Tutorial B (Drillholes)

Parent topic: User Manual and Tutorials

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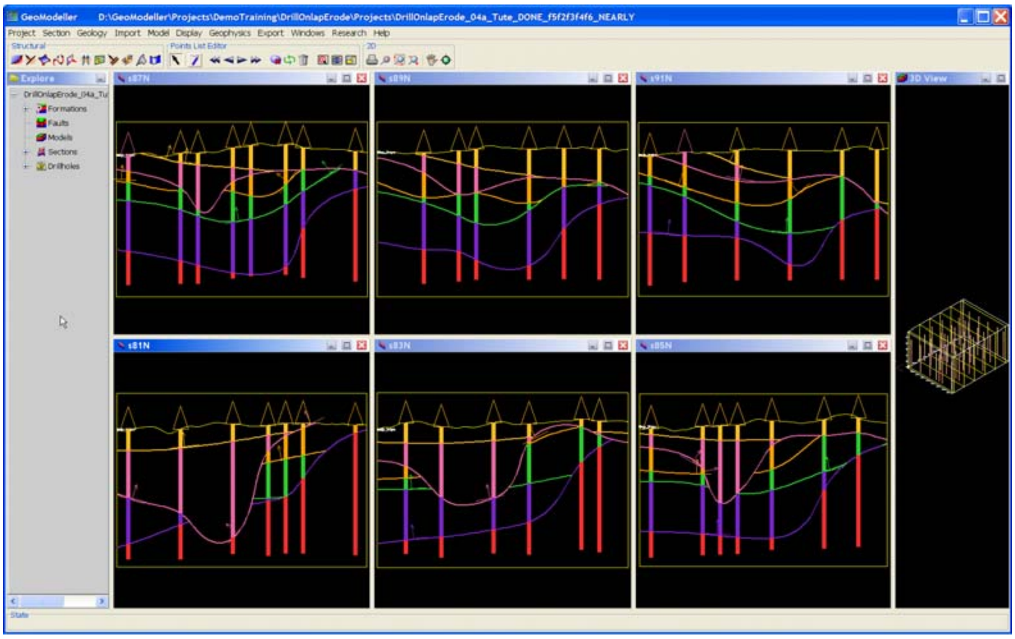
Using Drillholes in 3D GeoModeller – a Model-Building Strategy



In this case study:

- Tutorial B—Introduction
- Tutorial B1—Building a model from drillholes (erosional series f5)
- Tutorial B2—Building a model from drillholes (erosional series f2)
- Tutorial B3—Building a model from drillholes (onlapping series f3)
- Tutorial B4—Building a model from drillholes (onlapping series f4)
- Tutorial B5—Building a model from drillholes (onlapping series f6)
- Tutorial B6—Import Drillhole Assay Data
- Tutorial B7—Inverse Distance Interpolation

Tutorial B—Introduction

Parent topic: **Tutorial B (Drillholes)**

In this section:

- Project data preparation
- Topography of Tutorial B
- Geology of Tutorial B
- Strategy for Tutorial B

Project data preparation

Parent topic: **Tutorial B—Introduction**

For this tutorial we have created a project area containing synthetic geology.

We have prepared a beginning project file for this case study. You open it at the start of Tutorial B1—Building a model from drillholes (erosional series f5).

We have:

- Defined the project dimensions.

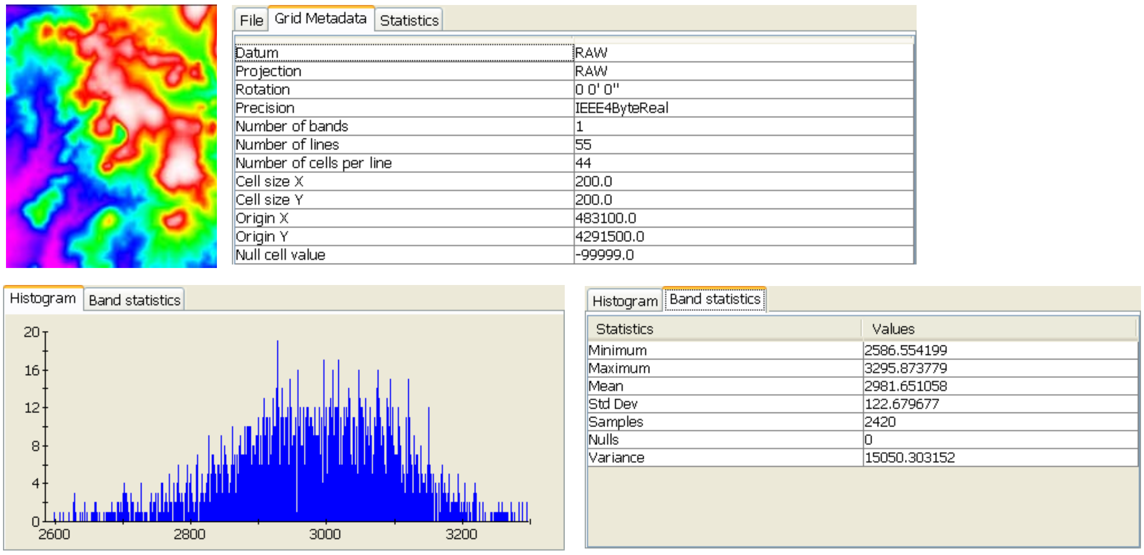
	Minimum	Maximum	Range
East	483,100	491,700	8,600 m
North	4,280,700	4,291,500	10,800 m
RL	–2000	4000	6000 m

- Created a 3D GeoModeller project using these extents.
- Loaded a digital terrain model (DTM) grid to create the topography for the project. See Topography of Tutorial B for details.
- Created an initial stratigraphic pile. The top or bottom reference for the pile is Bottom of formations. See Geology of Tutorial B for details.
- Created a series of sections: s81N, s83N, s85N, s87N, s89N, s91N.

Topography of Tutorial B

Parent topic: Tutorial B— Introduction

The following illustration shows the topography of the Tutorial B region.



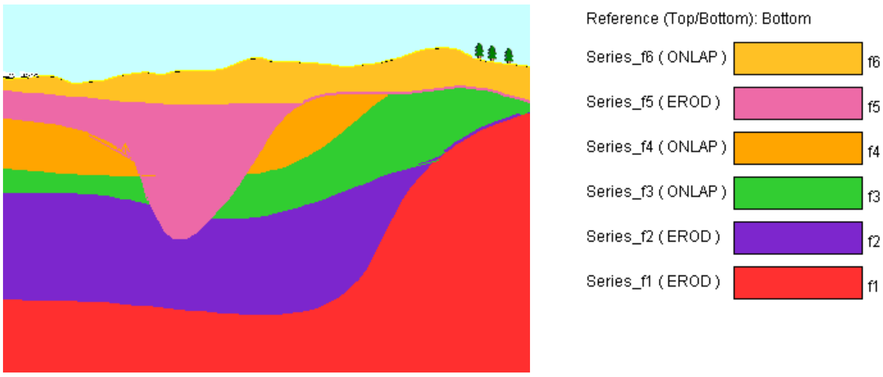
Datum	RAW
Projection	RAW
Rotation	0 0' 0"
Precision	IEEE4ByteReal
Number of bands	1
Number of lines	55
Number of cells per line	44
Cell size X	200.0
Cell size Y	200.0
Origin X	483100.0
Origin Y	4291500.0
Null cell value	-99999.0

Statistics	Values
Minimum	2586.554199
Maximum	3295.873779
Mean	2981.651058
Std Dev	122.679677
Samples	2420
Nulls	0
Variance	15050.303152

Geology of Tutorial B

Parent topic: Tutorial B— Introduction

The following illustration shows the geology of the case study region.



Notes about the project:

- There are six formations, f1 f2 f3 f4 f5 and f6 in a roughly layered sequence. Two of the units are erosional (**Relationship** = Erode) across the older strata, and the other units have an onlapping relationship (**Relationship** = Onlap) to older strata.
- The formations are in a correct stratigraphic order
  - f1 (oldest) at the bottom of the pile
  - f6 (youngest) at the top
- This project uses Bottoms of formations

Strategy for Tutorial B

Parent topic: **Tutorial B—Introduction**

We have found that a useful strategy for building any model in 3D GeoModeller is to:

1. Work stratigraphically downwards through the erosional or cross-cutting events (in this case study, first f5 and then f2).
2. Work stratigraphically upwards through any onlapping series occurring between these (in this case study, f3, f4, f6).

We recommend this work order because, if you model the youngest, cross-cutting event or geological surface and get get it right, all subsequent modelling work on all other (older) events or surfaces has no impact on that earlier modelling of the younger event.

Note that this tutorial follows one pathway towards building a 3D model of the Tutorial B project geology. There are several equally valid alternative approaches.

Tutorial B1—Building a model from drillholes (erosional series f5)

Parent topic: **Tutorial B (Drillholes)**

According to our strategy (see Strategy for Tutorial B), we model the youngest erosional series first.

In this tutorial we:

1. Import drillhole data
2. Create, display and refine the model for one formation

Stages in the tutorial:

- B1 Stage 1—Open the prepared 3D GeoModeller Project for Tutorial B
- B1 Stage 2—Import the drillhole data
- B1 Stage 3—Arrange the 2D Viewer windows
- B1 Stage 4—Project the Drillholes in each 2D Section-View
- B1 Stage 5—Prepare the project for modelling
- B1 Stage 6—Comparing the model with drillhole observations
- B1 Stage 7—Creating a 3D view

B1 Stage 1—Open the prepared 3D GeoModeller Project for Tutorial B

Parent topic: Tutorial B1—Building a model from drillholes (erosional series f5)

B1 Stage 1—Steps

1 If required, save and close any project that you are currently working on.

2 From the main menu choose **Project > Open** OR

From the **Project** toolbar choose **Open** OR
Press CTRL+O.

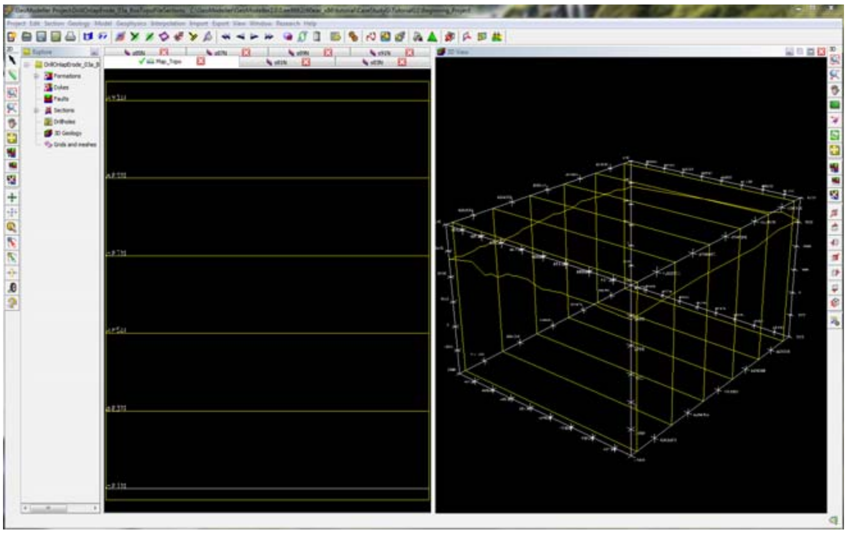
Open:
`Tutorial_B\Tutorial_B1\B1Beginning_Project\B1Beginning_Project.xml`

3 Save the project with a new name in the folder you are using for your tutorial data.

From the main menu choose **Project > Save As** OR

From the **Project** toolbar choose **Save As** OR
Press CTRL+SHIFT+S.

Note that a completed version of Stage 2 of the tutorial is available in **`Tutorial_B\Tutorial_B1\B1Completed_Load_Holes\B1Completed_Load_Holes.xml`**. Do not overwrite it.



B1 Stage 1—Discussion and exploration

To view the formations, from the main menu choose **Geology > Formations: Create or Edit**.

To view the whole stratigraphic pile, from the main menu choose **Geology > Stratigraphic Pile: Visualise**.

B1 Stage 2—Import the drillhole data

Parent topic: Tutorial B1—Building a model from drillholes (erosional series f5)

Our contractor has drilled a set of 40 deep vertical holes on the six sections. These holes are 4500 m deep (nice drilling budget!) and there are about six holes per section. The sections are 2000 m apart and the holes are at various spacings, 600 m – 1800 m.

The drillhole data are in a commonly used drillhole data file format. This is a set of three files containing the drillhole collars, surveys, and geology.

For interest, you could examine these files in a text editor. For example, you could examine:
`Tutorial_B\Tutorial_B1\Data\Drilling\VDH40Holes_Geology.csv`

The first line of each file gives field names for each column of data. You need to set these field names in 3D GeoModeller when you import the drillhole data. The following table contains the field name list for each file.

File	Field names

`VDH40Holes_Collars.csv`	`HoleID,X,Y,Z,EOH_Depth`
	`VDH_s81N_01,483500,4281000,2755,4500`
	`VDH_s81N_04,485300,4281000,2761,4500`
	`...`

`VDH40Holes_Survey.csv`	`HoleID,Dip,Azimuth,Depth`
	`VDH_s81N_01,90,0,0`
	`VDH_s81N_01,90,0,4500`
	`...`

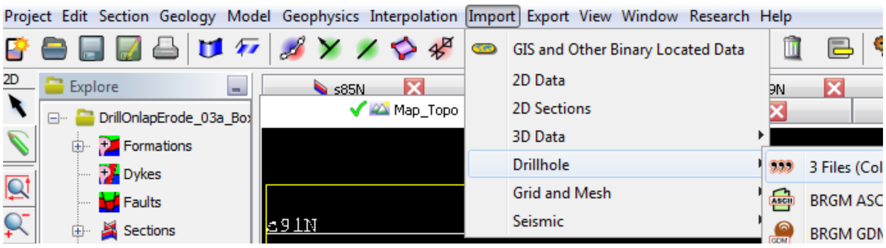
`VDH40Holes_Geology.csv`	`HoleID,From,To,Lithology`
	`VDH_s81N_01,0,743,f6`
	`VDH_s81N_01,743,2380,f5`
	`...`

B1 Stage 2—Steps

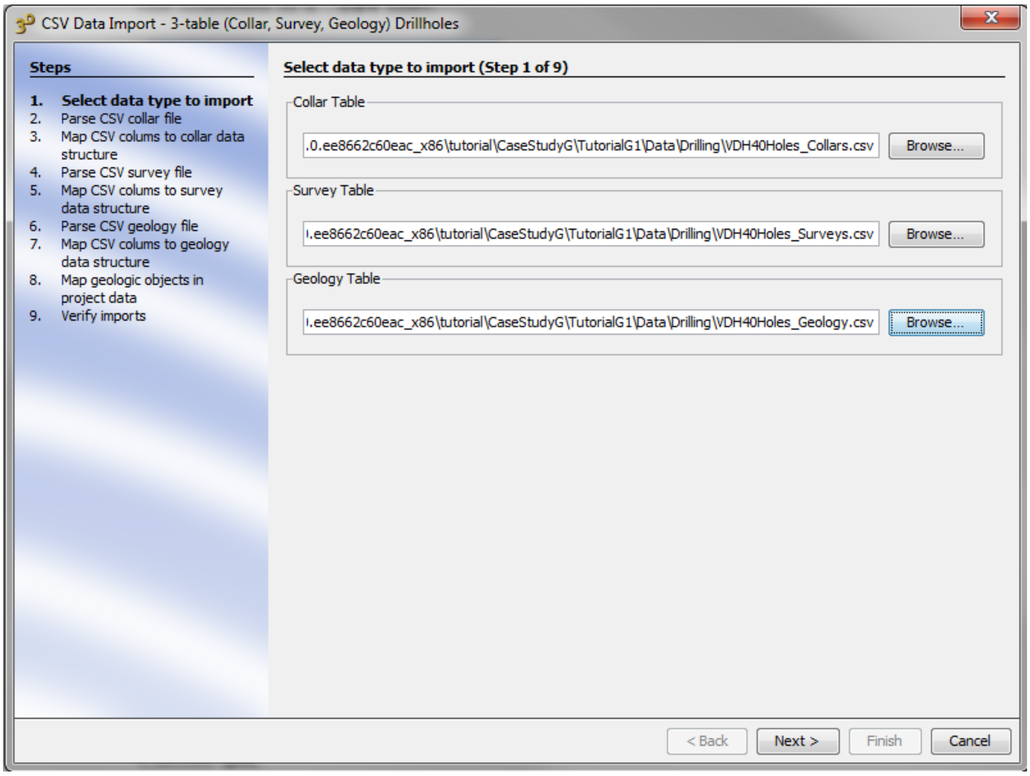
1 Ensure that you are using your own saved version of the project according to B1 Stage 1—Open the prepared 3D GeoModeller Project for Tutorial B.

Do not overwrite the completed version of this tutorial that we have supplied in your 3D GeoModeller installation.

