Preprocessor Janet

First Steps

UnTRIM-Edition

smile consult GmbH
www.smileconsult.de

Version 1.0 (19.9.2005)

1 Getting Started

1.1 Graphical User Interface

Starting Janet displays its main window. The main window consists of different parts, which are illustrated in Figure 1-1. The working window displays the models (computational grid, digital terrain model, density function, etc.) with various visualization modes. All mouse-based editing is performed in this part of the graphical user interface. The working window allows zooming with no limiting zoom factor. The current zoom state is highlighted in the overview window.

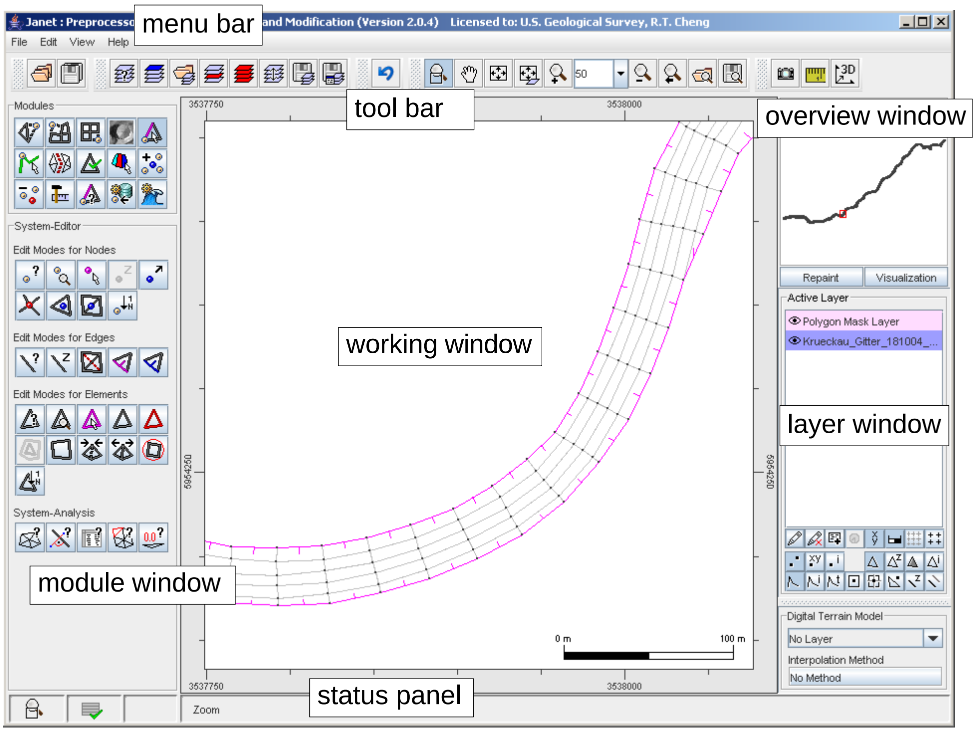

Figure 1-1. The graphical user interface

The tool bar gives access to the basic functionality. Among these functions are basic file operations, the undo function, zoom operations and the 3D visualization. More model specific functions are offered in the module window. Various functions grouped in different modules allow creating, editing, optimizing and analyzing different kind of models. The currently choosen function is displayed in the status panel with its icon and a short

description.
In the layer window the currently edited model is selected. The layer window also allows quick editing of basic visualization settings for the working area. Finally, the menu bar offers access to file history lists, basic program preferences and the help system.

1.2 Loading an UnTRIM model

An UnTRIM model is imported in the preprocessor with the [Load Layer] function from the tool bar or alternatively via the [Load Layer] → [Choose File] menu item in the file menu.
The specific file (e.g. “u_channel.grd” from the directory “examples”) is choosen in a file selection dialog. The file type has to be set to the file filter “UnTrim Ascii Format”.

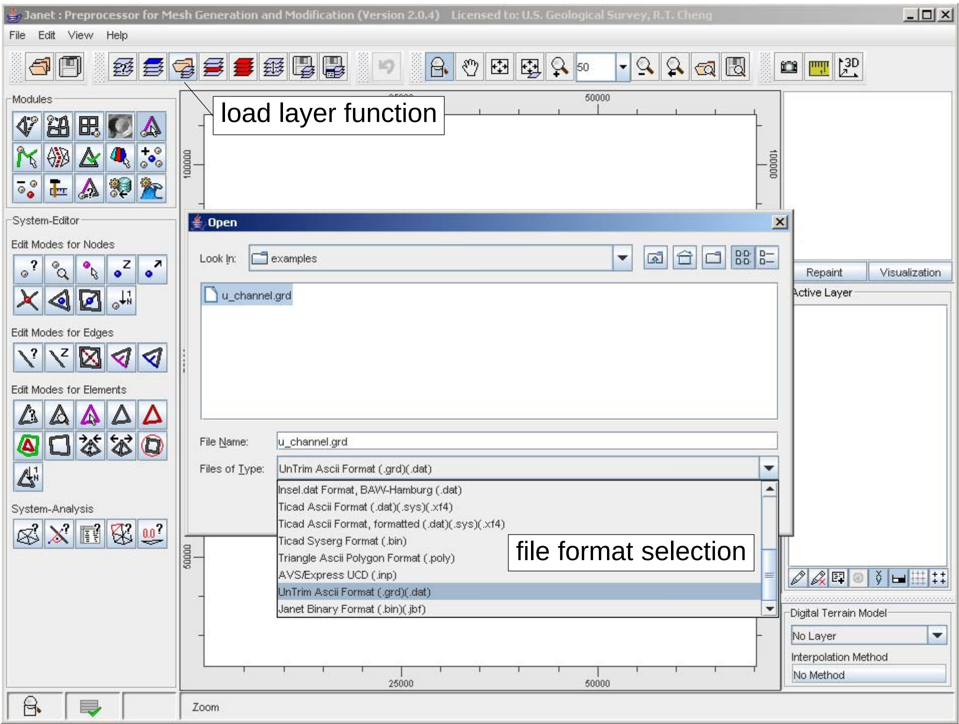

Figure 1-2. Loading the file “u_channel.grd”

Having successfully selected the file, the user is asked to define the model/layer type. In this specific case the model “Unstructured Orthogonal Grid” for the UnTRIM model is preselected and can be accepted without changes. This explicit model type definition allows model conversion, for example to convert a Finite Element model into an UnTRIM model.

