



User's Guide for Version 1.2

October 31, 1996

Introduction

3DStress is a tool for analyzing the tendency for faults and fractures to slip or dilate based on a user-specified three dimensional stress state. For a description of **3DStress**, see the **overview** section. For instructions on how to use **3DStress**, see the **table of contents**.

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3DStress User's Guide

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Overview

3DStress is a tool for computing the likelihood for a fault to slip or dilate based on three-dimensional (3D) stress conditions. **Slip tendency** is a ratio of the shear stress (τ_s) divided by the normal stress (σ_n) on a fault surface, as shown in the equation below:

$$\text{Slip tendency} = \tau_s / \sigma_n$$

Dilation tendency is the likelihood for a fault to dilate based on the 3D stress conditions and is computed as shown in the equation below:

$$\text{Dilation tendency} = (\sigma_n - \sigma_3) / (\sigma_1 - \sigma_3)$$

For additional background and details on slip tendency see the following references:

Morris, A., D. A. Ferrill, and D. B. Henderson, 1996, Slip-tendency analysis and fault reactivation, *Geology*, March 1996, v.24, no.3, p.275-278.

Morris, A. P., D. A. Ferrill, and D. B. Henderson, 1994, Slip tendency analysis and fault reactivation, *EOS, Transactions of the American Geophysical Union*, 75(44):591.

Ferrill, D. A., S. R. Young, A. P. Morris, D. B. Henderson, and R. H. Martin, 1994, 3-Dimensional stress domains interpreted from fault slip patterns in southern California and Nevada, *Geological Society of America Abstracts with Programs*, 26(7):A185.

Ferrill, D. A., A. P. Morris, D. B. Henderson, and R. H. Martin, 1994, Tectonic processes in the Central Basin and Range region. *NRC High-Level Radioactive Waste Research at CNWRA, July-December, 1994*. CNWRA 94-02S. 121-139.

For additional information about 3DStress contact:

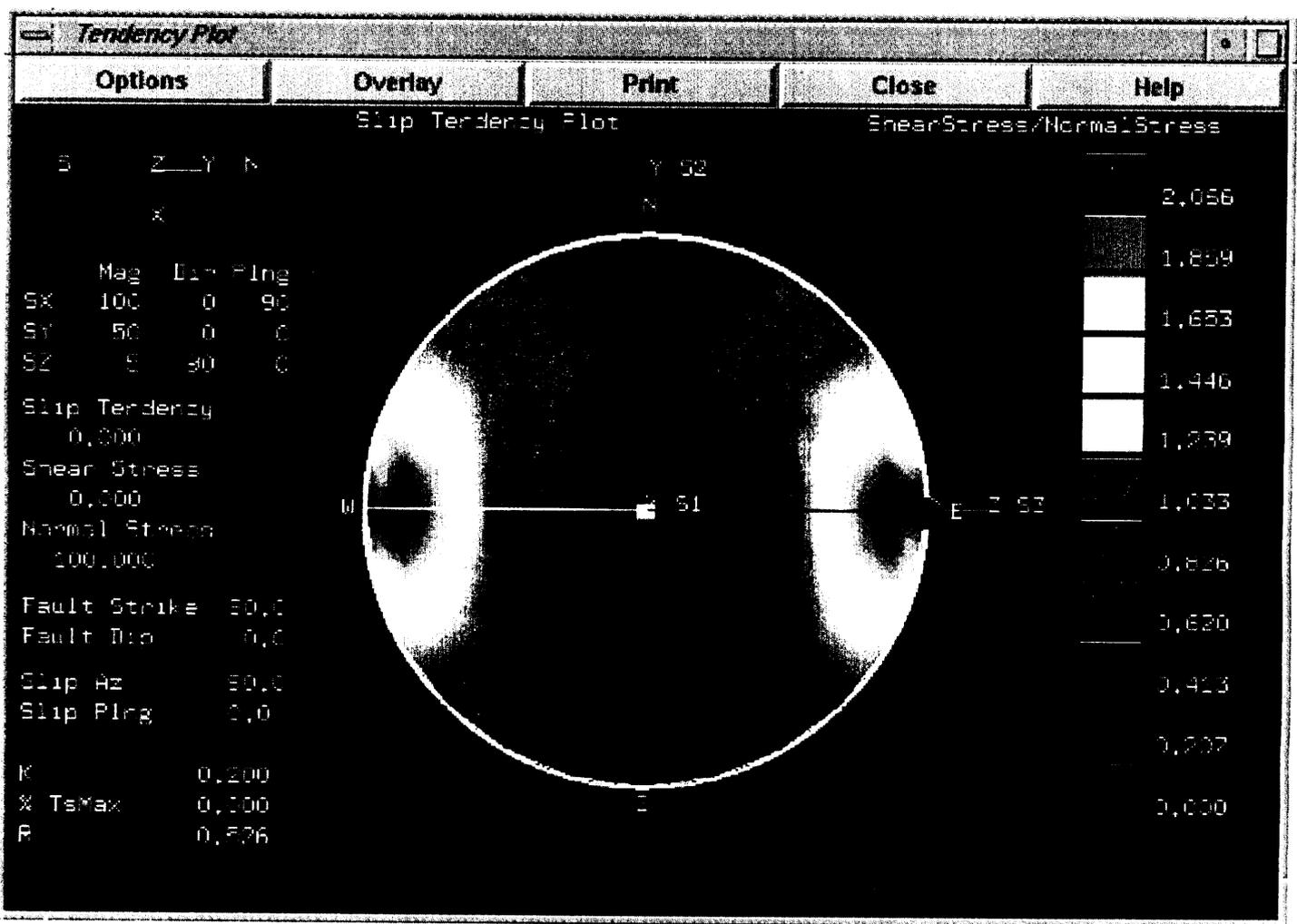
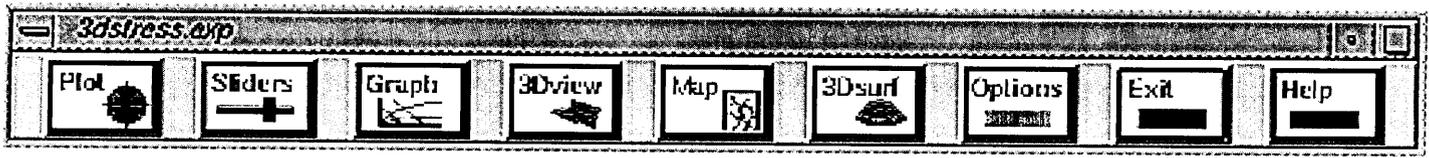
Dr. David Ferrill
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 Southwest Research Institute
 6220 Culebra Road
 San Antonio, TX 78238
 (210) 522-6082 voice (210) 522-5155 fax
 dferrill@swri.edu

Starting 3DStress

To start 3DStress from a shell window, change directories to the directory with the 3dstress executable and enter:

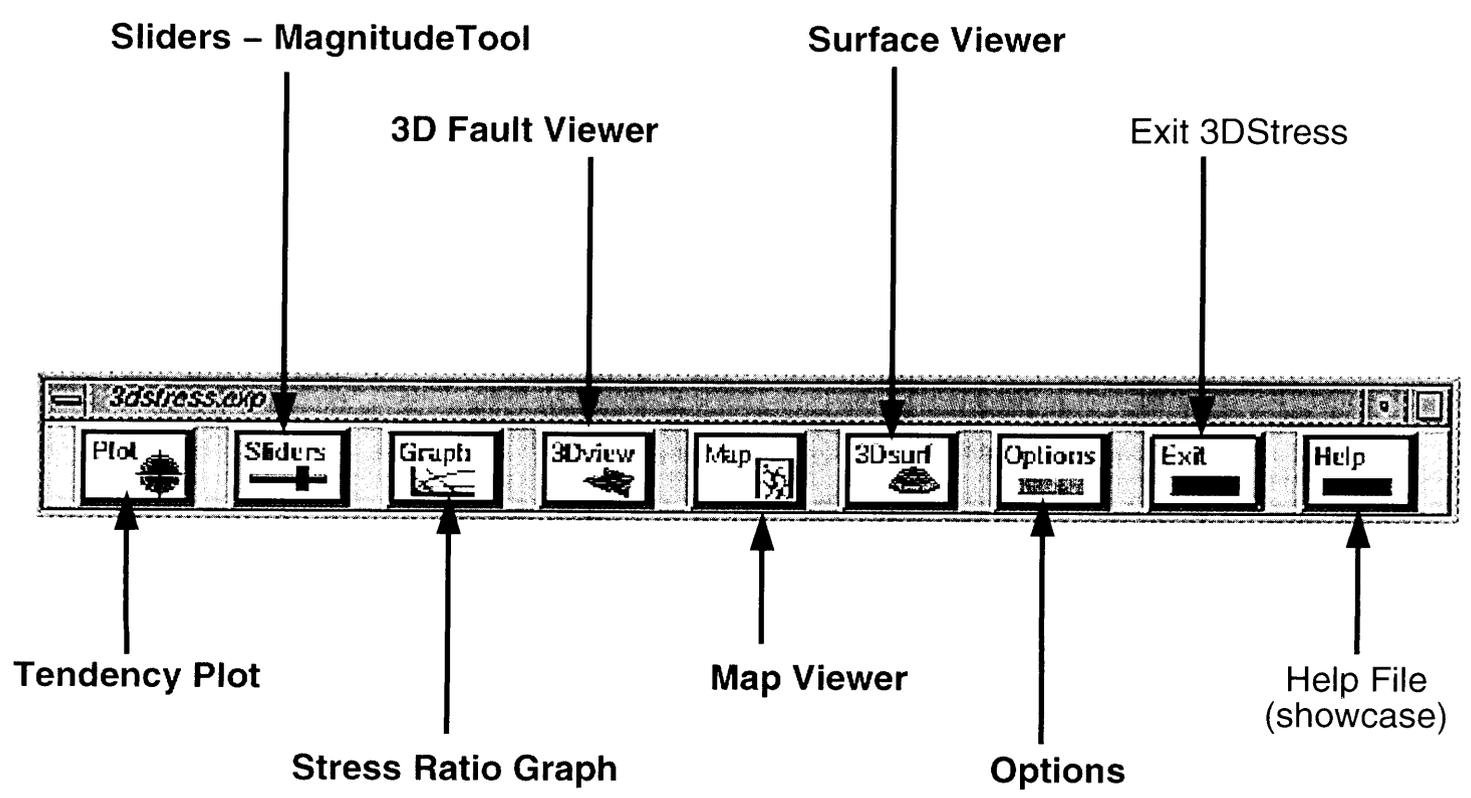
```
% 3dstress
```

Two windows similar to the ones below will appear on the display.



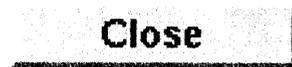
The Controller

The 3DStress controller is used to access each of the main windows by pressing the left mouse button over the desired controller button.



Common Buttons

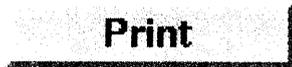
Each of the graphics windows (Tendency Plot, Stress Ratio Graph, 3D Fault Viewer, Map Viewer, Rose Diagram, and Surface Viewer) have common buttons at the top of the window with similar functions.



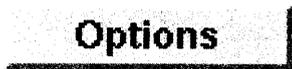
Closes the window



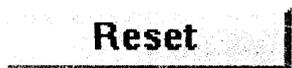
Displays a quick help file about the functions of the mouse and keyboard for that window



Saves the window to a screen raster file (Silicon Graphics rgb format)



Options that apply only to that particular window



Centers the viewer (for use in 3D Fault Viewer, Map Viewer, and Rose Diagram)

Tendency Plot

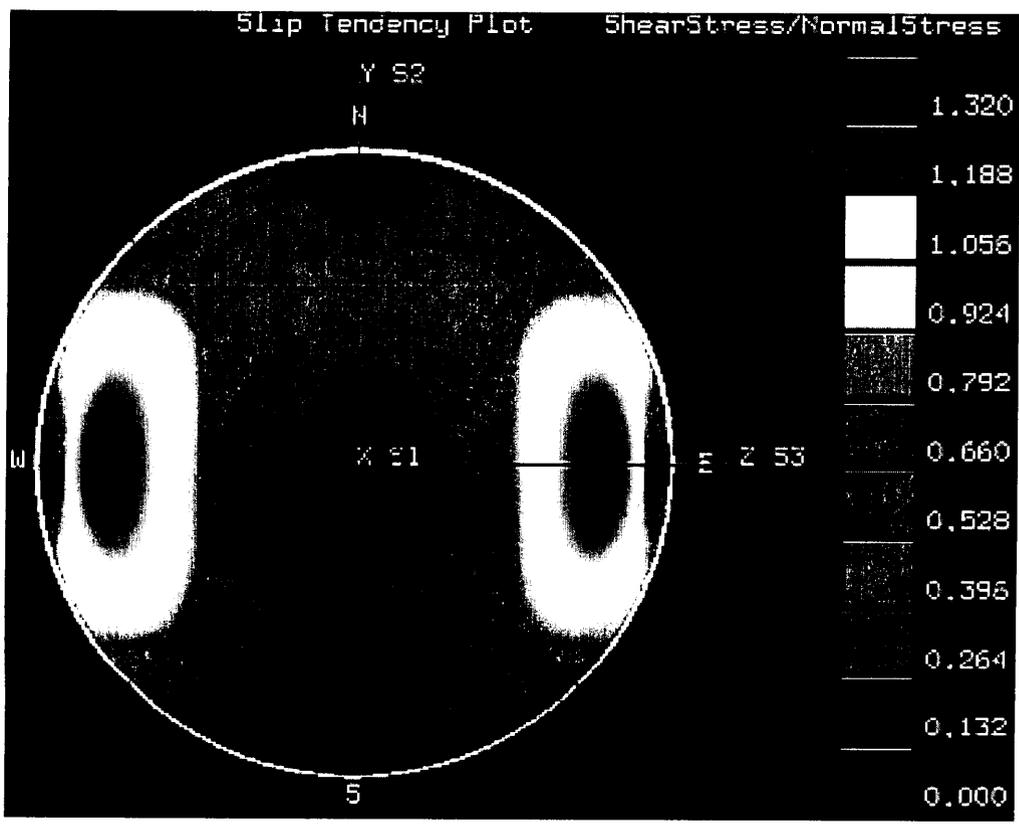
3DStress computes slip tendency based on a user-selected stress state. The stress state is defined by the magnitudes and orientations of the orthogonal stress axes called σ_x , σ_y , and σ_z . The magnitude values in 3DStress are **normalized** to range from 1 to 100. These represent compressional stresses.

