ARC HYDRO GROUNDWATER TUTORIALS – SUBSURFACE ANALYST

Building 3D models with the horizons method

Arc Hydro Groundwater (AHGW) is a geodatabase design used for representing groundwater datasets within ArcGIS. The data model helps to archive, display, and analyze multidimensional groundwater data, and includes several components to represent different types of datasets, including representations of aquifers and wells/boreholes, 3D hydrogeologic models, temporal information, and data from simulation models.

The Arc Hydro Groundwater Tools help to import, edit, and manage groundwater data stored in an AHGW geodatabase. This tutorial illustrates how to use the tools to manage subsurface data and create 3D representations of hydrostratigraphy. A basic familiarity with the AHGW data model is suggested, but not required, prior to beginning this tutorial.

1 Introduction

This tutorial works with simplified subsurface data from Roseville, California. The following tasks will be discussed and demonstrated:

- Create section line features.
- Explore the concept of horizons in a raster catalog.
- Create GeoSection features.
- Explore the Clip and Fill options when creating GeoSections and GeoVolumes.
- Create GeoVolume features.
- Transform 3D GeoSections to 2D cross section polygons.

The XMS Wiki has more information about the Groundwater Data Model[1] and horizons, clip, and fill attributes.[2]

1.1 Required Modules and Interfaces

Enable the following components in order to complete this tutorial:

- Arc View license (or ArcEditor/ArcInfo)
- 3D Analyst (the tools in this tutorial can be run without 3D Analyst, but not all the data can be visualized)
- AHGW Tutorial Files

The Arc Hydro Groundwater Tools require installation of a compatible ArcGIS service pack. Check the Arc Hydro Groundwater Tools documentation to find the appropriate service pack for version of the tools being used. 3D Analyst is required for the latter portion of the tutorial involving 3D objects. A license for 3D Analyst is required to view the results of the tutorial. The tutorial files should be downloaded and saved on a local drive.

2 Getting Started

Before opening the map, ensure that the Arc Hydro Groundwater Tools are correctly configured.

1. Launch ArcMap.
2. Click **ArcToolbox** to open the *ArcToolbox* window.
3. Make sure " Arc Hydro Groundwater Tools" is in the list of toolboxes. If it is, skip to step 7. If it is not, follow steps 3–6 to add it.
4. Add the toolbox by right-clicking anywhere in the *ArcToolbox* window and selecting **Add Toolbox…** to bring up the *Add Toolbox* dialog.
5. Select " Toolboxes" from the *Look in* drop-down.
6. Double-click on " System Toolboxes".
7. Select " Arc Hydro Groundwater Tools.tbx" and click **Open** to exit the *Add Toolbox* dialog.
8. Expand " Arc Hydro Groundwater Tools".
9. Expand " Subsurface Analyst".

The *Arc Hydro Groundwater Toolbar* will also be used. This toolbar contains additional user interface components not available in the toolbox. If the toolbar is not visible, do the following:

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[1] See https://www.xmswiki.com/wiki/AHGW:Arc_Hydro_Groundwater_Data_Model

[2] See https://www.xmswiki.com/wiki/AHGW:Horizons,_Clip,_and_Fill_Attributes

10. Right-click on a blank space on any visible toolbar and select **Arc Hydro Groundwater Toolbar** to make it appear.

When using geoprocessing tools, set the tools to overwrite outputs by default, and automatically add results to the map/scene. To set these options:

11. Select *Geoprocessing* | **Geoprocessing Options...** to bring up the *Geoprocessing Options* dialog.
12. In the *General* section, turn on *Overwrite the outputs of geoprocessing operations*.
13. In the *Background Processing* section, turn off *Enable*.
14. In the *Display / Temporary Data* section, turn on *Add results of geoprocessing operations to the display*.
15. Click **OK** to exit the *Geoprocessing Options* dialog.

3 Creating SectionLines

As the first step, create a set of section line features from which the 3D features will be derived.

1. Click **Open** to bring up the *Open* dialog.
2. Browse to the *subsurface analyst\horizons* folder for this tutorial.
3. Select “Horizons.mxd” and click **Open** to exit the *Open* dialog.
4. Click **List by Source** in the Table of Contents.
5. Right-click on “ Layers” and select **Activate**.
6. Click **List by Drawing Order** in the Table of Contents.

The map includes a boundary defining the extent of the 3D model as shown in Figure 1.

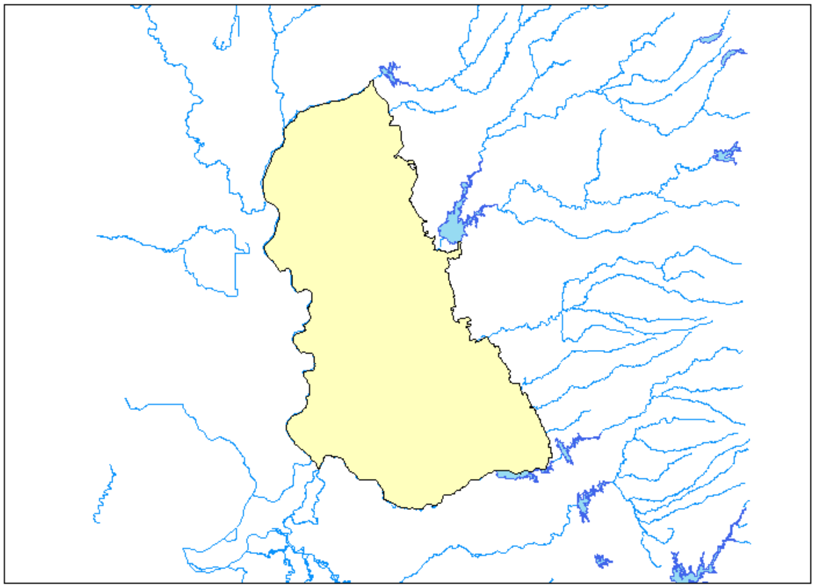


Figure 1 Boundary of the 3D model

3.1 Sketching the SectionLines

To start sketching section lines:

1. Select *Editor* | **Start Editing** from the drop-down in the Editor Toolbar to bring up the *Create Features* sidebar.
2. In the *Create Features* section on the right, select " SectionLine" to enable editing of section lines.
3. Select the **Straight Segment** tool from the Editor Toolbar.
4. Create line A-A˚, as shown in Figure 2, by clicking to begin the SectionLine, then double-clicking to end it. Make sure the lines stay within the model domain.
5. Repeat step 10 for lines B-B˚, C-C˚, D-D˚, E-E˚, and F-F˚, as shown in Figure 2.
6. In the Table of Contents, right-click on "SectionLine" and select **Open Attribute Table** to bring up the *Table* dialog displaying the SectionLines just created.
7. In the *SName* column on the first row, enter "A-A˚".
8. Repeat step 13 for B-B˚, C-C˚, D-D˚, E-E˚, and F-F˚, respectively from the second row down.

At this point, the map should be similar to the one shown in Figure 2.

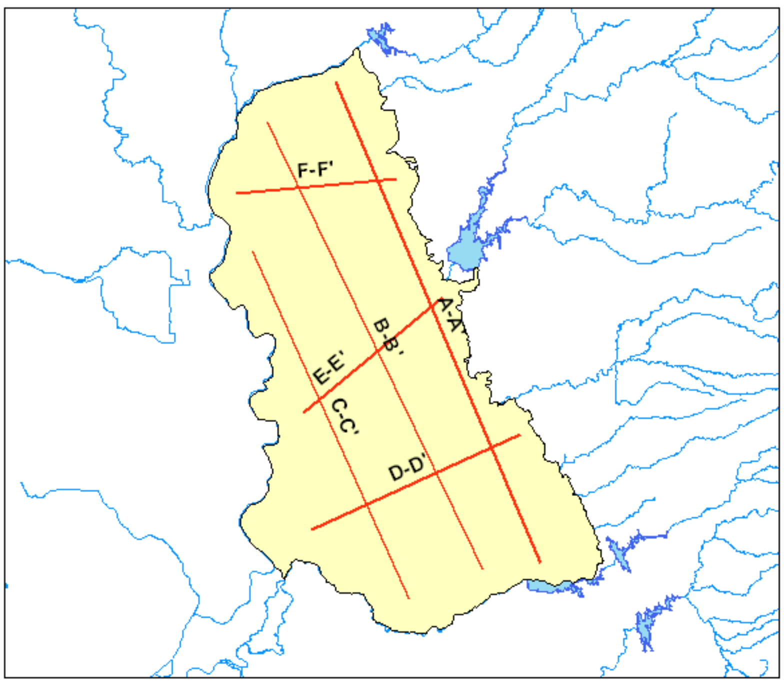


Figure 2 Section lines sketched within the model boundary

3.2 Assigning Vertical Exaggeration

Next, assign vertical exaggeration values to the section lines. The cross section features will be scaled based on the vertical exaggeration attribute.

1. Click **Clear Selection** to deselect all rows in the table.

2. Right-click on the *Vertical Exaggeration* column header and select **Field Calculator…** to bring up the *Field Calculator* dialog.
3. In the *VertExag2D=* field near the bottom, enter “20” (without the quotes).
4. Click **OK** to close the *Field Calculator* dialog.
5. Close the *Table* dialog by clicking the **X** in the top right corner.
6. Select *Editor* | **Save Edits** to save the changes made in the *Table* dialog.
7. Select *Editor* | **Stop Editing** to complete the editing session.

3.3 Assigning HydroIDs

After creating the features, assign HydroID values to them. The HydroID is the unique identifier of the feature within the geodatabase, and is used to create relationships between tables and feature classes.

1. In the ArcToolbox, expand “ Arc Hydro Groundwater Tools”and “ Groundwater Analyst”.
2. Double-click on the “ Create UniqueID Table” tool to bring up the *Create Unique ID Table* dialog.
3. Click the **Browse** button to bring up the *Output UniqueID Table* dialog.
4. Browse to the *subsurface analyst\horizons* folder, double-click on “Horizons.mdb”, and enter “UniqueID” as the *Name*.
5. Click **Save** to close the *Output UniqueID Table* dialog.
6. Leave the *Last HydroID Used* at the default of “1”.
7. Click **OK** to close the *Create Unique ID Table* dialog and open the *Create Unique ID Table* model wrapper dialog.
8. When the tool finishes running, click **Close** to exit the *Create Unique ID Table* dialog.

The tool creates a new table named “UniqueID” and adds it as a data layer in the Table of Contents.

3.4 Populating HydroID Values

Next, populate the HydroID values for the SectionLine features.

