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Makef15: An ADCIRC Model Fort.15 Input File Creation GUI for Parameter Specification and Periodic Boundary Forcing

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14. ABSTRACT The User's Manual for the Makef15 Graphical User Interface (GUI) software, makefort15gui.pl, contains descriptions of the software, including its functionality and usage. The Makef15 GUI is a window-based, platform-independent Perl script that can both create or modify the Advanced CIRCulation (ADCIRC) Model Parameter and Periodic Boundary Forcing File (fort.15). The software was developed for ADCIRC version 45.11.					
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1. Description

This document describes the Makef15 Graphical User Interface (GUI) software, *makefort15gui.pl*. The program is a window-based, platform-independent Perl script that can both create a new ADvanced CIRCulation (ADCIRC) Model Parameter and Periodic Boundary Forcing File (fort.15), or modify an existing one. This software was developed for ADCIRC version 45.11.

The GUI software is written in Perl and uses the Perl/Tk module for the graphics. The GUI design aims to follow the structure of the fort.15 file as closely as is feasible. Related parameters are grouped together, and are kept in descending order corresponding to the fort.15 file wherever possible.

a. Overview of the GUI

The GUI is divided into several sections that group the GUI functions and the fort.15 parameters logically. The GUI interface is shown in the sequence of Figures 1 through 4, which were generated on a Linux platform (Fedora Core 3 and Core 6) using the Gnome (version 2.8.0) and KDE (version 3.5.7) desktop environments. Each of these figures presents a view of the GUI as it is scrolled downward one screen at a time with parameter defaults assigned (no input from an existing fort.15 file). At the top of the GUI (Figure 1) is the menu bar. It contains a File menu with Open, Save, and Quit menu items. The menu bar also contains a Help menu with 'About' and Fort.15 Help menu items. Below the menu bar is the uppermost panel (Figure 1), hereafter referred to as the title panel. The title panel is decorative and displays the Naval Research Laboratory Detachment Stennis Space Center (NRL-SSC) and Naval Oceanographic Office (NAVOCEANO) logos with the ADCIRC logo in the center. The remaining panels contain the fort.15 model parameters in logical groupings. The details for each panel are described in §3. It is beyond the scope of this document to describe each parameter individually; the interested reader can refer to the on-line ADCIRC model documentation for details (found at <http://adcirc.org>: Documentation → User's Manual v45 → Input file Descriptions → Model Parameter and Periodic Boundary Forcing File (fort.15)).

Different amounts of the GUI will be visible depending on the size and resolution of the screen being used. The GUI can be resized by the user to a limited extent by dragging a corner of the window or by clicking on the Maximize button in the upper right corner of the window. The width of the GUI is limited so that the layout does not change if the window is resized. Similarly, the height of the GUI is limited, although the height of the current version may be greater than that of some computer monitors.

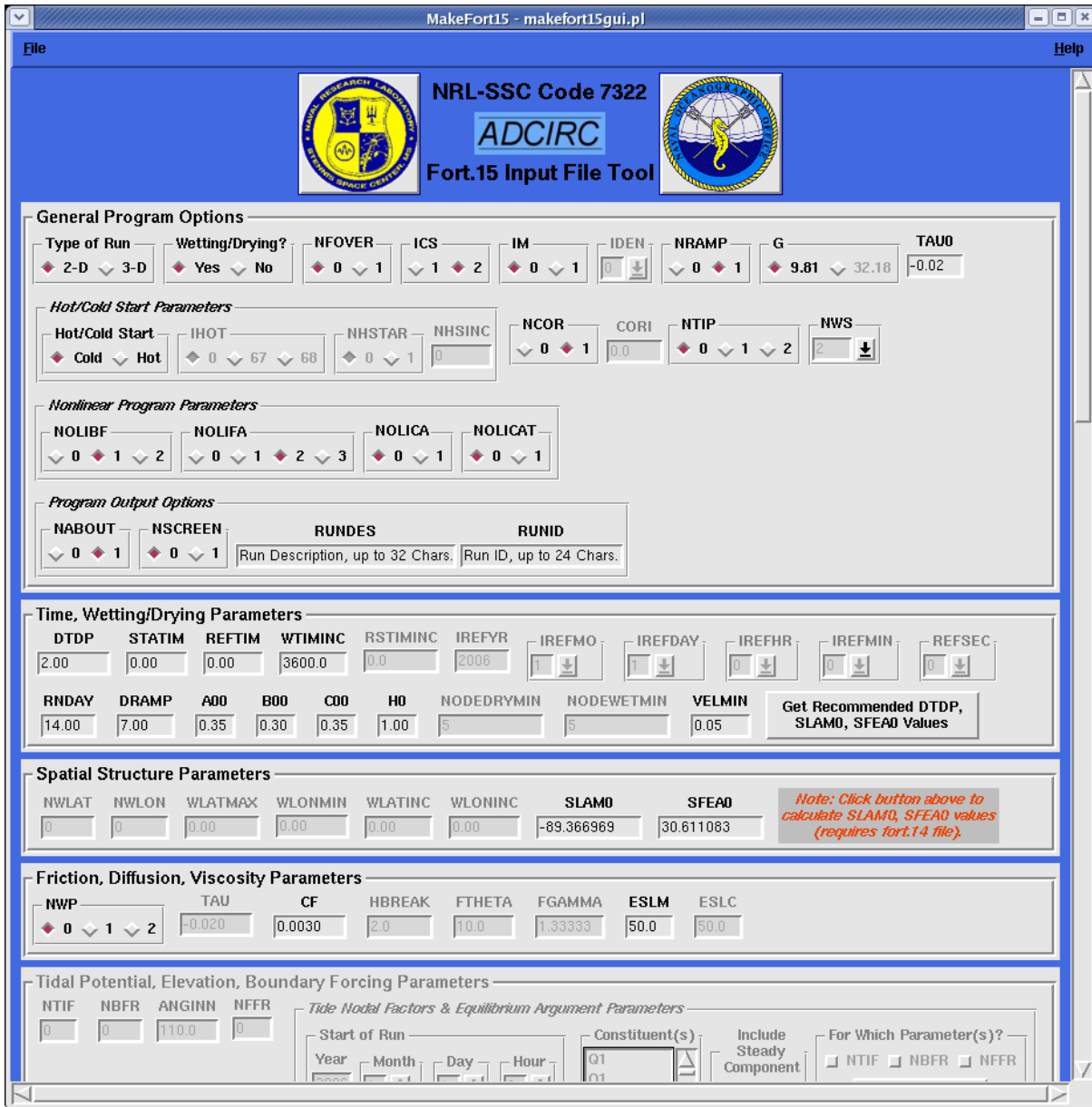


Figure 1. A display of the topmost page of the Makef15 GUI.



Figure 2. A display of the second page of the Makef15 GUI.

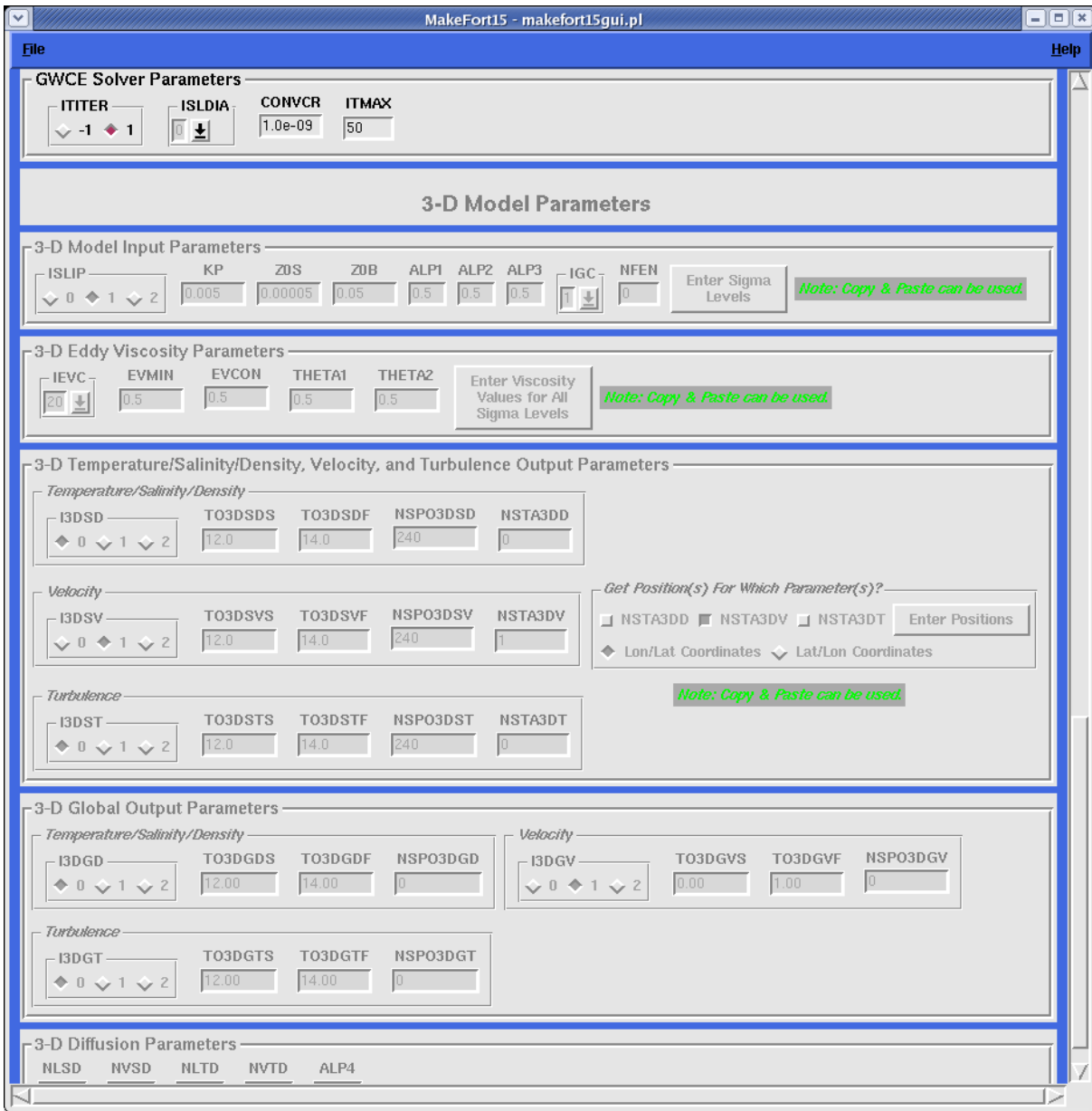


Figure 3. A display of the third page of the Makef15 GUI.

