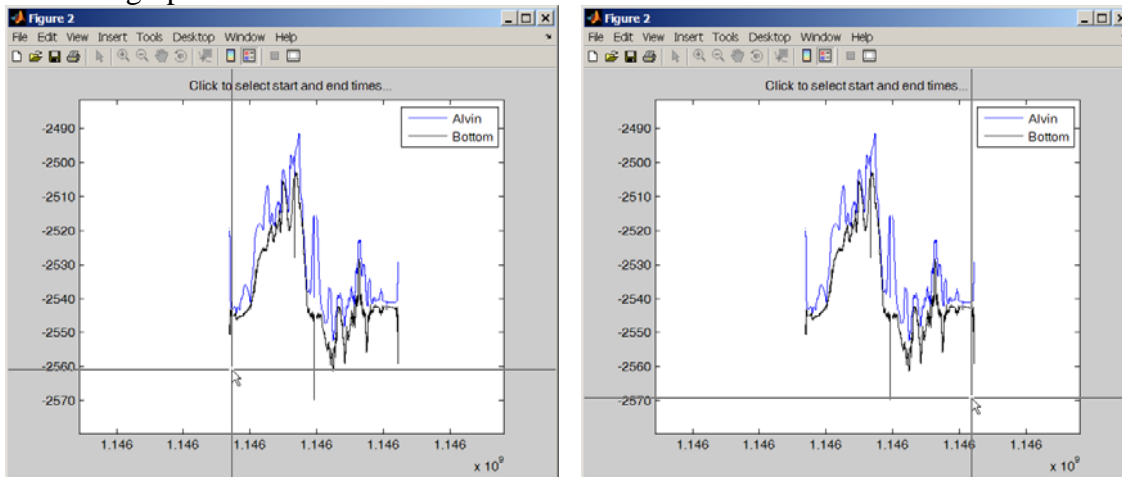




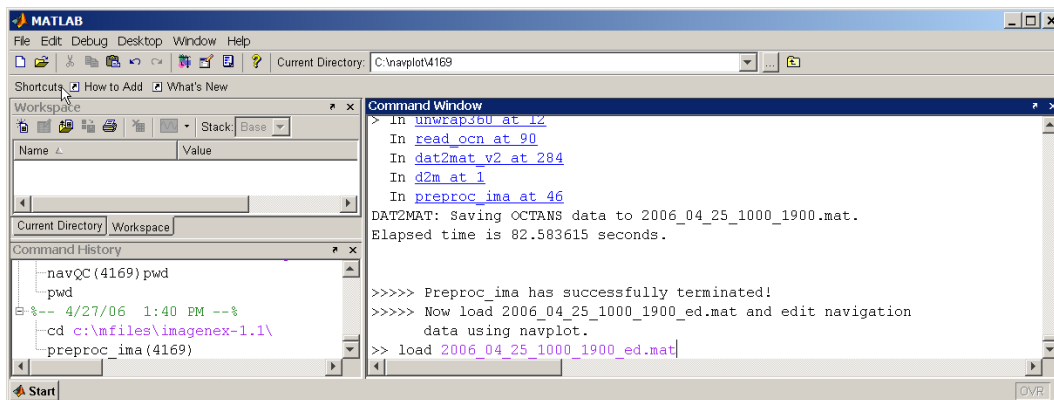
- 3) In the Matlab command window, type **preproc\_ima**(divenumber):  
e.g. **preproc\_ima(4169)**