2 From the main menu choose **Import > Import drillhole data > Import collars, surveys, geology (3 files)**.



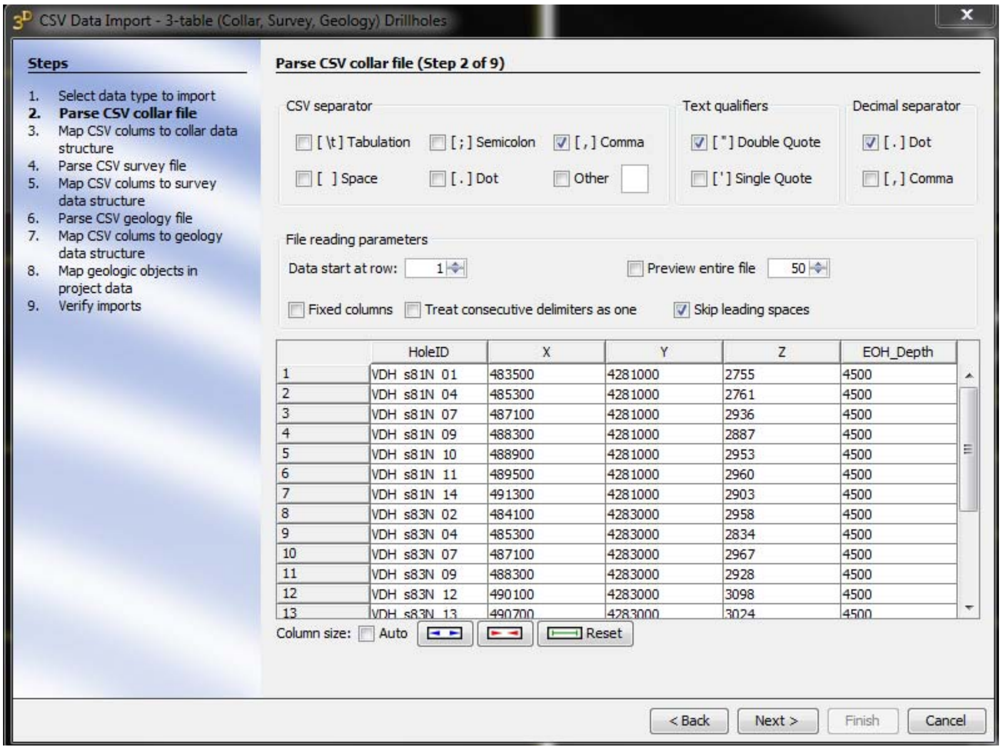
This starts the CSV Data Import - 3-table (Collar,Survey,Geology) Drillholes wizard as shown below



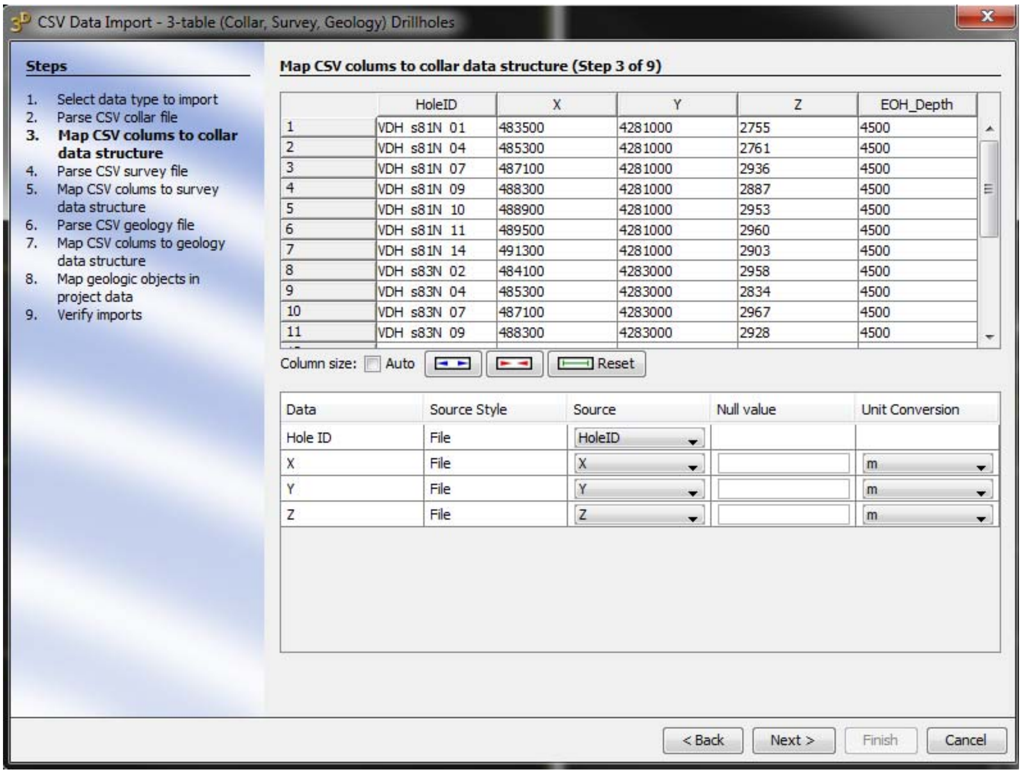
3 In the first page of the **CSV Data Import - 3-table** wizard dialog box, choose **Browse** for the **Collar Table** and locate the drillhole collars file `Tutorial_B\Tutorial_B1\Data\Drilling\VDH40Holes_Collars.csv`

4 Repeat step 2 for **Survey Table** and **Geology Table**, correspondingly named.

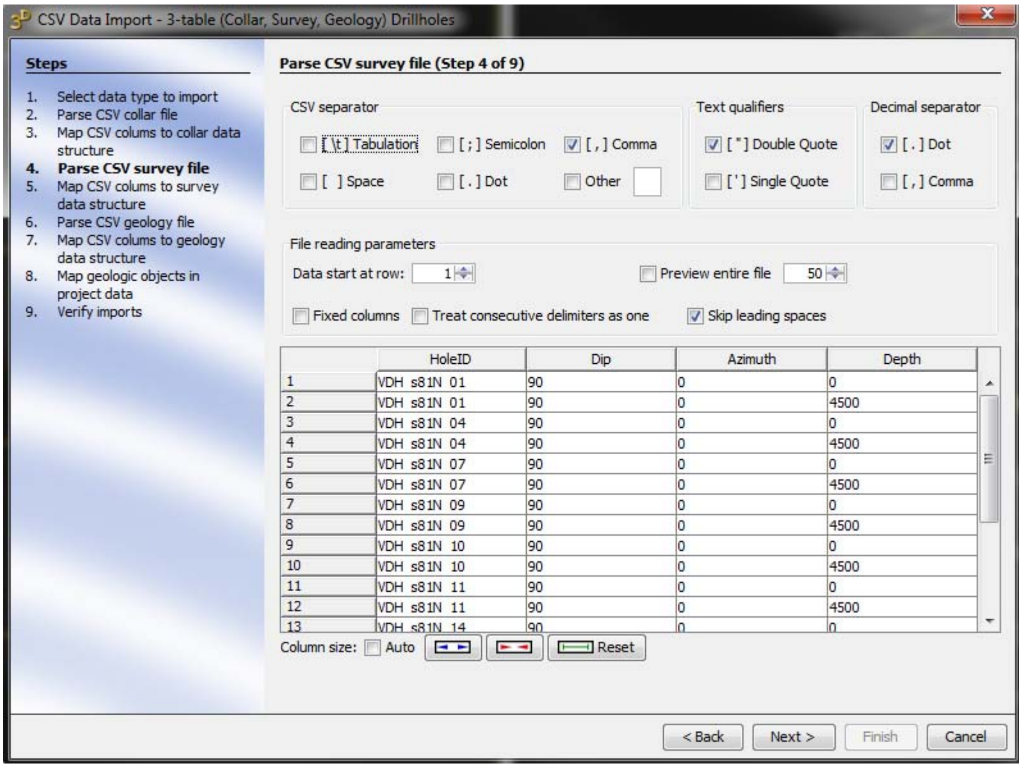
5 Select the correct data file field name from the drop-down lists for each 3D GeoModeller field name in the dialog boxes, using the results of your examination above or the names shown in the data preview panels shown below:



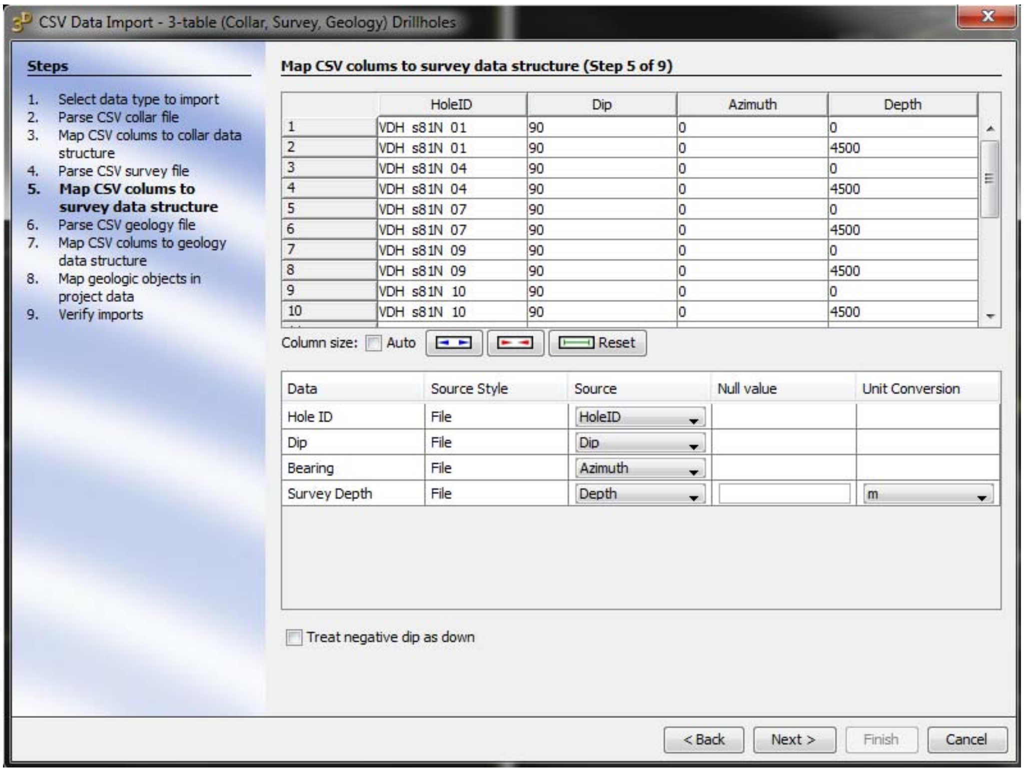
Choose **Next**.



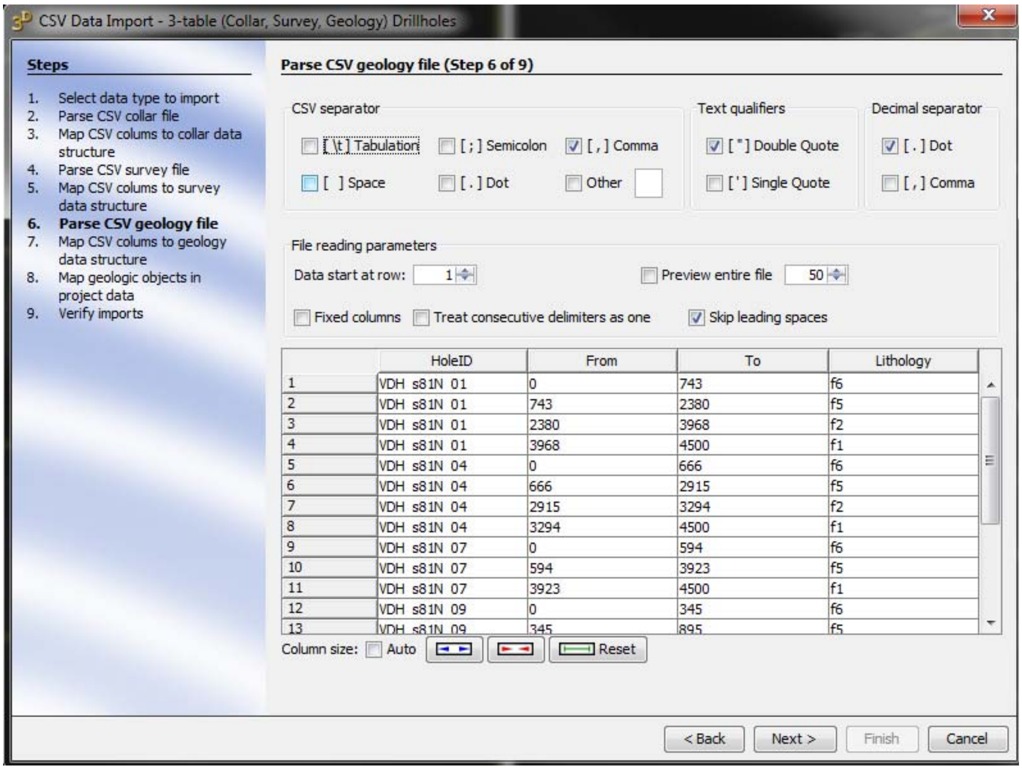
Choose **Next**.



Choose **Next**.

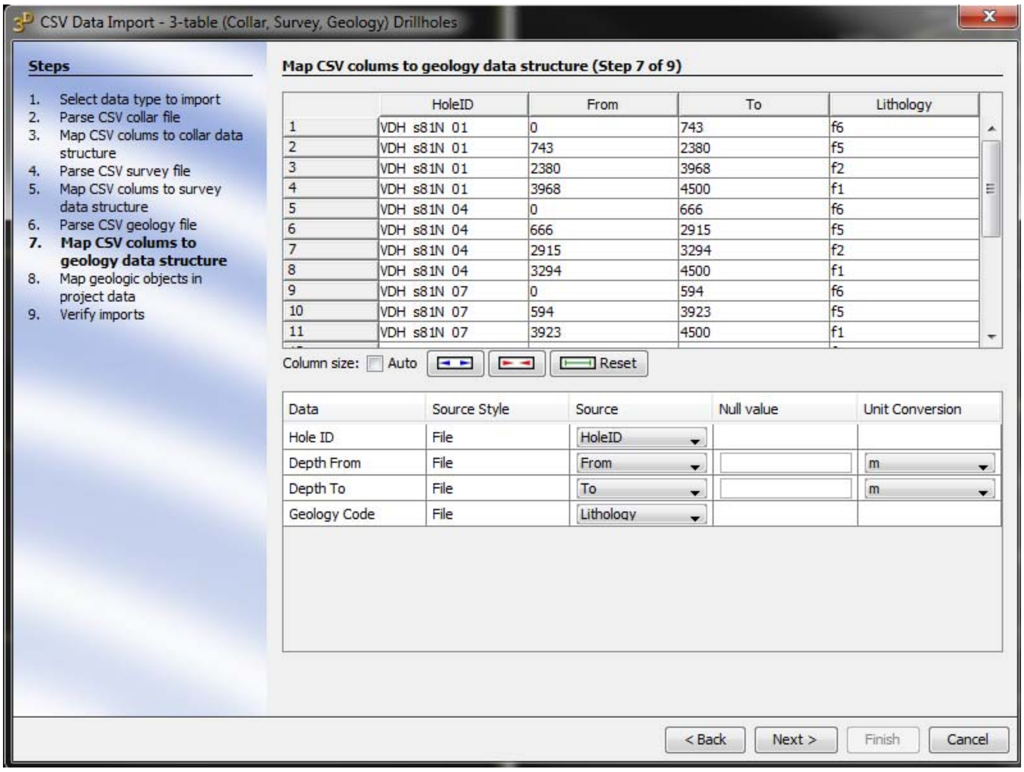


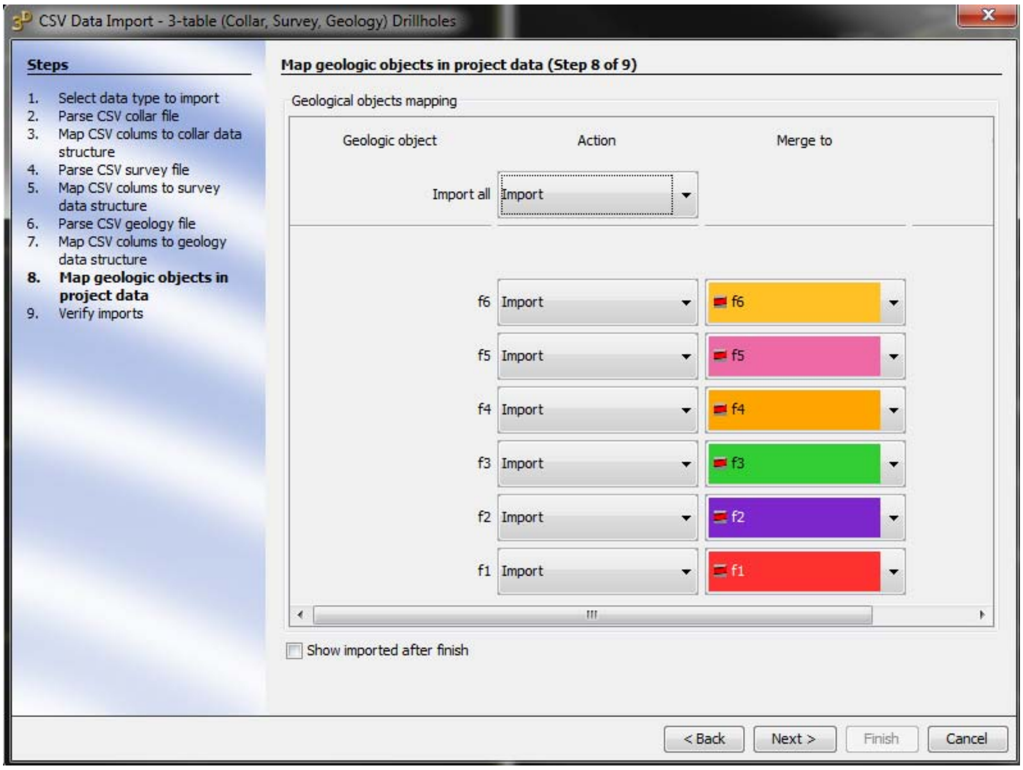
Choose **Next**.