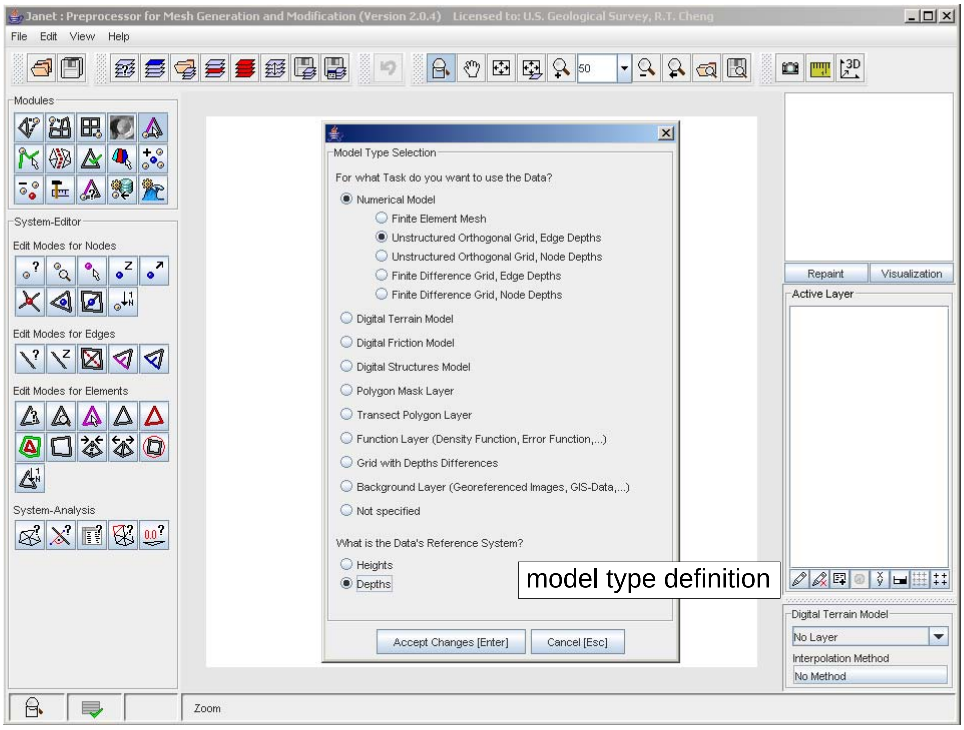

Figure 1-3. Defining the model type

1.3 Using the Zoom Function

After the grid was imported into the preprocessor, the entire domain is displayed on the working window. The next task is to change the zoom factor to a more detailed view of the grid.

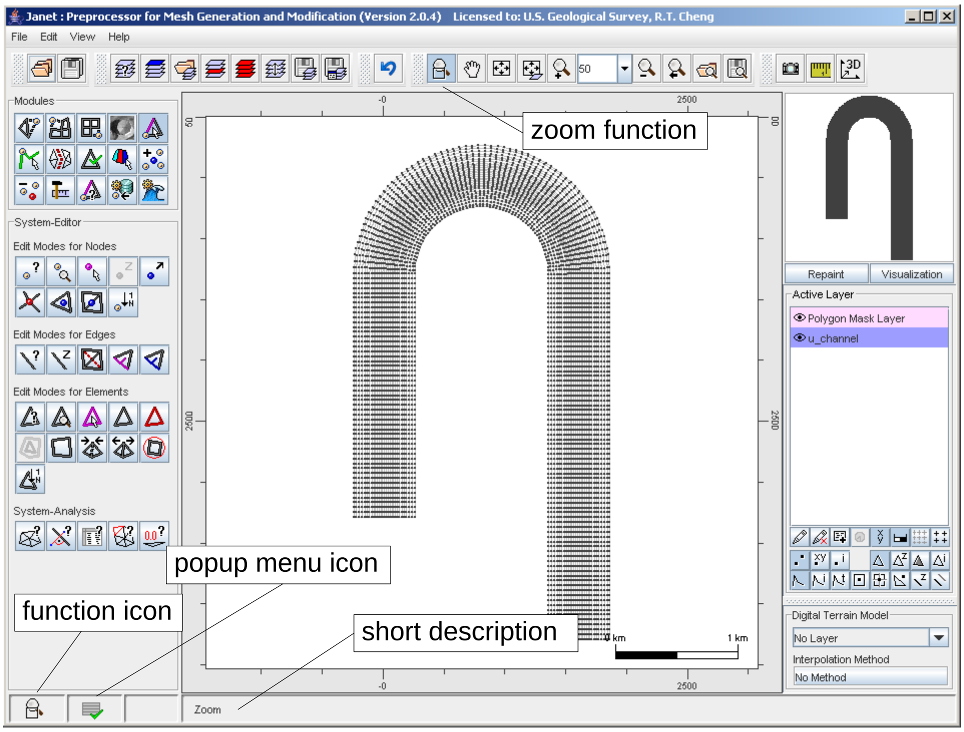

Figure 1-4. Defining the model type

The zoom function is enabled by selecting the specific button in the tool bar. Zooming is a mouse–based function, so the button remains pressed and the status panel is updated with the current settings. Besides the function icon and a short description, the popup menu icon indicates that a popup menu with further available actions can be accessed via the right mouse button on the working window.
Zooming is done with the left mouse button by pressing and dragging a bounding box for the desired zoom state.

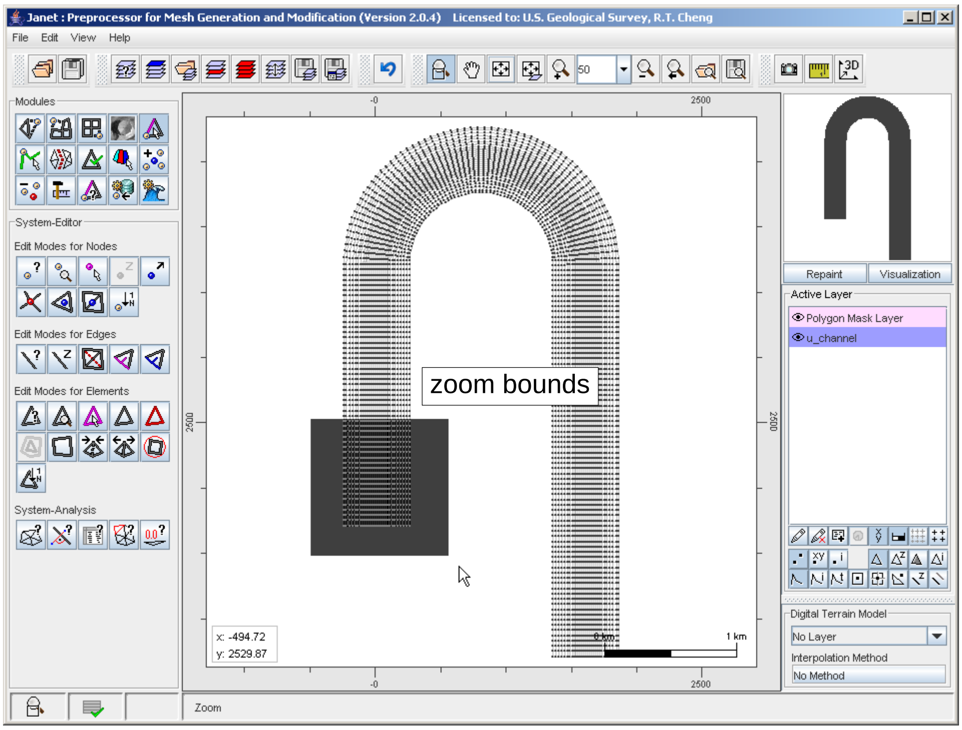

Figure 1-5. Changing the zoom state

When the left mouse button is released the working window is repainted for the changed zoom state (see Figure 1-6).

To restore the default zoom state, either the menu item “Zoom to full extend” in the popup menu of the zoom function or the function button from the tool bar has to be selected (see Figure 1-6).