The stress axis with the **greatest** magnitude is called σ_1 . The stress axis with the **smallest** magnitude is called σ_3 . The **intermediate** stress axis is called σ_2 . Any of the stress axes (σ_x , σ_y , or σ_z) can be σ_1 , σ_2 , or σ_3 depending on the user selection.

Initially, σ_x is positive in the down (vertical) direction, σ_y is positive in the north direction, and σ_z is positive in the east direction. However, the user may rotate the stress axes in other orientations (see the **Magnitude Tool** section). Only mutually orthogonal stress-axis orientations are allowed by 3DStress.

Reading Slip Tendency and Direction Values

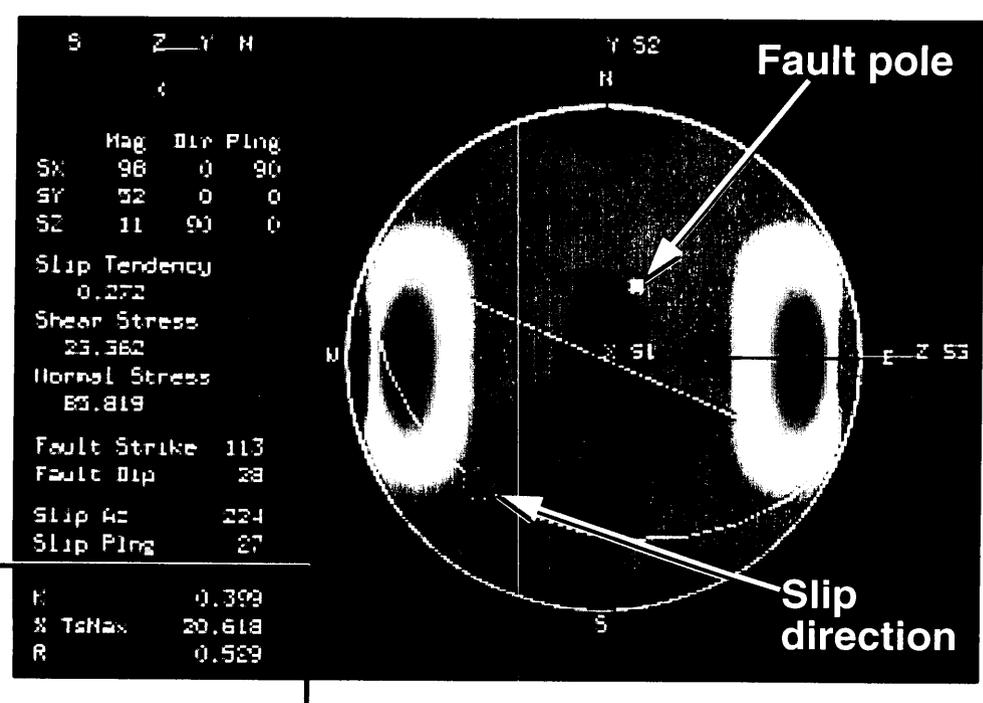
Slip tendency is displayed on a lower hemisphere equal-angle stereographic projection as shown below. Locations on the lower hemisphere plot correspond to fault surface poles. The slip tendency for a given fault pole is indicated on a color scale where **red** indicates relatively **high** slip tendency and **blue** indicates relatively **low** slip tendency.



Slip is likely to occur on a surface when the resolved shear stress equals or exceeds the frictional resistance to sliding. For more information see the references listed in the **overview** section.

Reading Slip Tendency and Direction Values (cont'd)

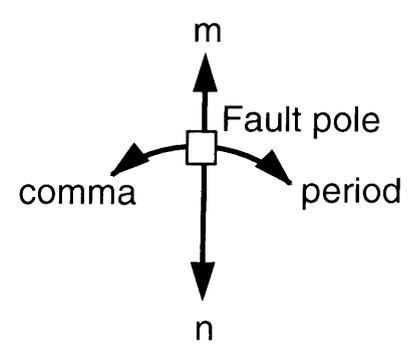
Slip direction is shown as a purple dot on the lower hemisphere plot. Slip direction is always in the plane of the fault, orthogonal to the fault pole, indicated by the white square. The user may select the fault pole by holding down the left mouse button and moving the mouse over the lower hemisphere plot or by keyboard control. For keyboard control the **comma** and **period** keys control fault pole strike while the **n** and **m** keys control dip (for additional key controls see **quick help** or select the help button on the tendency plot window).



For further explanation of K, TsMax, and R see the **Stress Ratio Graph** section.

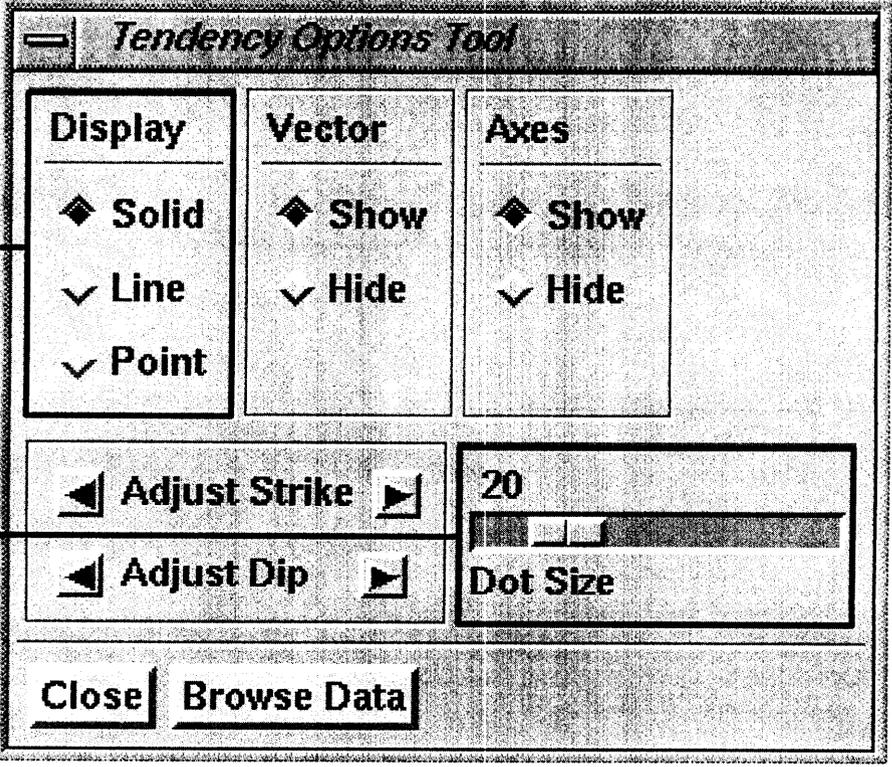
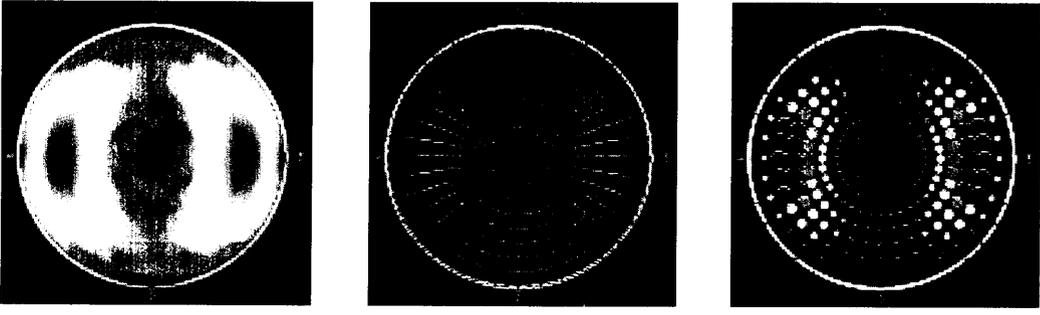
$$\%TsMax = \frac{\text{Slip Tendency for a select fault orientation}}{\text{Max Slip Tendency for all fault orientations in the current stress state}}$$

Keyboard Fault Pole Control:

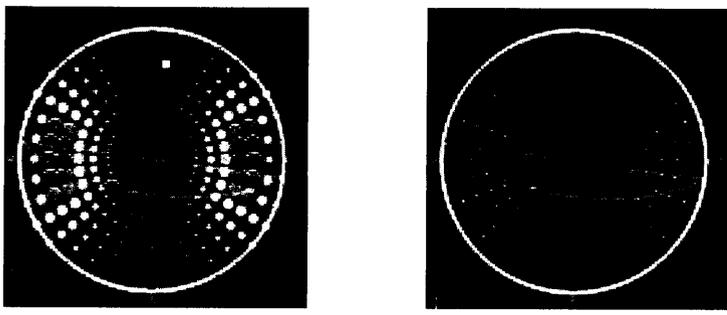


Tendency Plot Options

The **display** option allows rendering of the plot using either a **solid**, **line**, or **points** as shown below.

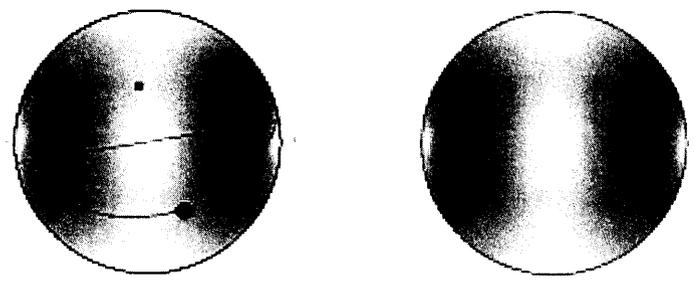


The **dot size** slider is only used with the display point mode as shown below.



Tendency Plot Options (cont'd)

The vector show and hide button controls the slip vector data display as shown below.



Tendency Options Tool

| Display | Vector | Axes |
|---|--|--|
| <input checked="" type="checkbox"/> Solid | <input checked="" type="checkbox"/> Show | <input checked="" type="checkbox"/> Show |
| <input checked="" type="checkbox"/> Line | <input type="checkbox"/> Hide | <input type="checkbox"/> Hide |
| <input type="checkbox"/> Point | | |

◀ Adjust Strike ▶

◀ Adjust Dip ▶

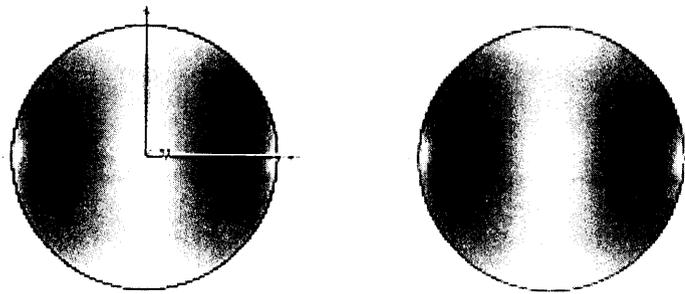
20

Dot Size

Close Browse Data

Controls the positioning of the pole.

The axes show and hide button controls the plot axes display as shown below.

