Stratigraphic Modeling Tools in MineSight Part 2

In part one of this series we looked at the basics of stratigraphic modeling, how it can be applied to mining, and how to build a MineSight stratigraphic project. In part two we will look at some of the common tools that MineSight offers for use specifically in coal mining.

MAIN TYPES OF COAL DEPOSITS

Coal deposits fall into two main types: Simple sub-horizontal deposits with minimal reverse faulting or folding (Figure 1); and complex deposits, often featuring overturns and reverse faulted seams (Figure 2).

Figure 1. Simple sub-horizontal stratigraphy.

Figure 2. Complex overturned stratigraphy.

In North America these could be described as Prairie and Rocky Mountain deposits respectively. A stratigraphic model is best suited to a sub-horizontal type deposit. For a complex coal deposit it is usually best to build a multiple ore per cent 3D block model

COMPOSITING

Assuming that we have a sub-horizontal type deposit, the starting point is to build a stratigraphic PCF (project control file) and stratigraphic model file 15 (see Part 1 in April's newsletter for more information). The next step is to composite the drilling data. Two options are available.

You can use the standard **Bench Compositing** procedure, p50101.dat, using a very long composite length and breaking the composites up by geology (seam) code.

Bench Compositing	p50101.dat	Calculation

The great thing about Bench Compositing is that it can add missing seams to your composites.

Or use the **Seam Compositing** procedure, p50102.dat. This builds a composite from the first interval of a seam in an assay file to the last. You won't want to use this if you have an overturned fold or reverse faulted seam.

Seam Compositing	p50102.dat	Calculation

To use the stacking method described below, you will need to know the interburden thickness between seams. This can be calculated using procedure **Calc Interburden in M501SM Composites**, cmpint.dat.

Calc Interburden in M501SM Composites	cmpint.dat	Calculation

SEAM BUILDING METHODS

We now have to decide on the seam building methodology to use. Two main methods are used for building coal stratigraphic models. Which to use generally depends on the amount of drilling information you have and the type of deposit:

1. Building a stratigraphic model from surfaces, and;
2. Building a stratigraphic model using stacking.

Building a Stratigraphic Model from Surfaces

To build the model from surfaces, use procedure **Grid DHs Using DTM/Gradient,** pdhgrd.dat.

Grid DHs using DTM/Gradient	pdhgrd.dat	Data Convert

This procedure builds complex surfaces directly from drillhole or composite intervals and/or ASCII control points by several different methods:

- Triangulate
- Gradient
- Inverse Distance Weighting
- Kriging

All four methods produce different results. Which to use depends on the data density and required result. It is a good idea to run a few examples to see which fits best before committing to a choice and setting up a MultiRun. One of the really useful options in pdhgrd.dat is the ability to enhance your surface with control points. You can digitize points in MineSight 3D and export them to a 3D points ASCII file. If you have missing data, (perhaps a river or road prevented you from drilling the area), you can digitize in some control points to guide the surface.

Two common workflows when building models from surfaces are to:

- Build top and bottom surfaces and calculate the thickness;
- Build the bottom surfaces and interpolate the thickness, then calculate the top surface.

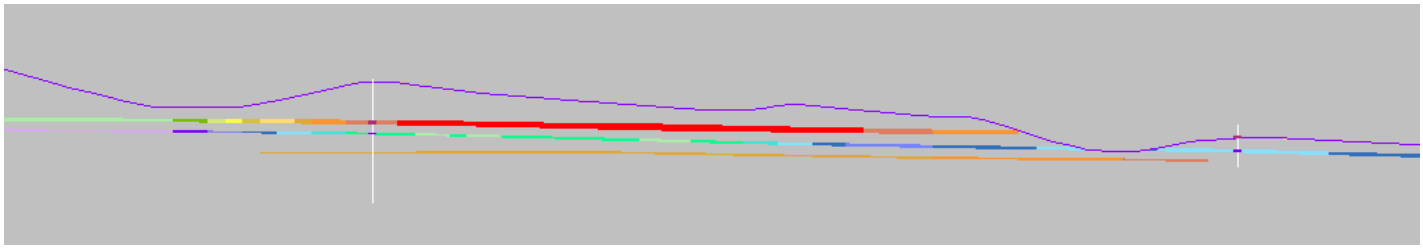

Figure 3: Sectional View of a Gridded Seam Model, Drillholes and Topographic surface.

If you have variable seam dips then it is best to calculate the true thickness using first procedure **Calculate Grid Slopes in GSM**, grdslp.dat, to calculate the slope of a surface back to the composites; then procedure **Calculate True Thickness**, cmptru.dat, to calculate the true thickness; and finally procedure **User-Calcs (Model)**, p61201.dat, to back calculate an accurate vertical thickness.

