C-Nav®

C-Tides® Quick Start Guide

Revision 6

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Release Notice

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6	08/15/2018	Updated for C-Tides v2.2.2	C. Thompson
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1	05/09/2013	Initial document creation	C. Thompson

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Table of Contents

List of Figures

Manual Organization

This is a short tutorial explaining the minimum steps required to configure a fresh **Oceaneering® C-Tides®** worldwide tidal data software installation. Sections are organized in a manner that facilitates quick operator orientation.

The first section, Section 1 - Installation (Page 10), details how to install both versions of the C-Tides® software and all prerequisite software necessary to run either C-Tides® application.

Section 2 - Running C-Tides® Online Software (Page 16) and
Section 3 - Running C-Tides® Offline (Page 18) give basic instructions for running the C-Tides® applications.

Section 4 - Calculations (Page 20) gives a brief description of each of the various values output by the C-Tides® software suite and how they are derived.

Appendix A - Frequently Asked Questions (Page 22) explains how to resolve a few of the common errors that occur while running either C-Tides® software.

Related Documents

CNAV-MAN-018.7 (C-Tides Online User Manual)

Similar to this manual, the C-Tides® Online User Manual describes how to configure and operate the C-Tides® Online application. It is available on the **Oceaneering® C-Nav®** website at https://www.oceaneering.com/C-Nav/Software/C-Tides/PDFDownloads/CNAV-MAN-018.7%20%28C-Tides%20Online%20Users%20Manual%29.pdf.

CNAV-MAN-019.7 (C-Tides Offline User Manual)

Similar to this manual, the C-Tides® Offline User Manual describes how to configure and operate the C-Tides® Offline application. It is available on the C-Nav® website at https://www.oceaneering.com/C-Nav/Software/C-Tides/PDFDownloads/CNAV-MAN-019.7%20%28C-Tides%20Offline%20Users%20Manual%29.pdf.

CNAV-MAN-020.3 (Sentinel Driver Installation Manual)

This is a short tutorial explaining the how to install Sentinel security driver that is required to run the C-Tides® software. It is available on the C-Nav® website at https://www.oceaneering.com/C-Nav/Software/Utilities/PDFDownloads/CNAV-MAN-020.3%20(Sentinel%20Driver%20Installation%20Manual).pdf.

CNAV-MAN-021.4 (MATLAB Compiler Runtime Installation Manual)

This is a short tutorial explaining the how to install the MATLAB Compiler Runtime (MCR) library that is used by the C-Tides® software. It is available on the C-Nav® website at https://www.oceaneering.com/C-Nav/Software/C-Tides/PDFDownloads/CNAV-MAN-021.4%20%28MATLAB%20Compiler%20Runtime%20Installation%20Manual%29.pdf.

Modelling the global ocean tides: modern insights from FES2004

Details the methodology used to determine the predicted tide values used in the C-Tides® software. It is available on the C-Nav® website at https://www.oceaneering.com/C-Nav/Software/C-Tides/PDFDownloads/FES2004%20Modern%20Insights.pdf.

Unified Tidal Analysis and Prediction Using the UTide Matlab Functions

Describes the underlying methodology of the UTide harmonic analysis used in the C-Tides® Offline application. It is available on the C-Nav® website at https://www.oceaneering.com/C-Nav/Software/C-Tides/PDFDownloads/2011Codiga-UTide-Report.pdf.

Manual Conventions

Arial font is used for plain text in this document.

Arial italic font is used for settings names.

"Arial quoted" font is used for settings values.

Arial Bold font is used for button names.

Arial Bold Italic font is used for menu items.

Arial Blue font is used for cross-references.

Arial Blue Underline font is used for hyperlinks.

Arial red italic is used for typed commands.

Arial Bold font size 10 is used for captions.

ARIAL BLACK ALL-CAPS font is used for port connection names.

⚠ This symbol means Reader Be Careful. It indicates a caution, care, and/or safety situation. The user might do something that could result in equipment damage or loss of data.

⚠ This symbol means Danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical and RF circuitry and be familiar with standard practices for preventing accidents.

Important notes are displayed in shaded text boxes.

Please note:
Such note boxes display important information that should not be ignored.

Simple file content is displayed in Courier New Black font in a text box.

```
#Sample File
Version 0.1
```

Section 1 - Installation

System Requirements

The minimum requirements to run C-Tides® software are:

- Windows 7 OS
- 2 GHz Processor
- 2 GBs RAM
- 1.25 GBs HDD Disk Space

> **Note:**
> The C-Tides® software cannot be run on Windows XP.

Sentinel Dongle Driver Installation

The C-Tides® software are protected by a security dongle that must be installed before running the application. For instructions on how to install the Sentinel Driver, please see the document Sentinel Driver Installation Manual available on either the installation thumb drive or our website https://www.oceaneering.com/positioning-solutions/customer-access-and-resources/#sw-ctides.

MATLAB Compiler Runtime Installation

The C-Tides® applications are compiled MATLAB software that require the installation of the MATLAB Compiler Runtime (MCR). For instructions on how to install the MATLAB Compiler Runtime library, please see the document MATLAB Compiler Runtime Installation Manual available on either the installation thumb drive or our website https://www.oceaneering.com/positioning-solutions/customer-access-and-resources/#sw-ctides.

Install C-Tides® Software

The installation process is the same for both the C-Tides® Online application and the C-Tides® Offline application. If installing both on the same computer, it is recommended to install them into the same folder. This will prevent the need for installing the large data files twice.

This guide will use the C-Tides® Offline application as the example.

1. Copy the installation files onto your computer.

2. Double click on the C-Tides Offline vX.Y.Z Installer.exe to start the installation wizard for the C-Tides® Offline application.

