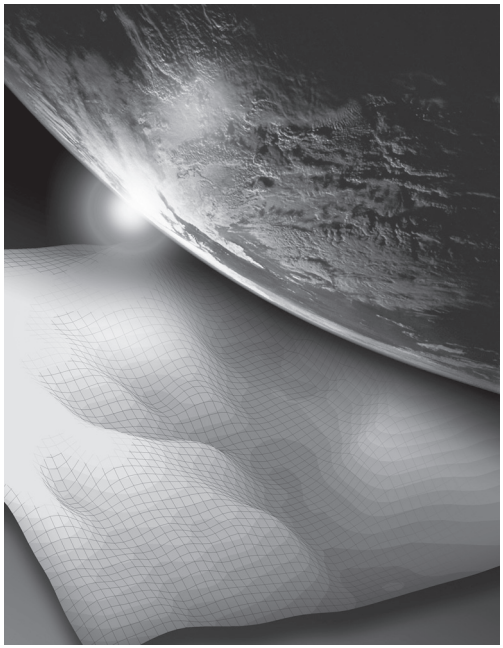
Surfer® Getting Started Guide

Contouring and 3D
Surface Mapping for
Scientists and
Engineers



Golden Software, Inc.
809 14th Street, Golden, Colorado 80401-1866, U.S.A.
Phone: 303-279-1021 Fax: 303-279-0909
www.goldensoftware.com

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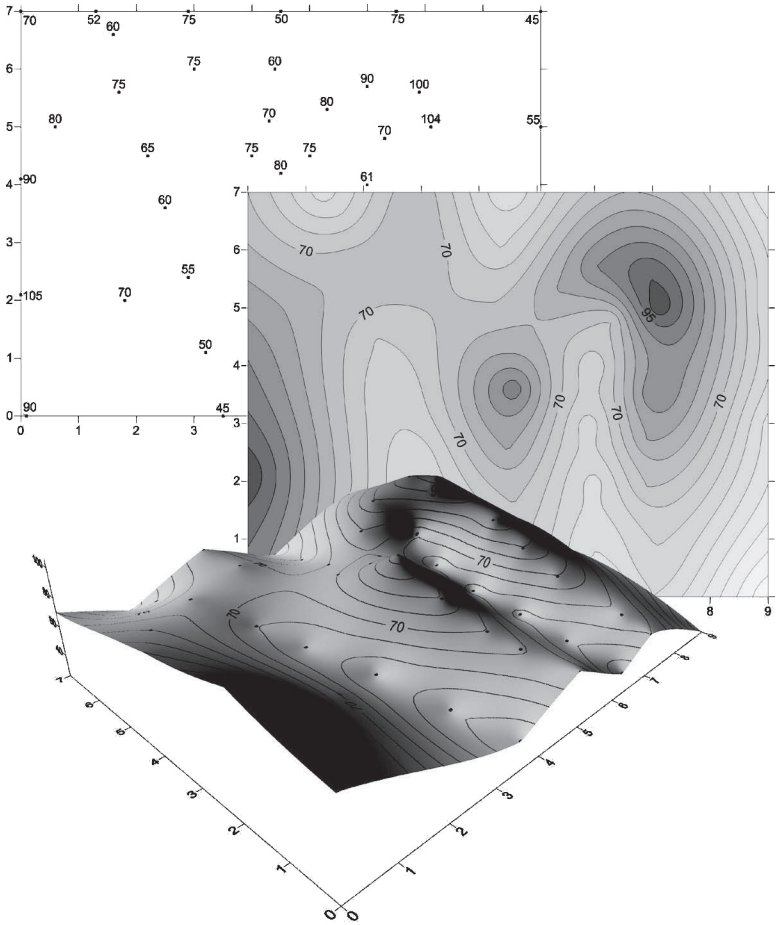
Table of Contents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105
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90
45
70
95
0
1
2
3
4
5
6
7
8
9

Introduction to Surfer

Welcome to **Surfer**, a powerful contouring, gridding, and surface mapping program for scientists, engineers, educators, or anyone who needs to generate maps quickly and easily.

Surfer is a grid-based mapping program that interpolates irregularly spaced XYZ data into a regularly spaced grid. Grids may also be imported from other sources, such as the United States Geological Survey (USGS). The grid is used to produce different types of maps including contour, vector, image, shaded relief, 3D surface, and 3D wireframe maps. Maps can be displayed and enhanced in **Surfer**, allowing you to produce the map that best represents your data. Adding multiple map layers, customizing the map display, and annotating maps with text allows you to create publication quality maps.

An extensive suite of gridding methods is available in **Surfer**. The variety of available methods provides different interpretations of your data and allows you to choose the most appropriate method for your needs. In addition, data metrics allow you to gather information about your gridded data. Surface area, projected planar area, and volumetric calculations can be performed quickly in **Surfer**. Cross sectional profiles can also be computed and exported.

The grid files themselves can be edited, combined, filtered, sliced, queried, and mathematically transformed. For example, create an isopach map from two grid files. An isopach map shows the difference between two surfaces. You will need the original surface grid file and the surface grid file after a volume of material was removed. Subtract the two surfaces to create an isopach map. The resulting map displays how much material has been removed in all areas.

The **Scripter**™ program, included with **Surfer**, is useful in creating, editing, and running script files that automate **Surfer** procedures. By writing and running script files, simple mundane tasks or complex system integration tasks can be performed precisely and repetitively without direct interaction. **Surfer** also supports ActiveX Automation using any compatible client, such as Visual BASIC. These two automation capabilities allow **Surfer** to be used as a data visualization and map generation post-processor for any scientific modeling system.

New Features of **Surfer 9** are summarized

- Online at: www.goldensoftware.com/products/surfer/surfernew.shtml
- In the program help file: **Help | Contents**

Who Uses Surfer?

People from many different disciplines use **Surfer**. Since 1984, over 100,000 scientists and engineers worldwide have discovered **Surfer's** power and simplicity. **Surfer's** outstanding gridding and contouring capabilities have made **Surfer** the software of choice for working with XYZ data. Over the years, **Surfer** users have included hydrologists, engineers, geologists, archeologists, oceanographers, biologists, foresters, geophysicists, medical researchers, climatologists, educators, students, and more! Anyone wanting to visualize their XYZ data with striking clarity and accuracy will benefit from **Surfer's** powerful features!

System Requirements

The minimum system requirements for **Surfer** are:

- Windows 2000, XP, Vista, or higher
- 512MB RAM minimum for simple data sets, 1GB RAM recommended
- At least 100 MB free hard disk space
- 1024 x 768 or higher monitor resolution with a minimum 16-bit color depth

Installation Directions

Installing **Surfer 9** requires logging onto the computer with an account that has Administrator rights. Golden Software does not recommend installing **Surfer 9** over any previous versions of **Surfer** (i.e. do not install version 9.01 over version 9.00). Please ensure that you install **Surfer 9** into a new directory, which is the default. **Surfer 9** can co-exist with older versions (i.e. **Surfer 8**) as long as they are in different directories.

To install **Surfer** from a CD:

1. Insert the **Surfer** CD into the CD-ROM drive. The install program automatically begins on most computers. If the installation does not begin automatically, double-click on the AUTORUN.EXE file located on the **Surfer** CD.
2. Choose *Install **Surfer*** from the **Surfer Auto Setup** dialog to begin the installation.

To install **Surfer** from a download:

1. Download **Surfer** according to the directions you received.
2. Double-click on the downloaded file to begin the installation process.

Updating Surfer

To update **Surfer**, open the program and select the **Help | Check for Update** command. This will launch the Internet Update program which will check Golden Software's servers for any updates. If there is an update for your version of **Surfer** (i.e. **Surfer 9.0** to **Surfer 9.01**), you will be prompted to download the update.

Uninstalling Surfer

Windows 2000 and XP: To uninstall **Surfer**, go to the Control Panel and double-click on Add/Remove Programs. Select "**Surfer 9**" from the list of installed applications. Click the *Remove* button to uninstall **Surfer**.

Vista: To uninstall **Surfer** when using the *Regular Control Panel Home*, click the *Uninstall a program* link. Select "**Surfer 9**" from the list of installed applications. Click the *Uninstall* button to uninstall **Surfer 9**.

Vista: To uninstall **Surfer** when using the *Classic View*, go to the Control Panel and double-click on Programs and Features. Select "**Surfer 9**" from the list of installed applications. Click the *Uninstall* button to uninstall **Surfer 9**.

A Note about the Documentation

The **Surfer** documentation includes this getting started guide and the online help. Use the **Help | Contents** command in the program to access the detailed online help. Information about each command and feature of **Surfer** is included in the online help. In the event the information you need cannot be located in the online help, other sources of **Surfer** help include our support forum, FAQs, knowledge base, and contacting our technical support engineers.

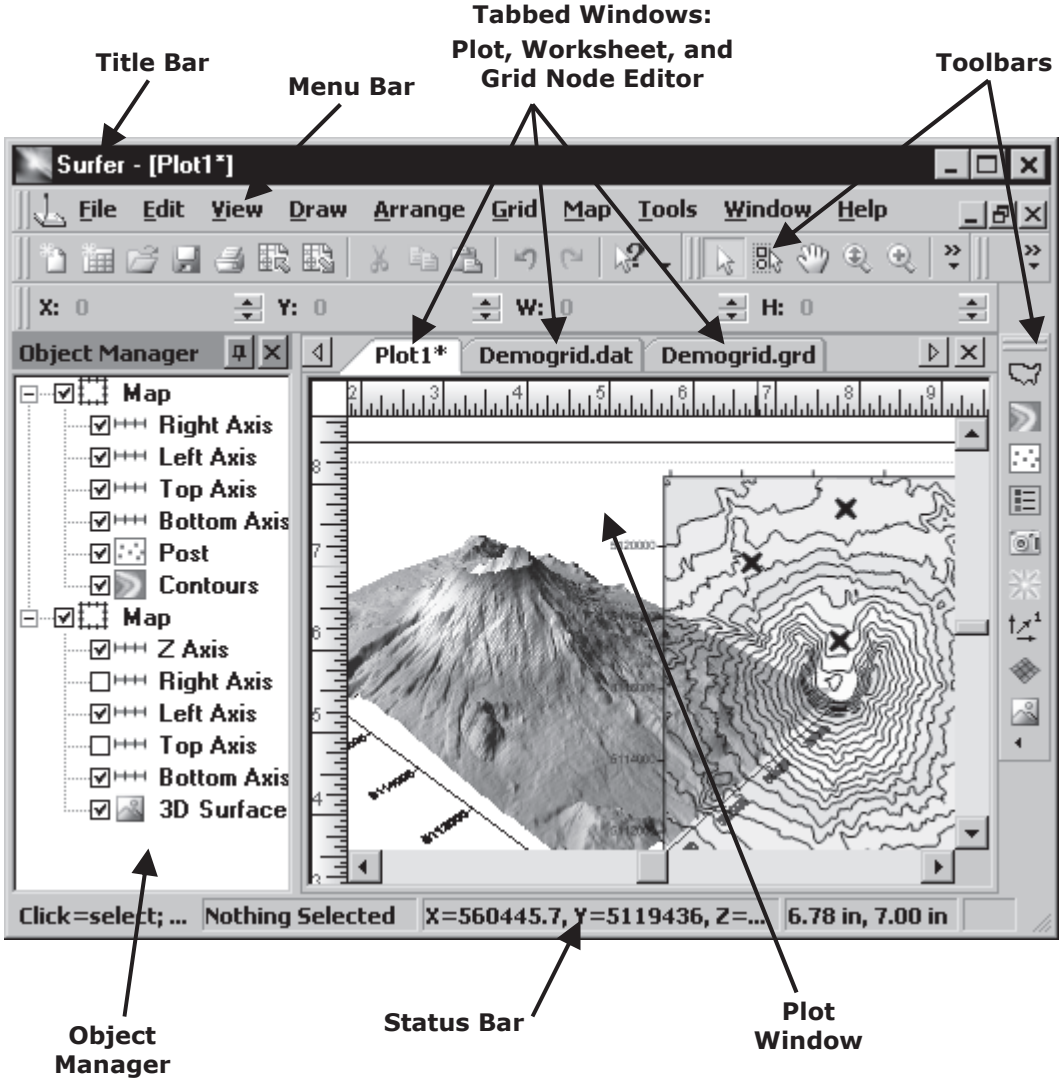
If you prefer printed documentation, you may print the online help in part or in full. See the *Printing the Online Help* section for more information.