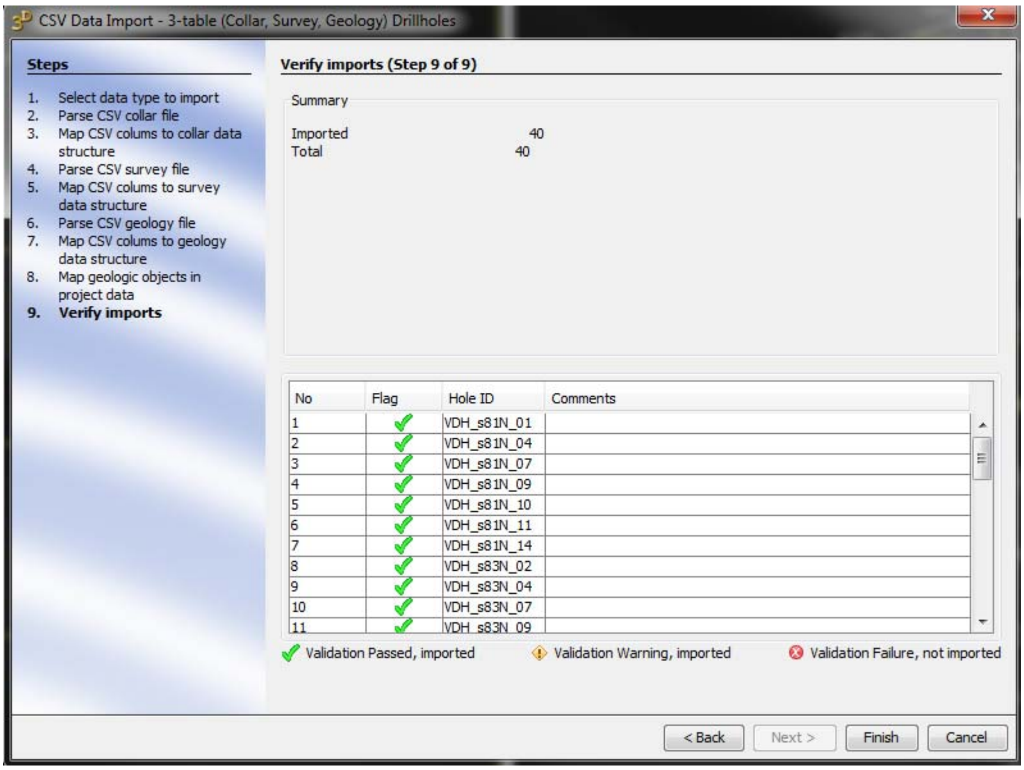
Note, of course, that the lithology coding in the **geology** file must correspond to geology formations defined in the 3D GeoModeller project.

Choose **Next**.



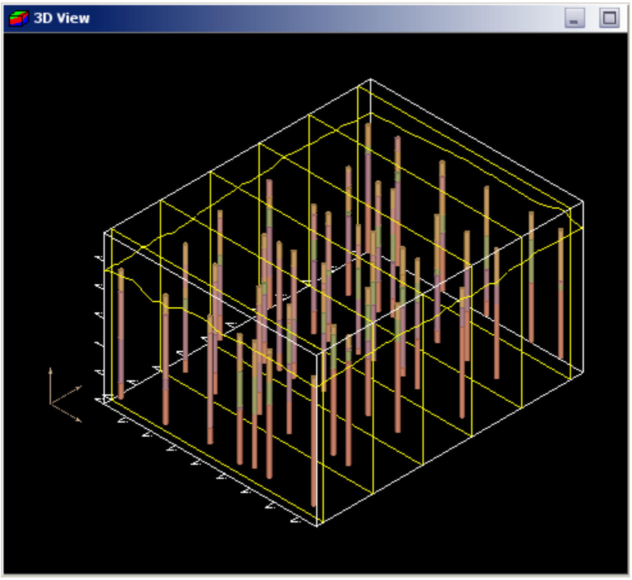


Choose **Next**.



Choose **Finish**.

View the 40 drillholes in the **3D Viewer**. *(If not already displayed)* In the **Project Explorer**, from the **Drillholes** shortcut menu, choose **Show**.


3D View

6 Save your project

From the main menu choose **Project > Save** OR

From the **Project** toolbar choose **Save** OR
Press CTRL+S.

Note that a completed version of Stage 2 of the tutorial is available in `Tutorial_B\Tutorial_B1\B1Completed_Load_Holes\B1Completed_Load_Holes.xml`. Do not overwrite it.

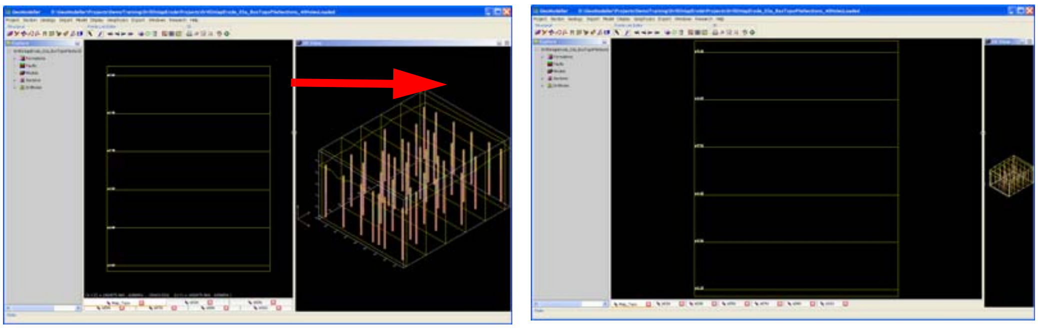
B1 Stage 3—Arrange the 2D Viewer windows

Parent topic: Tutorial B1—Building a model from drillholes (erosional series f5)

3D GeoModeller has a powerful window arrangement feature. For this project, it is useful to view all six drill-sections in a tiled window arrangement.

B1 Stage 3—Steps

1 *Expand the* ***2D Viewer*** *so that it occupies about 75% of the main 3D GeoModeller window*

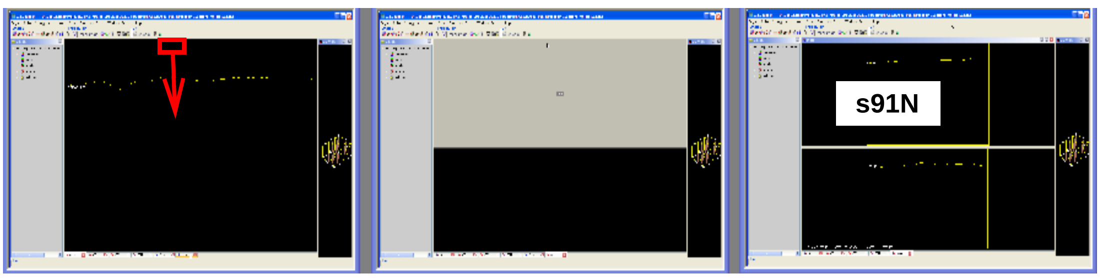


Drag the border between the **2D Viewer** and the **3D Viewer** to the right.

2 *Drag the* ***s91N*** *tab so that it becomes a window above the rest of the* ***2D Viewer*** *tabs.*

In the **2D Viewer**, drag the **s91N** tab down in the **2D Viewer** window. 3D GeoModeller displays a grey rectangular drop spot. This shows the size and position of the new window. Drop the **s91N** tab. **s91N** is now in its own window.

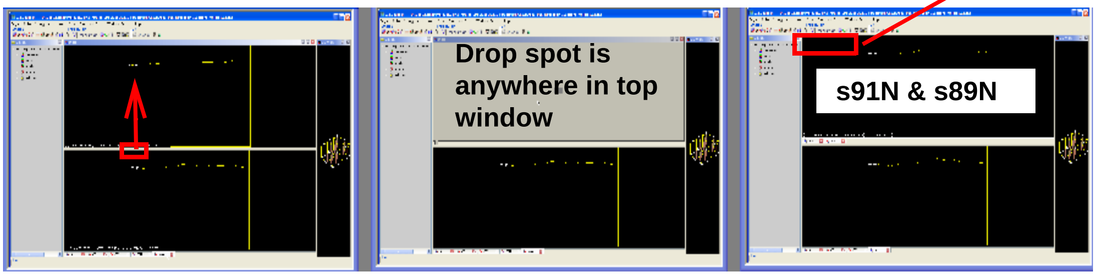
Drag s91N tab down and drop **Horizontal split**



3 *Drag the **s89N** tab to become a tab in the **s91N** window*

In the **2D Viewer**, drag the **s89N** tab to the middle of the of the **s91N** window. 3D GeoModeller displays a grey rectangular drop spot that covers the whole **s91N** window. If a half-sized drop spot appears, drag the tab further up or down until you see a full-sized drop spot. Drop the **s89N** tab. **s89N** is now a tab of the upper window.

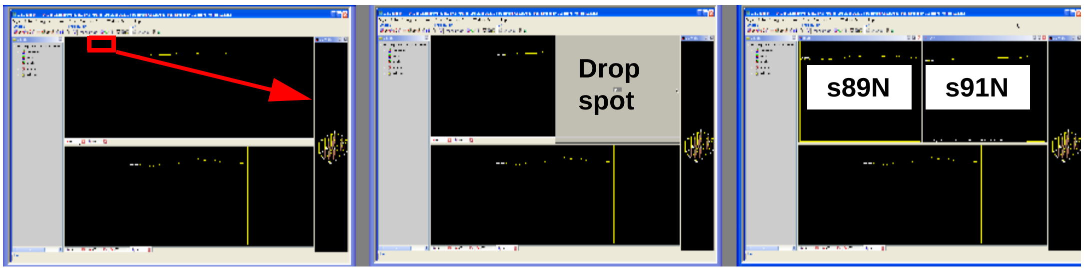
Drag s89N tab to top window and drop **Two tabs in top window**



4 *Drag the **s91N** tab into its own window at the right, separating it from the **s89N** window.*

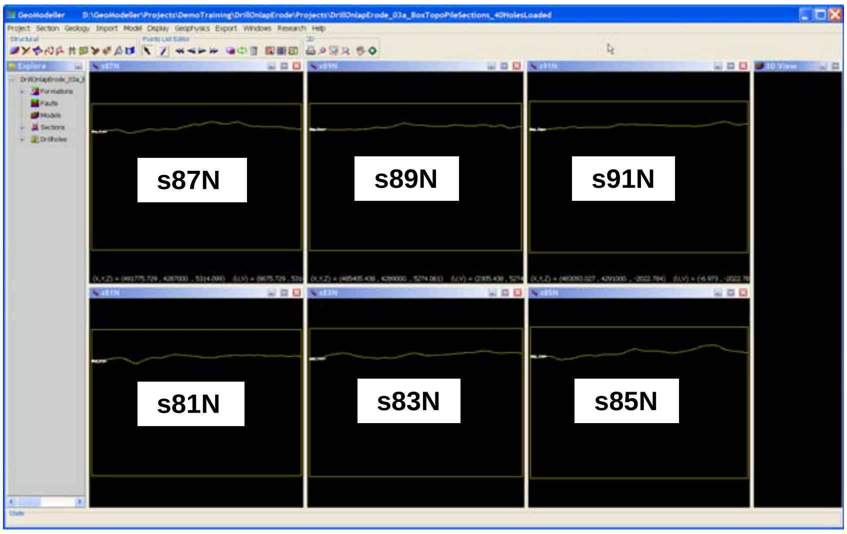
In the **2D Viewer**, drag the **s91N** tab to the right border of the upper window. 3D GeoModeller displays a grey rectangular drop spot. This shows the size and position of the new window. Drop the **s91N** tab. **s91N** now has its own window to the right of **s89N**.

Drag s89N tab to right edge and drop **Top window split**



5 Continue using this technique and create the window arrangement shown in the illustraton below.

You may need to adjust the relative widths of the **2D Viewer** windows as you go (see step 1 of this stage for instruction)



6 Use **Zoom—Fit section to window** in the **2D Toolbar** to fit each section view into its window.

B1 Stage 4—Project the Drillholes in each 2D Section-View

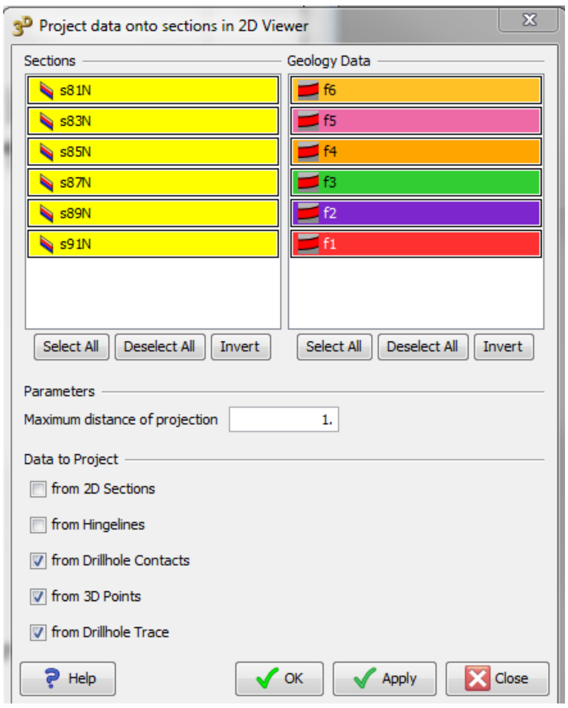
Parent topic: **Tutorial B1—Building a model from drillholes (erosional series f5)**

Drillholes are separate data structures within 3D GeoModeller. They do not 'belong' to any particular section. You can project drillholes onto nearby sections. This shows the drillhole geology intervals on the target section in the **2D Viewer**.

B1 Stage 4—Steps

1 In the **Model** toolbar choose **Project data onto section in 2D Viewer** .

3D GeoModeller displays the **Project data onto section** dialog box.



From the **Sections** list select all sections s81N, s83N, s85N, s87N, s89N, and s91N.

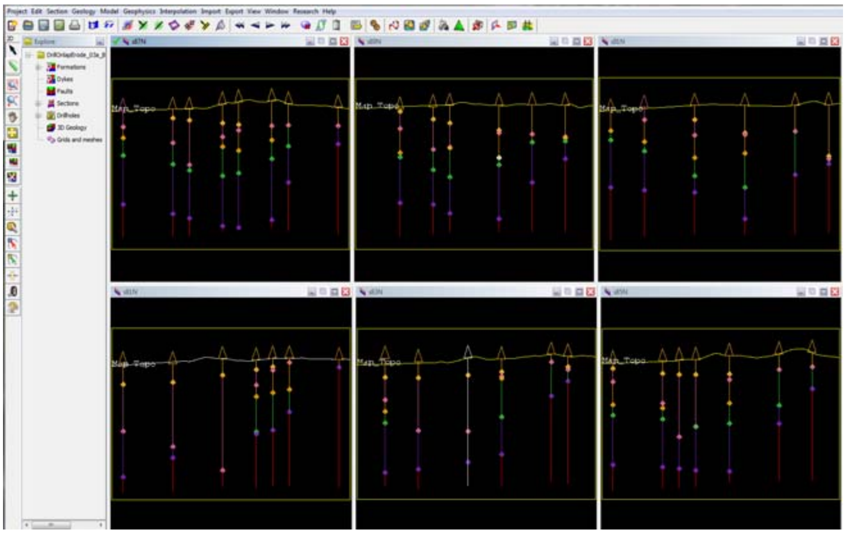
For **Maximum distance of projection**, enter 1. All of the drillholes are exactly on these project sections, so this is an appropriate distance.

Clear **from 2D Sections and from Hingelines**.

Check **From Drillholes Contacts, from3D Points, and fromDrillhole Trace**.

Choose **Apply**.

2 3D GeoModeller displays the projected drillholes.



3 Choose **Close**.

B1 Stage 5—Prepare the project for modelling

Parent topic: **Tutorial B1—Building a model from drillholes (erosional series f5)**

The first task in this tutorial is to model formation f5.

To model any geology surface, 3D GeoModeller requires the following:

- At least one contact point for each formation within a series AND
- At least one point of orientation data for one of the formations within the series.

In our case, we have no contact points as such. However, 3D GeoModeller automatically extracts valid contact points from the geology intervals described in the drillhole data. It turns out that there are numerous contact points in the assemblage of 40 drillholes imported here. (**Note:** 3D GeoModeller may not necessarily find a geology contact from drill hole data. If it cannot, then you must supply your own contact points before it can compute the series.)

There are no orientation data in the project yet. 3D GeoModeller requires orientation data before it can compute a series.

Perhaps you have some measured structural data for the f5 series. You could import that data.

In the absence of measured data, we can provide an interpreted piece of orientation data. We shall examine the drill-hole data made available to us in the section views and decide where we can reasonably estimate the attitude of the (bottom of the) f5 boundary. After locating this we enter an orientation data point describing that attitude.

In this tutorial we place the interpreted orientation data point on Section s81N.

B1 Stage 5—Steps

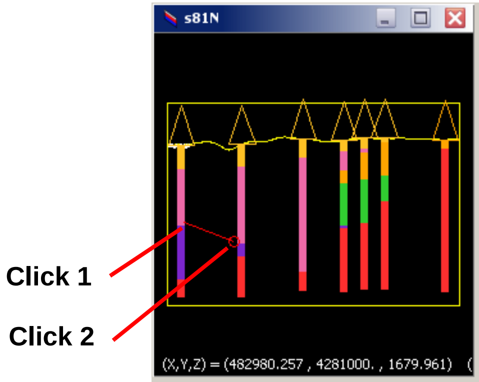
1 Select the **s81N** section in the **2D Viewer**.

In the **Points List** toolbar:

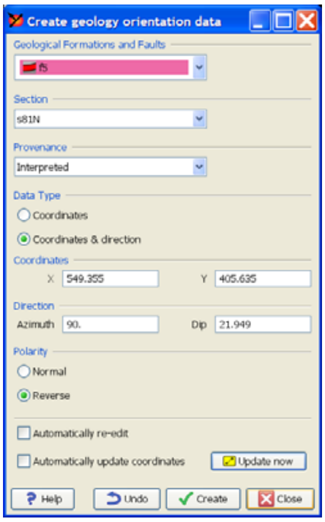
- Choose **Delete all Points** to erase any contents of the Points List
- Choose **Create** OR press C.