1. In the ArcToolbox, double-click on the “ Assign HydroID GW” tool under “ Groundwater Analyst” to bring up the *Assign HydroID GW* dialog.
2. Select “UNIQUEID” from the *Input UniqueID Table* drop-down.
3. Select “SectionLine” from the *Input Features to Assign HydroID* drop-down.
4. Select “HydroID” from the *HydroID Field of Input Features* drop-down.
5. Turn on *Overwrite Existing HydroID Values*.
6. Click **OK** to close the *Assign HydroID GW* dialog and open the *Assign HydroID GW* model wrapper dialog.

7. When it finishes, click **Close** to exit the *Assign HydroID GW* model wrapper dialog.
8. Right-click on "SectionLine" in the Table of Contents and select **Open Attribute Table** to bring up the *Table* dialog.

The HydroID column has now been populated.

9. Click the **X** in the top right corner to close the *Table* dialog.

4 Opening the Scene

Next, create 3D GeoSection and GeoVolume features and visualize them in ArcScene.

Begin by opening a scene of Roseville.

1. Open ArcScene.
2. Click **Open**  to bring up the *Open* dialog.
3. Browse to the *subsurface analyst\horizons* folder for this tutorial.
4. Select "Horizons.sxd" and click **Open** to exit the *Open* dialog.

The scene should appear similar to Figure 3, showing a set of subsurface layers near Roseville. This data was obtained from a groundwater model created for the region, then modified for the purposes of the tutorial to illustrate concepts and protect confidentiality. There are different rasters representing horizon data, which will be used to create GeoSection and GeoVolume features. The individual rasters are drawn using the options on the *Base Heights* tab in the *Layer Properties* dialog in order to show their elevations in relation to each other.

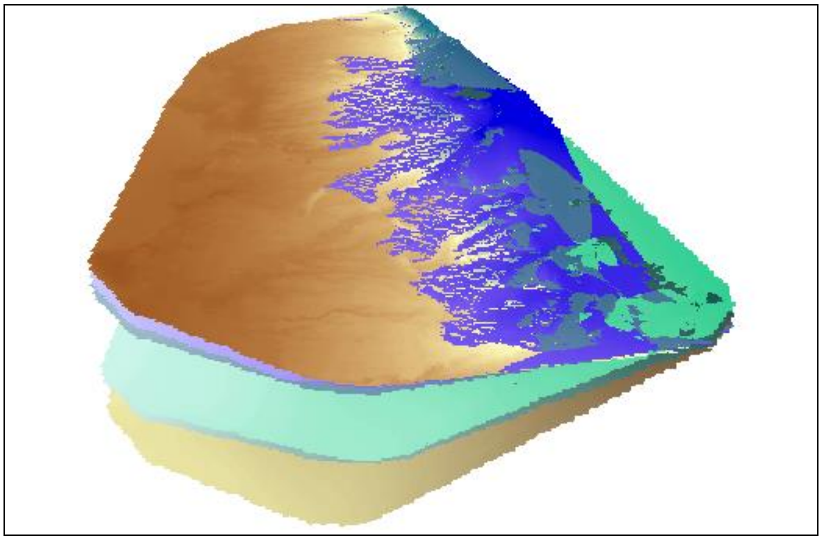


Figure 3 Rasters representing Horizon data

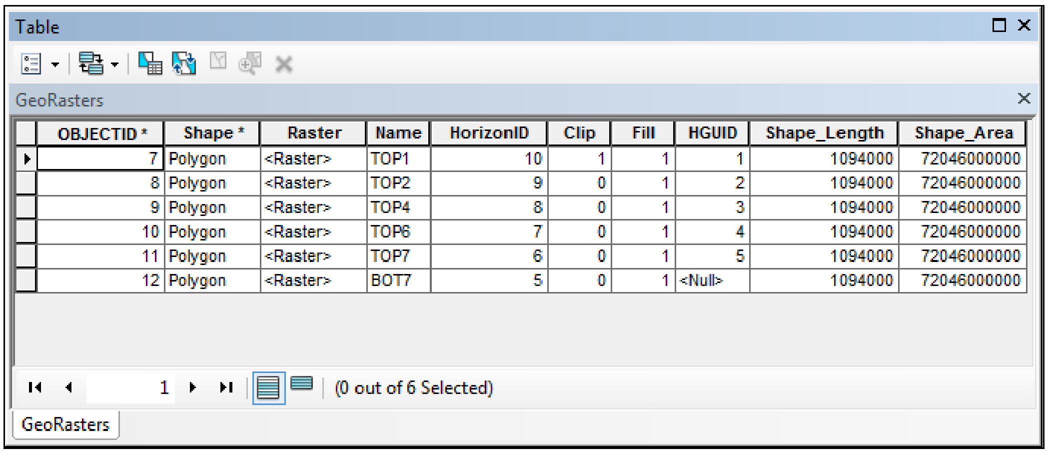
The rasters are also organized in table format as a raster catalog. The rasters in the catalog overlap each other and contain different attributes to describe the horizons. The raster catalog will later be used to build GeoSection and GeoVolume features.

5. After examining the scene, click **Expand** next to “Rasters” in the Table of Contents to reveal the individual rasters: TOP1, TOP2, TOP4, TOP6, TOP7 and BOT7 (they may be listed in a different order).
6. Turn off each of the six rasters, leaving “Rasters” turned on.
7. Select “GeoRasters”.

This is the raster catalog storing the same rasters representing the horizon data.