Various font styles are used throughout the **Surfer** documentation. **Bold** text indicates menu commands, dialog names, window names, and page names. *Italic* text indicates items within a dialog such as group box names, options, and field names. For example, the **Save As** dialog contains a *Save as type* drop-down list. Bold and italic text occasionally may be used for emphasis.

In addition, menu commands appear as **File | Open**. This means, "click on the **File** menu at the top of the **Surfer** window, then click on the **Open** command within the **File** menu list." The first word is always the menu name, followed by the commands within the menu list.

Surfer User Interface

Surfer contains three document window types: the plot window, worksheet window, and grid node editor window. Maps are displayed and created in the plot window. The worksheet window displays, edits, transforms, and saves data in a tabular format. The grid node editor window displays and edits Z values for the selected grid. The **Surfer** user interface layout consists of the title bar, menu bar, tabbed windows, toolbars, object manager, and status bar.



*This is the **Surfer** window with the **Object Manager** on the left and the plot window and worksheet window tabbed on the right.*

The following table summarizes the function of each component of the **Surfer** layout.

Component Name	Component Function
Title Bar	The title bar lists the program name plus the saved **Surfer** [.SRF] file name (if any). An asterisk after the file name indicates the file has been modified.
Menu Bar	The menu bar contains the commands used to run **Surfer**.
Tabbed Windows	**Surfer 9** supports tabbed windows. Multiple plot windows, worksheet windows, and grid node editor windows can be tabbed.
Toolbars	The toolbars contain **Surfer** tool buttons, which are shortcuts to menu commands. Move the cursor over each button to display a tool tip describing the command. Toolbars can be customized with the **Tools | Customize** command. Toolbars can be docked or floating.
Status Bar	The status bar displays information about the current command or activity in **Surfer**. The status bar is divided into five sections. The sections display basic plot commands and descriptions, the name of the selected object, the cursor map coordinates, the cursor page coordinates, and the dimensions of the selected object. The status bar also indicates the progress of a procedure, such as gridding. The percent of completion and time remaining will be displayed.
Object Manager	The **Object Manager** contains a hierarchical list of all the objects in a **Surfer** plot document displayed in a tree view. The objects can be selected, added, arranged, and edited. Changes made in the **Object Manager** are reflected in the plot document, and vice versa. The **Object Manager** is initially docked at the left side of the window, giving the window a split appearance; however, it can be dragged and placed anywhere on the screen.

Changing the Layout

The windows, toolbars, and menu bar display in a docked view by default; however, they can also be displayed as floating windows. The visibility, size, and position of each item may also be changed. Refer to the *Changing the Layout* topic in the online help for more information on layout options.

Three-Minute Tour

We have included several example files so that you can quickly see some of **Surfer's** capabilities. Only a few example files are discussed here, and these examples do not include all of **Surfer's** many map types and features. The **Object Manager** is a good source of information as to what is included in each file.

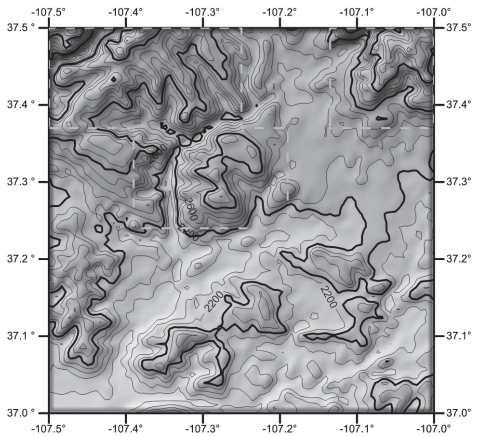
Example Surfer Files

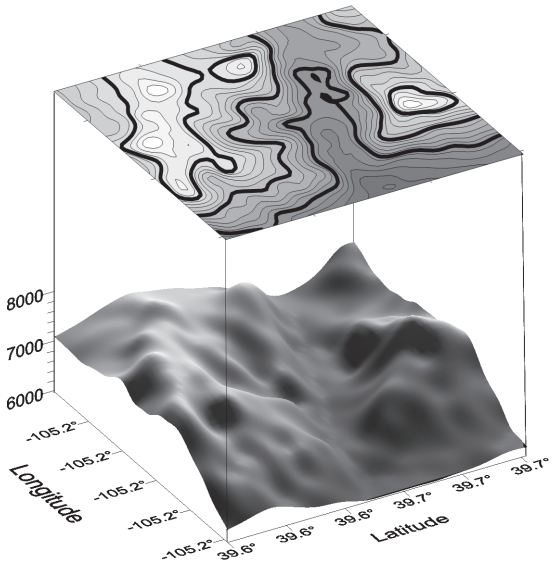
To see the example **Surfer** files:

1. Open **Surfer**.
2. Choose the **File | Open** command and click on a [*.SRF] file located in the *SAMPLES* folder. By default, the **Surfer** installation folder is located in C:\Program Files\Golden Software\Surfer 9\Samples.

Map Layers.SRF

The map layers sample file contains a map with multiple map layers. The contour map has partially transparent color fill to allow the ability to see through to the shaded relief map layer beneath it. The base map layer contains two polygons that define an area of interest on the map. The properties of each polygon can be adjusted individually. A color scale for the contour fill values was added to the map.





Stacked Maps.SRF

The stacked maps sample file contains two maps: a contour map and a 3D surface map. The two maps were created from the same grid file. Both maps have a custom view with a 30° tilt, 30° field of view, 300° rotation, and an orthographic projection. The maps were stacked to align the two maps horizontally on the page. The polylines were drawn to create a custom display.

Using Surfer

The general steps to progress from a XYZ data set to a finished, grid-based map are as follows:

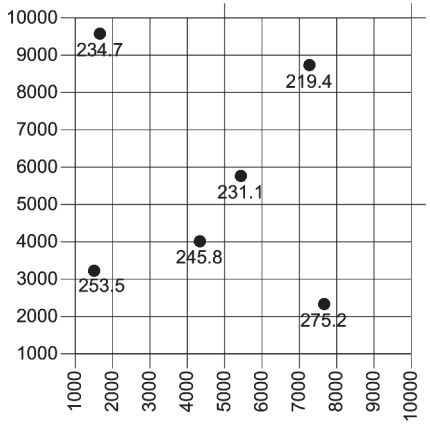
1. Create a XYZ data file. This file can be created in a **Surfer** worksheet window or outside of **Surfer** (using an ASCII text editor or Excel, for example).
2. Create a grid file [.GRD] from the XYZ data file using the **Grid | Data** command.
3. To create a map, use the **Map | New** command, select a map type, and use the grid file from step two. Grid-based maps include contour, image, shaded relief, vector, 3D wireframe, and 3D surface maps.
4. Double-click the map to open the map properties dialog and customize your map as needed.
5. Use the **File | Save** command to save the project as a **Surfer** file [.SRF] that contains all of the information needed to recreate the map, including the data file.

XYZdata.dat

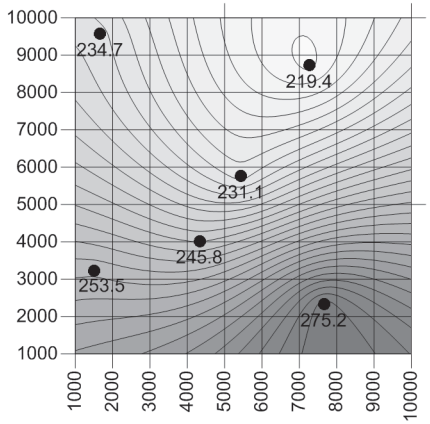
A1 | X Coord.

	A (x)	B (y)	C (z)
1	X Coord.	Y Coord.	Z value
2	1665.4	9567.2	234.7
3	7659.3	2324.6	275.2
4	1499.5	3212.9	253.5
5	5438.1	5753.9	231.1
6	4327.4	4013.9	245.8

*The XYZ data can be created in the **Surfer** worksheet.*



Gridding interpolates a Z value at the intersection of each row and column in the grid file, thereby filling holes in the data. Here the rows and columns are represented by grid lines.



The post map layer shows the original data points. The contour map layer shows the grid-based contour map.

Using Scripter

Tasks can be automated in **Surfer** using Golden Software's **Scripter** program or any ActiveX Automation-compatible client, such as Visual BASIC. A script is a text file containing a series of instructions for execution when the script is run. **Scripter** can be used to perform almost any task in **Surfer**. You can do practically everything with a script that you can do manually with the mouse or from your keyboard. Scripts are useful for automating repetitive tasks and consolidating a sequence of steps. **Scripter** is installed in the same location as **Surfer**. Refer to the *Surfer Automation* help book in the online help for more information about **Scripter**. We have included several example scripts so that you can quickly see some of **Scripter's** capabilities.

Example Script Files

To run a sample script:

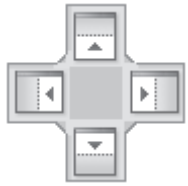
1. Open **Scripter** by navigating to the installation folder, C:\Program Files\Golden Software\Surfer 9\Scripter. Double-click on the Scripter.EXE application file.
2. Choose the **File | Open** command and select a sample script file [.BAS] in the C:\Program Files\Golden Software\Surfer 9\Samples\SCRIPTS folder.
3. Use the **Script | Run** command and the script is executed.

Object Manager

The **Object Manager** allows access to all objects in the plot window. The **Object Manager** contains a hierarchical list of the objects in a **Surfer** plot document. Objects can be edited, arranged, and removed through the **Object Manager**.

Position

The **Object Manager** can be docked, floating, or minimized with *Auto Hide*. To hide the manager, click on the  button in the upper right corner of the **Object Manager**. Click the  button to return the manager to docked mode. Drag the **Object Manager** title bar to a new location to display as a floating window or dock in a new location with the docking mechanism. You can also double-click the **Object Manager** title bar to toggle between floating and docked modes. You can drag the sides of a floating window to change the window size.



The docking mechanism has docking indicators.

Object Visibility

Each item in the list consists of an icon indicating the object type, a text label for the object, and a check box. A checked box indicates that the object is visible. An empty box indicates that the object is not visible. Click the check box to the left of an object icon to change its visibility status. Invisible objects do not appear in the plot window or on printed or exported output.

Object Manager Tree

If an object contains sub-objects, a plus (+) or minus (-) displays to the left of the object name. Click on the + or - button to expand or collapse the list. For example, a Map object contains a map layer (i.e. Contours) plus axes.

Selecting Objects

Click on the object name to select an object. The selection handles in the plot window change to indicate the selected item. The status bar displays the name of the selected object.

Opening Object Properties

Double-click on the object name to display its properties. Each map object has a specific set of properties.

Opening Map Properties

Double-click on the Map object to display the **Map Properties** dialog. The **View**, **Scale**, **Limits**, and **Frame** properties are displayed.

*The **Object Manager** contains a hierarchical list of the objects in the **Surfer** plot window.*

Editing Object IDs

Select the object and then click again on the selected item text (two slow clicks) to edit the text associated with an object or map. You must allow enough time between the two clicks so it is not interpreted as a double-click. Enter the new name into the box. Alternatively, you can right-click on an object name and select **Object ID**, or select an object and use the **Edit | Object ID** command to rename the object.

