

**National Park Service
Inventory and Monitoring Division**



Initial Post Survey Processing—Version 1.0

Bracewell, J. Initial post survey processing—Version 1.0. Gulf Coast Network Standard Operating Procedure NPS/GULN/SOP—SHR06. Gulf Coast Network, Lafayette, Louisiana.

This standard operating procedure (SOP) details the steps required to download and convert the collected shoreline position data into a useable dataset that is correctly formatted and has undergone initial Quality Assurance/Quality Control (QA/QC) checks. These steps include: Importing GPS data, performing differential corrections, exporting GPS data to GIS data, editing the shoreline feature in a GIS environment, generating metadata, and data management procedures. Download and QA/QC of the survey data are to occur immediately following the field data collection to ensure that no data are lost due to equipment failure. In addition, prompt data processing immediately informs the surveyor if a repeat survey day is required due to equipment issues.

[illegible]

Contents

	Page
Summary.....	1
Revision Log.....	1
Digital Photos.....	3
GPS File Transfer, Correction, and Export.....	4
Transfer GPS File to Computer	5
Set Units and Time	14
Differential Correction of the GPS File.....	15
Export Corrected GPS File as Shapefile	27
Initial QA/QC and Shoreline Edits	44
Benchmark Verification	45
Editing the Shoreline Feature	46
Creating Metadata for the Shoreline Shapefile	47
List of Final Post-Processed Data Products.....	48
Literature Cited	48

Digital Photos

Navigate to the GULN network drive at Z:\gis\guis\mon\geomorph\shoreline\photos. Within this directory create a folder using the date of the first survey day and the serial number recorded on the surveyor's field sheet (Figure 1). For example, the photo folder for a survey completed on 16 April 2016 with the serial number 2157 would be named "20170416_2157." This is especially important when multiple surveyors are simultaneously working on different sections of the shoreline.

GULN 'Monitoring Shoreline Position' Field Sheet: <u>1</u> of <u>1</u>				
Location: GUIS Fort Pickens	Prot. Ver: 2016.01	Surveyor/s: Jeb S Bracewell Whitney J Granger	+Survey Date: 4/16/2016	
#Start Time: 9:00	End Time: 13:50	GPS Type: Trimble Geo 7x	GPS SN: 2157	
Event Comments: no JTV available - shoreline was walked.				

Figure 1. Labeling photo folders with date and Serial Number from data logger and field data form will help to tie together an individual surveyor's data logger, field data form, and photos.

Copy photos from the camera to this drive where they will be renamed using the following format:

ParkYYYYMMDD_PtId_SeqNum

where:

- Park is the four letter park code,
- YYYY is the four digit year,
- MM is the two digit month,
- DD is the two digit day,
- PtId is the name assigned to the GPS Point taken at the photo location.

If more than one photo was taken at a point, append with number sequence.

For example, Guis20141015_photoPt1_2 is a file collected on at Gulf Islands National Seashore October 15, 2014 at photoPt1 and is the second photo taken at that point.

GPS File Transfer, Correction, and Export

Once the shoreline GPS files are collected in accordance with GULN SOP SHR05 – *Conducting the survey* (Bracewell 2017), use the following steps to differentially correct the GPS data for higher positional accuracy. Using Pathfinder Office software, transfer the raw GPS files from the data logger to a personal computer (PC) before differentially correcting them and exporting them as a shapefile.

The original naming scheme of the GPS file should be used to rename the files created throughout the process. The naming conventions should use the following format:

ParkYYYYMMDDHH_XXXX

where:

- Park is the four letter park code,
- YYYY is the four digit year,
- MM is the two digit month,
- DD is the two digit day,
- HH is the two digit hour of the survey start time (24-hour format),
- _XXXX is the last four digits of the data logger's serial number. This will identify different concurrent data collections at the same park at the same time.

For example, GUIS2014101516_2157 is a file collected at Gulf Islands National Seashore on 15 October 2014 at 4:00 p.m. using data logger 5629472157.

Transfer GPS File to Computer

The following section describes how to transfer a GPS file from a data logger to a PC. The GPS file transfer should be performed soon after data collection to ensure data backup.

1. Connect the data logger to the computer and power it ON. The “Windows Mobile Device Center” window will appear and attempt to connect with the data logger (Figure 2).



Figure 2. Windows Mobile Device Connecting.

2. Click CONNECT WITHOUT SETTING UP YOUR DEVICE (Figure 3)

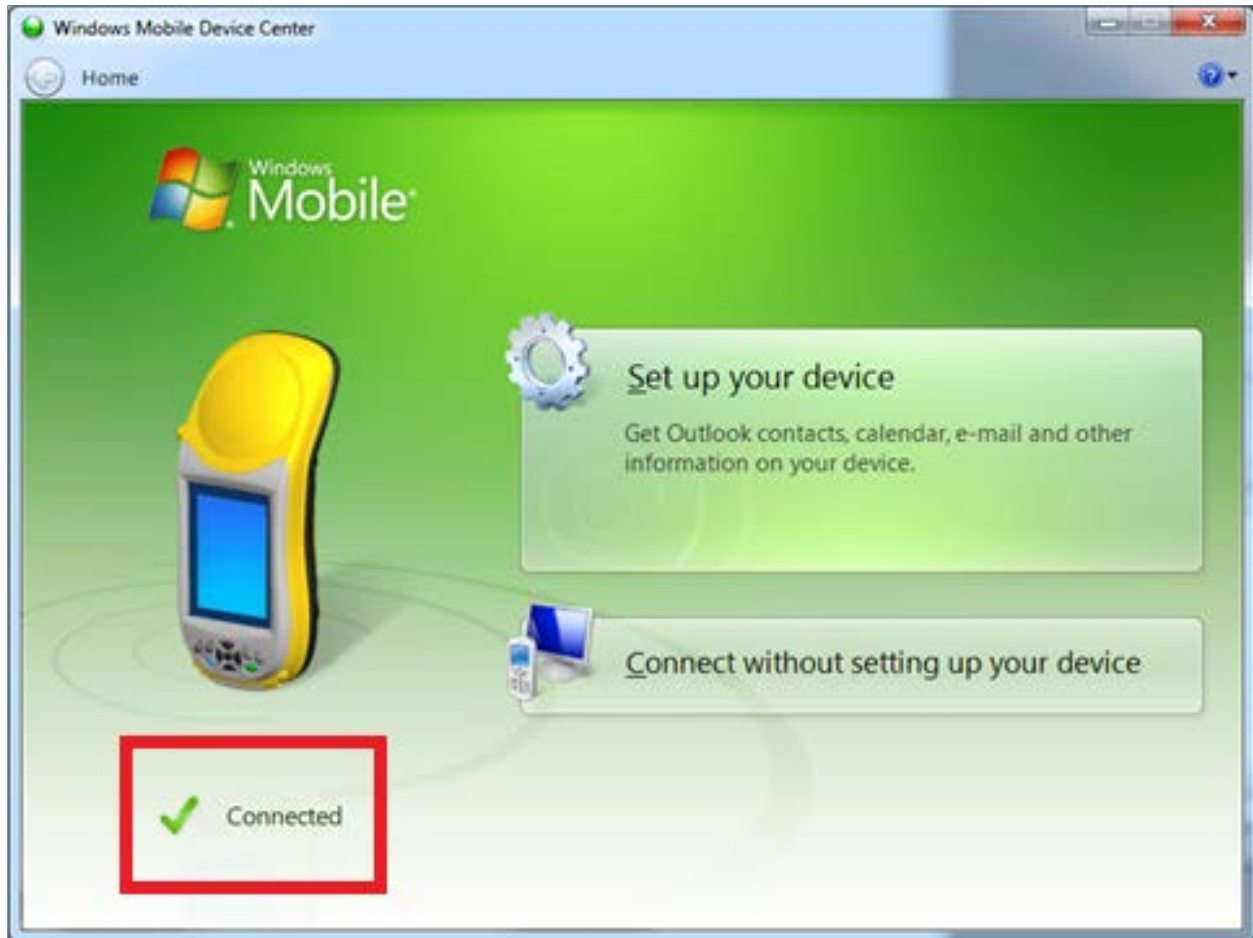


Figure 3. Once connected, the WINDOWS MOBILE DEVICE window will display CONNECTED.

3. Open Pathfinder Office. The SELECT PROJECT window will appear (Figure 4).

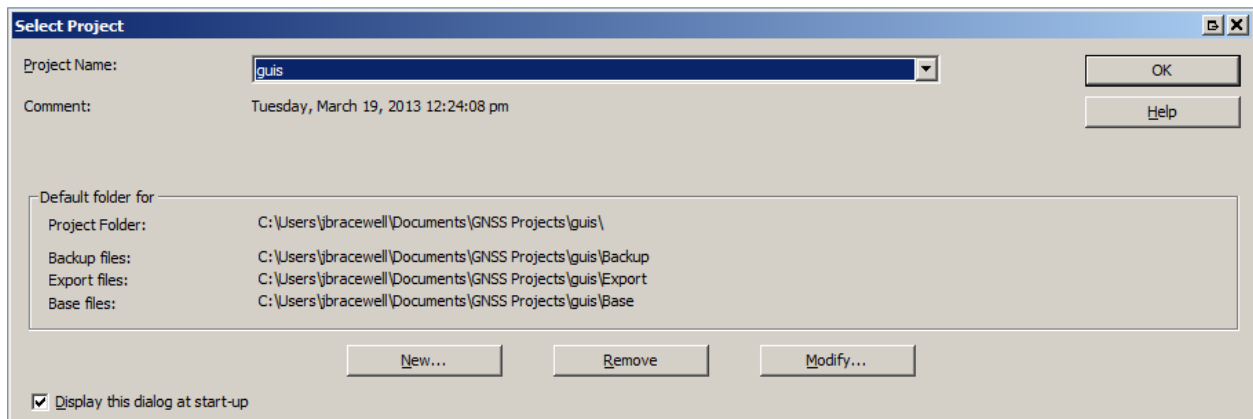


Figure 4. Select Project window.

4. Select the park project where the data were collected. If there is not a project for the park where the data were collected, create a new park project.
 - a. In the SELECT PROJECT window, click the drop down arrow next to the PROJECT NAME field (Figure 5).

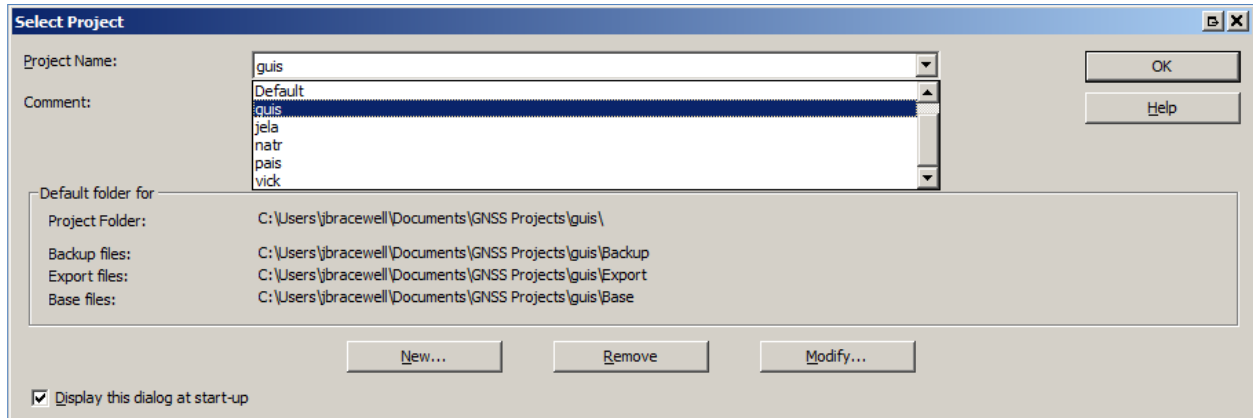


Figure 5. Selecting the project/park.

- b. Click OK
5. Transfer the data from the data logger to the PC by clicking UTILITIES > DATA TRANSFER (Figure 6). The DATA TRANSFER window will appear and will begin connecting to the data logger (Figure 7**Figure 6**). Note that the data logger needs to be ON in order to connect to the PC.

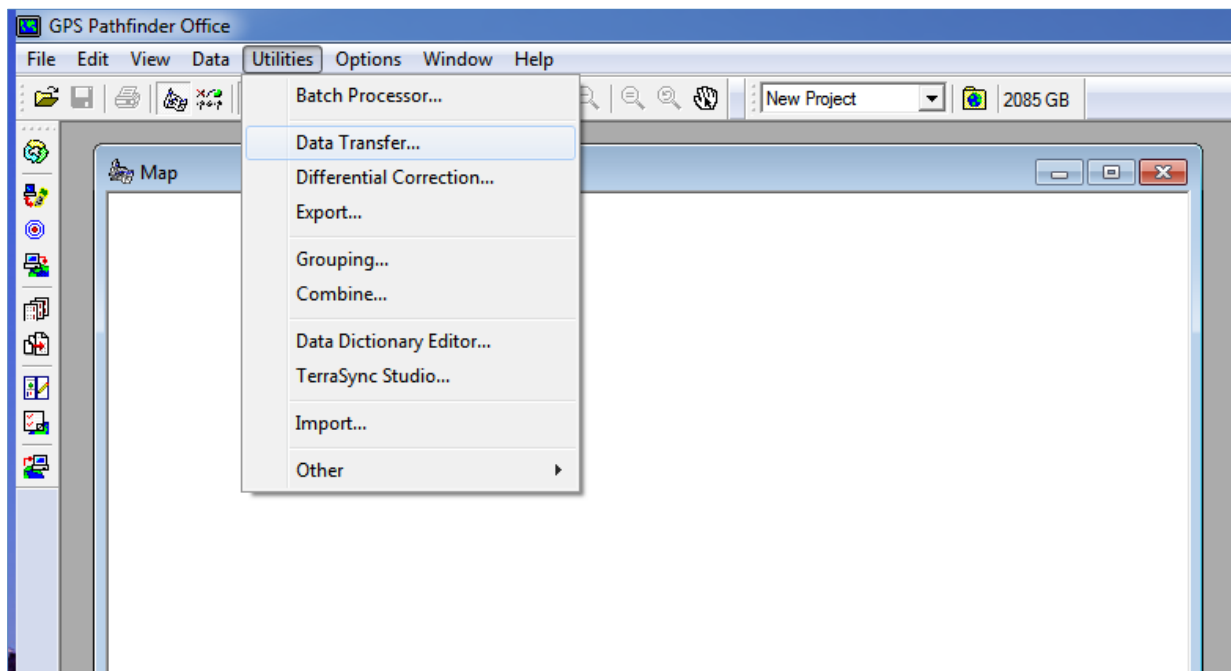


Figure 6. Opening Data Transfer Utility.

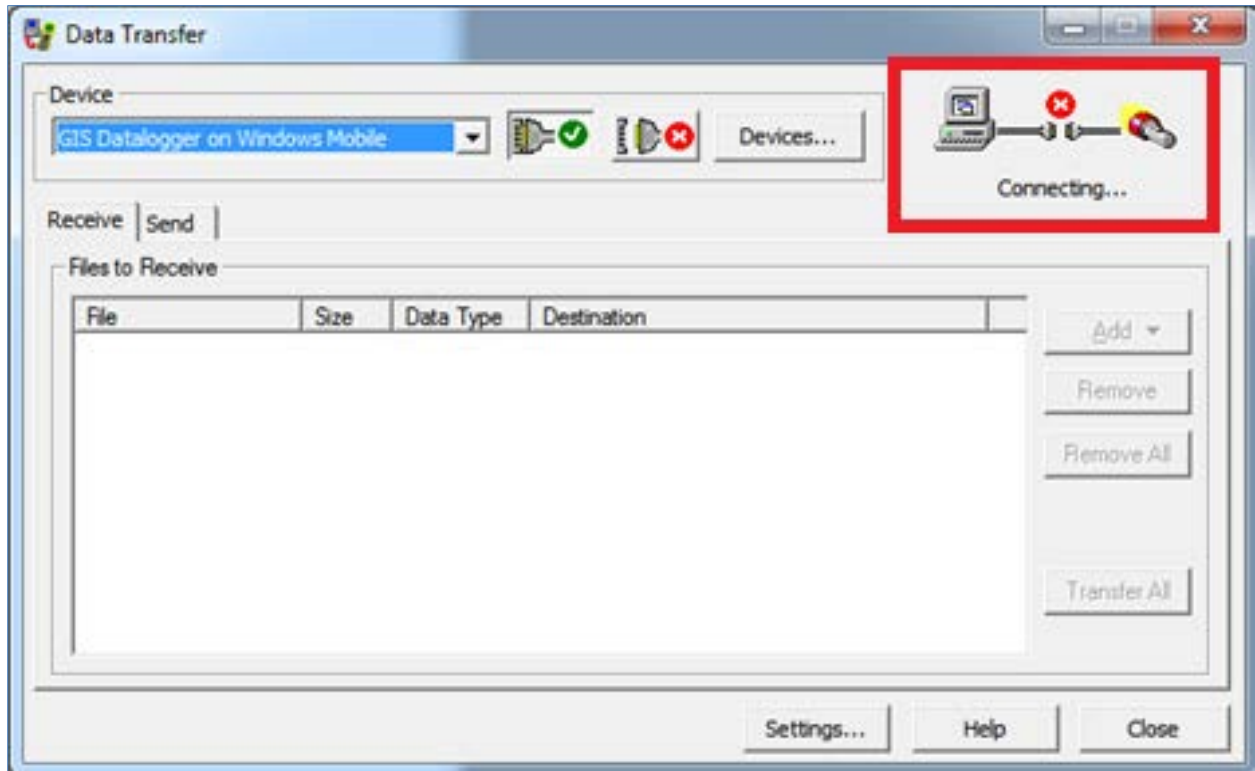


Figure 7. Data Transfer Utility. Data logger is connecting to desktop computer.

Once the data logger connects, a checkmark icon will appear (Figure 8). If the data logger does not connect, check the Windows Mobile window to see if the unit is still connected. If the unit is still not connected in the Windows Mobile window, disconnect the cable between the PC and data logger and reconnect it.

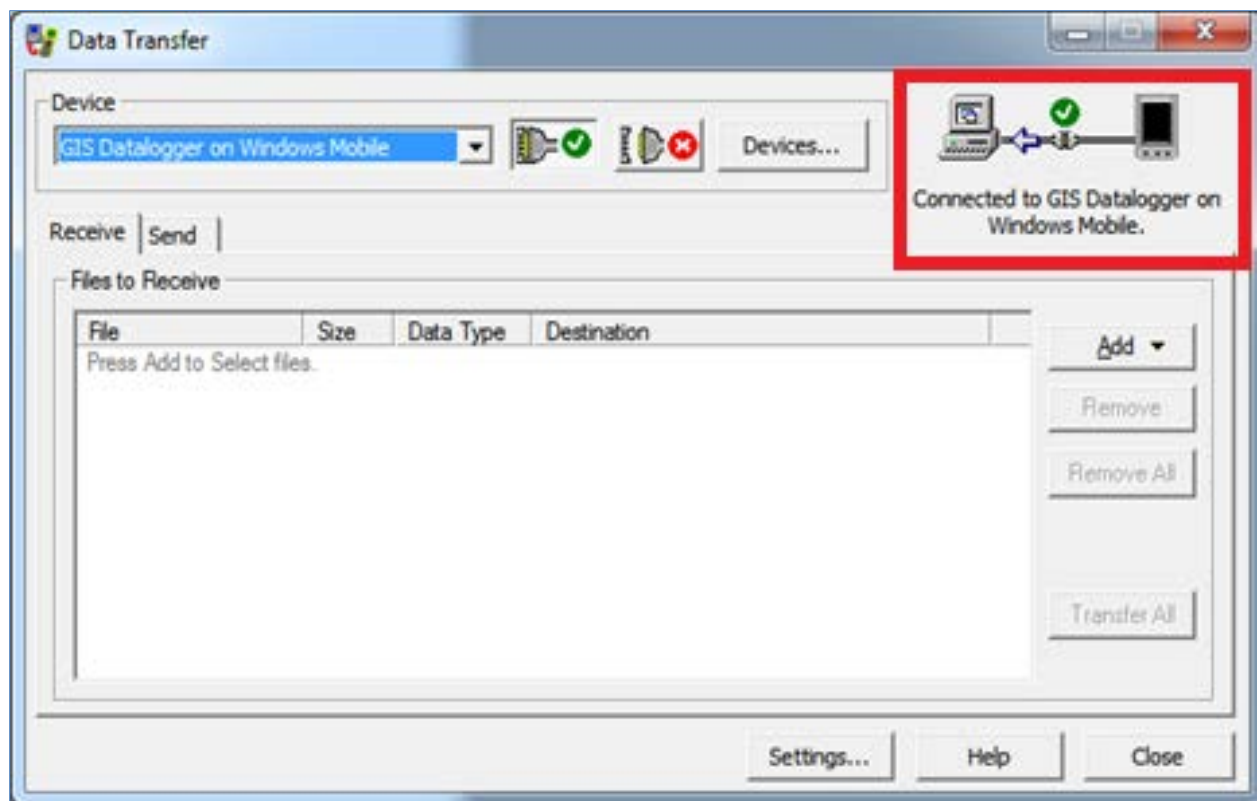


Figure 8. Data logger connected.