2 Click the bottom of the f5 (pink) formation on the first drillhole. This is the location of the orientation data point that you are creating.

Click the bottom of the f5 (pink) formation on the second drillhole. This indicates the dip of the orientation point.



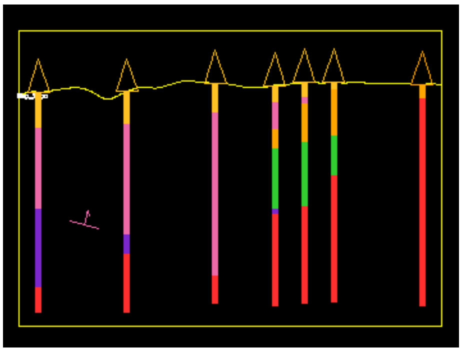
3 In the **Structural** toolbar, choose **Create geology orientation data** .



From **Geological formations and faults**, select f5.

From **Provenance** select Interpreted.

Choose **Create**.



4 Check the orientation data point. The shaft of the T shape should point up in the section. If it points down, edit the point and reverse the **Polarity**.

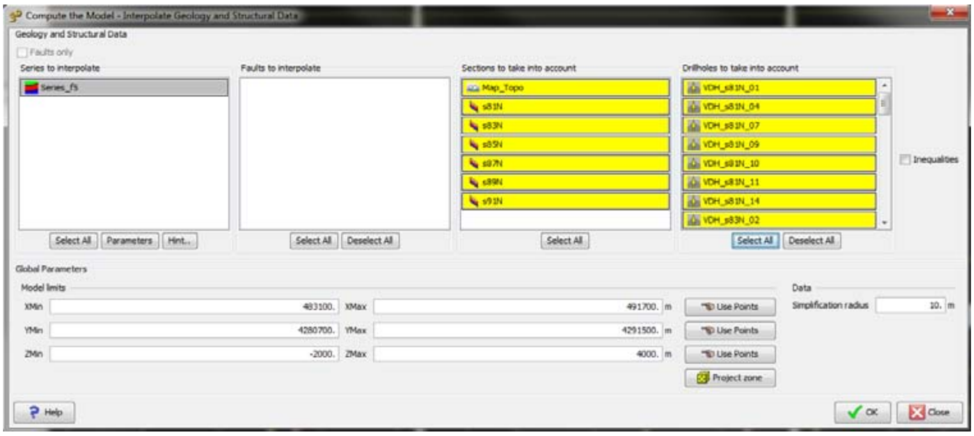
To edit the point, point to it so that it turns white. From the shortcut (right click) menu, choose **Edit**. In the **Create geology orientation data** dialog box, from the **Polarity** options, select **Normal** or **Reverse**, whichever is not selected. Choose **Edit**.

Close the **Create geology orientation data** dialog box.

5 *Compute the model with all series and sections.*

From the main menu choose **Model > Compute** OR

From the **Model** toolbar choose OR
Press CTRL+M.



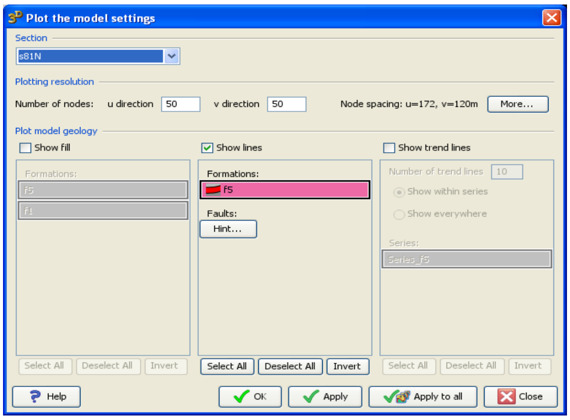
For **Series to interpolate**, **Sections to take into account**, and, **Drillholes to take into account** choose **Select All**.

Choose **OK**.

6 Plot the model with lines in each of the section views

From the main menu choose, choose **Model > Plot the model settings** OR

From the **Model** toolbar, choose **Plot the model settings** OR
Pess CTRL+D.



From the **Section** drop-down list, select a section.

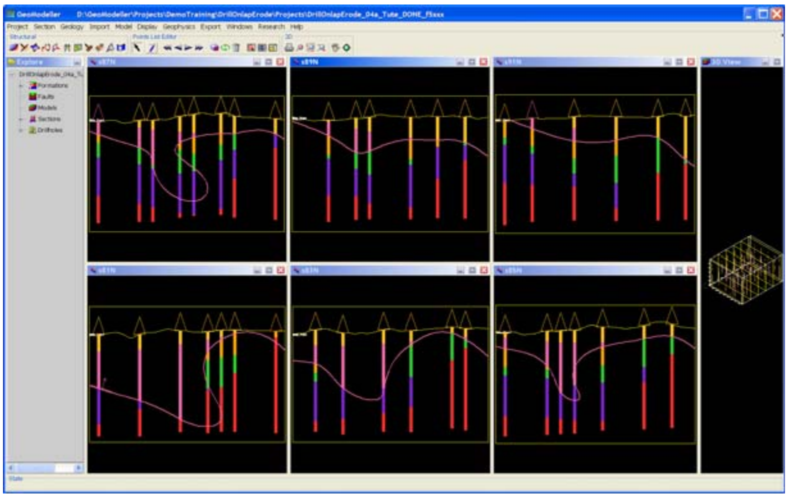
Check **Show lines** and clear **Show fill**.

Choose **OK**.

3D GeoModeller plots the model on the selected section.

From the main menu choose, choose **Model > Plot the model on all sections** OR

From the **Model** toolbar, choose **Plot the model on all sections** .



B1 Stage 5—Discussion

Note that 3D GeoModeller only calculates and plots the model for formation f5. To calculate the model for a formation, 3D GeoModeller requires that there be at least one orientation point associated with it. Currently, f5 is the only formation that matches this criterion.

At these early stages of modelling a surface, you may get unexpected results.

This is mainly because there is very little orientation data to give information about the attitude of the geology surfaces.

In the following stage, we shall work through the issues, dealing with the biggest problems first.

B1 Stage 6—Comparing the model with drillhole observations

Parent topic: **Tutorial B1—Building a model from drillholes (erosional series f5)**

Note: Using 3D GeoModeller's 'Compare the model with drillhole observations' feature is a useful tool, but it is not required or obligatory in this case study. You may be able to find and fix problems with the model just as easily using enlarged views and examining the graphic representation.

When using drillholes, since the contact point from the data is certain, we would expect 3D GeoModeller to place the geology boundary from the model exactly at this point. Sometimes 3D GeoModeller places a geology boundary through the middle of some drilled geology interval. Sometimes, also, the model surface appears to 'meander'.

This is because 3D GeoModeller is using two other techniques that may, from its viewpoint, conflict with the drillhole data:

- It is trying to keep the model surface smooth.
- It is using geological statistics to predict the course of the boundary.

These problems typically occur at the hole collar, and near the end-of-hole.

The problems are occurring at places where 3D GeoModeller does not have enough information to generate the model properly. To fix the problems, add geology contact or orientation points. As interpreters, we influence the modelling calculation according to our belief about the geology.

We can do this by:

- Tracing out a 'line-of-points' where we believe the geology should be OR
- Add orientation data to influence the attitude of the geology horizons

Note that that we may not necessarily correct the data at the location of the error. The error may result from lack of orientation data at a neighbouring drillhole. We could even add mapping data on the surface that would resolve the problem.

Comparing the model with drillhole observations gives information about the location of the problems. It does the following:

1. Examines each interval of observed geology from the drillhole data
2. Checks the model's predicted geology over the same interval
3. Highlights drillholes where the difference error exceeds the specified precision.

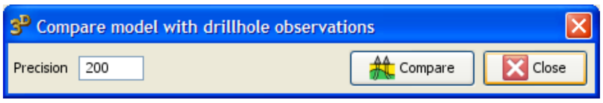
Specify a large value for **Precision** first. This enables you to identify the big problems. Fix those first. Often, fixing the big problems automatically fixes some of the smaller problems.

B1 Stage 6—Steps

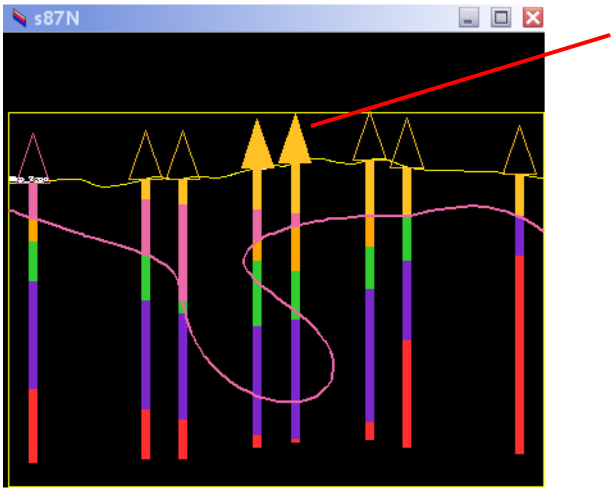
1 From the main menu choose **Model > Compare model with drillhole observations** OR

From the **Model** toolbar choose **Compare model with drillhole observations** .

2 For **Precision**, enter 200.



Choose **OK**.



Highlighted drillholes have model differences compared to the drilled intervals

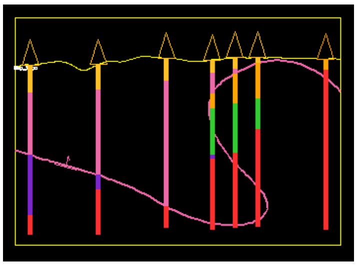
3 *Fix the problems at the drillholes where 3D GeoModeller has identified a problem.*

You can experiment with adding geology contact or orientation points yourself, or follow our solution.

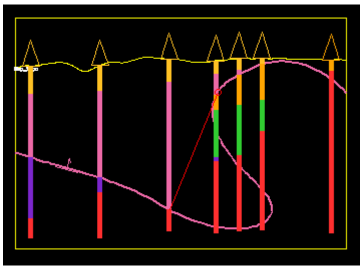
In section **s81N**, add an orientation point between the third and fourth drillholes from the left, to guide the model away from the loop that it is mistakenly generating through the fourth, fifth and sixth drillholes.

Use the steps in B1 Stage 5—Prepare the project for modelling to add the new point, recalculate and replot the model.

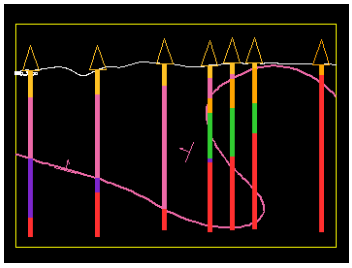
Compare the model with drillhole observations again with a distance of 200 m. Add further points in other sections as required. Recalculate. The illustration below shows the steps and the result.



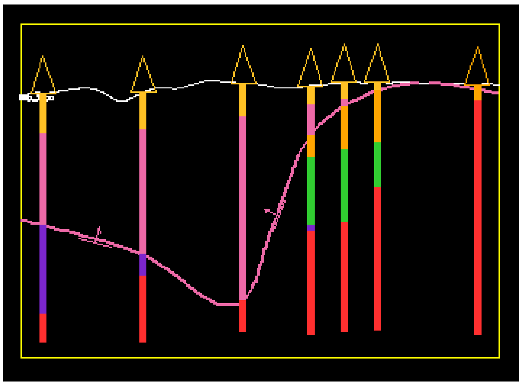
1. Model has loop



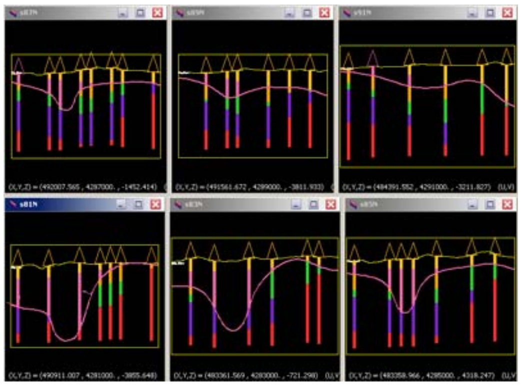
2. Click trace points



3. Create orientation point



4. Recalculate model

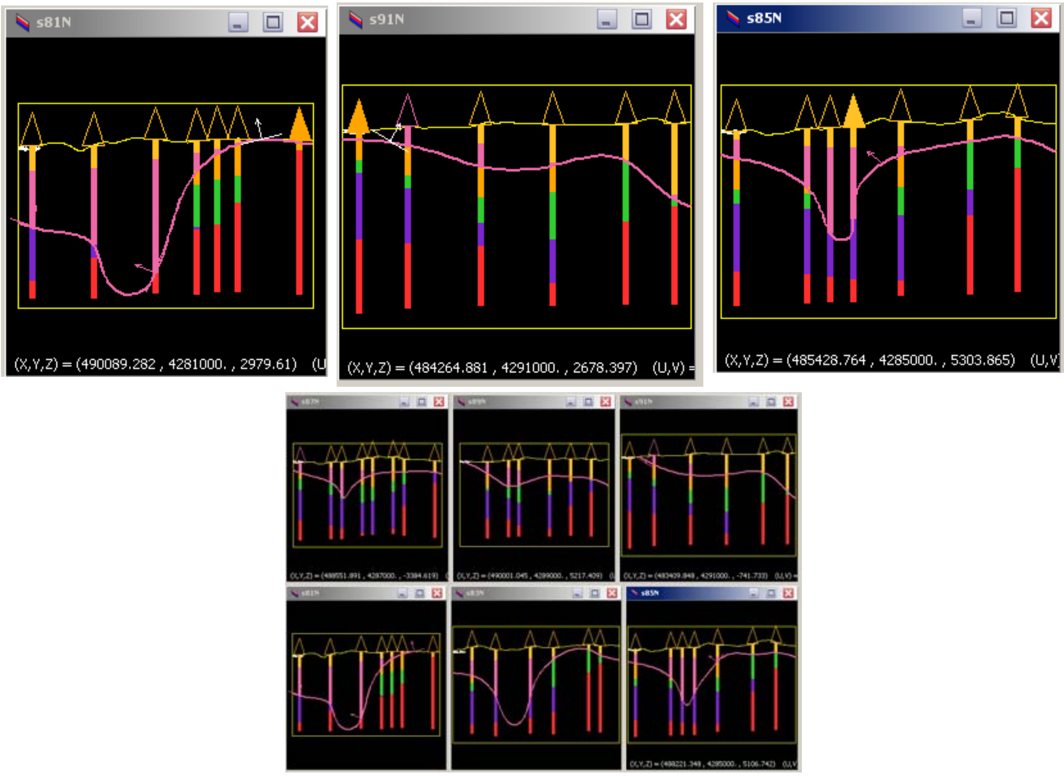


5. Add orientation points in other sections as necessary and recalculate.

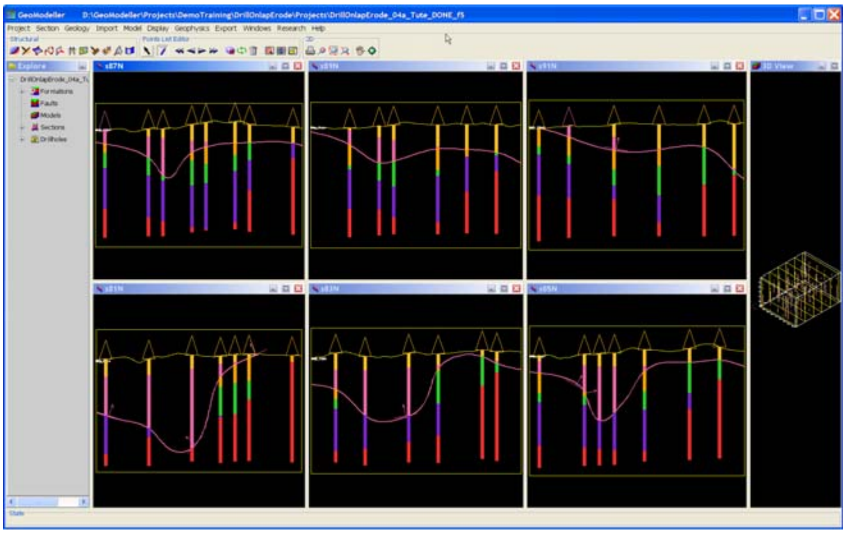
In this illustration, we have removed discrepancies in the model to an accuracy of 200 m.

4 Compare the model with drillhole observations using progressively finer precision, 50 m, then 15 m, then 5 m, repeating steps 1–3.

At 50 m, we added orientation points to s81N and s91N. When we recalculated the model, we found another problem in s85N, which we fixed. The results are in the illustration below.



As you work through the problems in the model, the interpreted horizon begins to look more plausible.



Important note about 3D GeoModeller's 'Compare the model with drillhole observations' feature: At larger **Precision** values, 3D GeoModeller calculates genuine errors. You can review the project geology and add further geology observations or interpretations to seek to resolve the reported discrepancies.

At smaller **Precision** values, the 'errors' may be due to the mathematical uncertainty in the model. You would gain very little from further interpretive work to try and resolve such relatively small errors ('small' relative to the overall dimensions of the model project).

B1 Stage 7—Creating a 3D view

Parent topic: Tutorial B1—Building a model from drillholes (erosional series f5)

When you are satisfied that you have modelled the f5 surface in a credible geological manner, and that the model is consistent with the drilled geology intervals, you can quickly generate a 3D surface and view this in the 3D Viewer.