3. Ensure that all Windows programs are closed then press **Next >** to proceed.
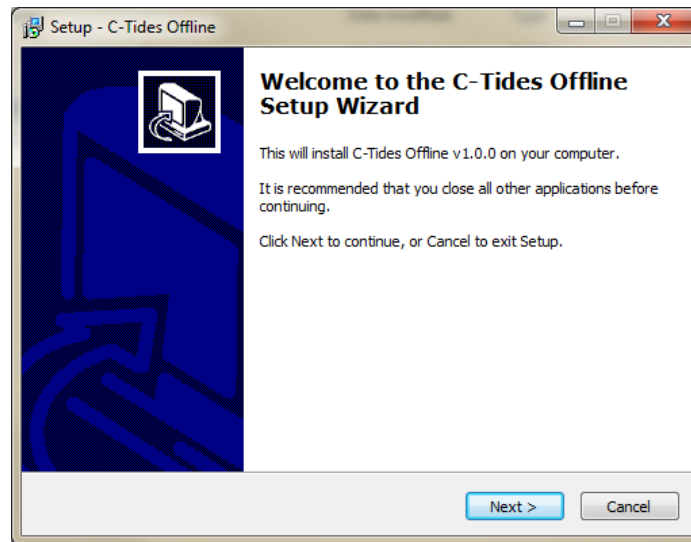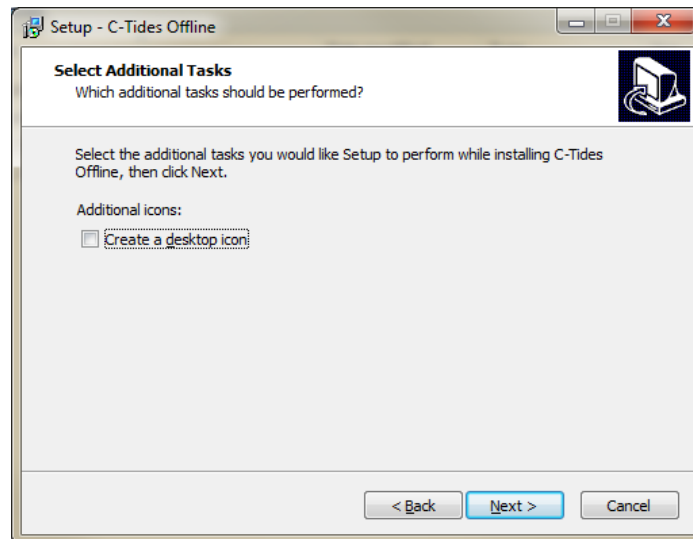

4. Choose the *Destination Location* then select **Next >** to proceed. The default installation location is C:\Program Files (x86)\C-Nav\C-Tides.
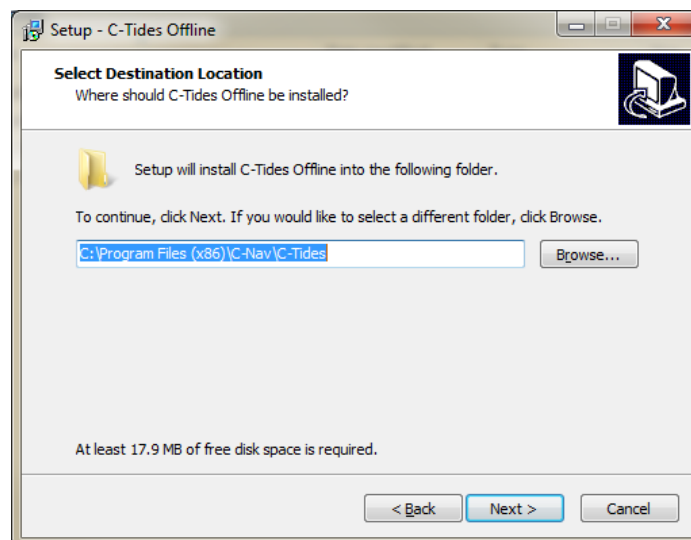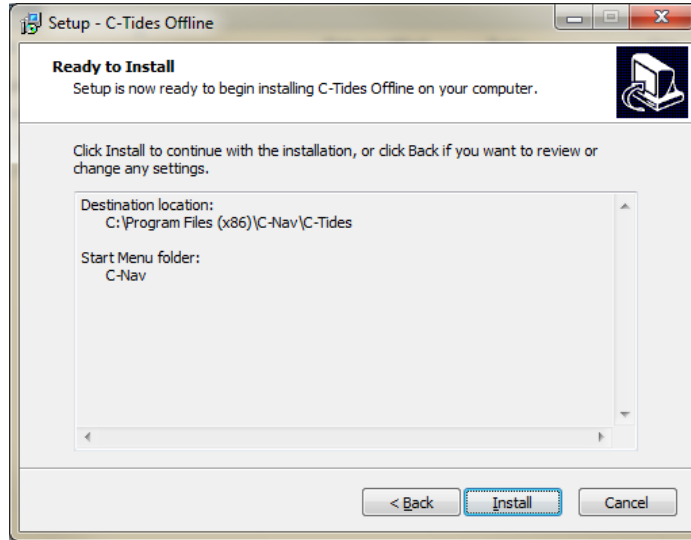
5. Select a Program Folder to add a shortcut in the Windows Start menu and select **Next >** to continue. The default folder is "C-Nav".
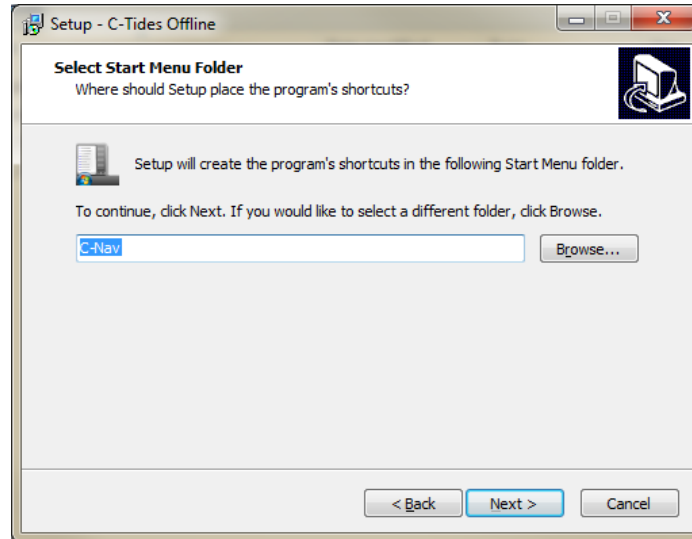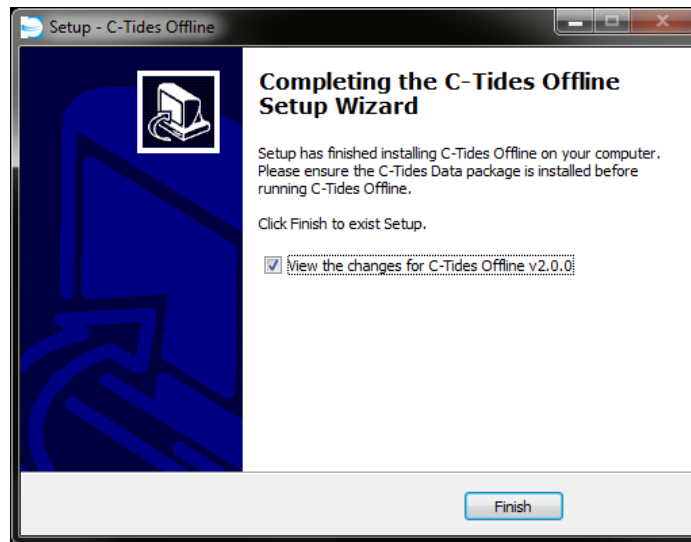

