RVR MEANDER – TUTORIALS

ArcGIS VERSION

Roberto Fernández[1], Davide Motta[2], Jorge D. Abad[3],

Eddy J. Langendoen[4], Nils Oberg[5], Marcelo H. Garcia[6]

August 29, 2011

ABSTRACT

This document includes tutorials describing the possibilities of the RVR Meander Graphical User Interface (GUI) developed for ArcMap. Each tutorial shows specific capabilities of the GUI while guiding the user on a step-by-step fashion from input to output. A tutorial by itself doesn't describe all the components of the GUI. Detailed description of each one is provided on the User's Manual.

Author Affiliations:

1 Graduate Research Assistant, Dept. of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, 61801. E-mail: fernan25@illinois.edu

2 Graduate Research Assistant, Dept. of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, 61801. E-mail: dmotta2@illinois.edu

3 Assistant Professor, Dept. of Civil and Environmental Engineering, University of Pittsburgh, Pittsburgh, PA, 15260. E-mail: jabad@pitt.edu

4 Research Hydraulic Engineer, US Department of Agriculture, Agricultural Research Service, National Sedimentation Laboratory, Oxford, MS, 38655. E-mail:eddy.langendoen@ars.usda.gov

5 Resident Programmer, Dept. of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, 61801. E-mail: noberg@illinois.edu

6 Chester and Helen Siess Professor, Dept. of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign. 205 N. Mathews Av., Urbana, IL, 61801.E-mail: mhgarcia@illinois.edu

TABLE OF CONTENTS

TABLE OF FIGURES

1. INTRODUCTION

RVR Meander for ArcGIS is basically a toolbar that lets the user access forms to input parameters, run the software and visualize output inside ArcMap. It has been developed for ArcGIS 9.3.1 and is currently being tested on ArcGIS 10.0 in order to support the newest version of ESRI's software. The RVR Meander Graphical User Interface (RVR-GUI) provides different functionalities that facilitate the use of the RVR capabilities available for the standalone version inside ArcMap.

This manual contains different sections that will guide the user on a step-by-step basis. It first describes how to install the RVR-GUI and then shows the steps required to load its capabilities into ArcMap. Additional sections are tutorials designed to guide the user through some test cases that describe the use of the RVR-GUI's components. Tutorials by themselves do not cover all the capabilities. Detailed description of all components is provided in the User's Manual.

2. INSTALLING THE RVR MEANDER GRAPHICAL USER INTERFACE

Browse to the folder where the "RVR Meander 9.3.msi" file is saved. Double click on the icon (see Figure 1). An installation wizard will appear on screen (see Figure 2). Click Next and specify the folder where RVR Meander will be installed (see Figure 3). Click Next again and on the confirmation screen click Next again (see Figure 4). Installation will begin and the progress will be shown by the wizard (see Figure 5). Finally the wizard will display a message letting the user know that the installation is complete (see Figure 6).

Figure 1. RVR-GUI setup icon.

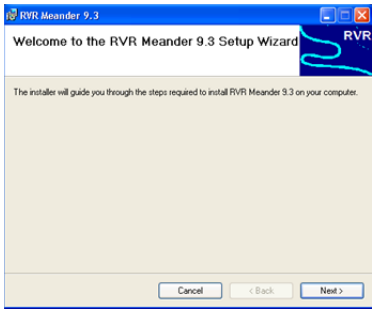

Figure 2. RVR-GUI Installation Wizard: Welcome Screen.

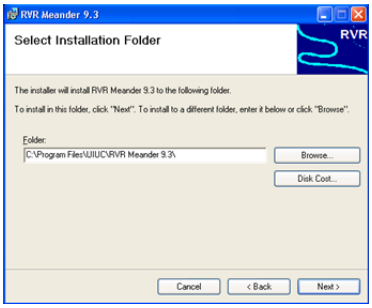

Figure 3. RVR-GUI Installation Wizard: Installation Folder.

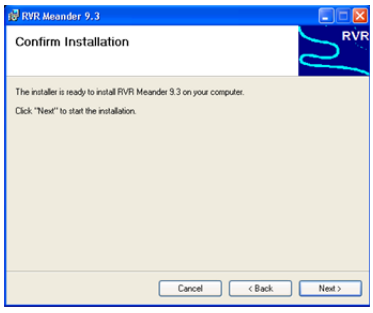

Figure 4. RVR-GUI Installation Wizard: Confirm Installation.

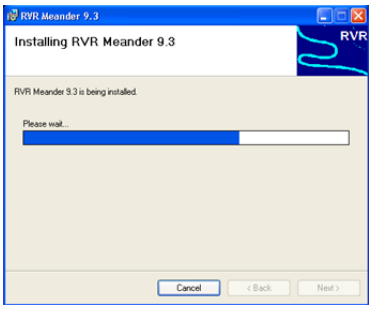

Figure 5. RVR-GUI Installation Wizard: Setup Progress.

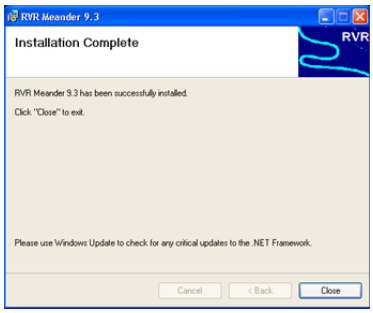

Figure 6. . RVR-GUI Installation Wizard: Installation Complete.

3. ADDING THE RVR MEANDER TOOLBAR INTO ARCMAP

Inside ArcMap open the Customize window located in the Tools menu and in the Toolbars tab browse for the RVR Meander toolbar (see Figure 7). If the toolbar is not displayed click on the "Add from file" button and browse for the installation folder. Select the file with the ".tlb" extension and click "Open". A new dialog indicating the "Added Objects" will appear on screen. Click "OK" and in the Customize window check the box to include the toolbar (see Figure 8). After clicking the "Close" button the toolbar will be displayed on the ArcMap interface (see Figure 9).

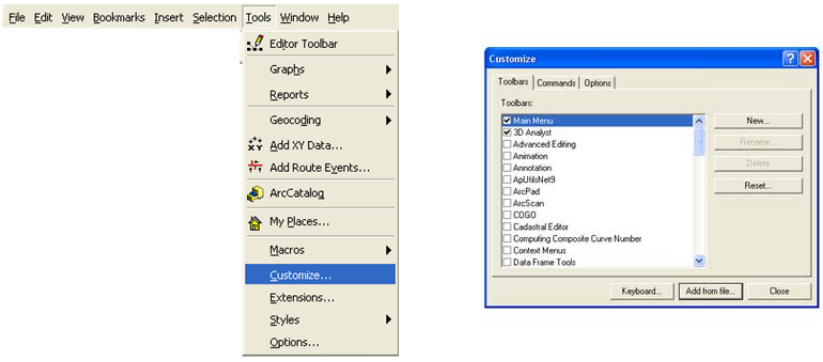

Figure 7. Loading the RVR Meander toolbar into ArcMap using the Customize window.

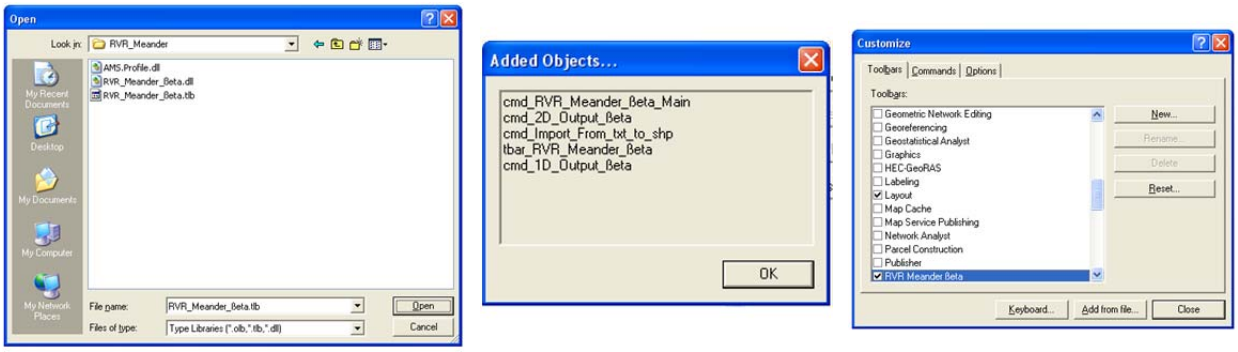

Figure 8. Browse to installation folder and select the file with the ".tlb" extension (left). Added Objects dialog will be shown on screen(center) and the RVR Meander Toolbar will be visible on the Customize window (right).