Arranging Objects

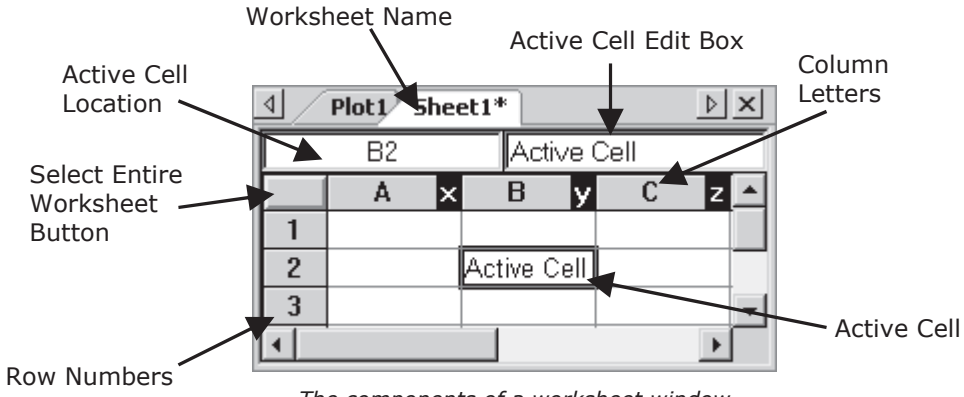
To change the display order of the objects with the mouse, select an object and drag it to a new position in the list above or below an object at the same level in the tree. The cursor changes to a black arrow if the object can be moved to the cursor location or a red circle with a diagonal line if the object cannot be moved to the indicated location. Objects can also be arranged using the **Arrange | Order Objects** menu commands or by right-clicking on an object and selecting **Order Objects**.

Deleting Objects

To delete an object, select the object and press the DELETE key. Alternatively, you can right-click on an object and select **Delete**.

Worksheet Window

The components of the worksheet window are displayed below.



The components of a worksheet window shown above are shown above.

Component Name	Component Function
Column Letters	The column letters identify a column of the worksheet.
Row Numbers	The row numbers identify a row of the worksheet.
Active Cell	The cell highlighted with a bold outline. The active cell receives data input (numeric values or text strings) from the keyboard. Only one cell is active at a time.
Active Cell Location	The location of the active cell is indicated with the column letter and row number (i.e. B2).
Active Cell Edit Box	The box displaying the data or text contained in the active cell. Data typed into an empty cell appears in both the edit box and the active cell.
Worksheet Name	The name of the data file displayed in the worksheet or the worksheet number prior to saving.
Select Entire Worksheet Button	The button used to select all cells in the worksheet.

File Types

Surfer uses four basic file types: data, grid, boundary, and **Surfer** files [.SRF].

Data Files

Data files contain the input data provided by the user. Data files are used to produce grid files, post data points on a map, or generate a residuals log. These files are generally referred to as "XYZ data files" or "data files" throughout the documentation. Data can be read from various file types. Most data files contain numeric XY location coordinates as well as optional numeric Z values. The Z values contain the variable to be modeled, such as elevation, concentration, rainfall, or similar types of values.

XYZ data files contain the raw data **Surfer** interprets to produce a grid file. Before you can create a grid file in **Surfer**, you must create an XYZ data file. XYZ data files must be organized in column and row format. **Surfer** requires the X, Y, and Z data to be in three separate columns. **Surfer** can read data that is in a projection. Data can be projected in the worksheet. When using Latitude (Y) and Longitude (X) values, the data must be in decimal degrees.

Grid Files

Grid files are used to produce several different types of grid-based maps, to perform grid calculations, and to carry out grid operations. Grid files contain a regularly spaced rectangular array of Z data organized in columns and rows. Grid files can be created in **Surfer** using the **Grid | Data** command or can be imported from a wide variety of sources.

Boundary Files

Boundary files contain XY location data such as state boundaries, rivers, or point locations. Boundary files are used to layer a base map on another map, or to specify the boundary limits for blanking, faults, breaklines, or slice calculations. Boundary files can be created from a wide variety of vector formats.

Surfer Files

Surfer files [.SRF] preserve all the objects and object settings contained in a plot window.

Gridding

A grid is a rectangular region comprised of evenly spaced rows and columns. The intersection of a row and column is called a grid node. Rows contain grid nodes with the same Y coordinate. Columns contain grid nodes with the same X coordinate.

Gridding is the process of taking irregularly spaced XYZ data and generating a Z value at each grid node by interpolating or extrapolating the data values. **Surfer** has several different gridding methods. These gridding methods define the way in which the XYZ data are interpolated when producing a grid file.

Introduction to Grid Files

Contour maps, image maps, shaded relief maps, vector maps, 3D surface maps, and 3D wireframe maps all require grids in **Surfer**. The **Grid | Data** command provides you with several methods for generating a grid file from your XYZ data. **Surfer** can also use a variety of other grid files directly. For a list of these, please refer to the online help. This means that you do not have to go through the gridding process if you already have a USGS [.DEM], GTopo30 [.HDR], SDTS [.DDF], DTED [.DT*], or [.HDR] file, for example.

Grid Menu Commands

There are many ways to manipulate grid files in **Surfer**. The **Grid** menu contains several utilities used to blank, convert, create, extract, filter, mosaic, slice, smooth, and transform grid files. In addition, volume calculations, variogram generation, calculus operations, cross section creation, and residual calculations can be performed using these utilities.

Create a Grid File

Gridding options are selected in the **Grid Data** dialog, which is accessed through the **Grid | Data** command. When you select a gridding method in this dialog, you can specify the parameters for the particular method by clicking on the *Advanced Options* button.

Grid Line Geometry

The grid line geometry is set in the **Grid Data** dialog. Grid line geometry defines the grid limits and grid density. Grid limits are the *Minimum* and *Maximum* X and Y coordinates for the grid. Grid density is usually defined by the number of columns and rows in the grid. The *# of Lines* in the *X Direction* is the number of grid columns, and the *# of Lines* in the *Y Direction* is the number of grid rows. By defining the grid limits and the number of rows and columns, the *Spacing* values are automatically determined as the distance in data units between adjacent rows and adjacent columns.

*In the **Grid Data** dialog, the* Grid Line Geometry *group allows you to specify the grid limits and the grid density by entering the appropriate values.*

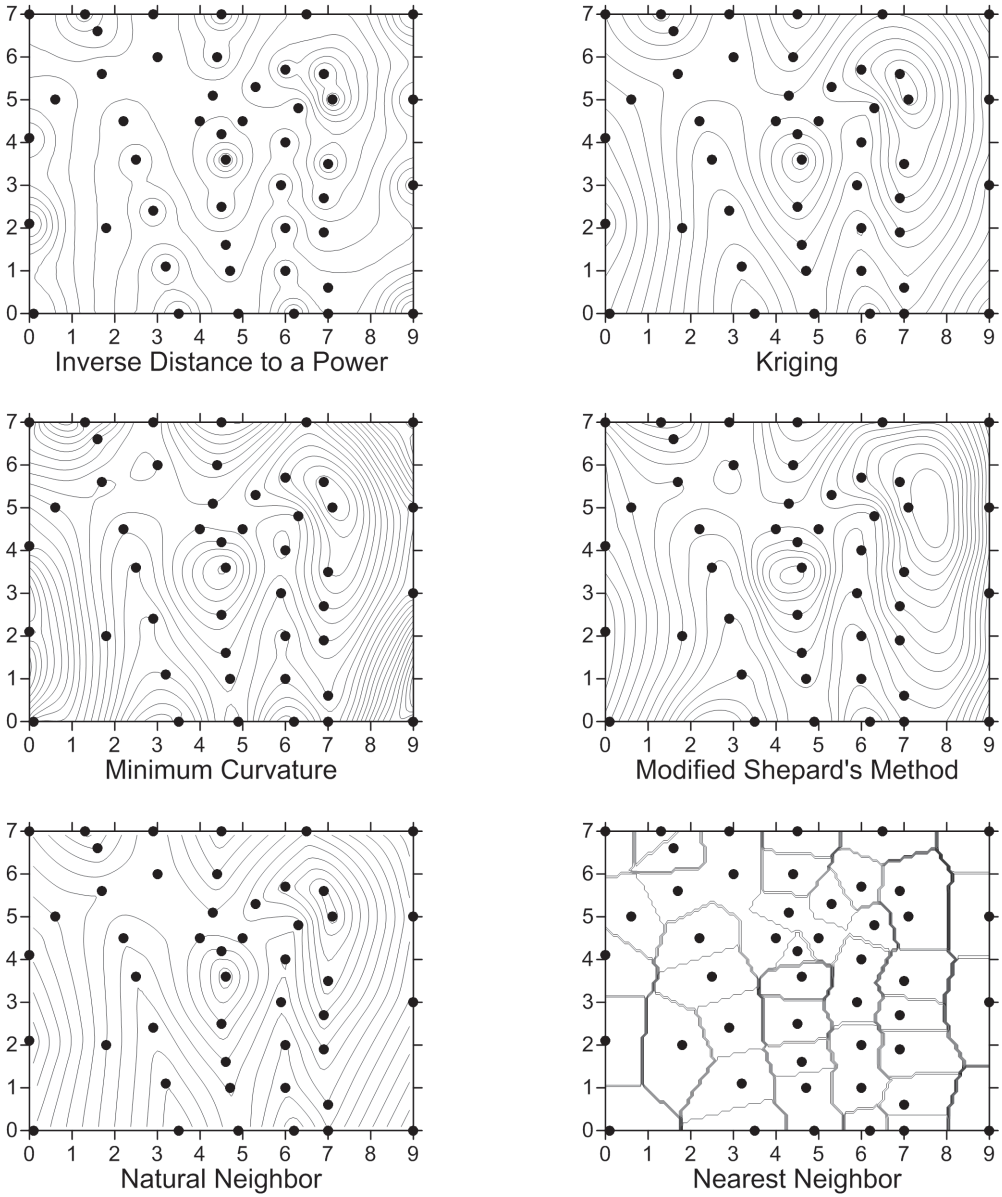
Surfer computes the minimum and maximum X and Y values from the XYZ data file. These values are used as the default minimum and maximum coordinates for the grid. The direction that covers the greater extent (the greater number of data units) is assigned 100 grid lines by default. The number of grid lines in the other direction is computed so that the grid line spacing in the two directions are as close to one another as possible.

Gridding Methods

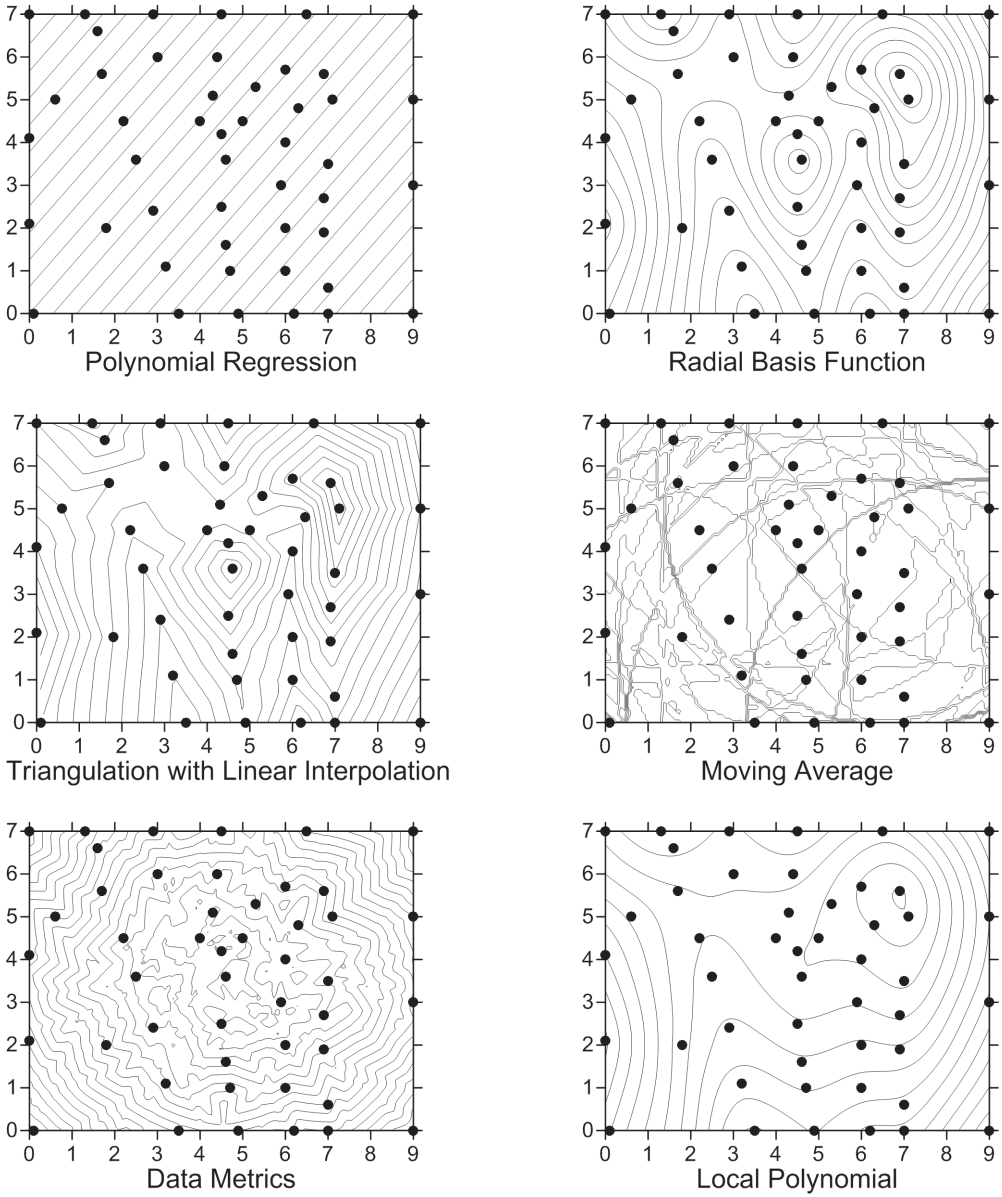
Gridding methods produce a regularly spaced, rectangular array of Z values from irregularly spaced XYZ data. The term "irregularly spaced" means that the points follow no particular pattern over the extent of the map, so there are many "holes" where data are missing. Gridding fills in these holes by extrapolating or interpolating Z values at those locations where no data exists.