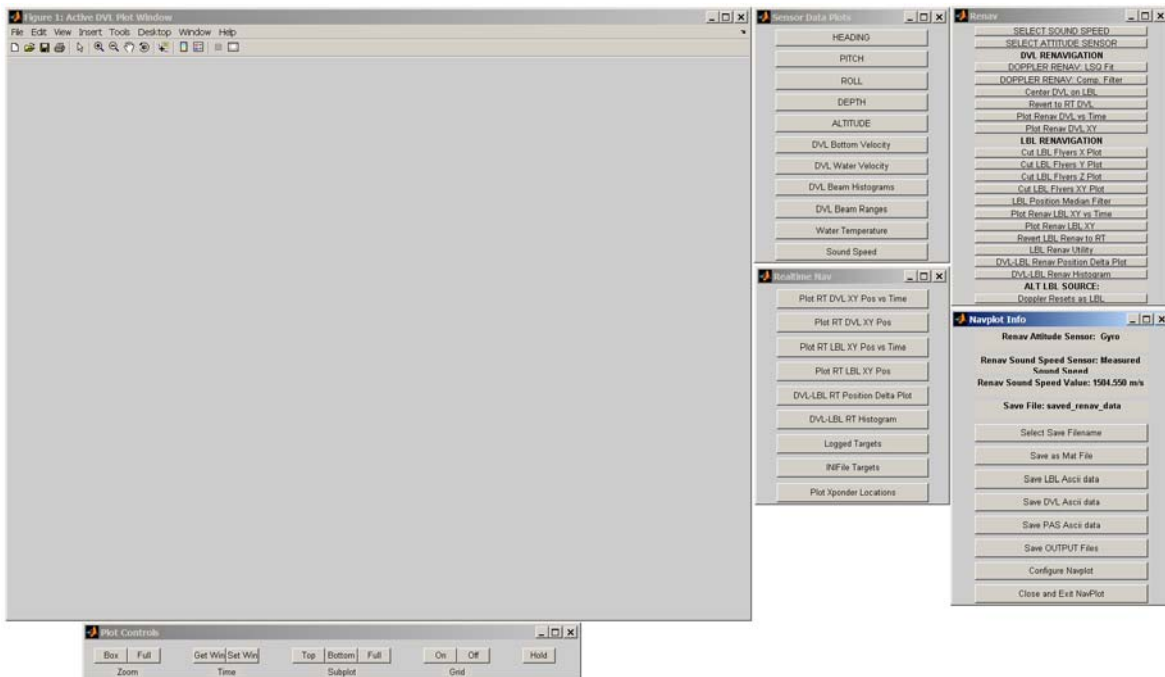
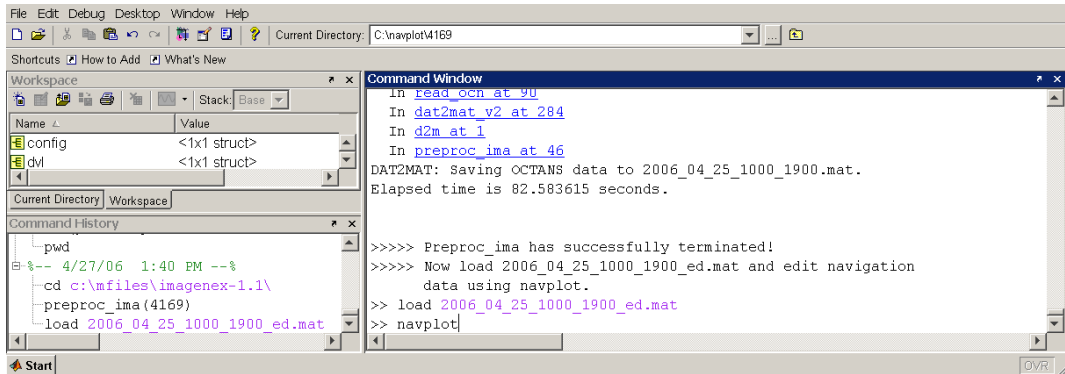
- 4) You will be prompted to manually define the On Bottom/Off Bottom times via a graphical user interface:



- 5) When this completes, load the \*.ed.mat file as prompted by the display:  
e.g. **load 2006\_04\_25\_1000\_1900\_ed.mat**