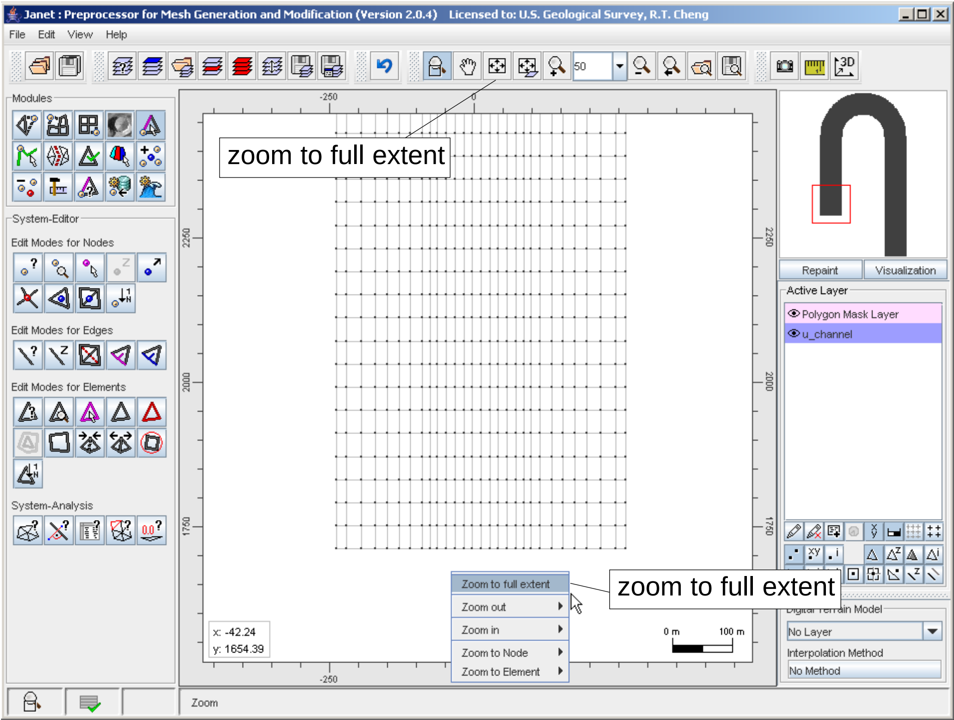

Figure 1-6. Zoom to full extent

1.4 Modify a Grid's Visualization Settings

The preprocessor allows various visualization methods for unstructured orthogonal grids. Basic modifications can be performed with the quick edit buttons in the layer window.

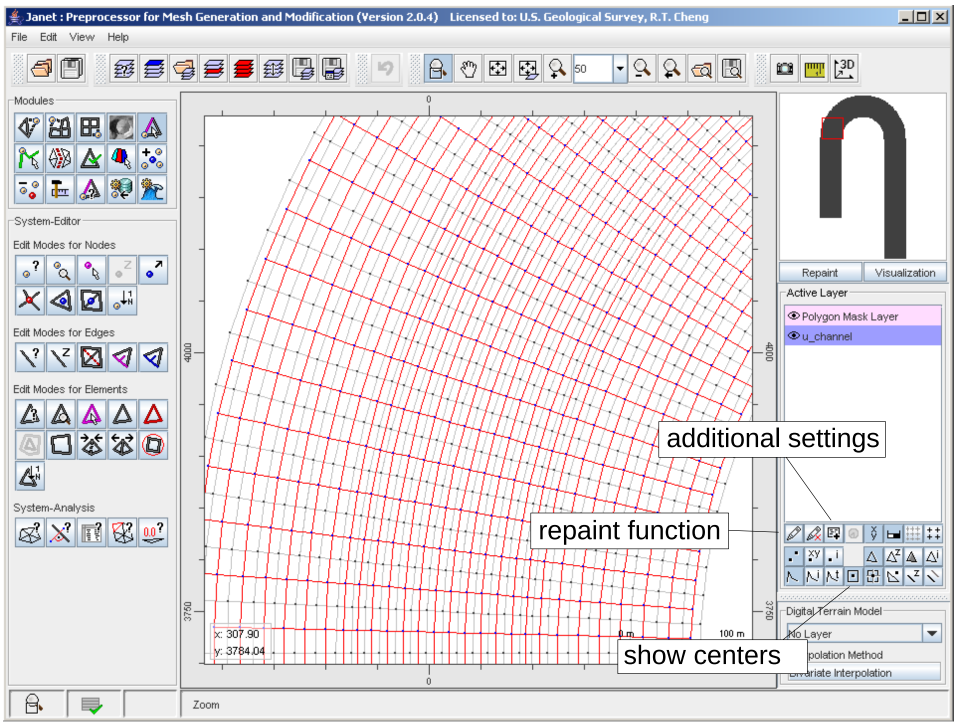

Figure 1-7. Modify visualization settings with quick edit buttons

To display the center points and center point connections for example, the specific buttons (see tooltips!) are selected and the changes are submitted by pressing the repaint button.

Additional settings can be modified in a separate dialog window. The user interface offers different methods for alphanumerical plotting the grid’s properties, enabling 2D surface plots and displaying the basic geometric objects of the model.
A surface plot for example is performed by activating the tab “Elements” and selecting the Checkboxes [Element Depth] and [Color Elements by Value].

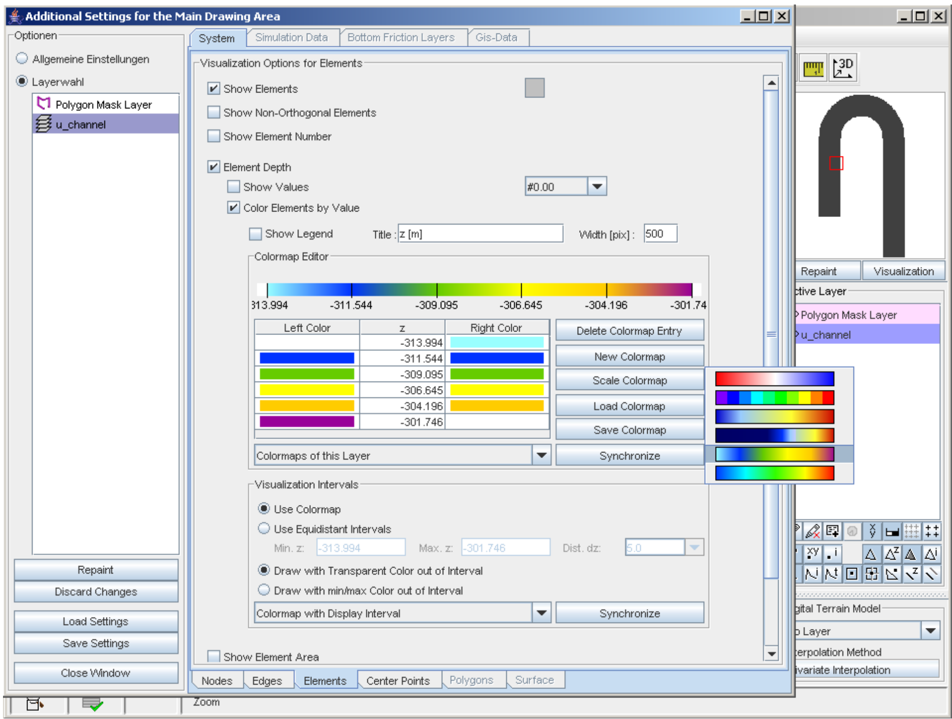

Figure 1-8. Show a surface representation of the grid

The surface plot relies on a colormap which assigns colors to depths values. The colormap can be individually modified with the integrated editor. The editor allows operations to create map entries, to perform an automatic scaling to the z-bounds of the grid and offers a set of predifined colormaps. The application of this visualization method for the “u_channel.grd” leads to the result presented in the next figure.