The differences between gridding methods are in the mathematical algorithms used to compute the weights during grid node interpolation. Each method can result in a different representation of your data. It is advantageous to test each method with a typical data set to determine the gridding method that provides you with the most satisfying interpretation of your data.

The grid method comparison on the next page uses the sample file DEMOGRID.GRD. Refer to the *Gridding Method Comparison* topic in the online help for more information about this gridding comparison.



This is a comparison of the different gridding methods. For these examples, the same file, DEMOGRID.DAT, was used. All the defaults for the various methods were accepted. This data set contains 47 data points, irregularly spaced over the extent of the map. The data point locations are indicated on a post map layer (solid circle symbols on the maps).



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Breaklines

A breakline is a three-dimensional boundary file [.BLN] that defines a line with X, Y, and Z values at each vertex. When the gridding algorithm sees a breakline, it calculates the Z value of the nearest point along the breakline, and uses that value in combination with nearby data points to calculate the grid node value. **Surfer** uses linear interpolation to determine the values between breakline vertices when gridding. Unlike faults, breaklines are not barriers to information flow, and the gridding algorithm can cross the breakline to use a point on the other side of the breakline. If a point lies on the breakline, the value of the breakline takes precedence over the point. Breakline applications include defining streamlines, ridges, and other breaks in the slope.

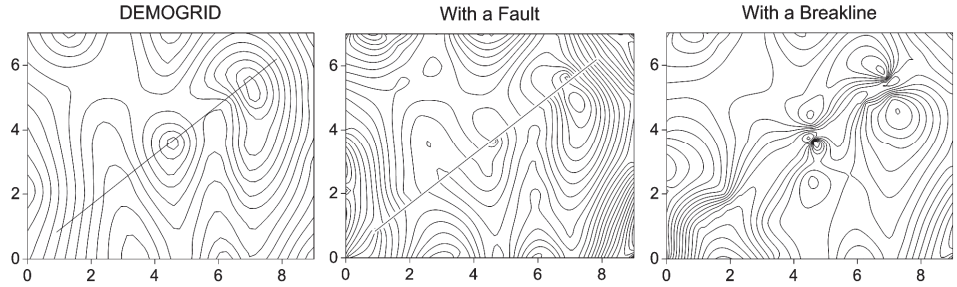
The following gridding methods support breaklines: *Inverse Distance to a Power, Kriging, Minimum Curvature, Nearest Neighbor, Radial Basis Function, Moving Average, Data Metrics,* and *Local Polynomial*.

Faults

In **Surfer**, a fault is a two-dimensional boundary file [.BLN] that defines a line acting as a barrier to information flow when gridding. When gridding a data set, data on one side of a fault is not used when calculating grid node values on the other side of the fault.

If the fault line is a closed polygon, the gridding algorithm will grid the data on the side of the polygon where the data is located. If the fault line is not a closed polygon, the gridding algorithm can search around the end of the fault to see a point on the other side of the fault, but this longer distance reduces the weight of the point in interpolating the grid node value. If a point lies directly on the fault line, random round-off error determines which side of the fault captures the point.

The following gridding methods support faults: *Inverse Distance to a Power, Minimum Curvature, Nearest Neighbor,* and *Data Metrics*.



All three maps used the Minimum Curvature gridding method.

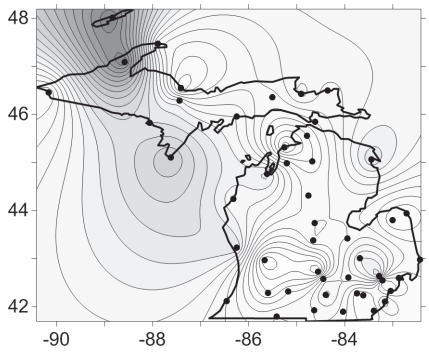
Map Layers

It is possible to combine several maps created from related data to create one map object with multiple layers. You can add any combination of contour, base, post, image, shaded relief, vector, or 3D surface maps. You can add any combination of contour, base, post, and vector maps with 3D wireframe maps.

Map layers use a single set of X, Y, and Z axes and the maps are positioned according to the composite coordinate system. If two or more maps use the same map limits, they will overlay on top of one another. If maps cover adjacent areas, adding a map layer places the two maps in the correct position relative to one another and creates a single set of axes that span the entire range. Layered maps become a single object and are moved and scaled as a single entity. The opacity value of each layer can be adjusted to make a layer transparent or semi-transparent.

The **Map | Add** command allows you to add a map layer to the selected map. Most combinations of map types can be layered. The combinations of map types that cannot be layered include layering a 3D wireframe and 3D surface map, layering multiple 3D wireframe maps, and adding a raster map layer to a 3D wireframe. Raster maps include shaded relief maps, image maps, 3D surfaces, and base maps containing an image.

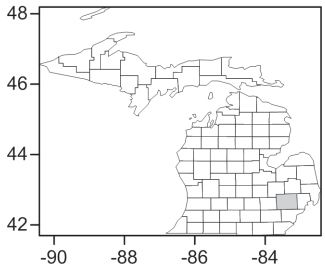
Refer to the *Introduction to Map Layers* topic in the online help for additional information about map layers.



This map has three map layers that share coordinate limits and axes. The base map layer displays the state boundary. The post map layer displays some city locations. The contour map layer displays the distribution of a Z value.

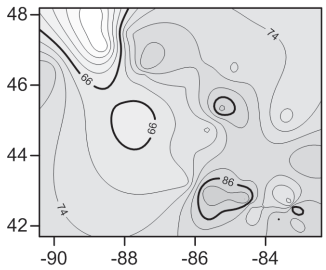
Map Types

Several different map types can be created, modified, and displayed with **Surfer**. These map types include base, contour, post, classed post, image, shaded relief, vector, 3D surface, and 3D wireframe maps.



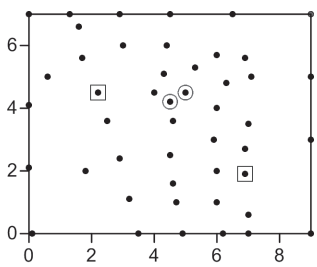
Base Map

Base maps display boundaries on a map. Boundaries can be areas, curves, points, and text. Base maps can be used with other maps to show features such as roads, buildings, streams, city locations, areas of no data, and so on. You can overlay base maps by using **Surfer** layers. Base maps can be produced from several file formats. Individual base map object properties can be edited.



Contour Map

Contour maps are two-dimensional representations of three-dimensional data. Contours define lines of equal Z values across the map extents. The shape of the surface is shown by the contour lines. Contour maps can display the contour lines and colors or patterns between the contour lines.



Post Map

Post maps and classed post maps show data locations on a map. You can customize the symbols and text associated with each data location on the map.

Classed Post Map

Classed post maps allow you to specify classes and change symbol properties for each class. Classes can be saved and loaded for future maps.

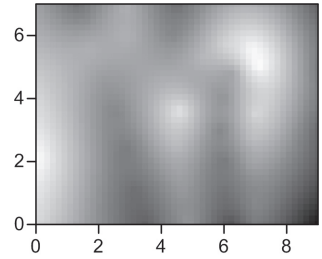
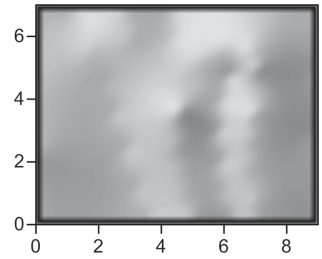


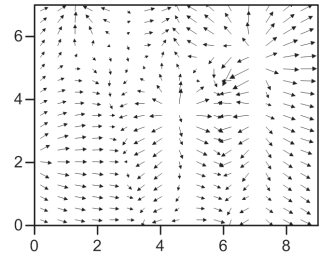
Image Map

Image maps are raster images based on grid files. Image maps assign colors based on Z values from a grid file. Blanked regions on the image map are shown as a separate color or as a transparent fill. Pixels can be interpolated to create a smooth image.



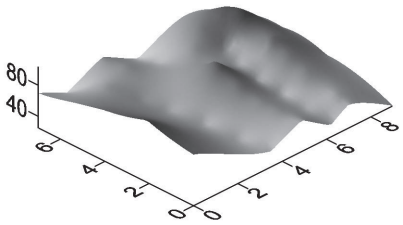
Shaded Relief Map

Shaded relief maps are raster images based on grid files. Shaded relief maps assign colors based on slope orientation relative to a light source. **Surfer** determines the orientation of each grid cell and calculates reflectance of a point light source on the grid surface. The light source can be thought of as the sun shining on a topographic surface.



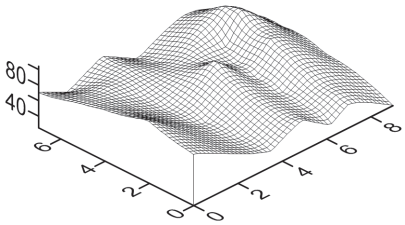
Vector Map

Vector maps display direction and magnitude data using individually oriented arrows. For example, at any grid node on the map, the arrow points in the direction of the steepest descent ("downhill") and the arrow length is proportional to the slope magnitude. Vector maps can be created using the information in one grid file (i.e. a numerically computed gradient) or two different grid files (i.e. each grid giving a component of the vectors).



3D Surface Map

3D surface maps are color three-dimensional representations of a grid file. The colors, lighting, overlays, and mesh can be altered on a surface. Multiple 3D surface maps can be layered to create a block diagram.



3D Wireframe Map

3D wireframe maps are three-dimensional representations of a grid file. Wireframes are created by connecting Z values along lines of constant X and Y.

Tutorial

The tutorial is designed to introduce you to some of **Surfer's** basic features. After you have completed the tutorial, you should be able to begin to use **Surfer** with your own data. We strongly encourage completion of the tutorial before proceeding with **Surfer**. The tutorial should take less than an hour to complete. The tutorial can be accessed in the program using the **Help | Tutorial** command.

Tutorial Lesson Overview

The following is an overview of lessons included in the tutorial.

- ***Lesson 1 - Creating an XYZ Data File*** shows you how to import a data file and how to create a new data file.
- ***Lesson 2 - Creating a Grid File*** shows you how to create a grid file, the basis for most map types in **Surfer**.
- ***Lesson 3 - Creating a Contour Map*** shows you how to create a contour map and change the contour map properties.
- ***Lesson 4 - Posting Data Points and Working with Layers*** shows you how to add a post map layer to display data points to the contour map. Both maps will share the same axes, limits, and scaling.
- ***Lesson 5 - Creating a 3D Surface Map*** shows you how to create a 3D surface map and change the surface map properties.
- ***Lesson 6 - Adding Transparency, Color Scales, and Titles*** shows you how to add transparency, color scales, and titles to maps.