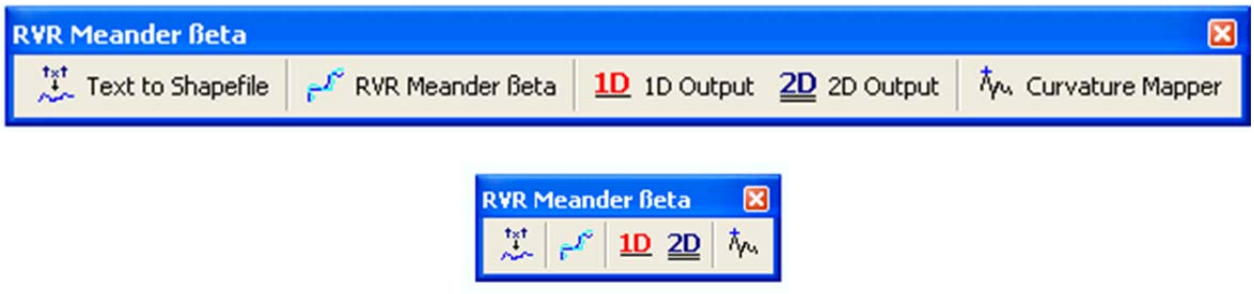

Figure 9. RVR Meander Toolbar with "Image and Text" (top) and with "Image Only" (bottom).

4. TUTORIAL 1: MACKINAW RIVER, IL USA; USING THE MIGRATION COEFFICIENT EMPIRICAL APPROACH

4.1. INTRODUCTION

This tutorial for the Mackinaw River in Illinois, USA presents a step by step description regarding the use of some of the capabilities of the RVR Meander GUI. It uses the Migration Coefficient empirical approach which is the simplest available to get the user started.

In order to run this tutorial you will need the files that came with the installation. If the RVR Meander toolbar is not visible in ArcMap please add it. If you're not sure on how to do it please refer to Section 3 of this manual.

4.2. CREATING THE SHAPEFILES (.SHP) FROM TEXT FILES (.TXT)

Click on the "Text to Shapefile" command button in the toolbar (see Figure 10). An "Open File Dialog" will be displayed that lets you browse for the required text file (see Figure 11). The current version supports only one file at a time and therefore you need to do the process twice. First select the "Mackinaw_River.txt" file and click Open. A "Save File Dialog" will appear prompting you to provide a name and to specify the folder where you wish to save the shapefile (see Figure 12). Click Save and it will be created and added into ArcMap. Repeat the process for the "Mackinaw_Valley.txt" file. The result should look like the one presented in Figure 13 except for the colors that might look different on your computer.

Figure 10. Create shapefile from a text file.

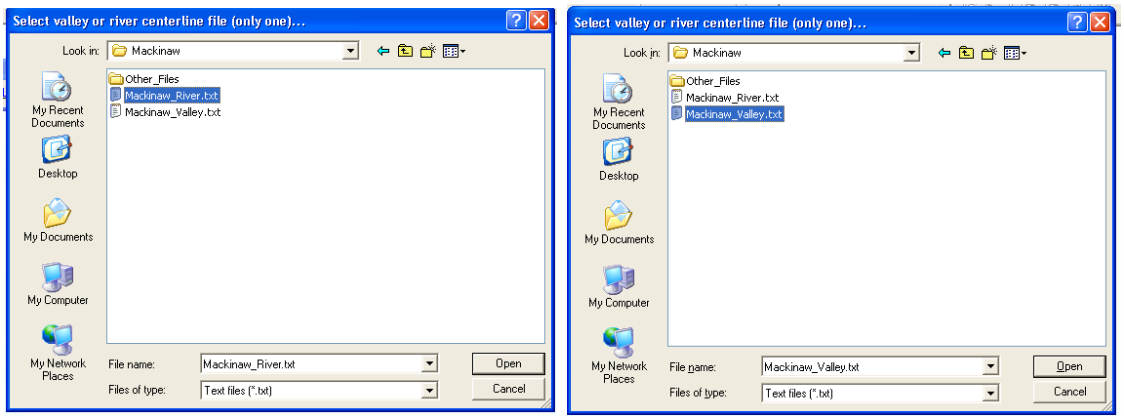

Figure 11. Select either the river or the valley centerline to input. Currently only one file at a time is supported.

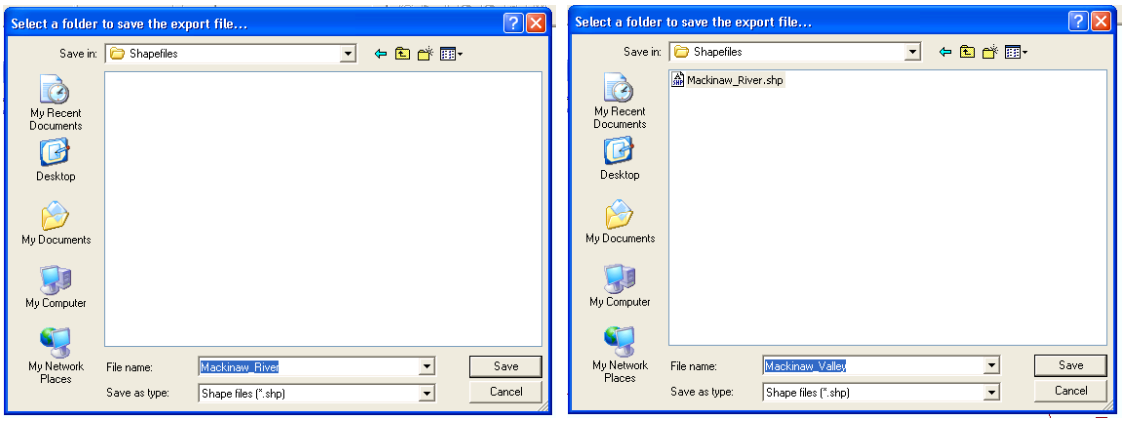

Figure 12. Browse to the folder where the shapefile will be created, give it a name and select Save.

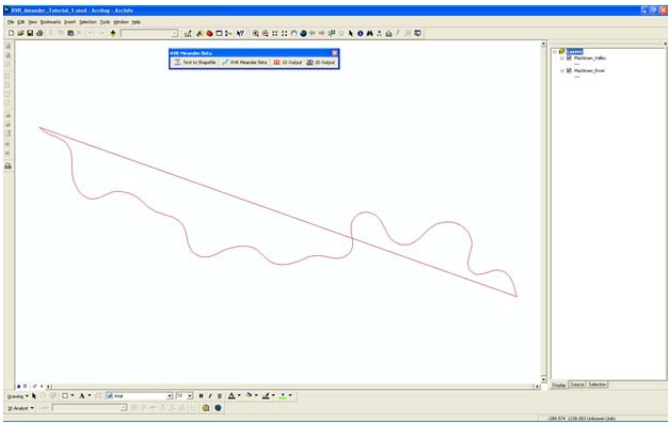

Figure 13. River and valley centerlines displayed in ArcMap.

4.3. OPEN THE RVR MEANDER GRAPHICAL USER INTERFACE (RVR-GUI)

Click on the "RVR Meander ßeta" command button (see Figure 14) to access the user interface. A new window will appear (see Figure 15). The RVR GUI contains eight different tabs provided to enter the input parameters for the run. Some parameters are set to default or typical values. Explore the contents of the different tabs and get familiar with them before continuing with this tutorial.

Figure 14. Open RVR-GUI by clicking on the RVR Meander command button.

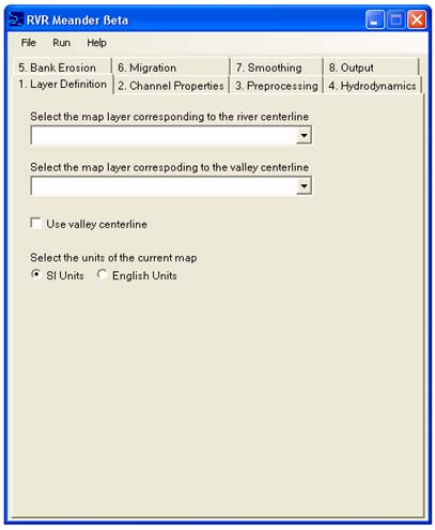

Figure 15.RVR-GUI.

4.4. IMPORTING THE CONFIGURATION FILE

Click on the File menu and select "Import Configuration" (see Figure 16). An "Open File Dialog" will appear on screen prompting you to browse for the configuration file. Find "Tutorial_1_Data.txt" file on the installation folder and click Open (see Figure 17). After doing so, all the tabs should be automatically populated according to the parameters contained in the file just loaded. If you are curious about the format of the configuration file imported you can find it and open it using the Notepad.

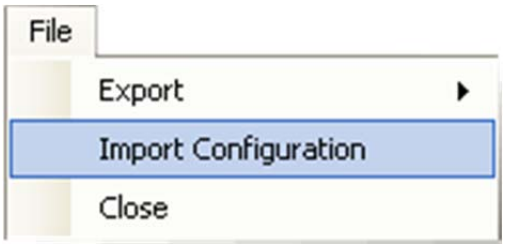

Figure 16. RVR-GUI File Menu; Import Configuration.