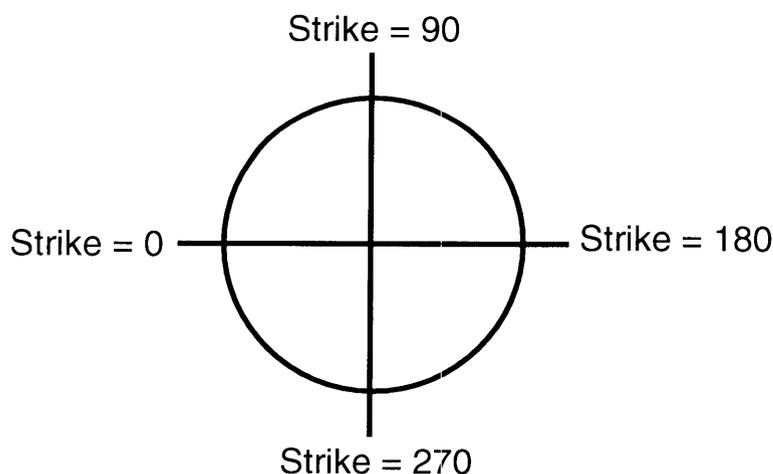


Overlaying Points on the 2D Slip Tendency Plot

Measured or pre-computed fault pole and slip vector data points may be displayed over the lower hemisphere plot. This enables comparison of measured or pre-computed data with user selected stress conditions. Measured or pre-computed data stored in an ASCII data file with the following format may be displayed with 3DStress.

```
# Comment lines begin with a "#" symbol
# Strike / dip
45 65
90 65
135 65
180 65
225 65
270 65
315 65
0 65
```

The convention used for overlay surface strike pole values is shown below:

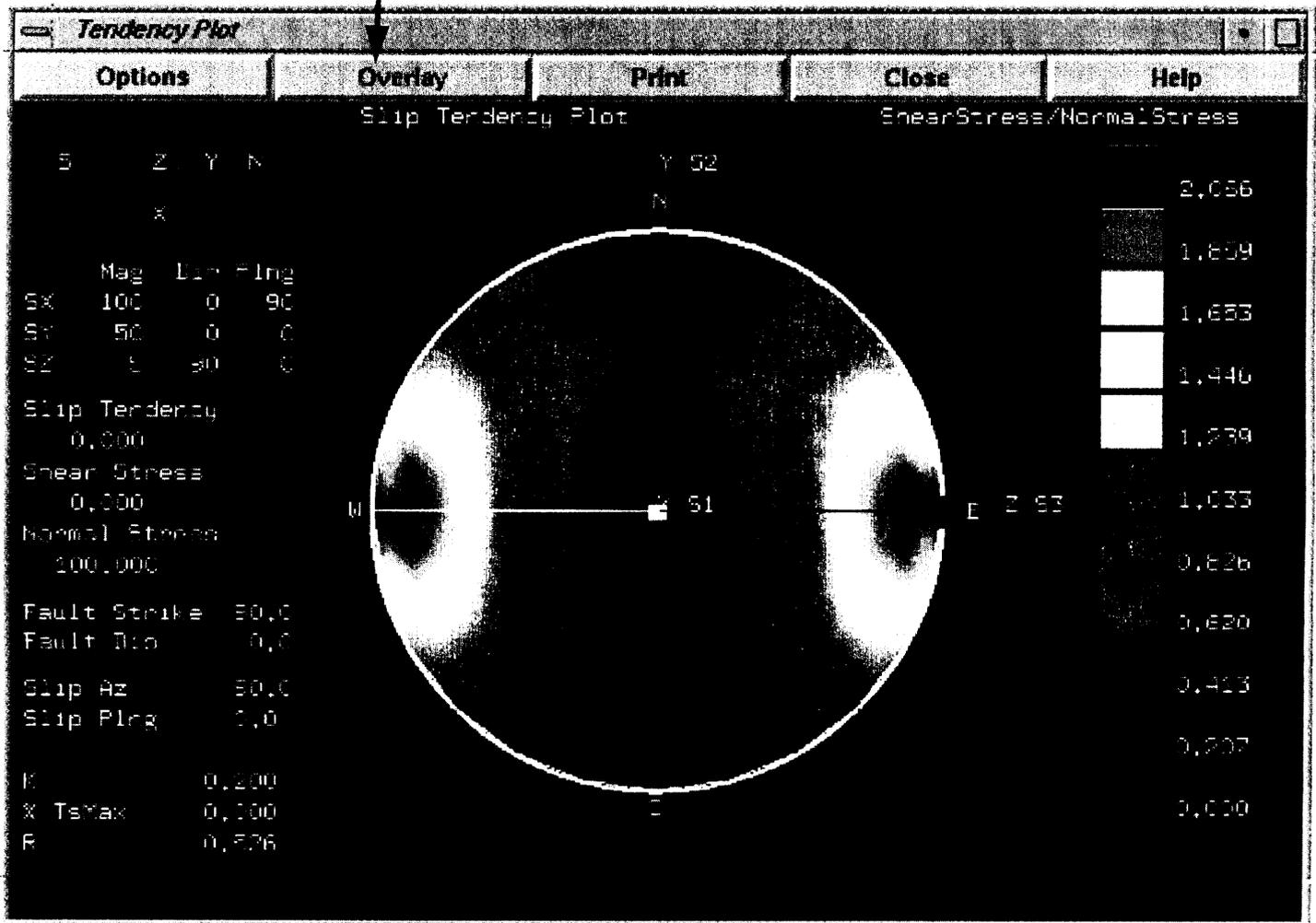


Overlay files are expected to have a file name extension of "ovr". Each overlay file may contain 1 or more data points. Multiple overlay files may be displayed simultaneously with 3DStress.

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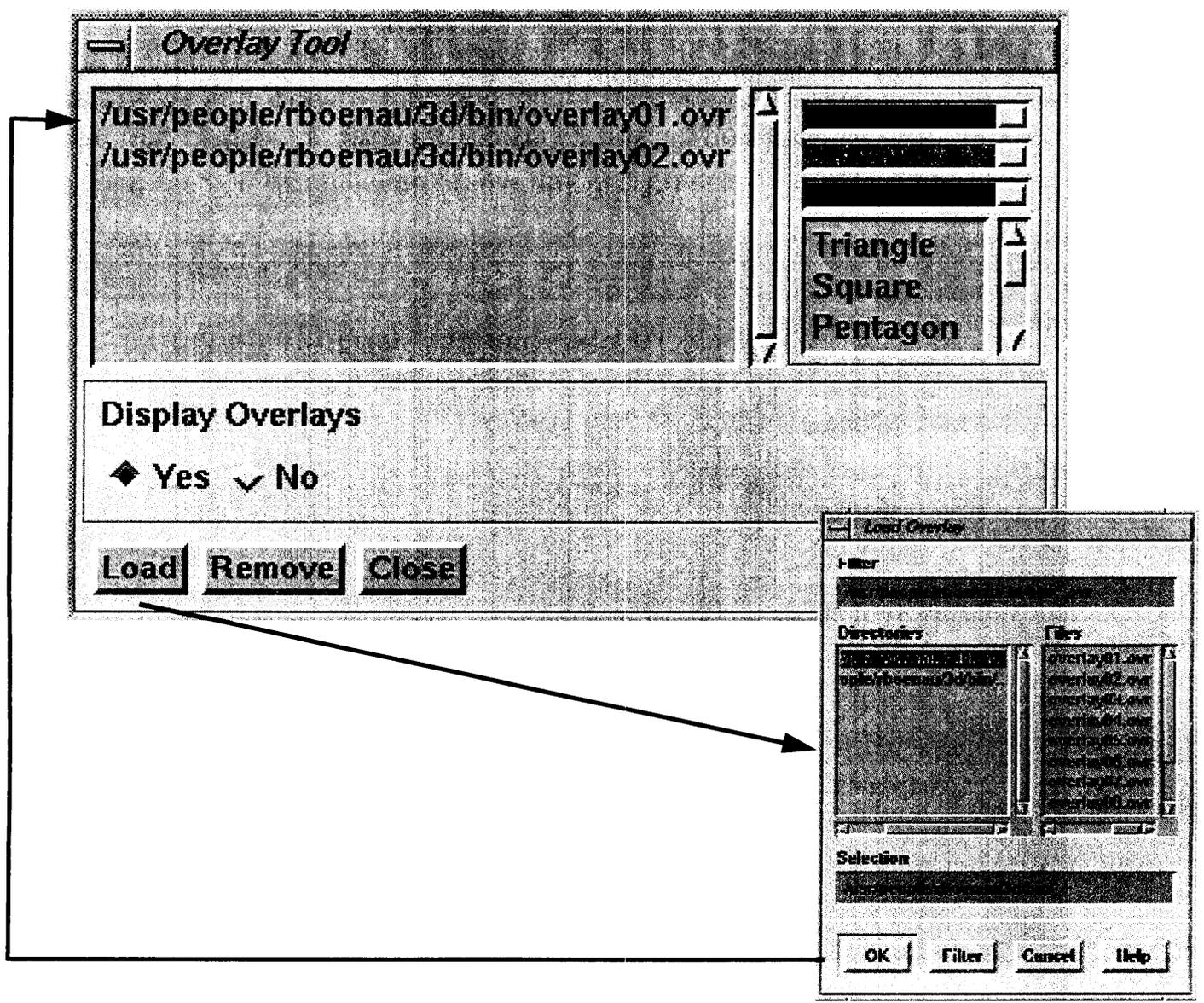
Overlaying Points on the 2D Slip Tendency Plot (cont'd)

Overlays are handled by the Overlay Tool, which is displayed by pressing the overlay button on the Tendency Plot.



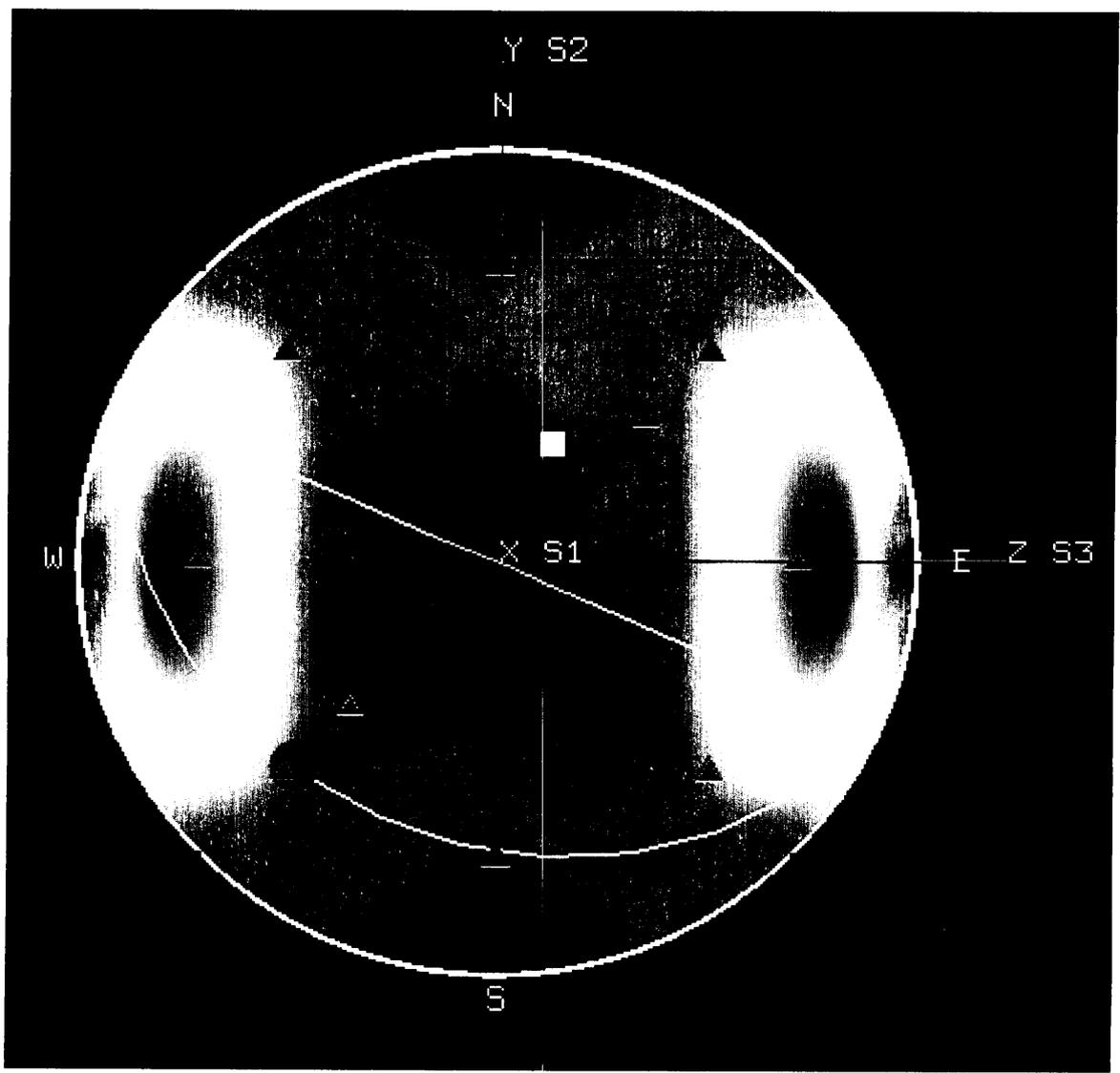
Overlaying Points on the 2D Slip Tendency Plot (cont'd)

To load an overlay file, press the **Load** button and a file selector will appear. After selecting an overlay file, the name of the file is displayed in the Overlay Tool. Each loaded overlay may be manipulated by clicking on the overlay name, then adjusting the color sliders or clicking on one of the various shapes. Removal is done in a similar fashion by selecting an overlay and pressing the **Remove** button.