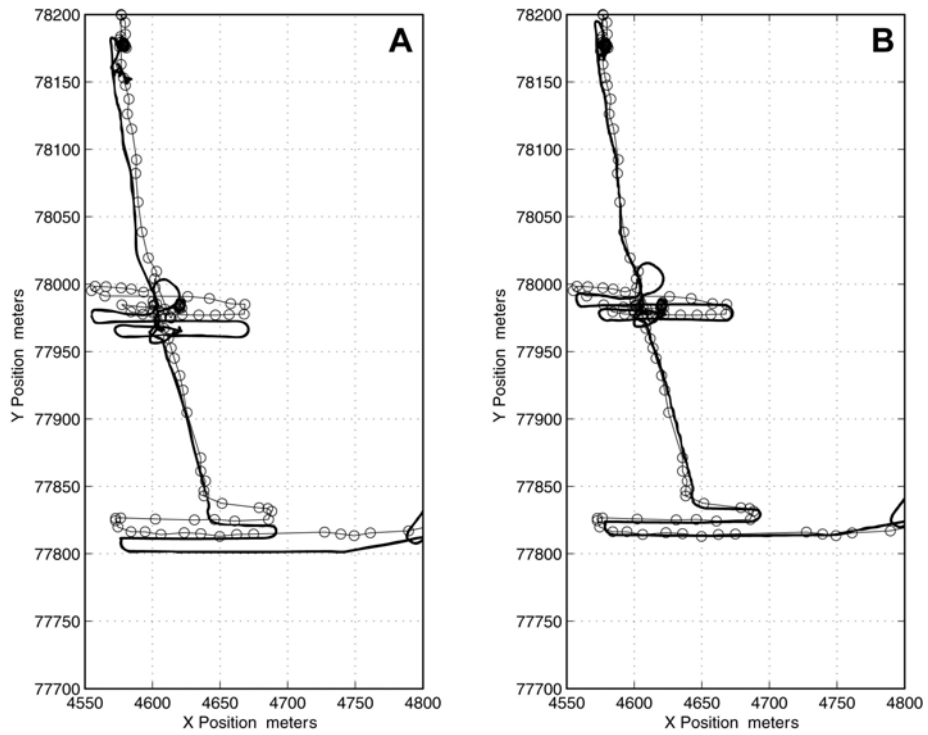


- 6) Type **navplot** in the Matlab command window to engage the navigation editing suite:



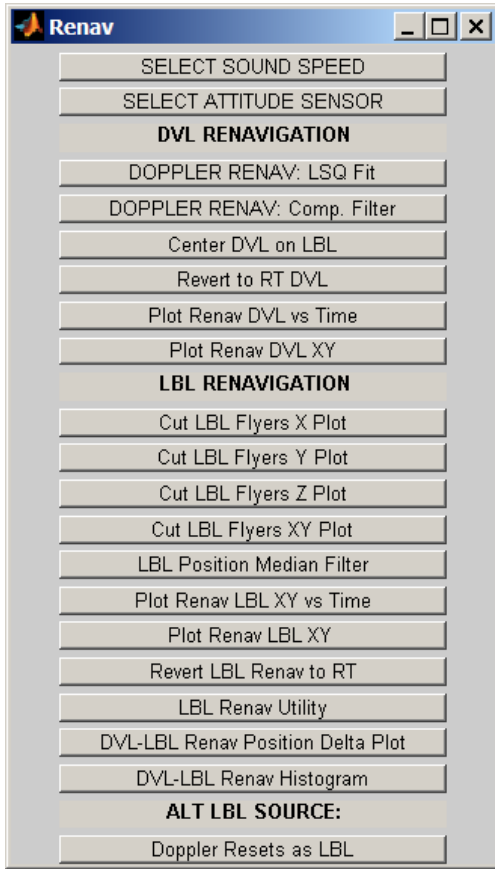
\*\*Note: If the any of these windows are truncated by the top of your screen (typically happens with extra wide screens), double clicking any the edge of the window will move it down so that the menu bar can be reached, and the window can then be moved/resized.

\*\*The goal of this renavigation process is to remove LBL fliers and to re-integrate the Doppler velocities to shift the raw Doppler track closer to the edited LBL track:



A: raw Doppler tack (solid line), edited LBL track (line with circles).  
B: renavigated Doppler track shifted to the LBL track.

**\*\*LBL Renav:**

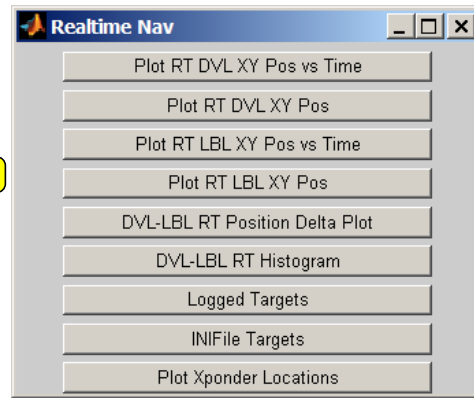


Renav window

\*Note that the LBL data does not have to be edited perfectly. The goal is to remove huge outliers from the data set. Excessive editing will not significantly change the output data product (if at all).

\*If LBL data are no good or non-existent, you may opt to use **Doppler resets as LBL** fixes. This is can be enabled by pressing the button near the bottom of the Renav window.

\*\***Revert to RT LBL** reverts to the original LBL data that was displayed when the software was initialized.