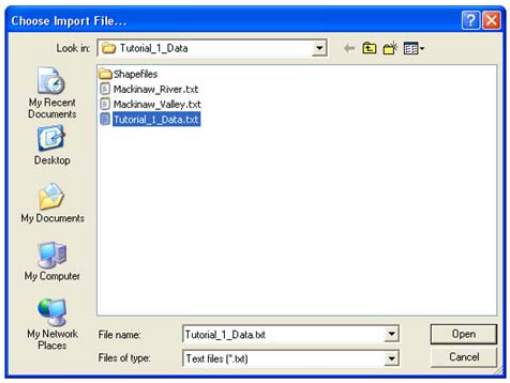

Figure 17. Import the Configuration File for the run.

4.5. SELECTING THE SHAPEFILES FOR THE RUN AND THE OUTPUT FOLDER

Before running the simulation two more things are required. Go to the "Layer Definition" tab and in the corresponding dropdown boxes select the files for the river and the valley centerlines. After selecting them your RVR Meander interface should look like the one shown in Figure 18. Go to the "Output" tab and click on the browse button ... to select the folder where you wish to save the output files. A "Browse Folder Dialog" will appear on screen (see Figure 19). Select the folder and click OK. In this case, a new folder named "Output_Run_1" was created. Now the "Output" tab should look like the one shown in Figure 20. You will probably have differences in the path of the output folder but that is not a problem. You are now ready to run the simulation.

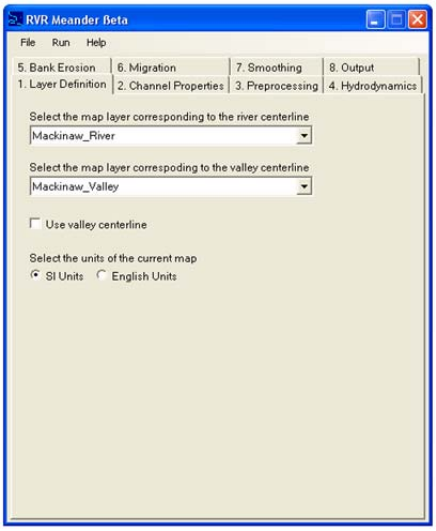

Figure 18. RVR-GUI; Layer Definition tab with selected layers.

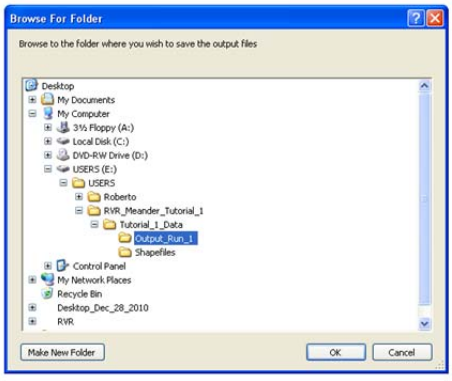

Figure 19. Folder Browser Dialog to select where to save the Output files for the current run.

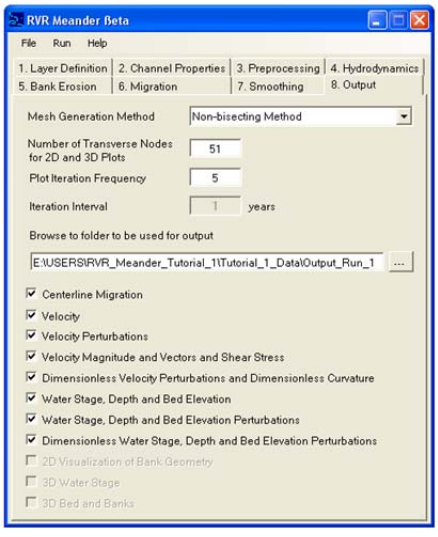

Figure 20. RVR-GUI; Output tab with al the information required in place.

4.6. RUN SIMULATION

Open the Run Menu and click “Run Simulation” (see Figure 21). If everything is correct a new window called Log File Watcher will appear that will show the progress of the computations as well as some parameters. Once the run is completed, the Log File Watcher will display a message that says Exiting and the Save and Close buttons will be enabled. Figure 22 shows the Log File Watcher before, during and after the run.

The results displayed on the Log File Watcher are not saved unless you decide to do so. If you click Save you’ll need to browse to the folder where you wish to save the Log File information. An example of this file opened with the Notepad is shown in Figure 23. If you are curious to see how the output files look like browse to the folder where you saved them and take a look. Their names will start with “TecPlot” (see Figure 24) because the output format was originally created to be opened using that software package. The meaning of the variables is explained in the header lines of the file and is also presented in the table located in Appendix 1.

If you haven’t done so yet close the Log File Watcher to begin creating the output shapefiles to visualize the run’s results in ArcMap.

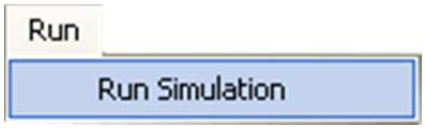

Figure 21. RVR-GUI Run Menu.

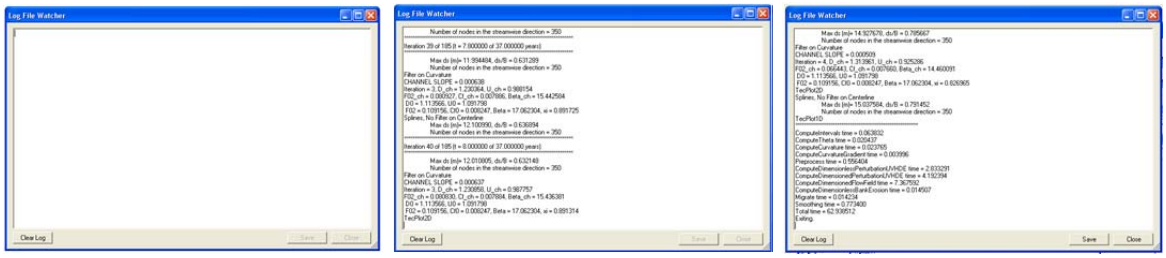

Figure 22. Log File Watcher before the run (left) during a run (center) and after the run finishes (right).

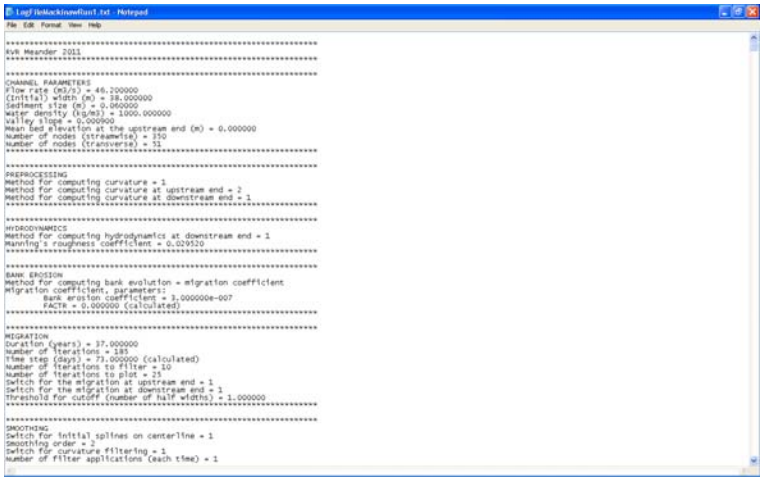

Figure 23. Log File in .txt. format.

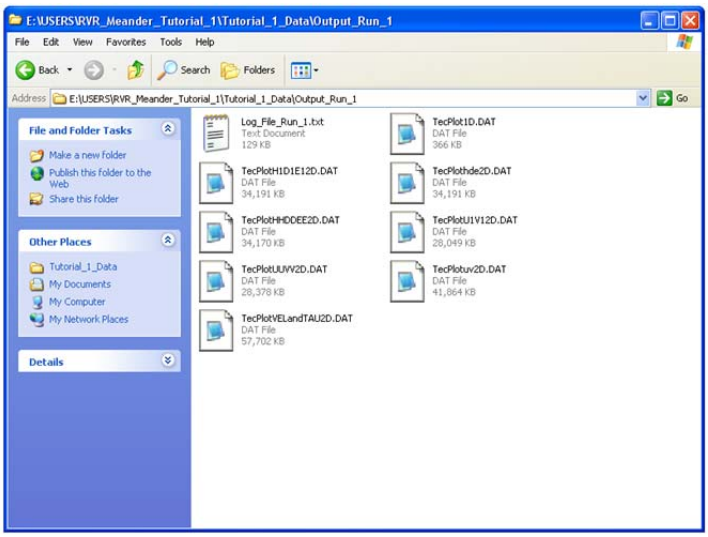

Figure 24. Output Files created during the run.