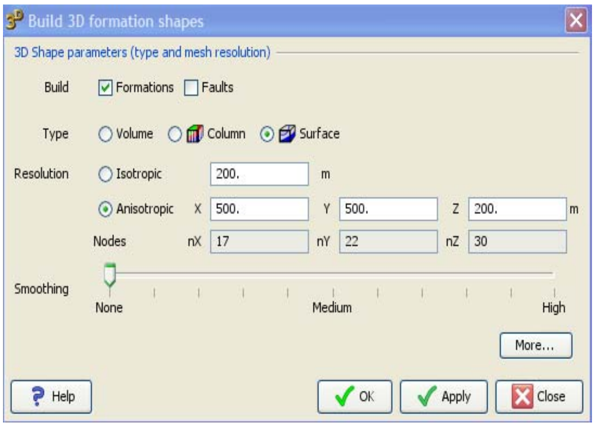
B1 stage8—Steps

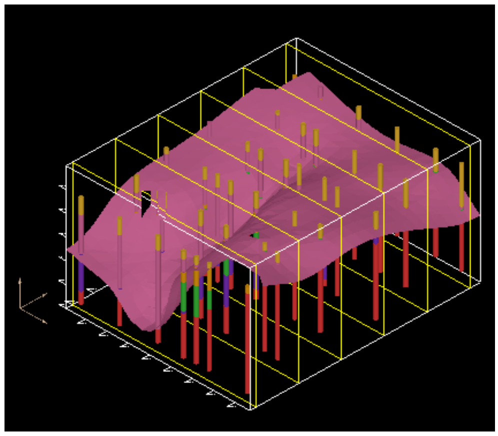
1 View the 40 drillholes in the **3D Viewer**. *(If not already displayed)* In the **Project Explorer**, from the **Drillholes** shortcut menu, choose **Show**.

2 Choose main menu **Model > Build 3D formations and faults** OR

In the Model toolbar choose **Build 3D formations and faults**

Check **Surface** and choose **OK**.

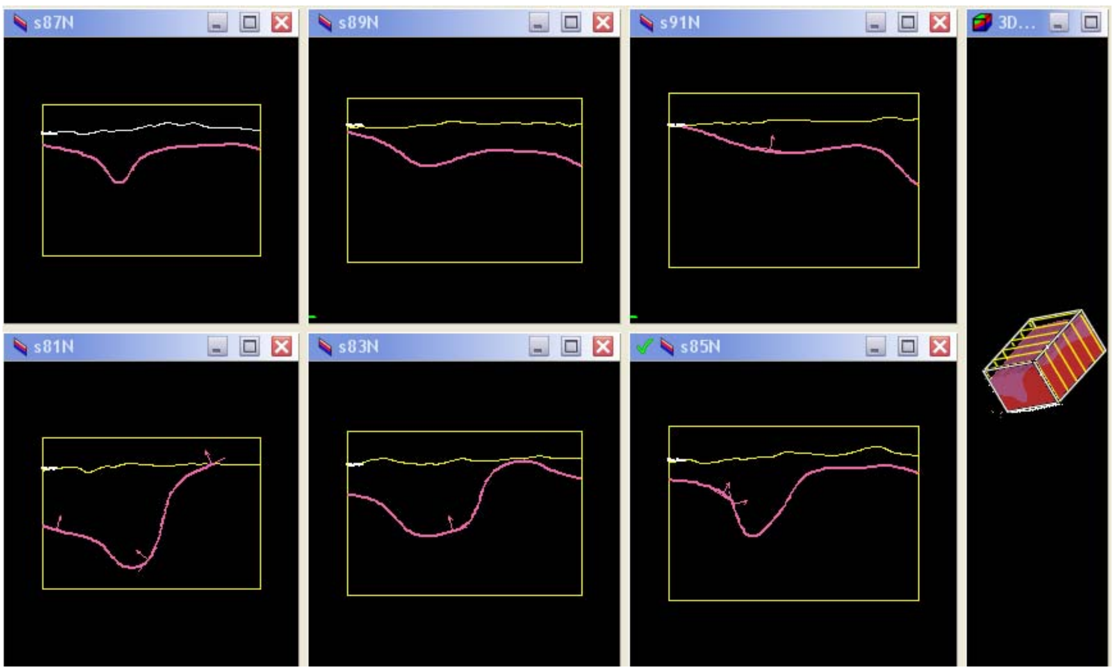




To change the colour of the surface, in the **Project Explorer**, from the shortcut menu of **Model > Surface_f5**, choose **Appearance**.

Note that a completed version of Stage 8 of the tutorial is available in `Tutorial_B\Tutorial_B1\B1Completed_F5\B1Completed_F5.xml`. Do not overwrite it.

Here is an illustration of the completed Tutorial B2 project



Tutorial B2—Building a model from drillholes (erosional series f2)

Parent topic: **Tutorial B (Drillholes)**

In this tutorial we create, display and refine the model for (erosional) series f2

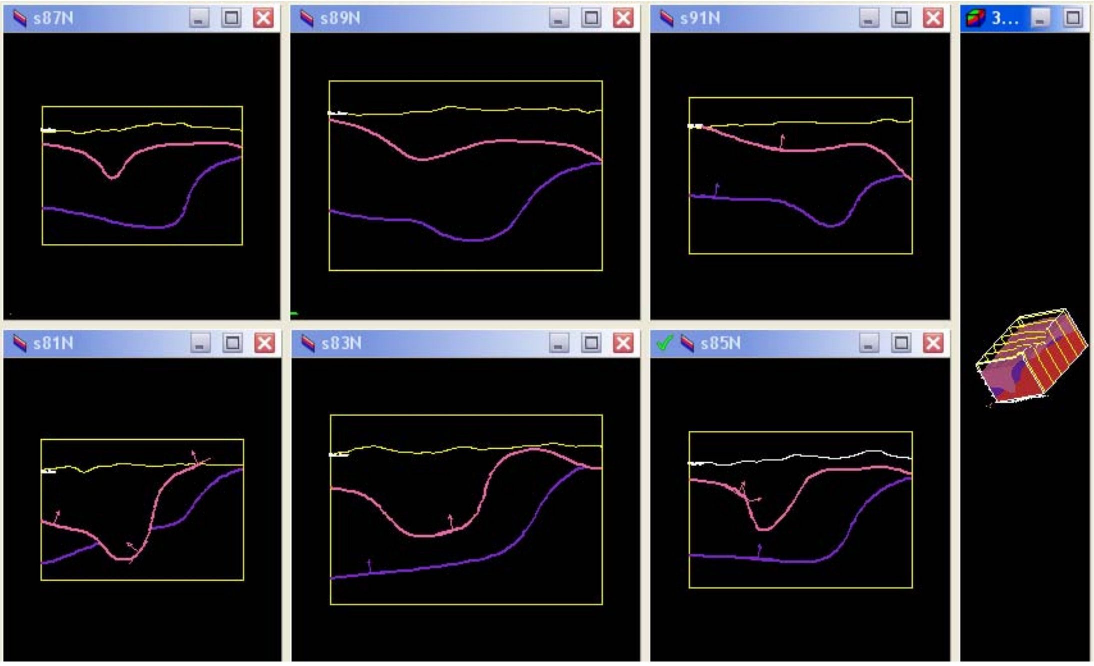
After series f5 (Tutorial B1—Building a model from drillholes (erosional series f5)), series f2 is the next older erosional surface, and the next series for modelling (see Strategy for Tutorial B).

Repeat the steps from Tutorial B1—Building a model from drillholes (erosional series f5), but for section f2.

1. Start with your completed project from B1 Stage 6—Comparing the model with drillhole observations or open the completed version that we have supplied `Tutorial_B\Tutorial_B1\B1Completed_f5\B1Completed_f5.xml`.
2. Start repeating the steps from B1 Stage 4—Project the Drillholes in each 2D Section-View.
3. Continue to the end of B1 Stage 7—Creating a 3D view.

Note that a completed version of this tutorial is available in `Tutorial_B\Tutorial_B2\B2Completed_f5f2\B2Completed_f5f2.xml`. Do not overwrite it.

Here is an illustration of the completed Tutorial B2 project



Tutorial B3—Building a model from drillholes (onlapping series f3)

Parent topic: Tutorial B (Drillholes)

In this tutorial we create, display and refine the model for (onlapping) series f3

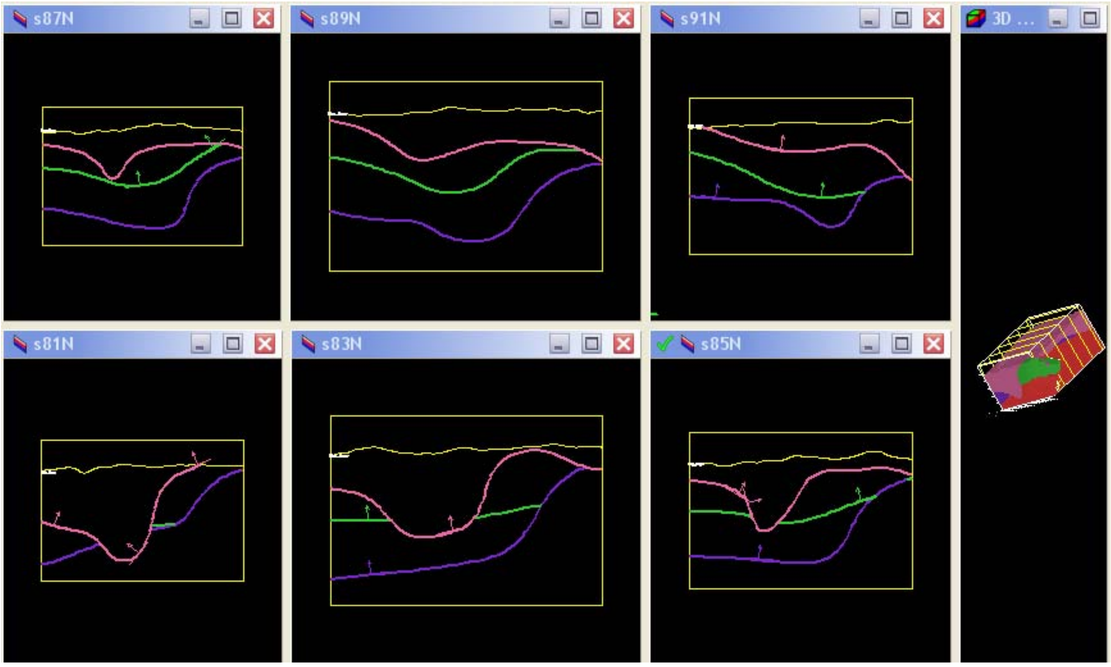
Now that we have modelled the erosional series, we are ready to model serties f3, the oldest onlapping series (see Strategy for Tutorial B).

Repeat the steps from Tutorial B1—Building a model from drillholes (erosional series f5), but for section f3.

1 Start with your completed project from Tutorial B2—Building a model from drillholes (erosional series f2) or open the completed version that we have supplied `Tutorial_B\Tutorial_B2\B2Completed_f5f2\B2Completed_f5f2.xml`.
2 Start repeating the steps from B1 Stage 4—Project the Drillholes in each 2D Section-View.

Note that a completed version of this tutorial is available in `Tutorial_B\Tutorial_B3\B3Completed_f5f2f3\B3Completed_f5f2f3.xml`. Do not overwrite it.

Here is an illustration of the completed Tutorial B3 project



Tutorial B4—Building a model from drillholes (onlapping series f4)

Parent topic: Tutorial B (Drillholes)

In this tutorial we create, display and refine the model for (onlapping) series f4

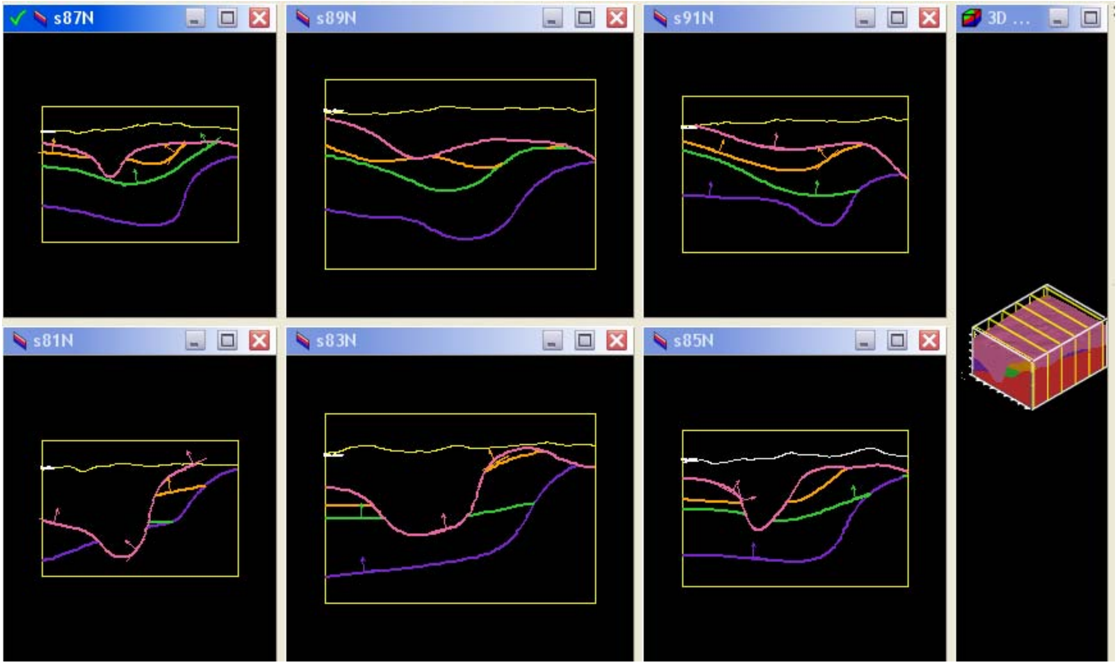
After series f3, series f4 is the next youngest onlapping surface, and the recommended next series for modelling (see Strategy for Tutorial B).

Repeat the steps from Tutorial B1—Building a model from drillholes (erosional series f5), but for section f4.

1. Start with your completed project from Tutorial B3—Building a model from drillholes (onlapping series f3) or open the completed version that we have supplied **`Tutorial_B\Tutorial_B3\B3Completed_f5f2f3\B3Completed_f5f2f3.xml`**.
2. Start repeating the steps from B1 Stage 4—Project the Drillholes in each 2D Section-View.
3. Continue to the end of B1 Stage 7—Creating a 3D view.

Note that a completed version of this tutorial is available in **`Tutorial_B\Tutorial_B4\B4Completed_f5f2f3f4\B4Completed_f5f2f3f4.xml`**. Do not overwrite it.

Here is an illustration of the completed Tutorial B4 project



Tutorial B5—Building a model from drillholes (onlapping series f6)

Parent topic: Tutorial B (Drillholes)

In this tutorial we create, display and refine the model for the final (onlapping) series f6

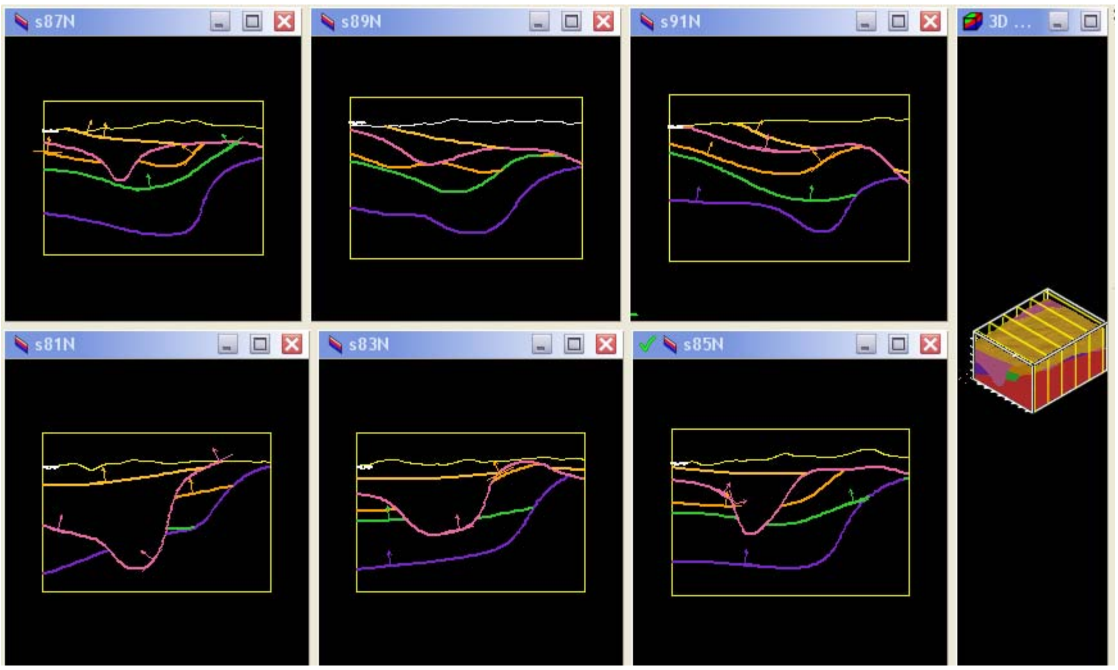
After series f4, series f6 is the next youngest onlapping surface, and the next series for modelling (see Strategy for Tutorial B).

Repeat the steps from Tutorial B1—Building a model from drillholes (erosional series f5), but for section f4.