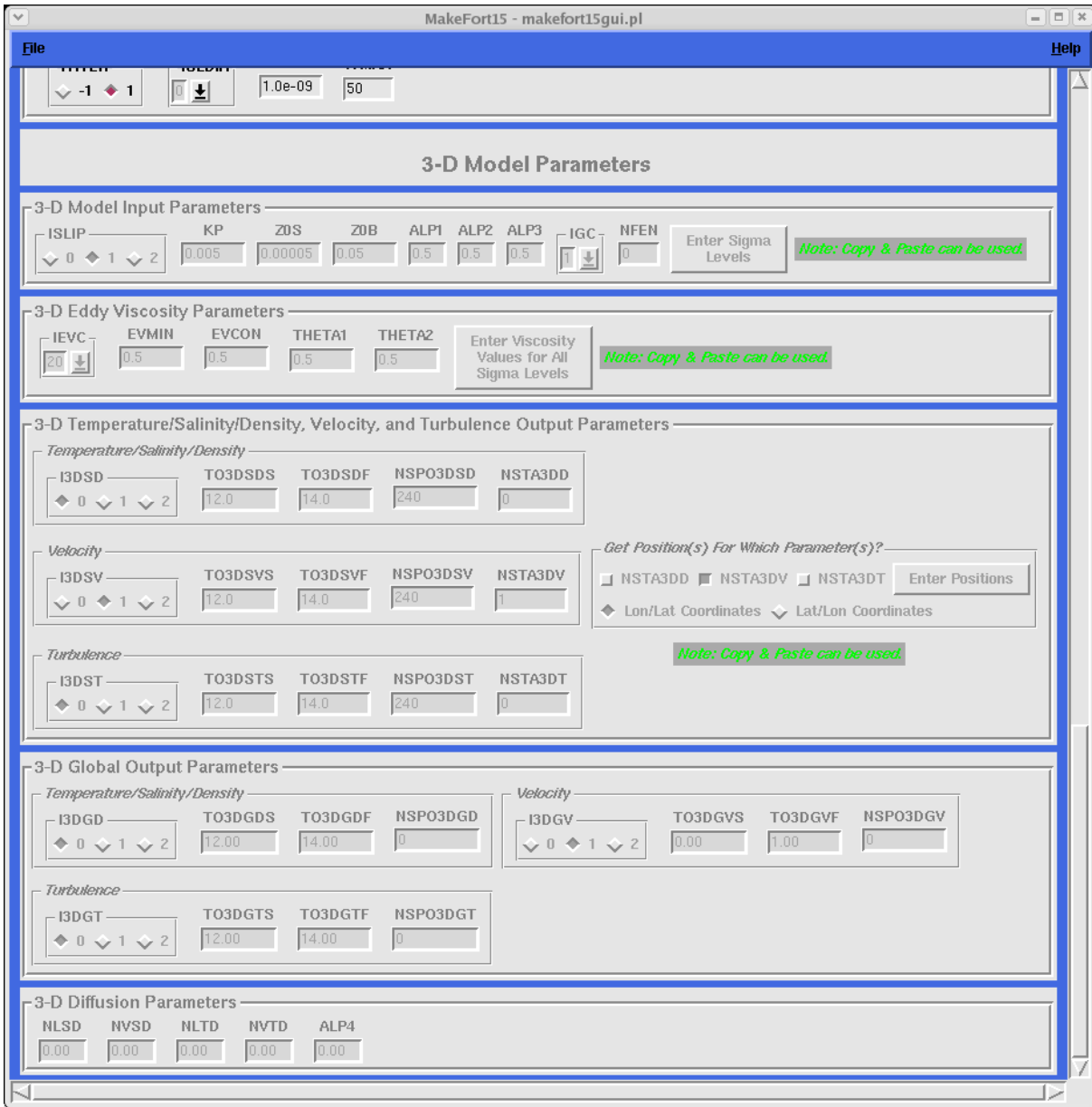


Figure 4. A display of the final page of the Makef15 GUI.

b. Software Components

The complete Makef15 GUI tool consists of sixteen files in total:

1. *adcirc_banner_tiny.gif* - A GIF image file with the ADCIRC banner.
2. *delt_interact.pl* - A Perl script that calculates the mean longitude and latitude of a finite element mesh (FEM) specified by the fort.14 file, and calculates a suggested time step for tidally-dominated flows based on the CFL condition.
3. *extract_gren.F* - A Fortran 90 program that extracts tidal boundary forcing parameters from the Grenoble FES99 global tidal solution database (Lefevre et al., 2002).
4. *Makefile* - A “makefile” to compile the executable program for *extract_gren.F* and its associated subroutines.
5. *Makefile_gfor.w32* - A sample “makefile” for *extract_gren.F* using the Windows® version of the GNU Fortran compiler, *gfortran*.
6. *makefort15gui.pl* - The Makef15 GUI Perl source code and executable program.
7. *navo_log.gif* - A GIF image file with the NAVOCEANO logo.
8. *nrlicon.gif* - A GIF image file with the NRL logo in icon form.
9. *nrltiny.gif* - A GIF image file with the NRL logo.
10. *param_defs_test.txt* - An ASCII text file with default specifications of the ADCIRC model parameters.
11. *README.makefort15gui* - An informational “readme” file for the GUI software.
12. *README.tidefac15* - An informational “readme” file describing certain tidal forcing parameters.
13. *tblk2.f* - A Fortran subroutine called by *extract_gren.F*.
14. *tide_gren.dat* - The Grenoble FES99 global tide solution database.
15. *tide_gren.f* - A Fortran subroutine called by *extract_gren.F*.
16. *tide_fac.f* - A Fortran program to calculate tidal node factors and equilibrium arguments for the periodic boundary forcing.

All of these files must be present, and the Fortran programs must be compiled for the platform on which the system is installed. Note that the file *tide_gren.dat* is a big-endian binary file requiring compilation of the *extract_gren.F* program with appropriate byte-swapping options as contained in the two provided makefiles.

c. Software Prerequisites

Perl must be installed on the platform on which the software will be installed. On Windows®-based systems, the latest version of Perl from ActiveState Software Inc. (www.activestate.com) is recommended. The Perl modules, Perl/Tk and Date::Manip, must be installed for this script to work. These third-party modules are available through the World Wide Web (WWW) at the Comprehensive Perl Archive Network (CPAN) (www.cpan.org). The ActiveState version has Perl/Tk bundled with the core Perl installation. An existing ADCIRC Grid and Boundary Information File (fort.14) must be present in the current working directory for certain options to work.

The standalone, external Perl script, *delt_interact.pl*, must be present in the same location as

the GUI installation for proper execution of the time step calculations and coordinate transformations using the Carte Parallelo-Grammatique Projection (CPP). Additionally, the external, standalone, Fortran 90 tidal parameter programs, *tide_fac.f*, and *extract_gren.F*, must be present (see §1d for details) to allow computation of the tidal parameters. Although the GUI software is platform-independent, the standalone Fortran programs must be compiled for each platform on which they are installed. A binary tidal parameter database file also must be installed. A copy of this file, or a symbolic link to it, must be present in the user's current working directory. Lastly, several Graphics Interchange Format (GIF) image files must reside in the installation directory. These programs and files are described in §1d.

d. Installation

The *makefort15gui.pl* utility is located in the ADCIRC_Utilities repository in the Makef15 directory. The directory has the following contents:

- CONTENTS
- (directory) Documentation/
 - CONTENTS
 - ADCIRC_MAUAL_MakeF15_FINAL_09-25-2007.pdf
 - *README.makefort15gui*
- *adcirc_banner_tiny.gif*
- *delt_interact.pl*
- (directory) fortran/
 - *adcirc_bc.f*
 - *grenoble99.f*
 - *tide_fac.f*
- *makefort15gui.pl*
- *navo_log.gif*
- *nrlicon.gif*
- *nrltiny.gif*
- *param_defs_test.txt*

The tidal node factor and equilibrium argument processing program, *tide_fac.f*, should be compiled manually in the fortran subdirectory. The Grenoble FES99 database and associated extraction software are located in the ADCIRC_Utilities repository in the Boundary_Processing/Forcings/Tidal/Constituents/Grenoble_FES99 directory. The files of interest are as follows:

- *tide_gren.dat*
- *tide_gren.f*
- *extract_gren.F*
- *tblk2.f*
- *Makefile*
- *Makefile_gfor.w32*

Step 1: Compilation

The Grenoble FES99 database extraction program, *extract_gren.F*, should be compiled using the supplied *Makefile*. An alternative makefile, *Makefile_gfor.w32*, is supplied for use on Windows®-based systems.