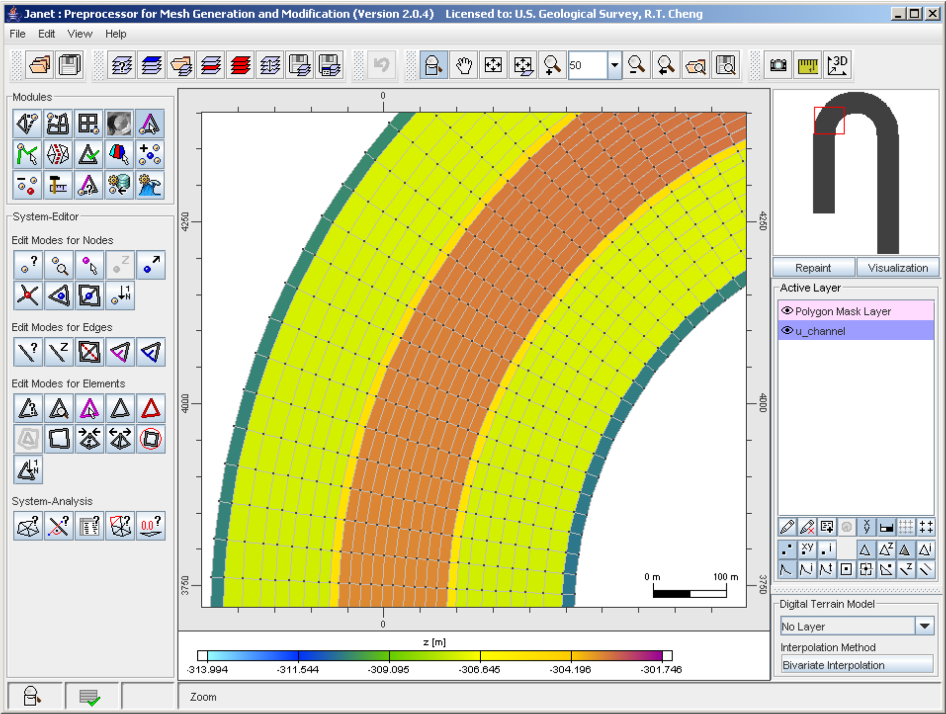

Figure 1-9. Surface representation of the grid

1.5 3D-Visualization

The integrated 3D viewer allows a detailed analysis of an UnTRIM model. The 3D function of the tool bar can be applied to the current zoom state, so even large models are comfortably analyzed. The three dimensional presentation of the grid is especially adopted to the specific properties of an UnTRIM model (e.g. discrete element depths). Different operations, such as rotation, scaling, etc. can be performed with the 3D viewer.

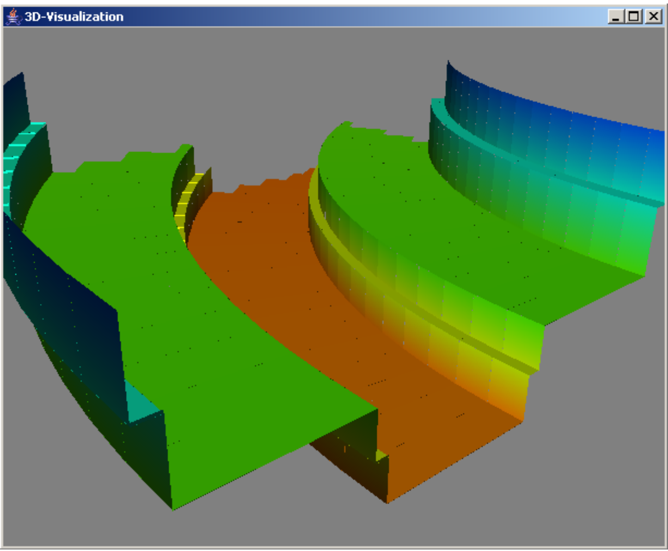

Figure 1-10. 3D viewer

Creating a simple UnTRIM Model

2

2.1 Basic Steps

In this chapter basic steps to create a first UnTRIM model are presented. The grid file “u_channel.grd” from the “expample” directory is used to demonstrate

- mapping of bathymetry data to the grid,
- the definition of open/land boundaries and finally
- exporting the model to the UnTRIM file format.

The simple example touches some basic concepts of the preprocessor. It helps to understand

- the integration of digital models (e.g. terrain model, bottom friction model) in the grid generation process,
- the layer handling and
- using masks for algorithmic editing.

The basic concepts shown in this example can easily be transferred to more complex problems.

2.2 Mapping Bathymetry Data to the Grid

Bathymetry data combined with an approximation method represent a digital terrain model in the concept of the preprocessor Janet. Various approximation and interpolation methods are available (e.g. linear interpolation, nearest neighbour interpolation, natural neighbour interpolation, inverse distance interpolation) and can be applied to unstructured and gridded bathymetry data. In the following example a linear interpolation on triangulated data points is used for mapping data to the UnTRIM model.
The “examples” directory contains an unstructured grid “dtm_u_channel.jbf” in the “Janet Binary Format”, which is imported into the preprocessor with the [Load Layer] function (see chapter 1). The layer type is changed to “Unstructured Digital Terrain Model”, so this layer is automatically set as the digital terrain model in the layer window of the graphical user interface.