6. Optionally a shortcut can be placed on the Desktop by checking the *Create a desktop icon* checkbox.

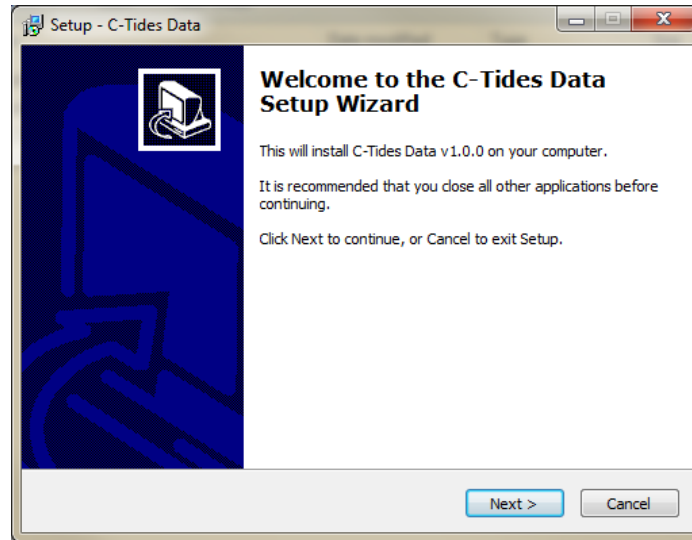7. Confirm the settings are correct and press **Install** to begin the installation.

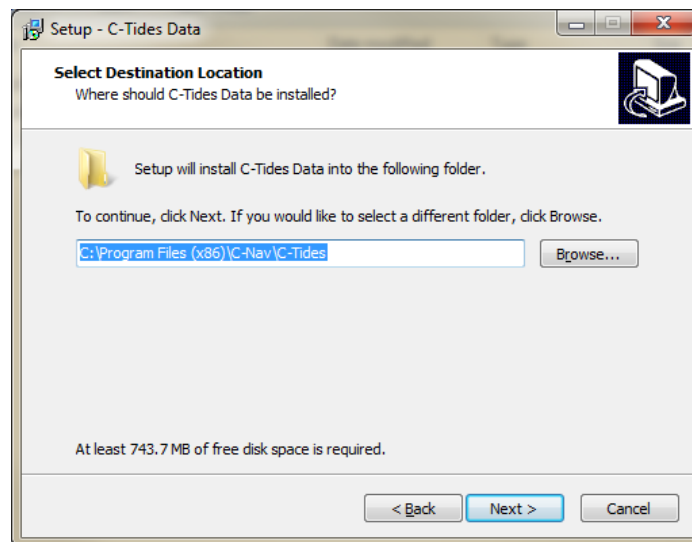8. Select **Finish** to complete the installation.

Install C-Tides Data

1. Double click on the C-Tides Data vX.Y.Z Installer.exe to start the data installation wizard.

2. Choose the *Destination Location* then select **Next >** to proceed. The *Destination Location* should be the same as the C-Tides® Online application or C-Tides® Offline application.

3. Review the settings and press **Install** to begin the installation. The installation can take a few minutes depending on the computer.
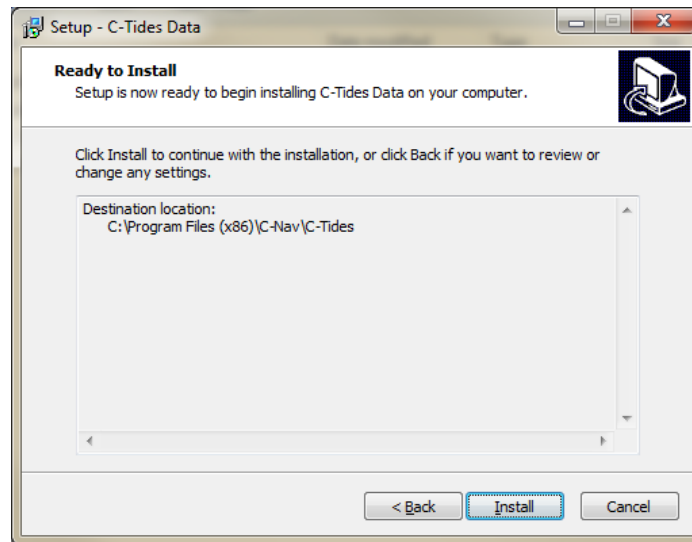
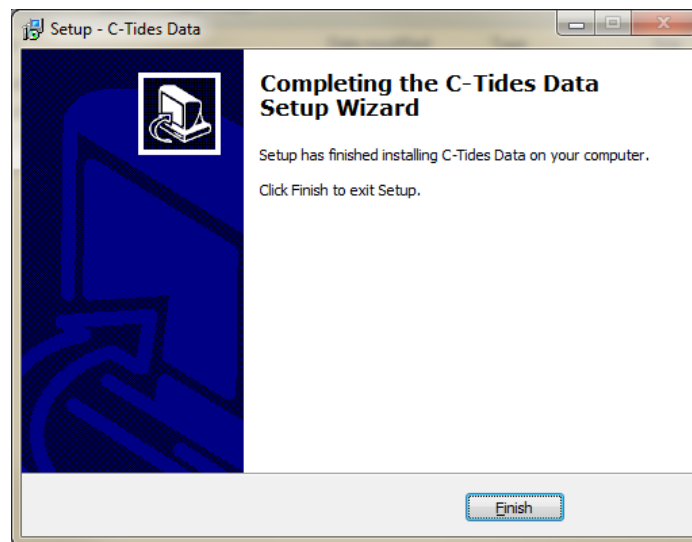4. Select **Finish** to complete the installation.