(OPTIONAL) Step 2: Define Environmental Variables for Tidal Parameter Programs

Two environmental variables may be set, **TIDE_PROG1** and **TIDE_PROG2**, which identify directories other than the default ADCIRC_Utility/Boundary_Processing/Forcings/Tidal/Constituents/Grenoble_FES99 directory for the tidal database programs. These user-specified directories define the location of tidal database programs if the user has a non-standard installation. Examples for setting the environmental variables in C shell (csh) and Bourne shell (sh) are as follows:

```
csh: setenv TIDE_PROG1 "/path/to/tide_fac"
csh: setenv TIDE_PROG2 "/path/to/extract_gren.x"
sh: set TIDE_PROG1="/path/to/tide_fac";export TIDE_PROG1
sh: set TIDE_PROG2="/path/to/ extract_gren.x";export TIDE_PROG2
```

in which the actual paths of the programs are specified in place of “/path/to/.” If the environment variables are not set, the default directories are used, and a message to that effect is printed in the command window from which the program was invoked.

2. Fort 15 Creation: Using the *makefort15gui.pl*

a. Execution

The recommended method for starting the GUI is from the command line in a command prompt, or terminal window. The user changes to the appropriate working directory and verifies that the correct fort.14 and fort.15 files are present. An existing fort.15 file is needed only if the user wished to edit that file. The tidal database file, *tide_gren.dat* (see Installation instructions, §1d) also must be present if tidal parameters are to be calculated.

To start the GUI, the user invokes the Perl script *makefort15gui.pl* from the command line as follows:

```
# makefort15gui.pl
```

The full path name must be included if the directory containing the GUI program is not in the user’s path (see Installation, §1d).

As presented in §1a, sequential views of the GUI are shown in Figures 1 through 4. Navigation within the GUI is the same as for other window-based applications: using the mouse or other pointing device, or by using the keyboard (i.e., the four arrow keys, Tab key, Page Up and Page Down keys – *not fully supported*). Menu items also can be navigated in

the standard way using the mouse or keyboard (e.g., Alt-F to select the File menu, then O to select the Open menu item – *not fully supported*).

If an existing fort.15 file is located in the user's current working directory, the GUI program reads that fort.15 file after generating the GUI. If no such file is present, the program loads default values for the parameters (except for boundary forcing values and tidal parameter arrays). Additionally, the user can have the GUI read in an existing fort.15 file by selecting the File → Open menu item, which opens an Open File dialog as shown in Figure 5.

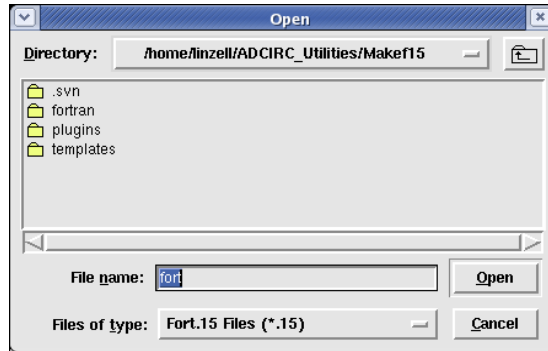


Figure 5. The Open file selection dialog window.

The file selection dialog window shown in Figure 14 has a look and functionality that is common to most window-based applications. The user-supplied fort.15 file can have any name supported by the system. After the fort.15 file name has been entered, the user is prompted to open a new grid file (fort.14) as shown in Figure 6. If the user selects ‘Yes’, then an Open File dialog appears similar to that shown in Figure 5.

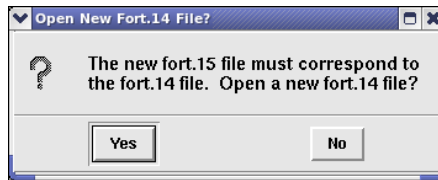


Figure 6. The Window Prompt for opening a new grid (fort.14) file.

If there is an existing fort.14 file in the user's current working directory, the GUI program automatically reads it in after startup. If none is found, an error message is issued (see Figure 7) and the user is prompted for a file name. It is crucial that the fort.14 file corresponds to the fort.15 file in use, particularly if an existing fort.15 file has been read by the software. If an existing fort.14 file is read at program startup and an existing fort.15 file also is read at startup or opened later, the software has no method for determining whether the files correspond to one another, even if the comments at the beginning of the two files indicate such a correspondence. The number, location, and type of boundary nodes are defined by the grid file (fort.14) and used by the fort.15 file when extracting and assigning boundary forcing information. It is therefore incumbent on the user to exercise diligence to ensure that the fort.14 and fort.15 files correspond to one another. Creating a new fort.15 file through the GUI is one way to ensure that the fort.15 file is compatible with an existing fort.14 file.



Figure 7. The ERROR popup issued if a fort.14 grid file needed but not found.

Upon completion of the input for a fort.15 file via the GUI, the new fort.15 file is saved by selection of the File → Save menu item as shown in Figure 8.

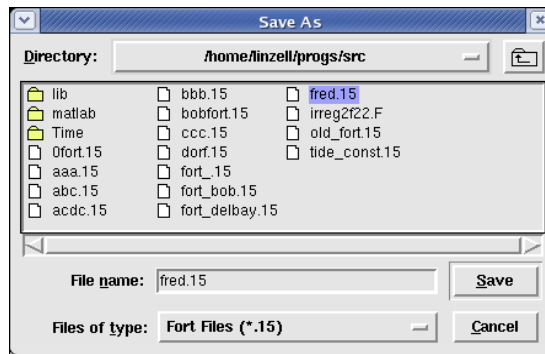


Figure 8. The Save file selection dialog window.

By default, the file is named “fort.15” but the user can choose to save and rename the created fort.15 file. Note that the GUI will append the file extension “.15” to the user-supplied file name. If a file with the same name already exists in the current working directory, the program prompts the user for whether to overwrite the file. An example of this prompt is shown in Figure 9.

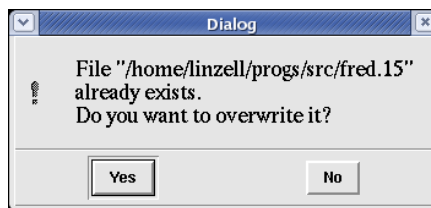


Figure 9. The File Overwrite user prompt window.

If the user chooses to overwrite the file, the new file replaces the existing file version. Otherwise, the file selection dialog reappears and the user chooses a different name for the output file, or cancels the save operation altogether.

b. Specifications

Many parameters within the GUI are relationally driven, that is parameters are disabled or

enabled depending on the values of related parameters. For example, if the default values initially are loaded, the 2-D option is selected, and the 3-D parameters (in the bottom half of the GUI) are disabled and colored gray as shown in Figure 4. Changing from 2-D to 3-D model operation enables the 3-D parameters and any other related parameters that are above the 3-D section, as shown in Figure 10.