4.7. CREATING AND VISUALIZING 1D OUTPUT IN ARCMAP

4.7.1. CREATING THE 1D OUTPUT SHAPEFILE

Click the "1D Output" command on the RVR Meander toolbar (see Figure 24). This command displays a window that will let you specify in what folder is the file with the output information saved (see Figure 25).

Figure 25. Import a 1D Output file of Migrated Centerlines.

Figure 26. 1D Outut user form.

Click on the browse button ... to select the folder where the output files from the current run were saved. Once you do so the window will expand allowing you to Finish or Cancel the operation (see Figure 27). Make sure you browse to the correct folder. If you don't a warning message will let you know that no output files are saved on the specified location. Click Finish to start processing the 1D Output. While the process is taking place messages will be displayed on ArcMap's status bar (bottom of the screen) asking the user to wait for a few seconds (see Figure 28). ArcMap's screen will freeze for an instant while the process takes place but will refresh as soon as it is finished. A new shapefile will be added into your map called "Migrated Centerlines"

and it might have a different color on your machine but it should look similar to the one shown in Figure 29 (other layers were turned off to show only the Migrated Centerlines layer).

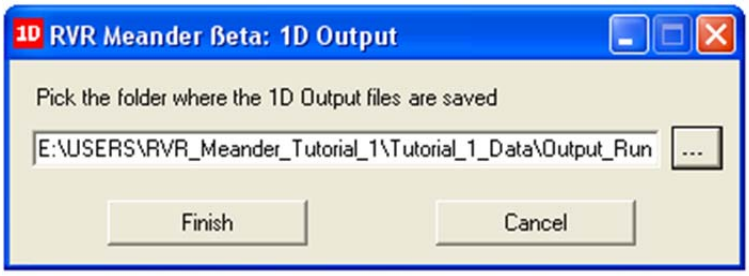

Figure 27. 1D Output expanded user form.

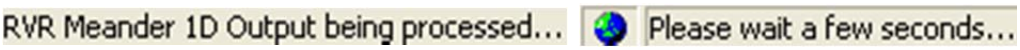

Figure 28. 1D Output – Status bar messages while processing.

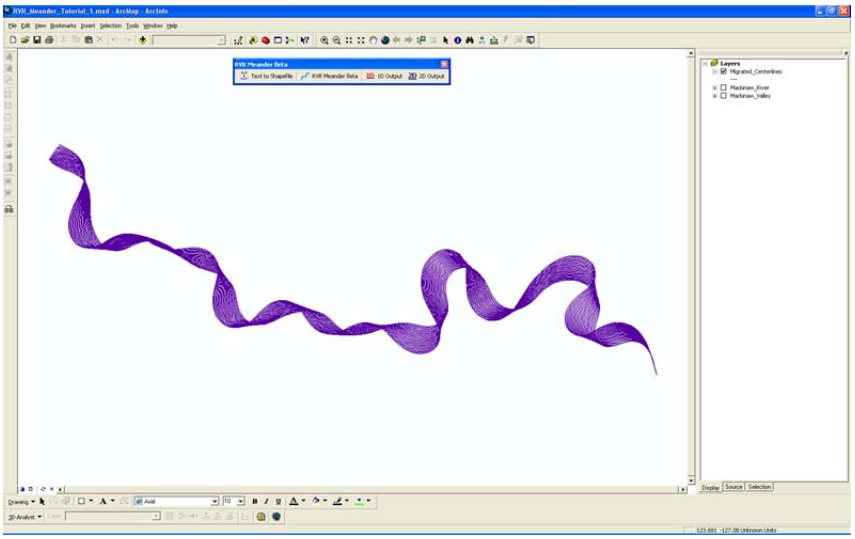

Figure 29. 1D output - Migrated Centerlines shapefile added into ArcMap.

Before going on to the 2D Output it's important to modify the properties of the Migrated Centerlines layer to make it easier to visualize. If you already know enough of ArcMap to do this without any guidance or are not interested at the time proceed to section 4.8. In case you wish to learn how to modify a layer's properties for better and customized visualization read thoroughly the next section.

4.7.2. CUSTOMIZING THE VISUALIZATION OF THE 1D OUTPUT SHAPEFILE

Right click on the Migrated Centerlines layer and on its context menu select Properties (see Figure 30). Go to the Symbology tab and on the left pane called Show select Categories – Unique Values (see Figure 31). Make sure that in the "Value Field" the option YEARS is selected and that you uncheck the box corresponding to all other values. Before going on make sure that everything looks like Figure 31.

If you want to display all values (all iterations) click on the Add All Values button but if you only want to visualize every 5 iterations click on the Add Values button. A new window will be displayed in which you can select the iterations (years) you want to visualize (see Figure 32). Hold the Ctrl key down on your keyboard and select the following iterations: 5, 10, 15, 20, 25, 30 and 35. Click OK and the Layer Properties Window will include these values. If you want a different Color Ramp use the dropdown menu and select the one you like. Click Apply and see how the Output will look like (see Figure 33). If you want, explore other options inside the Layer Properties Window and when you feel satisfied with the customized visualization of the 1D Output proceed to the next section.

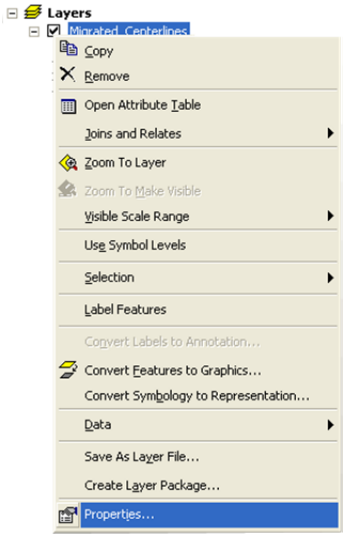

Figure 30. Select Properties on the Migrated Centerline's context menu.

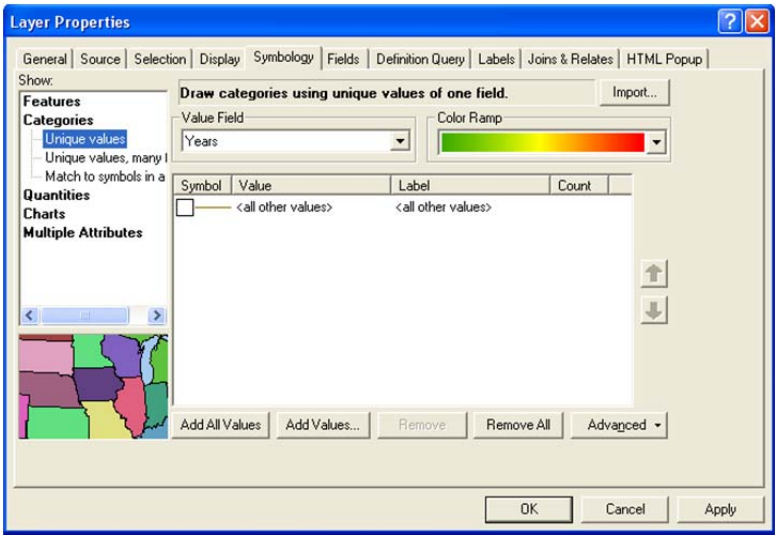

Figure 31. Layer Properties Window.

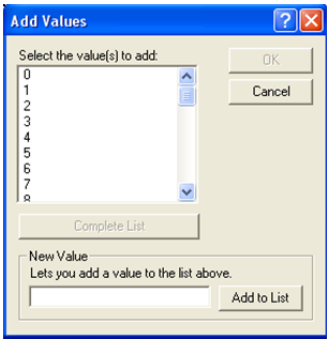

Figure 32. Add Values window. Select the ones you want while holding the Ctrl key down.

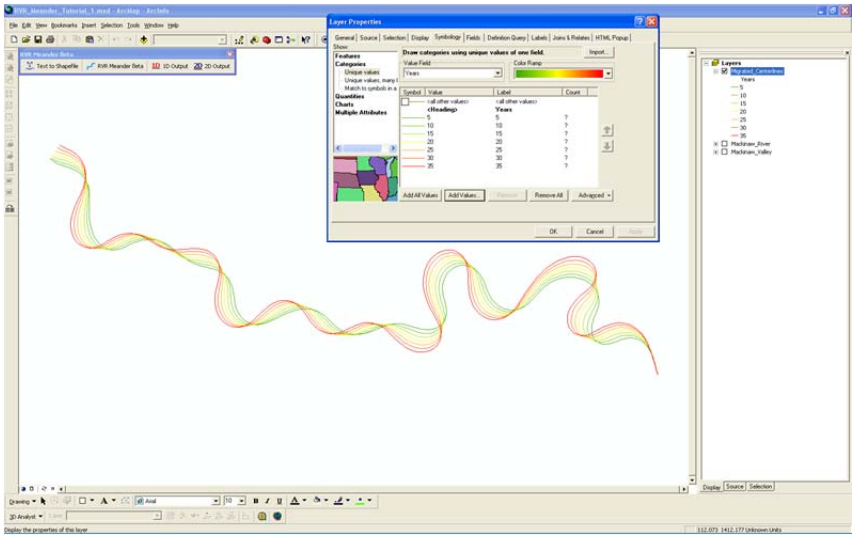

Figure 33. 1D Output customized visualization.