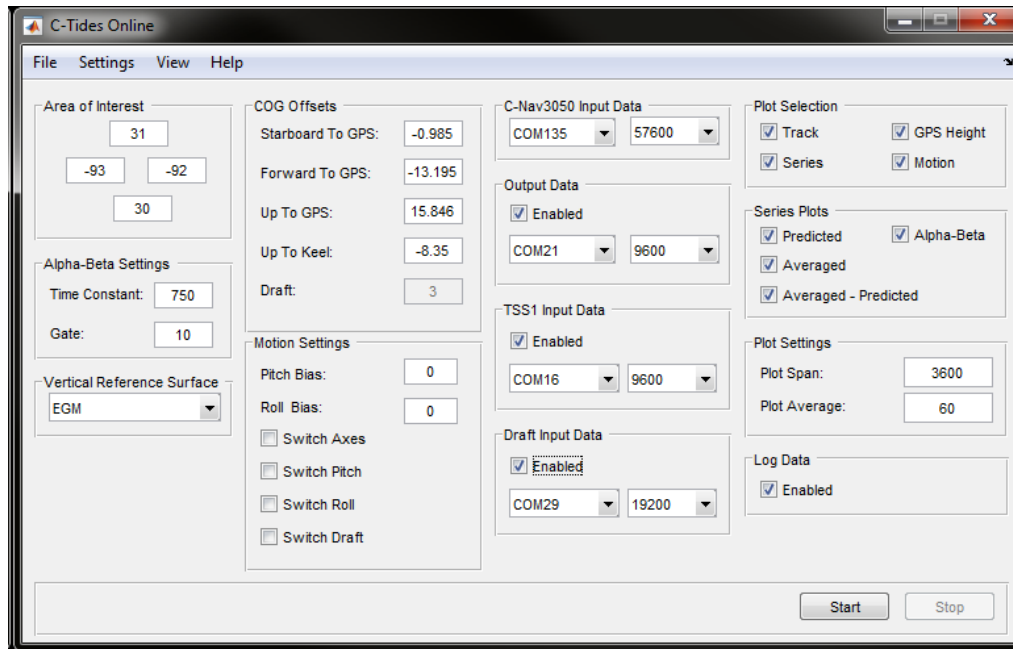# Section 2 - Running C-Tides® Online Software

Figure 1: C-Tides Online

The following is the basic sequence for using the C-Tides® Online application. It is available from within the application by selecting the **Help / Show Help** menu.

1. Select **C-Tides Online** from the Start Menu or double-click the desktop icon.
2. Load previously saved settings if available with **File / Import Settings**.
3. Enter the latitude and longitude extents of the *Area of Interest* (AOI), somewhat larger than the planned prospect.
4. To verify the correct AOI, **View / Plot Surfaces** and **View / Plot Constituents**.
5. Select the *Vertical Reference Surface* (VRS).
6. Enter the Alpha-Beta *Time Constant* (0 - 1500 seconds) and *Gate* (0 - 20 meters).
7. Select the *Plot Average* (10 - 3600 seconds) and *Plot Span* (60 - 3600 seconds).
8. Select the desired plots by checking the various options in the *Plot Selection* section.
9. If plotting the *Series* plot, check which individual data series to plot in the *Series Plots* section.

10. Enter the *COG Offsets* (-999.9 - 999.9 meters).
11. Enter any *Pitch* and/or *Roll Bias* (-10 - 10 degrees) if necessary.
12. Switch the axes orientation, pitch, or roll rotation senses if necessary.
13. Select the *C-Nav3050 PVT1B Input Data Port* and *Baud Rate*.
14. If Output is desired, check the *Enabled* checkbox and select the *Output Data Port* and *Baud Rate*.
15. If TSS1 input data is desired, check the *Enabled* checkbox and select the *TSS1 Input Data Port* and *Baud Rate*.
16. If draft input data is desired, check the *Enabled* checkbox and select the *Draft Input Data Port* and *Baud Rate*.
17. If draft input data is desired, select ***Settings / Configure Draft Message*** to configure the details of the draft data message.
18. If logging is desired, check the *Enabled* checkbox in the *Log Data* section.
19. Export the current settings if desired.
20. Press the **Start** button to start processing the input data.
21. Press the **Stop** button when done.
22. The resulting C-Tides® software data files can be opened in a spreadsheet or processed further in the C-Tides® Offline application, which has additional capabilities such as Doodson X0 and UTide harmonic analysis.
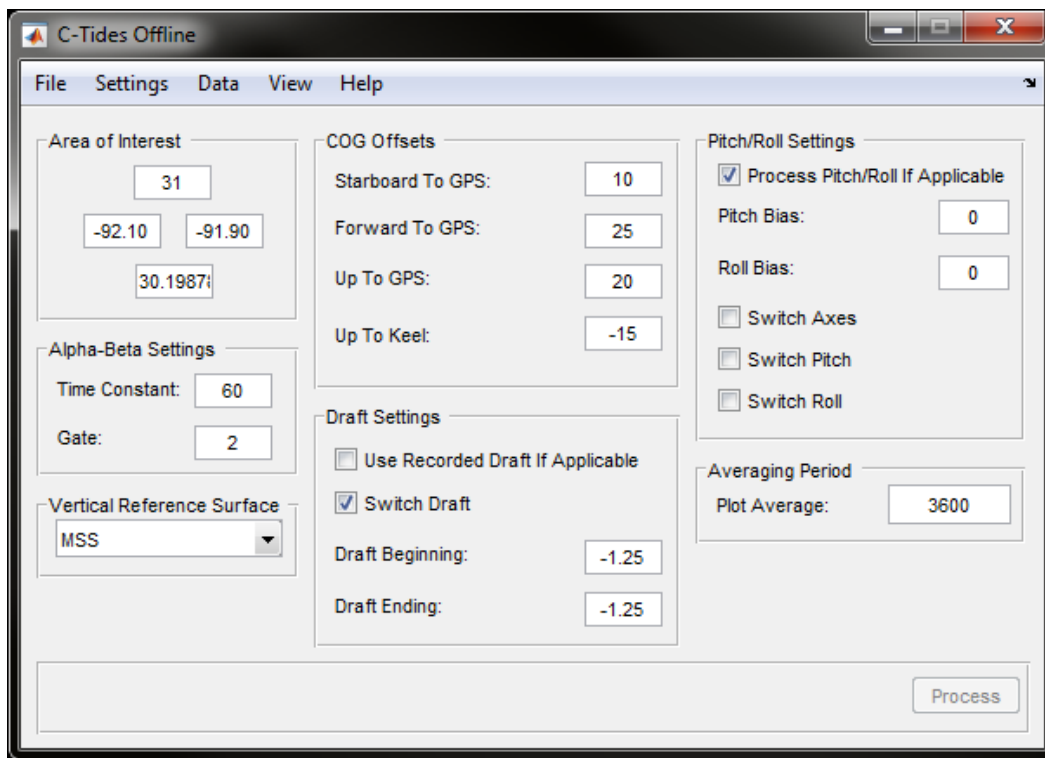
Section 3 - Running C-Tides® Offline Software