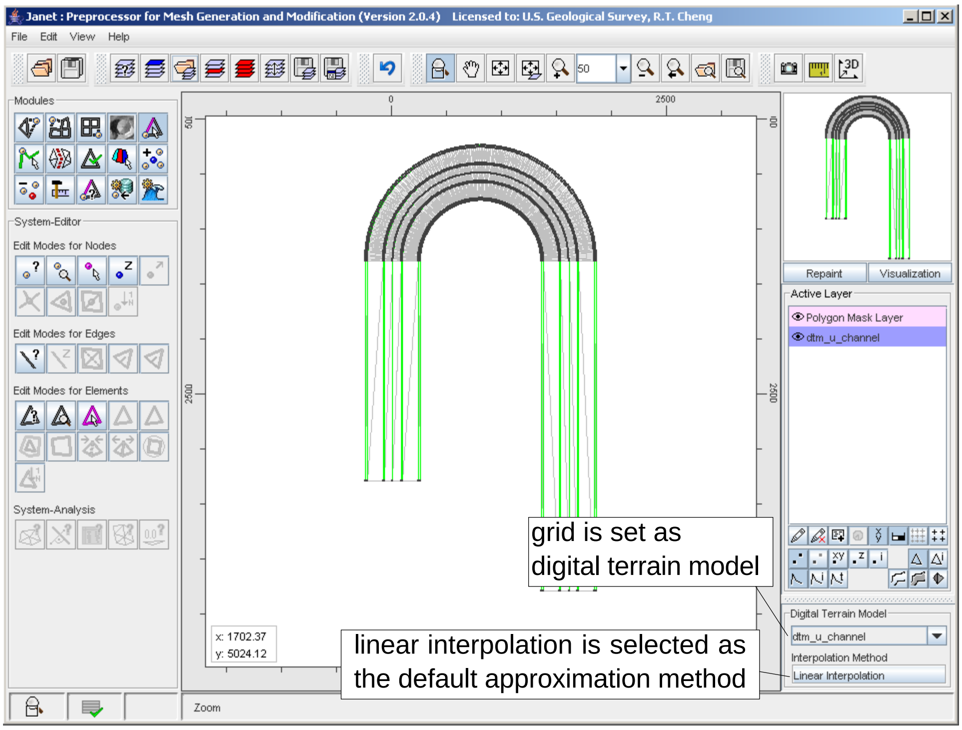

Figure 2-1. The imported digital terrain model

The preselected approximation method is edited by pressing the button labeled [Linear Interpolation]. All available methods and their related parameters are presented in a dialog window. For this example, the additional option [Allow Extrapolation on a triangulated DTM] is selected for the linear interpolation method.

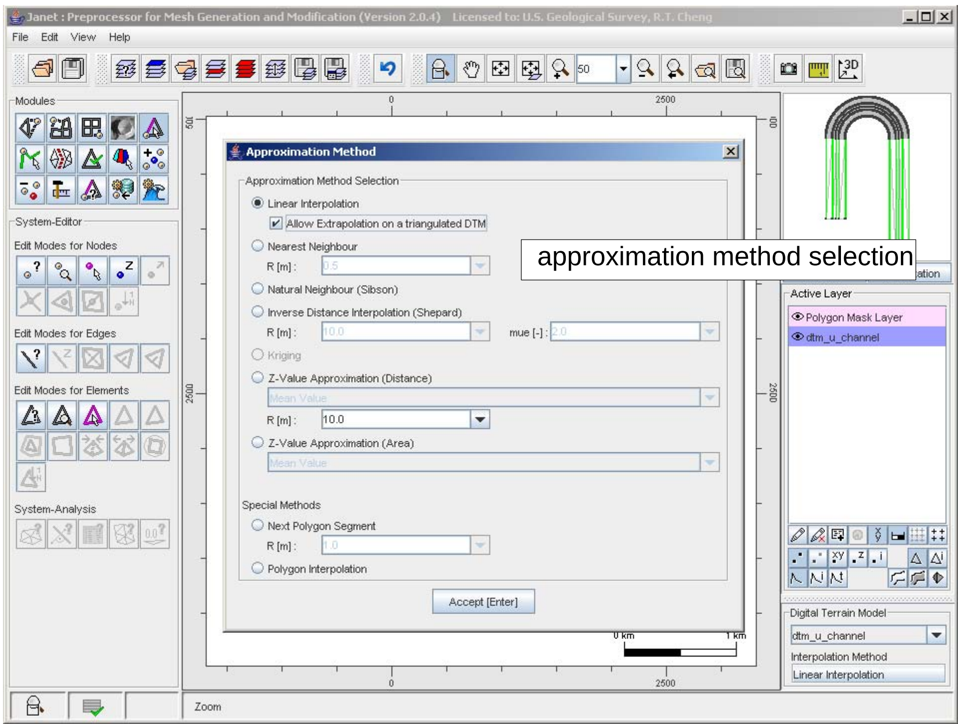

Figure 2-2. Editing the approximation method

In a next step the grid file “u_channel.grd” (see chapter 1) is loaded as an unstructured orthogonal grid to a new layer. The layer is added to the layer list and is selected as the active layer (highlighted entry). All modifications performed with the preprocessor’s functionality are applied to the layer indicated as the “active layer”. To change this layer just select the specific layer with the mouse in the layer window. For the interpolation example the active layer remains the layer named “u_channel”.

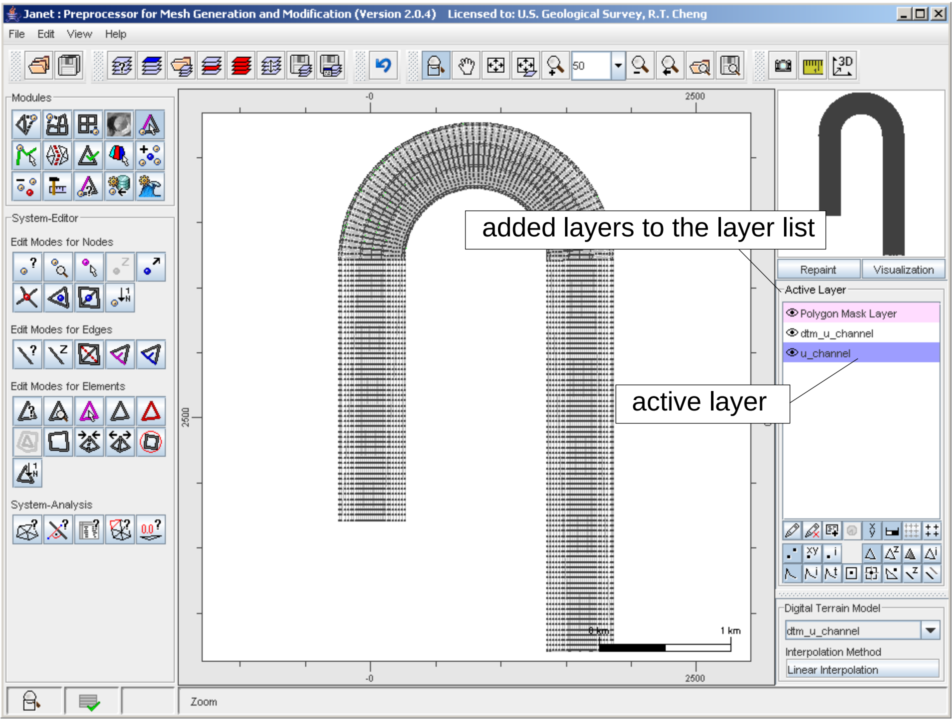

Figure 2-3. Selecting the active layer

In the UnTRIM model depth data is applied to the element edges. The depth is assumed to be constant for the entire edge. A special function enables the editing of those depths values. The mouse function can be used to edit single depths by interactivly selecting an edge on the working window.
Furthermore, in a popup menu different algorithmic editing functions are offered. The popup menu is accessed with the right mouse button pressed in the working area. Choosing the menu item [Interpolate Depth Values] opens a dialog window where the parameters for the interpolation method are edited.