8. Right-click on “GeoRasters” and select **Open Attribute Table** to bring up the *Table* dialog (Figure 4).

Note that the table includes a *Raster* field for the rasters, along with a field called *HorizonID* for storing the order of strata representing the horizons.



Table

GeoRasters

OBJECTID *	Shape *	Raster	Name	HorizonID	Clip	Fill	HGUID	Shape_Length	Shape_Area
7	Polygon	<Raster>	TOP1	10	1	1	1	1094000	72046000000
8	Polygon	<Raster>	TOP2	9	0	1	2	1094000	72046000000
9	Polygon	<Raster>	TOP4	8	0	1	3	1094000	72046000000
10	Polygon	<Raster>	TOP6	7	0	1	4	1094000	72046000000
11	Polygon	<Raster>	TOP7	6	0	1	5	1094000	72046000000
12	Polygon	<Raster>	BOT7	5	0	1	<Null>	1094000	72046000000

1 (0 out of 6 Selected)

GeoRasters

Figure 4 The raster catalog for the horizons data

9. Click the **X** in the top right corner to close the *Table* dialog.

5 Building GeoSection Features

The GeoSection features are an ideal starting point for creating subsurface data from horizons. The cross sections (or “fence diagrams”) are simpler to create and easier to view than the solid GeoVolume features. The GeoSection features can be used to see if the interpolation options applied are reasonable before building GeoVolume features for the entire area covered by the rasters in the raster catalog.

To build the GeoSection features, one or more SectionLine polyline features is needed to determine where the subsurface cross sections will be created, along with a raster catalog representing the horizon data, and the multipatch GeoSection feature class where the new features will be created.

5.1 Creating a GeoSection Feature Class

The first step will be to create a new GeoSection feature class:

1. In the ArcToolbox, expand “ Arc Hydro Groundwater Tools”, “ Subsurface Analyst”, and “ Features”.

2. Double-click on the "Create GeoSection Feature Class" tool to bring up the *Create GeoSection Feature Class* dialog.
3. Click the button to the right of *Output GeoSection Features* to bring up the *Output GeoSection Features* dialog.
4. Browse to the *subsurface analyst\horizons* folder for this tutorial and double-click on "Horizons.mdb".
5. Double-click on "Data" and enter "GeoSection" as the *Name*.
6. Click **Save** to exit the *Output GeoSection Features* dialog.
7. Leave *Input Spatial Reference* empty.

The Horizons.mdb\Data feature dataset has the correct XYZ coordinate systems defined. Because the GeoSection feature class will be placed in the feature dataset, a spatial reference does not need to be specified.

8. Click **OK** to close the *Create GeoSection Feature Class* dialog and bring up the *Create GeoSection Feature Class* wrapper dialog.
9. When the tool finishes, click **Close** to exit the *Create GeoSection Feature Class* wrapper dialog.

A new feature class named "GeoSection" should be added to the scene in the Table of Contents.

5.2 Building the GeoSection Features

At this point, the "SectionLine" feature class layer and the "GeoRasters" raster catalog layer should both be listed in the Table of Contents.

To build the GeoSection features, do the following:

1. Right-click on "GeoRasters" in the Table of Contents and select **Open Attribute Table** to bring up the *Table* dialog.
2. Note that the *Clip* and *Fill* columns on the row named "TOP1" both contain a value of "1". This means that subsurface layers (which are all of the other layers) do not extend above it.

The "TOP1" row in the raster catalog comes from a digital elevation model (DEM) of the ground surface elevation data. Depending on the interpolation values used to generate the rasters stored in the raster catalog, there might be portions of the raster on the edges which exceed the ground surface elevation.

3. Click the **X** in the top right corner to close the *Table* dialog.

5.3 Running the Rasters to GeoSection Features Tool

To run Rasters to GeoSections tool:

1. In the ArcToolbox, expand "Arc Hydro Groundwater Tools", "Subsurface Analyst", and "Features".
2. Double-click on the "Rasters to GeoSections" tool to bring up the *Rasters to GeoSections* dialog.

3. Select “SectionLine” from the *Input SectionLine Features* drop-down.
4. Select “GeoRasters” from the *Input Raster Catalog* drop-down.
5. Select “HorizonID” from the *Raster Catalog Horizon ID Field* drop-down.
6. Select “Clip” from the *Raster Catalog Clip Field* drop-down.
7. Select “Fill” from the *Raster Catalog Fill Field* drop-down.
8. Select “HGUID” from the *Raster Catalog HGUID Field* drop-down.
9. Enter “1000” as the *Discretization Spacing*.
10. Select “GeoSection” from the *Input GeoSection Features* drop-down.
11. Make sure *Append to Existing GeoSection Features* is turned on.
12. Click **OK** to close the *Rasters to GeoSections* dialog and open the *Rasters to GeoSections* wrapper dialog.
13. When the tool finishes, click **Close** to exit the *Rasters to GeoSections* wrapper dialog.

The scene should have 3D features similar to those shown in Figure 5.