Figure 2: C-Tides Offline

The following is the basic sequence for using the C-Tides® Offline application. It is available from within the application by selecting the **Help / Show Help** menu.

1. Select **C-Tides Offline** from the Start Menu or double-click the desktop icon.
2. Load previously saved settings if available with **File / Import Settings**.
3. Select the *Vertical Reference Surface* (VRS).
4. Enter the Alpha-Beta *Time Constant* (0 - 1500 seconds) and *Gate* (0 - 20 meters).
5. Select the *Plot Average* (10 - 3600 seconds).
6. Enter the *COG Offsets* (-999.9 - 999.9 meters).
7. Enter any *Pitch* and/or *Roll Bias* (-10 - 10 degrees) if necessary.
8. Switch the axes orientation, pitch, or roll rotation senses if necessary.
9. Export the current settings if desired.
10. Load the raw data to be processed with **File / Load PVT1B Data** or **File / Load C-Tides Data**.

- Multiple data files can be loaded, but only if they are of the same type. i.e. all PVT1B or all C-Tides® software data format.

11. Review and dismiss the resulting plots. They can be re-plotted at any time with *View / Plot Raw Data*.

12. The *Area of Interest* (AOI) will be automatically determined by the loaded data. To verify the correct AOI, *View / Plot Surfaces* and *View / Plot Constituents*.

13. If PVT1B data has been loaded, it is efficient to save them in the C-Tides® software data format with *File / Save Raw Data*.

14. Press the **Process** button to process the loaded data.

15. Review and dismiss the resulting plots. They can be re-plotted at any time with *View / Plot Processed Data*.

16. Perform harmonic analysis of the tides with *Data / UTide*.

17. Save the processed data in C-Tides® software data format if desired with *File / Save Processed Data*.

18. If desired, use *Data / Decimate* to decimate the processed data and save it to disk in the C-Tides® software data format.

19. The resulting C-Tides® software data files can be opened in a spreadsheet.

Section 4 - Calculations

The C-Tides® software calculates several values useful when dealing with tides. Below are some details about each.

Predicted Tide

The predicted tide values are derived from an independent solution that is detailed in the paper *FES 2004 Modern Insights*, available on the C-Nav® website. The values are based on a combination of MSS and tide gauge values around the world. Within the C-Tides® software, the values are interpolated to the coordinates of the C-Nav3050® receiver. This value is typically within 50 cm any of the Vertical Reference Surface models. The value is output in meters.

Calculated Tidal Height

The calculated tidal height is derived based on the real-time ellipsoidal height of the C-Nav3050® receiver, the Center of Gravity Offsets adjusted for any pitch, roll, or draft movement, and the selected Vertical Reference Surface. The result gives the user the tidal height above the selected VRS in meters.

Filtered Tidal Height

Using the *Time Constant* and *Gate* settings, the C-Tides® software will perform an alpha-beta filtering technique on the calculated tidal height. The result is a smoothed tidal height above the selected VRS in meters.

Averaged Tidal Height

Using the *Plot Average* setting, calculates an average of the filtered tidal heights. The result is a tidal height above the selected VRS in meters.

Averaged Tidal Height Minus Predicted Tide

A simple subtraction of the average tidal height value by the predicted tide value. The result is given in meters.

Doodson XO

The Doodson XO filter process is useful for deriving a local VRS approximating MSS, valid during the period of observations. The value is the separation between the Doodson XO derived VRS and the selected VRS in meters. This value is only available via post-processing in the C-Tides® Offline application.

> **Note**:
>
> The Doodson XO value is provided for reference and QC purposes only. It is not used in any of the C-Tides® calculations.

UTide

The UTide harmonic analysis process will make an estimate of the 14 highest order harmonics of the measured tide. The calculation requires a minimum of three days of data. The value output for each epoch is the tidal height resulting from the use of the 14 harmonic parameters above the VRS in meters. This value is only available via post-processing in the C-Tides® Offline application.

Appendix A - Frequently Asked Questions

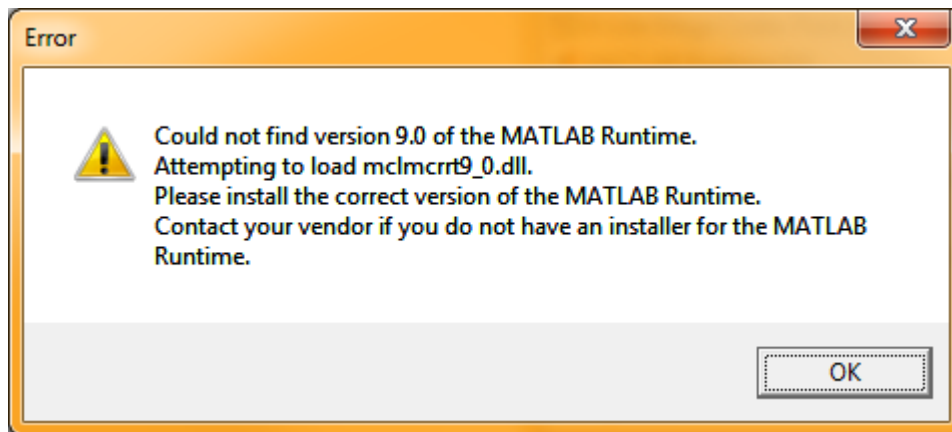*When I start the C-Tides® application, I get an error message about the MATLAB Runtime?*

Figure 3: Missing MATLAB Runtime Error Dialog

This occurs when the proper MATLAB Compiler Runtime has not been installed. Please follow the instructions in the MATLAB Compiler Runtime Installation (Page 10) section.