4.8. CREATING AND VISUALIZING 2D OUTPUT IN ARCMAP

4.8.1. CREATING THE 2D OUTPUT SHAPEFILES

Click the "2D Output" command on the RVR Meander toolbar (see Figure 34). This command displays a window (see Figure 35) that will let the user specify in which folder are the 2D output files saved.

Figure 34. Opens user form to import 2D Output parameters.

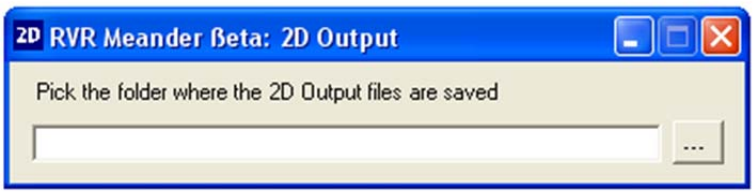

Figure 35. 2D Output user form.

Click on the browse button ... to select the folder where the output files from the current run were saved. Once you do so the window will expand (see Figure 36) allowing you to select which parameters and for which iteration (see Figure 37) you wish to output. Make sure you browse to the correct folder. If you don't a warning message will let you know that no output files are saved on the specified location.

Select the T=5.000000 years iteration (see Figure 37) and also check the box that says Select All. This will automatically select all the parameters that are available for output. The window should now look like the one shown in Figure 38. Click Finish to start processing the 2D Output. While the process is taking place messages will be displayed on ArcMap's status bar (bottom of the screen) asking the user to wait for a few seconds (see Figure 39). ArcMap's screen will freeze for an instant while the process takes place but will refresh as soon as it is finished.

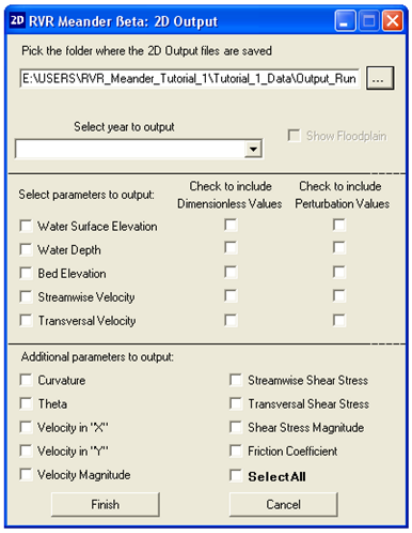

Figure 36. 2D Output user form – expanded.

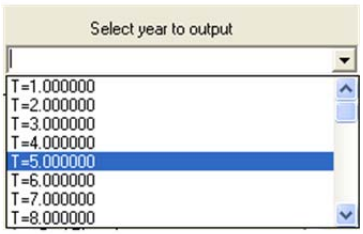

Figure 37. 2D Output user form – expanded.

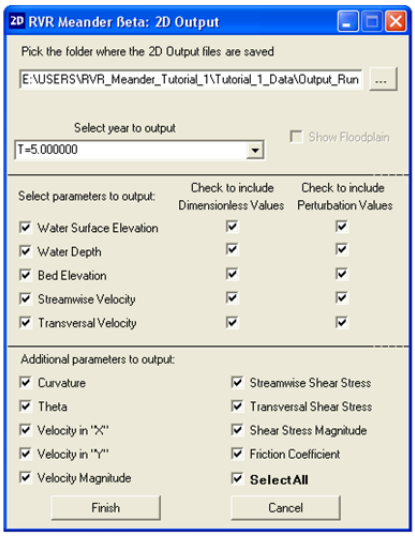

Figure 38. 2D Output Window completed and ready to create shapefiles.

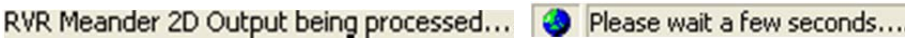

Figure 39. 2D Output – Status bar messages while processing.

Two shapefiles will be added into your map called "2Dafter_T=5.000000_yrs.shp" and "Boundary_After_T=5.000000_yrs". The first one contains the 2D Output values and is made up of points (see Figure 40). Each point is located on a given cross section and contains the value for the different computed parameters at that specific location in space. The values can be seen in the Attribute Table of the layer. If you want to visualize it right click on the layer to display its context menu and select Attribute Table. A new window will be displayed (see Figure 41) with all the values for the parameters that were checked in the 2D Output Window. The meaning of the variables can be found in Appendix 1.

The second layer is a boundary polygon for the corresponding iteration (see Figure 42). This boundary polygon is necessary to create a TIN or Raster to visualize different parameters in ArcMap. Figure 43 shows a close up view of the 2D output shapefiles. Display properties were changed for both layers (inside the Symbology tab of the Layer Properties window).

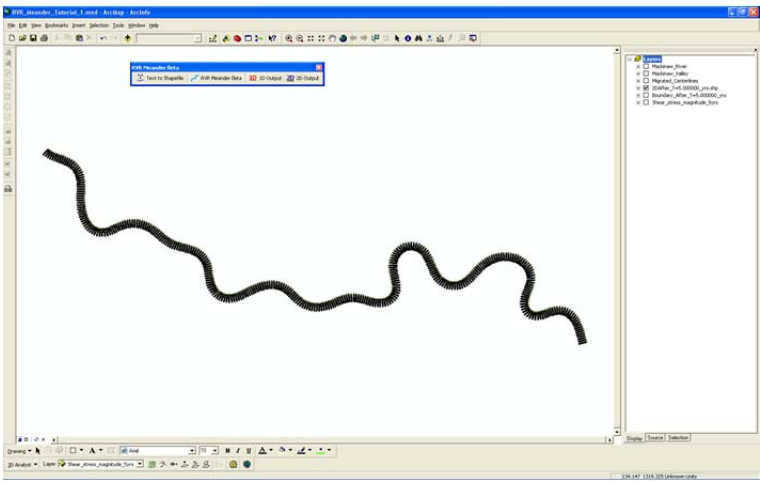

Figure 40. 2D Output shapefile added into ArcMap.

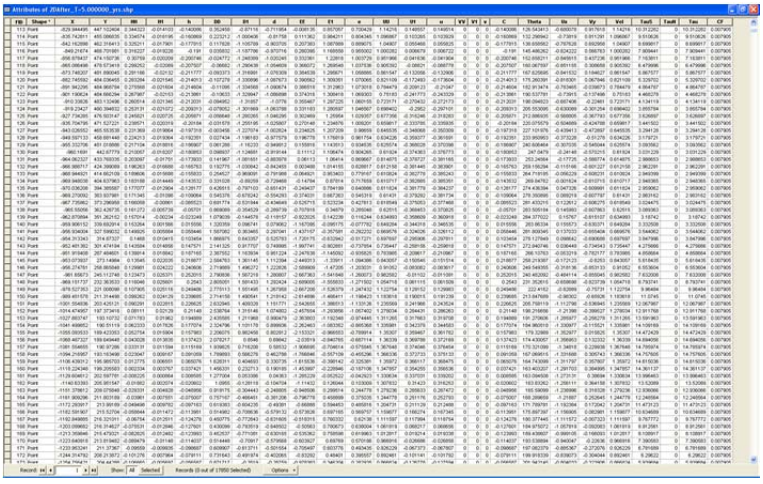

Figure 41. Attribute Table for the 2D Output including all selected parameters.

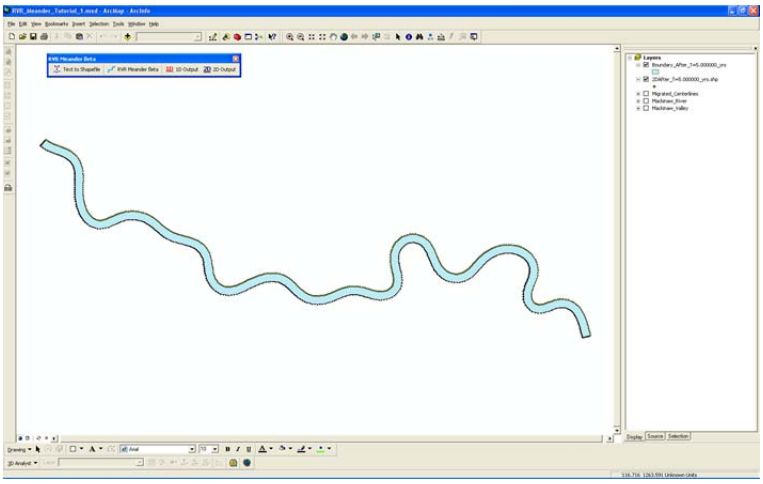

Figure 42. 2D Output Boundary Polygon added into ArcMap.