6. Select the RECEIVE tab and click ADD > DATA FILE (Figure 9). The OPEN window will appear (Figure 10).

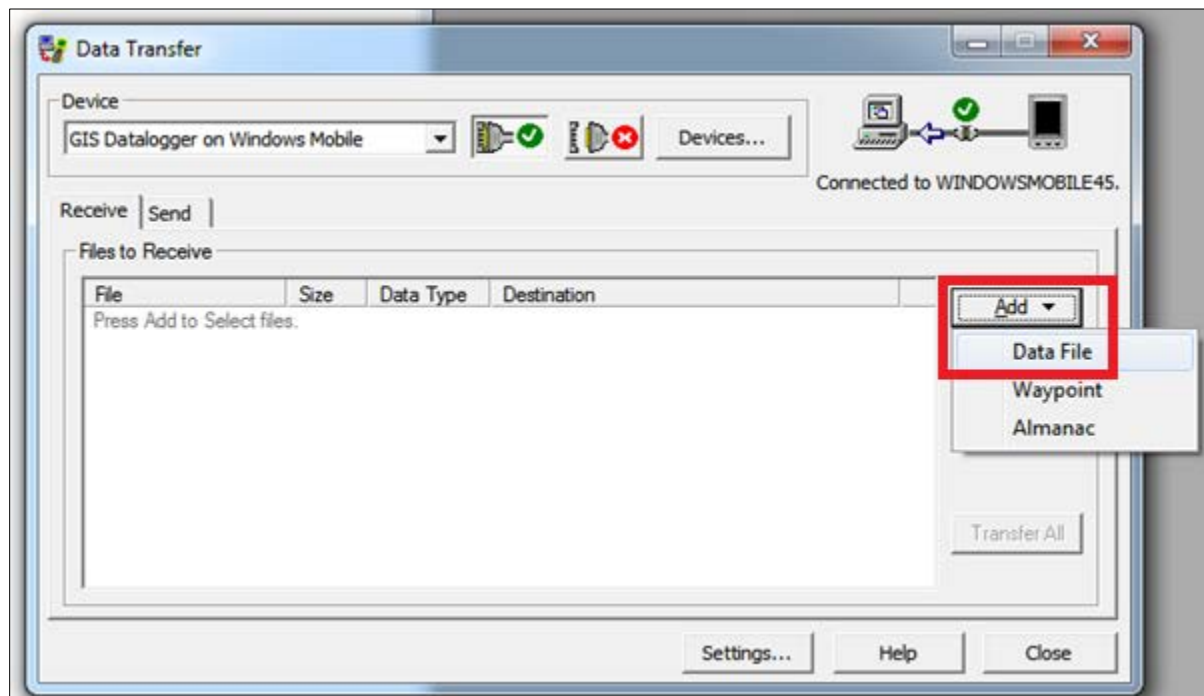


Figure 9. Data Transfer from data logger to desktop.

7. Select the data files for the park project selected to transfer and Click OPEN (Figure 10).
Note: any files that have not been transferred from the data logger will be automatically highlighted.

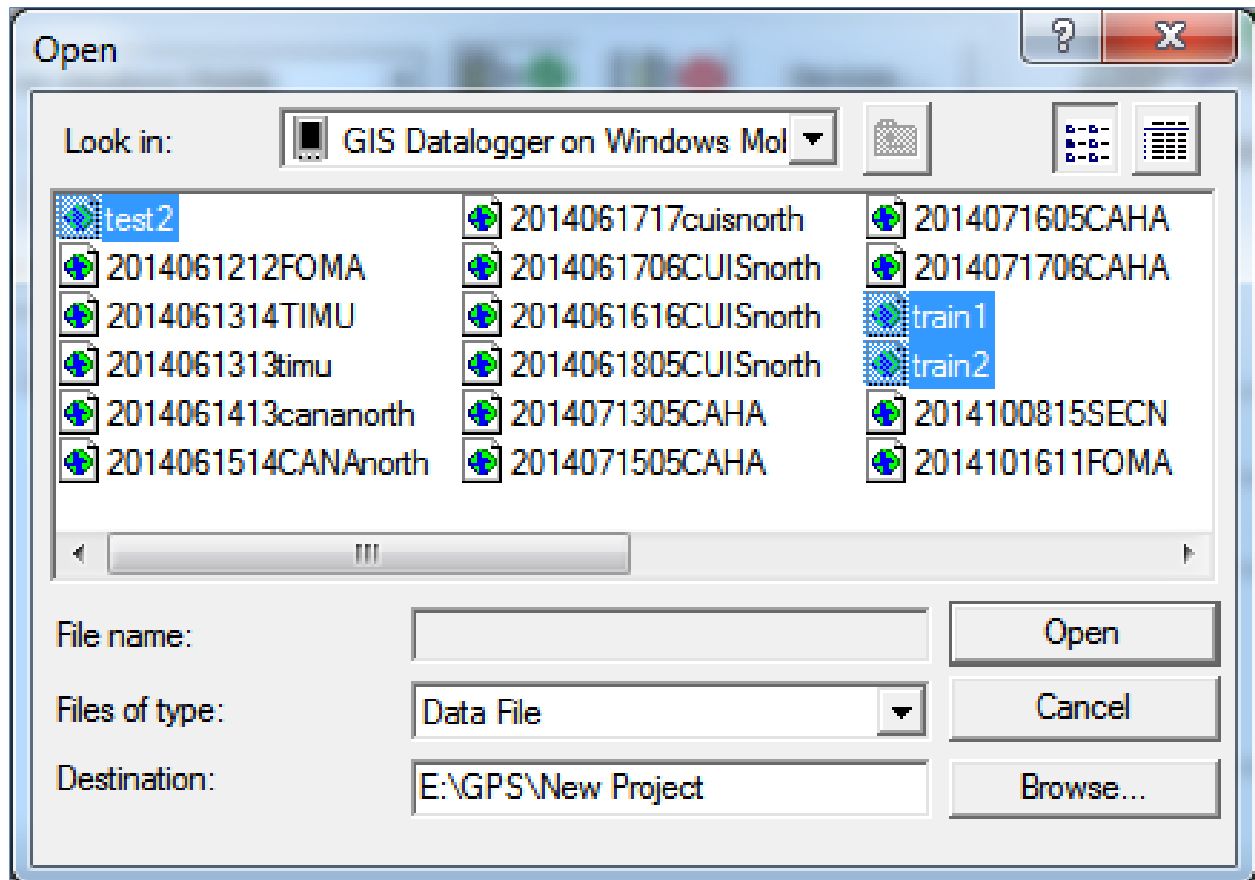


Figure 10. Selecting new files for transfer from the data logger.

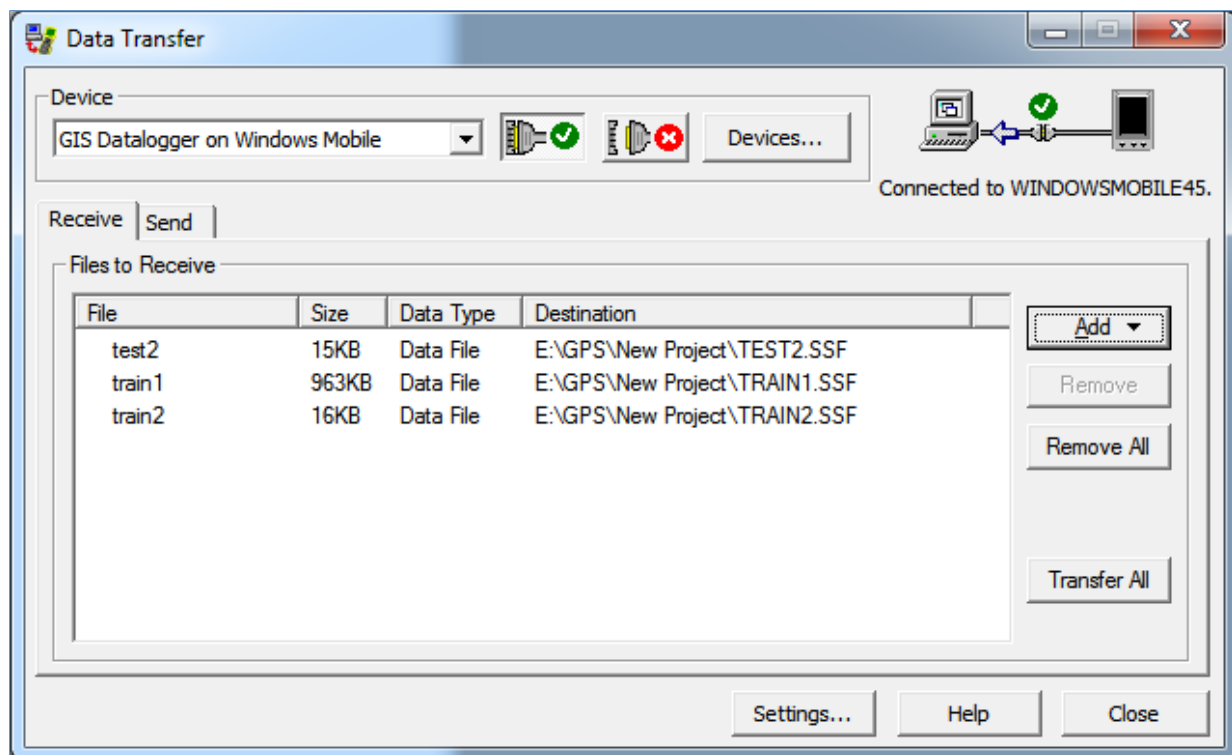


Figure 11. Selected file(s) listed in the DATA TRANSFER window.

8. Click 'Transfer All.' An information window will appear showing the progress of the transfer (Figure 12).

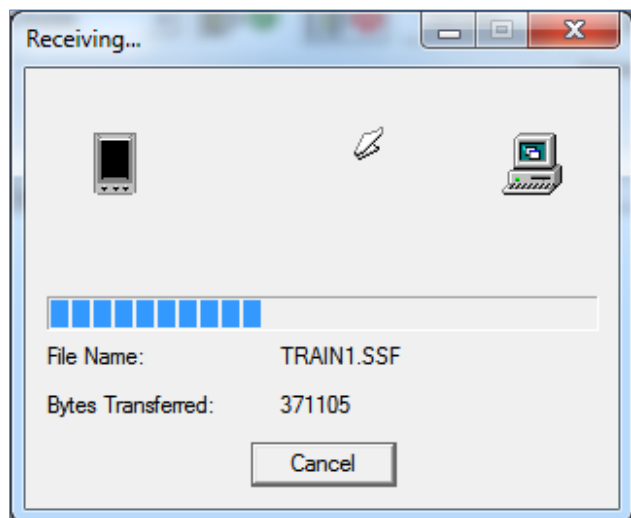


Figure 12. Screenshot of data transfer

Once the data have been transferred, a 'Transfer Completed' window will appear. Click 'Close' (Figure 13).

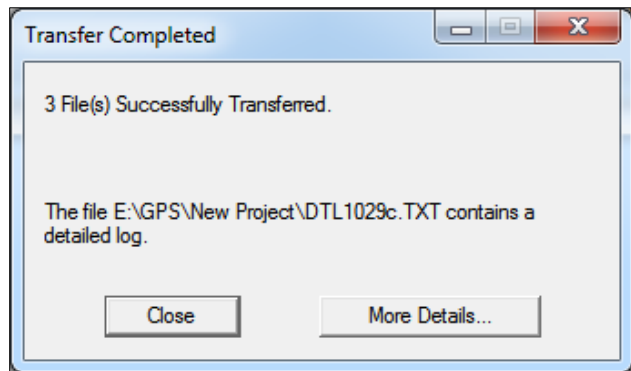


Figure 13. Screenshot of 'Transfer Completed' window

9. Verify that the data files have been properly transferred (Figure 14).
 - a. Open Windows Explorer by clicking 'Start' > 'Computer'
 - b. Navigate to the project file location
 - c. Data with an .ssf file ending should appear.

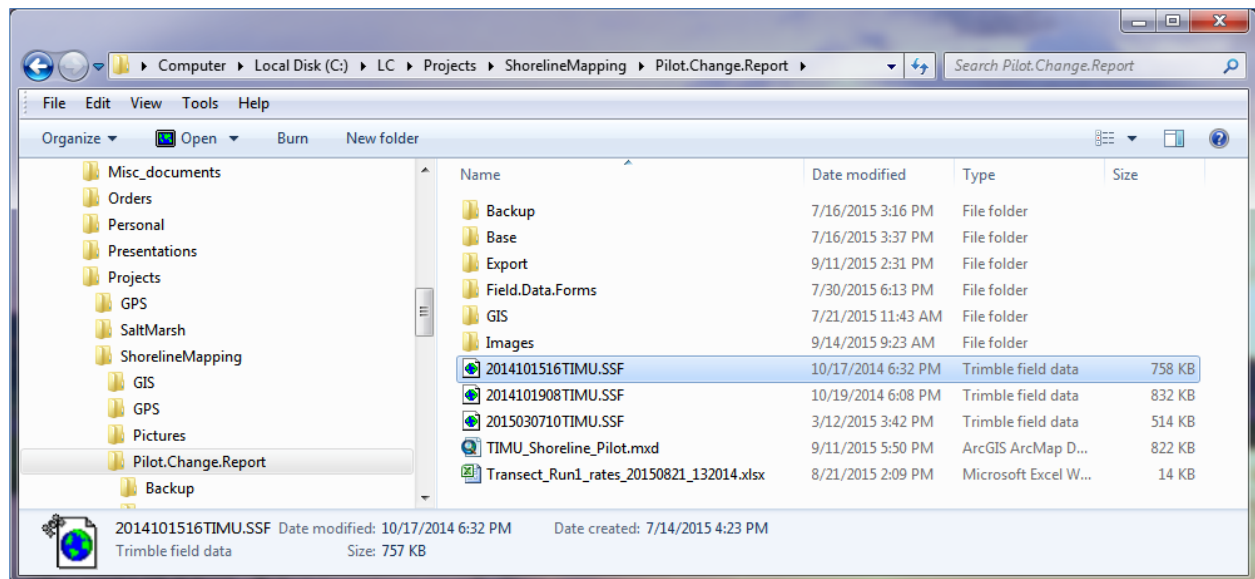


Figure 14. Local directory where .ssf files are transferred to.

10. Once the files have been transferred, close the 'Data Transfer' window and rename files if necessary using the convention outlined above, like ParkYYYYMMDDHH_XXXX.

Set Units and Time

This section contains instructions on how to set the unit and time settings in Pathfinder Office (PFO). Once the settings are set, they should remain this way when PFO is opened in the future; however, one should always verify the settings are correct.

1. Open Pathfinder Office
2. Click 'Options' > 'Units' and Check to determine the units are set as expected (Figure 15) and Click OK.

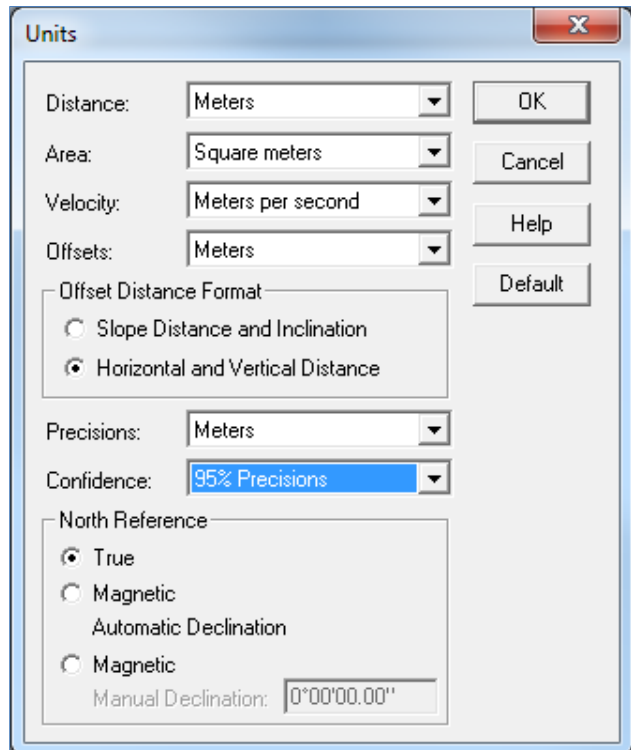


Figure 15. Setting Units.

3. Click 'Options' > 'Time Zone'
 - a. Ensure that the time zone is set to current local time, i.e., Central Day or Central Standard (Figure 16).
 - b. Click 'OK.'

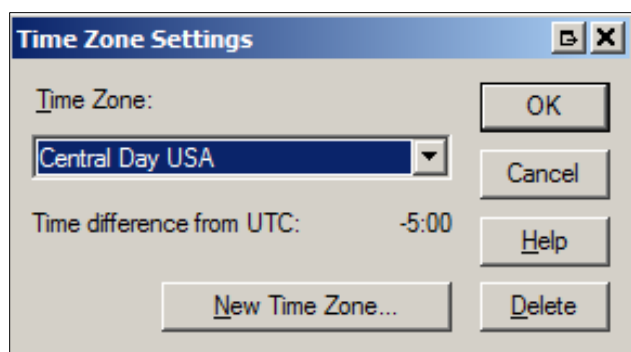


Figure 16. Setting Time Zone.

Differential Correction of the GPS File

The following section describes how to differentially correct the GPS files that were transferred from the data logger in the previous section. Differential correction utilizes the Continuously Operating Reference Station (CORS) sites and reduces positional errors in the collected GPS data.

1. Open Pathfinder Office.
2. Open the park project containing the files that require differential correction ('Z:\gis\pais\mon\geomorph\shoreline\ssf' or 'Z:\gis\pais\mon\geomorph\shoreline\ssf').
3. Open an .SSF file by clicking the folder button in the toolbar or 'File'>'Open' and double clicking the desired file (Figure 17).

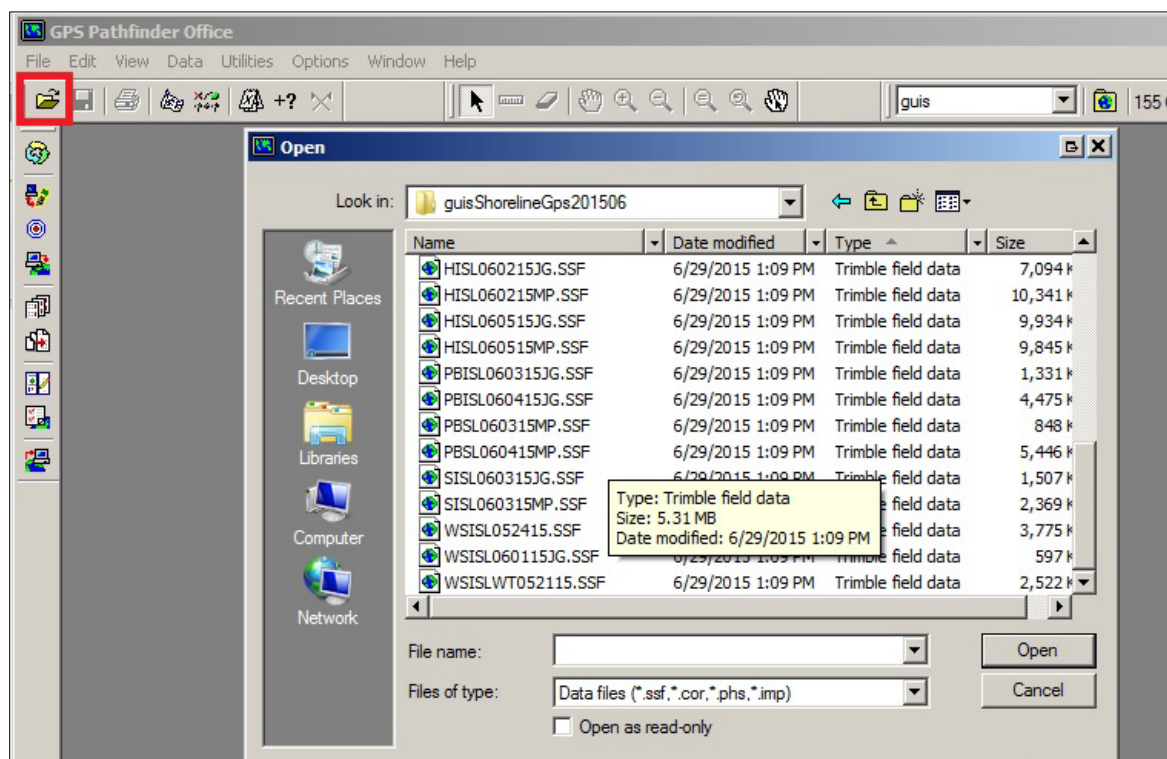


Figure 17. Screenshot of Open File dialog.