When I try to extract an AOI, why do I get the error message "Can't find "XXXX.mat" on path"?

Figure 4: Missing File Error Dialog

There are three possible reasons for this error.

1. The C-Tides Data package was not properly installed. Please read the section Install C-Tides Data (Page 14). Ensure that the C-Tides Data is installed into the same directory as the C-Tides® application.
2. The *Area of Interest* is too large. Ideally, the AOI should be as small as possible around the desired location. Select a smaller bounding area.
3. The MATLAB runtime has run out of system memory. Restart the C-Tides® application.

My computer made a ding sound while C-Tides was running, and now the application doesn't seem to be doing anything.

The ding sound indicates that the MATLAB Runtime has triggered an unexpected error that caused the C-Tides® software to stop execution. It is best to close the application and send the error to C-Nav® Support (cnavsupport@oceaneering.com) for further troubleshooting.

To close the application, press **Ctrl + C** in the busy dialog window. This will allow you to then close the main C-Tides® application window.

All errors are logged to a diagnostic log file. The most recent diagnostic log file can be found at:

C:\Users\{USERNAME}\AppData\Local\C-Nav\C-Tides\

When I start the PVT1B input, why do I get the error message "PVT1B data timeout"?
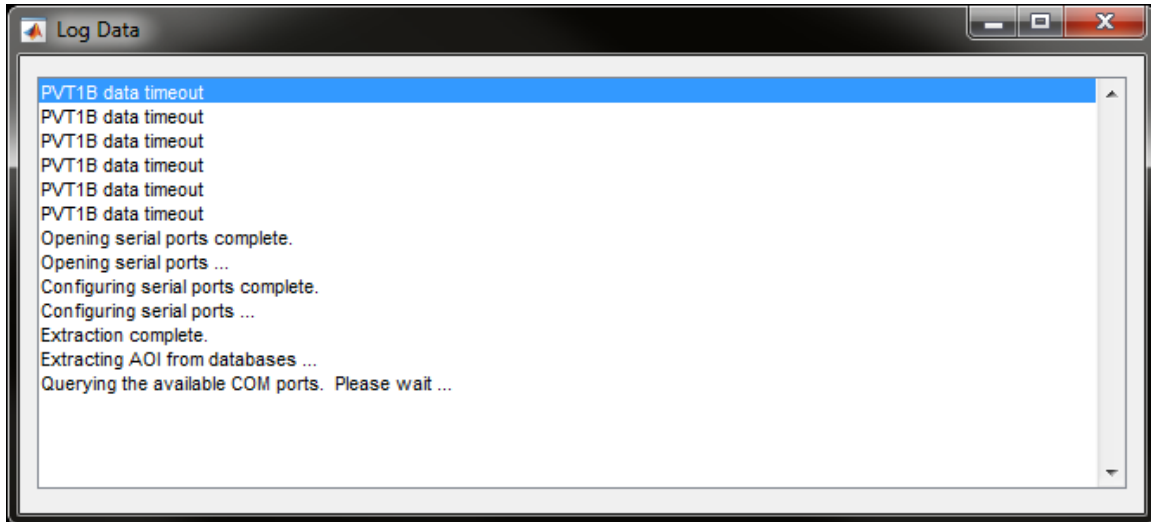

Figure 5: PVT1B Data Timeout in Log Data Dialog

This occurs when the C-Tides® Online application does not receive enough data to properly decode. Check the C-Nav3050® receiver output settings and ensure PVT1B is scheduled for at least 1Hz and that the baud rates match.

When I start the PVT1B input, why are there gaps in the output time?
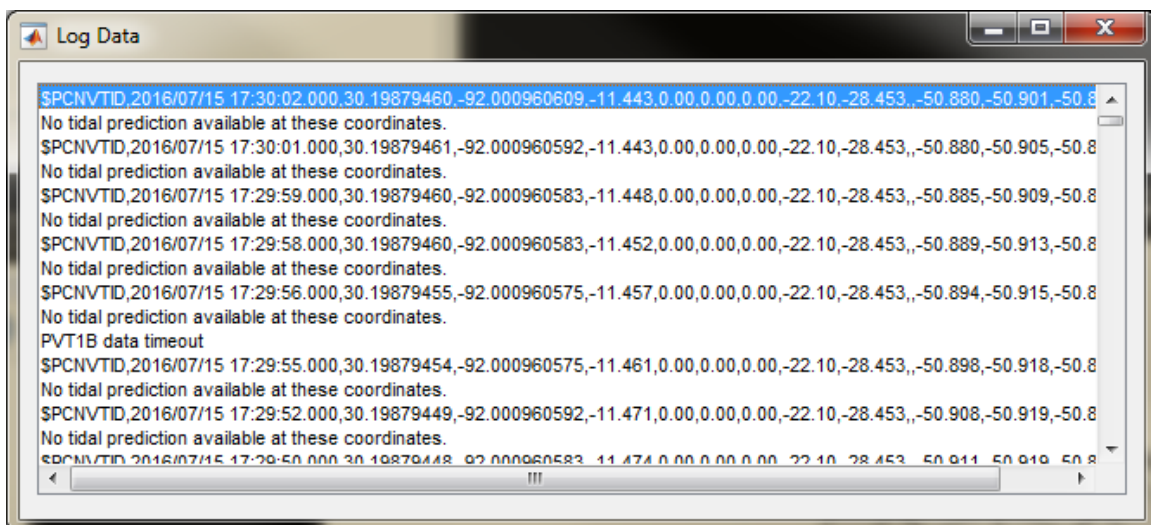

Figure 6: PVT1B Data with Gaps in Log Data Dialog

This occurs when the C-Nav3050® receiver has more messages scheduled on the serial port than the PVT1B. Check the C-Nav3050® receiver output settings and ensure that only PVT1B is scheduled for at least 1Hz.