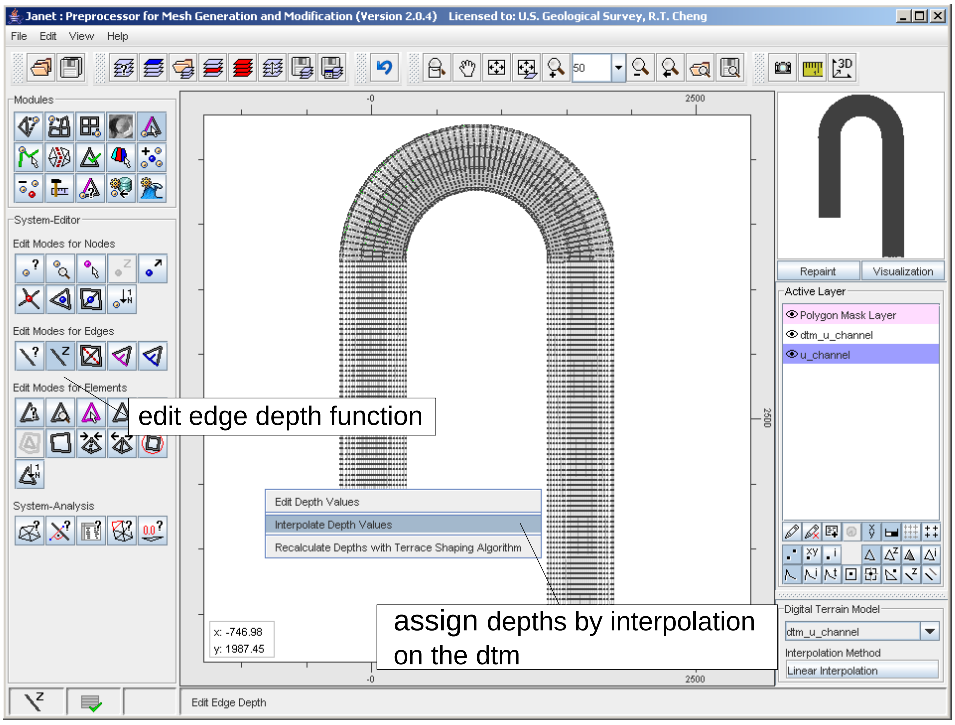

Figure 2-4. Starting the interpolation

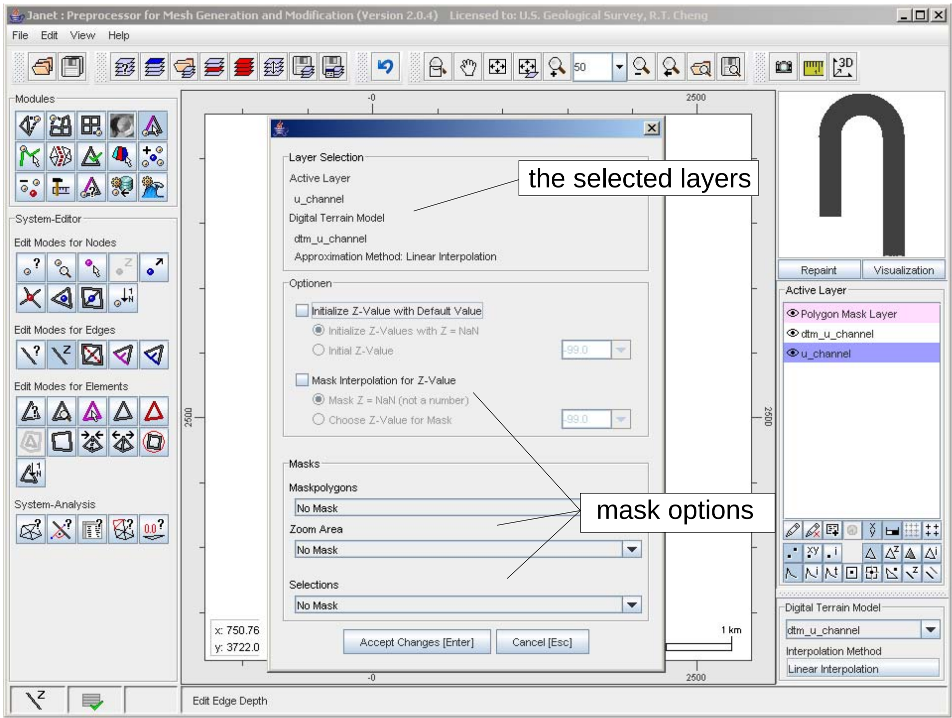

Figure 2-5. Dialog window to modify the options for the interpolation

In the example no modifications are applied in the dialog, so the depths of all edges in the entire grid are interpolated. The button [Accept Changes] starts the interpolation, the progress is plotted in the status panel and finally all views are updated when the method finishes.

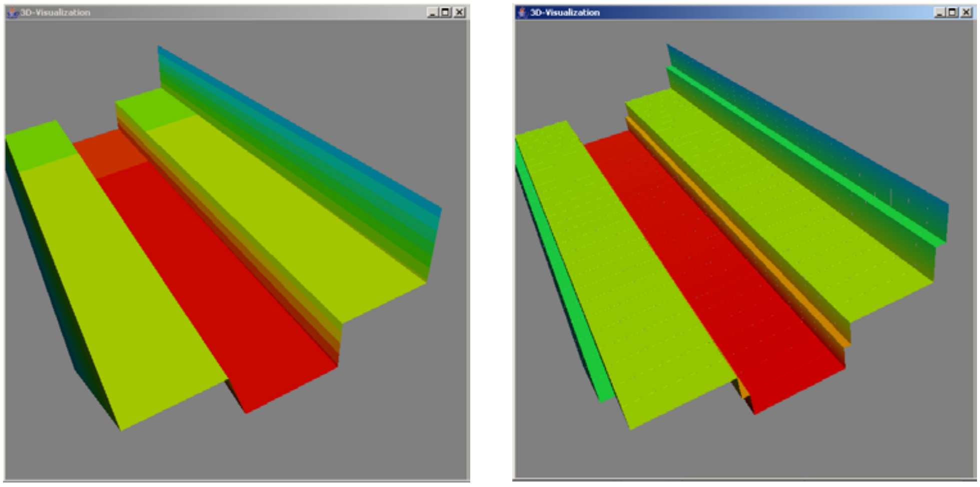

Figure 2-6. 3D view of DTM (left) and grid with interpolated depths (right)

The result of the interpolation is illustrated in Figure 2-6. The figure clearly shows that the interpolation method offered by Janet is suitable for UnTRIM grids.

2.3 Defining Open/Land Boundaries

The definition of open/land boundaries is done by setting markers to those edges which define the land boundary. The function [Edit Boundary Markers] of the system editor provides this functionality.