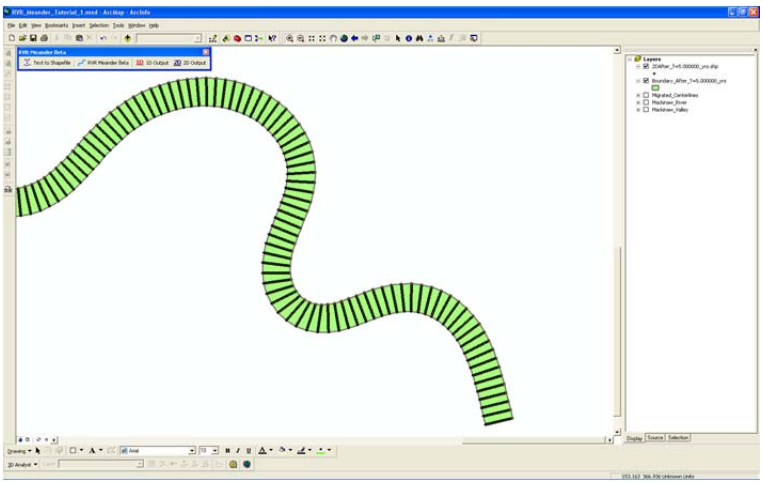

Figure 43. 2D Output – Close up to see the detail of the created shapefiles.

4.8.2. CREATING A TIN TO VISUALIZE SPECIFIC 2D OUTPUT PARAMETERS

In order to create a TIN for any given parameter the user must use the "3D Analyst" extension of ArcMap. If not yet activated, the user must do so by going to the Tools Menu and then Extensions (see Figure 44). Once it's activated the user can add the toolbar in the same way that the RVR Meander Toolbar was added (refer to Section 2).

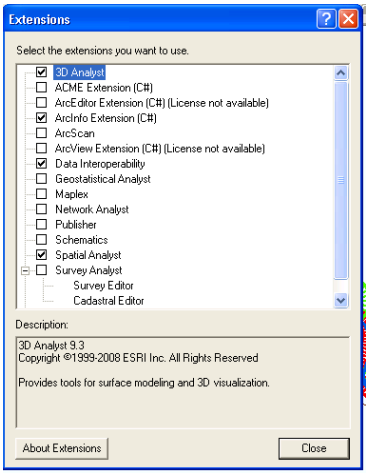

Figure 44. Enabling the 3D Analyst extension for ArcMap.

Click on the "3D Analyst" command and select "Create/Modify TIN" and then "Create TIN From Features" (see Figure 45). A new window appears in which you should select both the 2D Output shapefile and the boundary polygon.

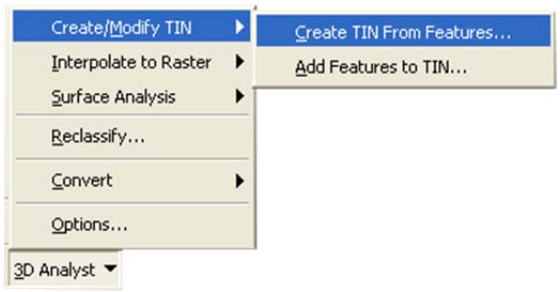

Figure 45. Accessing the "Create Tin from Features" window with the 3D Analyst toolbar.

You will create a TIN for the parameter "TAU" using the "5 years" iteration and the corresponding boundary polygon (see Figure 46). Note that for the 2D Output file the "Height source" for the TIN is the desired parameter ("TAU" - shear stress magnitude in this case) and in the case of the boundary polygon the option "None" should be selected as well as the "Soft Clip" option. User should also specify the name and folder to save the TIN (see Figure 47). You can name it "Shear_stress_magnitude_5yrs" or simply "TAU_5yrs". Do not forget to use the boundary polygon in the creation of TINs. Not using it will not avoid creating the TIN but it will not follow the river's migrated centerline. Once the user click's "OK" the TIN will be created and displayed in ArcMap (see Figure 48).

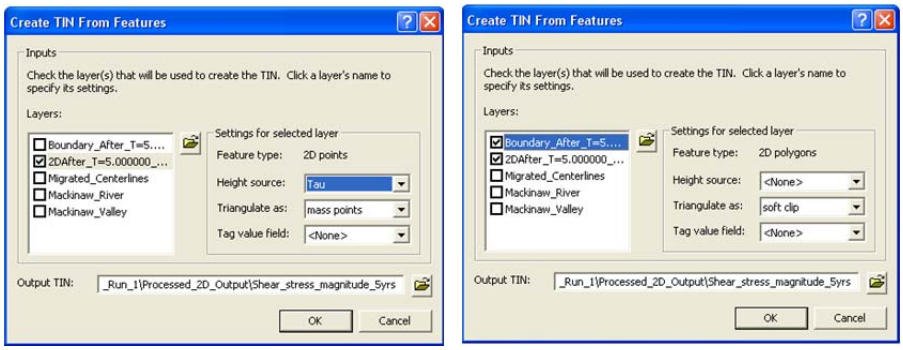

Figure 46. Required parameters to Create a TIN from features using the 2D Output produced with the RVR-GUI.

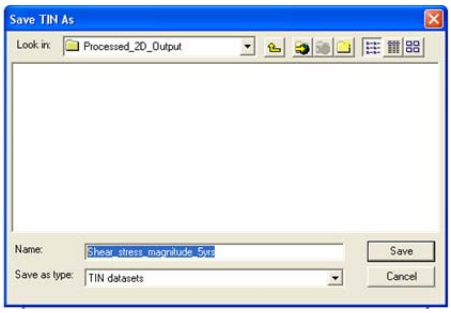

Figure 47. Select folder to Save the TIN.

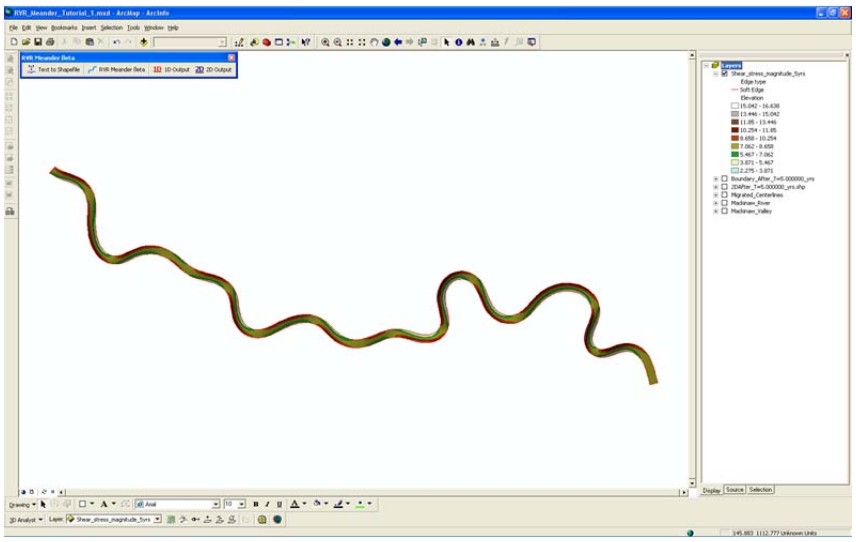

Figure 48. TIN created and added into ArcMap.

For visualization purposes it might be necessary to modify the properties of the new TIN. If you already know enough of ArcMap to do this without any guidance or are not interested at the time you are done with this tutorial. You can save the map and close ArcMap. In case you wish to learn how to modify the TINs properties for better and customized visualization read thoroughly the next section.

4.8.3. CUSTOMIZONG THE VISUALIZATION OF THE TIN CREATED FOR THE 5 YEARS ITERATION AND THE PARAMETER "TAU"

Right click on the TIN ("Shear_stress_magnitude_5yrs") to open its context menu. Select the Properties option and go to the Symbology tab. You might want to uncheck the Edge Types box (left pane) and go to Elevation. TINs are generally created with 9 classes but less might make it easier to visualize. Therefore on the dropdown menu for classes select 5. If you want you can uncheck the box to Show hillshade illumination effect in 2D display (bottom left). Make sure to click the Apply button to see what each change does to your display. You may need to drag the Layer Properties Window to a place where it lets you see the TIN (see Figure 50). Explore the possibilities (different color ramps, class numbers, effects, etc.) and when you feel satisfied with the customized visualization of the TIN click OK.