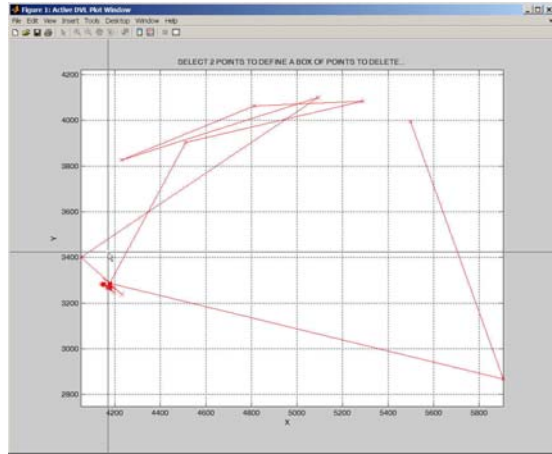
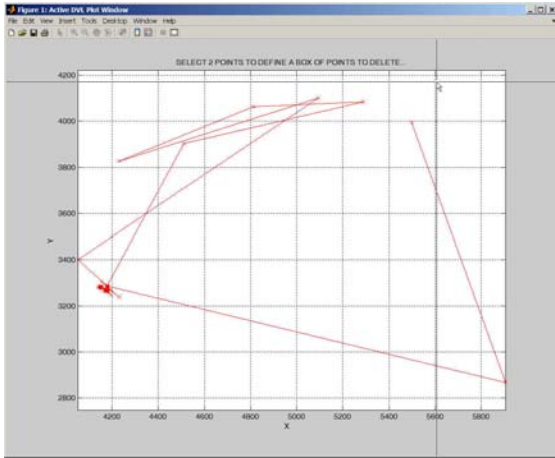


Realtime Nav window

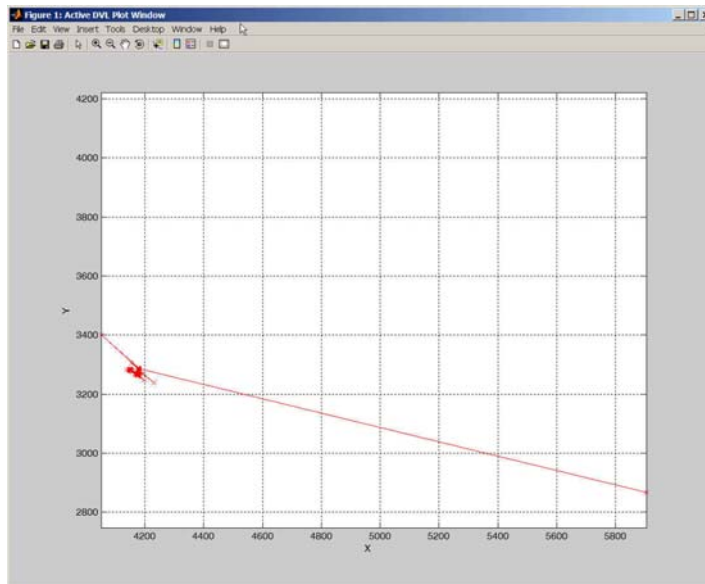
- a. Edit the LBL data using buttons in the Renav window:
  - i. Use buttons that allow the user to manually select the 2 corners of a box surrounding the data that should be removed:
    1. **Cut LBL Flyers XY Plot.**
    2. **Cut LBL Flyers X Plot**
    3. **Cut LBL Flyers Y Plot**
    4. **Cut LBL Flyers Z Plot**
  - ii. Use a Median Filter option:
    1. **LBL Position Median Filter**
- b. Compare with DVL data by using the **Hold** button in the Plot Control window:



Plot Controls Window






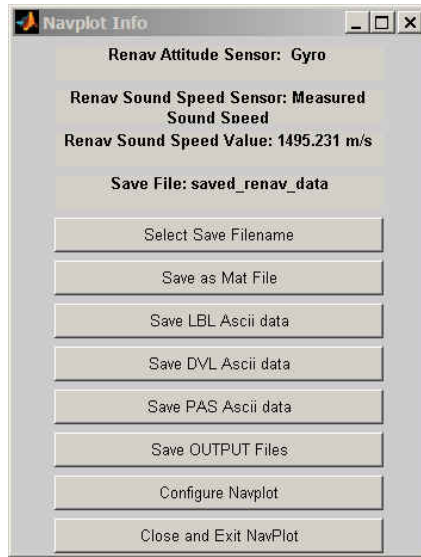
Example usage of Cut LBL Flyers XY Plot



Edited LBL data after single usage of Cut LBL Flyers XY Plot as shown in above figure.