4. The file will be displayed in the Map window (Figure 18). If the map window is not open, click “View” > “Map.”

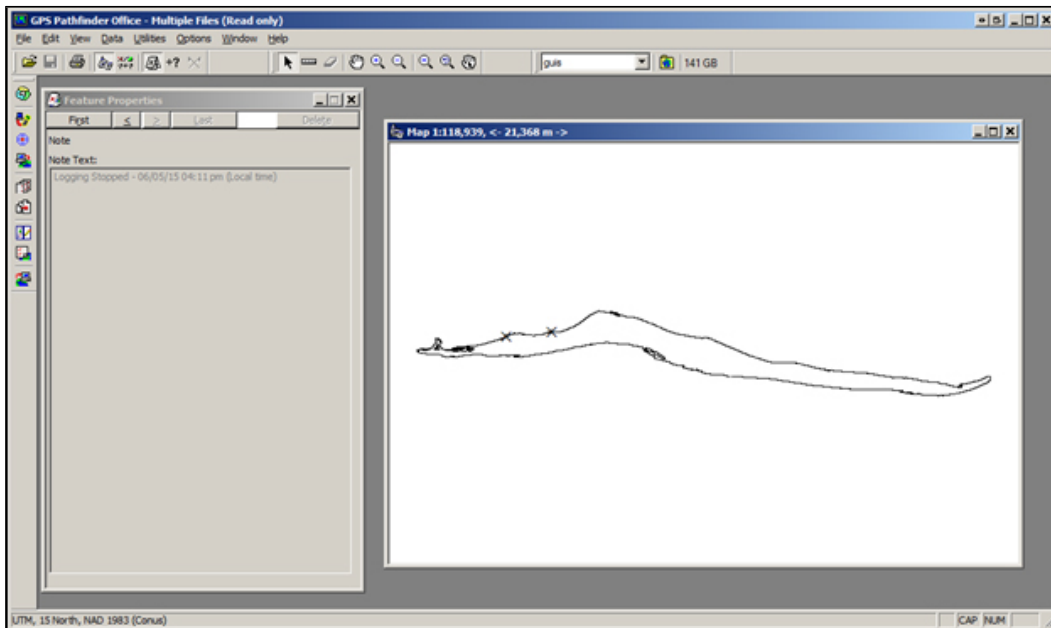


Figure 18. Display .ssf file.

5. Go to ‘Utilities’>’Differential Correction.’ The ‘Differential Correction Wizard’ window will appear with the open file listed. Files will be corrected using base stations that are proximal to the field work. Multiple .ssf files may be corrected together, but only if they are referencing the same base station (Figure 19).

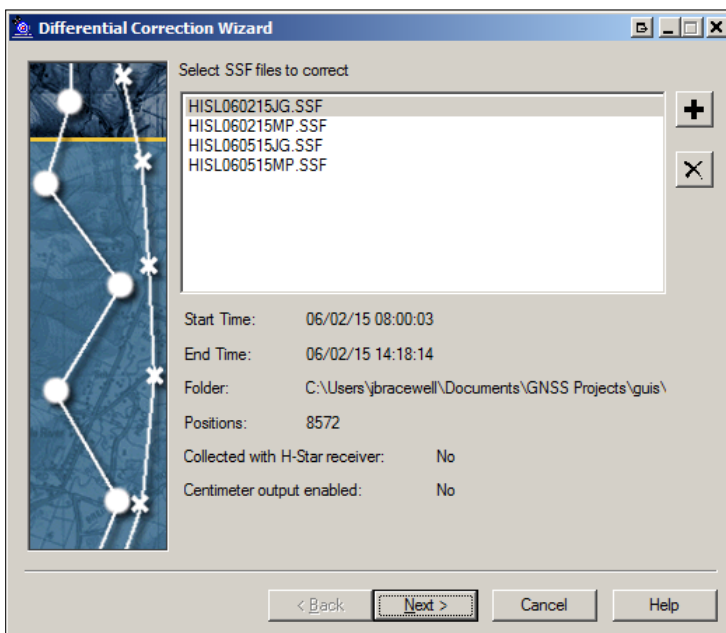


Figure 19. Screenshot of the ‘Differential Correction Wizard.’

6. Click 'Next.'
7. The Differential Correction Wizard will open; select the following criteria (Figure 20):
 - a. Processing Type: Automatic Carrier and Code Processing.
 - b. H-Star Processing: Use single base provider (may be grayed out, depending on data logger model).

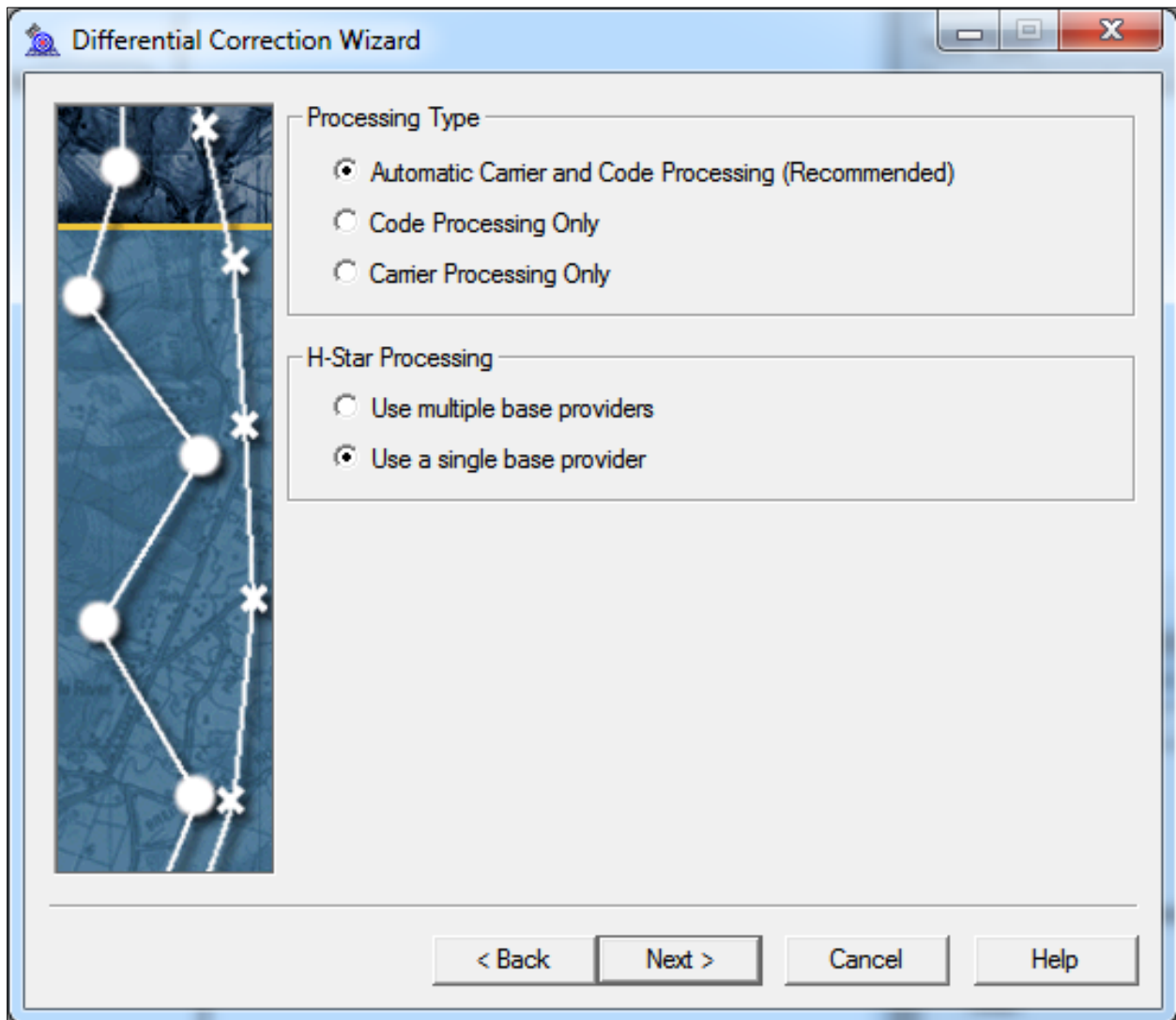


Figure 20. 'Differential Correction Wizard' settings.

8. Click 'Next,' The Connect Settings will be displayed (Figure 21).

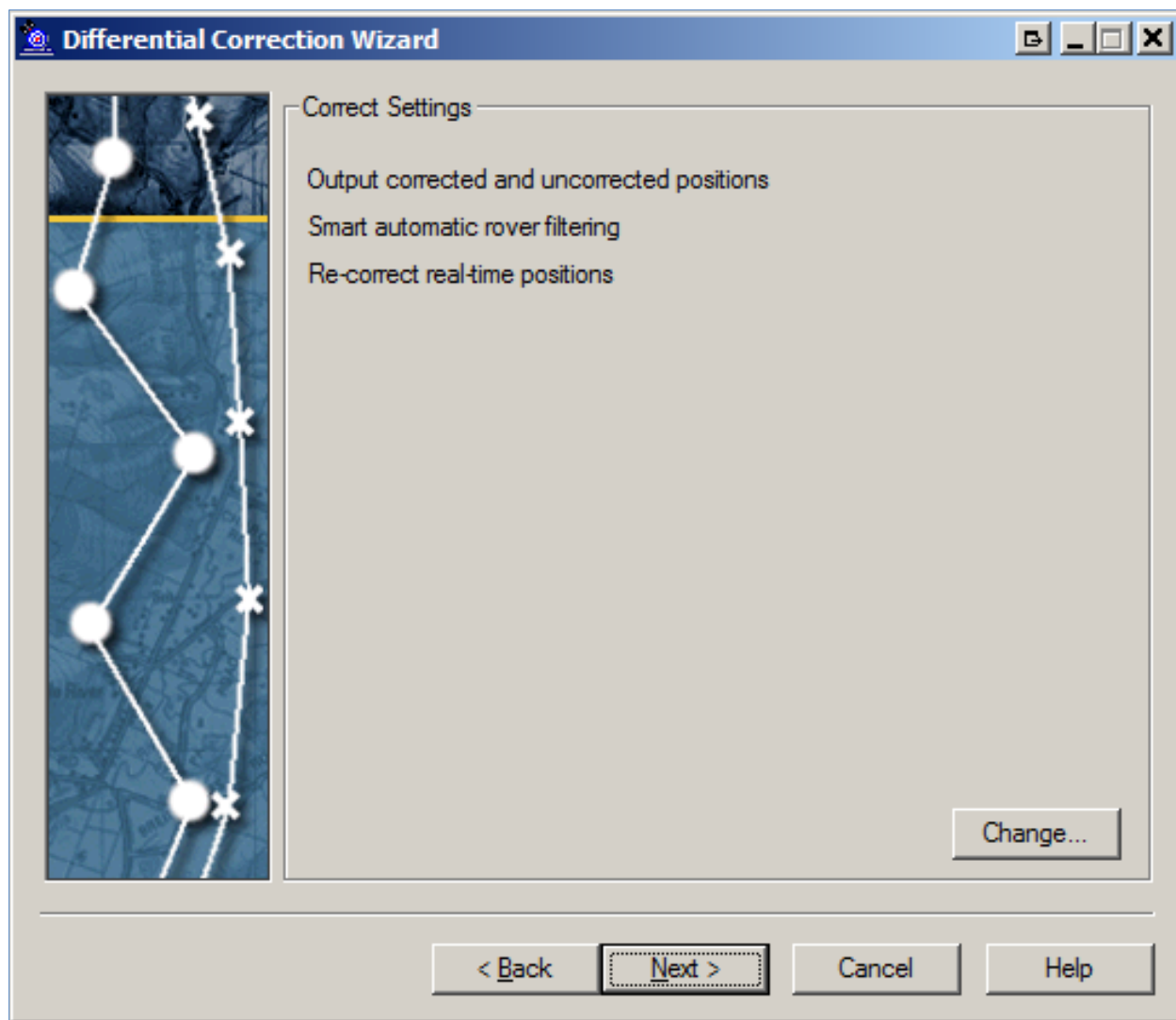


Figure 21. Ensuring Correction Wizard is set correctly.

9. Ensure Correction Wizard settings are set as in Figure 21. Then click 'Next' or 'Change' if necessary.
10. The 'Base Data' and 'Reference Position' information will be displayed (Figure 22). Select 'Base Provider Search' and click 'Select.' The Base Station list will open (Figure 23).

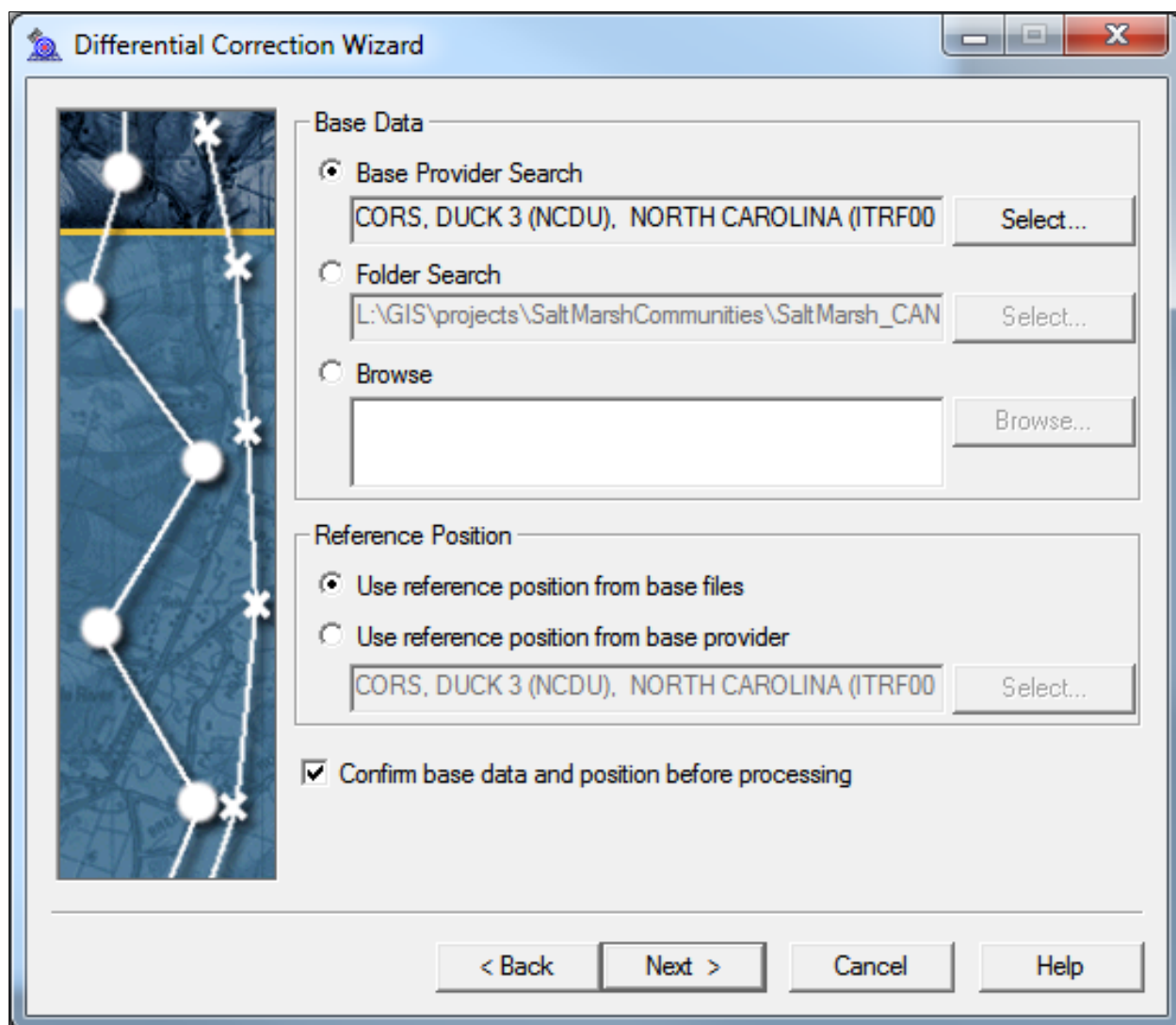


Figure 22. Selecting 'Base Data' and 'Reference Position.'

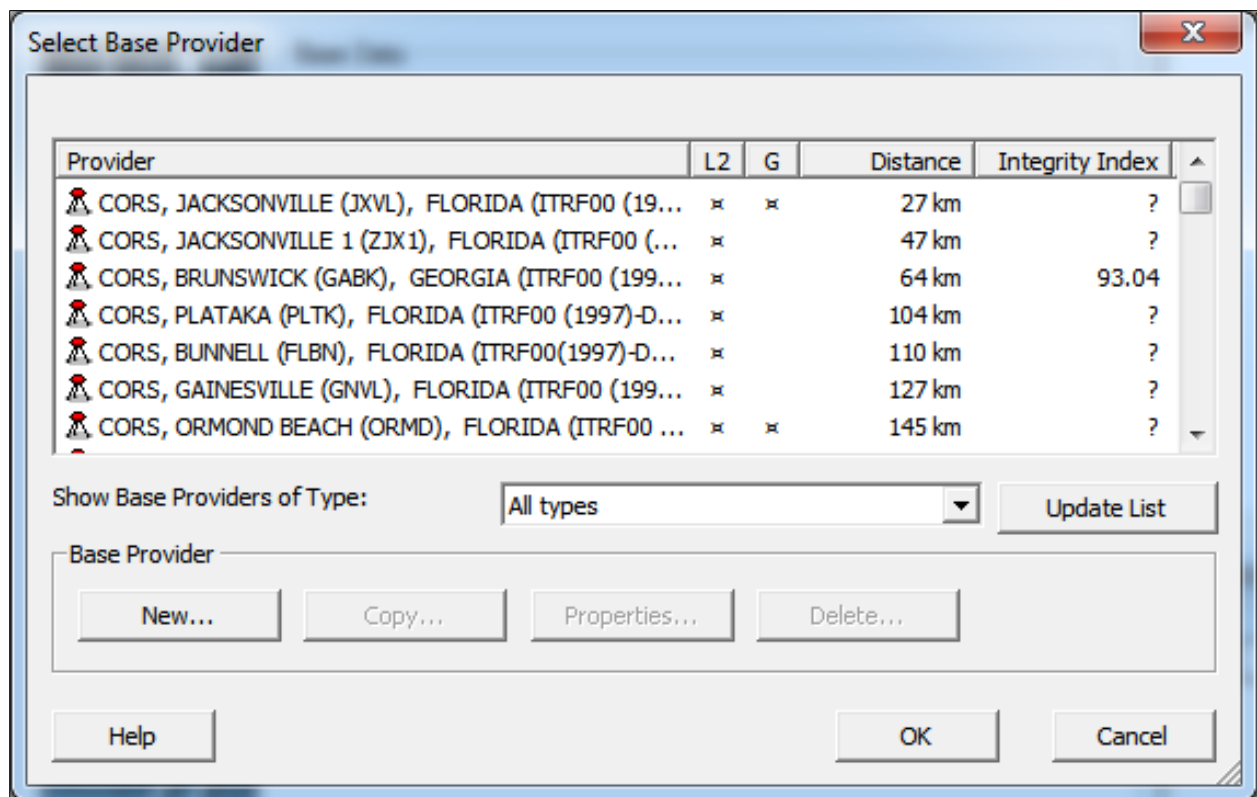


Figure 23. Base Station Provider list.