The lessons should be completed in order; however, they do not need to be completed in one session.

Advanced lessons are available in the online help in the program (**Help | Tutorial**). The advanced lessons are optional, but encouraged.

Starting Surfer

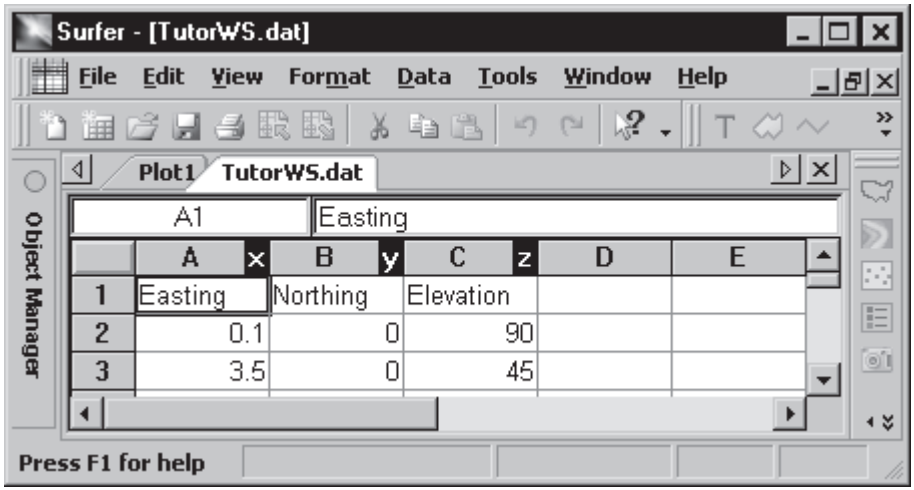
To begin a **Surfer** session:

1. Navigate to the installation folder, C:\Program Files\Golden Software\Surfer 9 by default.
2. Double-click on the Surfer.EXE application file.

Surfer starts with a new empty plot window. This is the work area where you can produce grid files, maps, and modify grids. If this is the first time that you have opened **Surfer**, you will be prompted for your serial number. Your serial number is located on the inside front cover of this getting started guide, or in the email download instructions, depending on how you purchased **Surfer**.

Lesson 1 - Creating an XYZ Data File

An XYZ data file is a file containing at least three columns of data values. The first two columns are the X and Y coordinates for the data points. The third column is the Z value assigned to the XY point. Although it is not required, entering the X coordinate in column A, the Y coordinate in column B, and the Z value in column C is a good idea. **Surfer** looks for these coordinates in these columns by default.



When a data file is displayed, the name of the file is shown in the title bar and in the worksheet tab. In this file, row 1 contains descriptive information about each column of data.

Opening an Existing Data File

To look at an example of an XYZ data file, you can open TUTORWS.DAT into a worksheet window:

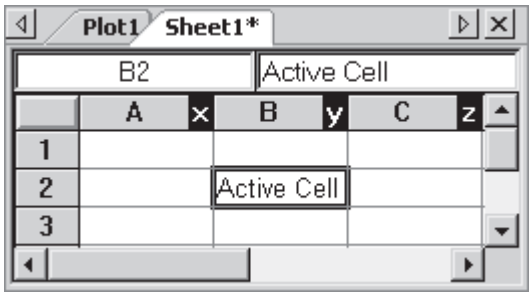
1. Choose the **File | Open** command, or click the  button to select the XYZ data file to display in the worksheet window.
2. Double-click on the SAMPLES folder. In the list of files, click TUTORWS.DAT and then click the *Open* button to display the file in the worksheet window.
3. Notice that the X coordinate (Easting) is in column A, the Y coordinate (Northing) is in column B, and the Z value (Elevation) is in column C. Although it is not required, the header text (the text in row 1) is helpful in identifying the type of data in the column, and this information is used in dialogs when selecting worksheet columns.

Creating a New Data File

The **Surfer** worksheet can also be used to create a data file.

To open a worksheet window and begin entering data:

1. Choose the **File | New | Worksheet** command, or click the  button. A new empty worksheet window is displayed.
2. The active cell is selected by clicking on the cell or by using the arrow keys to move between cells. The active cell is indicated by a heavy border and the contents of the active cell are displayed in the active cell edit box. The active cell location box shows the location of the active cell in the worksheet. Letters are the column labels and numbers are the row labels.
3. When a cell is active, enter a value or text, and the information is displayed in both the active cell and the active cell edit box.
4. The BACKSPACE and DELETE keys can be used to edit data as you type.
5. Press the ENTER key and the information is entered into the cell.
6. To preserve the typed data in the active cell, move to a new cell. Move to a new cell by clicking a new cell with the cursor, pressing one of the arrow keys, or pressing ENTER.



The active cell has a heavy border. The cell B2 is the active cell in this example.

Saving the Data File

When you have completed entering all of the data:

1. Choose the **File | Save** command, or click the  button. The **Save As** dialog is displayed if you have not previously saved the data file.
2. In the *Save as type* list, choose the *DAT Data (*.DAT)* option.
3. Type the name of the file in the *File name* box.
4. Click the *Save* button and a **Data Export Options** dialog opens.
5. Accept the defaults in the **Data Export Options** dialog by clicking the *OK* button.

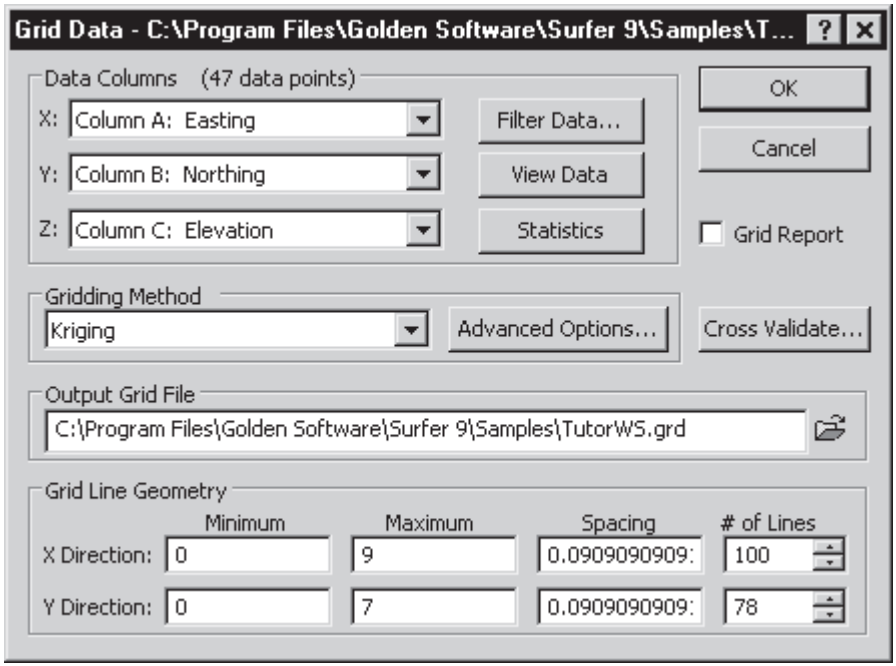
The file is saved in the Golden Software Data [.DAT] format with the file name you specified. The name of the data file appears at the top of the worksheet window and on the worksheet tab.

Lesson 2 - Creating a Grid File

Grid files are required to produce a grid-based map. Grid-based maps include contour maps, image maps, shaded relief maps, 1-grid vector maps, 2-grid vector maps, 3D surfaces, and 3D wireframes. Grid files are created using the **Grid | Data** command. The **Grid | Data** command requires data in three columns, one column containing X data, one column containing Y data, and one column containing Z data. We have included a sample XYZ data file (TUTORWS.DAT) with **Surfer** for you to see how to produce a grid file. After completing the tutorial, if you need to produce an XYZ data file of your data for your work, see *Lesson 1 - Creating an XYZ Data File*.

To produce a grid file from TUTORWS.DAT:

1. If you have the worksheet window open, click on the **Window** menu and choose **Plot1**. Alternatively, you can create a new plot window with the **File | New | Plot** command.
2. In the plot window, choose the **Grid | Data** command.
3. In the **Open Data** dialog, click the file TUTORWS.DAT (located in **Surfer's** SAMPLES folder). The name appears in the *File name* box below the list of data files. If the data file is already open, it will appear in the list of *Open worksheets* at the bottom of the **Open Data** dialog. You can click on the data file in this section as an alternative to locating the SAMPLES folder.
4. Once the file is selected and appears in the *File name* box, click the *Open* button and the **Grid Data** dialog is displayed.
5. The **Grid Data** dialog allows you to control the gridding parameters. Take a moment to look over the various options in the dialog. Do not make changes at this time, as the default parameters create an acceptable grid file.



*Use the **Grid Data** dialog to set gridding preferences and create a grid file.*

- The *Data Columns* group is used to specify the columns containing the X and Y coordinates, and the Z values in the data file.
- The *Filter Data* button is used to filter your data set.
- The *View Data* button is used to see a worksheet preview of your data.
- The *Statistics* button is used to open a statistics report for your data.
- The *Gridding Method* group is used to specify the interpolation gridding method and advanced options.
- The *Advanced Options* button is used to specify advanced settings for the selected gridding method.
- The *Output Grid File* group is used to specify the path and file name for the grid file.
- The *Grid Line Geometry* group is used to specify the XY grid limits, grid spacing, and number of grid lines (also referred to as rows and columns) in the grid file.
- The *Grid Report* option is used to specify whether to create a statistical report for the data.
- The *Cross Validate* button is used to assess the quality of the gridding method.

6. Click the *OK* button. In the status bar at the bottom of the window, a display indicates the progress of the gridding procedure. By accepting the defaults, the

grid file uses the same path and file name as the data file, but the grid file has a [.GRD] extension.

7. By default, a **Surfer** dialog appears after gridding the data with the full path name of the grid file that was created. Click the *OK* button in the **Surfer** dialog.
8. If *Grid Report* was checked in the **Grid Data** dialog, a report is displayed. You can minimize or close this report.

Lesson 3 - Creating a Contour Map

The **Map | New | Contour Map** command creates a contour map based on a grid file.

To create a contour map of the TUTORWS.GRD file created in the previous lesson:

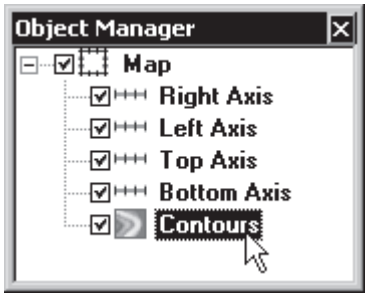
1. Choose the **Map | New | Contour Map** command, or click the  button.
2. The **Open Grid** dialog is displayed. The grid file you created in lesson 2 (TUTORWS.GRD) should appear in the *File name* box. If the file does not appear in the *File name* box, select it from the file list.
3. Click the *Open* button to create a contour map.
4. The map is created using the default contour map properties.
5. If you want the contour map to fill the window, choose the **View | Fit to Window** command. Alternatively, if you have a wheel mouse, roll the wheel forward to zoom in on the contour map. Push and hold the wheel button straight down while you move the mouse to pan around the screen.

Opening the Map Properties

After creating a map, you can change the map properties. The object properties are accessed:

- by selecting the **Edit | Properties** command when the object is selected,
- by double-clicking on the object in the plot window or in the **Object Manager**,
- or by right-clicking on an object in the plot window or in the **Object Manager** and selecting **Properties**.

Double-click the "Map" object to open the map properties dialog.