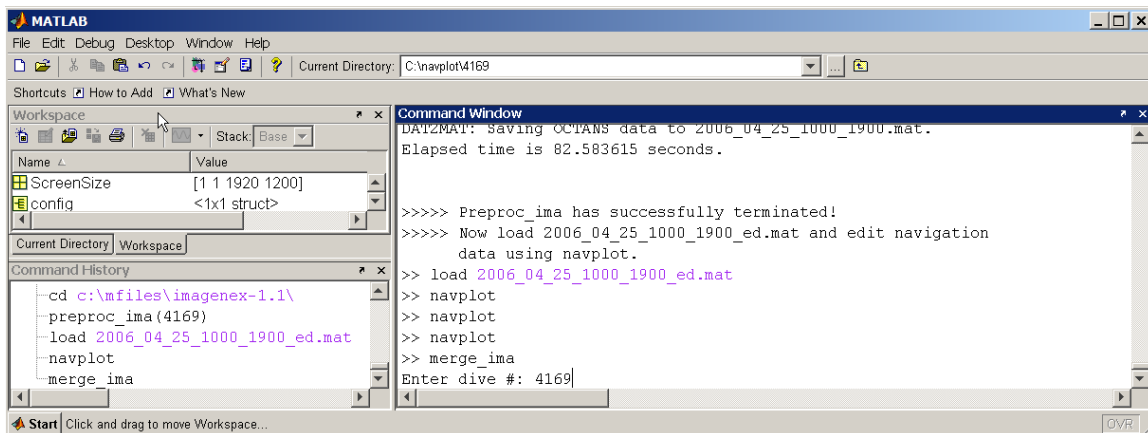
## **\*\*Doppler Renav:**

- a. **DOPPLER RENAV: LSQ Fit** does a least squares fit of the DVL to LBL data:
  -  i. Note that this is performed by re-integrating Doppler velocities (ignoring resets) – in the Doppler frame of reference (i.e. from 0,0). The average Doppler position is then calculated as is the average of the edited LBL fixes. The offset between the two is used to shift the re-integrated Doppler track to real-world coordinates (local XY) using the LBL data.
  - ii. This method fails when cumulative Doppler errors become significant (e.g. during long J2 dives). Failure is evident when the distance between the Renav Doppler positions and the edited LBL positions gets larger as the dive progresses.
- b. **DOPPLER RENAV: Comp. Filter** uses a complementary filter to combine the Doppler and LBL navigation. \*Should produce a better result than DOPPLER RENAV: LSQ Fit.
  -  i. Low-passes the LBL data, high-passes the DVL data and combines them. Overcomes the issue of cumulative Doppler errors.
- c. **Converge on a Renav Solution that seems reasonable.**
  - i. If dissatisfied with the results of the renavigation process, LBL data can be edited more (or less if **Revert LBL Renav to RT** is used).
  - ii. If still dissatisfied, try using **Doppler Resets as LBL**. This can also be used if the LBL data are of poor quality (or do not exist).
  - iii. When satisfied with the renav result, press **Save OUTPUT Files** in the Navplot Info window. This will save a series of files into the working directory including:
    -  -1Hz navigation text file
    - nav\_t.mat file
    - \*jpg of plot of RT DVL, edited LBL, and renav DVL data
    - prototype text file that can be ingested into the virtual van
    - lbl\_renav.mat
- d. **Close and Exit NavPlot** by pressing the button in the Navplot Info window. Note that this process will not begin until the dive number is entered in the Matlab command window.