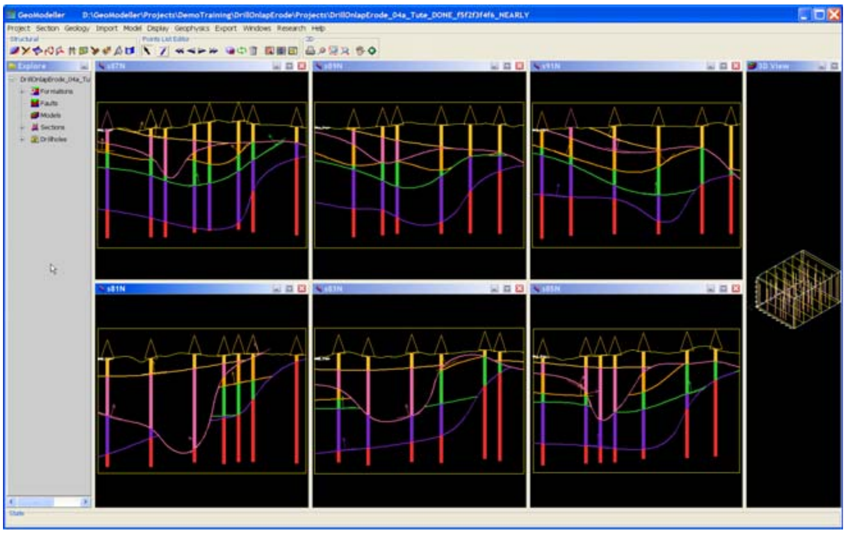
1 Start with your completed project from Tutorial B4—Building a model from drillholes (onlapping series f4) or open the completed version that we have supplied **`Tutorial_B\Tutorial_B4\B4Completed_f5f2f3f4\B4Completed_f5f2f3f4.xml`**.
2 Start repeating the steps from B1 Stage 4—Project the Drillholes in each 2D Section-View.
3 Continue to the end of B1 Stage 7—Creating a 3D view.

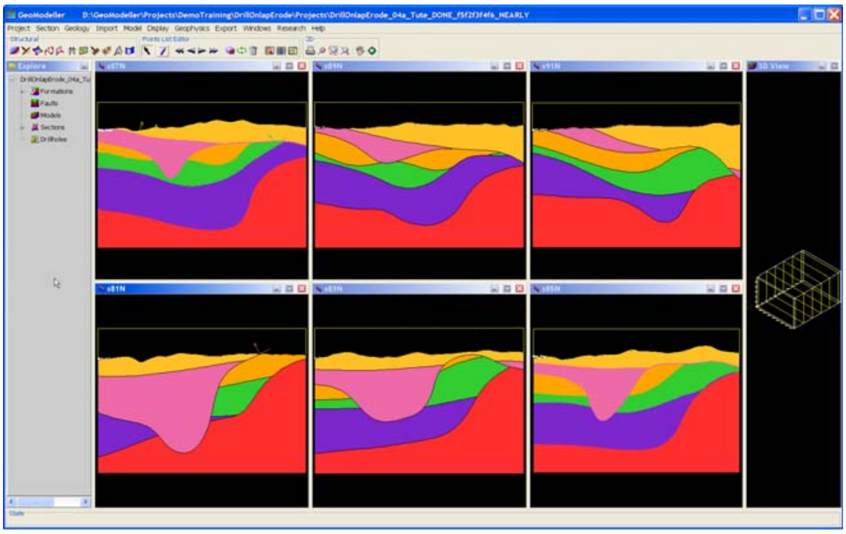
Note that a completed version of this tutorial is available in **`Tutorial_B\Tutorial_B5\B5Completed_f5f2f3f6\B5Completed_f5f2f3f6.xml`**. Do not overwrite it.

Here is an illustration of the completed Tutorial B4 project



The following illustrations are of the final model, using line and filled mode.

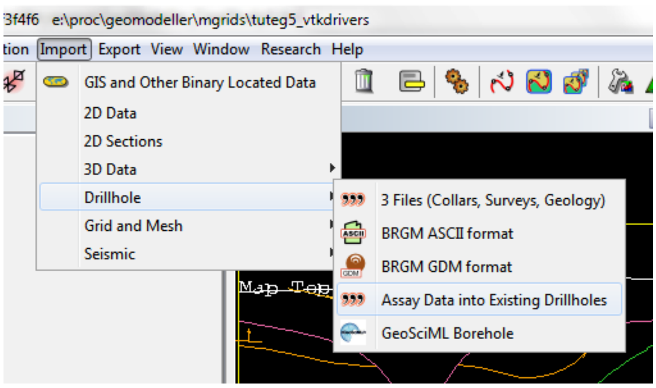




Tutorial B6—Import Drillhole Assay Data

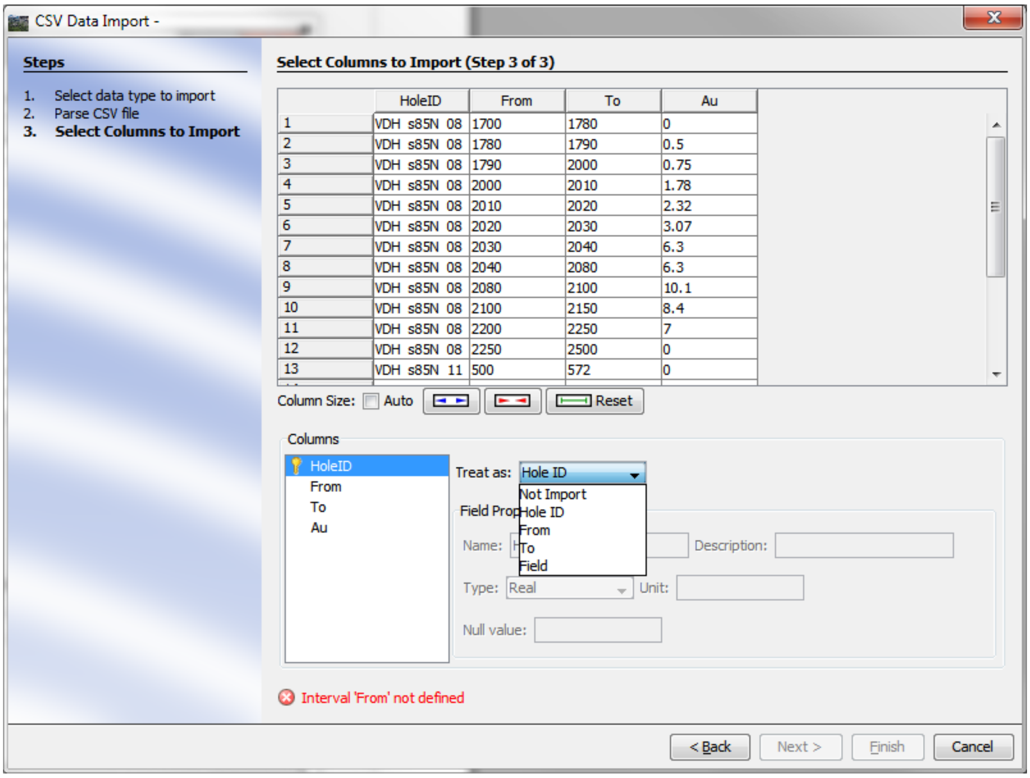
Parent topic: Tutorial B (Drillholes)

1 Choose **Import > Drillhole > Assay Data into Existing Drillholes**



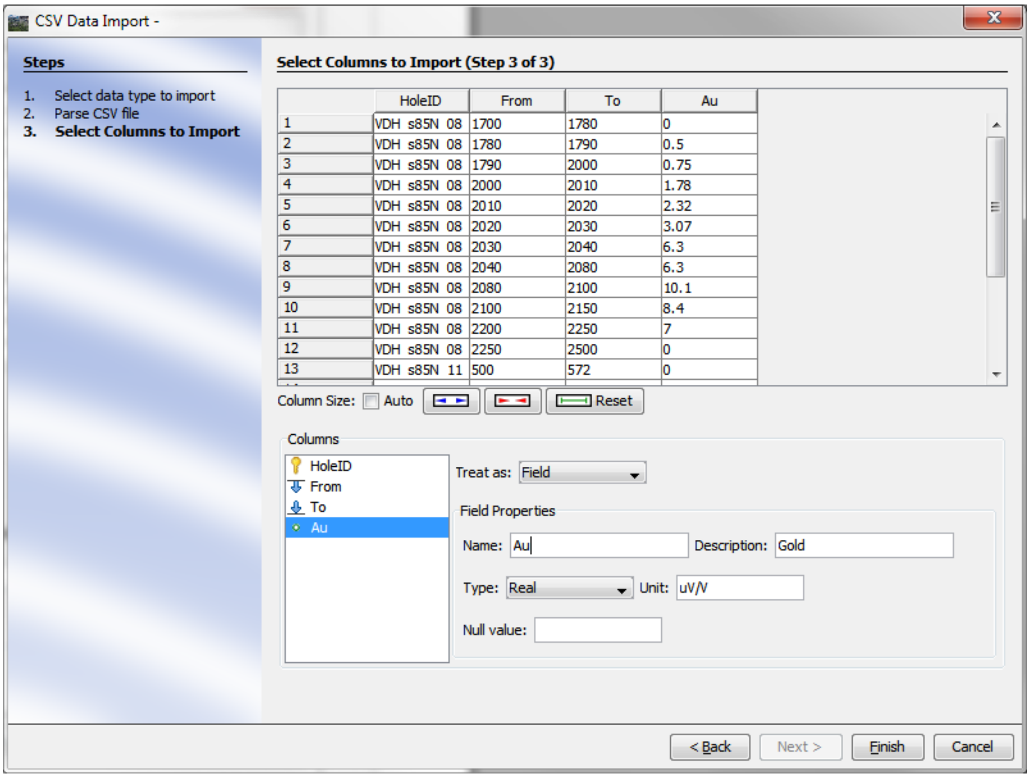
2 The **Import ASCII Wizard** will pop up.

1. On the first page, select the input file: `Tutorial_B\Tutorial_B5\Data\AssayImportExample.csv`
2. On the second page you will see the file is formatted correctly already. Choose **Next** to go to page 3.
3. Set the column mapping for the Hold ID.



3 Set the column mapping for the From and To in the same manner

4 Set the **Au** field paraters. Set the **Type** to Real, set the name, description and units as desired. The default NULL value can be used.

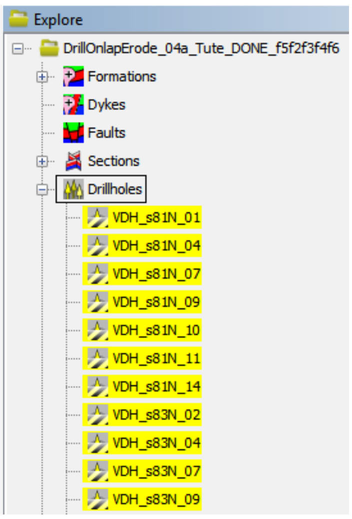


5 Choose **Finish** to close the wizard and import the data.

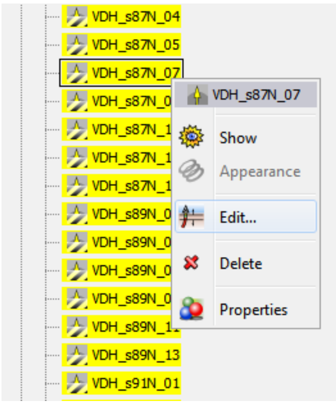
Tutorial B6 - Drillhole Properties Dialog

To view the assay field data for a drillhole you can use the **Drillhole Properties Dialog**.

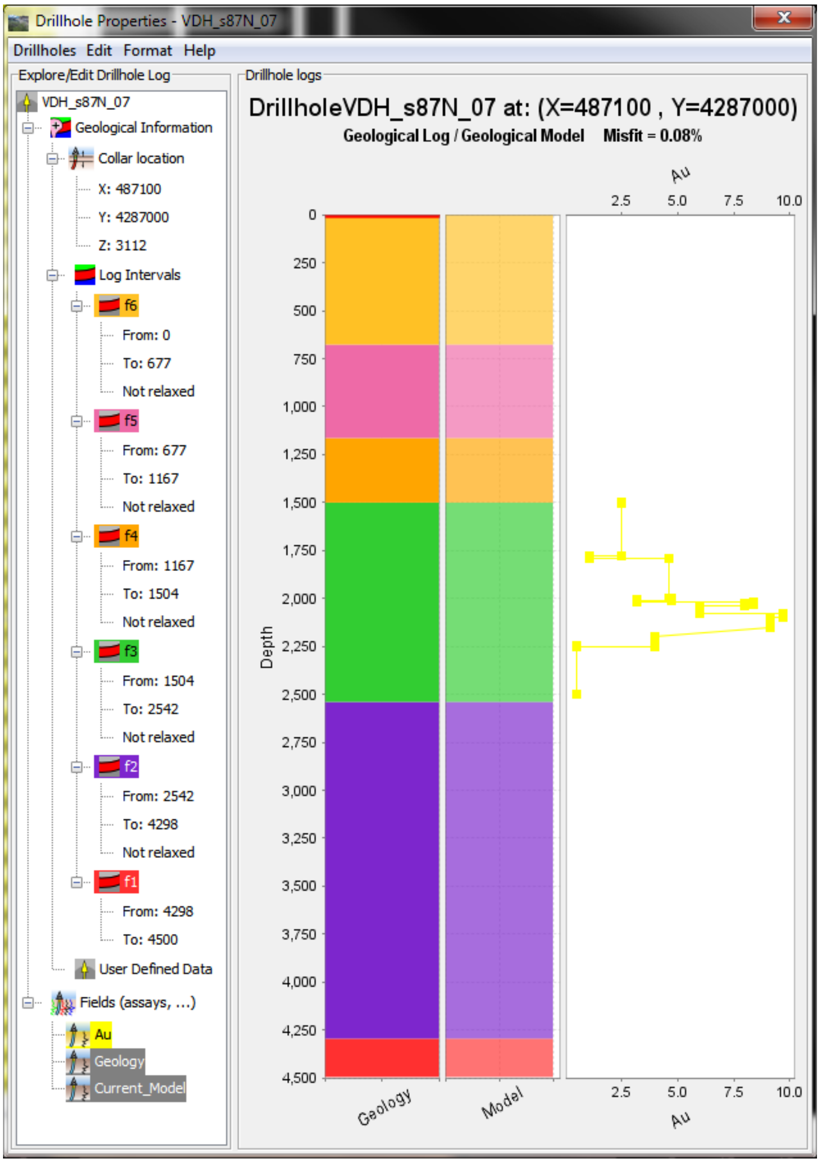
1 Expand the Drillhole list in the Project Explorer tree



2 Find Drillhole VDH_s87N_07 in the list and open its context menu using the mouse



3 Choose **Edit** to open the **Drillhole Properties Dialog**

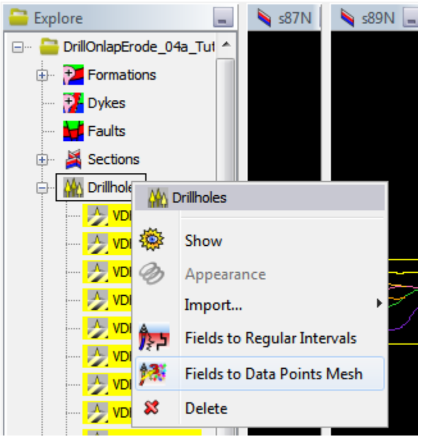


This dialog shows the drillhole log in the tree on the left hand side. The columns next to this highlight the drillhole log/geological model misfit and the assay field plot. As can be seen here there is now assay data in this drillhole.

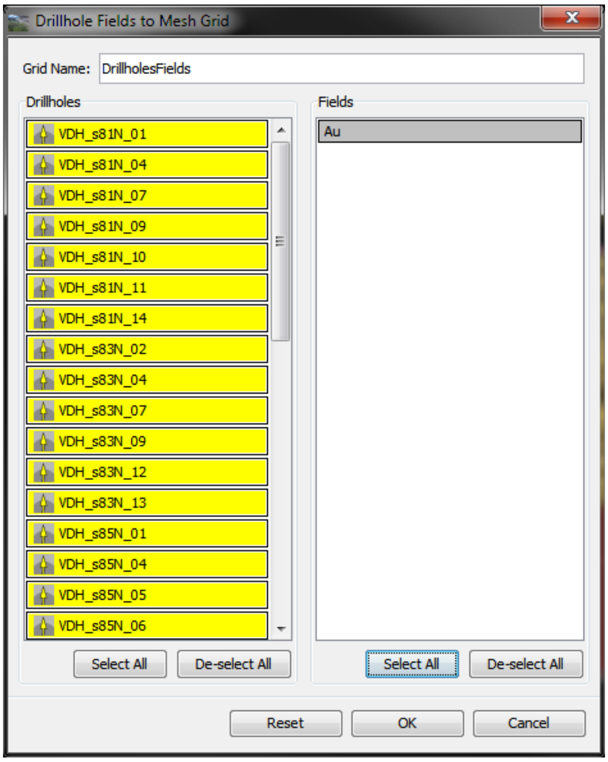
Tutorial B6: Assay Data to Observation MeshGrid

Once assay data has been imported into drillholes you will generally want to perform some sort of interpolation, analsysis or processing. To do this in GeoModeller v2012 you must first create an Observation MeshGrid from Drillhole fields.

1 Right click on the **Drillholes** entry in the project tree to bring up the context menu

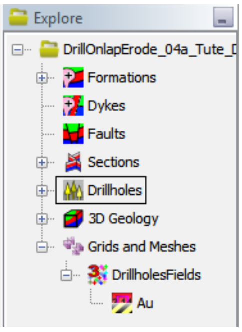


2 Select **Fields to Data Points Mesh** to bring up the filter dialog.



3 Choose **Select All** for both the drillholes (left side) and Fields (right side). Then choose **OK** to close the dialog and create the MeshGrid.

You should now see the MeshGrid in the Project tree.



This tutorial will not cover the vast number of tools available when working with MeshGrids. Instead a very simple "quick preview" interpolation of the assay data using Inverse Distance Interpolation will be shown.

NOTE: GeoModeller v2012 now supports both traditional Kriging and domain Kriging. Kriging can provide much better results than the Inverse Distance interpolation.