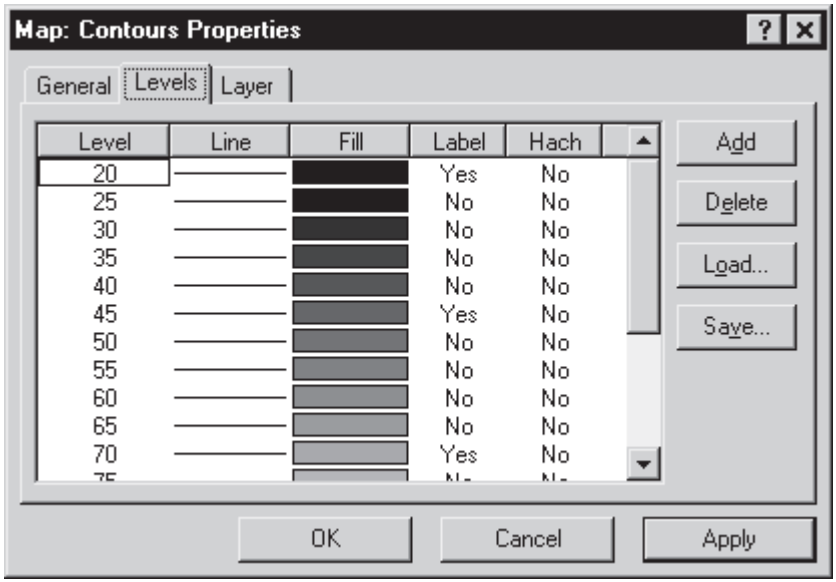
Double-click the "Contours" object to open the contour map properties dialog.

Changing Contour Levels

After you create a contour map, you can easily modify any of the map features. For example, you might want to change the contour levels displayed on the map.

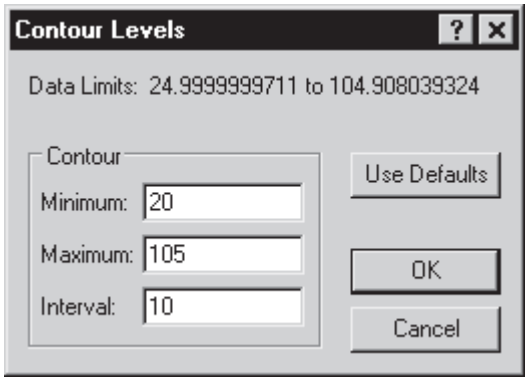
To change the contour levels of the map you just created:

1. Place the cursor inside the limits of the contour map and double-click to open the contour map properties dialog.
2. In the contour map properties dialog, click the **Levels** tab to display the contour levels and contour line properties for the map. In this example, the contour levels begin at Z = 20. Click on the scroll bar at the right to scroll to the bottom. You can see that the maximum contour level is Z = 105 for this map and that the contour interval is five.



*Go to the **Levels** page to display the contour level properties.*

3. To change the contour range and interval, click the *Level* button and the **Contour Levels** dialog is displayed. This shows the *Minimum* and *Maximum* contour level for the map, the contour *Interval*, and the *Data Limits* of the grid file.
4. Double-click in the *Interval* box and type the value 10. Click the *OK* button and the **Levels** page is updated to reflect the change. The contour interval for the map is now 10. The minimum contour level is Z = 20, and the maximum contour level is Z = 100.
5. Click the *OK* button in the contour map properties dialog and the map is redrawn with the new contour levels.



*Open the **Contour Levels** dialog by clicking on the* Level *button on the **Levels** page.*

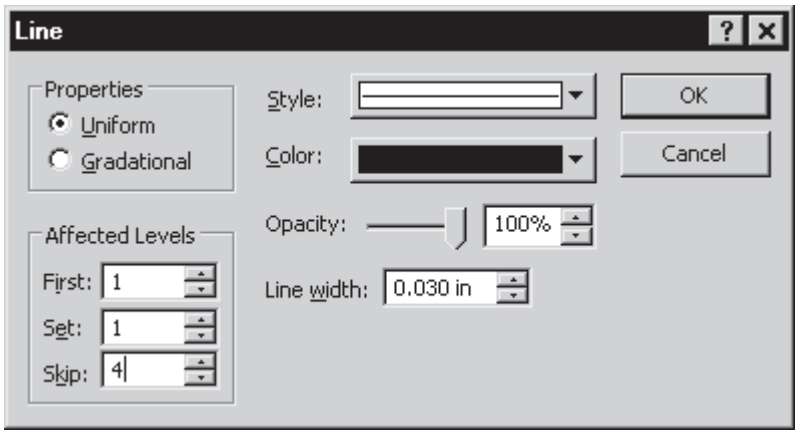
Changing Contour Line Properties

You can double-click any of the elements in the list on the **Levels** page to modify the individual element. For example, you can double-click an individual Z value in the list to change the Z value for that particular contour level. You can also double-click the line style for an individual level to modify the line properties for the selected level. This provides a way to emphasize individual contour levels on the map.

To change contour line properties:

1. Double-click the contour map to open the map properties.
2. On the **Levels** page, double-click the line sample for the contour level at Z = 70 to open the **Line Properties** dialog.
3. You can select the line *Color*, *Style*, *Width*, or *Opacity* for the selected line in the **Line Properties** dialog. In the *Width* box, click the up arrow, and change the width value to 0.050 in. (A width of 0.000 in is equivalent to one pixel width.)
4. Click the *OK* button in the **Line Properties** dialog and the **Levels** page is updated to reflect the change.
5. Click the *OK* button in the map properties dialog and the map is redrawn. The contour line at Z = 70 is drawn with a thicker line.

Alternatively, you can click on the column header buttons to make bulk changes at regular intervals or to the entire contour map. This provides a way to emphasize contours at a regular interval, such as an index contour where every fifth line is bold.



Click on the Line *column header button to open the* ***Line*** *dialog. Use the* ***Line*** *dialog to set the properties of multiple lines at once. This example creates an index contour, skipping four lines.*

Adding Color Fill Between Contour Lines

Color fill can be assigned to individual levels in the same way as line properties. Alternatively, you can assign colors based on a gradational spectrum between two colors, or select one of the preset color spectrums.

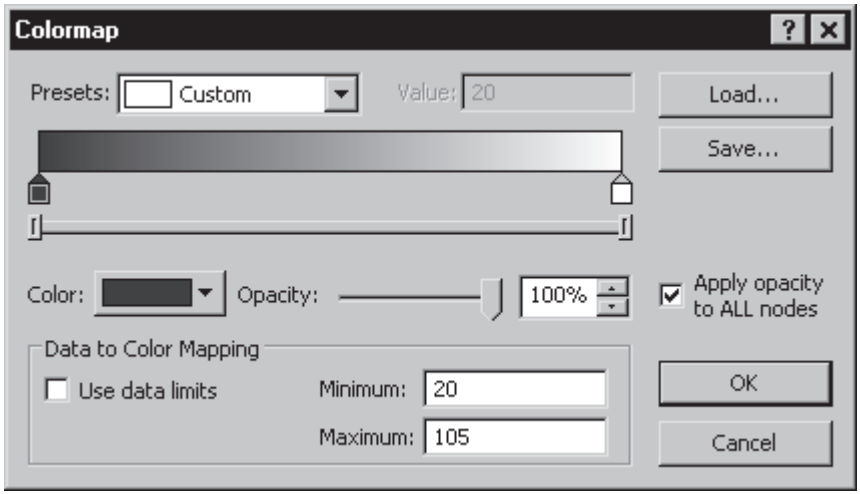
The **Levels** page in the contour map properties dialog shows a correspondence between a level (the values under the *Level* button) and a color (the values under the *Fill* button). The colors are used to fill in the space between the corresponding level and the next higher level. For example, if the contour levels are 20, 30, 40, etc., then the color corresponding to level 20 is used to fill in the space between the level 20 contour and the level 30 contour.

To display color fill:

1. Double-click on the contour map to open the contour map properties dialog.
2. On the **General** page, click the *Fill Contours* check box. Click the *Apply* button to see the default grayscale color fill between contours.

To change the color of the fill:

1. In the contour map properties dialog, on the **Levels** page, click the *Fill* button to open the **Fill** dialog.
2. In the **Fill** dialog, click the *Foreground Color* button to open the **Colormap** dialog. This dialog allows you to select colors to assign to specific Z values.
3. Click on the left node below the color spectrum, click on the color *Blue* in the color palette. The color spectrum now ranges from *Blue* to *White*. Alternatively, you could select a color spectrum from the *Presets* drop-down list, or by clicking the *Load* button.



To change the color spectrum, click the left node and then select a color from the color palette, select a color spectrum from the Presets *drop-down list, or load a [.CLR] by clicking the* Load *button.*

4. Click the *OK* button to return to the **Fill** dialog. The *Foreground Color* button is now displayed as a gradation from blue to white.
5. Click the *OK* button to return to the **Levels** page.
6. Click the *OK* button and the contour map is drawn with the new fill.

Add, Delete, and Move Contour Labels

Contour label locations can be changed on an individual basis. Labels can be added, deleted, or moved.

To add, delete, and move contour labels:

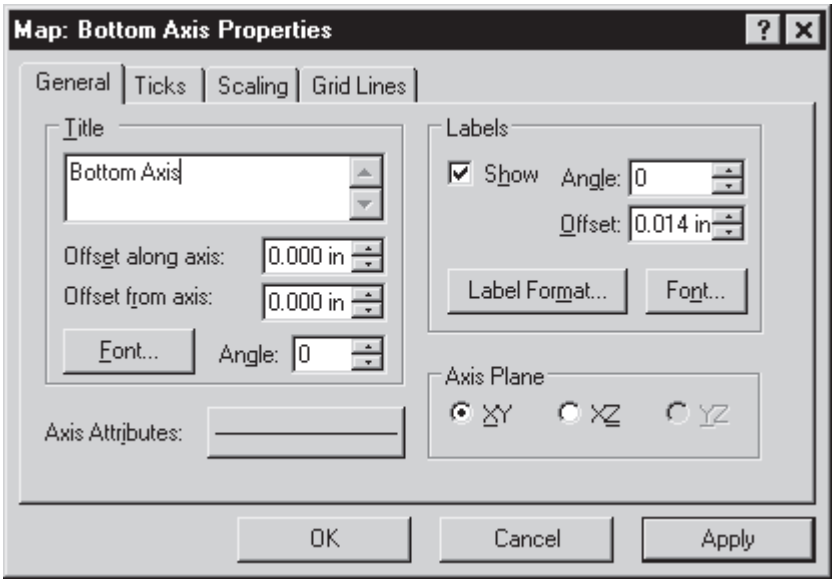
1. Select the contour map and choose the **Map | Edit Contour Labels** command, or right-click on the contour map and select **Edit Contour Labels**. The cursor changes to a black arrowhead to indicate that you are in edit mode.
2. To delete a label, click on the label and press the DELETE key on the keyboard. For example, click on the far left 70 label and then click the DELETE key on your keyboard.
3. To add a label, press and hold the CTRL key on the keyboard and left-click the location on the contour line where you want the new label located. The cursor changes to a black arrowhead with a plus sign + to indicate you are able to add a new label. Add a 60 contour label to the lower left portion of the map.
4. To move a contour label, left-click on the label, hold down the left mouse button, and drag the label. Release the left mouse button to complete the label move. Move the 70 contour label on the right portion of the map to the north.
5. To duplicate a label, hold the CTRL key on the keyboard while holding the left mouse button and drag the label to a new location.
6. To exit the **Edit Contour Labels** mode, press the ESC key.

Modifying an Axis

Every contour map is created with four map axes: the bottom, right, top, and left axes. You can control the display of each axis independently of the other axes on the map. In this example, we will change the contour spacing and add an axis label. 3D maps have an additional Z axis. Additional X, Y, or Z axes can be added to a map with the **Map | Add** command.

To modify an axis:

1. Move the cursor over one of the axis tick labels on the bottom X axis and left-click the mouse. In the status bar at the bottom of the plot window, the words "Map: Bottom Axis" are displayed. This indicates that you have selected the bottom axis of the contour map. Additionally, blue circle handles appear at each end of the axis, and green square handles appear surrounding the entire map. This indicates that the axis is a "sub-object" of the entire map.
2. Double-click on the bottom axis to display the bottom axis properties dialog.
3. In the *Title* box on the **General** page, type "Bottom Axis" (without quotes) and then click the *Apply* button. This places a title on the selected axis.



If you would like to edit other axes, click on the axis. You do not need to close the dialog before changing your selection.