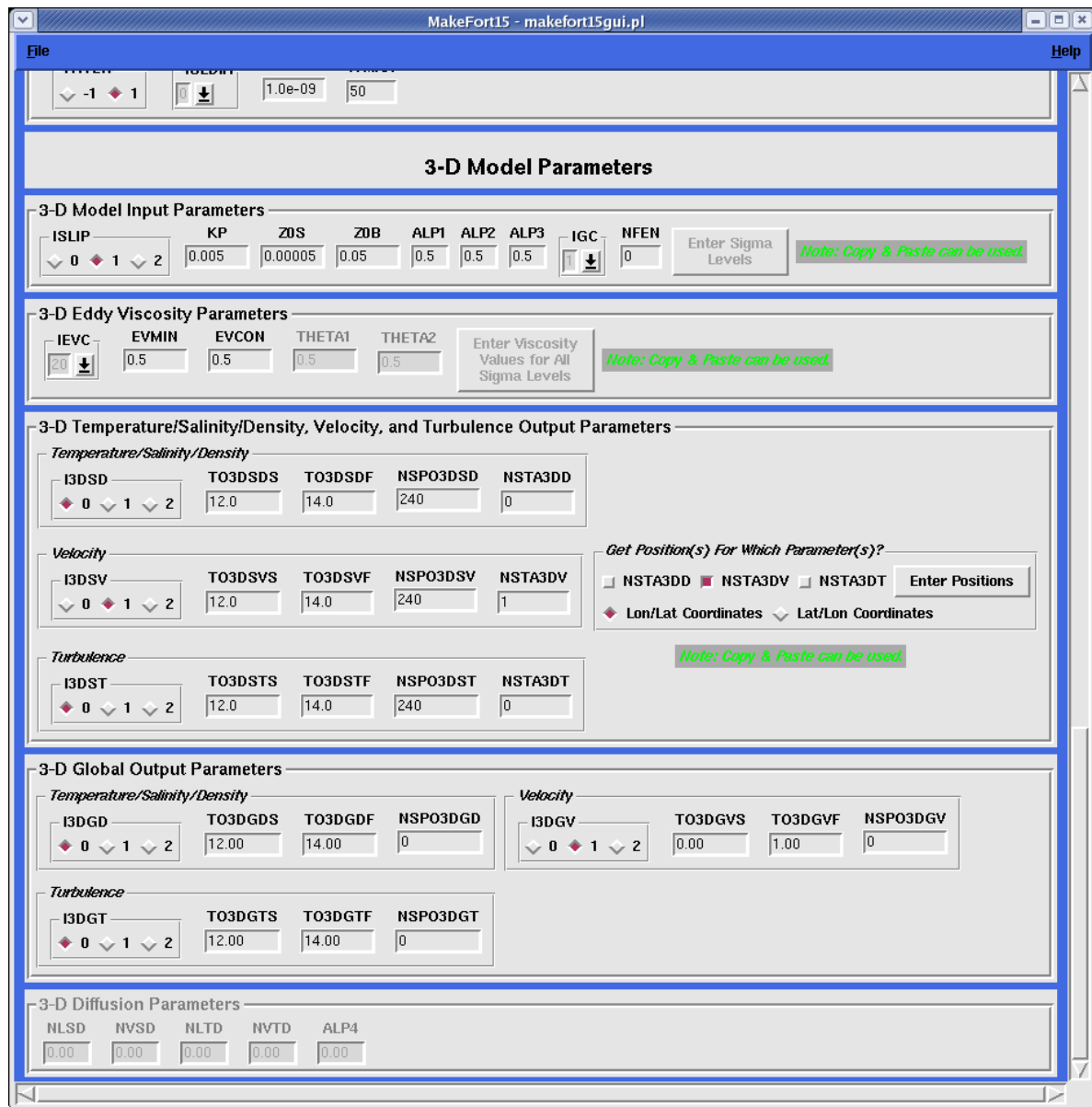


Figure 10. The enabled 3-D section of the GUI after selection of the 3-D model type parameter, IM = 1.

There are numerous other instances in which the values of certain parameters activate or deactivate other related parameters. The logic governing the parameter inter-relationships are discerned from the parameter definitions found in the official ADCIRC model documentation at http://www.adcirc.org/documentation/fort._15.html. The GUI contains

several different types of GUI elements, or “widgets,” for various parameters (e.g., Figure 11). These were described in detail in §1a. The GUI elements include text box entries in which the user modifies or replaces the value in the box. Acceptable values span the range of arbitrary text, floating point, and integer values. Examples are the entry boxes for KP and Z0S in Figure 10. Parameters which must be selected from a list of several specific values have a pull-down list of values from which to select. An example of this type of widget is IGC in Figure 10. The user clicks on the underlined arrow icon on the right side of the widget, and the list appears with the available values. The user selects the desired value, and the list disappears with the chosen value displayed in the widget.

Parameters which can take one or more values from a list of values have a pull-down list in which one or more values can be selected with the mouse by clicking, shift-clicking, or control-clicking, as appropriate. Figure 11 displays an example in which the first tidal constituent in the Constituent(s) list (Q1) is selected by clicking with the mouse, and the second (K1), which is not adjacent to Q1, is selected by holding the Control key and simultaneously clicking with the mouse (i.e., control-clicking).

Parameters in which one value must be selected from among two to four values are represented by radio buttons. When one value is selected, the others are automatically deselected. An example can be seen in Figure 11 under the Friction, Diffusion, Viscosity Parameters panel. The value of NWP can range from 0 to 2. In Figure 11, NWP has been set to 0, so the other values of NWP (1 or 2) have been deselected.

Several parameters can be enabled or disabled, respectively, by selecting or deselecting checkboxes prior to performing some operation. For example, Figure 11 shows three checkboxes for NTIF, NBFR, and NFFR, respectively, above the button labeled, “Generate Tidal Parameters.” The checkbox for NTIF has been selected since NTIF has a value of 2. The checkbox for NBFR has been deselected since NBFR has a value of 0. The checkbox for NFFR has been deactivated, as has the text entry box for NFFR; boundary information within the grid file (fort.14) since has triggered deactivation of the NFFR parameter.

Some parameters are comprised of arrays of values, such as station coordinates, or sigma levels. For these parameter types, a text entry widget is used, as shown later in Figures 19 and 22. This type of widget allows the user to enter values manually, copy and paste the values from another window (e.g., a text editor), or input the values from an existing ASCII text file. Columnar data can be comma-delimited or space-delimited. The entry widgets have brief messages describing the options.



Figure 11. GUI features include a) the selection of non-adjacent list items shown by the highlighted “Constituents” “Q1” and “K1”, b) radio buttons for selecting parameter values as evidenced by the selection of NWP = 0 under the Friction, Diffusion, Viscosity Parameters panel and, c) the enabling and disabling of checkboxes evident for NTIF and NBFR, respectively.

If a file is chosen for input, a message is displayed as shown in Figure 12 describing the required format. Then an open file selection dialog, similar to that shown in Figure 5 appears.

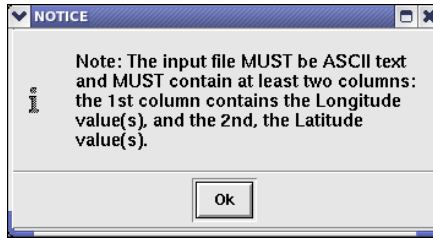


Figure 12. Example of a text entry widget where the message describes the format of an ASCII text input file.

If no file is selected, a notice is displayed (Figure 13) prompting the user to try file selection again.

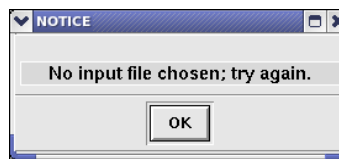


Figure 13. GUI message indicating that no input file was chosen; prompts the user to try again.

Once an input file is selected and read, a status message is displayed indicating the number of records read. An example is shown in Figure 14.

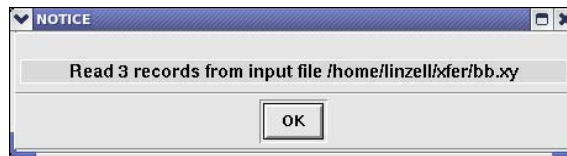


Figure 14. GUI status message indicating the number of records read from an input file.

This section has provided some quick start instructions and a general overview of the GUI functionality and features. The detailed operation of each parameter panel in the GUI is described in §3. Details information on the definitions and dependencies of various parameters can be found in the online ADCIRC model documentation: http://www.adcirc.org/documentation/fort_15.html.

3. Details of GUI Panel Functionality

Note below that although a mouse is used to describe navigation and interaction within the GUI, any supported pointing device will work. Though the keyboard also can be used for navigation and interaction this option at present is not fully supported (see §6). Since the mouse is the most commonly used pointing device, it will be assumed in the following descriptions.

a. The General Program Options Panel

The topmost GUI panel containing fort.15 parameters, shown in Figure 1, is labeled General Program Options. As its name implies, this panel contains many of the general options that control how the model is run, such as whether a 2-dimensional (2-D) or 3-dimensional (3-D) run is to be executed. Other option groups within this panel include Hot/Cold Start parameters, Nonlinear Program parameters, and Output Option parameters.

This panel contains three types of GUI elements, or “widgets.” The first is the radio button, which is a set of two or more toggling buttons grouped together. Only one of the buttons within a group can be selected. When one button is selected, the others are deselected. In Figure 1, for example, the “Type of Run” buttons allow the user to select either 2-D or 3-D model operation, but not both.

The next type of widget is the text entry box. This is a text box in which a value or string is displayed, and the user can replace or modify the existing value or string. In Figure 1, examples are the TAU0 value and the text strings for RUNDES and RUNID.

The third type of widget in this panel is the pull-down list. This is a combination of a button with an underlined arrow, a list of available values that appears when the button is activated (clicked), and a text box that displays the current value of that parameter. All of the pull-down lists have been configured so that the user cannot enter a value, but can only select from the list. In Figure 1, the NWS parameter employs a pull-down list.

One of the primary features of the GUI is that the inter-relational control of parameters is accommodated. In Figure 1, for example, the Type of Run options control the values of IM and the Hot/Cold Start Parameters, as well as the availability of the Output Harmonic Analysis Parameters and the 3-D Model Parameters sections. If the default “2-D” Type of Run is selected, then IM is set to 1, and the Hot/Cold Start option is enabled. The Output Harmonic Analysis Parameters are also enabled, but the entire 3-D Model Parameters section is disabled (e.g., Figure 3). If the “3-D” Type of Run is selected, then IM is set to 0, the Hot/Cold Start Parameters are disabled, the Hot/Cold Start option is set to Cold, and IHOT and NHSTAR are set to 0. Similarly for selection of the “3-D” Type of Run, Output Harmonic Analysis Parameters are disabled, and the entire 3-D Model Parameters section is enabled (except for those 3-D parameters which are controlled by other parameters, e.g., the 3-D Diffusion Parameters).

Considering the Hot/Cold Start Parameters, if the Hot/Cold Start option is enabled and the user selects Hot, a pop-up window appears prompting the user to select the Hot Start file unit number. This window is shown in Figure 15.

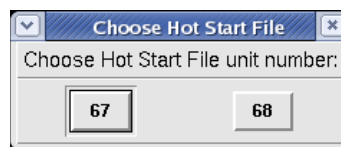


Figure 15. User prompt for the Hot Start File unit number.