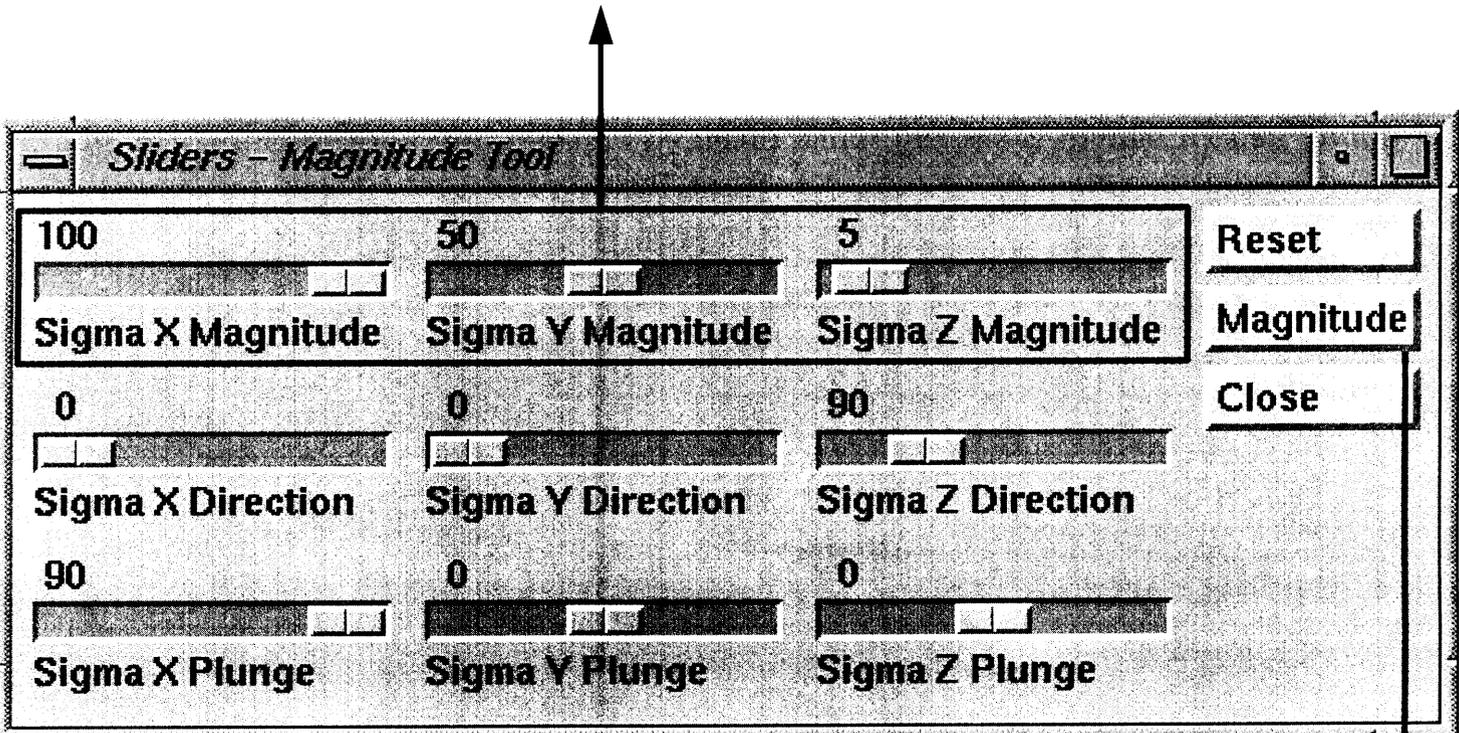
Overlaying Points on the 2D Slip Tendency Plot (cont'd)

Overlay data will appear as colored polygons on the lower hemisphere plot. All the points from a given overlay file will have the same color. Overlay data may represent fault poles or slip vectors. For example, one of the overlay datapoints (blue triangle) below is located near the current slip vector (purple circle). Clicking on an overlay with the right mouse button displays the overlay file name.

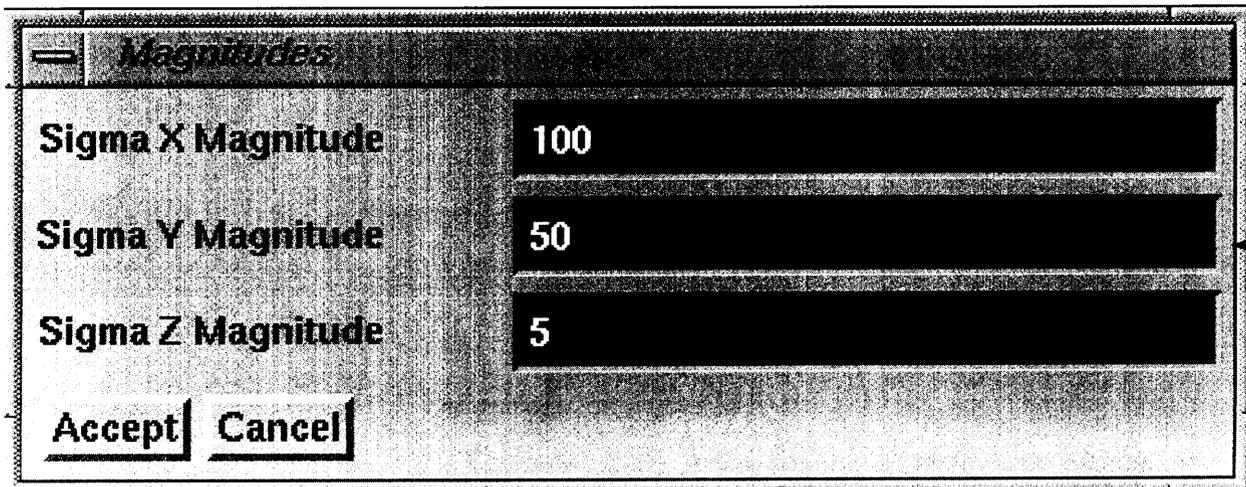


Sliders – Magnitude Tool

Stress magnitudes can be modified by using either the left or middle mouse button to select the desired normalized magnitude on the stress magnitude sliders. Input magnitudes range from 1 to 100 on each slider.



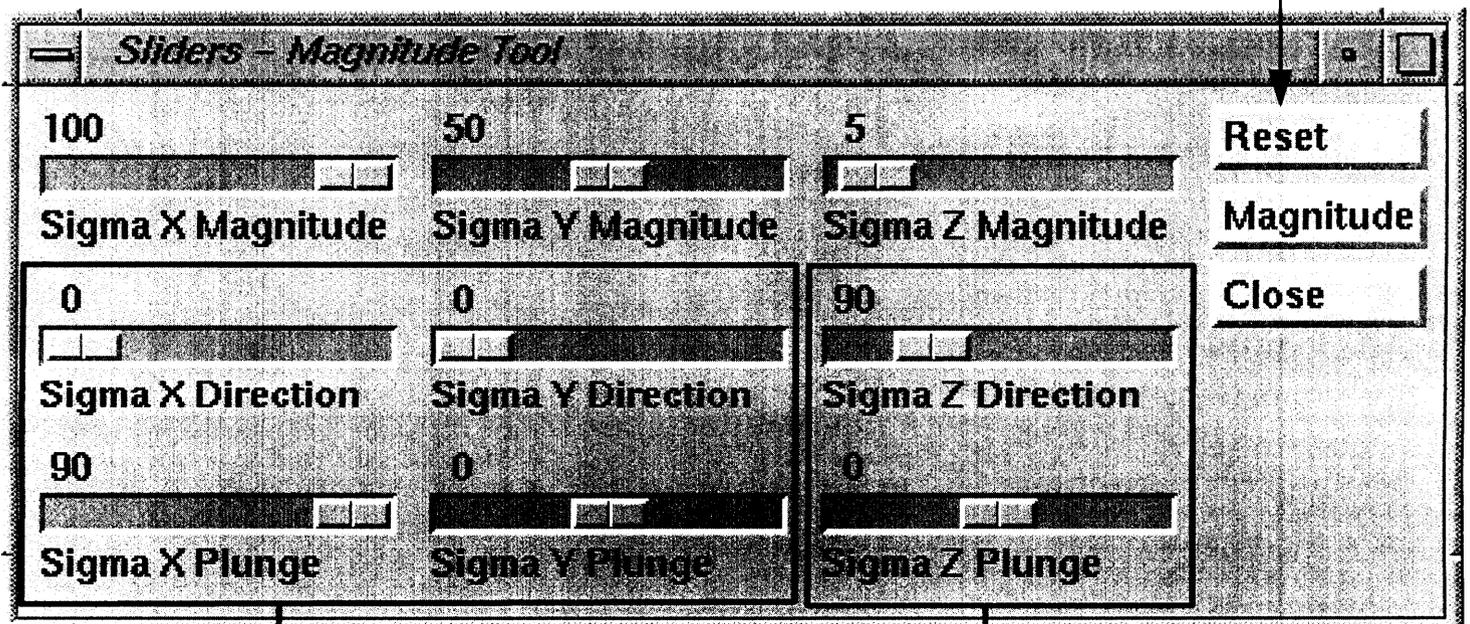
Use the magnitudes entry window to enter true magnitudes from the keyboard. The program will automatically normalize the input values to range from 1 to 100 while maintaining the correct magnitude ratios.



Sliders – Magnitude Tool Entering Stress Orientations

Stress orientations are shown in degrees and are selected by using the left and middle **mouse buttons** with the orientation control **sliders**. The labels of the first axis selected will turn **red**. The **direction** and **plunge** of the **first-selected axis** may be entered. Only **direction** changes are allowed for the **other two axes**. Pressing the **reset** button will reset the orientations and allow selection of a new first-selected axis. Directions range from 0 to 360 and plunges range from 0 to 90 in order to enable any measured or simulated 3D stress orientation.

Reset orientations by selecting the reset button.

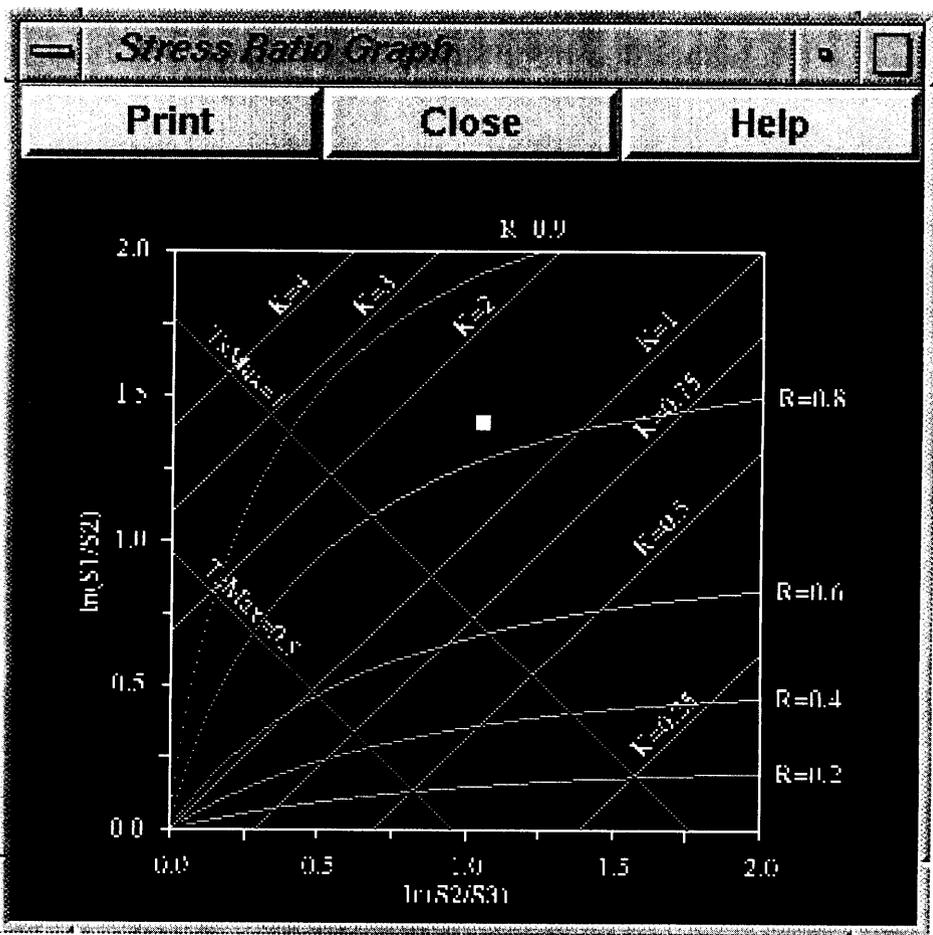


Other axes labels are **black**.
Only **directions** may be modified.

