

## Demonstration Video

### Surfer 9 - Part 3

### Gridding Data

#### PART 3

1. Introduction
2. Where to Get Grids
3. Gridding Data in Surfer

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1. Welcome to Golden Software's demonstration video for Surfer 9 – Part 3. In this demonstration I'll be covering the topic of gridding XYZ data to produce a grid file.
  2. Grid files are necessary to create seven of the ten map types in Surfer. You can download grid files from the internet (such as USGS DEM files or SRTM data), you can produce grid files in other software (such as ESRI products), or you can create grid files directly in Surfer using an XYZ data file. To grid the data in Surfer, the data file must be organized so that the X, Y and Z data are in three separate columns, and it must be saved in a supported data file format such as a text file, a CSV file, a database file, or Excel spreadsheet.
  3. To create a grid file, go to **Grid | Data**, select the data file and click *Open*. The **Grid Data** dialog box will open. In most cases, the default gridding parameters are suitable. However, you can fully customize your grid.
    - a. In the *Data Columns* section, you can specify which columns in your data file are the X, Y and Z columns.
    - b. If you have duplicate data or wish to apply a data exclusion filter, click the *Filter Data* button. Here you can tell Surfer what to do with duplicate data. For example, you can tell Surfer to keep the first data point and discard the other duplicate data points, or you can choose to average the duplicate data points. You can also specify the tolerance for what Surfer would consider a duplicate data point. You can also enter the data exclusion filter. For example, you can choose to exclude all data points in the data file with a Z value of -999. Click *OK* when you are done.
    - c. If you don't remember which columns contain the XYZ data, or need to refresh your memory on the data, click the *View Data* button to view the data. Close the **View Data** window by clicking on the red X in the upper right corner of the window.
    - d. If you wish to create a statistics report about your data, click the *Statistics* button and a **Data Statistics Report** will be generated. Close the report by clicking on the red X in the upper right corner.
    - e. If the *Grid Report* check box is checked, Surfer will generate a report after gridding is completed with information about your data and the grid file created.
    - f. Surfer offers you a choice of twelve gridding methods. What you choose for the *Gridding Method* will depend greatly on your data and what you would like the output to look like. There is no one best gridding method to use for all data sets or for any particular type of industry. However, there are some instances where some gridding methods may be more suitable than others.

The default gridding method, *Kriging* with a linear variogram, was selected as a good method as it produces a good looking map for the majority of data sets. However, it is not an exact interpolator and can extrapolate grid values beyond your data's original Z range. For example, if your data goes from 0-100, the Z range of your grid file may be -5 to 105.

If you wish to use a more exact interpolator that does not extrapolate Z values beyond the range of data, you can try the *Inverse Distance to a Power*, *Natural Neighbor*, *Nearest Neighbor*, or *Triangulation with Linear Interpolation* gridding methods.

If you like the look of the map produced with the *Kriging* gridding method, but wish to include a fault file, then *Minimum Curvature* might be the best option for you.

If your data is already on a regularly spaced grid, you might want to try the *Nearest Neighbor* gridding method, setting the grid spacing to be the same as the spacing of your data points.

There are many reasons why you might choose one gridding method over another. Each map will look slightly different with each gridding method, and it is really up to the personal preference of the user.

For this demonstration, I will choose *Inverse Distance to a Power*.

- g. Once you have selected a gridding method, you can access additional options for the gridding method chosen by clicking the *Advanced Options* button. The options available under *Advanced Options* will change depending on the gridding method chosen. Some of the more common options include:
  - i. A **General** page that has gridding method-specific options, and in some cases an *Anisotropy* section, which allows you to specify the ratio and angle for a preferred orientation in the data.
  - ii. The **Search** page controls which data points are considered by the gridding operation when interpolating grid nodes. If you have fewer than 250 data points, usually the *No Search* option is the most appropriate and the gridding algorithm uses all the data to calculate the grid node Z values. If you have between 250 to 750 data points, then the default is to use a search, but you still have the option to specify *No Search* if you want. If you have more than 750 data points, you must use a search.

The search rules define the number of data points to include when interpolating a grid node Z value. The search ellipse defines the shape and size of the searchable area around each grid node to use to calculate that grid node's Z value. Data points that fall outside the search ellipse for a grid node are not considered when calculating that grid node's Z value. If no data points fall within the search ellipse, then that grid node is blanked.

- iii. The **Breaklines** or **Breaklines and Faults page** allows you to include a breakline or fault file when gridding data. The breakline and fault lines must be saved in BLN format to use during gridding. Some gridding methods support breaklines, some support breaklines and faults, and some do not support either of them.

To help understand the difference between them, breaklines occur when there are changes in slope on either side of the line. This might be at the top of a ridge or at the bottom of a river bed. Breaklines have X, Y, and Z values for each vertex in the line in the BLN file. This is the only time when Z information is used

in a BLN file. Surfer can look across the breakline to the other side for data points to use when calculating grid nodes. The XYZ points of the breakline BLN file are also included as data points during gridding.

Faults, on the other hand, occur when there are differences in Z values on either side of the line. This could be because of a geologic fault or another reason, such as a landslide. Faults only have X and Y values in the BLN file. When gridding, Surfer sees the fault as a stop. It cannot look across the fault to the other side for data. It can go around the fault, but the distance will increase and the data on the other side of the fault will have less of an effect on the grid node values.

To select a breakline or fault file, simply click the yellow open folder icon, select the BLN file and click *Open*.

Adjust any of the advanced options you wish and click *OK*.

- h. Click the *Cross Validate* button to perform cross validation on your data. Generally, cross validation can be considered an objective method of assessing the quality of a gridding method, or to compare the relative quality of two or more candidate gridding methods. In Surfer, cross validation can be used with all gridding methods. You can save the results file by specifying the file name and location in the *Cross Validation Results File* section. For details and more information on the cross validation parameters, please click the Help button to open the **Cross Validation** Help page.
- i. The *Output Grid File* section allows you to specify the output grid file name and file path. By default, Surfer will create a Surfer grid file. However, you can click the yellow open folder icon, browse to any file location, type in the file name, and choose any of the supported grid formats to save in.
- j. The *Grid Line Geometry* section allows you to specify the extents and resolution of the grid file. You can choose to set a particular X and Y minimum and maximum value for the grid file, which is useful if you are trying to match the extents to another grid file or if you want the grid to be exactly a particular size. You can also choose the grid line spacing, which determines the number of grid lines. The smaller the grid spacing, the more grid lines you can have in your grid file. By default, Surfer sets 100 grid lines in the longest direction, the spacing values between directions to be equal, and then calculates the number of grid lines in the shorter direction. You can increase this number up to 32767 grid lines, but the more grid lines you have, the more memory it takes to create the grid file.
- k. When you are finished setting your parameters, click *OK* to create the grid file.
- l. You will be notified when the grid file is created and, if specified, the grid report will open. The grid can now be used to create maps, calculate volumes and areas, or perform other grid functions.

This concludes my demonstration of gridding data in Surfer.