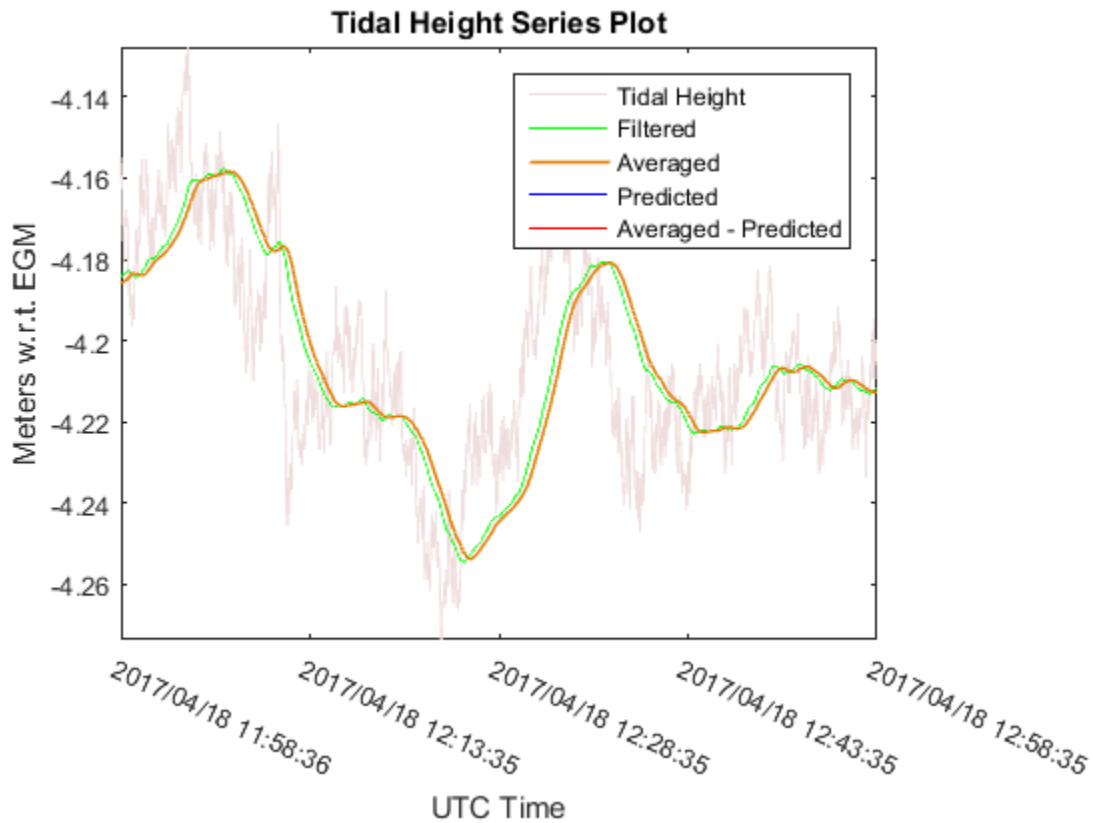***Why is there no predicted data in my AOI?***

Figure 7: Missing Predicted Data

The predicted tide data is not available on land or in some areas near land. The easiest method to determine if the predicted tide data is available in your *Area of Interest* is to **Plot Constituents**. The last constituents graph, "ISLW: Approximately LAT w.r.t. MSL (m)", will be non-white in areas with predicted tide data.

In certain areas there may be significant differences between the EGM and MSS model results. The MSS model should give a better correlation to the predicted tide beyond 10 km from shore. If both models are significantly different to the predicted tide, check the COG offsets.
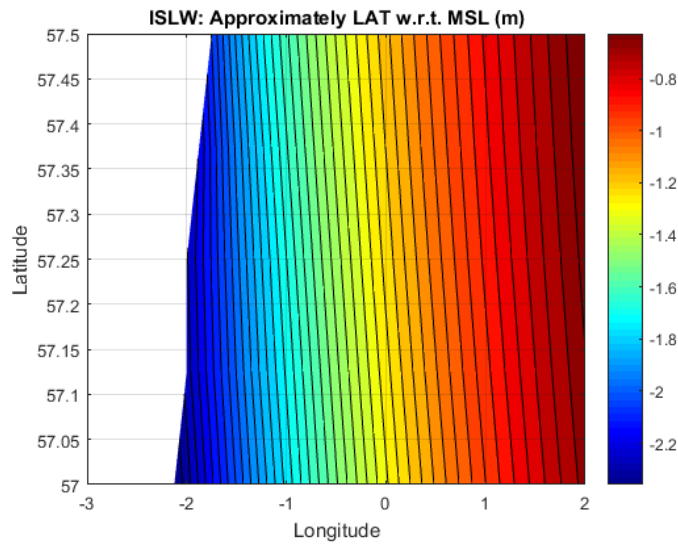
Figure 8: Sample Constituents Plot

Figure 8: Sample Constituents Plot (Page 26) shows an AOI with partially available predicted data. Figure 9: Predicted Data Worldwide Availability (Page 26) shows the availability of the predicted data worldwide. A larger version is available on the C-Nav® website: https://www.oceaneering.com/C-Nav/Images/islw_world.png
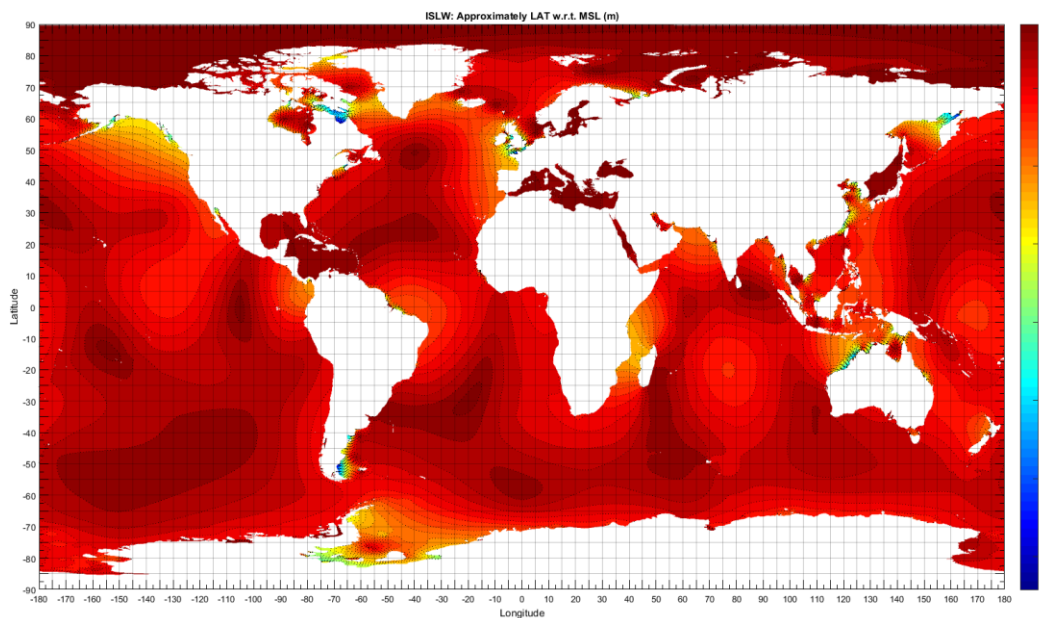