"First-selected" axis labels are **red**.
Direction and **plunge** may be modified.

Stress Ratio Graph

Use the **stress ratio graph** window to select the desired stress magnitude ratios by holding down the **left mouse button** and moving the cursor to the desired stress state and releasing the mouse button. The **right mouse button** toggles between a logarithm base 10 (log-log) and natural logarithm (ln-ln) scale.



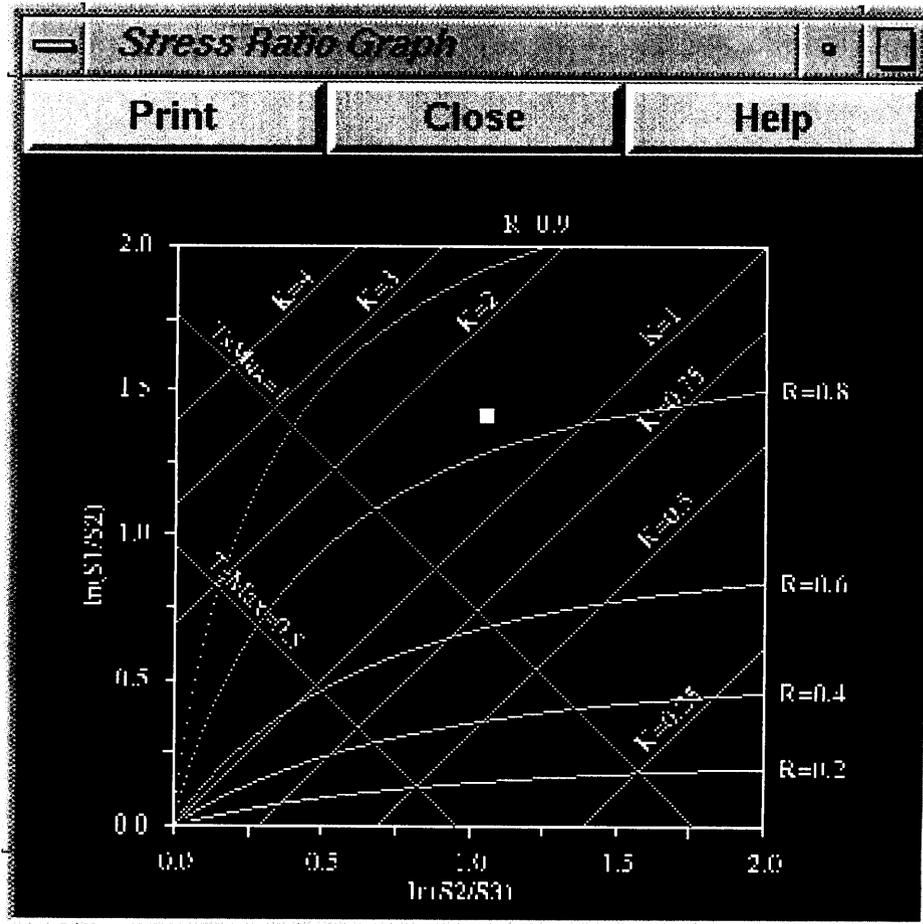
Stress Ratio Graph (cont'd)

The stress ratio graph displays a **yellow square** whose location is based on the stress ratios of σ_1 to σ_2 along the y-axis and σ_2 to σ_3 along the x-axis of the plot. σ_1 is the magnitude of the **greatest** principal stress. σ_2 is the principal stress with **intermediate** magnitude, and σ_3 is the principal stress with the **least** magnitude. In addition to showing the location of the current stress state on a logarithmic scale, the graph also shows where the current stress state lies relative to plots of the following parameters:

$$K = (\sigma_1/\sigma_2)/(\sigma_2/\sigma_3)$$

$$R = (\sigma_1 - \sigma_2) / (\sigma_1 - \sigma_3)$$

$TsMax =$ maximum slip tendency of all fault orientations for a given stress state.



Viewing 3D Fault Surfaces

Multiple 3D fault surfaces may be displayed and colored by slip tendency. Fault surface files are ASCII files with the following format.

```

# Comment lines begin with the "#" symbol
#
# mesh strip ID
# x    y    z
# .    .    .
# .    .    .
# .    .    .
# END
#
# mesh strip ID
# x    y    z
# .    .    .
# .    .    .
# .    .    .
# END
#
#
#
#
# mesh strip ID
# x    y    z
# .    .    .
# .    .    .
# .    .    .
# END
#
# END
#

```

Each block of XYZ data represents an interconnected triangular surface mesh as shown below. There must be at least 3 sets of XYZ data per mesh strip.

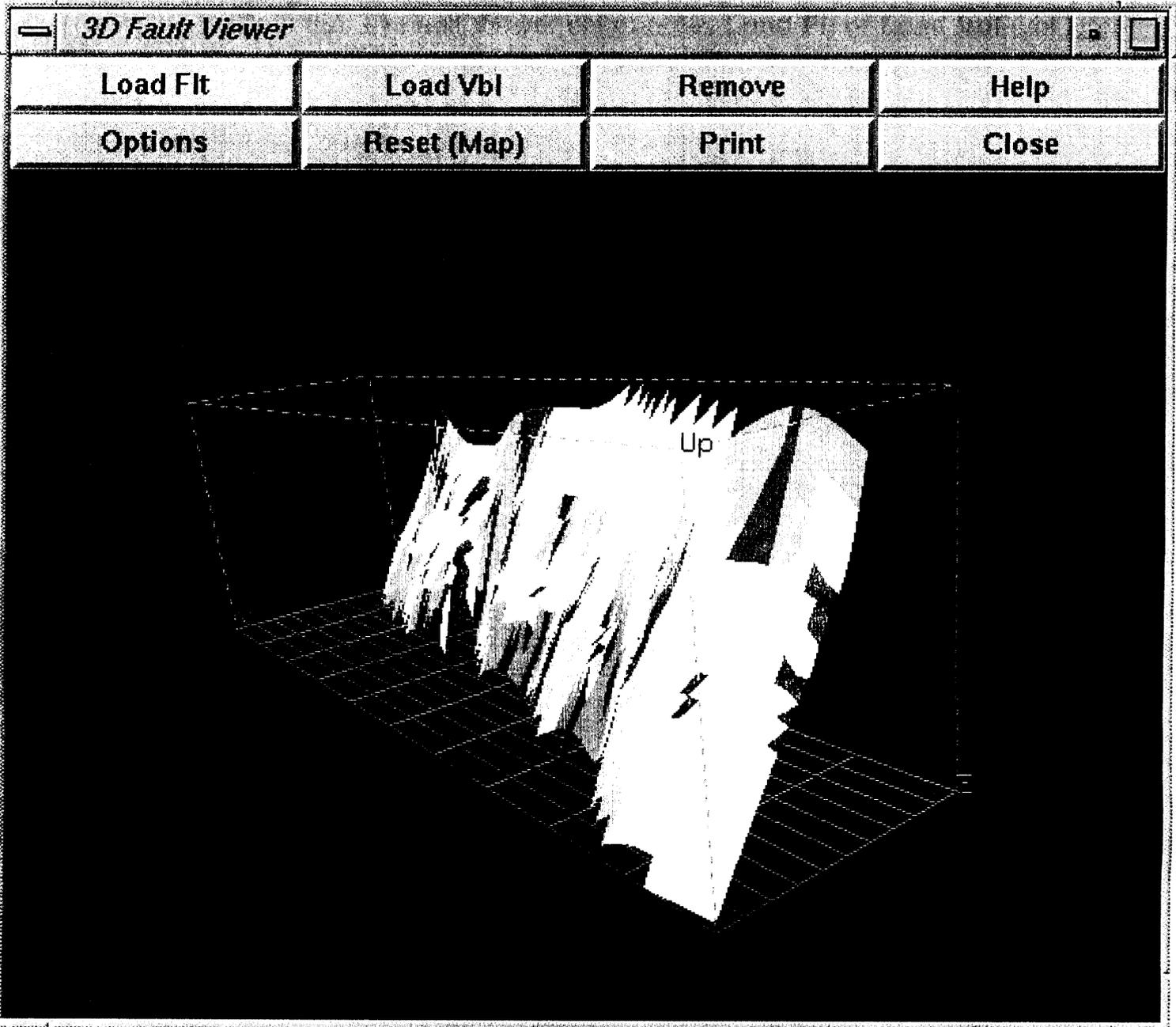
Mesh order:

2 consecutive ENDS signify end of file

Fault surface files are expected to use the file name extension "flt".

3D Fault Viewer

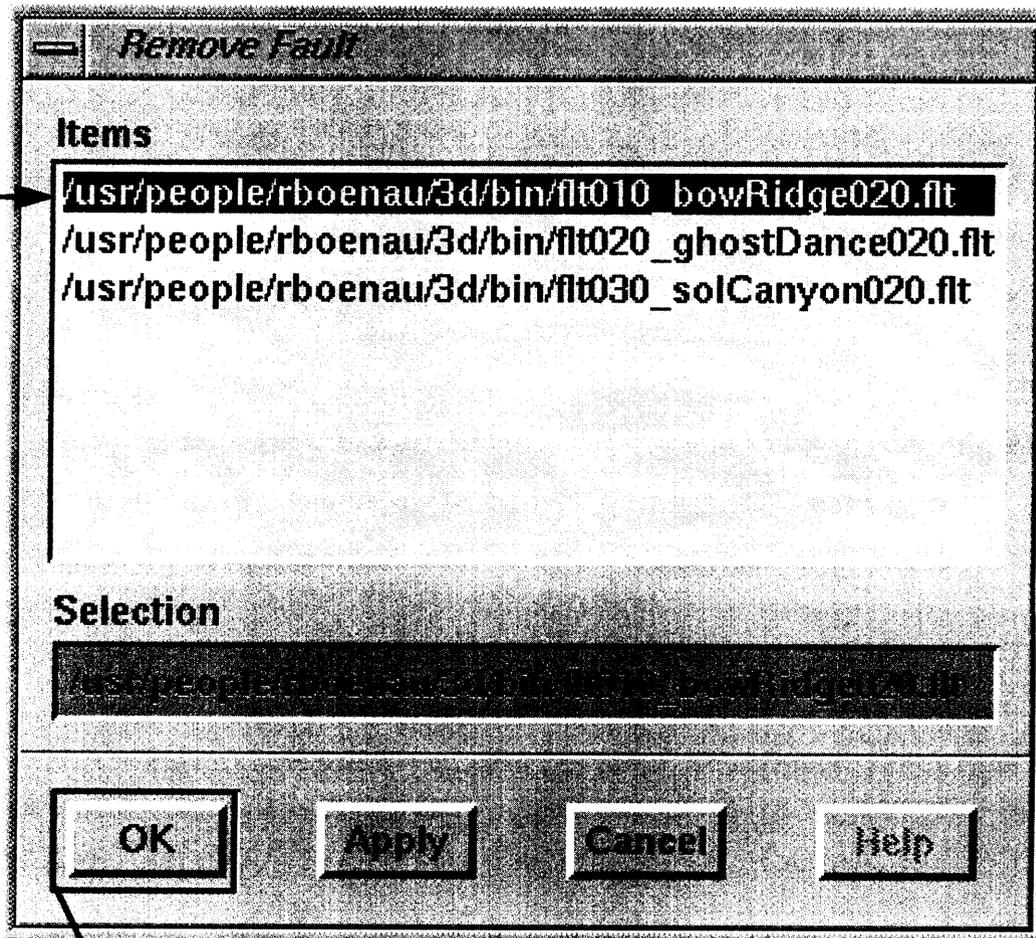
To display faults in the 3D Fault Viewer either press **Load Flt** or **Load Vbl** (vbl type files are ASCII VBL files generated by 3DMove). Use the mouse buttons to move or rotate the view of the fault. For additional information on special keyboard and mouse controls see the **quick help** section.



Removing Faults

To remove faults from the 3D Fault Viewer, press the **Remove** button. A window listing all of the files is displayed, similar to below. Select the fault to remove by clicking on the name of the fault with the mouse and press the **OK** button.