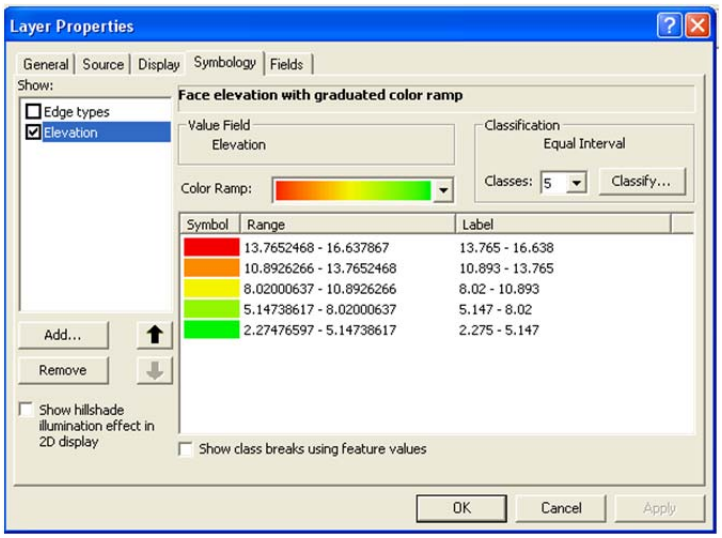

Figure 49. TIN Layer Properties Window – Customizing Symbology.

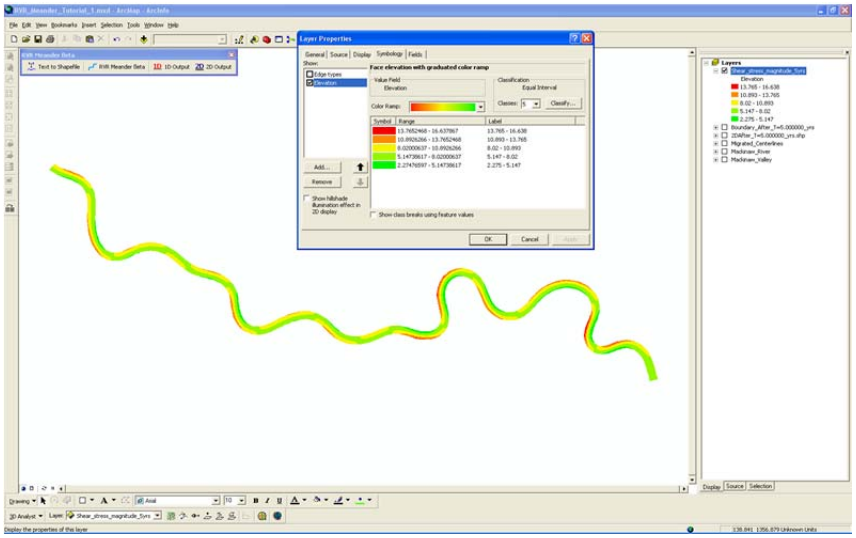

Figure 50. Visualization of the TIN while changing its properties.

You can repeat the process for different parameters or different iterations. Section 5 shows customized visualization made with two different iterations and 3 different parameters. It also includes Floodplain Heterogeneity visualization which wasn't explored in this tutorial. If you want to explore that option refer to Tutorial 3.

5. TUTORIAL 2: MACKINAW RIVER, IL USA; USING THE PHYSICALLY-BASED APPROACH

5.1. INTRODUCTION

This tutorial assumes that you already did the first one (Section 4). Several details are omitted since they were provided in Tutorial 1. The main difference between this tutorial and the previous one is the bank erosion approach used for the computations.

5.2. SETTING UP AND RUNNING A SIMULATION WITH THE PHYSICALLY-BASED APPROACH

Please follow these steps. In case you need more detail on any of them refer to Tutorial 1.

1. Open ArcMap and create a new map. Save it.
2. Create the river centerline and valley shapefiles from the text files provided in the Tutorial 2 folder. If you already did Tutorial 1 you can just add those shapefiles into your map.
3. Open the RVR-GUI and in the Layer Definition tab select the shapefiles for the run.
4. Import Configuration for the current run by browsing to the Tutorial 2 folder and selecting "Mackinaw-PB.txt".
5. Make sure you indicate the output folder for the run in the Output tab.
6. Go to the Run menu and click on Run Simulation.
7. An "Open File Dialog" will show up prompting the user to choose the Cross Section Properties file for the run (see Figure 51). Browse to the Tutorial 2 folder and select "InitialSectionProperties.dat". Currently, details on the format of this file are only given in the manual for the standalone version of RVR Meander. The simulation will start after clicking Open and the Log Watcher will appear on screen.

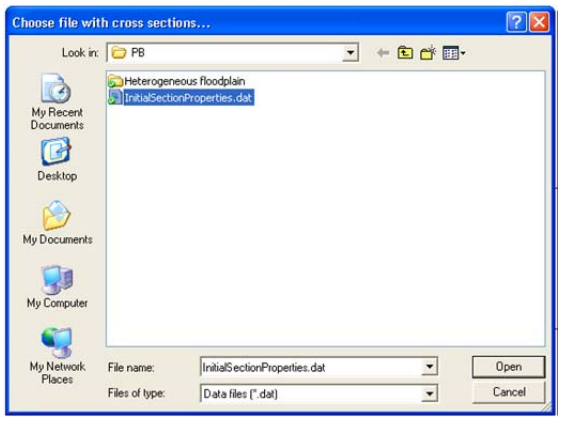

Figure 51. Choose file with cross section properties for the simulation.

8. Create, edit and visualize 1D and 2D output for the run.

6. TUTORIAL 3: MACKINAW RIVER, IL USA; USING THE PHYSICALLY-BASED APPROACH AND FLOODPLAIN HETEROGENEITY

6.1. INTRODUCTION

This tutorial assumes that you already did the first one (Section 4). Several details are omitted since they were provided in Tutorial 1. The main difference between this tutorial and the previous ones is the use of floodplain heterogeneity which assumes that soil properties are not constant and vary across the valley in which the river flows.

6.2. SETTING UP AND RUNNING A SIMULATION WITH THE PHYSICALLY-BASED APPROACH AND FLOODPLAIN HETEROGENEITY

Please follow these steps. In case you need more detail on any of them refer to Tutorial 1.

1. Open ArcMap and create a new map. Save it.
2. Create the river centerline and valley shapefiles from the text files provided in the Tutorial 3 folder. If you already did previous tutorials and have the shapefiles at hand you can just add them into your map.
3. Open the RVR-GUI and in the Layer Definition tab select the shapefiles for the run.
4. Import Configuration for the current run by browsing to the Tutorial 3 folder and selecting "Mackinaw-PB-HeterogeneousFloodplain.txt".
5. Make sure you indicate the output folder for the run in the Output tab.
6. Go to the Run menu and click on Run Simulation.
7. Two "Open File Dialogs" will show up prompting the user to choose the Cross Section Properties file for the run (see Figure 51) and the floodplain properties file (see Figure 52). First browse to the Tutorial 3 folder and select "InitialSectionProperties.dat" and second go to the Heterogeneous Floodplain folder and select any of the available "Grid.txt" files. Different grid sizes are provided in case you want to explore the effect of having more or less data describing the floodplain. Details on these two types of input files are currently only provided in the manual for the standalone version of RVR Meander.

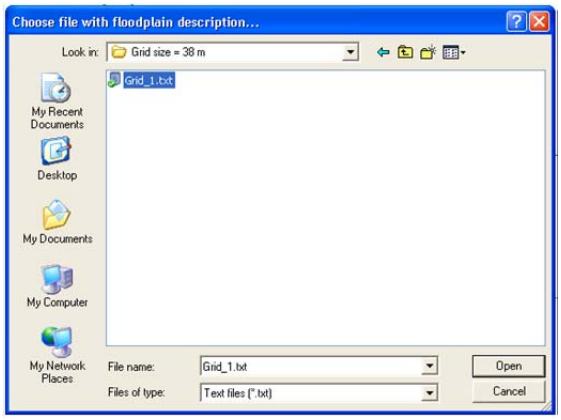

Figure 52.Choose file with floodplain description for the simulation.

8. Create, edit and visualize 1D and 2D output for the run. Make sure to select the checkbox to Show Floodplain in the 2D Output window. If you do so, after the 2D Output processing finishes you should have something similar to Figure 53 on your screen.

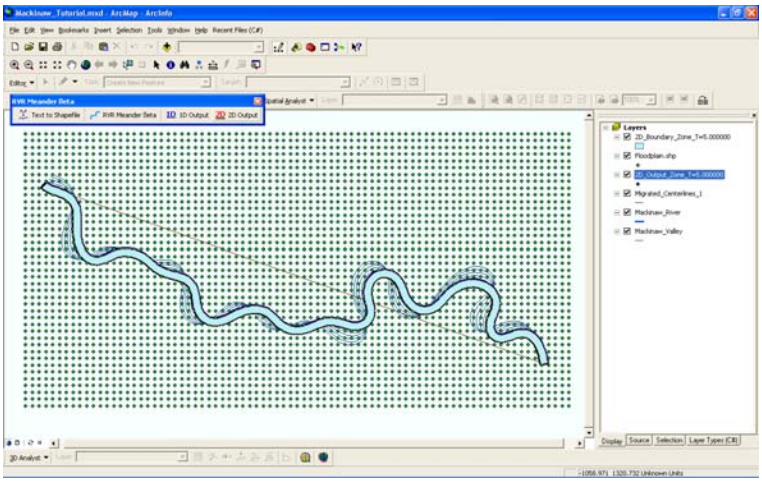

Figure 53. Floodplain Heterogeneity and 2D output shapefiles added into ArcMap.