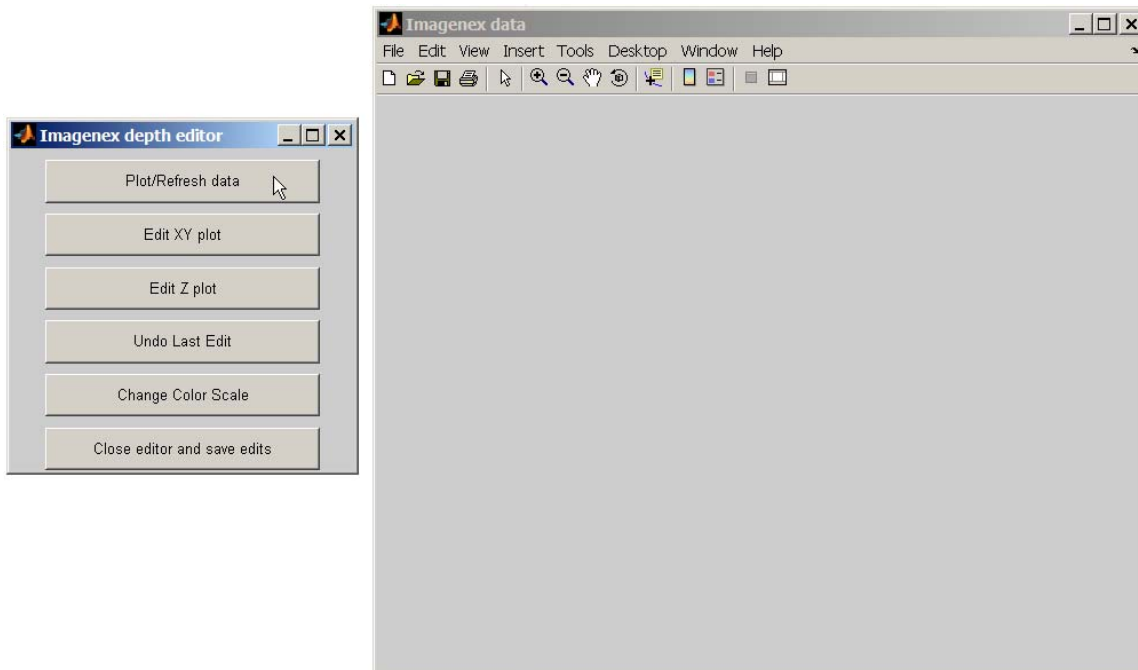


Navplot Info window

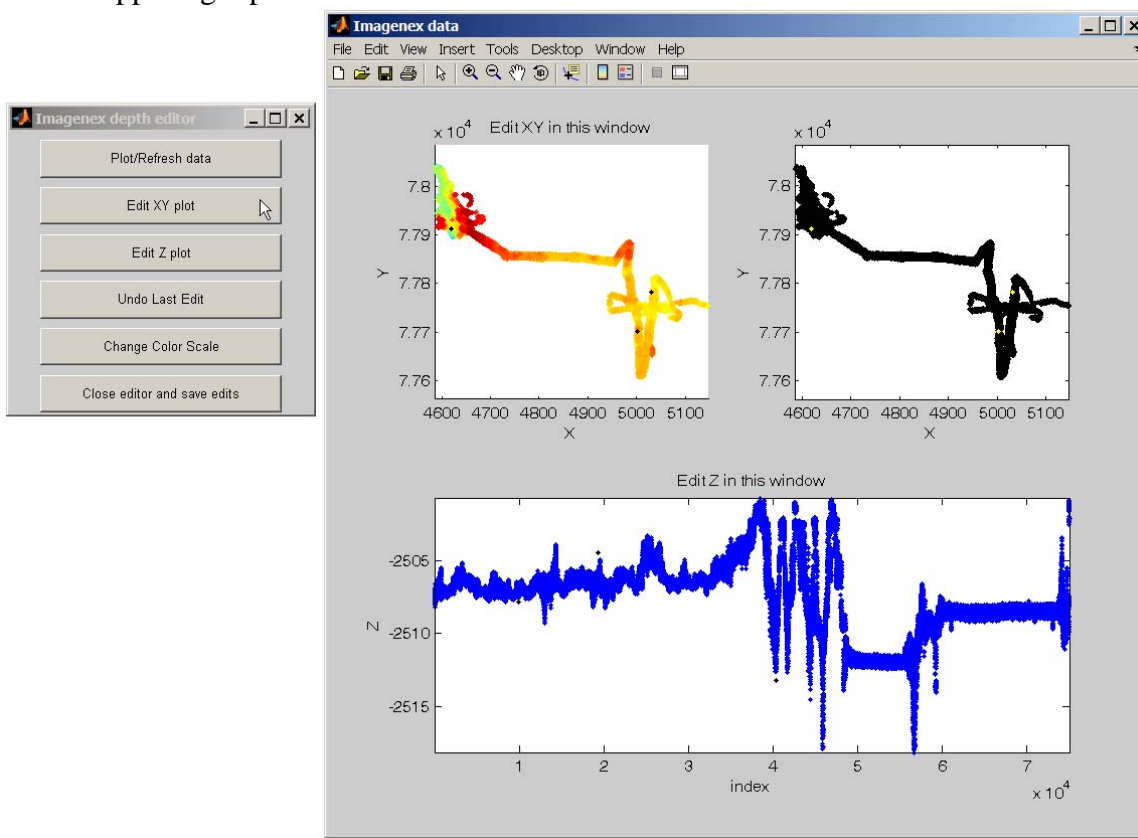
- 7) To merge navigation and Imagenex data execute the mfile: **merge\_ima**. This program requires user input of the dive number:



- 8) At the conclusion of this program an editing interface will be enabled to permit an extra level of quality control. Press on **Plot/Refresh data** to begin:

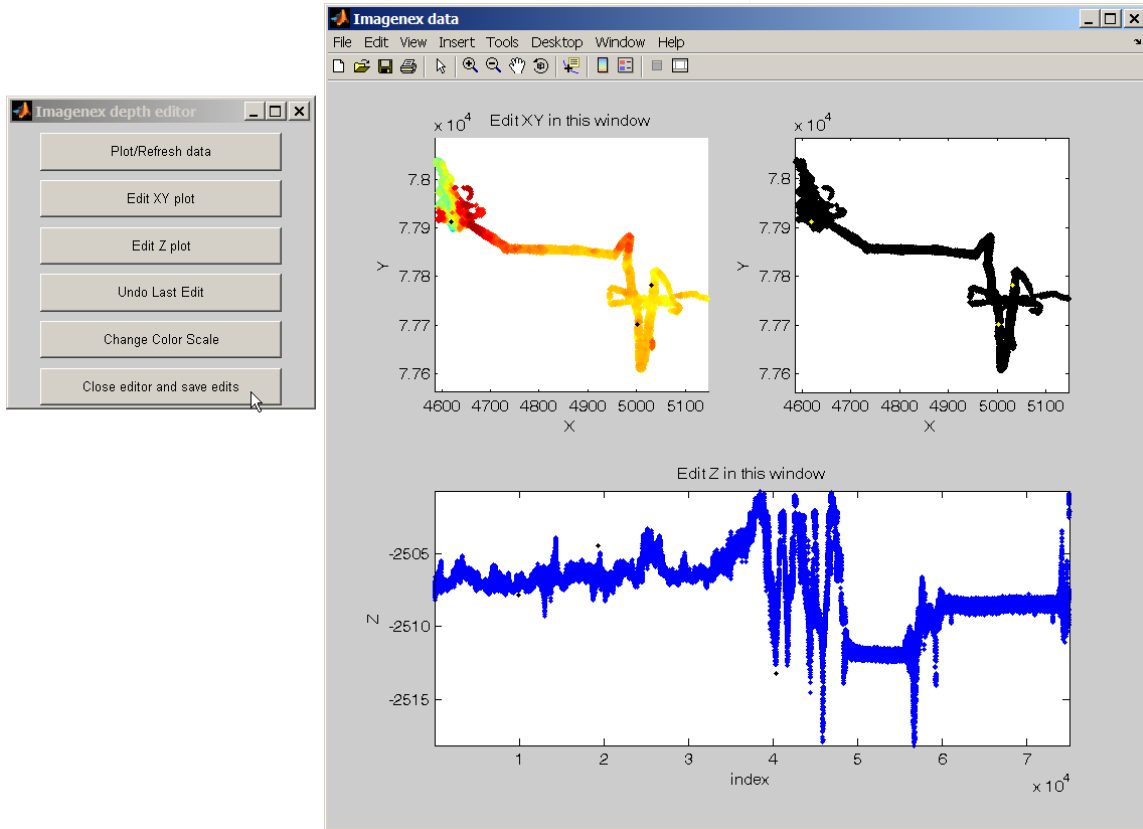


- 9) Use **Edit XY plot** and **Edit Z plot** to edit any outliers. Points that have been edited will appear black in the upper left and bottom plots, and yellow in the upper right plot.