Selected fault to be removed



Press OK to remove fault

3D Fault Viewer Options

Viewer Options Tool

| | | |
|---|---|--|
| Select Mode <input checked="" type="checkbox"/> On <input checked="" type="checkbox"/> Off | Rotate Mode <input checked="" type="checkbox"/> On <input checked="" type="checkbox"/> Off | <input type="checkbox"/> Average Mode <input type="checkbox"/> Show Axis <input type="checkbox"/> Orthographic <input checked="" type="checkbox"/> Highlight Mode |
|---|---|--|

| | | |
|---|--|-------------------------------------|
| Reset Mode <input checked="" type="checkbox"/> Map View <input checked="" type="checkbox"/> N→S View <input checked="" type="checkbox"/> S→N View | <input checked="" type="checkbox"/> E→W View <input checked="" type="checkbox"/> W→E View | 1 Axis Length 1 Axis Width |
|---|--|-------------------------------------|

```
usr/people/boonea/3d/bin/ff010_bowridge020.fl  
usr/people/boonea/3d/bin/ff020_ghostDance020.fl  
usr/people/boonea/3d/bin/ff030_valCanyon020.fl
```

| | | |
|---|--|---|
| Apply to <input checked="" type="checkbox"/> All <input checked="" type="checkbox"/> Selected Clear Select | Display <input checked="" type="checkbox"/> Solid <input checked="" type="checkbox"/> Line <input checked="" type="checkbox"/> Point | 1 Vector Length 1 Vector Width |
|---|--|---|

| | |
|--|--|
| <input checked="" type="checkbox"/> Show slip vector [Slider] [Slider] [Slider] | <input checked="" type="checkbox"/> Show normal vector [Slider] [Slider] [Slider] |
|--|--|

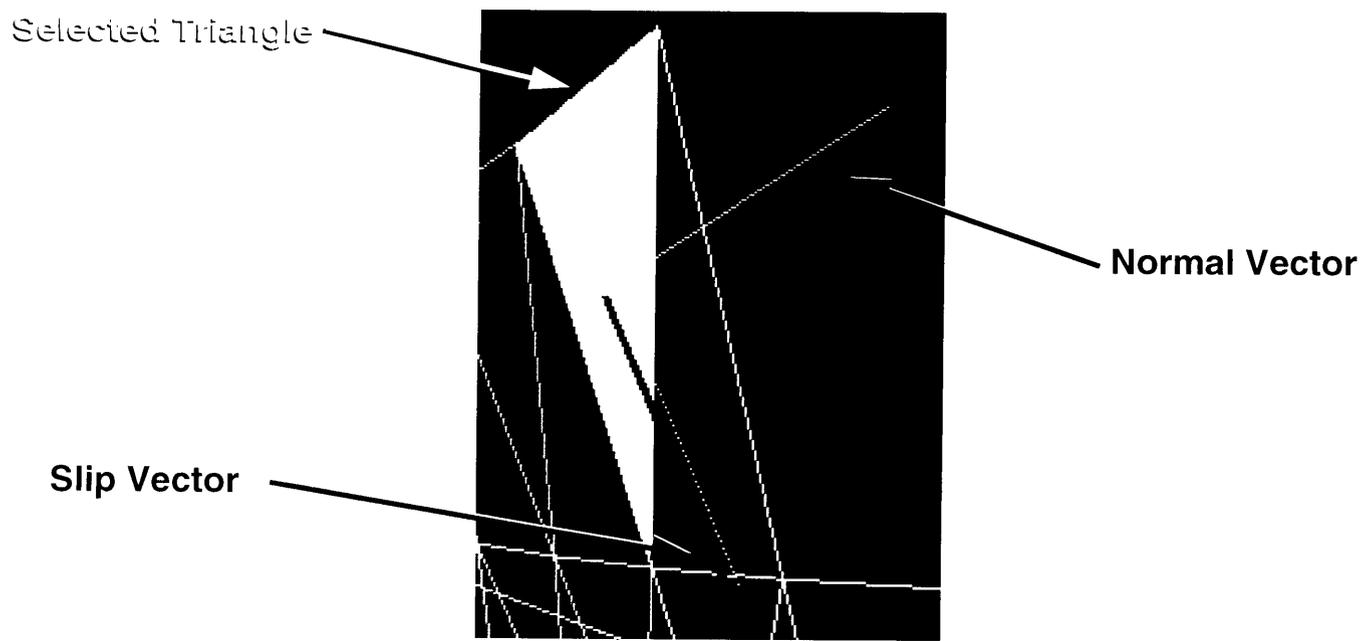
Close | **Browse Data**

3D Fault Viewer Options (cont'd)

When select mode is on, individual triangles that comprise the fault may be selected using the left mouse key and positioning the cursor over the region. Selecting the triangle again will deselect it. While in select mode, the center coordinates of the last selected triangle are displayed near the bottom of the window.

The orientation of the selected triangle is used to update the displayed fault orientation in the Tendency Plot window. Triangles can also be selected in the Tendency Plot window by moving the mouse cursor to the desired fault orientation and pressing the middle mouse button. For each selected triangle, the normal and slip vectors are displayed as shown below.

| | | |
|---|---|--|
| Select Mode <input checked="" type="checkbox"/> On <input checked="" type="checkbox"/> Off | Rotate Mode <input checked="" type="checkbox"/> On <input checked="" type="checkbox"/> Off | <input type="checkbox"/> Average Mode <input type="checkbox"/> Show Axis <input type="checkbox"/> Orthographic <input checked="" type="checkbox"/> Highlight Mode |
| Reset Mode <input checked="" type="checkbox"/> Map View <input checked="" type="checkbox"/> E->W View <input checked="" type="checkbox"/> N->S View <input checked="" type="checkbox"/> W->E View <input checked="" type="checkbox"/> S->N View | | 1  Axis Length 1  Axis Width |



3D Fault Viewer Options (cont'd)

Changes how the viewer is rotated with the right mouse button.

Averages all of the slip vectors, taking the surface of the triangle into account. The average is displayed at the bottom of the window.

The screenshot shows a menu with several sections:

- Select Mode:**
 - On
 - Off
- Rotate Mode:**
 - On
 - Off
- View Modes (checkboxes):**
 - Average Mode
 - Show Axis
 - Orthographic
 - Highlight Mode
- Reset Mode:**
 - Map View
 - E->W View
 - N->S View
 - W->E View
 - S->N View
- Axis Length:**
 - 1
 - [Progress bar]
- Axis Width:**
 - 1
 - [Progress bar]

Toggles between a perspective and orthographic view. Select mode may not be used while in orthographic mode.

Toggles the highlighting of triangles when they are selected.

Changes how the viewer is centered when the **reset button** is pressed.

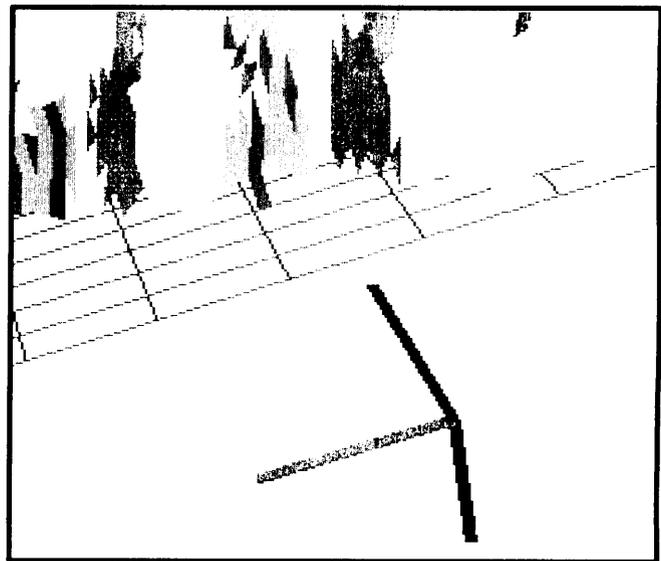
3D Fault Viewer Options (cont'd)

| | | |
|-------------------------------------|-------------------------------------|---|
| Select Mode ✓ On ◆ Off | Rotate Mode ◆ On ✓ Off | <input type="checkbox"/> Average Mode <input checked="" type="checkbox"/> Show Axis <input type="checkbox"/> Orthographic <input checked="" type="checkbox"/> Highlight Mode |
|-------------------------------------|-------------------------------------|---|

Toggles the showing of the axis in the lower right hand corner of the window

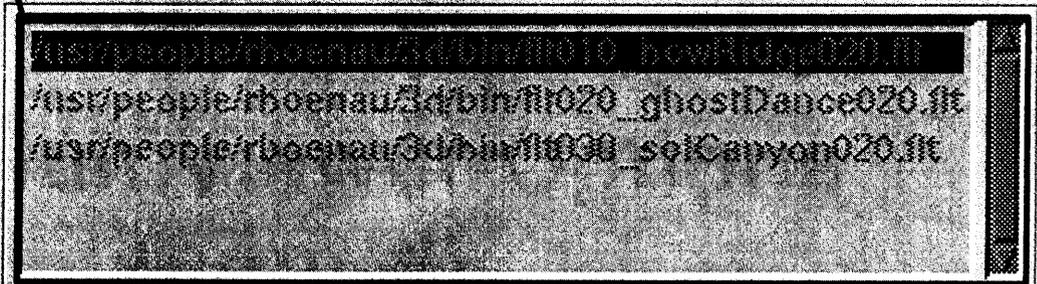
| | | |
|---|--------------------------|-------------------------------------|
| Reset Mode ◆ Map View ✓ N→S View ✓ S→N View | ✓ E→W View ✓ W→E View | 1 Axis Length 1 Axis Width |
|---|--------------------------|-------------------------------------|

Changes the length and width of the axis lines

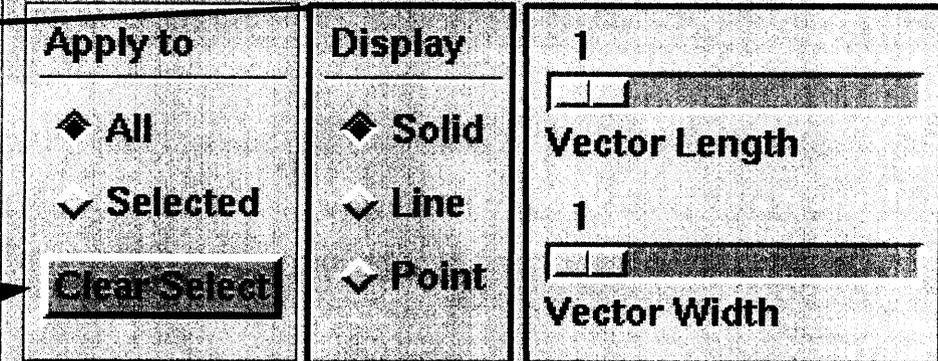


3D Fault Viewer Options (cont'd)

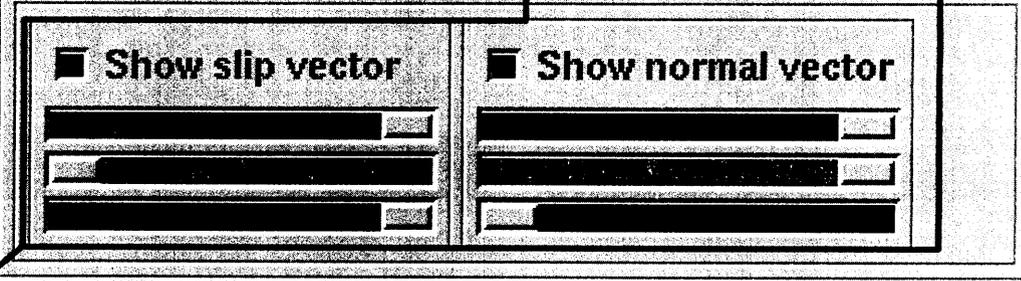
Listing of each loaded file



Changes the rendering mode of the faults using either a solid, line, or point style



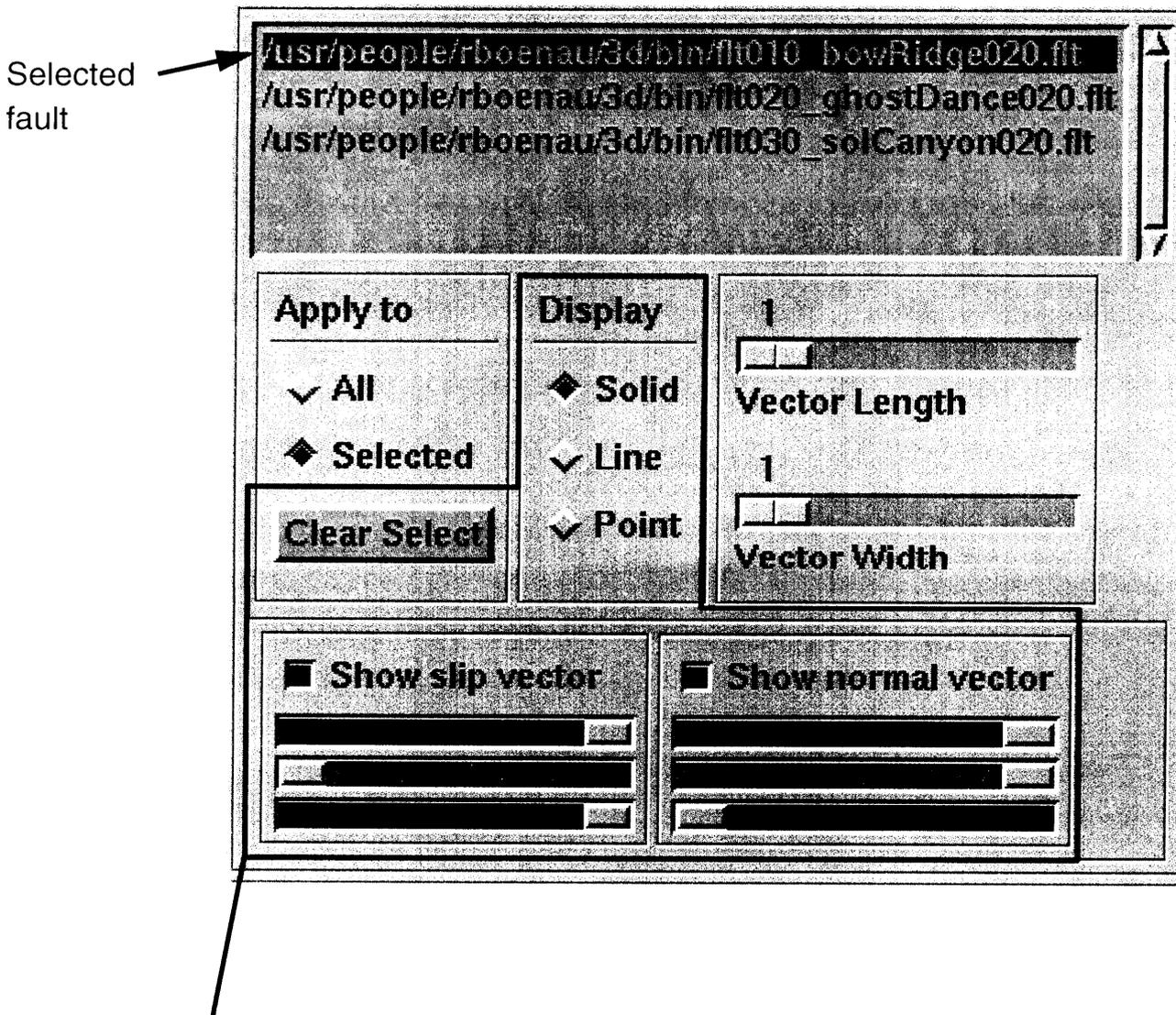
Clears all of the selected triangles



Changes the length, widths, and colors of all the normal and slip vectors

3D Fault Viewer Options (cont'd)