6.3. VISUALIZING FLOODPLAIN PROPERTIES IN ARCMAP

The floodplain shapefile is also made up of points (as the 2D Output shapefile). Each point contains the floodplain properties at that location. In order to visualize the floodplain properties you can use the Spatial Analyst, the 3D analyst or even the Geostatistical Analyst to create a raster to show the properties. An example will be shown here using the 3D Analyst toolbar (see Figure 54) to create a floodplain Raster using the "Inverse Distance Weighted – IDW" algorithm (see Figure 55). The parameter used is the critical shear stress (TauC). The resulting raster with some modifications for better visualization is shown in Figure 56.

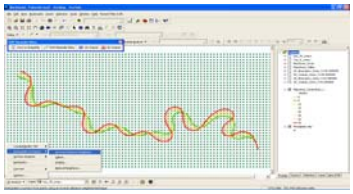

Figure 54. Create a Raster using the IDW method from the 3D Analyst toolbar.

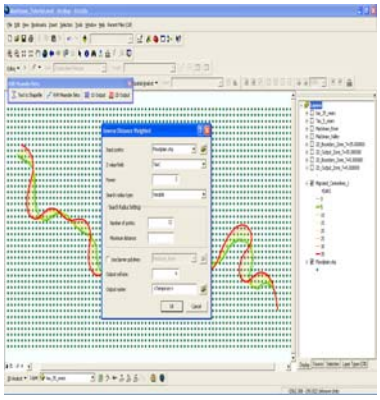

Figure 55. IDW parameter definition window for the Floodplain raster.

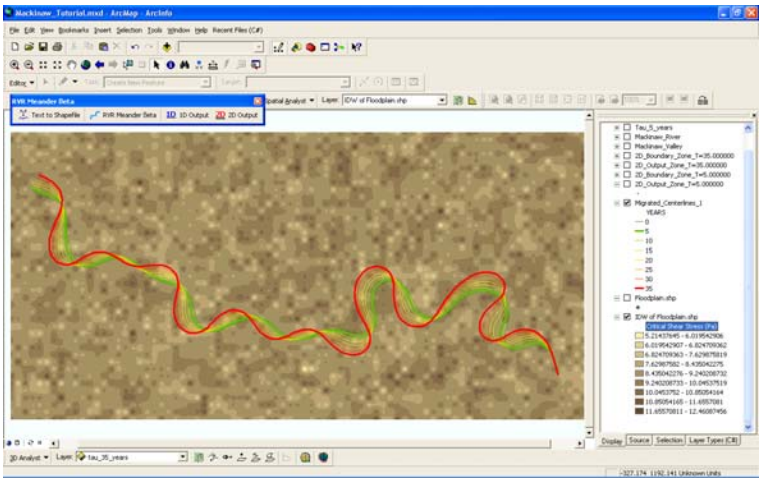

Figure 56. Floodplain Heterogeneity Raster using the Critical Shear Stress TauC.

7. EXAMPLE OF POST-PROCESSED OUTPUT USING ARCMAP'S CAPABILITIES

The RVR-GUI in ArcMap allows using all the built in functionalities which is an added future for the interface. Quality output can be made with some post processing effort with ArcMap's tools. An example is shown below (see Figure 57).

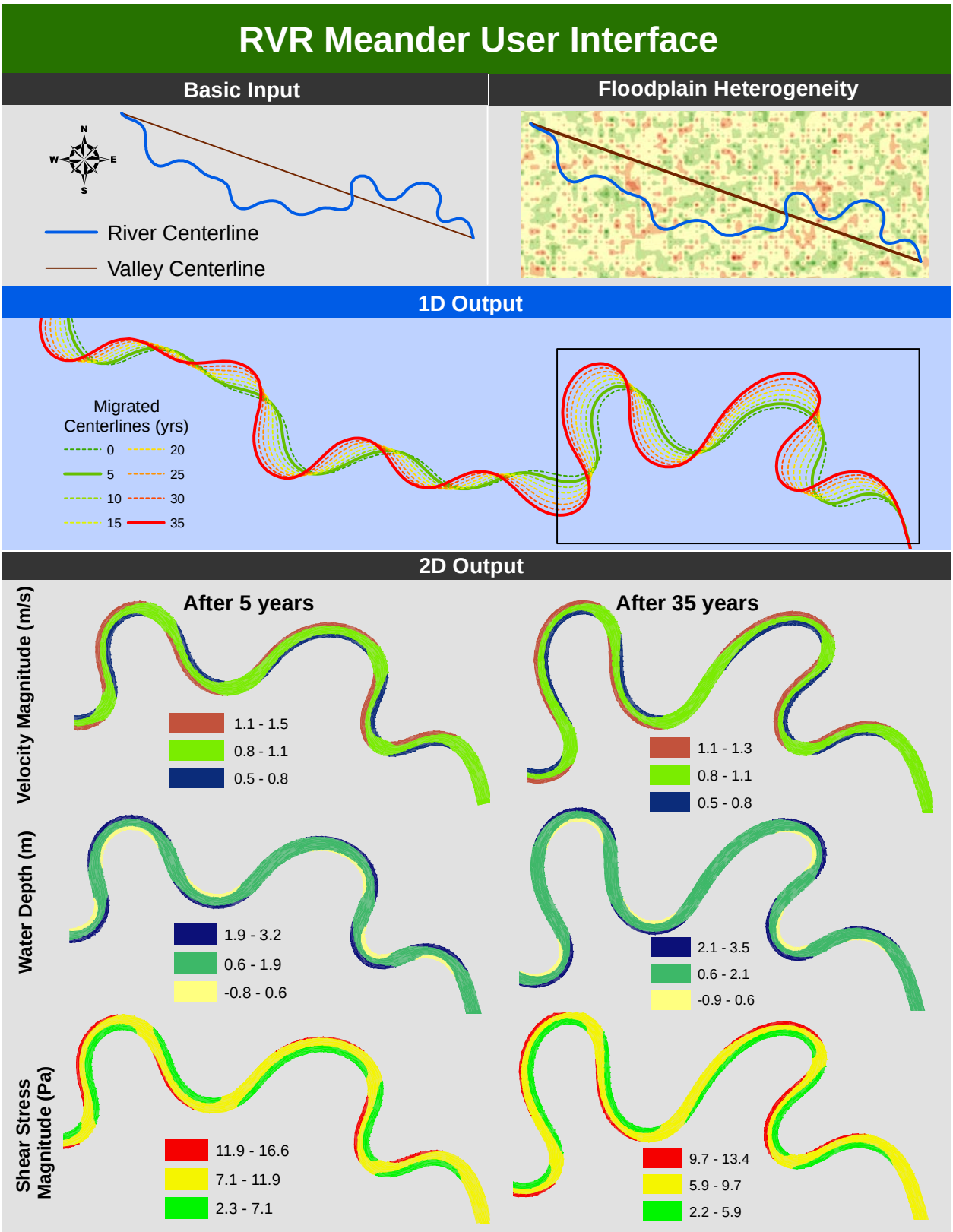

Figure 57. Example of post-processed output using RVR-GUI and ArcMap.

A1. APPENDIX 1: DESCRIPTION OF THE PARAMETERS IN THE OUTPUT FILES

Table A1 presents a simple description of the different variables produced as Output in RVR Meander.

Table A 1. Description of RVR Meander output parameters.

Parameter		Meaning
1	HH	Water surface elevation
2	DD	Water depth
3	EE	Bed elevation
4	H1	Water surface elevation perturbations
5	D1	Water depth perturbations
6	E1	Bed elevation perturbations
7	h	Dimensionless water surface elevation
8	d	Dimensionless water depth
9	e	Dimensionless bed elevation
10	UU	Streamwise velocity
11	VV	Transverse velocity
12	U1	Streamwise velocity perturbations
13	V1	Transverse velocity perturbations
14	u	Dimensionless streamwise velocity
15	v	Dimensionless transverse velocity
16	C	Curvature
17	Theta	Angle of curvature
18	Ux	Velocity in the "x" component
19	Vy	Velocity in the "y" component
20	Vel	Velocity magnitude
21	TauS	Streamwise shear stress
22	TauN	Transverse shear stress
23	Tau	Shear stress magnitude
24	CF	Friction coefficient