Figure 9: Predicted Data Worldwide Availability

When post-processing data I get a 'Discontinuities' error. How do I resolve this?
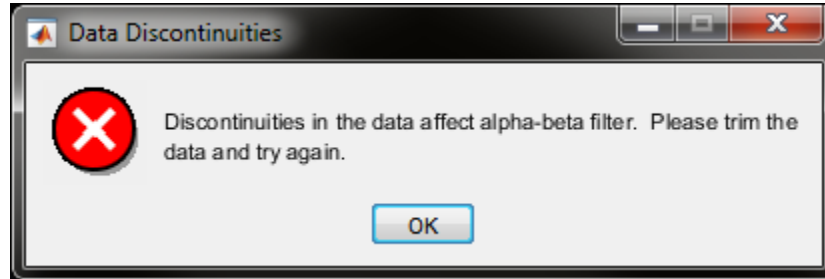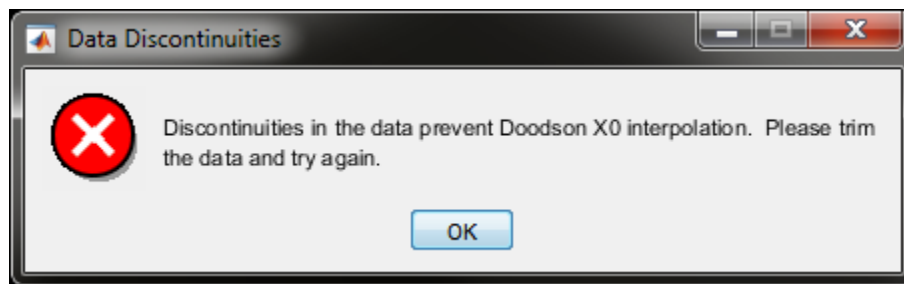

Figure 10: Data Discontinuities Filtering Error Dialog

Figure 11: Data Discontinuities Doodson X0 Error Dialog

These errors occur when the data is not contiguous, as the example below shows.
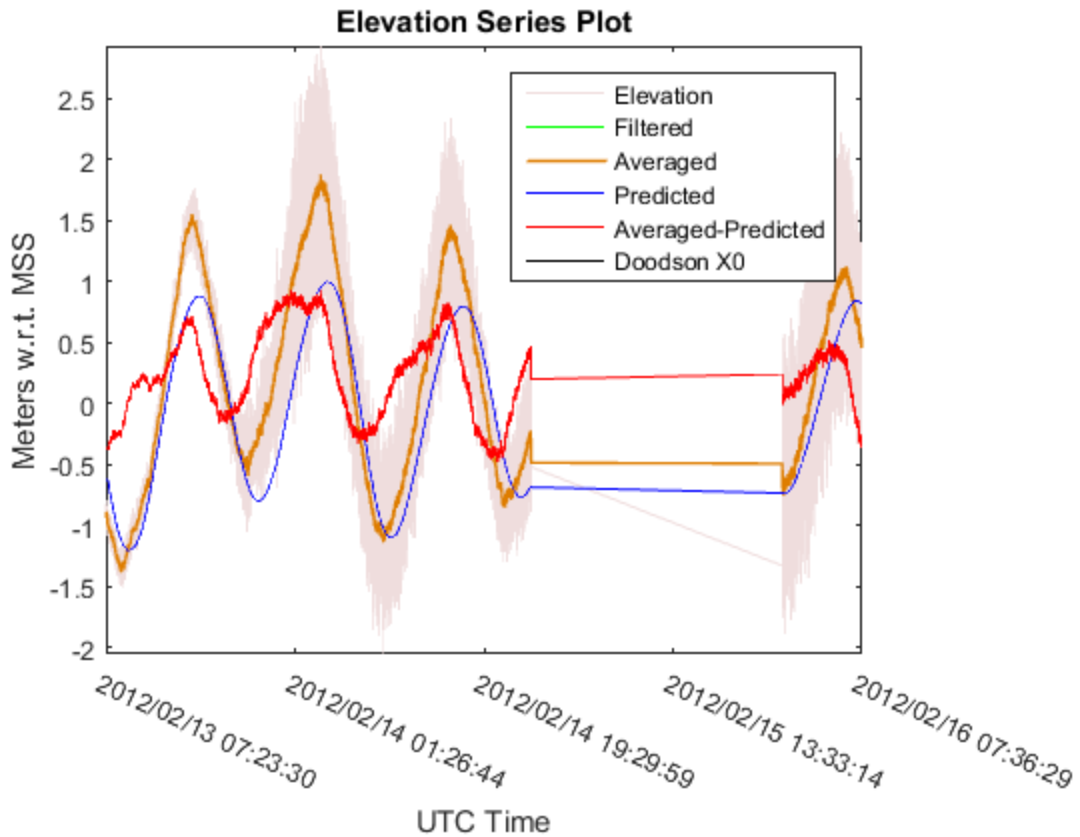
Elevation Series Plot

Figure 12: Non-Contiguous Data

The most likely reason for non-contiguous data is the coordinates for the gaps lie outside of the AOI and were therefore skipped. Increasing the size of the AOI or trimming the data can alleviate the problem.

Why is the tidal height not the same as the predicted tide height?

The predicted tide is a 14-year average of model data. The tidal height is based off real values that are open to influence by local conditions such as weather, GPS errors, or COG offset errors.

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Why is the tidal height not the same as the tide gauge in my area?

The C-Tides® applications are not replacements for a tide gauge system. If the user is close enough to shore that tide gauges are available then the user is too close to shore to be using the C-Tides® software.

- To use the MSS model, the vessel must be 10 kilometers from the nearest land mass.
- To use the EGM model, the vessel must be in water with a depth of at least 10 meters. It is preferable to have a depth of at least 25 meters.

Using these models near-shore or in shallow water will affect the results due to land mass.