The user must select either 67 or 68, which determines the unit number of the file, *fort.67* or *fort.68*, respectively, to be read in for initialization of the hot start model run.

Numerous other parameters identified by the GUI have similar behavior in which the value of one parameter controls the values and availability of other related parameters. The *fort.15* file documentation and parameter descriptions provide details on which parameters are interrelated (http://adcirc.org/document/fort_15.html).

b. The Time, Wetting/Drying Parameters Panel

The second panel containing *fort.15* parameters is labeled Time, Wetting/Drying Parameters (Figure 1). This panel contains parameters that specify the model time step, start and reference times, durations of the model run and ramping function, and select various wetting and drying options available within the model. Most of these parameters are accessed via text entry boxes, and can therefore accept any reasonable values. Some reference time parameters are selected from pull-down lists. Activation for most of these reference time parameters depends on the value of NWS.

The Time, Wetting/Drying Parameters panel has a large, rectangular button labeled, “Get Recommended DTDP, SLAM0, SFEA0 Values”. The user can click on this button to perform calculations to estimate time step, DTDP, for tidally dominated flows (assuming an M_2 frequency tide), and compute geometric mean values for the central longitude (SLAM0) and latitude (SFEA0) of a particular domain. Such values identify the centroid location for the CPP coordinate transformation. If ICS is set to 1 (indicating Cartesian coordinates), calculated CPP centroid coordinates are not available since the CPP transformation is unnecessary. Once time step and centroid calculations are complete, a pop-up window appears prompting the user to decide whether or not to replace current values of DTDP and SLAM0 and SFEA0, if ICS is set to 2 (indicating spherical coordinates). Figure 16 shows the user prompt for the case in which ICS is 2 and all three parameters have been computed and are available to replace default values. Figure 17 shows the user prompt for the case in which ICS is 1 and only the time step, DTDP, can be replaced. If the user chooses to replace the existing values, the newly computed values appear in place of the previous values. Otherwise, the existing values are retained.

It is important to note that the DTDP and SLAM0/SFEA0 parameter calculations can be performed only if a valid *fort.14* finite element grid file has been input. If the user clicks the button but no *fort.14* file had been read upon program startup, and none can be found in the current working directory, an error message is issued by a popup, displayed previously in Figure 7. The user is prompted for a grid file name (details in §2), and that file is used for the calculations.

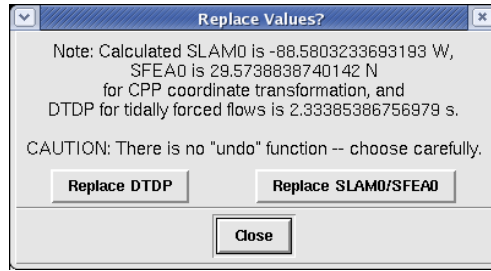


Figure 16. Activation of the “Get Recommended DTDP, SLAM0, SFEA0 Values” button results in a user prompt for replacement of the time step, DTDP, and centroid of the CPP projection (SLAM0/SFEA0) for the case of ICS=2.

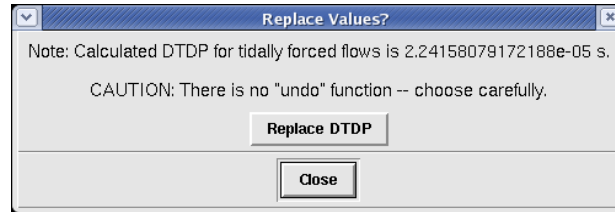


Figure 17. Activation of the “Get Recommended DTDP, SLAM0, SFEA0 Values” button results in a user prompt for replacement of the time step, DTDP, only for the case of ICS=1.

c. The Spatial Structure Parameters Panel

The Spatial Structure Parameters Panel (Figure 1) contains dimensional parameters describing the structure of the meteorological forcing file activated for certain values of NWS. This panel also contains the centroid coordinates of the projection for the CPP coordinate transformation. As described in §3b, CPP center coordinates can be calculated only if ICS is set to 2 (spherical coordinates) and a fort.14 file has been read. The user can, however, manually modify the values SLAM0 and SFEA0 regardless of the value of ICS, though for ICS set to 1, these values are ignored. All of the parameters in this panel are contained in text entry boxes.

d. The Friction, Diffusion, Viscosity Parameters Panel

The Friction, Diffusion, Viscosity Parameters Panel (Figure 1) contains a set of radio buttons and several text entry boxes for bottom friction, horizontal eddy viscosity and transport diffusivity parameters. These parameters are enabled or disabled based on the values of IM and NOLIBF.

e. The Tidal Potential and Periodic Elevation/Flux Boundary Forcing Parameters Panel

This panel (shown in Figure 2) contains text entry boxes for four of the relevant fort.15 file parameters, and as well as several widgets for generating the remaining periodic (tidal) forcing parameters. The four text entry boxes contain the values of, respectively, NTIF, NBFR, ANGINN, and NFFR. Changing the value of NTIF, NBFR, or NFFR (if enabled) also selects or deselects (if zero) the checkboxes on the right side of the panel. A value of

zero for NTIP automatically assigns a zero value to the NTIF parameter.

To perform tidal parameter calculations, the date and time assigned by the user to the start of the ADCIRC model run are entered using the widgets in the Start of Run sub-panel. The year is entered manually, and must be between 1900 and 2100, inclusive. The default year is the current system year at the time the GUI is started. The month, day, and hour are selected from pull-down lists. The defaults for these are 00 hours on January 1.

Once the Start of Run parameters have been set, the tidal constituents can be selected. Nine constituents are available, including the principal diurnal and semi-diurnal components. The steady component also can be included by selecting the indicated checkbox. Note if the steady component *is* included, the values of NBFR and/or NFFR are automatically incremented by 1. The steady component *is not* available to the tidal potential forcing option. At least one constituent (not including the steady component) must be selected from the scrolling list. If more than one constituent is needed, the user can click on the first constituent, and then shift-click (press the Shift key and then click) on the last needed constituent to select all from the first to the last. If non-adjacent constituents are needed, the user can control-click (press the Control key and then click) on the desired constituents.

After all desired constituents are selected, the user clicks the Generate Tidal Parameters button to generate the tidal parameters. One or both of the standalone, external, Fortran 90 tidal programs (see §1b, #3 and #16) are then executed. Only tidal parameters corresponding to the selected checkboxes for NTIF, NBFR, or NFFR are generated. If, for example, the checkbox for NTIF is selected and the others are deselected, then only the parameters TPK, AMIGT, ETRF, FFT, and FACET are generated. Similarly, if only the checkbox for NBFR is selected, then only the parameters AMIG, FF, FACE, EMO, and EFA are generated. If the checkboxes for both NTIF and NBFR are selected, then all of these parameters are generated.

If the user selects checkboxes for any of NTIF, NBFR, or NFFR on the right side of the panel and there is a discrepancy between the values of NTIF, NBFR, or NFFR and the number of selected constituents for the activated checkboxes, or if the user neglects to select any constituents, an error message such as that shown in Figure 18 appears. The user is advised to correct the situation, and try again. Note that the user can perform tidal calculations for each of the NTIF, NBFR, and NFFR parameters individually by selecting only the desired checkbox at the right of the panel. In this case, a consistency check is only applied to that parameter for which tidal parameter calculations are indicated. This action can be repeated for each parameter, NTIF, NBFR, and NFFR as desired. This allows the specification of different numbers and names of constituents for each of the tidal potential (NTIF), elevation (NBFR) or flux (NFFR) period boundary forcing parameters.

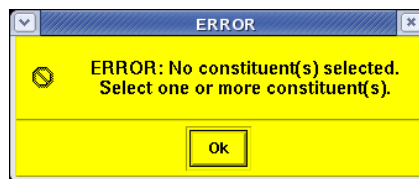


Figure 18. Example error message for inconsistent input in the Tidal Potential and Periodic

Elevation/Flux Boundary Forcing Parameters Panel.

It is important to note that the tidal parameter calculations can be performed only if a valid fort.14 file has been input. This also is noted in §2. The user must ensure that the fort.14 file corresponds to the fort.15 file if an existing fort.15 file is being modified. If no fort.14 file can be found in the current working directory, an error message is issued as seen in Figure 8. The user is then prompted to enter a new grid file name, and if a valid fort.14 file is specified, the calculations are performed.

A Help Information button, indicated by an “i” label, also is found on this panel (see Figure 2). Details about this button can be found in the discussion of Help features (see §4).

f. Output Station Parameters Panel

The Output Station Parameters panel (Figure 2) contains the parameters necessary to activate the output of available model variables at specific locations or stations. The format, time window, frequency, number of stations, and station locations can be specified for elevation, current velocity, and (if enabled) meteorological and concentration time series. The output format flags (NOUTE, NOUTV, NOUTC, and NOUTM) are selected from pull-down lists, while the remaining parameters are specified in text entry boxes. If the number of stations for the different variables are nonzero, then the station locations can be input by using a Position Entry Form as shown in Figure 19.