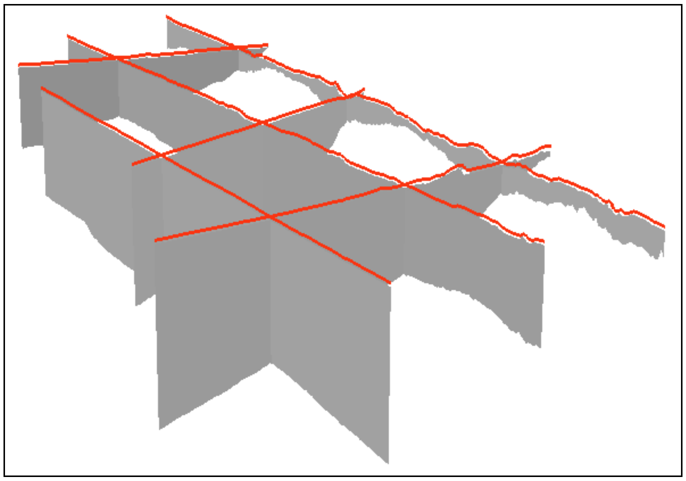


Figure 5 *GeoSection features created by running the Rasters To GeoSections tool*

14. If the 3D features do not appear, right-click on the “GeoSection” layer in the Table of Contents and select **Refresh**.

5.4 Symbolizing the GeoSections

To better visualize the cross sections, symbolize the GeoSections by the HorizonID used to build them.

1. Select “GeoSection” in the Table of Contents, then right-click on it and select **Properties…** to bring up the *Source* tab in the *Layer Properties* dialog.
2. On the *Symbology* tab, in the *Show* section, select “Categories” and then “Unique Values”.
3. Select “HorizonID” from the *Value Field* drop-down.
4. Click **Add All Values** to add all the HorizonID fields to the list.

5. Right-click in the list area and select **Reverse Sorting**.

This sorts the unique HorizonID values from the highest value at the top to the lowest value on the bottom.

6. Click **Apply**, then click **OK** to exit the *Layer Properties* dialog.
7. As desired, use the **Navigate** tool in to view the GeoSection features from multiple angles to view the results of the tool.

The results should be similar to those found in Figure 6, though the colors may be different.

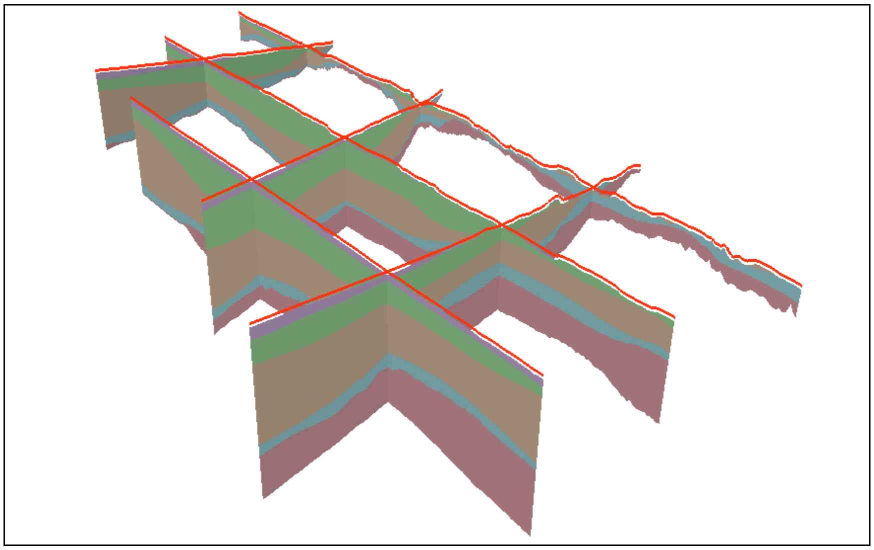


Figure 6 GeoSection features symbolized by the HorizonID field

Next, create 3D GeoVolumes to visualize the hydrogeologic units as volume elements.

6 Creating a Projection TIN

A TIN (Triangular Irregular Network) is used to define the extent of the GeoVolume features to be created, as well as to determine the size and extent of the triangle strips used to define the multipatch features. The number of triangles on the TIN determines the amount of processing that must be done. The TIN used in the *Rasters to GeoVolumes* tool is referred to as a projection TIN, because the elevations on the TIN are not used, but the triangles are used only to define the shape and extent of the GeoVolumes.

A simplified projection TIN has been provided in the tutorial for the benefit of those who do not have access to the "3D Analyst Tools" extension.

1. Turn on the "projtin4k" layer in the Table of Contents.

The TIN should appear similar to Figure 7.

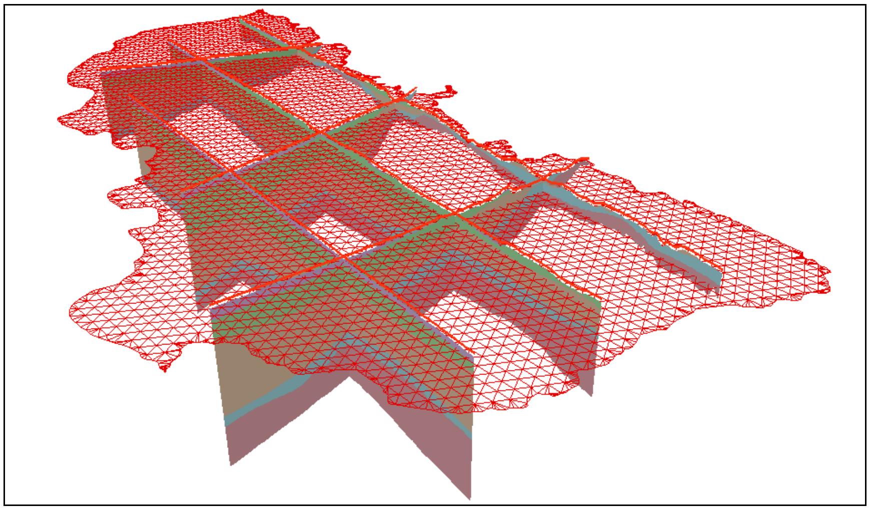


Figure 7 A projection TIN used for creating GeoVolume features

2. Turn off "projtin4k" projection TIN in the Table of Contents.

6.1 Enable the 3D Analyst Tools

A license for the 3D Analyst extension is required to create a TIN using the **Polygon to TIN** tool using the following steps. For those without the 3D Analyst Tools, please skip to Section 7 and use the provided "projtin4k" TIN for the remaining of the tutorial.