11. Click 'Update List' and the base provider list will be updated (Figure 24).

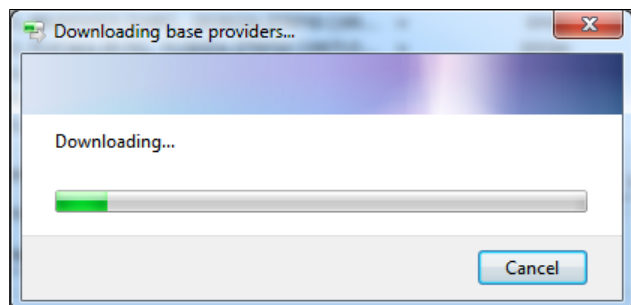


Figure 24. Base Station Providers list is being updated.

12. Select a CORS base provider that is closest and Click 'OK' (Figure 25).

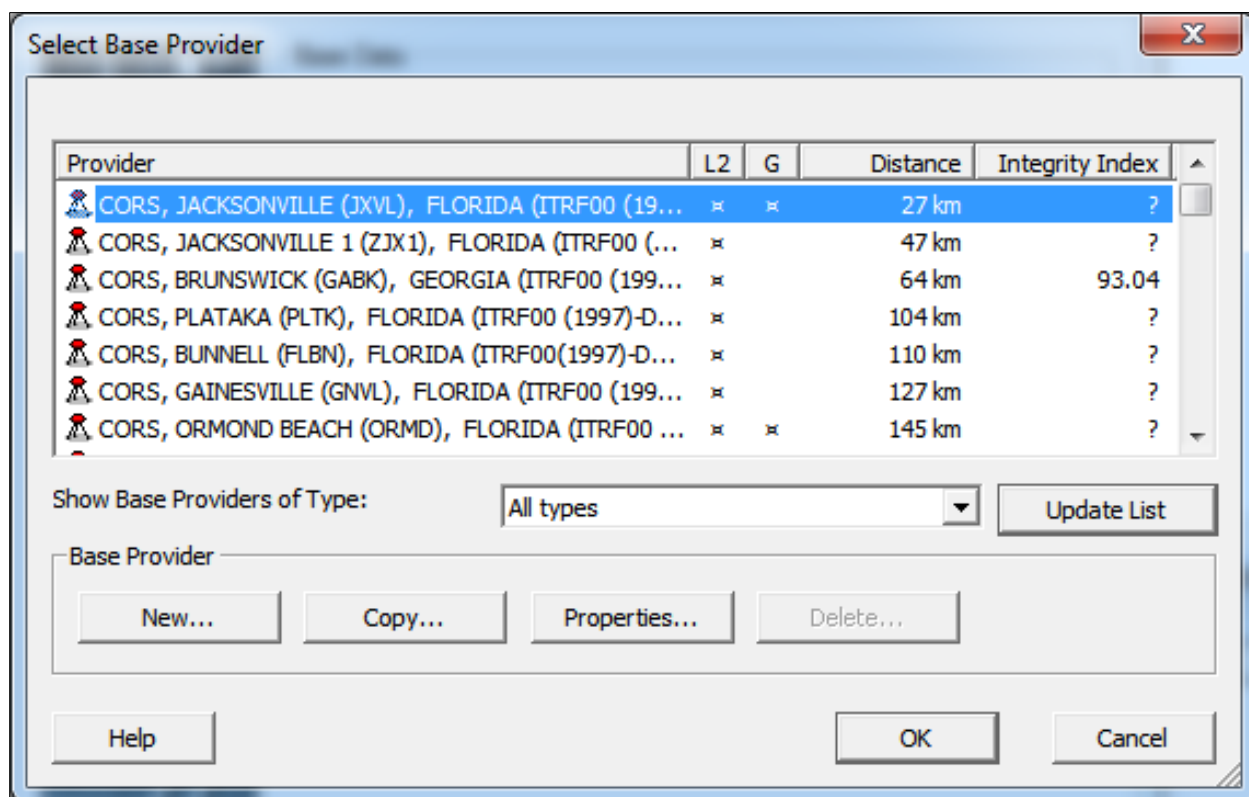


Figure 25. Selecting closest Base Provider.

13. Ensure the proper settings in the Differential Correction Wizard (Figure 26):

- a. Toggle ON 'Use reference position from base files.'
- b. Check the box near the bottom of the window to 'Confirm base
- c. Click 'Next.'

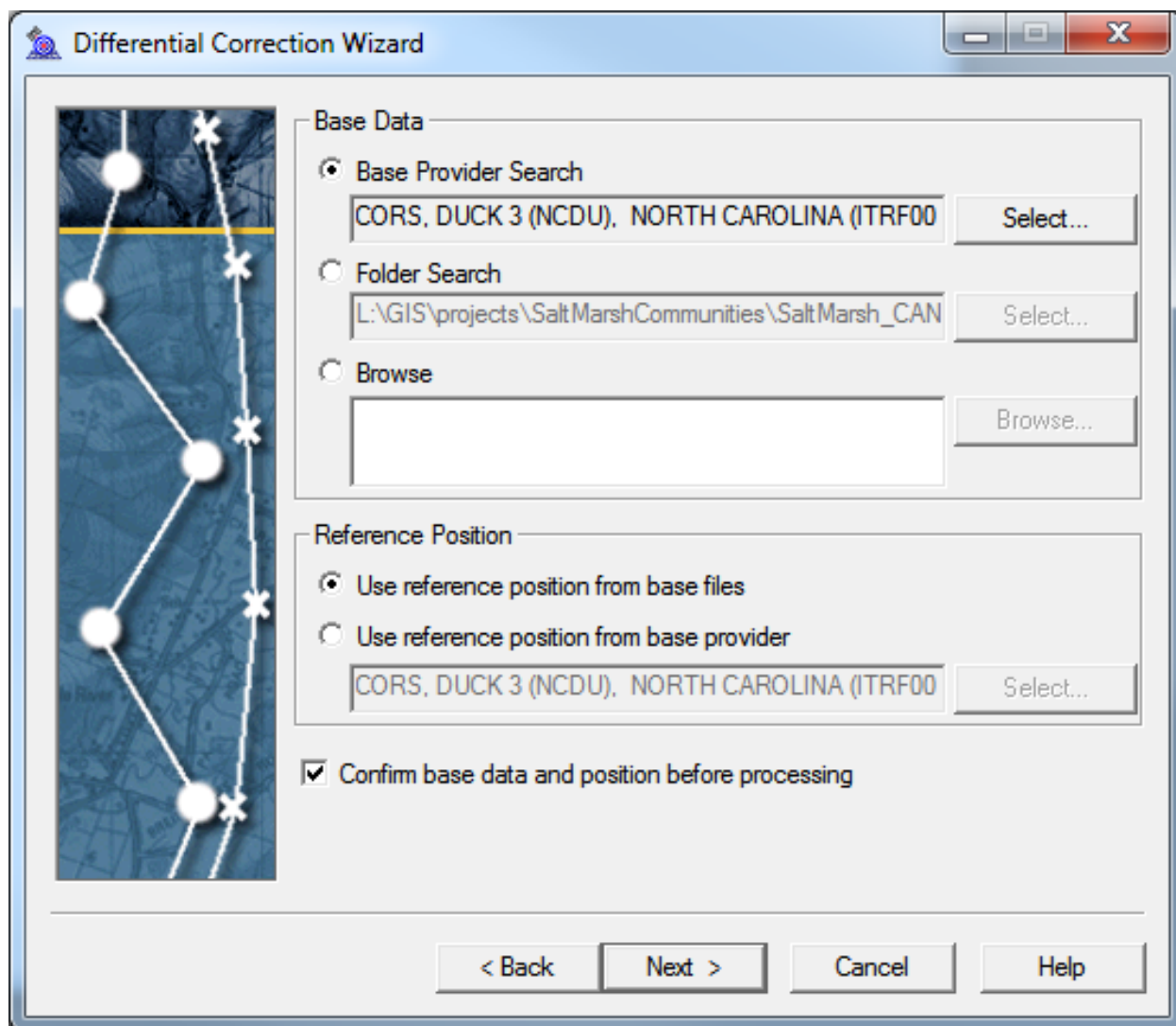


Figure 26. Ensuring proper setting in Differential Correction Wizard.

14. The Output dialog will appear. Ensure the proper settings for output (Figure 27):
 - a. Output Folder: Use the project folder.
 - b. Output Filename: Create a unique filename based on the input filename.
 - c. Click 'Start.'

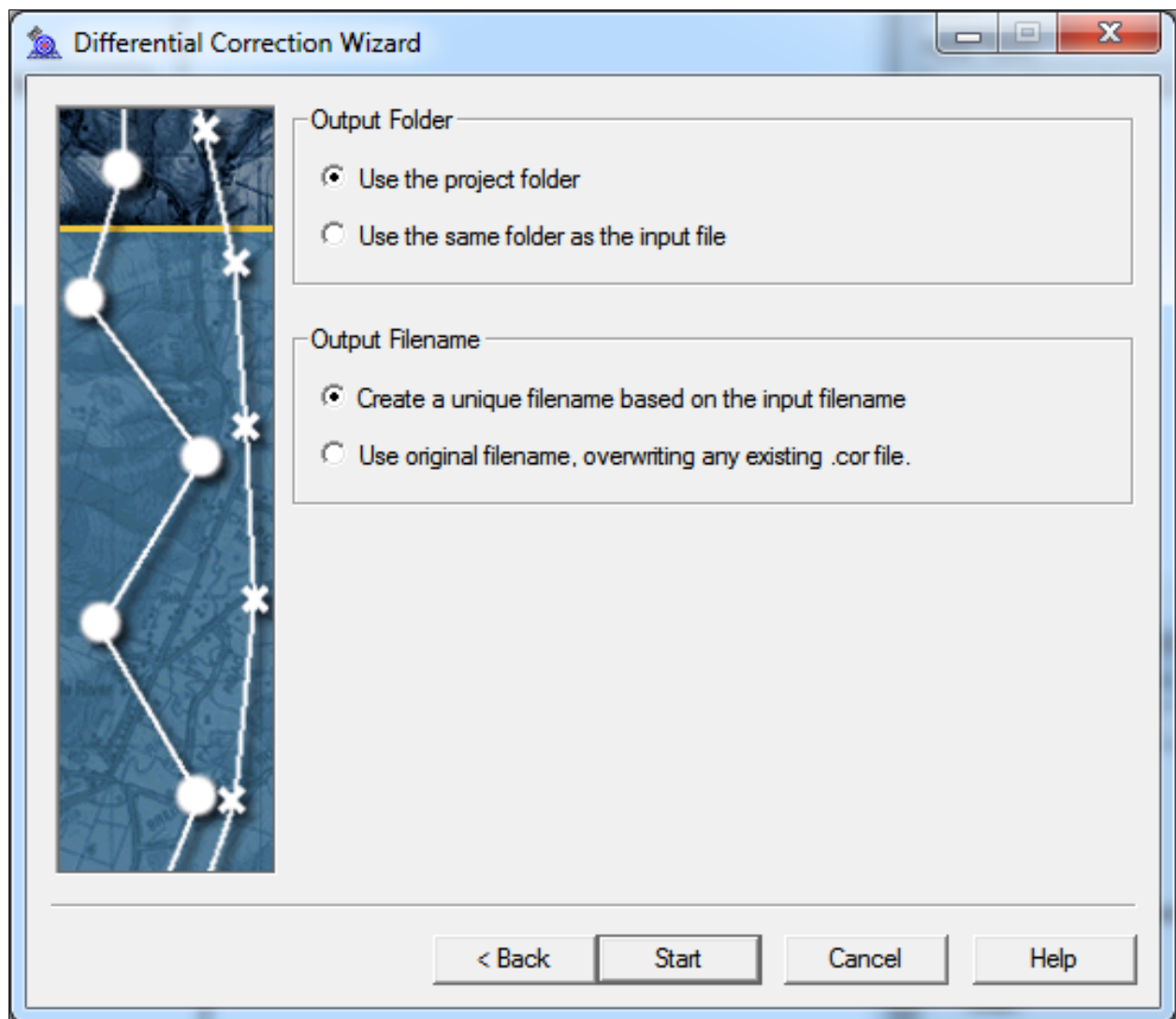


Figure 27. Setting Differential Correction output parameters.

The wizard will search for the base files (Figure 28).

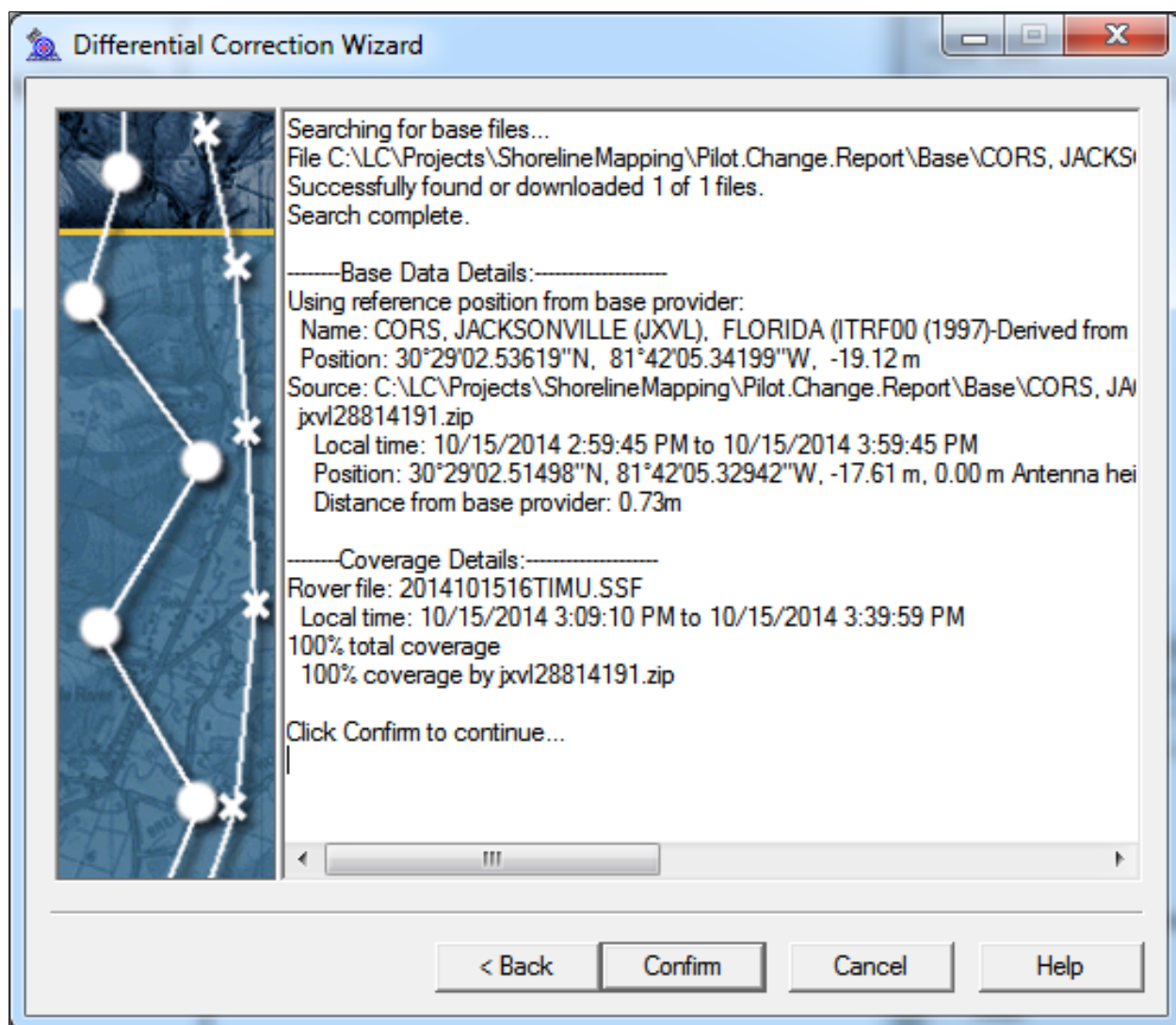


Figure 28. Differential Correction Wizard searching for base files.

15. To verify that corrections were done accurately, open an internet browser and navigate to <http://www.ngs.noaa.gov> (NOAA 2017).
 - a. Click the 'CORS' link on the left side of the page.
 - b. Type in the four letter CORS station selected, it is listed in the Differential Correction Wizard window.
 - c. Click 'Enter SiteID.'
 - d. Click 'Coordinates' on the left side of the webpage.
 - e. Click 'Position And Velocity.'

- f. Compare the position displayed in the Differential Correction Wizard window with the coordinates shown in the NAD_83 (2011) POSITION (EPOCH 2010.0). These should match up to the fifth decimal place.
16. If there is 100% coverage, click 'Confirm' (Figure 28). If there is not 100% coverage, click 'Back' and select the next closest CORS site (step 12), until you get 100% coverage.
17. The wizard will display the error associated with the corrected data. Click 'Close' (Figure 29).

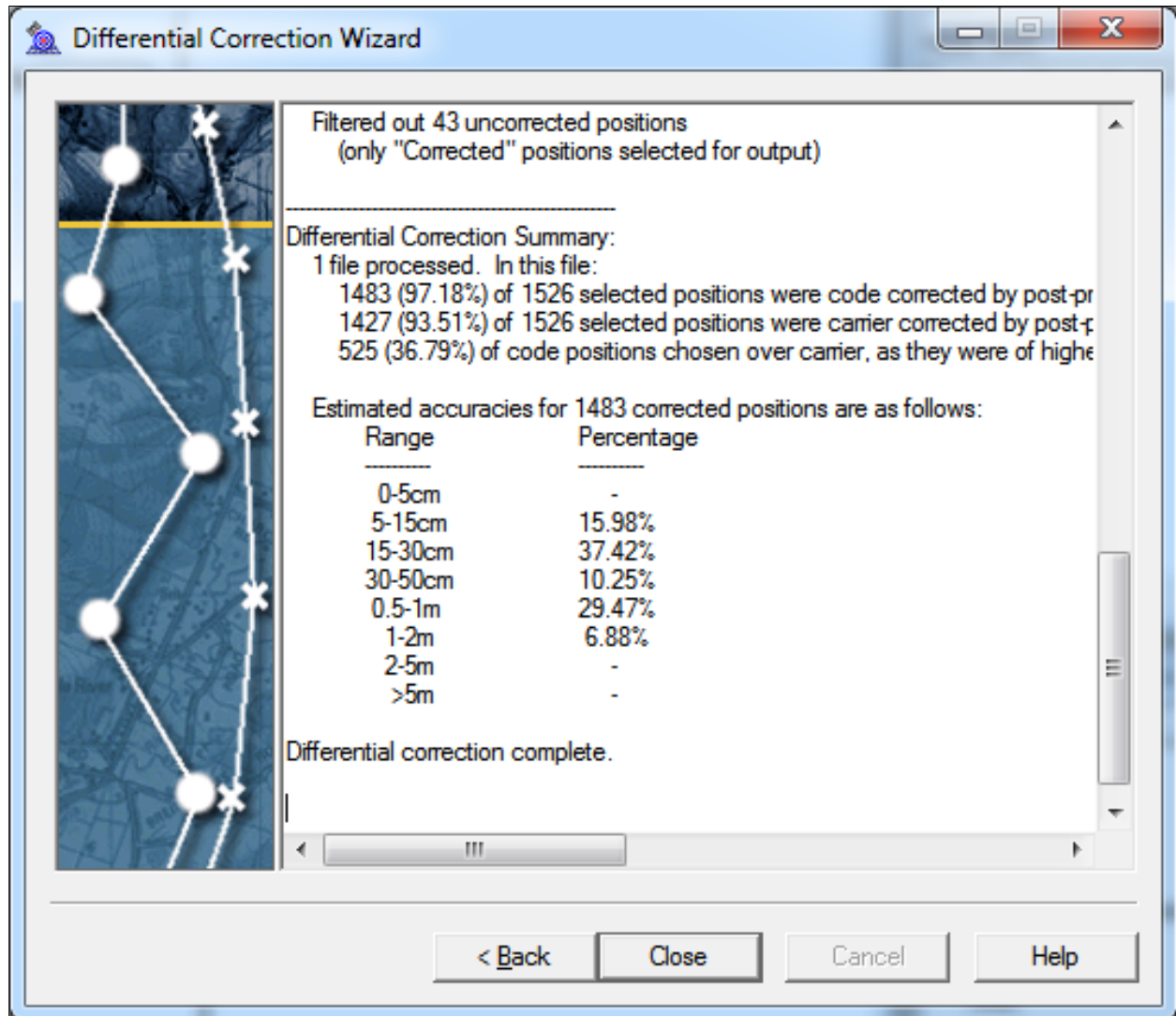


Figure 29. Accuracy ranges for positions.