Tutorial B7—Inverse Distance Interpolation

Parent topic: **Tutorial B (Drillholes)**

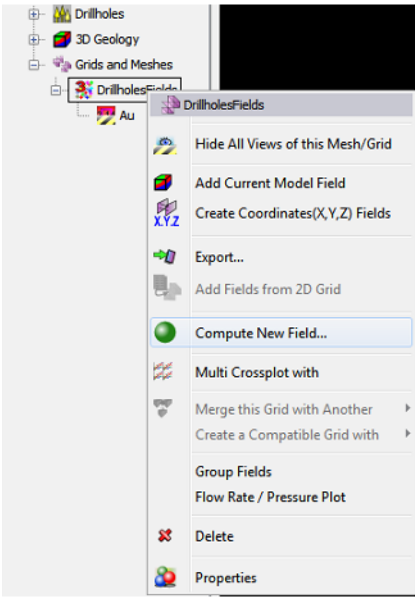
In this exercise you will:

- Compute a new MeshGrid field using the MeshGrid calculator.
- Interpolate data in a MeshGrid field using Inverse Distance Interpolation.
- Add your Geological model as a field to an existing MeshGrid.
- Use the calculator to threshold field data by unit.

It is common for Gold data to have a log-normal distribution. For interpolation it is desirable to normalise the distribution first. Therefore, the first step in this exercise is to use the MeshGrid calculator to take the LOG of the Gold field **Au**.

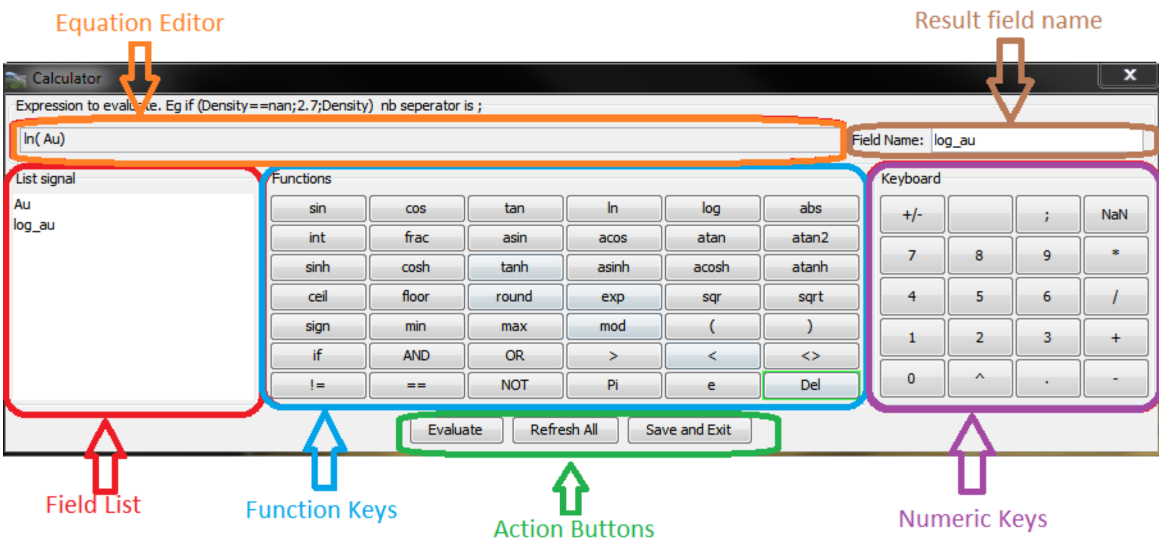
Compute the LOG of a MeshGrid field

1 Right click on the MeshGrid **DrillholeFields** and choose **Compute New Field** from the context menu.



2 In the calculator dialog:

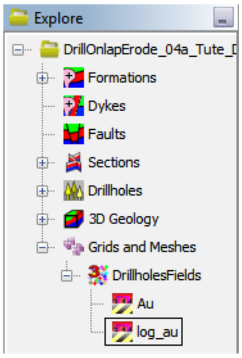
1. Choose **ln** (natural log) from the **Function Keys**
2. Choose **Au** from the **Field List**
3. Choose **")"** from the **Function Keys** to close the brackets.
4. Change the **Result Field Name** to "log_au" or something appropraite.
5. Choose **Evaluate** to evaluate the expression and create the new field.



6. Choose **Save and Exit** to save the results into the Projet tree.

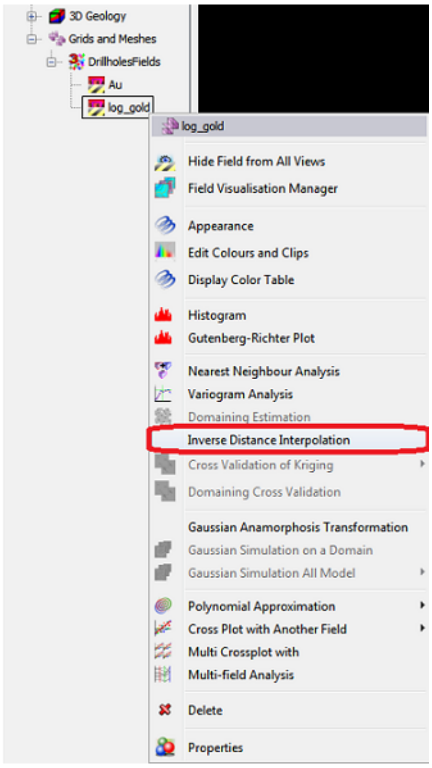
***Important**: You must always **Evaluate** the expression before choosing **Save and Exit.** Otherwise the result will not be saved in the Project Tree.*

You should now have two fields in the MeshGrid, as shown.

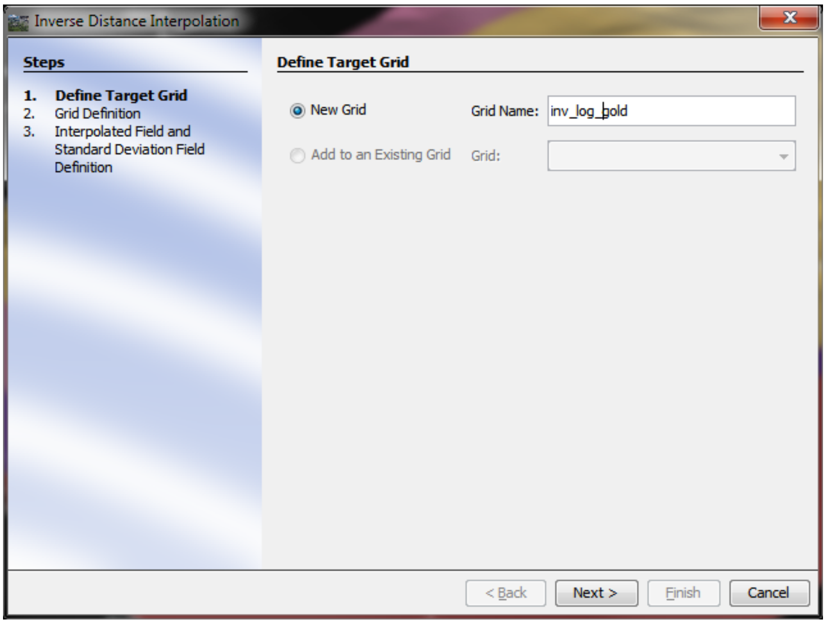


Inverse Distance Interpolation

1 Right click on the **log_au** field to open the MeshGrid field context menu. Choose **Inverse Distance Interpolation**.

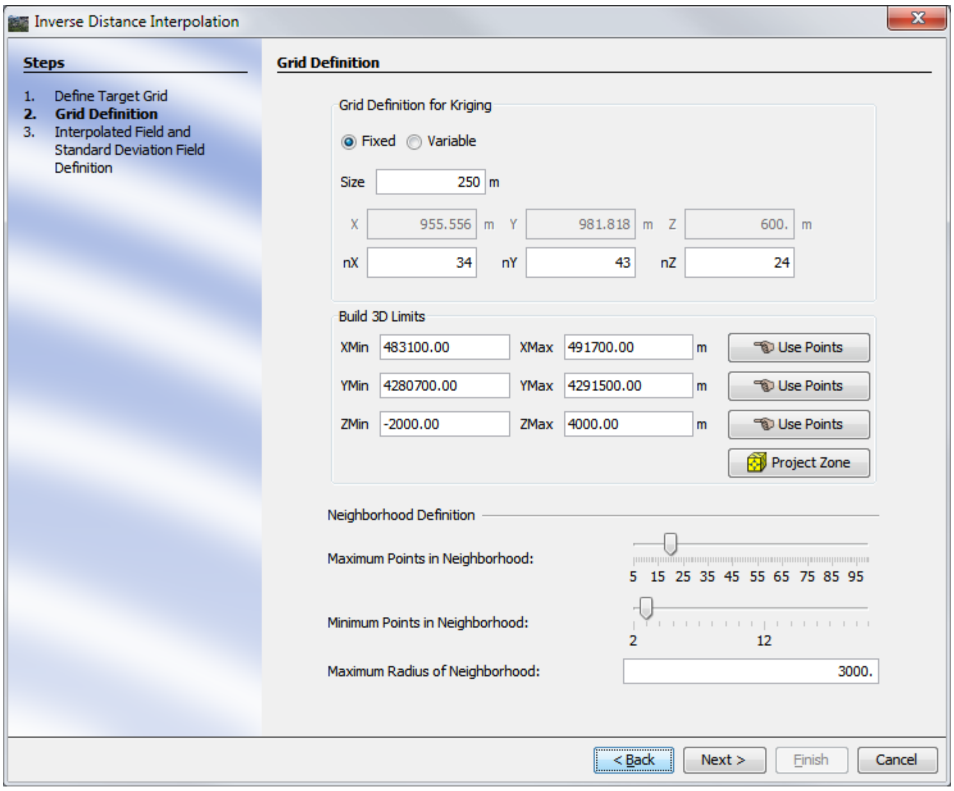


2 In the dialog choose **New Grid** and enter the name of the grid. Here it is shown as *inv_log_gold.*



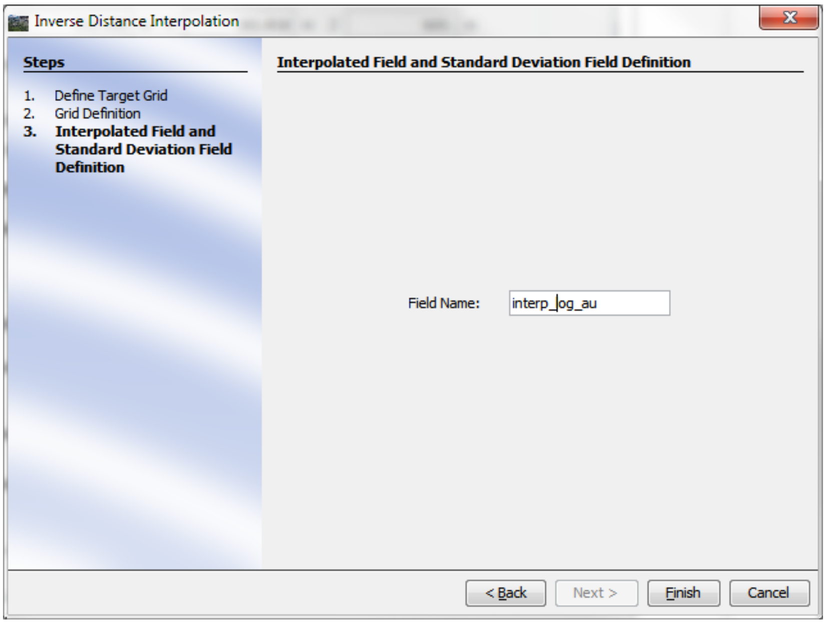
Choose **Next** to move to the next page of the wizard.

3 On the next page under Grid Definition choose **Fixed** and enter 250m cell spacing. Then specify the **Maximum Radius of Neighbourhood** as 3000 metres.



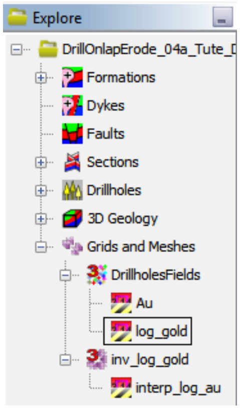
Choose **Next** to go to page 3 of the wizard.

4 Enter the name of the interpolation field. In this example it is called *interp_log_au*.



Choose **Finish** to perform the interpolation.

You should now have a new MeshGrid in your project called **inv_log_gold**, or whatever name you chose of page 1 of the wizard. This grid is a regular voxet with fixed cell size of 250m.



Remove linearisation of the interpolated field.

Recall that the interpolation was performed on the log of the gold assay data. Now you will need to remove the linearisation to revert back to a log-normal distribution.

1 Right click on the **inv_log_gold** and choose **Compute New Field.** This will open the calculator dialog box again.

2 In the calculator perform the following steps:

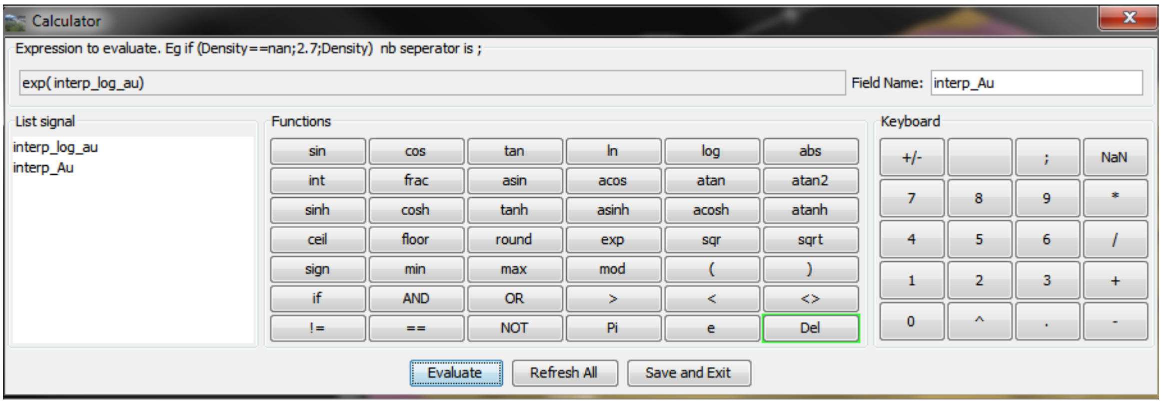
1 Choose **exp** from the **Function Keys**,

2 Choose **interp_log_au** from the **Field List**

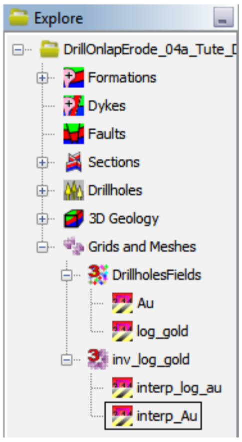
3 Choose **“)”** to close the brackets.

4 Enter the name for the new field. Here it is specified as **interp_Au**.

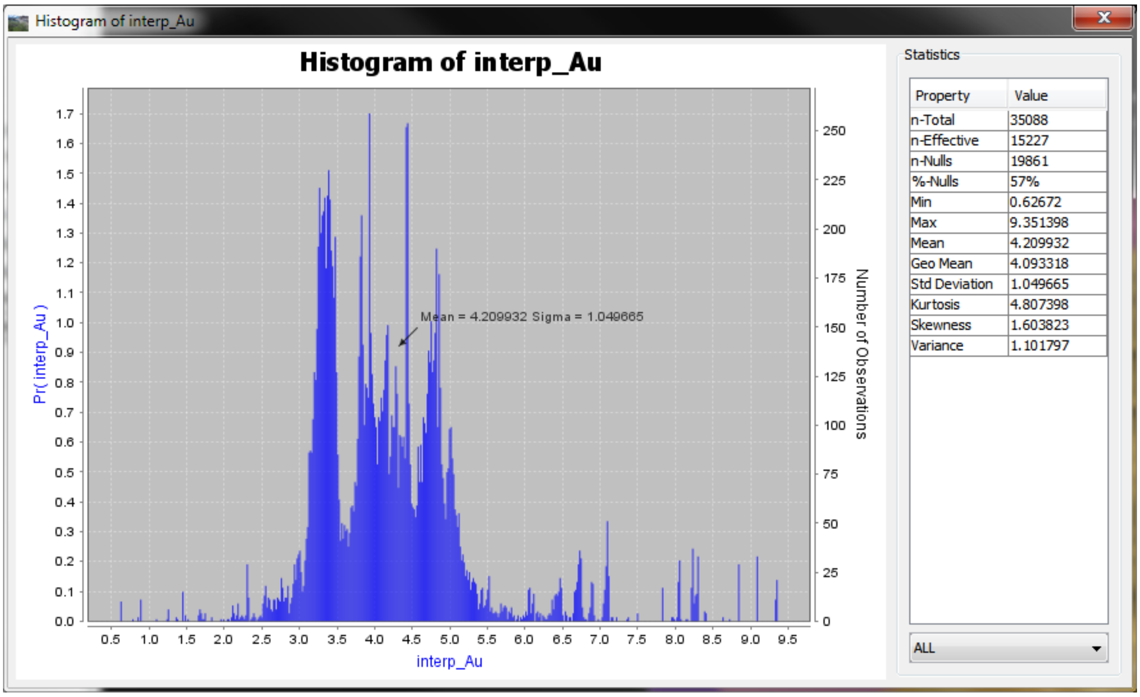
5 Choose **Evaluate** followed by **Save and Exit.**



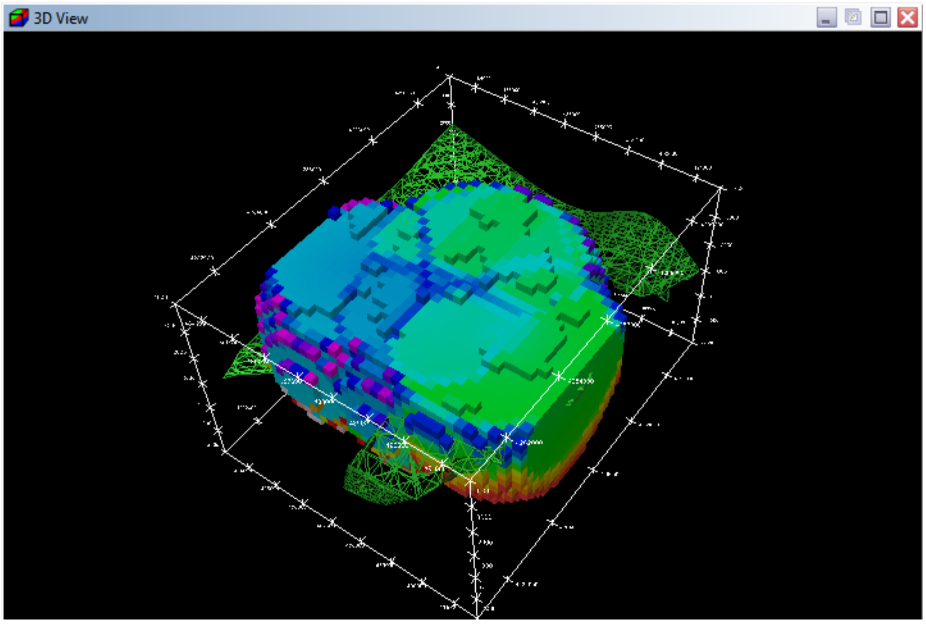
You should now have the new field **interp_Au** in your project MeshGrid **inv_log_gold**



3 Explore the field **interp_Au** by looking at the histogram and statistics. Right click on the field and choose **Histogram** from the context menu. This will bring up the histogram dialog which also contains summary statistics.