To enable the "3D Analyst Tools" toolbox, do the following:

1. Select *Customize* | **Extensions…** to bring up the *Extensions* dialog.
2. Make usre "3D Analyst" is turned on in the *Select the extensions you want to use* section.
3. Click **Close** to exit the *Extensions* dialog.
4. In the ArcToolbox, make sure that " 3D Analyst Tools" is listed.
5. If it is not listed, right-click in the ArcToolbox and select **Add Toolbox…** to bring up the *Add Toolbox* dialog.
6. Select "System Toolboxes" from the *Look in* drop-down.
7. Select "3D Analyst Tools" and click **Open** to exit the *Add Toolbox* dialog.

6.2 Creating a TIN Using 3D Analyst

Next, create a projection TIN:

1. In the ArcToolbox, expand the " Arc Hydro Groundwater Tools" toolbox, the " Subsurface Analyst" toolset, and the " TIN" toolset.
2. Double-click on " Polygon to TIN" to bring up the *Polygon to TIN* dialog.
3. Select "ModelBoundary" from the Input Polygon Feature drop-down to set the polygon defining the boundary of the projection TIN.
4. Enter "4000" as the *TIN Triangle Spacing*.

This creates equilateral triangles inside the TIN with edge spacing equal to the value entered. Irregular triangles are created along the boundary of the TIN.

5. Click **Browse** to the right of *Output Projection TIN* to bring up the *Output Projection TIN* dialog.
6. Browse to the *subsurface analyst\horizons* folder and enter "projtin" as the *Name*.
7. Click **Save** to exit the *Output Projection TIN* dialog.

The *TIN Spatial Reference (otional)* field should automatically populate with "NAD_1983_StatePlane_California_II_FIPS_0402_Feet / VCS:NAD_1983".

8. Click **OK** to close the *Polygon to TIN* dialog and bring up the *Polygon to TIN* wrapper dialog.
9. When the tool finishes, click **Close** to exit the *Polygon to TIN* wrapper dialog.

6.3 Symbolizing the New TIN

The next step is to symbolize the new TIN by doing the following:

1. Select "projtin" in the Table of Contents, then right-click on it and select **Properties…** to bring up the *Layer Properties* dialog.
2. In the *Show* section, turn off "Faces" and any others in the list.
3. Below the *Show* list, click **Add…** to bring up the *Add Renderer* dialog.
4. Select "Edges with the same symbol" and click **Add** to add an entry for "Edges" in the *Show* list in the *Layer Properties* dialog.
5. Click **Dismiss** to exit the *Add Renderer* dialog.
6. Click **Apply**, and then click OK to close the *Layer Properties* dialog.

The TIN should appear similar to Figure 8.

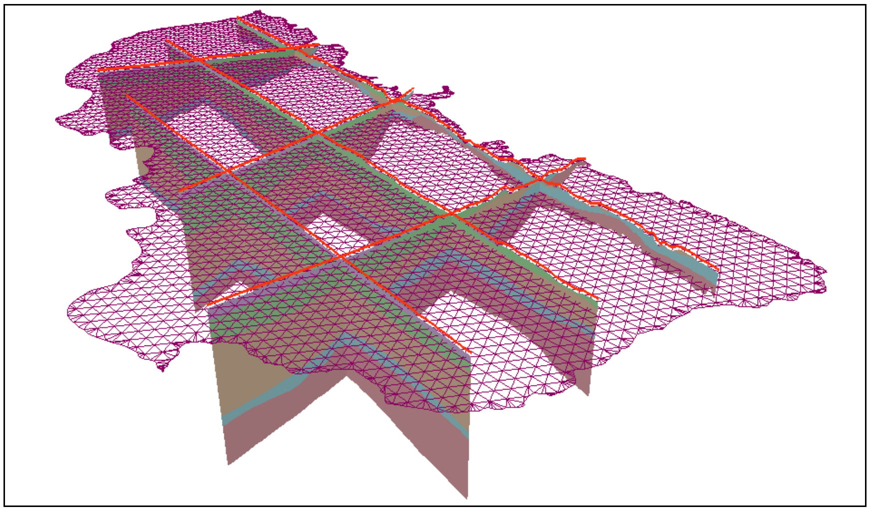


Figure 8 The new appearance of the TIN

7 Building GeoVolume Features

Once acceptable clip and fill options have been determined and a projection TIN has been defined, GeoVolume features can be created to generate a 3D volume of the horizons data. The **Rasters to GeoVolumes** tool contains the same options (as the **Rasters To GeoSections** tool) for clipping and filling in between rasters.