When Selected is used in the Apply box, each fault is treated separately. To change a field in a fault, the fault file must be selected in the fault file listing. Vector length and width may not be used to change the vectors in each individual fault file.



Effects only the selected fault

Viewing 2D Fault Traces

Fault traces may be displayed and colored by slip tendency in 3DStress. Fault trace files are ASCII files with the following format.

```

# Comment lines begin with the "#" symbol
#
# line ID
# x      Y
# .      .
# .      .
# .      .
# x      Y
# END
#
# line ID
# x      Y
# .      .
# .      .
# .      .
# x      Y
# END
#
#
#
# line ID
# x      Y
# .      .
# .      .
# .      .
# x      Y
# END
# END

```

Each block of XY data represents an interconnected line segment. There must be at least 2 sets of XY data per line segment.

Two consecutive ENDS signifies the end of the file

```

100
3450      78000
3650      79120
3780      79345
END

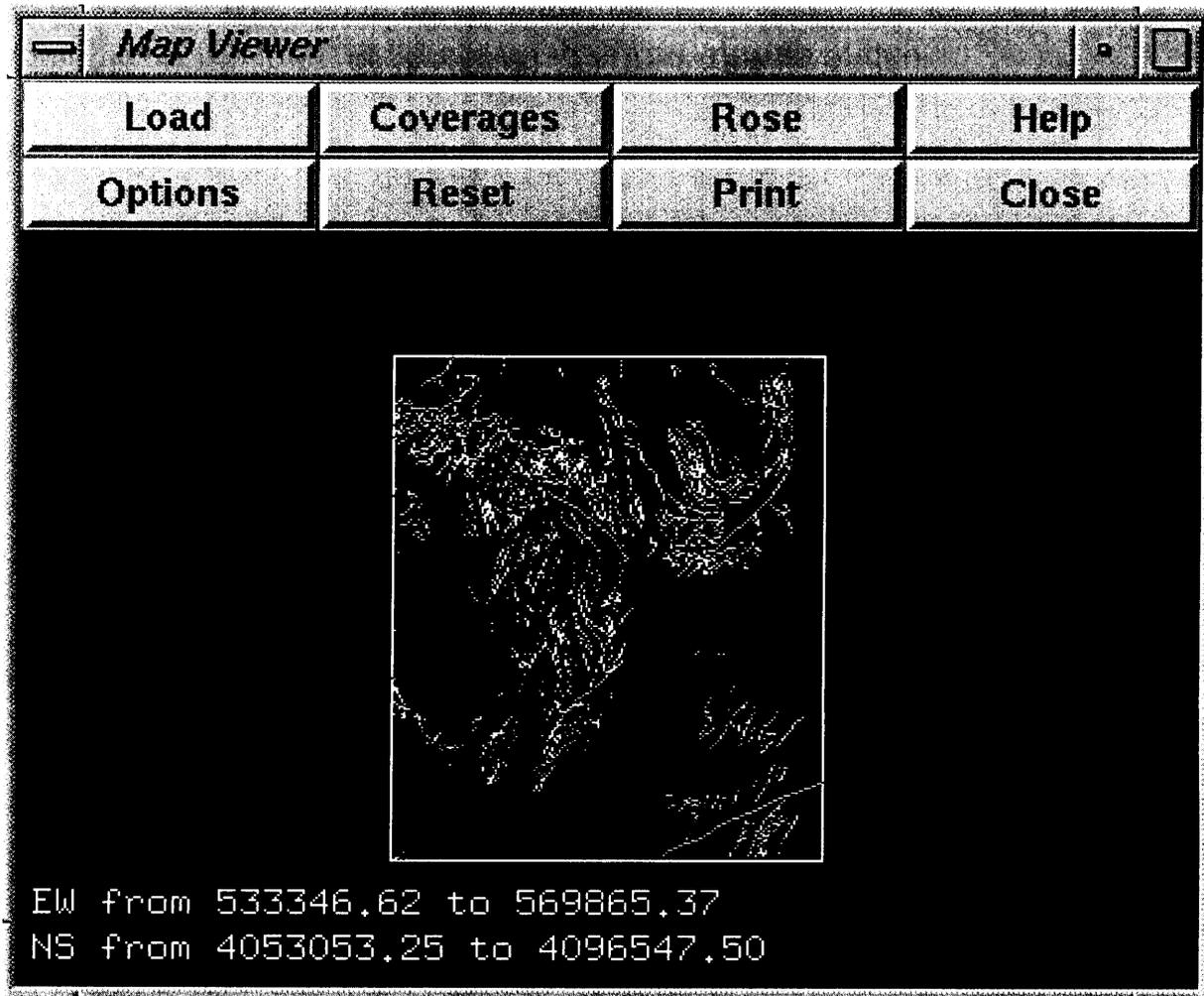
200
4390      77645
4480      78520
END
END

```

Fault trace files are expected to use the file name extension "lin".

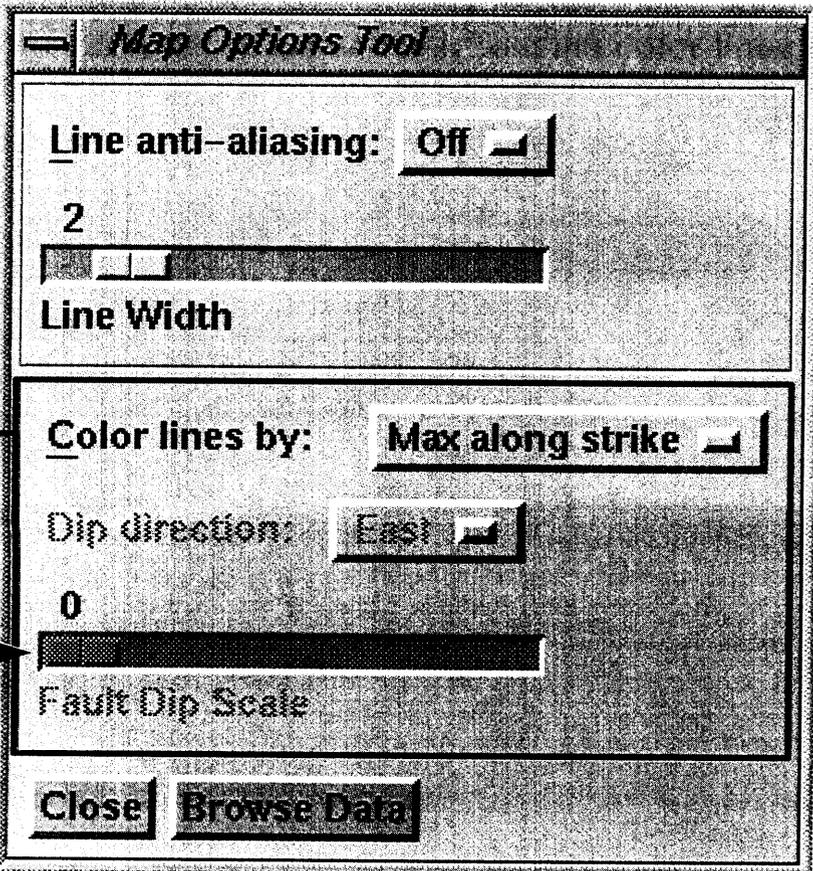
Map Viewer

Fault trace file may be loaded using the **load button** on the map viewer. Only one fault trace file may be displayed at a time. The fault trace is automatically colored by slip tendency. The tendency of a fault can be displayed in the Tendency Plot by positioning over the fault and pressing the **right mouse** button.



Map Viewer Options

The **color lines by max along strike** or **fault dip scale** controls the coloring of fault traces. When the **max along strike** mode is selected, fault traces are colored by the maximum tendency for all dip values at the same strike orientation as the fault trace. This method may be desirable when fault dip information is not known. An alternate method of coloring fault traces is to use the **fault dip scale** mode. In this case, the user may select a dip value so that fault traces are colored by the tendency for the selected dip at the strike orientation of the fault trace. The **dip direction** option is used only with the **color lines by dip scale** mode. This option enables the user to select the dip direction of the fault pole as either **east** or **west** for all fault traces. When the dip direction is east, east–west fault traces are given a south dip direction. When the dip direction is west, east–west fault traces are given a north dip direction.

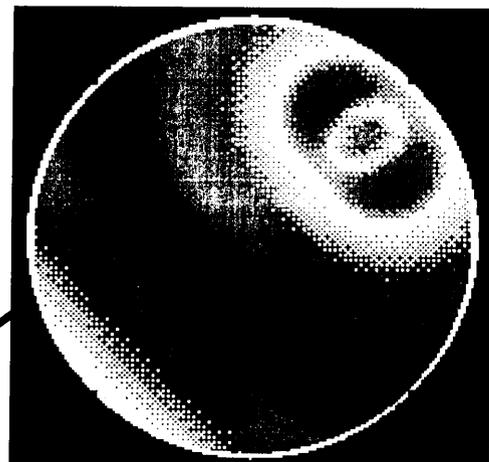
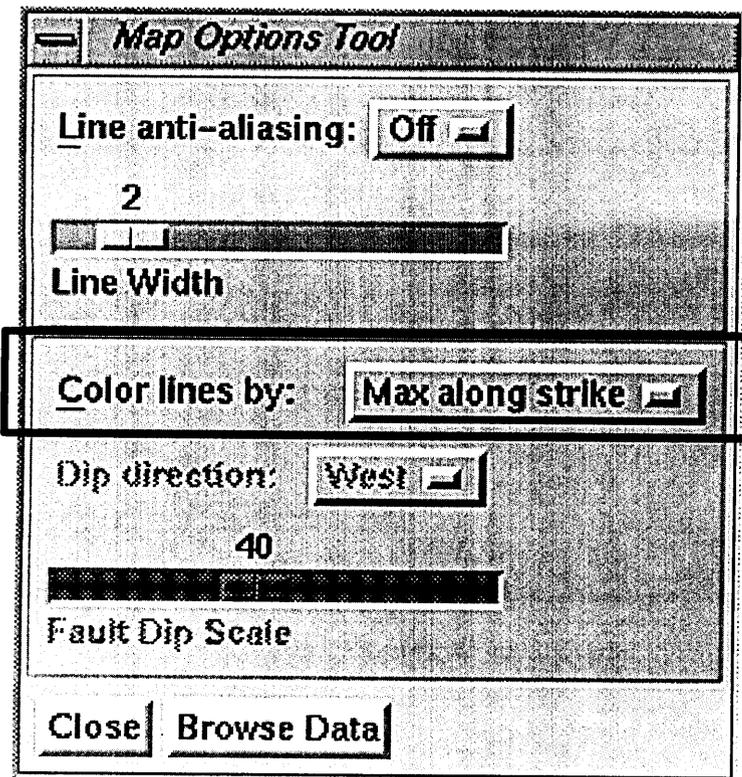
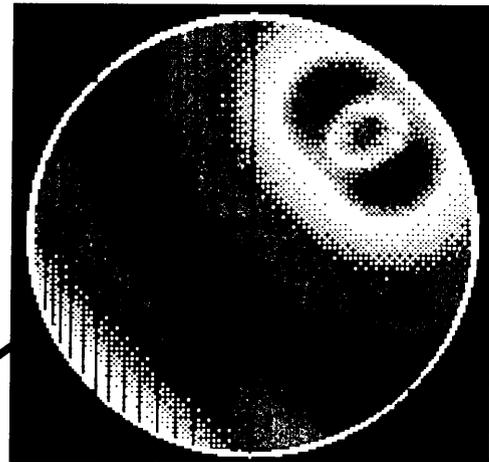
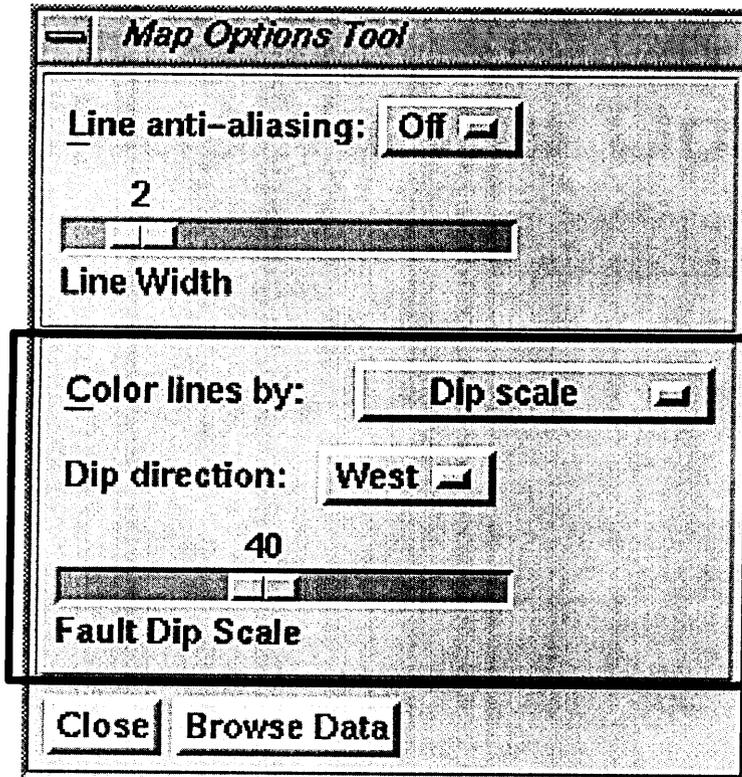