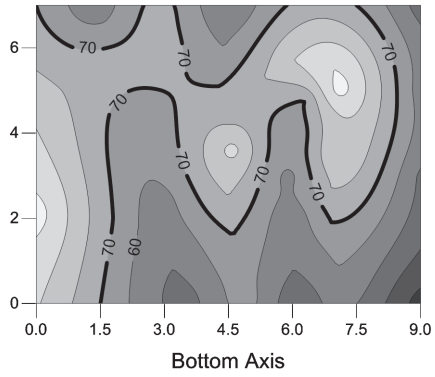
4. If you cannot see the axis title, select **View | Zoom | Selected**. Notice that you do not have to close the properties dialog to select menu commands, toolbar buttons, or objects in the plot window.
5. Click on the **Scaling** tab to display the axis scaling options. In the *Major Interval* box, type the value 1.5 and then click the *Apply* button. This changes the spacing between major ticks along the selected axis.
6. Click on the **General** tab and then click the *Label Format* button to open the **Label Format** dialog.
7. In the **Label Format** dialog, select the *Fixed* option in the *Type* group. Click on the down arrow on the *Decimal Digits* box and change the value to 1. This indicates that only one digit follows the decimal point for the axis tick labels.
8. Click the *OK* button in the **Label Format** dialog to return to the axis properties dialog.
9. Click the *OK* button in the axis properties dialog and the map is redrawn. The axis tick spacing and labels are changed, and the axis title is placed below the map.

Saving a Map

When you have completed the map or drawing in the plot window, you can save the map to a **Surfer** file [.SRF] containing all the information necessary to reproduce the map. When you save a map, all the scaling, formatting, and parameters for the map are preserved in the file. An asterisk (*) next to the file name in the title bar and tab indicates the file has been modified and the modifications have not yet been saved.

To save a map:

1. Choose the **File | Save** command, or click the  button. The **Save As** dialog is displayed because the map has not been previously saved. Select a directory where you can save the file.
2. In the *File name* box, type TUTORWS.
3. Click the *Save* button and the file is saved to the current directory with an [.SRF] extension. The saved map remains open and the title bar changes reflecting the changed name. There is no longer an asterisk next to the file name.



This is an example of a customized contour map created from TUTORWS.GRD.

Exporting 3D Contours

(Optional) When you have completed a contour map in the plot window, you can export the contour lines with associated Z values to an AutoCAD DXF file, 2D SHP, or 3D SHP file.

To export contour lines:

1. Select the map by clicking on the map in the plot window or by clicking on the word "Contours" in the **Object Manager**.
2. Choose the **Map | Export Contours** command.
3. In the **Save As** dialog, type TUTORWS into the *File name* box, specify AutoCAD DXF File (*.dxf), 2D ESRI Shape File (*.shp), or 3D ESRI Shape File (*.shp) in the *Save as type* box.
4. Click the *Save* button and the file is exported to the current directory. This creates a file titled TUTORWS.DXF or TUTORWS.SHP depending on what file type you selected. If you export to a [.SHP] file, you will also have a [.DBF] and [.SHX] file created. All three of these files are needed to import into some other programs.

Lesson 4 - Posting Data Points and Working with Map Layers

Post maps are created by placing symbols representing data points at the X, Y data point locations on a map. Posting data points on a map can be useful in determining the distribution of data points, as well as placing data or text information at specific points on the map. Data files contain the X, Y coordinates used to position the points on the map. Data files can also contain the labels associated with each point.

Add multiple map layers to an existing map to create one map object consisting of multiple types of maps. The layers use a single set of axes and are positioned according to the composite coordinate system. For example, if you have a contour map of weather data created, you can add a post map layer displaying the location and station names of each data collection station.

Adding a Map Layer

When a new post map is created with **Map | New | Post Map**, it is independent of any other map in the current plot window. When the two maps are displayed, notice that two sets of axes are also displayed, one set for each map. When you select a map and then use the **Map | Add** command, a new map layer, axis, or scale bar can be added to the selected map to create a single multi-layer map with one set of axes. If two maps already exist, a map layer can be dragged to a different map object in the **Object Manager**. To delete a map layer, select the layer in the **Object Manager** and press the DELETE key. To remove a map layer from the map object, right-click the layer and select **Break Apart Layer**.

To add a post map layer to the current tutorial map:

1. Using the TUTORWS.SRF file you created in the previous lesson, select the contour map.
2. Choose the **Map | Add | Post Layer** command, or right-click on the contour map and select **Add | Post Layer**.
3. In the **Open Data** dialog, select TUTORWS.DAT from the SAMPLES folder.
4. Click the *Open* button and the post map layer is added to the contour map. Notice in the **Object Manager** that the post map layer has been added to the existing map and the two maps layers (Post and Contours) now share the same set of axes. Changes made in the map properties dialog will affect the contour map layer and the post map layer.

Changing the Post Map Properties

To change the post map properties:

1. Open the **Object Manager** with the **View | Object Manager** command if it is not already open.
2. Double-click on the word "Post" in the **Object Manager**, or right-click over the word "Post" and select **Properties** from the context menu.
3. In the post map properties dialog **General** page, click the *Default Symbol* button to open the **Symbol Properties** dialog.
4. Choose the filled diamond symbol (*Symbol set: Default Symbols, Number: 6*) from the symbol palette.
5. Choose *Cyan* from the drop-down color palette. *Opacity* can be adjusted to create semi-transparent symbols (optional).
6. Click the *OK* button. The selected customized symbol appears as the *Default Symbol* button.
7. Click the *Apply* button and the symbol appears at the posted data points on the map.
8. In the *Symbol Size* section, change the *Fixed Size* to 0.09 in. Alternatively, symbol size can be controlled by proportional scaling (optional).
9. Click the *OK* button and the post map is drawn with the custom symbol.

If the post map is not visible, ensure that the post layer is on top of the contour layer in the **Object Manager**. The order the layers are listed in a map object is the order the map layers are drawn in the plot window. To move a map layer, left-click and drag up or down in the map object. Alternatively, select the map layer and use the **Arrange | Order Objects** command or right-click and select **Order Objects**.

Selecting a Map Layer and Changing the Object ID

After creating a multi-layer map with a post map layer and a contour map layer, you can still modify the individual map layers.

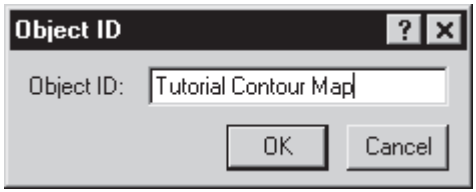
Selecting Map Layers

The easiest way to select a map layer in a multi-layer map is to click on the layer name in the **Object Manager**. However, you can also select the layer in the plot window with the mouse. Whenever two or more objects occupy the same position in the plot window, use the CTRL key and the left mouse button to select the desired object. The CTRL key allows you to cycle through the selection of overlapping objects. For example, if you want to select a contour map layer behind a post map layer, hold down the CTRL key and click until the contour map layer is selected. You can use the status bar to help you to determine which object is selected.

Renaming the Map Layers

To select a map layer and assign or change the Object ID:

1. Click the contour map layer name in the **Object Manager**. In this case, click the word "Contours". The status bar should now report "Map: Contours".
2. Choose **Edit | Object ID**. Alternatively, right-click the map layer name and select **Object ID**.
3. In the **Object ID** dialog, type the name "Tutorial Contour Map" and click the *OK* button. The status bar, **Object Manager**, and properties dialog title reflect the name change.



*Enter a new object name in the **Object ID** dialog.*

4. Repeat steps 1-3 and rename the post map layer to "Tutorial Post Map".

If you double-click on the "Tutorial Contour Map" layer in the **Object Manager**, notice that the properties dialog title is set to **Map: Tutorial Contour Map Properties**. When you rename an object in **Surfer**, the object's properties dialog reflects the name change making it easier for you to keep track of the object you are editing. For example, if you have eight maps in the plot window, it is beneficial to change the map names to something meaningful to save time when trying to edit them. This is especially important because the properties dialog can stay open when changing selections.

Adding Labels to the Post Map

Labels can be added to data points on post maps and classed post maps. The post map can be selected by a few different methods, though only the **Object Manager** method is discussed here.

To add labels:

1. Right-click on "Tutorial Post Map" layer in the **Object Manager** and select **Properties**.
2. Click on the **Labels** tab. In the *Worksheet Column for Labels* group, click the drop-down arrow and a list of columns in TUTORWS.DAT are displayed.
3. Select *Column C: Elevation* from the list.
4. Click the *Format* button to open the **Label Format** dialog.
5. Change the *Type* to *Fixed* and the *Decimal Digits* value to zero.
6. Click the *OK* button to return to the post map properties dialog, **Labels** page.
7. Click the *OK* button and the post map layer is redrawn with labels on each of the data points.

Move Individual Post Labels

You can move individual labels of post map and classed post maps. A customizable lead line is automatically added from the data point label to the actual X, Y data point location.

To move individual labels:

1. Select the Tutorial Post Map in the **Object Manager**.
2. Select the **Map | Edit Post Labels** command or right-click on the selected map and choose **Edit Post Labels**. The cursor will change to a  to indicate you are now in post label editing mode.
3. Left-click on a label, hold the left mouse button down, and drag the label to a new position. With the left mouse button held down, the arrow keyboard keys can be used to nudge the label location. Release the left mouse button to place the label in the new location. A lead line is automatically added from the point location to the new label location by default. The leader line visibility and line properties are controlled on the **Labels** page of the post map properties dialog.
4. Press the ESC key to exit the post label editing mode.

Before moving to the next lesson, be sure to save your progress with the **File | Save** command. Your TUTORWS.SRF file will be saved to include all the additions from Lesson 4.

Lesson 5 - Creating a 3D Surface Map

Surface maps are three-dimensional shaded renderings of a grid file that provide an impressive visual interpretation of data. 3D surface maps can be layered with other surface maps, so that the surfaces will intersect with each other. Surfaces can also have layers of other map types, excluding wireframes. You can control the color, lighting, overlay blending, and wire mesh grid of a surface.

This is a 3D surface map of the Telluride, Colorado USGS SDTS grid file.

Creating a 3D Surface

To create a surface:

1. Select the **File | New | Plot** command to open a plot document.
2. Select the **Map | New | 3D Surface** command, or click the  button.
3. Choose the grid file TUTORWS.GRD from the list of files in the **Open Grid** dialog. The TUTORWS.GRD, created in *Lesson 2 - Creating a Grid File*, is located in **Surfer's** SAMPLES folder.
4. Click the *Open* button, and the 3D surface map is created using the default settings.

Adding a Mesh

Mesh lines can be applied to surfaces. 3D surface maps have more capability than 3D wireframe maps. Adding mesh lines to a 3D surface map simulates a 3D wireframe map.

To add a mesh:

1. Double-click on the 3D surface map to open the 3D surface properties.
2. Click the **Mesh** tab.
3. Check the *X* and *Y* boxes in the *Draw Lines of Constant* section.
4. Change the *Frequency* to five for the X and Y lines.
5. Click the *OK* or *Apply* button to add a mesh to the selected 3D surface.

Changing Colors

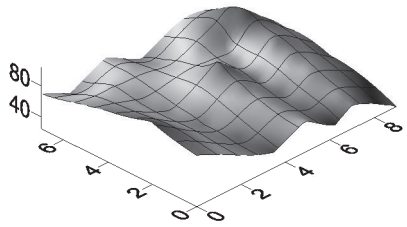
Changing color schemes on 3D surfaces is similar to changing colors on other map types such as image maps or contour maps. The **Colormap** dialog is used to load previously defined color schemes, or to create your own color schemes.

To change the surface material color:

1. Double-click on the 3D surface to open the 3D surface properties.
2. On the **General** page, click the *Upper* button in the *Material Color* group. The **Colormap** dialog opens.
3. In the **Colormap** dialog, select *Rainbow* from the *Presets* drop-down list. The *Presets* list contains a variety of pre-defined color schemes. Alternatively, you can click the *Load* button and select a pre-defined or custom color spectrum file with a [.CLR] extension. The COLORSCALES folder contains many sample [.CLR] files.
4. Click the *OK* button to return to the **General** page.
5. Click the *OK* button to see the updated surface color.

Notice that the colors and anchor node positions have changed when a preset color spectrum is selected. The *Rainbow* preset has six nodes that range from purple to red. You can add, remove, customize the nodes, or accept the default selections.