Calculate Grid Slopes in GSM	grdslp.dat	Calculation
Calculate True Thickness	cmptru.dat	Calculation
User-Calcs (Model)	p61201.dat	Calculation

Building a Stratigraphic Model using Stacking

Stacking is done by building a key or marker surface using an appropriate method. This could be:

- Manually, which gives maximum control but can be time consuming, or;
- Automatically using procedure pdhgrd.dat

Once you have a starting surface you can use an interpolation method, such as inverse distance weighting, to interpolate the seam and interburden thicknesses into the model file. The procedure **Stack GSM Thicknesses**, gsmstk.dat, can then be used to build the seams from the key surface.

Stack GSM Thicknesses	gsmstk.dat	Calculation

Whichever way you build your seam top and bottom surfaces, you should now have a series of seams with a ZTOP, ZBOT and THICK value.

Rationalize

The next stage after building your surfaces is to ensure that there are no overlaps in the seams. This can happen with sparse data, especially when building the model from surfaces. The procedure to use for this is **Rationalize GSM**, gsmrat.dat. This can also be used to clip seams to topography.

Rationalize GSM	gsmrat.dat	Calculation

Interpolate

The next steps are similar to a normal 3D block model, where you interpolate grades and qualities into the blocks using inverse distance weighting or kriging methods. Because interpolation is done within the seam there is no need to use any unfolding methodology as the samples already live in a pseudo-unfolded space.

MultiRun It

A really useful option for stratigraphic modeling is that all of the procedures mentioned in this article can (and probably, should) be run from a MineSight Compass MultiRun package (Figure 4).

MultiRuns provide:

- An auditable workflow.
- The ability to run a single procedure multiple times.
- The ability to run a workflow over and over when you get new data.

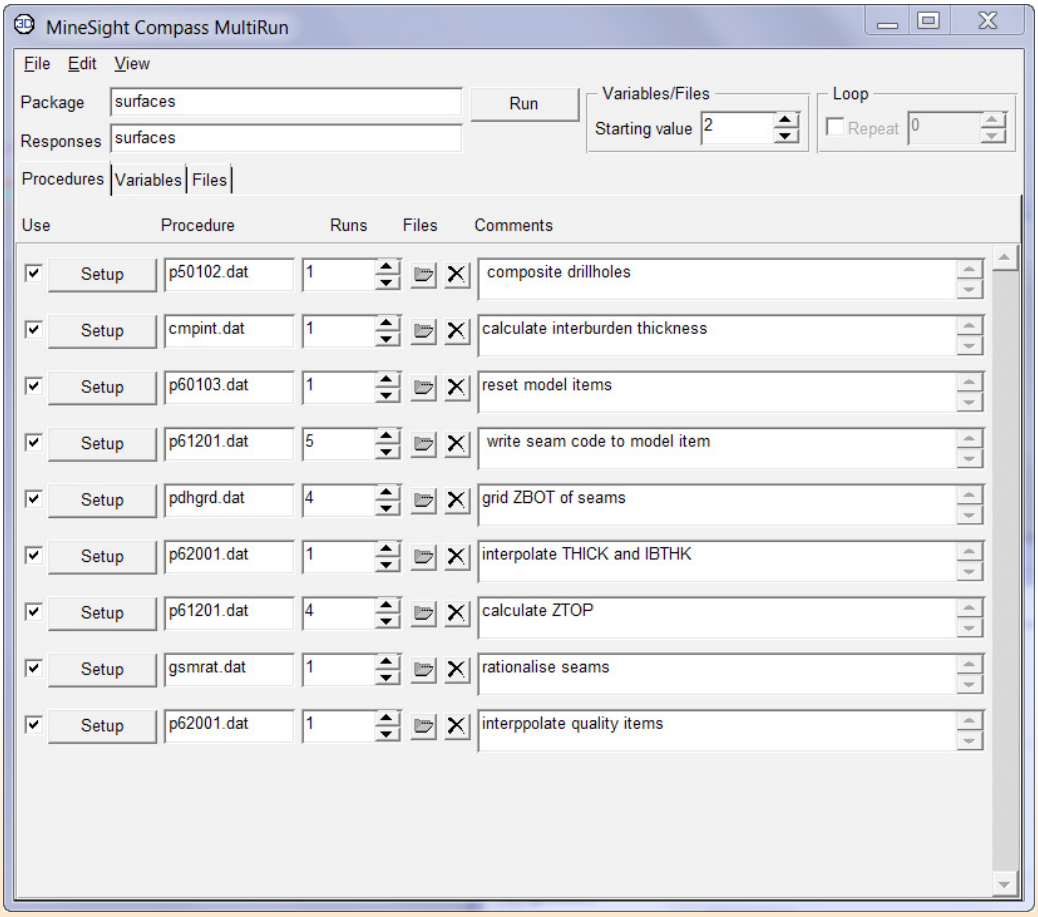

Figure 4. A MultiRun package setup for stratigraphic modeling.

This is a brief overview of some of the tools used for coal seam modeling. As you can see, these tools can be applied outside of coal mining. For example, they can be used to model chemical seams, such as bauxite or nickel laterites. Or, as we will see in the final instalment of this series, they can be used for applications that have no relevance to seam mining at all.