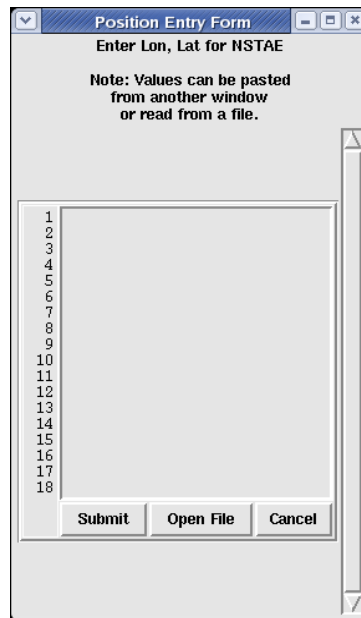


Figure 19. The Position Entry Form for the specification of station location coordinates for the station output, ICS = 2.

This widget has the same number of input lines as user-specified stations. If the user manually enters the positions, the coordinates should be entered as a comma-delimited or space-delimited pair on each line. As the note in the widget indicates, the user can also copy

the coordinate values from another window and paste them into this widget, or provide the name of an ASCII text file name from which the coordinates are subsequently read. Once all coordinates have been entered, either manually, by copy-and-paste, or file read, the user clicks the Submit button to complete the operation.

As seen in Figure 2, the Get Position(s) for Which Parameter(s) sub-panel contains radio buttons to specify the order of the coordinates, either longitude followed by latitude, or latitude followed by longitude. The value of ICS controls whether the coordinates are degrees of longitude/latitude or Cartesian (i.e., X/Y distances). If ICS is 2, then the sub-panel and entry form are as shown in Figures 2 and 19, respectively. If, on the other hand, ICS is 1, then the wording is changed to reflect the X/Y or Y/X coordinate system (see Figure 20).

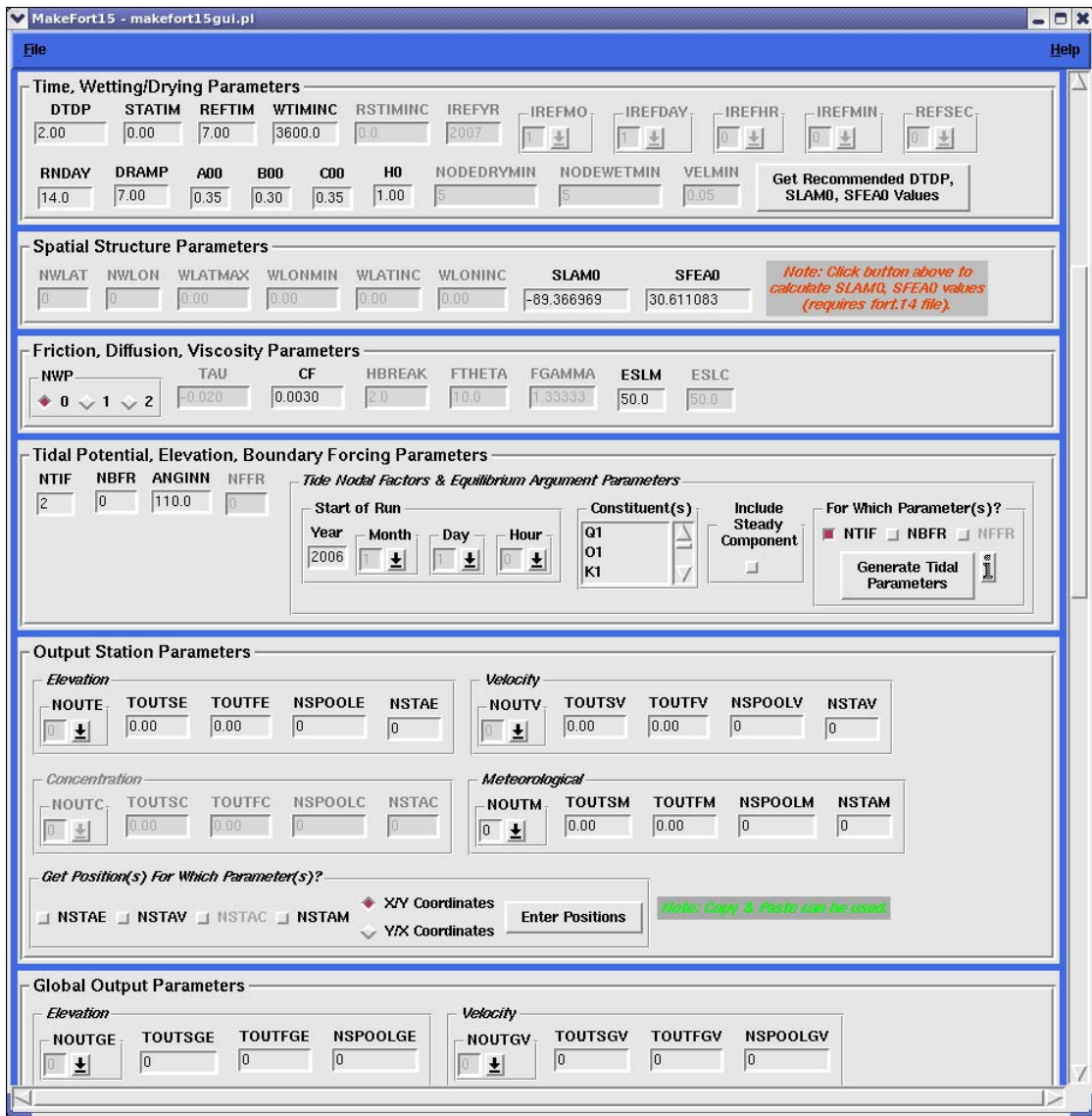


Figure 20. For the Output Station Parameter panel, wording of “Get Position(s) For Which Parameter(s)?” sub-panel reflects Cartesian coordinate options when ICS=1.

The GUI operation is unchanged; only the wording of the GUI and associated widgets is changed. The wording in the position entry form also is modified accordingly, as shown in Figure 21. Similarly, the entry of the coordinates is unchanged; only the wording is changed.

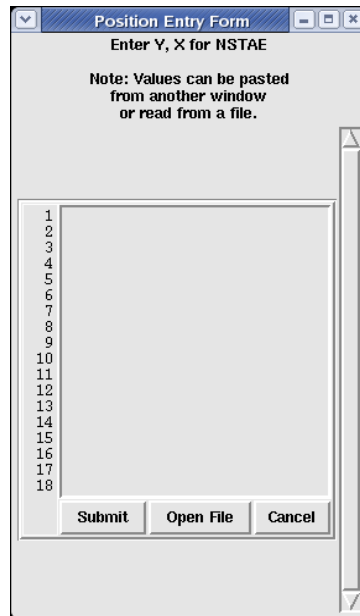


Figure 21. For the Output Station Parameter panel, wording of Position Entry Form sub-panel reflects Cartesian coordinate options when ICS=1.

Note that availability of the Meteorological sub-panel is controlled by the value of NWS, and availability of the Concentration sub-panel is controlled by the value of IM.

g. Global Output Parameters Panel

The Global Output Parameters panel (Figure 2) contains parameters controlling model output from the entire model grid. As for the Output Station Parameters panel (§3f), the output format flags are specified using pull-down lists, and the remaining parameters are specified in text entry boxes. Since the Global Output Parameters apply to the all points comprising the grid, no input of coordinate locations is necessary. Similar to the Output Station Parameter panel, the Meteorological output sub-panel is controlled by the value of NWS, and the Concentration sub-panel is controlled by the value of IM.

h. Output Harmonic Analysis Parameters Panel

This panel (Figure 2) contains parameters associated with harmonic analysis of the model results. Note that availability of this panel is controlled by the Type of Run option. If Type of Run is set to 2-D (the default), the panel is enabled; if set to 3-D, it is disabled. This panel has only one parameter specifying the number of tidal constituents (NFREQ), so the “Generate Tidal Parameters” button on the right need only be activated once. The text entry

box for NFREQ is controlled by the values of NHASE, NHASV, NHAGE, and HHAGV. If any of these parameters is set to 1, then NFREQ is enabled. If NFREQ is set to a value greater than zero, then the Generate Tidal Parameters button is enabled. For the harmonic analysis option, up to thirty-seven (37) tidal constituents are available under the “Constituents” pull-down menu and operation of the Output Harmonic Analysis Parameters panel is the same as for the Tidal Potential and Periodic Elevation/Flux Boundary Forcing Parameters Panel described in §3e. The steady component also can be included by selecting the indicated checkbox.

i. GWCE Solver Parameters Panel

The GWCE Solver Parameters panel (Figure 3) contains parameters controlling the type of solver to be used for the generalized wave-continuity equation (GWCE). The value of ITITER is selected by clicking one of the two radio buttons. The value of ISLDIA is selected from a pull-down list and the two remaining parameters, CONVCR and ITMAX, are specified using text entry boxes.

j. 3-D Model Parameters Panel

The 3-D Model Parameter panel (Figure 3) serves as a divider between the upper portion of the GUI, with general and 2-D-specific parameters, and the lower portion containing 3-D model specific parameters.

k. 3-D Model Input Parameters Panel

The 3-D Model Input Parameters panel (Figure 3) contains input parameters for the 3-D model option pertaining to the bottom slip condition and the vertical sigma coordinate grid. The value of ISLIP is selected from among three radio buttons. The value of IGC is selected from a pull-down list, and the remaining parameters in this panel are specified using text entry boxes. The Enter Sigma Levels button is enabled or disabled according to the value of IGC. If enabled, the user can enter the sigma levels using a Data List Entry Form, as shown in Figure 22. This entry form is similar to the Position Entry Form described in §3f; the user can manually enter the values, copy values from another window and paste them into the form, or read values from a user-specified ASCII text file.