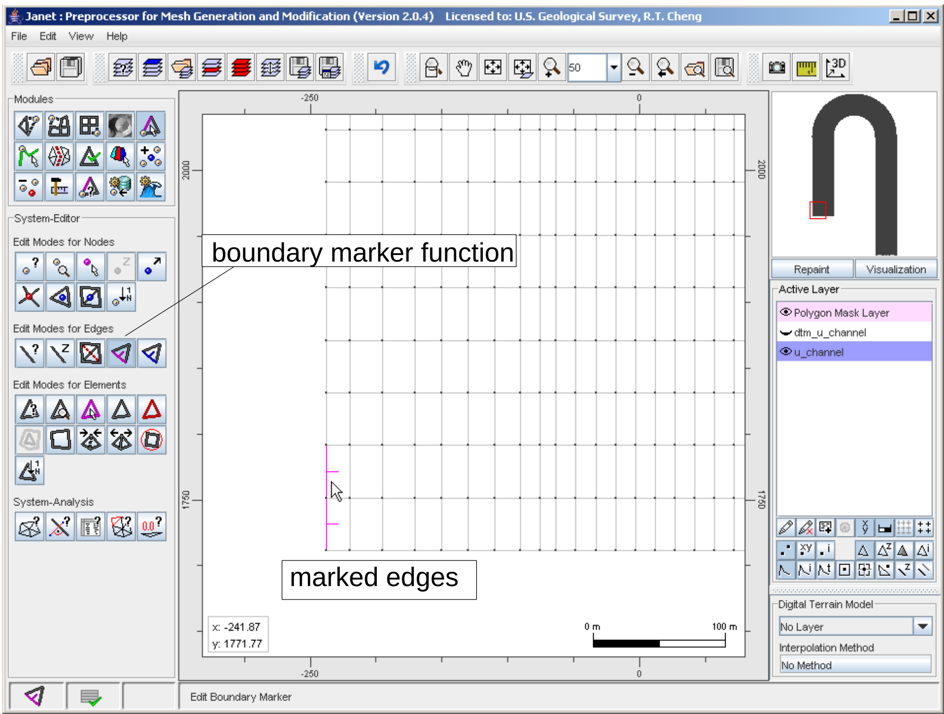

Figure 2-7. Marking edges with the mouse

Single edges are marked by selecting the geometry object in the working window. The current zoom state can be panned by pressing the [Alt] key and dragging the left mouse button in the desired panning direction. The

boundary marker functions still remains active.
The presented approach occurs to be time consuming, even for a simple model. In a next step a more automatic way is suggested. The popup menu on the right mouse button offers the function [Set Boundary Markers] which is started and confirmed in the dialog window. All boundary edges are marked with this function as it can be seen in the next figure.

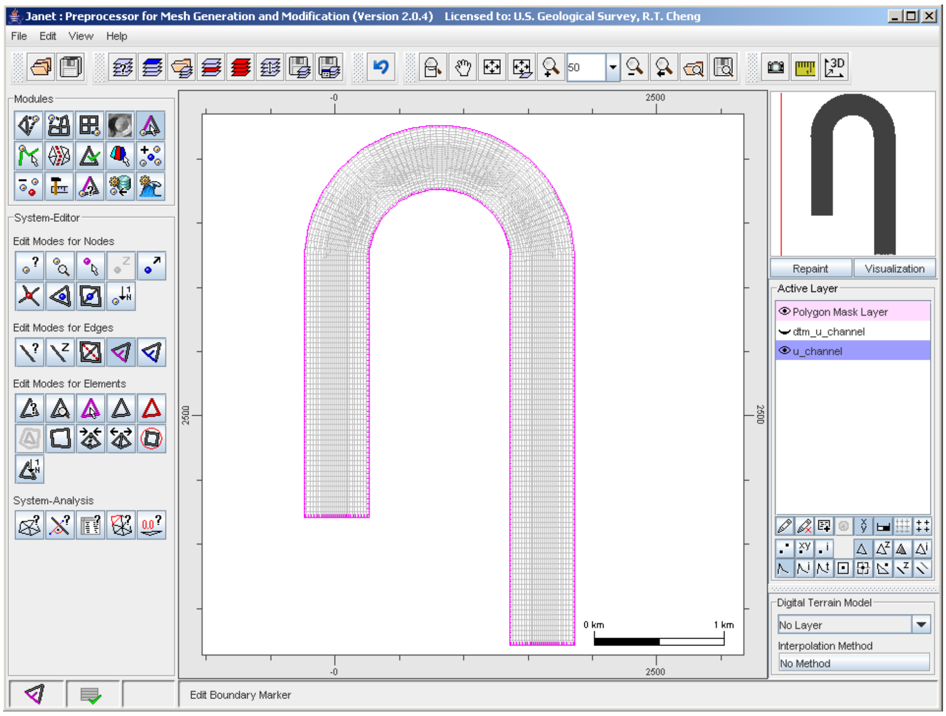

Figure 2-8. Automatically set boundary markers

The applied markers at the in- and outflow boundary have to be deleted again. For this task the preprocessor's masking functionality is used. Closed polygons can be defined on a special layer. The areas described by the polygons are then used to limit the application of an algorithmic function. To active this layer, the entry "Polygon Mask Layer" in the layer list has to be selected.
Polygons are created with the [Define Polygon] function in the polygon editor. Figure 2-9 shows one of the two generated polygons for the example.

After the polygon creation is finished, the active layer is reset to "u_channel" and the function [Edit Boundary Markers] is again selected. Markers are deleted with the [Delete Boundary Markers] method from the related popup menu. To enable the polygon mask, the option "Edge completly inside a maskpolygon" is choosen in the Maskpolygon section (Figure 2-10).

Starting the editing function finally leads to the desired result (Figure 2-11).