18. Open Windows Explorer and navigate to the project folder location. Notice there are two new files listed, a .cor and a .txt (Figure 30).

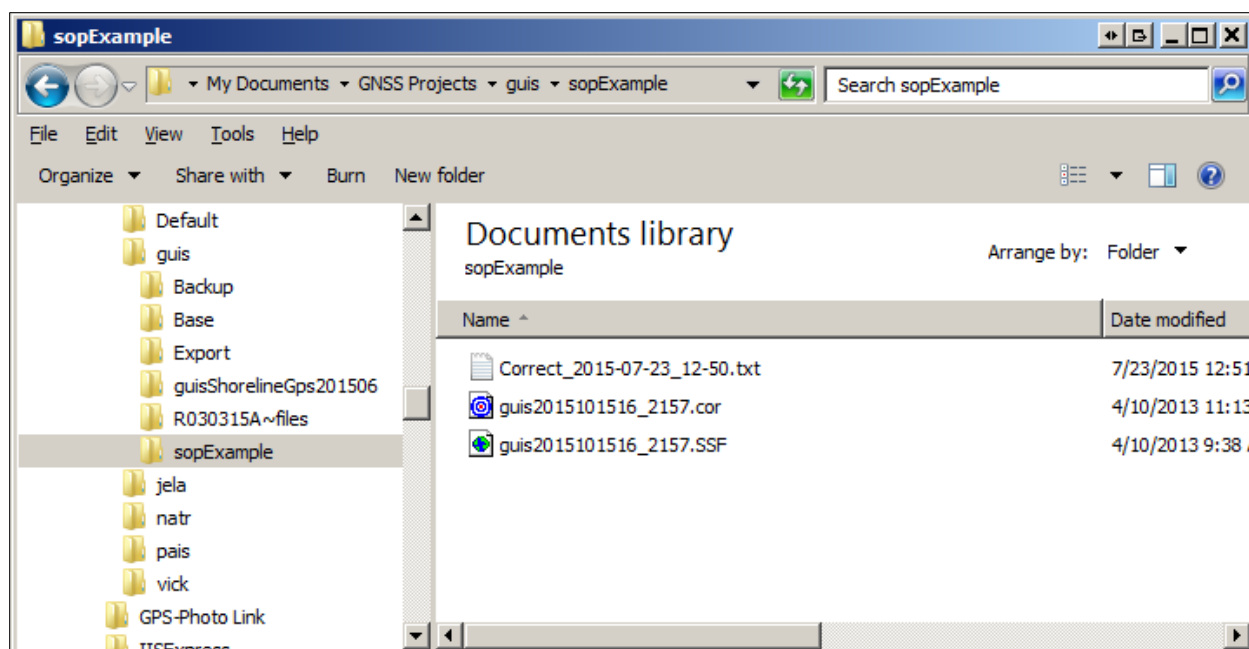


Figure 30. Differential Corrections output files.

19. Rename the new .txt file with the same naming convention as the .SSF and .cor filename from which it was created, but retain the 'Correct_YYYY_MM_DD_TIME' at the end of the filename (Figure 31).

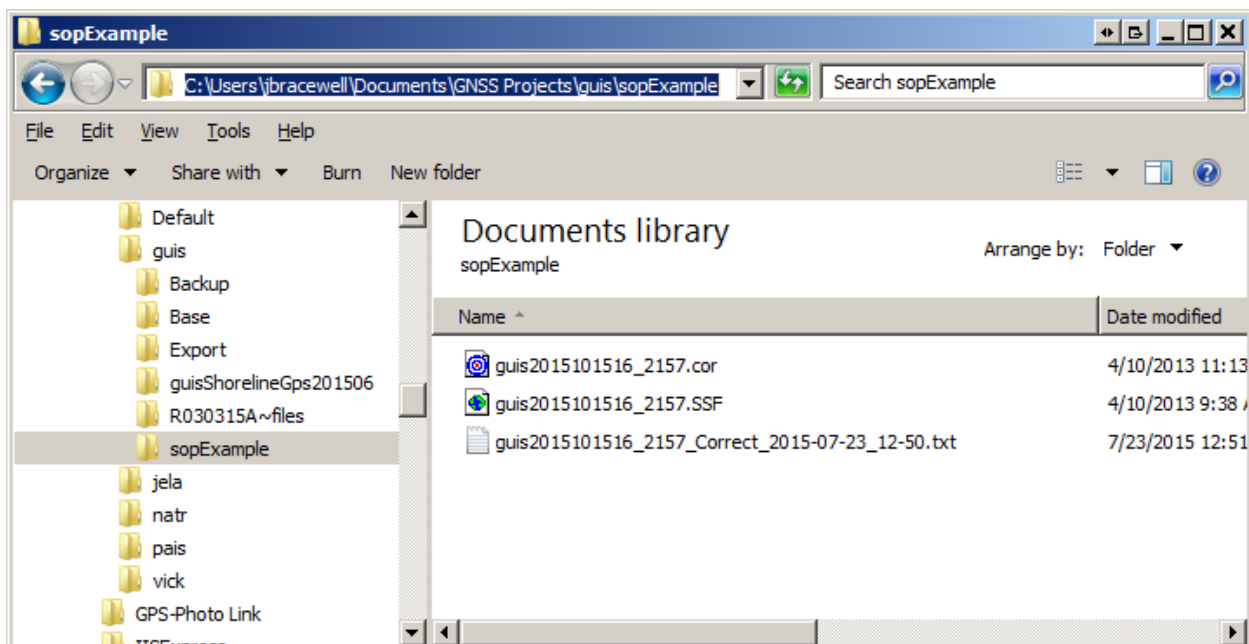


Figure 31. Renamed output files.

20. Repeat the steps in this section to differentially correct the rest of the files that need to be corrected.

Export Corrected GPS File as Shapefile

The following section describes how to use Pathfinder Office 5.60 to export, rename, and define the projection for a corrected GPS file.

1. In Pathfinder Office, using the park project from the previous section, open the .cor file by clicking on the folder button or 'File'>'Open' (Figure 32).

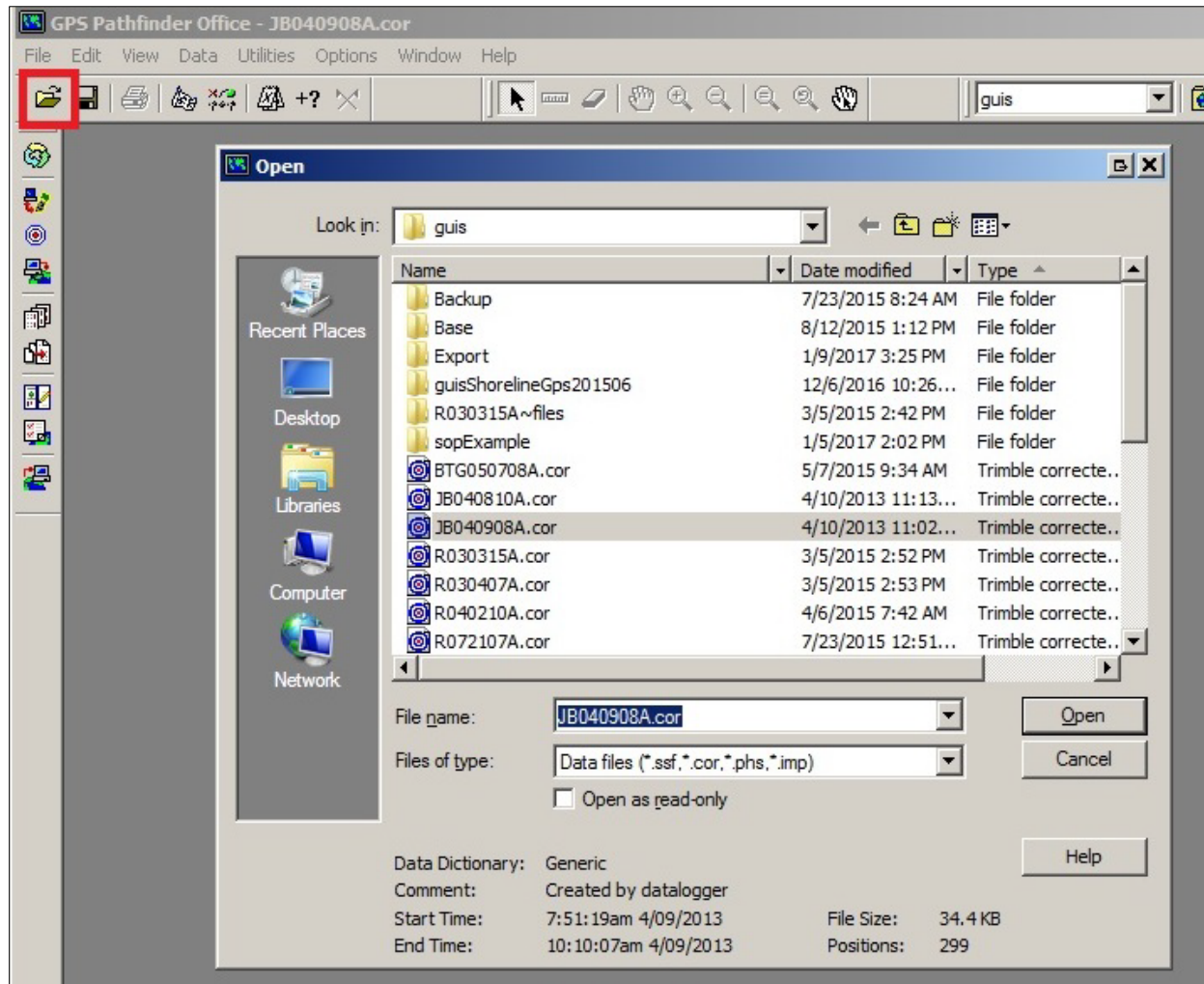


Figure 32. Opening .cor file.

The corrected GPS file will be displayed in the Map window (Figure 33).

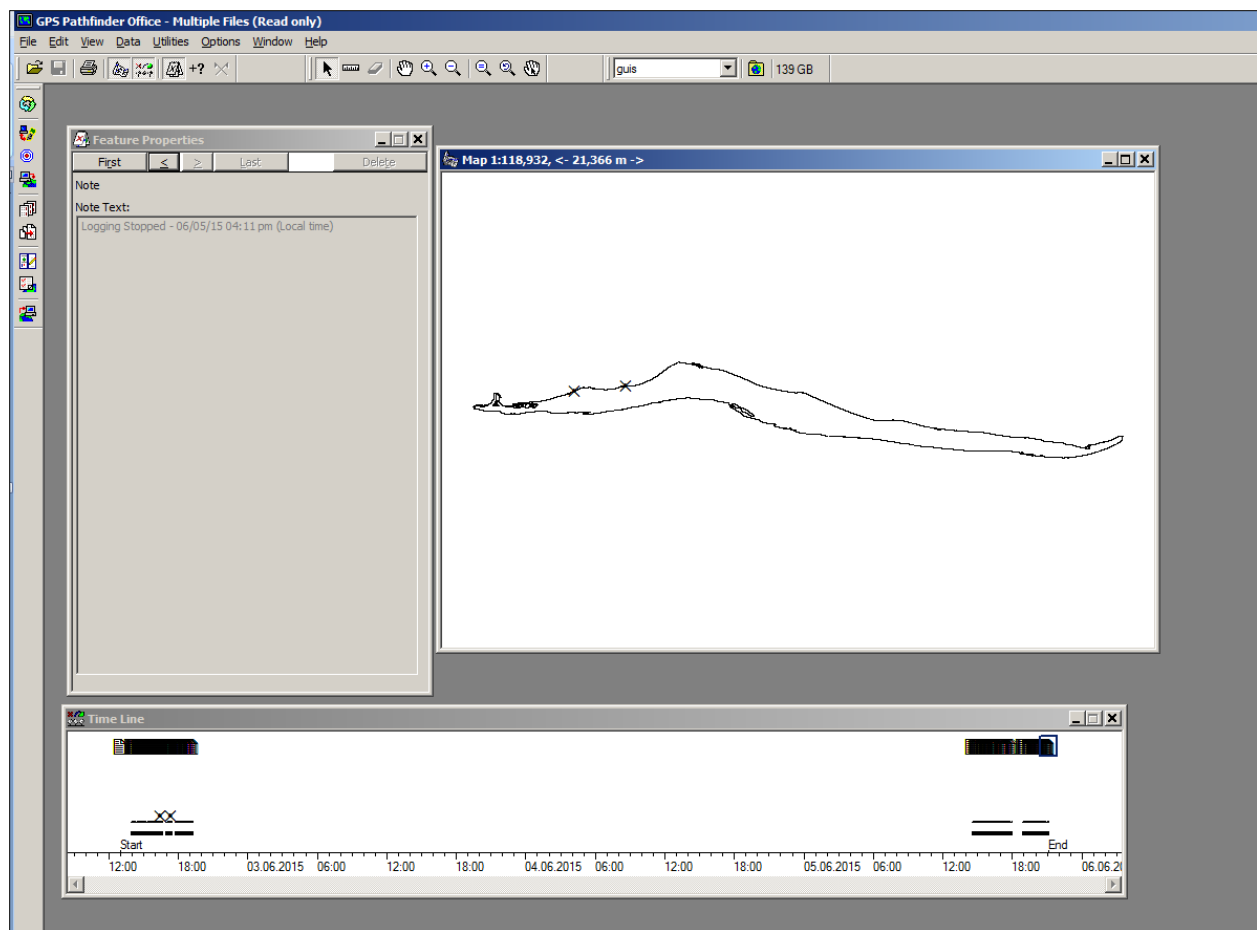


Figure 33. Map window displaying .cor file.

2. Click 'Utilities' > 'Export' (Figure 34).

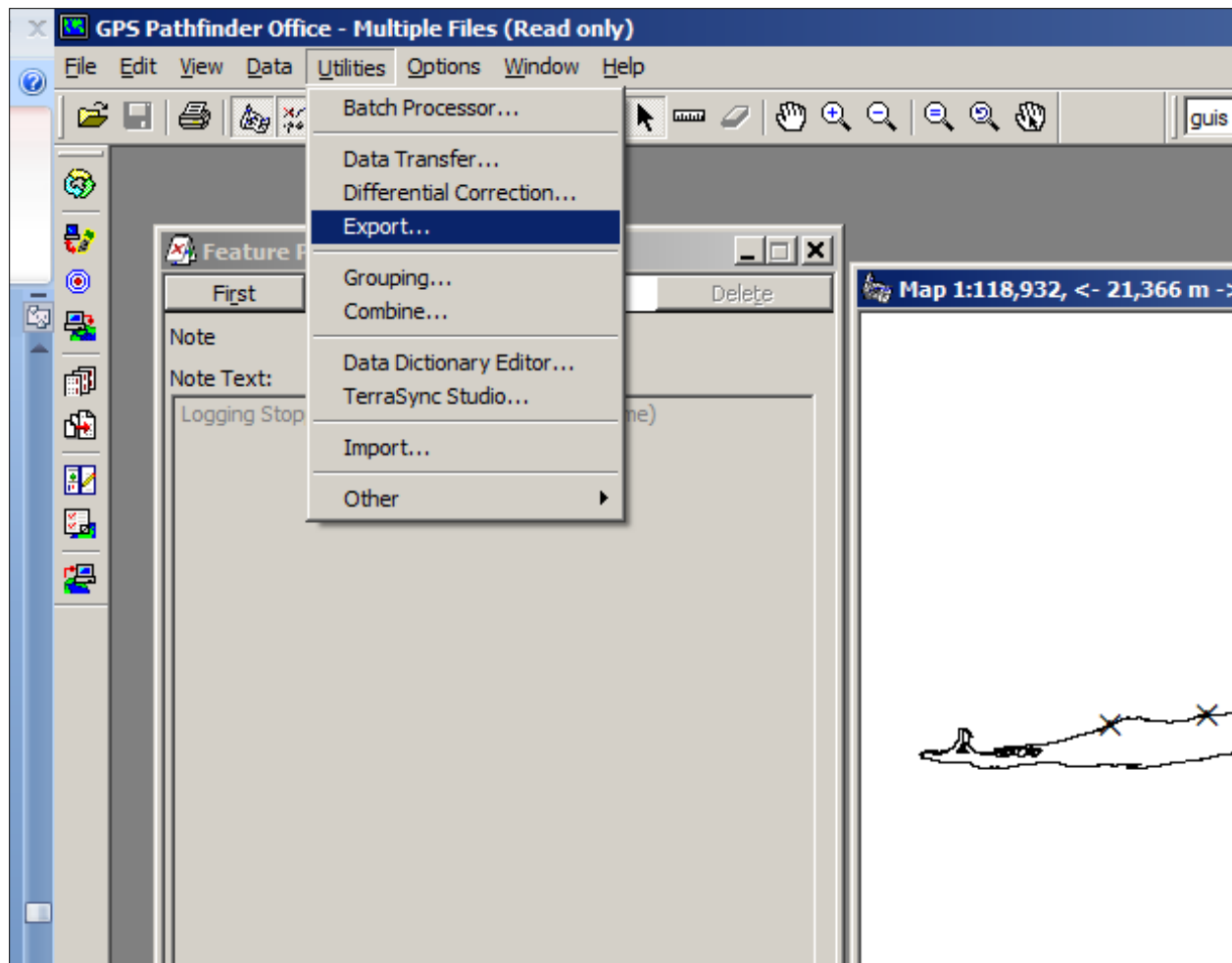


Figure 34. Exporting the .cor file.

3. The Export window will appear (Figure 35).
 - a. Ensure that the file(s) you wish to export is listed under 'Selected Files.' If not, browse to the location of the file, select it, and click 'Open.'
 - b. Ensure the proper output location in 'Output Folder.' By default, Pathfinder Office exports the corrected file to the Export folder within the project folder.
 - c. In the 'Choose an Export Setup' section, choose an ESRI Shapefile format. The format may be listed as 'New ESRI Shapefile' or 'Sample ESRI Shapefile.'