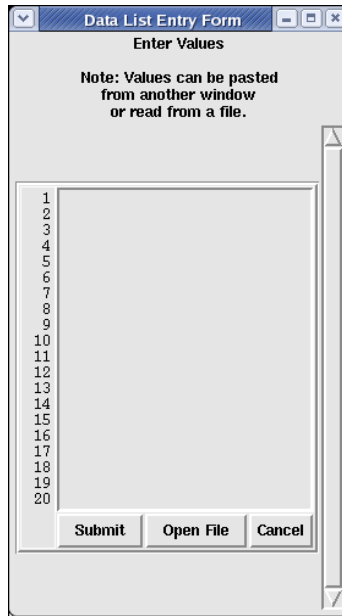


Figure 22. From the 3-D Model Input Parameter panel, a Data List Entry Form for entering the vertical sigma levels.

l. 3-D Eddy Viscosity Parameters Panel

The 3-D Eddy Viscosity Parameter panel (Figure 3) contains parameters related to vertical eddy viscosity and turbulence calculations. The value of IEVC is selected from a pull-down list. The values of EVMIN and EVCON are specified in text entry boxes. The value of IEVC also controls the text entry boxes for THETA1 and THETA2, as well as the button labeled, “Enter Viscosity Values for All Sigma Levels.” In a manner similar to the sigma level entry described in §3k, the Data List Entry Form is used to enter eddy viscosity values associated with each sigma level.

m. 3-D Temperature/Salinity/Density, Velocity, and Turbulence Output Parameters Panel

This panel (Figure 3) contains parameters that control the time series output of 3-D model variables at user-specified locations or stations. These parameters are analogous to the 2-D versions described in §3f. The output format flags are specified by selecting radio buttons. The other parameters are specified in text entry boxes. The coordinates of the output stations are entered using the Position Entry Form shown in either Figure 19 for latitude/longitude coordinates or Figure 21 for X/Y coordinates. As previously described, the order of the coordinates is specified by selecting the appropriate radio button. Wording of the Get Position(s) for Which Parameter(s) sub-panel and the Position Entry Form reflect the coordinate system specified by the value of ICS as noted earlier.

n. 3-D Global Output Parameters Panel

This panel (Figure 3) contains parameters for the control of time series output of model variables for the entire model grid (all nodes). As for the Temperature/Salinity/Density, Velocity, and Turbulence Output Parameters Panel (§3m), the output format flags are specified using radio buttons, and the remaining parameters are contained in text entry boxes. Since the 3-D Global Output parameters cover the entire grid, there is no input of station coordinates.

o. 3-D Diffusion Parameters Panel

This panel (Figure 4) contains four parameters specifying lateral and vertical diffusion parameters for salinity (NLSD and NVSD, respectively) and temperature (NLTD and NVTD, respectively), as well as a time stepping parameter (ALP4). All are specified using text entry boxes. Availability of these widgets is controlled by the value of IDEN.

4. Help Features of the GUI

The GUI includes a comprehensive help facility. All model parameters and buttons, and numerous descriptive labels, have “Tool Tips” (also known as “Bubble Help”). When the mouse pointer is placed over the item of interest, a small window appears near the pointer with a brief description of the item. Figure 23 shows an example Tool Tip for the Wetting/Drying model option.

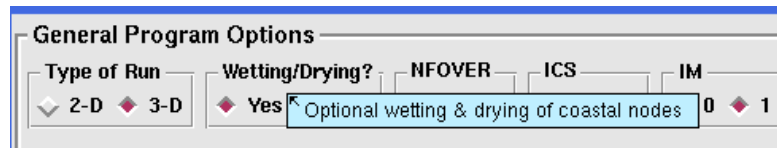


Figure 23. Display of the Tool Tip for the Wetting/Drying option, an example of the “Bubble Help” feature of the GUI.

Many parameters have also been hyperlinked to Help pages. If additional information is available for a particular parameter than is shown in the Tool Tip, the user can click on the parameter name and a pop-up window appears with descriptive text for that parameter. Figure 24 demonstrates the hyperlinked Help associated with the NFOVER parameter.

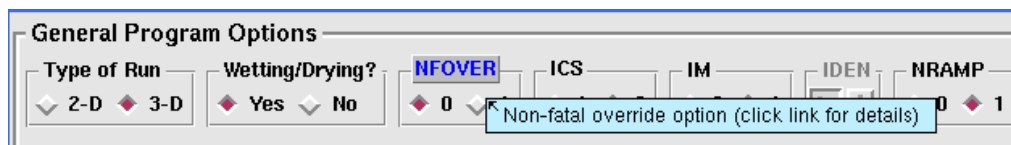


Figure 24. The hyperlinked parameter, NFOVER, indicates the availability of additional Help information on that parameter.

Notice that the Tool Tip has a note informing the user to click on the hyperlink for details.

Figure 25 shows the hyperlinked pop-up window with a parameter description for NFOVER. This window appears when the user clicks on the hyperlink for NFOVER, as shown in Figure 24. Information for the Help description windows are largely derived from the v45 online ADCIRC model manual (http://documentation/fort_15.html). Note the text of the description can be copied from the Parameter Description window and pasted to another window (e.g., a text editor or an e-mail client).

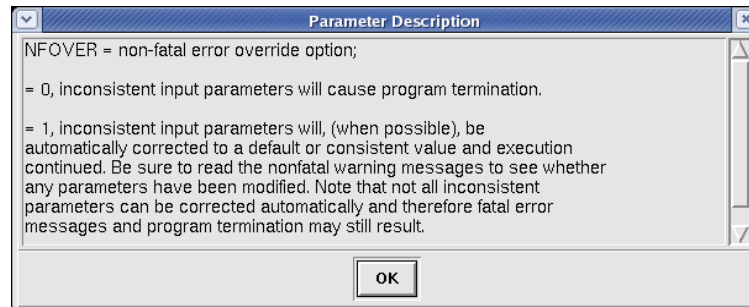


Figure 25. The hyperlinked Help popup for the parameter, NFOVER.

For each of the Panels, Tidal Potential and Periodic Elevation/Flux Boundary Forcing Parameters and Output Harmonic Analysis Parameters (e.g., Figure 2), an information button is available, indicated by an “i” label. If the user clicks on the “i” button, a pop-up window appears with explanatory text, as shown in Figure 26.

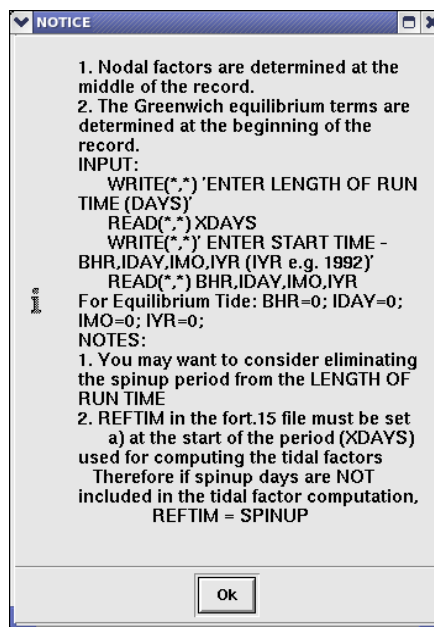


Figure 26. The Information window describing tidal parameter specification, activated by clicking the “i” button on the Tidal Potential, Elevation, Boundary Forcing Parameters Panel.

The text for the “i” buttons are contained within ASCII text files. If a text file is not found upon startup of *makefort15gui.pl*, a notification appears instead of the explanatory text, as

shown in Figure 27, when the information button is clicked. If this occurs, the user should attempt to locate the text file (*README.tidefac15*) and move or copy it to the indicated directory. See §1d for details on the files and their directory paths.

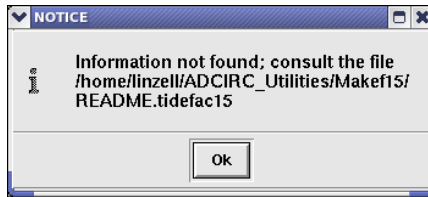


Figure 27. Notification of a missing Information text file.

In addition to the Tool Tips and hyperlinked Help, the Help item in the menu bar (e.g., Figure 20) has a button (Help → Fort.15 Help) that opens a web browser with the ADCIRC on-line fort.15 documentation (http://adcirc.org/documentation/fort_15.html). An example of the documentation displayed in a browser for a Linux system is shown in Figure 28.