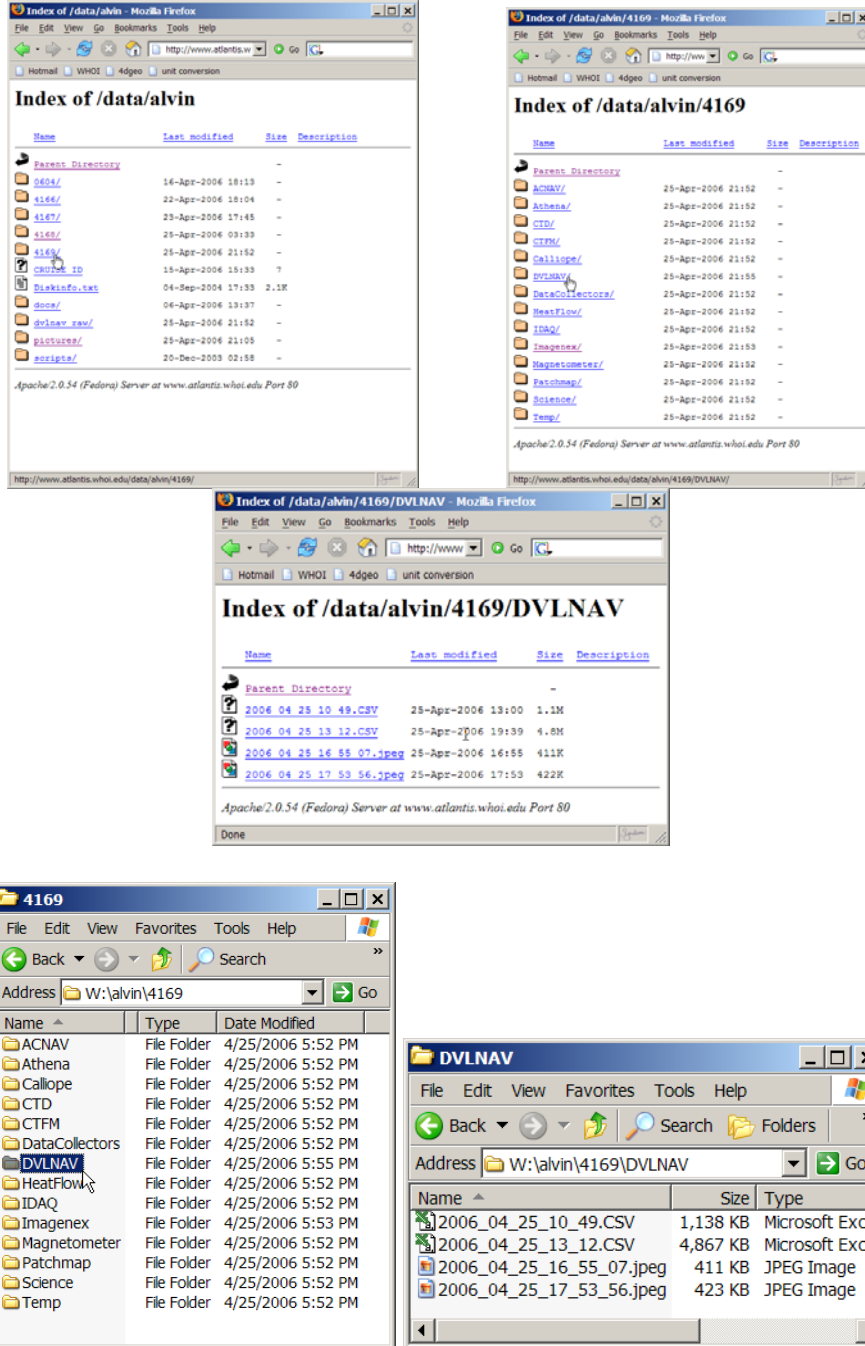
- 10) When satisfied with the editing, press **Close editor and save edits**. If the data were accidentally over-edited, go to step 7 to run `merge_ima` again.



- 11) To generate 1-m gridded maps using the `m_map` Matlab toolbox, execute **`alvin_bathy1m`** in the Matlab command window. This program requires user input of the dive number and generates a series of `*eps` files including a nav track and contour plots.

## 2.2 Processing Imagenex data when LBL was NOT used:

- 1) Copy Imagenex data to hard drive (e.g. to c:\imagenex\4169\ or /usr/sci0/imagenex/4169/) either via webpage or mapped drive (as above).
- 2) Copy DVLNAV from the server:



- 3) Open Matlab and change the working directory to the mfile directory (see above)
- 4) In the Matlab command window, execute **do\_ima**. Enter dive number when prompted.
- 5) Follow steps 8-11 in section 2.1.

### **QuickRef:**

If LBL was used :

- 1) Copy the dvlnav\_raw and Imagenex (\*81b) data from the server
- 2) preproc\_ima
- 3) navplot
- 4) merge\_ima
- 5) alvin\_bathy1m

IF NO LBL:

- 1) Copy the DVLNAV/\*csv and Imagenex (\*81b) data from the server
- 2) do\_ima
- 3) alvin\_bathy1m