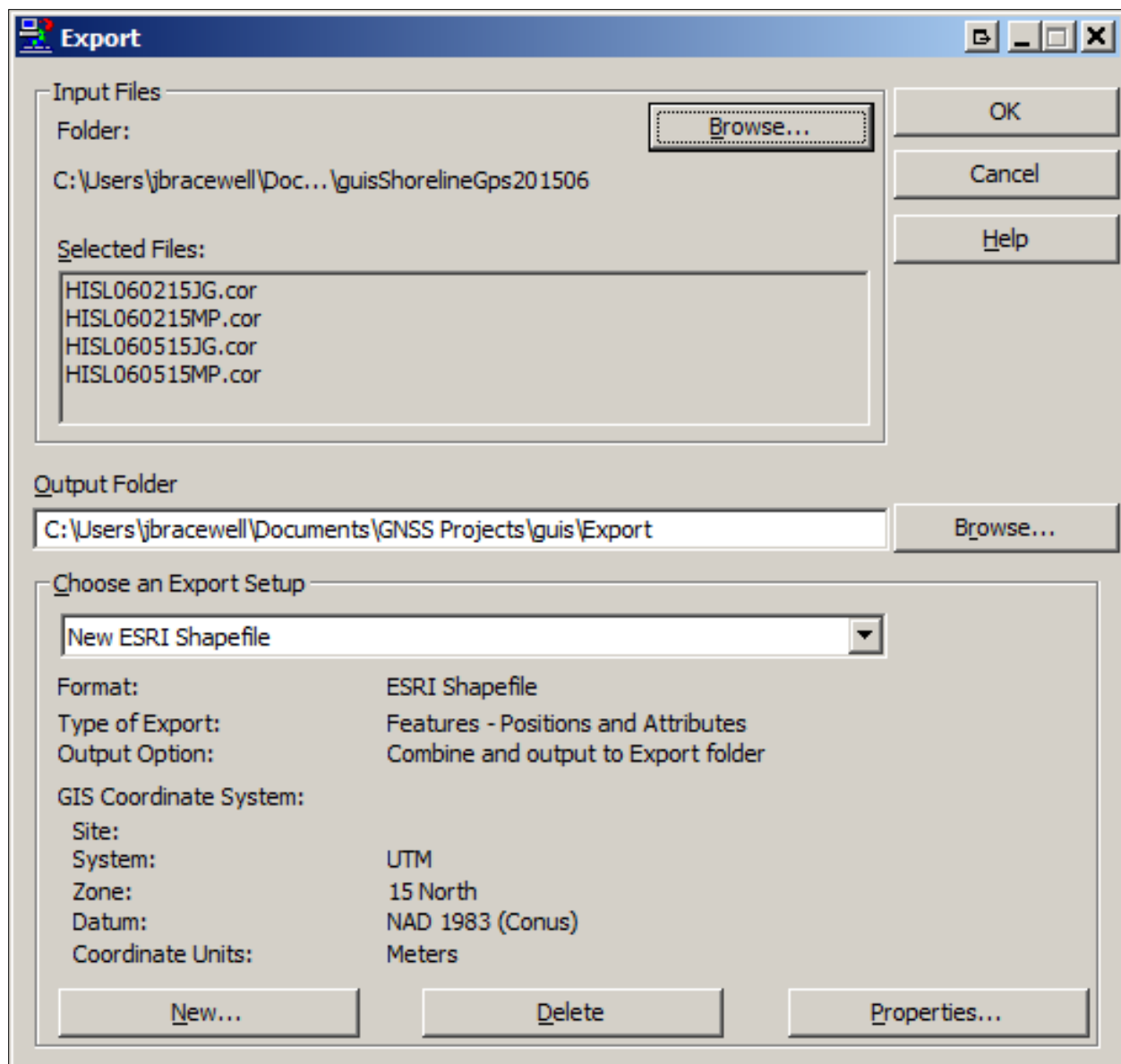


Figure 35. Export window.

4. Click 'Properties...' (Figure 35) to open the 'Export Setup Properties...' dialog (Figure 36).

The screenshot shows the 'Export Setup Properties - New ESRI Shapefile' dialog box with the 'Data' tab selected. The dialog has a title bar with a maximize button and a close button. Below the title bar are tabs for 'Data', 'Output', 'Attributes', 'Units', 'Position Filter', 'Coordinate System', and 'ESRI Shapefile'. The 'Data' tab is active and contains the following sections:

- Type of Data to Export:**
 - ☒ **Features - Positions and Attributes:**
 - A dropdown menu showing 'Export All Features'.
 - ☐ **Include Not In Feature Positions**
 - A dropdown menu showing 'One point per Not in Feature position'.
 - ☐ **Positions Only**
 - A dropdown menu showing 'One point per GNSS position'.
- Create Point Features From:**
 - ☐ **Notes**
 - ☐ **Velocity Records**
 - ☐ **Sensor Records**
- Starting Feature ID:**
 - A text box labeled 'Value:' containing the number '1'.
 - ☒ **Start Each Session with this Value**
 - ☐ **Continue Increment from Previous Session**
 - ☐ **Label 1**
 - ☐ **Label 1 and Label 2**

At the bottom of the dialog are four buttons: 'OK', 'Cancel', 'Default', and 'Help'.

Figure 36. Export Setup Properties window—Data tab.

5. On the 'Data' tab (Figure 36), under 'Type of Data to Export,' select:
 - a. 'Features—Positions and Attributes'
 - b. 'Export All Features'

6. On the 'Output' tab (Figure 37), ensure the default settings are selected:
 - a. Output Files: Combine all input files and output to the project export folder.
 - b. System File Format: DOS Files.

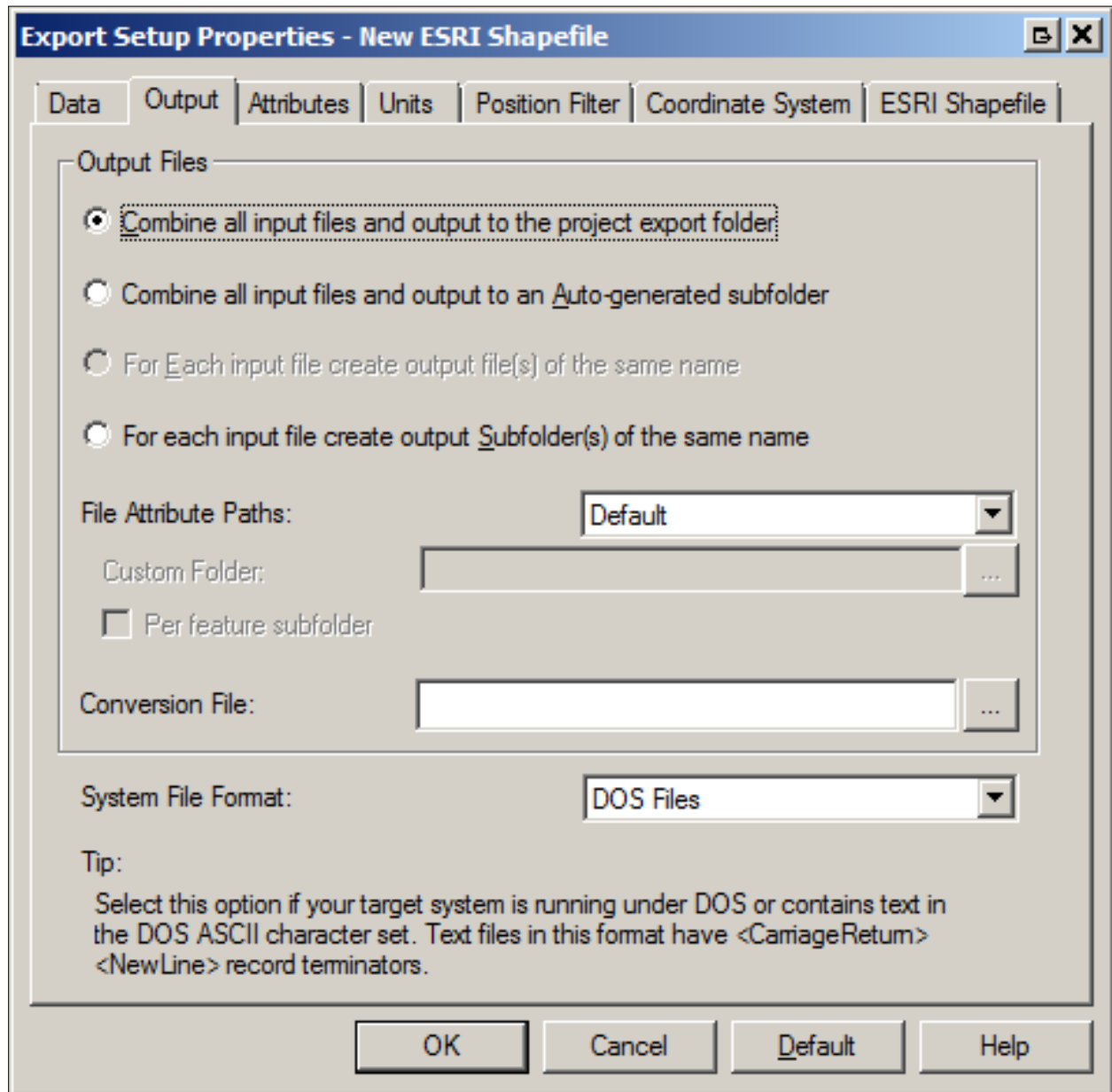


Figure 37. Export Setup Properties window—Output tab.

7. On the 'Attributes' tab (Figure 38), select the following:
 - a. 'Export Menu Attributes As': 'Attribute Value'
 - b. 'All Feature Types': Toggle ON all attributes
 - c. 'Line Features': Toggle ON all attributes
 - d. 'Point Features': Toggle ON all attributes
 - e. 'Area Features': Toggle ON all attributes

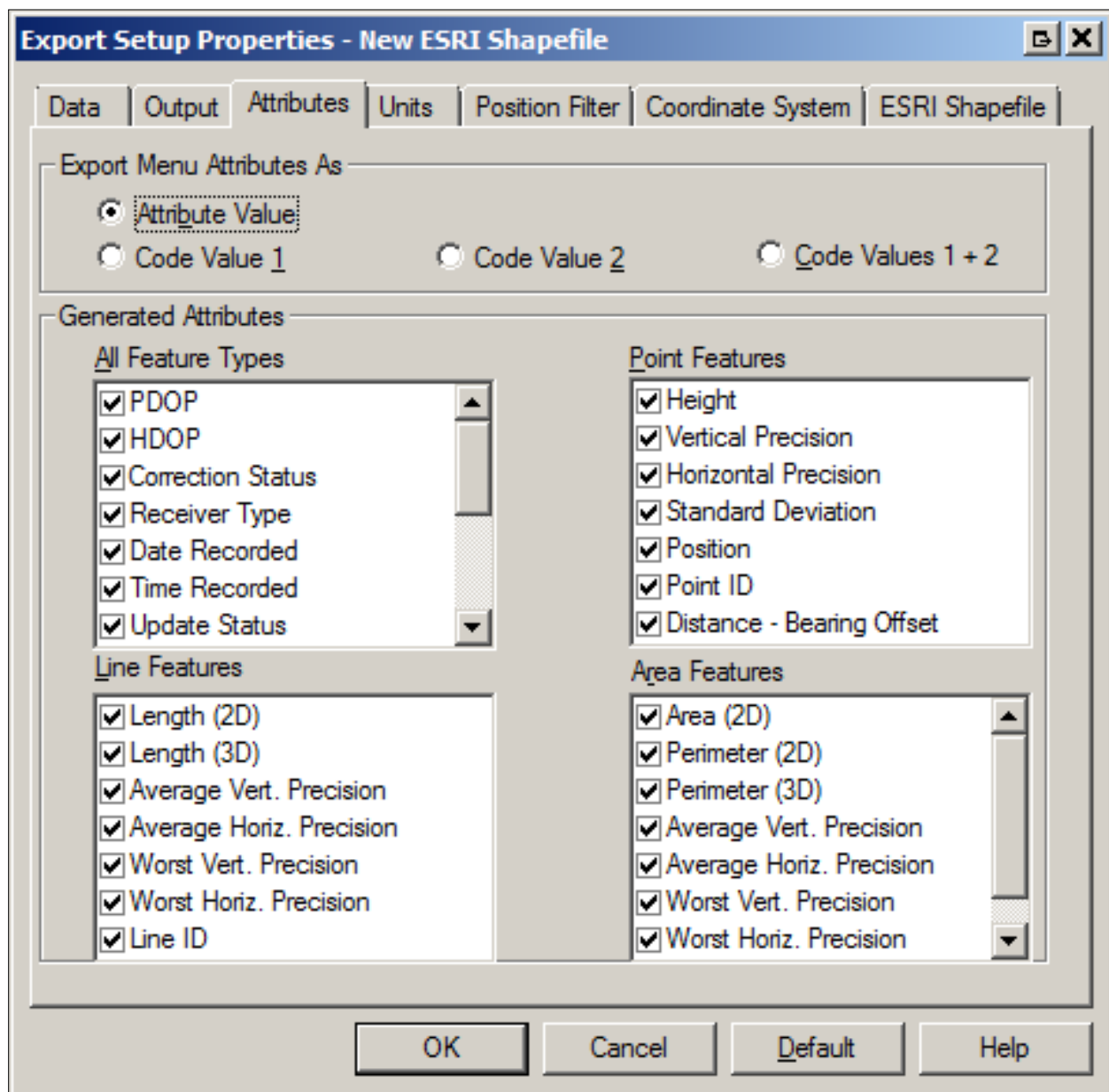


Figure 38. Export Setup Properties window—Attributes tab.

8. On the 'Units' tab (Figure 39), ensure the following selections:
 - a. Units: 'Use Export Units'
 - b. Distance: Meters
 - c. Area Units: Square Meters
 - d. Velocity Units: Meters Per Second

The image shows the 'Export Setup Properties - New ESRI Shapefile' dialog box with the 'Units' tab selected. The dialog has several tabs: Data, Output, Attributes, Units, Position Filter, Coordinate System, and ESRI Shapefile. The 'Units' tab contains two main sections: 'Units' and 'Decimal Places'. In the 'Units' section, the 'Use Export Units' radio button is selected, and a 'Change...' button is next to it. Below this, the following units are listed: Distance Units: Meters, Area Units: Square Meters, and Velocity Units: Meters Per Second. The 'Use Current Display Units' radio button is unselected, and its corresponding units are: Distance Units: Meters, Area Units: Hectares, and Velocity Units: Kilometers Per Hour. The 'Decimal Places' section on the right has input fields for: Lat/Long: 9, North/East: 3, Height: 3, Distance: 3, Area: 3, Velocity: 3, Precision: 1, and Time: 0. At the bottom of the dialog are four buttons: OK, Cancel, Default, and Help. Below the dialog box, there are two sections: 'Latitude/Longitude Options' with 'Format' set to 'DDD.ddddddd' and 'Quadrant' set to '+/-', and 'Date/Time Options' with 'Time Format' set to '12 Hour Clock' and 'Date Format' set to 'MM/DD/YY'.

Section	Property	Value
Units (Selected)	Distance Units	Meters
	Area Units	Square Meters
	Velocity Units	Meters Per Second
	Use Export Units	Selected
Units (Unselected)	Distance Units	Meters
	Area Units	Hectares
	Velocity Units	Kilometers Per Hour
	Use Current Display Units	Unselected
Decimal Places	Lat/Long	9
	North/East	3
	Height	3
	Distance	3
	Area	3
	Velocity	3
	Precision	1
	Time	0
Latitude/Longitude Options	Format	DDD.ddddddd
	Quadrant	+/-
Date/Time Options	Time Format	12 Hour Clock
	Date Format	MM/DD/YY

Figure 39. Export Setup Properties window—Units tab.

9. On the 'Position Filter' tab (Figure 40), select the following:
 - a. 'Filter by GNSS Position Info'
 - i. Minimum Geometry: 2D (3 or more measurements)
 - ii. Maximum PDOP: Any
 - iii. Maximum HDOP: Any
 - b. 'Include Positions That Are' (Uncheck 'Uncorrected')

Toggle ON 'Include Non-GNSS Positions'

The screenshot shows the 'Export Setup Properties - New ESRI Shapefile' dialog box with the 'Position Filter' tab selected. The 'Position Filter Criteria' section has 'Filter by GNSS Position Info' selected. Below this, 'Minimum Geometry' is set to '2D (3 or more measurements)', 'Maximum PDOP' is set to 'Any', and 'Maximum HDOP' is set to 'Any'. The 'Include Positions That Are' section has 'Uncorrected' unchecked and 'P(Y) Code', 'Real-time SBAS', 'Real-time Code', 'Postprocessed Code', 'Real-time Carrier', 'Postprocessed Carrier Float', 'RTK Fixed', and 'Postprocessed Carrier Fixed' all checked. The 'Filter By Precision (68% confidence)' section has 'Horizontal Precision' set to '1.92 m' and 'Vertical Precision' set to '0.00 m'. The 'Include Non-GNSS Positions' checkbox is checked. At the bottom, the 'Export Features That Have No Positions' checkbox is unchecked. The 'OK', 'Cancel', 'Default', and 'Help' buttons are at the bottom right.

Export Setup Properties - New ESRI Shapefile

Data | Output | Attributes | Units | **Position Filter** | Coordinate System | ESRI Shapefile

Position Filter Criteria

☒ Filter by GNSS Position Info

Minimum Gemetry: 2D (3 or more measurements)

Maximum PDOP: Any

Maximum HDOP: Any

Include Positions That Are

☐ Uncorrected

☒ P(Y) Code

☒ Real-time SBAS

☒ Real-time Code

☒ Postprocessed Code

☒ Real-time Carrier

☒ Postprocessed Carrier Float

☒ RTK Fixed

☒ Postprocessed Carrier Fixed

☐ Filter By Precision (68% confidence)

Horizontal Precision: 1.92 m

Vertical Precision: 0.00 m

☒ Include Non-GNSS Positions

☐ Export Features That Have No Positions

OK Cancel Default Help

Figure 40. Export Setup Properties window—Position Filter tab.

10. On the 'Coordinate System' tab, Toggle ON 'Use Export Coordinate System' and click 'Change' (Figure 41).

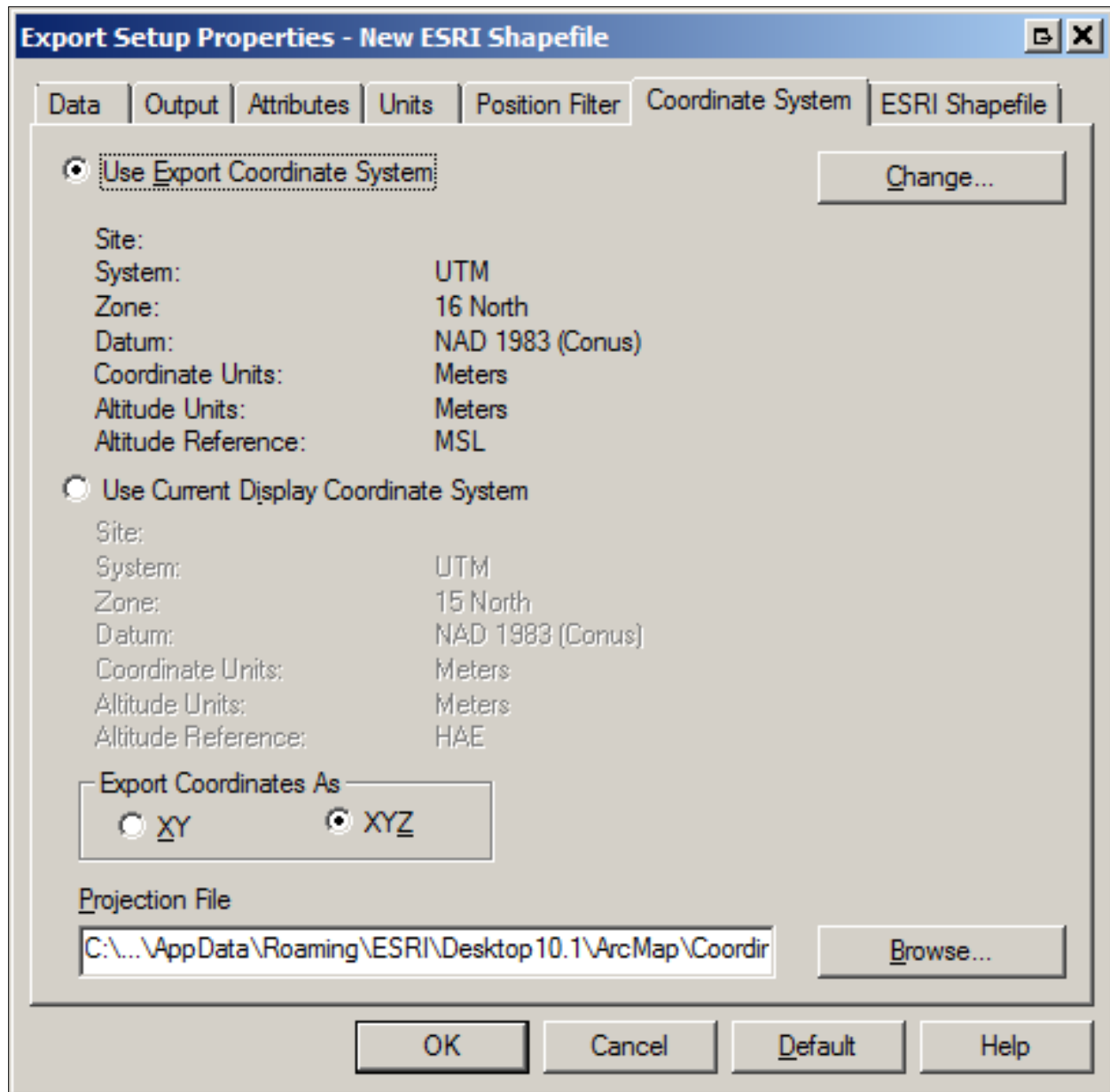


Figure 41. Export Setup Properties window—Coordinate System tab.