7.1 Creating a GeoVolume Feature Class

Before creating GeoVolume features from the rasters, create a GeoVolume feature class:

1. In the ArcToolbox, expand "Arc Hydro Groundwater Tools", "Subsurface Analyst", and "Features".
2. Double-click on the "Create GeoVolume Feature Class" tool to bring up the *Create GeoVolume Feature Class* dialog.
3. Click **Browse** to bring up the *Output GeoVolume Features* dialog.
4. Browse to the *subsurface analyst\horizons* folder for this tutorial.
5. Double-click on "Horizons.mdb", then double-click on "Data".
6. Enter "GeoVolume" as the *Name* and click **Save** to exit the *Output GeoVolume Features* dialog.
7. Click **OK** to close the *Create GeoVolume Feature Class* dialog and bring up the *Create GeoVolume Feature Class* wrapper dialog.
8. When the tool finishes, click **Close** to exit the *Create GeoVolume Feature Class* wrapper dialog.

A new "GeoVolume" layer should appear in the Table of Contents.

7.2 Converting Rasters to Geovolumes

To simplify the following steps, "projtin4k" will be used for the projection TIN. Feel free to use "projtin" if Section 6 was completed.

Now build the GeoVolume features by doing the following:

1. In the ArcToolbox, expand "Arc Hydro Groundwater Tools", "Subsurface Analyst", and "Features".
2. Double-click on the "Rasters to GeoVolumes" tool to bring up the *Rasters to GeoVolumes* dialog.
3. Select "projtin4k" from the *Input Projection TIN* drop-down.
4. Select "GeoRasters" from the *Input Raster Catalog* drop-down.
5. Select "HorizonID" from the *Raster Catalog Horizon ID field* drop-down.
6. Select "Clip" from the *Raster Catalog Clip field* drop-down.
7. Select "Fill" from the *Raster Catalog Fill field* drop-down.
8. Select "HGUID" from the *Raster Catalog HGUID field* drop-down.

9. Make sure “1” is the value entered as the *Minimum MultiPatch Thickness*.

Sections of the GeoVolume that have a thickness less than this value will not be created.

10. Select “GeoVolume” from the *Input GeoVolume Features* drop-down.
11. Make sure *Append to Existing GeoVolume Features* is turned on.
12. Click **OK** to close the *Rasters to GeoVolumes* dialog and open the *Rasters to GeoVolumes* wrapper dialog.
13. When the tool finishes, click **Close** to exit the *Rasters to GeoVolumes* wrapper dialog.

The GeoVolumes should now appear as 3D features (Figure 9).

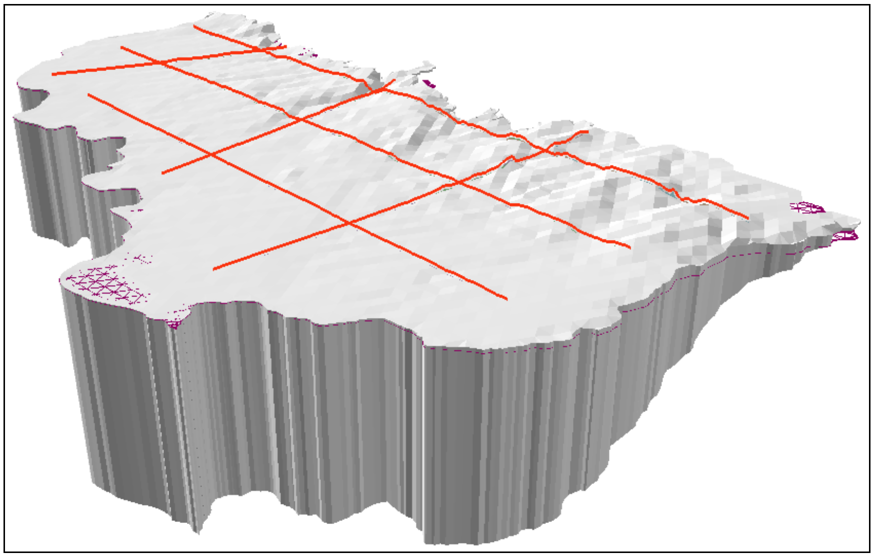


Figure 9 GeoVolume features in 3D

7.3 Symbolizing the GeoVolumes by HorizonID

To better visualize the results, symbolize the GeoVolumes by the HorizonID used to build them.

1. Select the “GeoVolume” layer in the Table of Contents, then right-click on it and select **Properties…** to bring up the Layer Properties dialog.
2. On the *Symbology* tab, in the *Show* section, click on “Categories”, then on “Unique values”.
3. Select “HorizonID” from the *Value Field* drop-down.
4. Click **Add All Values** to populate the list with all of the HorizonIDs.
5. Right-click in a blank spot in the list and select **Reverse Sorting** to sort the HorizonID values from highest value at the top to lowest value at the bottom.
6. Click **Apply**, then **OK** to exit the *Layer Properties* dialog.

The GeoVolume features should appear similar to Figure 10, though the colors may vary.