You can continue to experiment with the colors by opening the **Colormap** dialog again and selecting other color spectrum files from the *Presets* drop-down list or by loading custom color files.



This is a 3D surface map with mesh lines, created from TUTORWS.GRD.

Adding a Map Layer

You can add additional map layers to the 3D surface map with the **Map | Add** command, or by right-clicking on the 3D surface and selecting **Add**. All map layers, except other 3D surfaces, are converted into a type of image known as a texture map. This texture map is then applied to the surface by stretching or shrinking it as necessary. When these maps are added to the surface map, you have a choice on how to treat the texture map. You can use the colors from the surface only, from the texture only, or blend colors from the surface and texture. For example, you could create a color filled contour map, add the contour map and surface, and then display the colors from the contour map only. A 3D wireframe layer cannot be added to a 3D surface map.

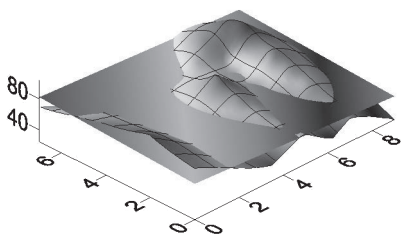
When multiple 3D surfaces of differing elevations are added, the surfaces can intersect and overlap each other. If the surfaces are adjacent to each other in the X or Y direction, the surfaces are drawn side-by-side after using **Map | Add**. In this example, we will add a plane with the surface you just created.

First, rename and select the 3D surface:

1. Right-click on the 3D Surface in the **Object Manager**, select **Object ID**, and change the text to TUTORWS to make it easier to distinguish the map layer. Click the *OK* button.
2. Select the TUTORWS map in either the **Object Manager** or the plot document.

Next, add a planar 3D surface map layer:

1. With the TUTORWS map selected, use the **Map | Add | 3D Surface Layer** command, or right-click the surface map and select **Add | 3D Surface Layer**.
2. In the **Open Grid** dialog, open **Surfer's** SAMPLES folder and select the planar grid, TUTORPL.GRD.
3. Click the *Open* button, and the surface map layer is created using the default settings.
4. Right-click on the new 3D surface in the **Object Manager**, select **Object ID**, and change the text to TUTORPL to make it easier to distinguish the two surfaces in the **Object Manager** list. Click the *OK* button.
5. Change the surface material color to *Rainbow* for the TUTORPL surface to match the TUTORWS surface using the steps from the previous section, *Changing Colors*.



This is a 3D surface map with mesh lines created from TUTORWS.GRD and a planar 3D surface map layer created from TUTORPL.GRD.

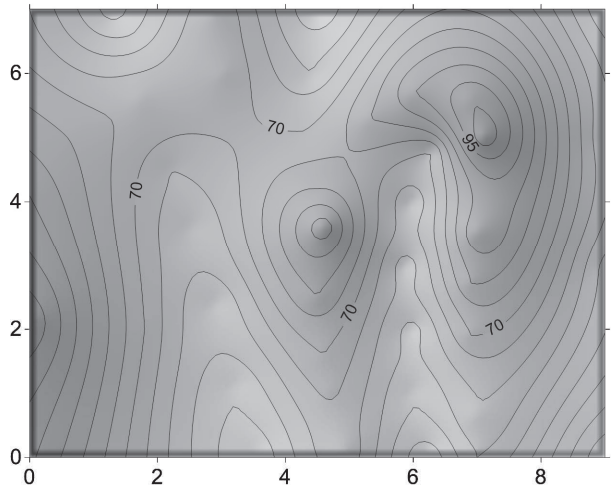
Lesson 6 - Adding Transparency, Color Scales, and Titles

The opacity of a map, image, text, line, fill, symbol, or entire layer can be customized in **Surfer 9**. By default, objects are displayed with 100% opacity. An object can be made semi-transparent by adjusting the opacity value.

Reducing the opacity of an object allows the ability to see through the object to other objects. This may be useful when wanting to create a semi-transparent object. For example, you may want to display a semi-transparent contour map over a base map of a satellite image.

Color scales are available for contour, 3D wireframe, 3D surface, image, and vector maps. They are legends that show the fill assigned to each contour level on a filled contour map, the colors assigned to levels in a 3D wireframe, the colors used in an image map or 3D surface, and the fill assigned to vector symbols.

Having a completed map with multiple layers, color scale legends, and titles allow you to provide well organized and easily understandable publication quality maps.



This is a map with a shaded relief map layer and a semi-transparent contour map layer on top.

Creating a Contour Map

To create a contour map:

1. Select the **File | New | Plot** command, or click the  button. A new empty plot window is displayed.
2. Select the **Map | New | Contour Map** command.
3. Choose the grid file TUTORWS.GRD from the list of files in the **Open Grid** dialog, click *Open*, and the map is created using the default settings. (TUTORWS.GRD, created in *Lesson 2 - Creating a Grid File*, is located in **Surfer's** SAMPLES folder.)

Adding Transparency

You can adjust the *Opacity* of a map layer, individual contour fill, polygon fill, text, lines, or symbols in the appropriate properties dialog.

To add transparency to the contour map:

1. Open the contour properties dialog.
2. On the **Levels** page, click the *Fill* button.
3. In the **Fill** dialog, click the *Foreground Color* button.
4. In the **Colormap** dialog, select *Forest* from the *Presets* drop-down list. The color scale now ranges from *White* to *Green*.
5. Change the *Opacity* to 40%.
6. Click the *OK* button to return to the **Fill** dialog.
7. Click the *OK* button to return to the **Levels** page of the contour properties dialog.
8. Click the *OK* button and the map is drawn with semi-transparent contour fill.

Adding a Shaded Relief Map Layer

Adding a shaded relief map layer to our existing semi-transparent contour map will help display the elevation behind the contour fill.

To add a shaded relief map layer:

1. Click on the contour map once to select it.
2. Select the **Map | Add | Shaded Relief Layer** command.
3. Select the file TUTORWS.GRD, and click the *Open* button. A shaded relief map layer is added to the map object in the **Object Manager**. Notice how the shadows of the shaded relief map layer help distinguish the topography of the grid file.

Adding a Color Scale

You can add a color scale to contour, 3D wireframe, 3D surface, image, and vector maps.

To add a color scale to the contour map:

1. Open the contour map properties.
2. On the **General** page, be sure the *Fill Contours* option is checked. Click the *Color Scale* check box.
3. Click the *OK* button and a default color scale is created. A new Color Scale object is added to the **Object Manager**.

To change the color scale properties:

1. Change the Color Scale object ID to "Contour Map Color Scale".
2. Double-click the scale bar to display the color scale properties dialog.
3. Change the *Label Frequency* to four.
4. Click the *OK* button to redraw the color scale bar with updated properties.

Adding a Map Title

Adding a title to a map is a great way to stay organized and create publication quality maps.

To add a title to the map:

1. Open the top axis properties of the map you have created.
2. Click on the **General** tab in the top axis properties dialog.
3. In the *Title* section, type "Tutorial Map" without the quotes.
4. Press the ENTER key to move to the next line.
5. On the second line, we will use a dynamic pre-defined math text instruction to insert the current date. In this case, we will use the term "\date " to display the current date. Be sure to add a space at the end of "\date ". Failure to put a space after the "e" of "\date " will result in a math text error.
6. Click the *Font* button in the *Title* section to open the **Font Properties** dialog. Click the checkbox next to *Bold* in the *Style* section. Change the *Size (points)* to 14.
7. Click the *OK* button to return to the **General** page of the top axis properties dialog.
8. Click the *OK* button to redraw the map with the new map title.

Advanced Tutorial Lessons

Optional advanced tutorial lessons are available in the program help file. Use the **Help | Tutorial** command to access the advanced tutorial lessons in **Surfer 9**.

Printing the Online Help

The online help topics may be printed. You can print a single topic, a section of the table of contents, or all topics in the table of contents.

Printing One Topic

To print one topic:

1. Open the topic you wish to print.
2. Click the 

button.
3. If the **Contents** page is open in the help navigation pane, you are prompted to *Print the selected topic* or *Print the selected heading and all subtopics*. Select *Print the selected topic* and then click the *OK* button.

Printing One Book

To print one book, the tutorial for example:

1. Open the online help by selecting **Help | Contents** in the **Surfer** window.
2. Click the **Contents** page on the left side navigation pane.
3. Click on the *Tutorial* book to select the book.
4. Click the 

button within the help window.
5. A prompt appears asking if you would like to *Print the selected topic* or *Print the selected heading and all subtopics*. Select *Print the selected heading and all subtopics* and then click the *OK* button. All the topics included in the *Tutorial* book are printed.

Printing the Entire Help File

To print all of the topics in the help file table of contents:

1. Open the top-level book in the help book, ***Surfer 9***.
2. Click on the *Printing the Online Help* topic.
3. Click the 

button within the help window.
4. A prompt appears asking if you would like to *Print the selected topic* or *Print the selected heading and all subtopics*. Select *Print the selected heading and all subtopics* and then click the *OK* button. All the topics included in the online help table of contents are printed. WARNING: Printing the entire help file takes hundreds of letter-sized sheets of paper and is very time consuming to print. There is no table of contents or index printed with the file.

Getting Help

The getting started guide is a quick way to learn about the basics in **Surfer**. There are also other sources of help with **Surfer**.

Online Help

Extensive information about **Surfer** is located in the online help. To access the online help, choose the **Help | Contents** command. You can navigate help using the **Contents**, **Index**, **Search**, and **Favorites** pages in the navigation pane to the left of the topic page.

Context-Sensitive Help

Surfer also contains context-sensitive help. Highlight a menu command, window region, or dialog, press the F1 key, and help is displayed for the highlighted item. You may also access context-sensitive help by pressing SHIFT+F1 or clicking on the  button. After clicking the  button, the cursor appears like this  . Simply click the item for which help is required and the help dialog appears.

In addition, the dialog and **Properties** window contain a help button. Click the  button in the dialog title bar to obtain help for that dialog or click the *Help* button.

Clicking the  button in the **Properties** window opens the help topic for the displayed properties.

Internet Resources

There are several Internet help resources.

- Direct links to the Golden Software home page (www.goldensoftware.com), the **Surfer** product page, the knowledge base, and the Frequently Asked Questions are available by selecting **Help | Golden Software on the Web**.
- Click the *Forums* button at the top of the online help (**Help | Contents**) to post a question.
- Use the **Help | Feedback** commands to send a problem report, suggestion, or information request by email directly to **Surfer** technical support.

Technical Support

Golden Software's technical support is free to registered users of Golden Software products. Our technical support staff is trained to help you find answers to your questions quickly and accurately. We are happy to answer all of your questions about any of our products, both before and after your purchase. We also welcome suggestions for improvements to our software and encourage you to contact us with any ideas you may have for adding new features and capabilities to our programs.

Technical support is available Monday through Friday 8:00 AM to 5:00 PM Mountain Time, excluding major United States holidays. We respond to email, phone, and fax technical questions within one business day. When contacting us with your question, have the following information available:

- Your **Surfer** serial number (located in the front cover of the getting started guide or in **Help | About Surfer**)
- Your **Surfer** version number, found in **Help | About Surfer**
- The operating system you are using (i.e. Windows XP or Vista)

If you encounter problems with **Surfer**, you are welcome to send an email message to Golden Software using **Help | Feedback | Problem Report** (surfersupport@goldensoftware.com). Report the steps you perform when the problem occurs and include the full text of any error messages that are displayed. You are welcome to attach a [.ZIP] file (8 MB maximum) containing the [.SRF] file and other files that illustrate the problem. Larger files may be uploaded to our FTP site at ftp://ftp.goldensoftware.ws/incoming/Surfer/.

Contact Information

Telephone: 303-279-1021

Fax: 303-279-0909

Email: surfersupport@goldensoftware.com

Web: www.goldensoftware.com (includes FAQs, knowledge base, support forum, training videos, newsletters, downloads, and more!)

Mail: Golden Software, Inc., 809 14th Street, Golden, Colorado 80401-1866, USA

Index

M

N

O

P

R

S

T

U

V

W

X

Z