4 Now display the voxet in the 3D viewer. Right click on the **interp_Au** field and choose **Field Visualisation Manager** to show the visualisation dialog. For now just select **View Grid in 3D** as a **3D Volume**.



Because we know that the gold is all in the **f3** unit we have shown it here as a wireframe. You will notice immediately that the interpolation is not contrained to this unit. It is for this purpose that you would choose *Domain Kriging*.

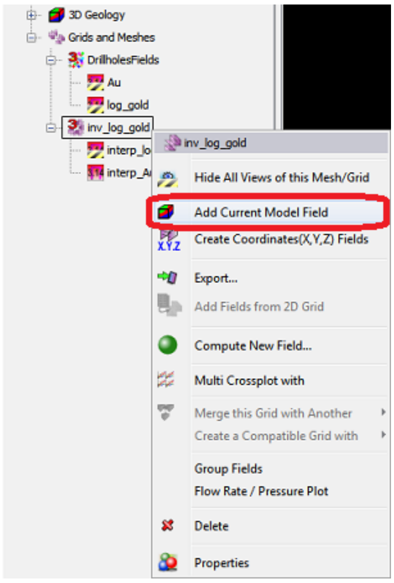
However, we can still visualise and perform processing on the inverse distance interpolated data which only falls within the unit **f3.** To do this two steps additional steps are required.

1 Add a model field to the MeshGrid
2 Threshold the **interp_Au** field to only those voxels within the **f3** unit using the model field.

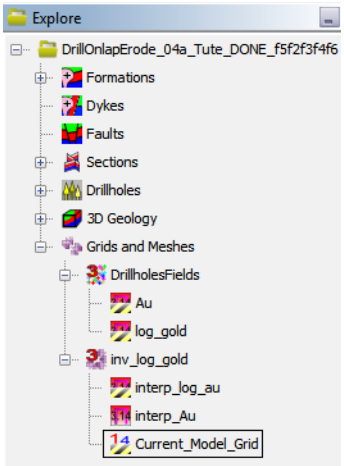
Adding a model field to a MeshGrid

Any MeshGrid can have a *model field* added to it. A model field is a lithology field that contains the units at each cell in a MeshGrid. For example, a voxet model field will the lithology unit number that each voxel is in, whereas, an observation MeshGrid will contain the unit number at each point of the mesh grid.

1 Right click on the **inv_log_gold** MeshGrid and from the context menu select **Add Current Model Field**.



You should then see in your Project Tree the new field **Current_Model_Grid**.



2 Right click on the **inv_log_gold** MeshGrid to open the context menu and choose **Compute New Field.**

3 In the Calculator Dialog, perform the following steps:

1 Choose **IF** from the Function Keys

2 Choose **Current_Model_Grid** from the Field List

3 Choose "**==**" from the Function Keys**,** followed by **"3"** from the Numeric Keys.

4 Choose **";"** from the Numeric Keys

5 Choose **interp_Au** from the Field List

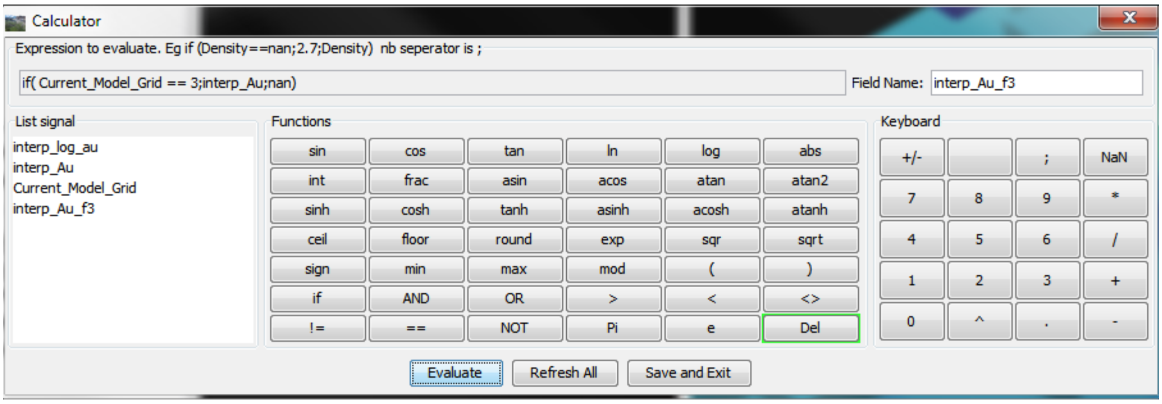
6 Choose **";"** from the Numeric Keys

7 Choose **NaN** from the Numeric Keys

8 Chosoe **")"** from the Function Keys.

9 Enter the result field name as **interp_Au_f3**

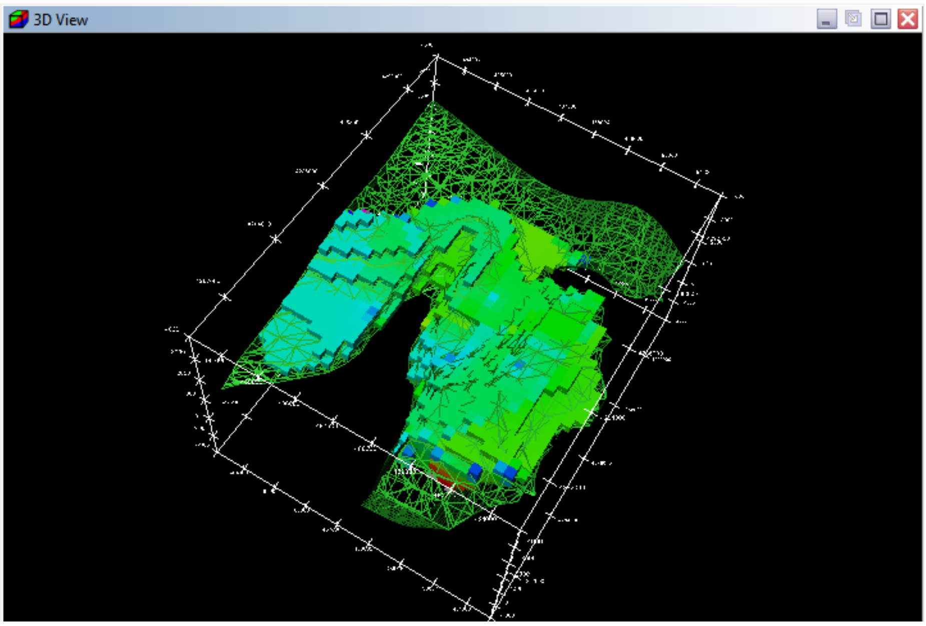
10 Choose **Evaluate** followed by **Save and Exit.**



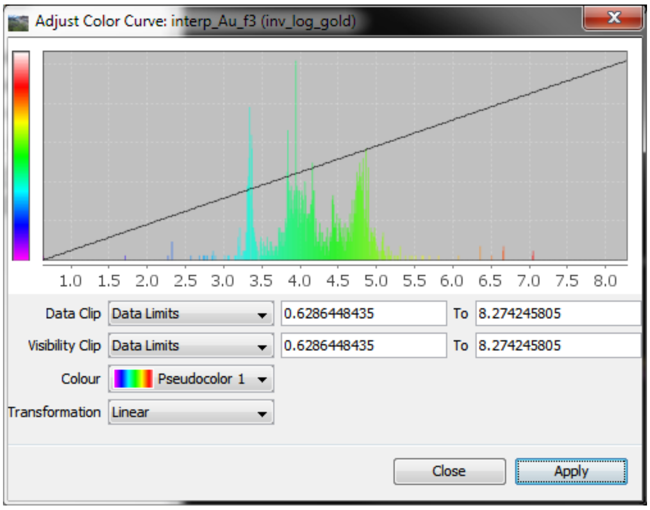
The expression should look like the one above. It simply says:

***IF** voxel lithology is* f3 ***THEN** output* interp_Au ***ELSE** output null.*

4 Visualise the new field using the Field Visualisation Manager, via the context menu of the **interp_Au_f3** field. In the dialog choose **View Grid in 3D** and **3D Volume**.



The visualisation now shows interpolated gold data within the lithology unit of interest. You can view the colour map via the context menu for the field **interp_Au_f3**. Choose **Edit Colours and Clips**.



Estimate the volume of gold within the f3 unit.

1 To get an estimate of the volume with the f3 unit you can use the MeshGrid Calculator again. Open the calculator from the context menu of **inv_log_gold**.

2 Create the expression: ***IF(interp_Au_f3 <> NaN;Current_Model_Grid;NaN)*** using the keys and field list.

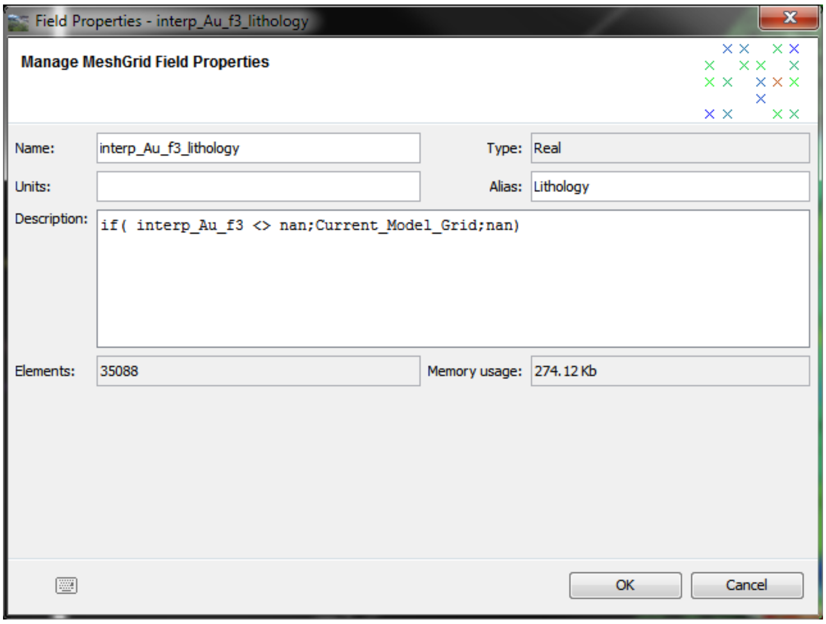
3 Enter the name of the new field as **interp_Au_f3_lithology**.

4 Choose **Evaluate** followed by **Save and Exit**.

Check that the field was created in the project tree.

5 Right click on the new field **interp_Au_f3_lithology** and choose **Properties**. This will open the properties dialog.

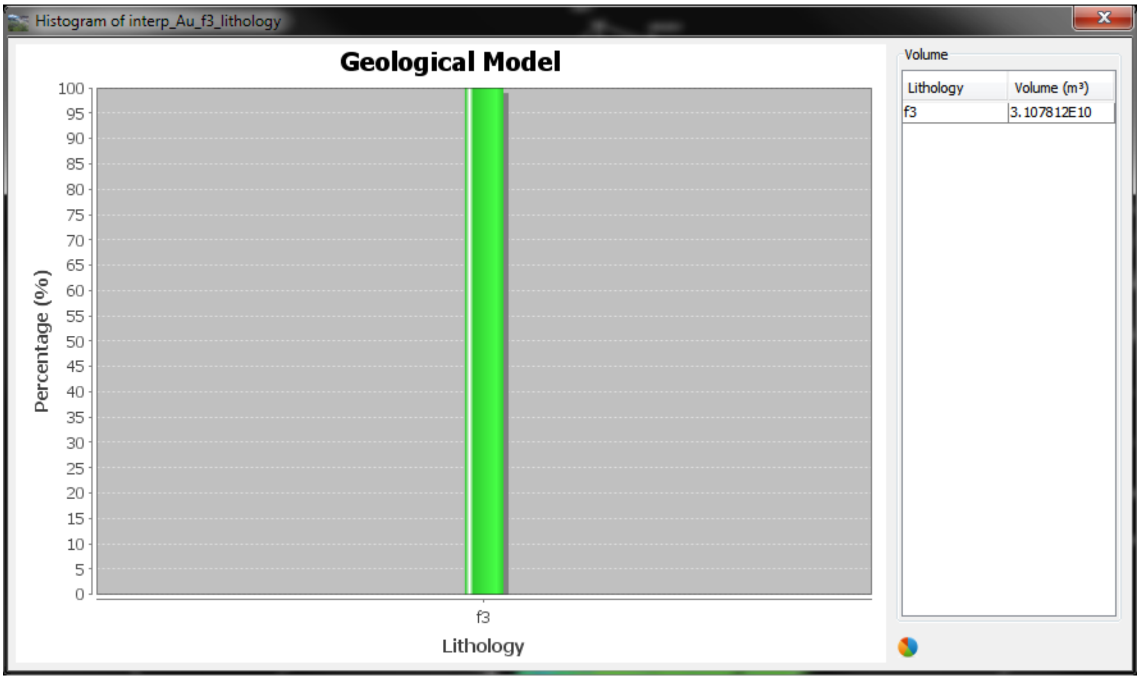
6 In the dialog change the **Alias** from *none* to *Lithology*.



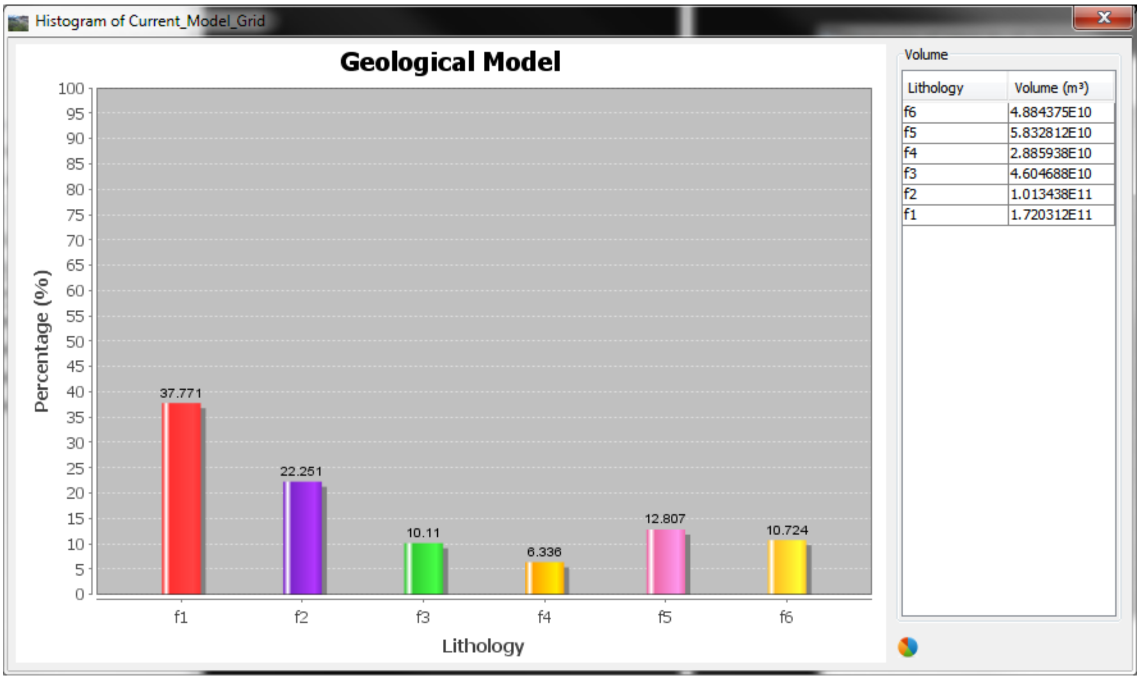
Choose **OK**. GeoModeller will now recognise this field as a lithology field.

7 Open the context menu for the field **interp_Au_f3_lithology** and choose Histogram. This will display the histogram together with the volume of voxels

which contain gold (interpolated) for the unit f3.



Compare this number with the value from the **Current_Model_Grid** field.



The volume of unit f3 is 4.604688E10 $m^{3.}$

The volume of unit f3 which contains (interpolated) gold is 3.107812E10 $m^{3.}$

This does not show an estimate of the grade of the gold in the f3 unit, just the cells which contain gold.