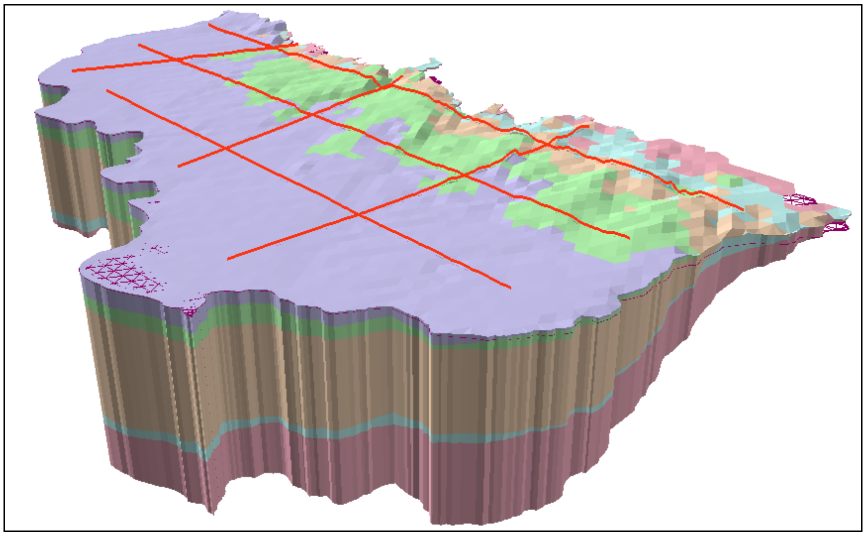


Figure 10 The GeoVolume features symbolized

7. As desired, use the **Navigate** tool in to view the GeoVolume features from multiple angles to view the results of the tool.

The Field Filter in the Arc Hydro Groundwater Toolbar can be used to view individual GeoVolume layers. To view a single GeoVolume:

8. Select the "GeoVolume" layer in the Table of Contents.
9. Select "HorizonID" from the first Field drop-down in the Arc Hydro Groundwater Toolbar.
10. Select "8" from the second Field drop-down in the Arc Hydro Groundwater Toolbar.

The results should appear similar to Figure 11, though colors may vary. Feel free to experiment by selecting different HorizonIDs or HGUIDs from the drop-downs. Additionally, the 3D Effects toolbar can be used to control the layer transparency, face culling, lightning and shading.

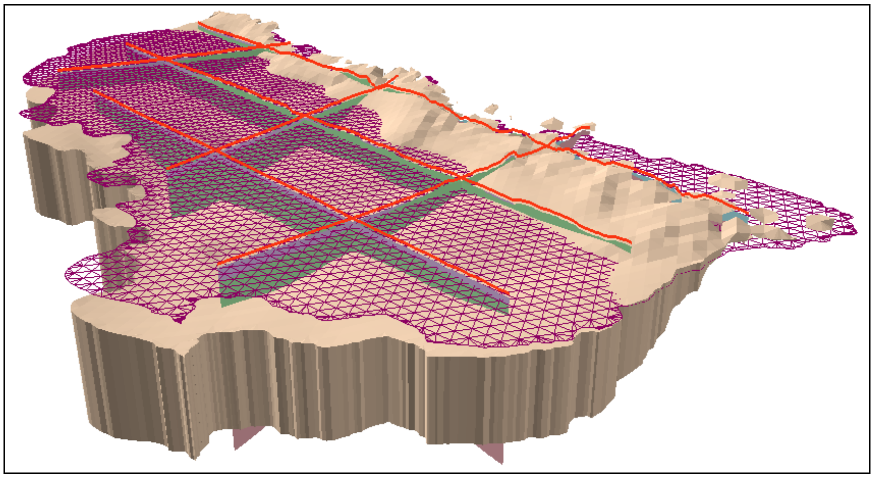


Figure 11 Display only HorizonID 8 by using the Field Filter tool

8 Using the HGU Color Manager

The features in the GeoSection and GeoVolume feature classes are different representations of the same hydrogeologic units. The HGU Color Manager can be used to apply a common set of colors to display features tied to the same HorizonID fields.

1. In the Arc Hydro Groundwater Toolbar, select **HGU Color Manager** from the *Subsurface* drop-down to bring up the *HGU Color Manager* dialog.
2. Click **Setup…** to bring up the *HGU Setup* dialog.
3. Select “HydrogeologicalUnit from the *HGU Table* drop-down.
4. Select “HydroID” from the *HGU ID Field* drop-down.
5. Select “HGUName” from the *HGU Name Field* drop-down.
6. Click **OK** to close the *HGU Setup* dialog.

Notice that the two lists have now been populated.

7. In the upper list, in the *Symbology* column, select the first desired color from the drop-down.
8. Repeat step 7 for each of the remaining four entries in the upper list.
9. In the lower list, turn off “GeoRasters”.
10. Click **Apply Symbology** to apply the changes.
11. Click **Save and Exit** to close the *HGU Color Man*ager dialog.
12. Using the *Field Filter* drop-downs, view each of the HorizonIDs in turn. Notice that the colors apply to both the GeoSections and GeoVolumes.

The HGU Color Manager has saved the selected colors (as numbers) in the “HGUColor” field of the “HydrogeologicUnit” table. These colors will be available for application to the features when using the HGU Color Manager in ArcMap or ArcScene.

9 Conclusion

This concludes the “Horizons” tutorial. The following key concepts were discussed and demonstrated in this tutorial:

- SectionLine features are sketched in ArcMap and used to create 3D GeoSections.
- Horizons can be used to represent stratigraphic units.
- Horizons stored in a raster catalog can be used to create GeoSection and GeoVolume features.
- Clip and fill options can be used to manage the way GeoSection and GeoVolume features are created.
- A projection TIN is used to define the GeoVolume features created from the raster catalog.
- The HGU Color Manager is used for managing the symbology of multiple layers representing hydrogeologic units.