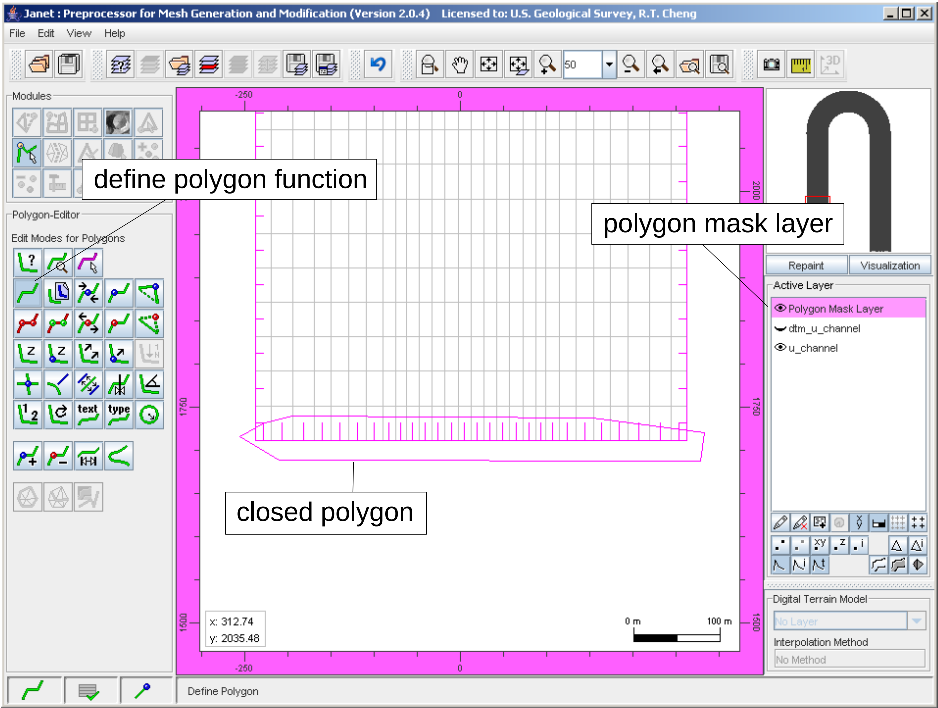

Figure 2-9. Defining a polygon mask

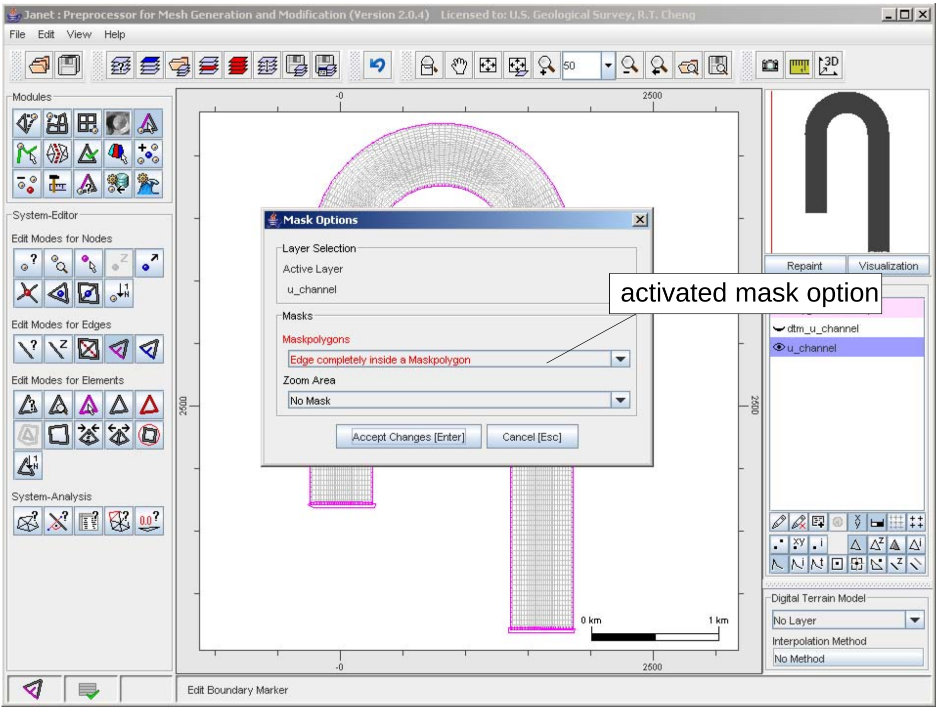

Figure 2-10. Editing the mask settings

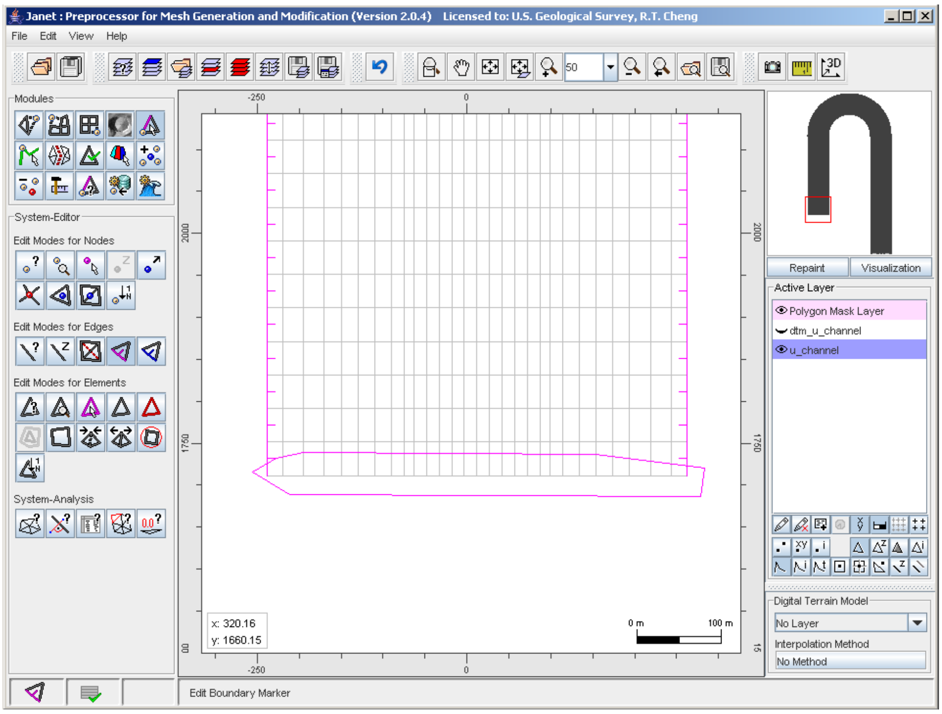

Figure 2-11. Deleted markers at the inflow boundary

2.4 Export the Model to the UnTRIM File Format

The modified model is finally exported to the UnTRIM file format with the [Save Layer as] function and choosing the file filter “UnTRIM Ascii Format”. Specific model parameters can be edited in the export dialog as shown in the next figure.

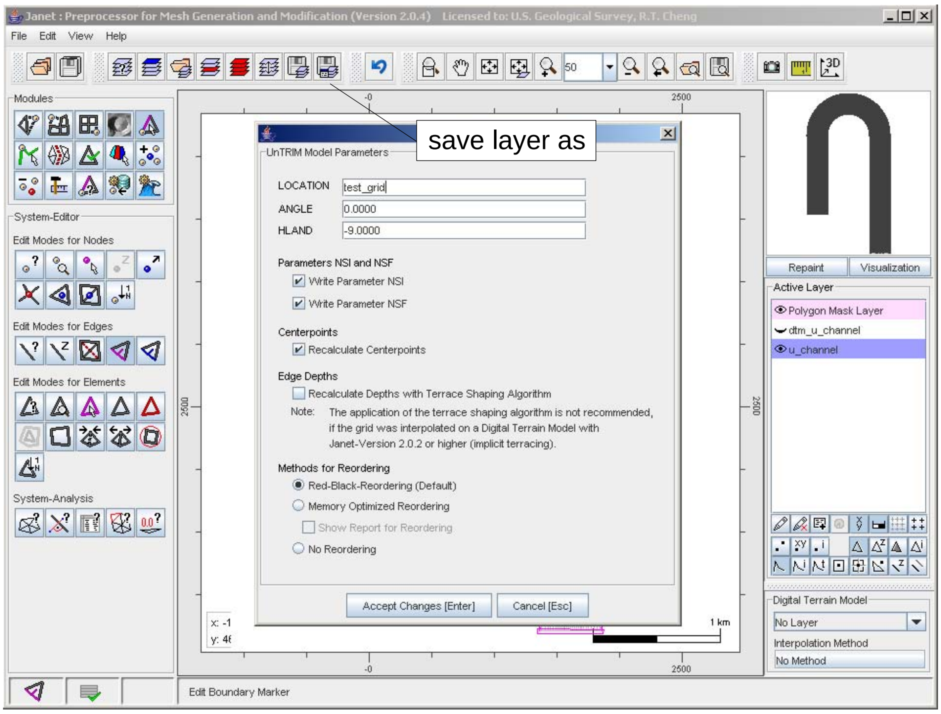

Figure 2-12. Export dialog for UnTRIM

The UnTRIM export supports the model versions “UnTRIM 2002” and “UnTRIM 2004”, which have a slightly different file header and body. By default the exported file is stored for “UnTRIM 2004”. Files for the earlier version can be generated by deselecting the options “Write Parameter NSI” and “Write Parameter NSF”.