11. Ensure the correct settings (Figure 42):

- a. System: UTM
- b. Zone: 14N or 16N
 - i. Padre Island NS—14N
 - ii. Gulf Islands NS—16N
- c. Datum: NAD 1983 (Conus)

The image shows a screenshot of a software dialog box titled "Export". The dialog box has a blue title bar with standard window controls (minimize, maximize, close). On the right side, there are three buttons: "OK", "Cancel", and "Help".

The main content area is divided into several sections:

- Select By:** This section contains two radio buttons. The first, labeled "Coordinate System and Zone", is selected. The second, labeled "Site", is unselected.
- System:** A dropdown menu showing "UTM".
- Zone:** A dropdown menu showing "16 North".
- Datum:** A dropdown menu showing "NAD 1983 (Conus)".
- Altitude Measured From:** This section contains two radio buttons. The first, labeled "Height Above Ellipsoid (HAE)", is unselected. The second, labeled "Mean Sea Level (MSL)", is selected.
- Geoid Model:** This section is nested within the "Mean Sea Level (MSL)" group. It contains two radio buttons. The first, labeled "Defined Geoid (EGM96 (Global))", is selected. The second, labeled "Other", is unselected.
- Geoid:** A dropdown menu showing "EGM96 (Global)".
- Coordinate Units:** A dropdown menu showing "Meters".
- Altitude Units:** A dropdown menu showing "Meters".

Figure 42. Changing Coordinate System in Export settings

12. Click 'OK.' The selected settings will be displayed under 'Use Export Coordinate System' (Figure 43).

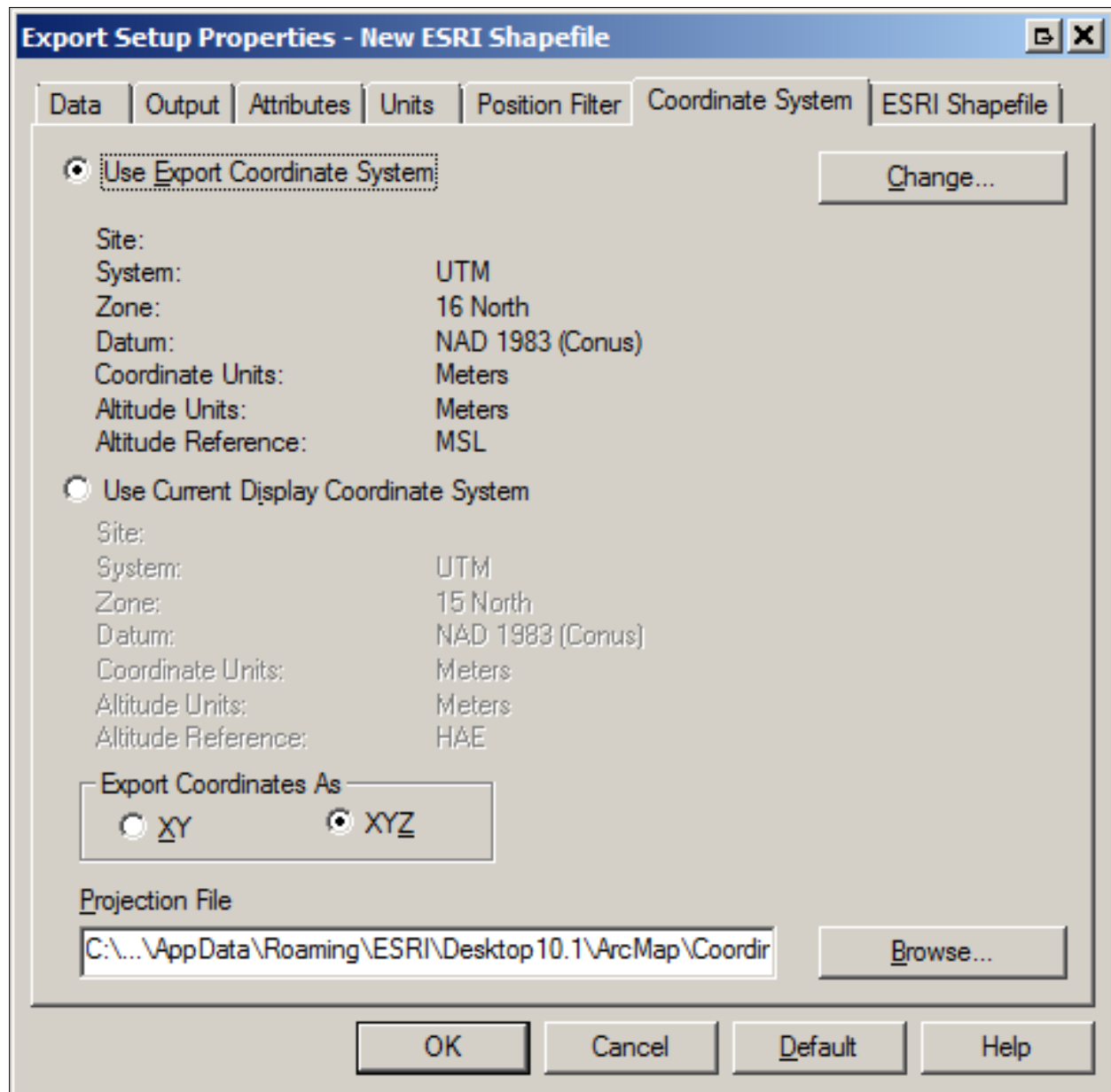


Figure 43. Setting output coordinate system.

13. Ensure the proper ESRI projection file (.prj) is attached to the shapefile. Under 'Projection File', browse to the list of projection files and select the representative file. The nomenclature here is slightly different than the projection datum from the above step. The commonly used projection files for GULN .cor exports are: NAD 1983 (2011) UTM Zone 14N.prj or NAD 1983 (2011) UTM Zone 16N.prj (Figure 44).

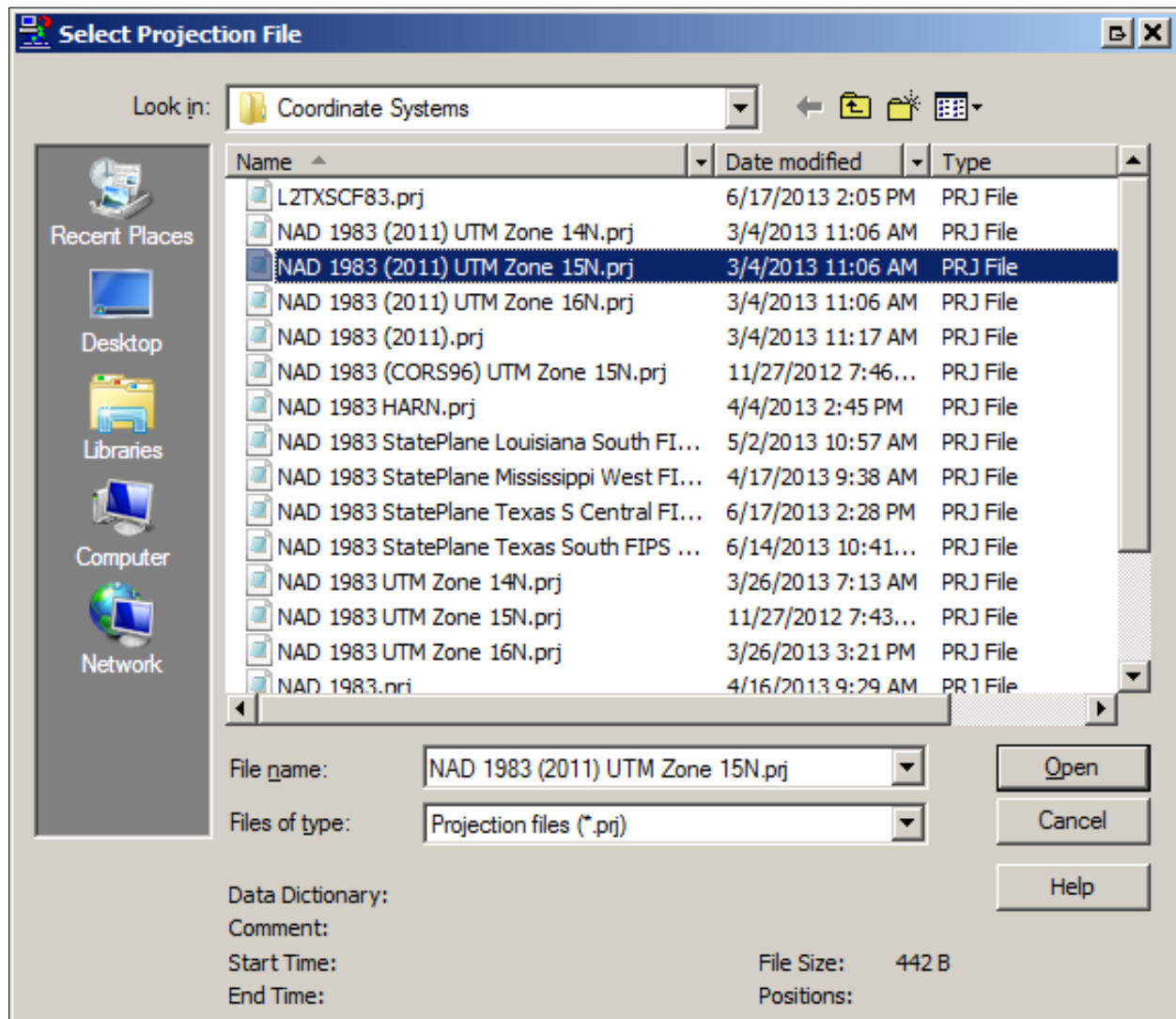


Figure 44. Appending the correct .prj file.

14. On the 'ESRI Shapefile' tab, Toggle OFF 'Export Tracking Themes,' Click 'OK'(Figure 45).

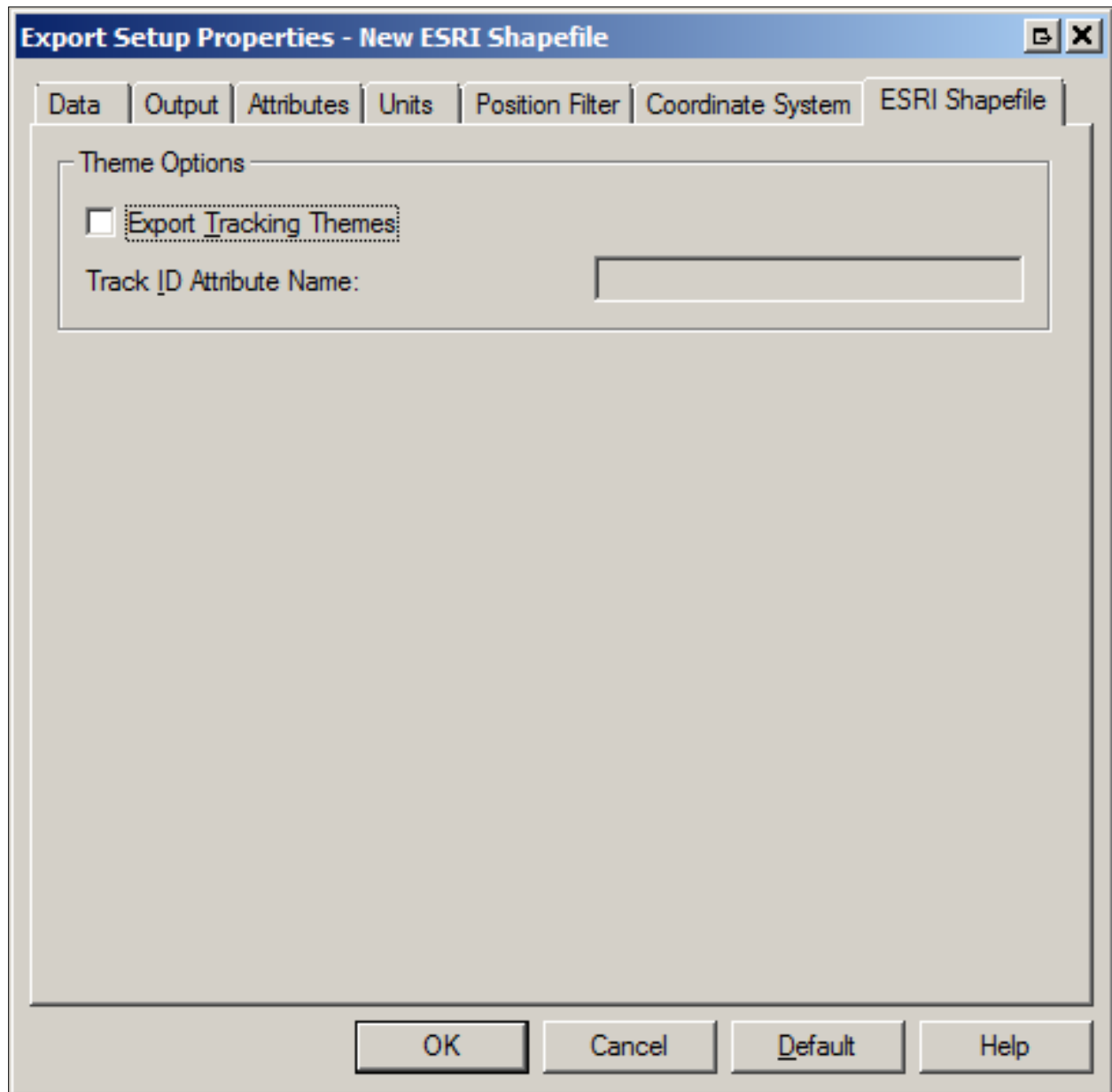


Figure 45. Export Setup Properties window—ESRI Shapefile tab.

15. Ensure the Export window is updated with the proper coordinate system information and Click 'OK' (Figure 46).

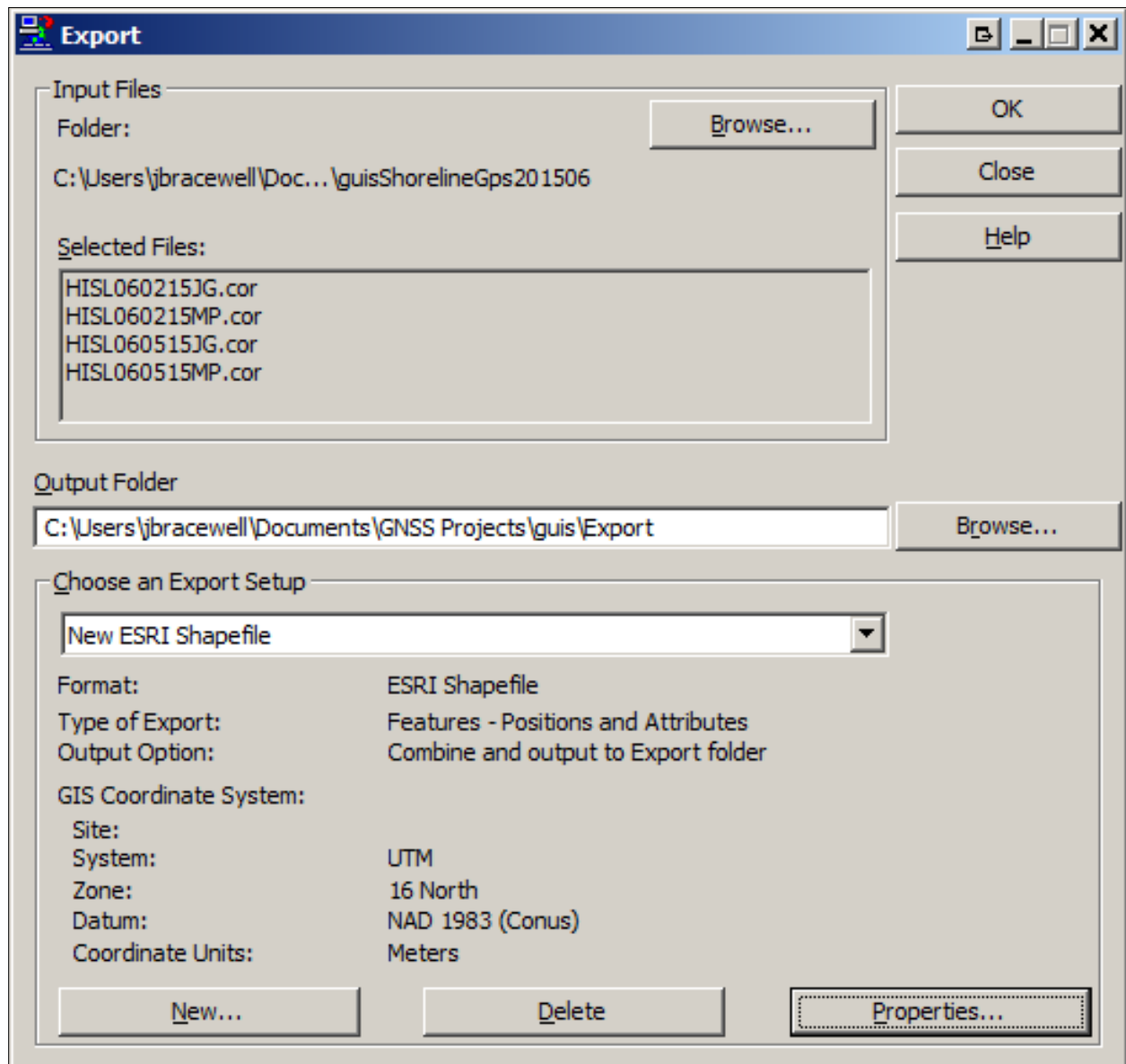


Figure 46. Checking coordinate system before export.

16. A window will appear with information about the exported data (Figure 47). Click 'Close.'

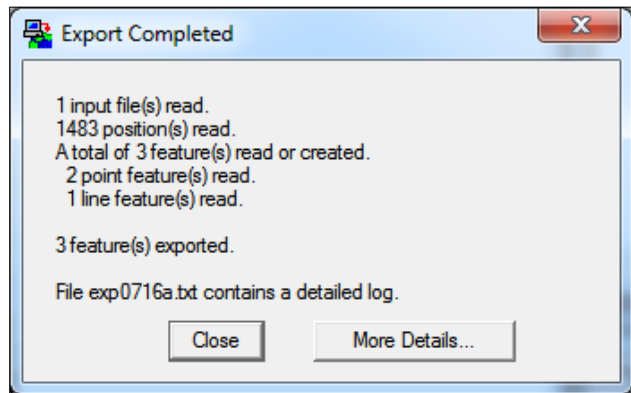


Figure 47. Export Completed window.

17. Open ArcCatalog and navigate to the location of the exported shapefile.

18. In addition to the shapefiles, there will be a .txt file exported also. Rename the exported files so that the GPS filename is followed by the exported name, as shown below (Figure 48).