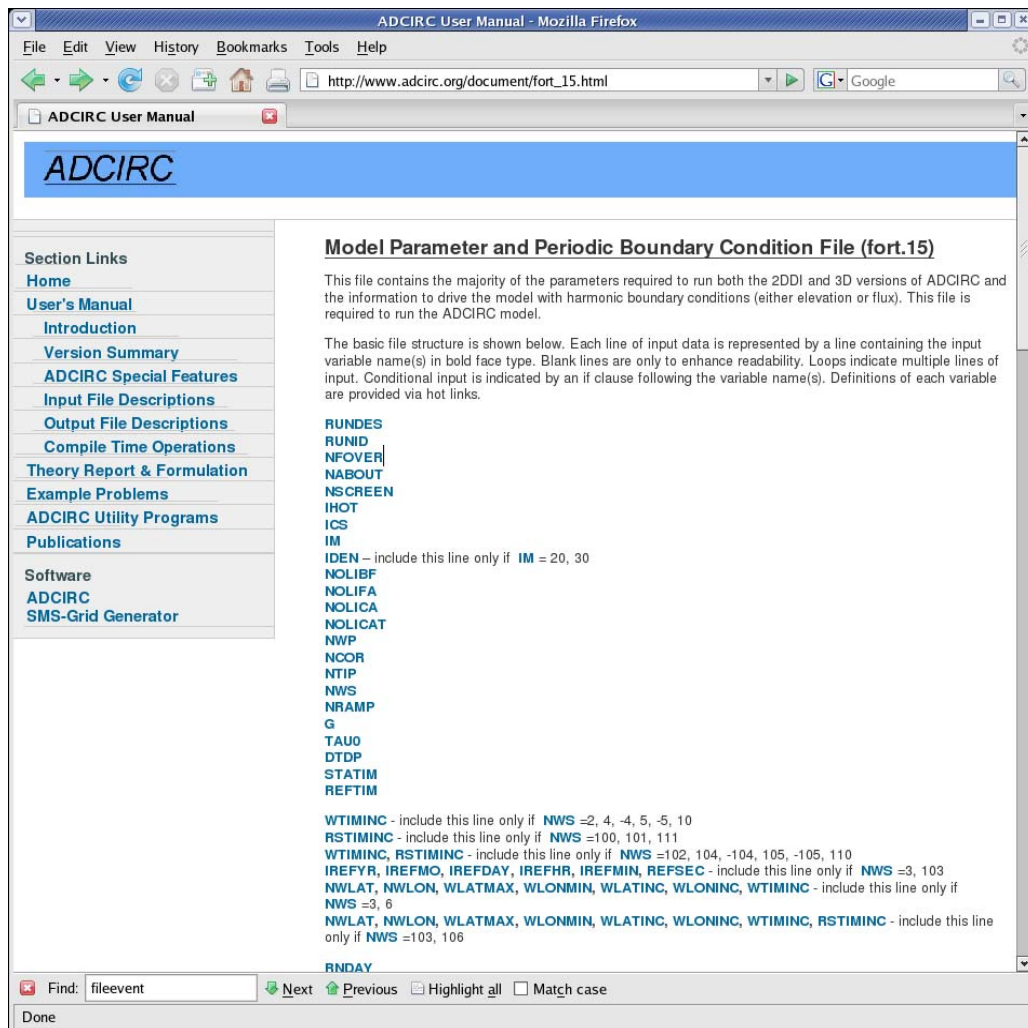


Figure 28. Browser pointing at the on-line ADCIRC model documentation for the fort.15 file.

Note that the on-line version may not necessarily be the same version that is current as of this writing. This version of *makefort15gui.pl* targets ADCIRC v45.11.

Lastly, the Help menu has an additional popup window item (Help → About) that provides a listing of the names and e-mail addresses of the principle investigator and author(s), software versions, and dates of installation, as shown in Figure 29.

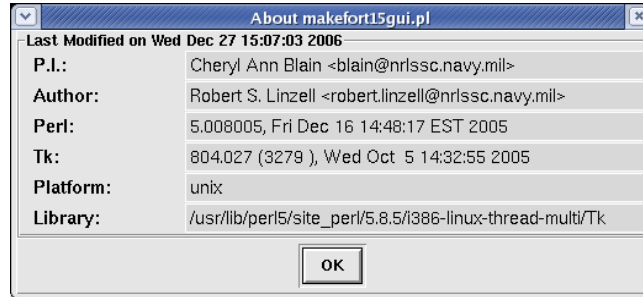


Figure 29. Help → About window with NRL contact and software installation information.

5. Error Check Provisions in the GUI

The GUI has extensive error checking built-in so that erroneous values are either not possible or are identified before the fort.15 file is written. The radio buttons and pull-down lists are configured so that only the values that are shown can be selected. Additionally, consistency checks are performed where possible for user-entered parameters that are related to other user-entered parameter (e.g., the number of tidal constituents desired vs. the number of selected constituents, see the error display in Figure 18). Several examples were discussed in §3b and §3e. For insufficient station coordinate entries in the Output Station Parameter panel, Position Entry Form, Figure 30 shows the error message that is displayed indicating the number of station entries required.

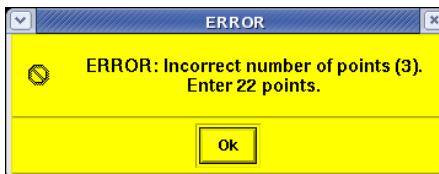


Figure 30. Error message from the Output Station Parameter panel triggered by too few station coordinate entries.

The number entered by the user is shown in parentheses (“(3)” in Figure 30), and the number expected is listed in the second sentence of the message (“22” in Figure 30). If more points are entered than were specified, a warning message is displayed such as that shown in Figure 31. The extraneous values are read, but only the user-specified number for NSTAE, NSTAV, NSTAM, NSTAC is retained.

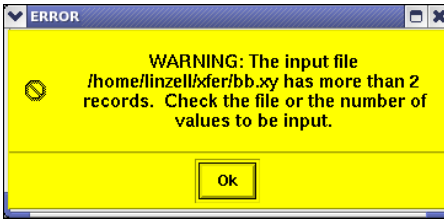


Figure 31. Warning message from the Output Station Parameter panel indicating more station location records were input than were read in according to the station number parameter (NSTAE, NSTAV, NSTAM, NSTAC).

If the user chooses to generate arrays for parameters not shown in the GUI, such as tidal forcing parameters, boundary forcing values, or sigma levels, and those parameters already exist, a pop-up window appears prompting the user to choose whether or not to replace existing parameters. Figure 32 shows an example from the Tidal Potential, Periodic Elevation/Flux Boundary Forcing Parameter panel in which several of the tidal potential parameter arrays of interest have existing values and the user is prompted for whether or not to replace them. If the user response is “Yes,” the operation proceeds and the parameters are replaced; if “No,” the operation is canceled and the existing parameters are retained.

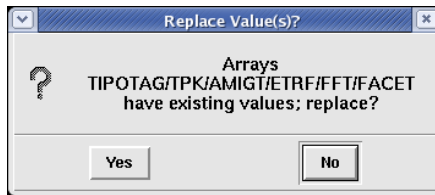


Figure 32. An example of the Replacement prompt from the Tidal Potential, Periodic Elevation/Flux Boundary Forcing Parameter panel triggered by existing values for the TIPOTAG, TPK, AMIGT, ETRF, FFT, and FACET data arrays.

Entry boxes for floating point or integer values (see, e.g., Figure 20) have been designed to prohibit the entry of non-numerical values (i.e., spaces, symbols, or letters). Note however, as of this writing, the ranges of the user-input parameters are not checked. It is therefore incumbent on the user to ensure that realistic and reasonable values are entered. The ADCIRC program also performs checks on the input values, so invalid or nonsensical parameter values are often be caught before the model execution begins.

6. Known Limitations

The software described in this document was developed for ADCIRC version 45.11. Other versions of the ADCIRC model that use the same format and content of the fort.15 file are supported. But, versions that contain modifications to the fort.15 format, content, or dependencies are not supported.

The software does not check to ensure that the specified fort.14 grid file and the fort.15 file, if read in, correspond to one another. Compatibility is only guaranteed when a new fort.15

file is created. Careful consideration of file naming and directory structure conventions is a good approach that can help avoid inadvertently mixing compatible grid (fort.14) and input parameter (fort.15) files.

While restrictions on some parameter values are enforced through the use of pull-down lists, not all entered parameter values are checked against ranges of validity. The ADCIRC model code itself performs many checks of this nature, so this is not perceived to be a crucial limitation of the software.

One limitation is that the only global tidal data for boundary forcing available through the GUI at this time is the Grenoble FES99 tidal database. This database may or may not be the most appropriate source of boundary forcing for the user's application. Furthermore, the Grenoble FES99 database must be installed and have a copy or a symbolic link in the user's current working directory. One approach to address this issue would be to use a hard-wired path for the database, and force the installation to use that path. Section 1d describes the installation procedure delineating the files and directories required for this software.

Note that all Fortran programs associated with the software must be compiled for the platform on which the software is installed. Considering that the ADCIRC model code requires the same, this is not deemed a real limitation.

At the time of this writing, an unresolved issue exists in which text entry boxes do not operate correctly under the operating environment described by the use of Linux Fedora Core 6 running on 32-bit hardware. Other tested operating environments for which the software operates without issue are: Linux Fedora Core 6 running on 64-bit hardware and Windows® XP Professional.

Presently, keyboard navigation and interaction with the pull-down and scrolling lists is not supported. Nor is navigation using the keypad cursor control keys supported. Checkboxes do not always change when the corresponding value changes. For example, in the Output Station Parameters panel (Figure 20), if value of NSTAE changes, the checkbox for NSTAE may not be selected or deselected. Though clicking in another text entry box causes the associated checkbox to be selected or deselected if appropriate. Future upgrades will address such enhancements.

7. Reference

Lefevre, F., F. H. Lyard, C. Le Provost, E. J. O. Schrama, 2002. FES99: A Global Tide Finite Element Solution Assimilating Tide Gauge and Altimetric Information, *Journal of Atmospheric and Oceanic Technology*, 19(9), 1345-1356.