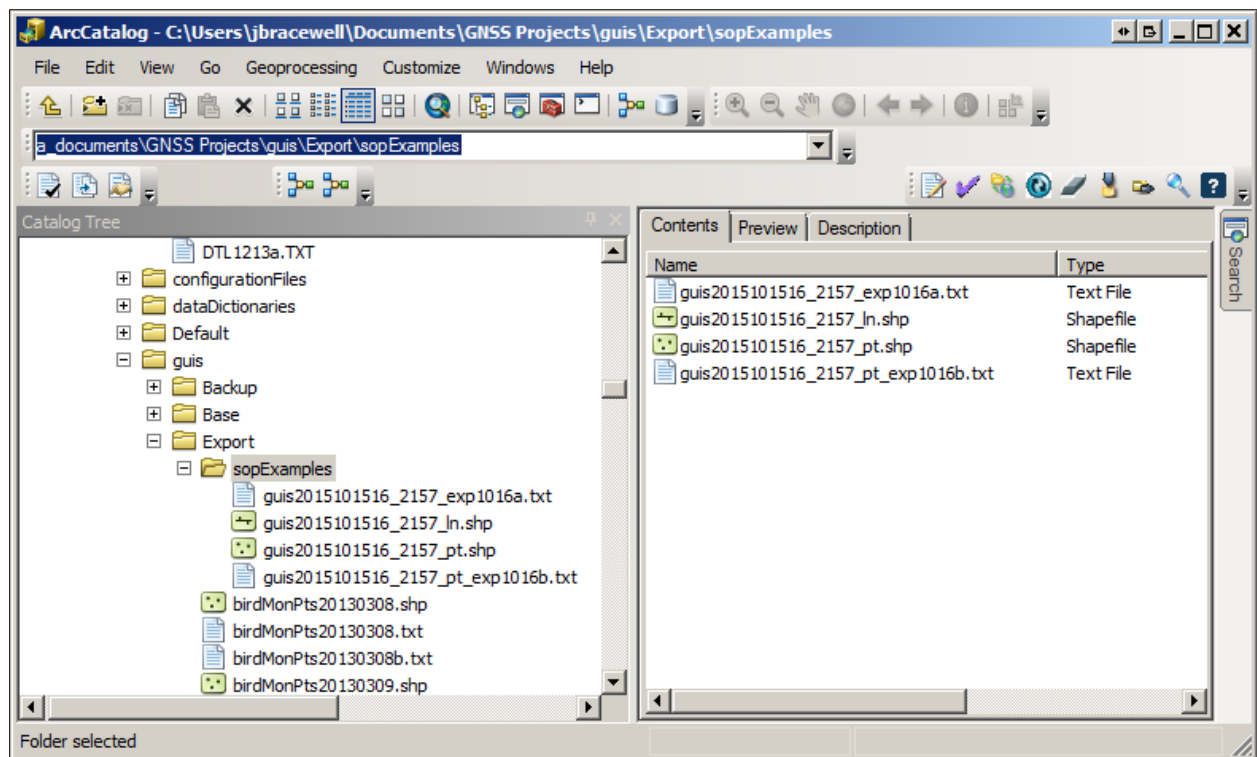


Figure 48. Renaming export files.

19. Ensure the proper projection has been assigned to the exported shapefiles (Figure 49.)
 - a. Padre Island NS—NAD 1983 (2011) UTM Zone 14N
 - b. Gulf Islands NS—NAD 1983 (2011) UTM Zone 16N

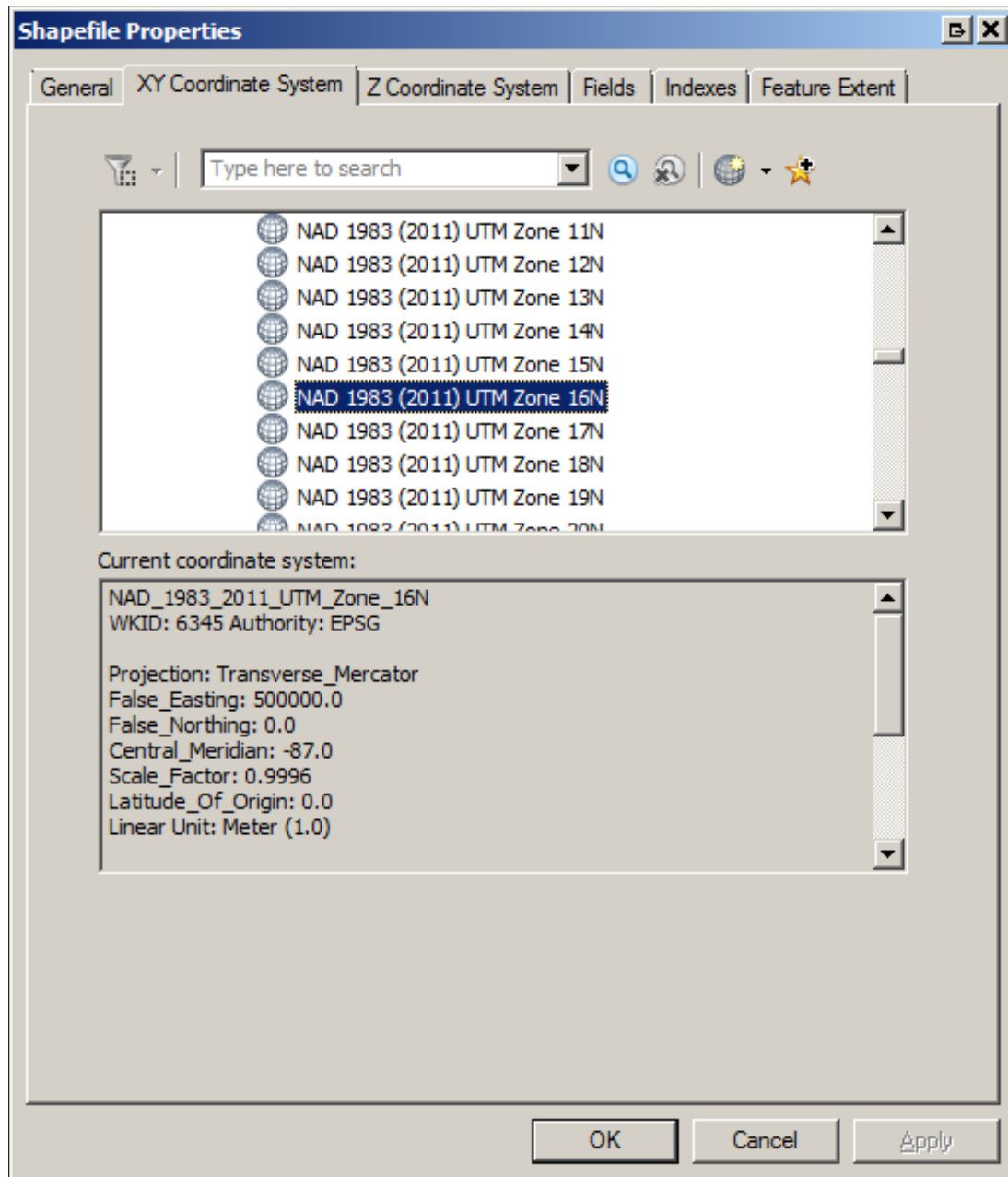


Figure 49. Checking coordinate system in ArcCatalog.

20. Once the shapefiles have been renamed and their projections have been defined, repeat the Export process for any other differentially corrected GPS files (.cor).

Initial QA/QC and Shoreline Edits

QA/QC (Quality Assurance/Quality Control) is a verification step that ensures the data collected have had obvious errors removed and the remaining data are likely to accurately represent the shoreline. Verification of the known benchmarks embedded in the survey adds credence to the collected shoreline positions. During this procedure the surveyor should be present. The expected feature locations should be compared with recorded locations.

The steps below describe how to edit the shoreline shapefiles and prepare them for DSAS.

1. Open ArcMap, then the Catalog window, and navigate to the location where the shapefiles were exported (Figure 50).

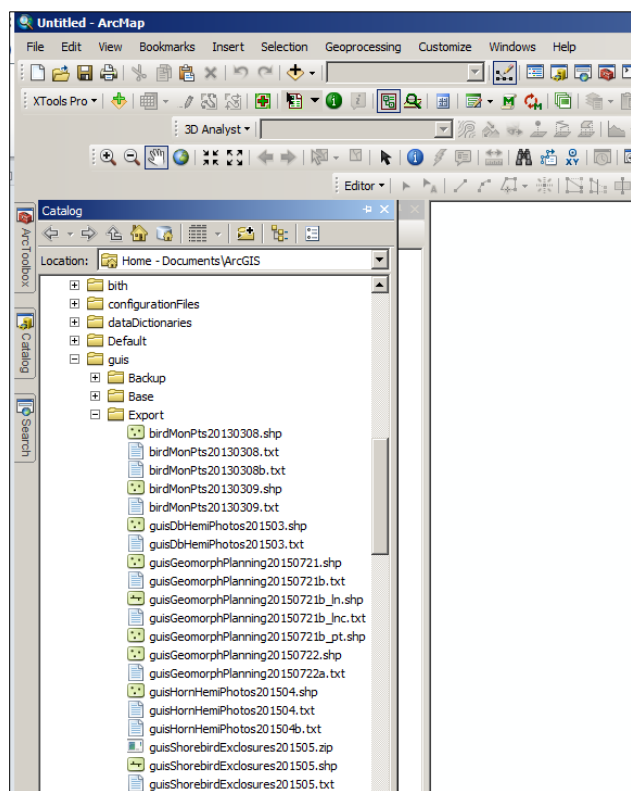


Figure 50. ArcCatalog window within ArcMap.

2. Create a copy of the shoreline shapefile(s) and rename it with ‘_edit’ at the end. For example, ‘guis2015101516_2157_In_edit.shp’ (Figure 51).

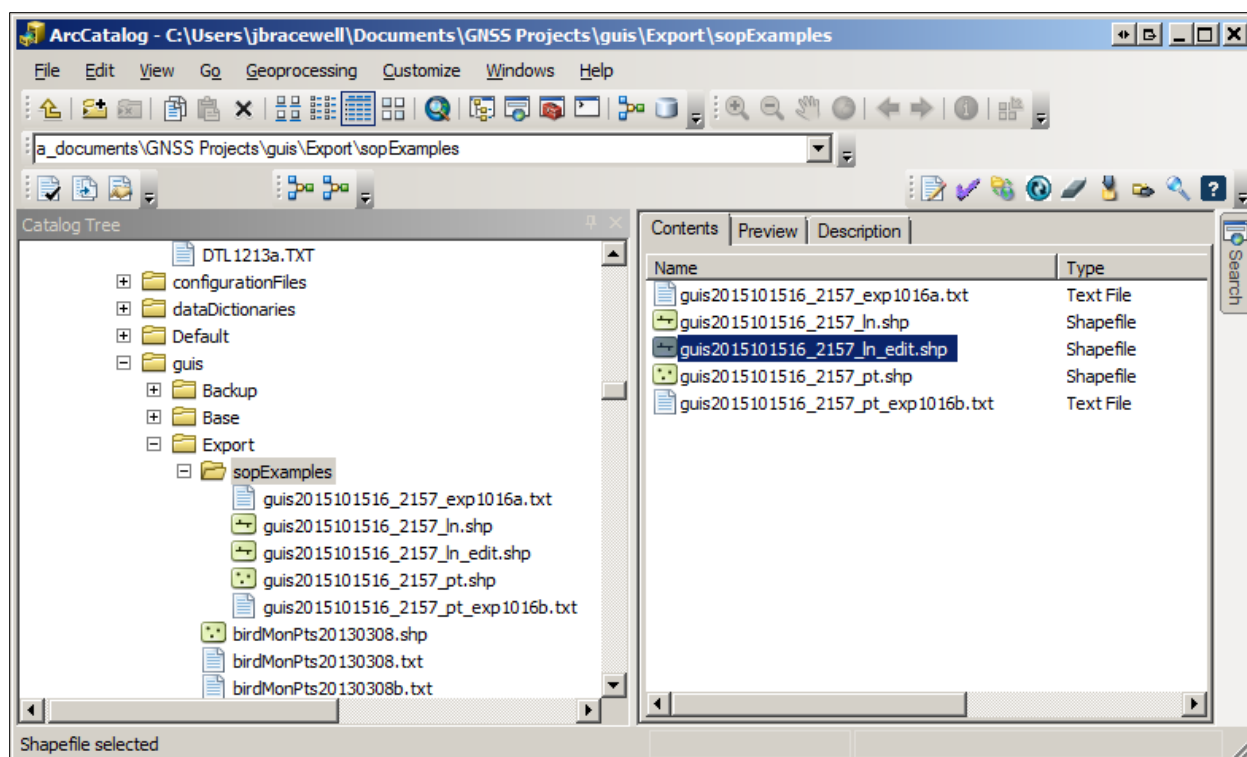


Figure 51. Example of renaming file for edits.

Benchmark Verification

3. Open a GIS project and add spatial references such as: benchmarks, previously collected shorelines, verification data collected during the survey, and recent aerial imagery or LiDAR.
4. A spatial accuracy check should be performed between established GIS data sets and the newly collected verification data set. A primary accuracy check should focus on a comparison between current survey results and extant, high accuracy benchmarks. These primary benchmarks include those recorded to decimeter horizontal accuracy and whose positional information is validated through multiple observations across time. Assuming that the current benchmark verification points were recorded at sub-meter accuracy, verification points should fall within approximately 1 meter (3.2 feet [ft]) of primary benchmark positions in the GIS. If for some reason a primary benchmark is not accessible, a less accurate secondary benchmark might be used to verify spatial accuracy. These secondary marks might include physical objects that would be visible in current aerial imagery, such as the corner of a parking lot, a dock, or a trail intersection. Given that the accuracy of aerial imagery may vary, and some degree of subjectivity is associated with interpreting an intersection, the data processor should expect verification points to be within 3–5 meters (9.8–16.4 ft) of secondary benchmarks. Deviations outside of these thresholds should be closely examined to ensure that no errors occurred in GPS post-processing.

Editing the Shoreline Feature

5. Review the data using the Field Data Form notes and the surveyors' input. Visually assess the shoreline feature(s) and correct any errors. With the exception of known discontinuities, such as jetties or inlets, the shoreline should be a continuous non-overlapping feature or set of features. Deviations from the survey course caused by other temporary obstacles should have been noted in the field data form. Obstacles include a breach causing a new tidal inlet, recreationists, or exclosures. If unexplained gaps occur in the shoreline feature, a record should be added to the field data sheet, noting the approximate coordinates of the discontinuity and that the break was discovered during GIS QA/QC.
6. Extraneous data should be edited (removed) from the shoreline feature. These errors are frequently self-intersections caused when a line overlaps itself. These errors may be the result of a surveyor deviating from the shoreline to avoid an obstacle or to make a noteworthy casual observation, thus creating a loop (Figure 52).

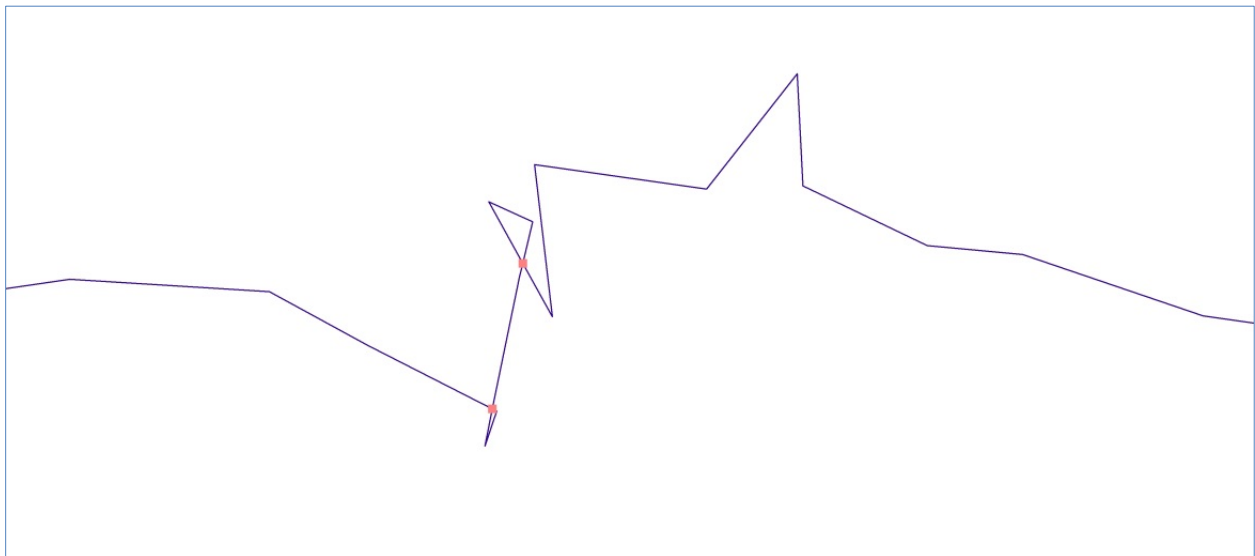


Figure 52. Editing loops.

7. Likewise, small gaps or section overlaps, caused when a surveyor stops data collection then restarts, should be edited to create a continuous line (Figure 53).

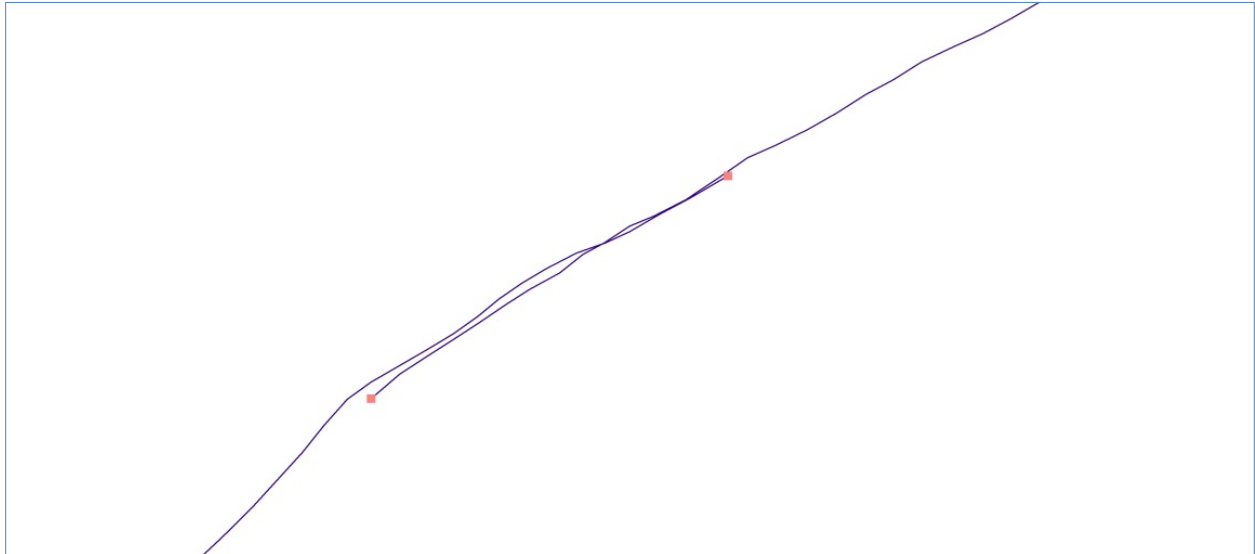


Figure 53. Editing gaps and overlap.

Creating Metadata for the Shoreline Shapefile

The GULN has created a metadata template for the shoreline change protocol that already contains much of the relevant information regarding creation of the line shapefile (Z:\gis\guis\mon\geomorph\guisShorelineChangeMetadataTemplate.xml). Most of the remaining information to be included in the metadata record will be derived directly from the field sheet completed prior-to and during the data collection process. Table 1 summarizes where this information should be included in the metadata file.

Table 1. Organizational comparison of field data and metadata files.

Field form data	Metadata tag
Park unit	Abstract, Keywords
GPS/GNSS unit make and model	Process step, Process description
Expected accuracy with differential correction	Positional accuracy, Horizontal positional accuracy, Horizontal positional accuracy report
GPS/GNSS unit settings	Positional accuracy, Horizontal positional accuracy, Horizontal positional accuracy report
Who processed the data	Process step, Process contact
Software used to download and post-process data; Base station(s) used; Description of any data editing	Process step, Process description

List of Final Post-Processed Data Products

The following raw data products should be stored, archived, and their locations documented in the shoreline change database:

1. All raw GPS data files (.ssf) downloaded from the data logger;
2. All differentially corrected GPS data files (.cor), if real-time correction was not employed;
3. Cleaned, exported ESRI point shapefile (.shp; if applicable);
4. Cleaned, continuous shoreline line shapefile (.shp);
5. Metadata for the above line shapefile;
6. Hard or scanned copies of all field sheets;
7. Photographs taken during survey.

Literature Cited

Bracewell, J. 2017. Conducting the GPS shoreline survey—Version 1.0. Gulf Coast Network Standard Operating Procedure NPS/GULN/SOP—SHR05. Gulf Coast Network, Lafayette, Louisiana. Available at <https://irma.nps.gov/DataStore/Reference/Profile/2242637> (last accessed August 2017).

National Oceanic and Atmospheric Administration (NOAA). 2017. National Geodetic Survey. Available at: <https://www.ngs.noaa.gov/> (last accessed February 2017).