For an example of each type of color control mode see the next page.

The **fault dip scale** may only be used when the **color lines by fault dip scale** mode is selected as described above. The slider is used to select a fault dip value that is used for all fault traces.

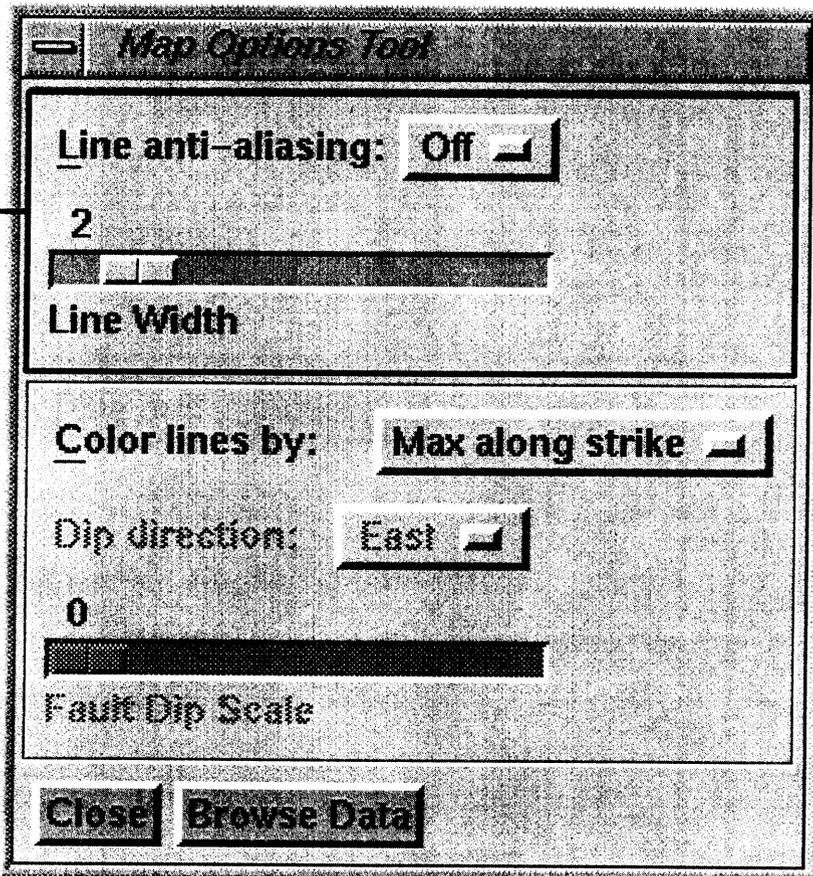
Map Viewer Options (cont'd)

Two color control examples are shown below.



Map Viewer Options (cont'd)

The **line anti-aliasing on** or **off** button is used to control the appearance of fault trace lines. Use of anti-aliasing on some computer workstations may result in **slower** program performance. Use the line width slider to increase the width of the fault trace lines.



Anti-aliasing on

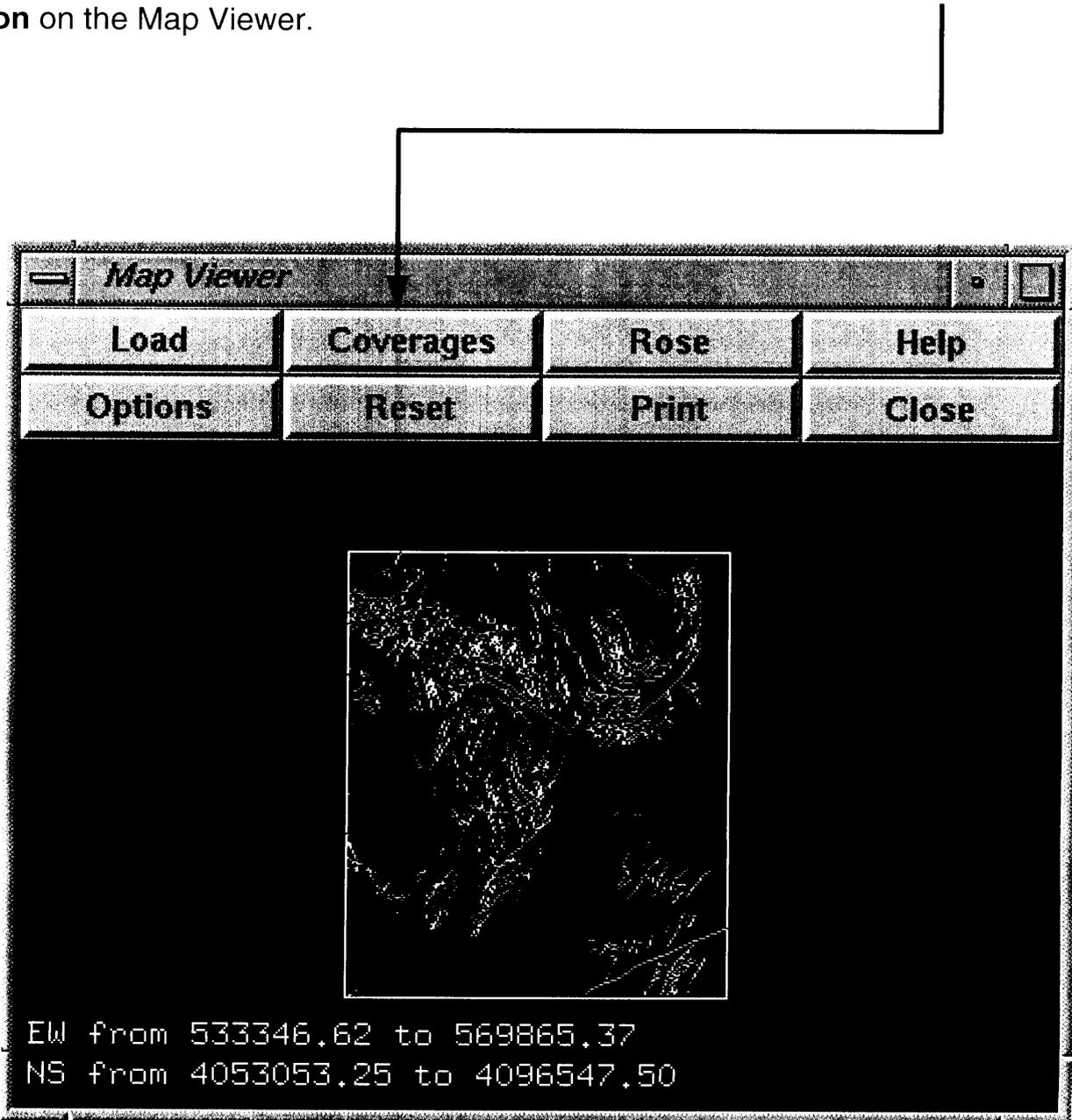


Anti-aliasing off



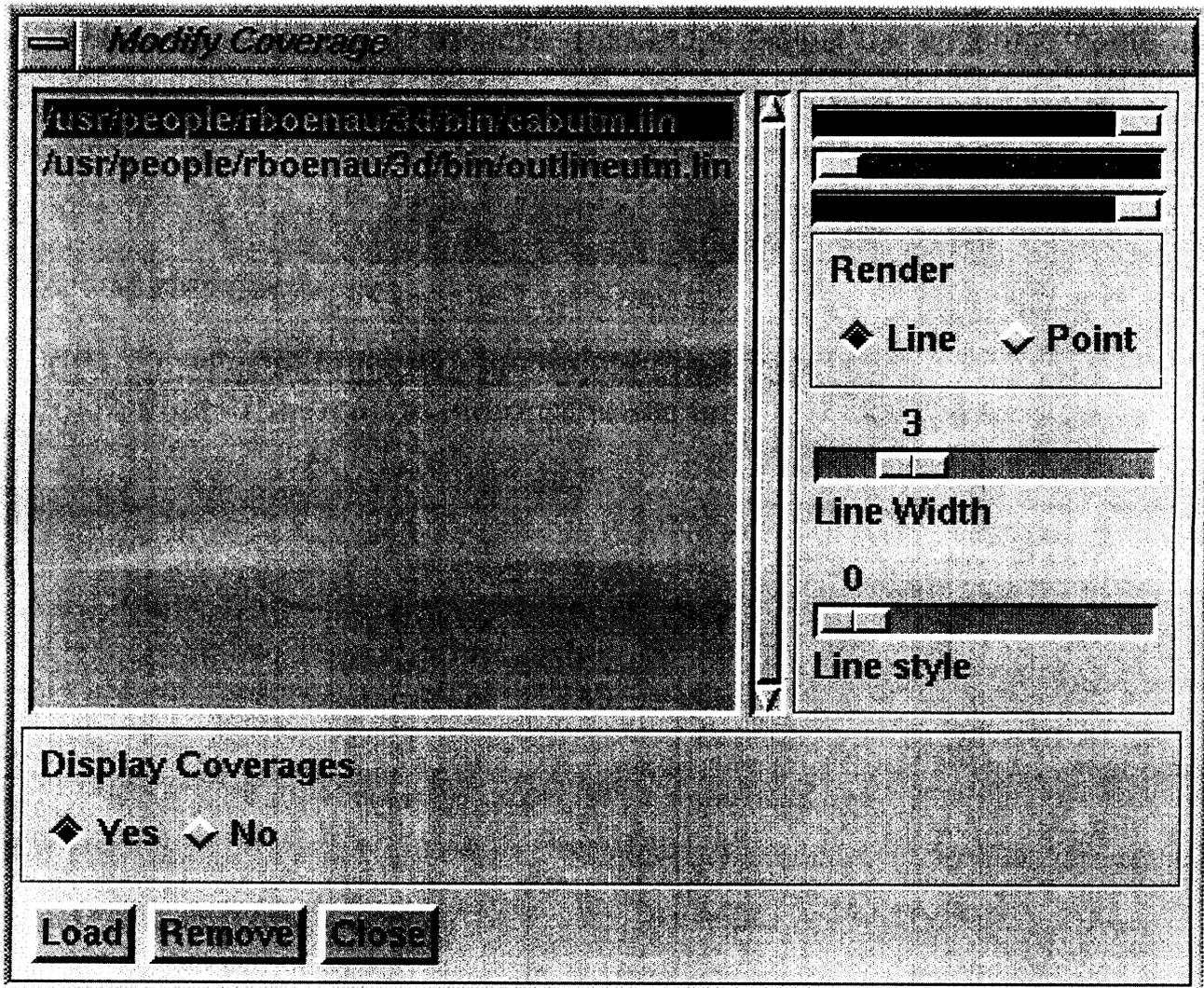
Coverages

Coverages can be used to denote boundaries, wells, borders, scale bars, etc. They are handled by the Coverage Tool that is displayed by pressing the **Coverages** button on the Map Viewer.



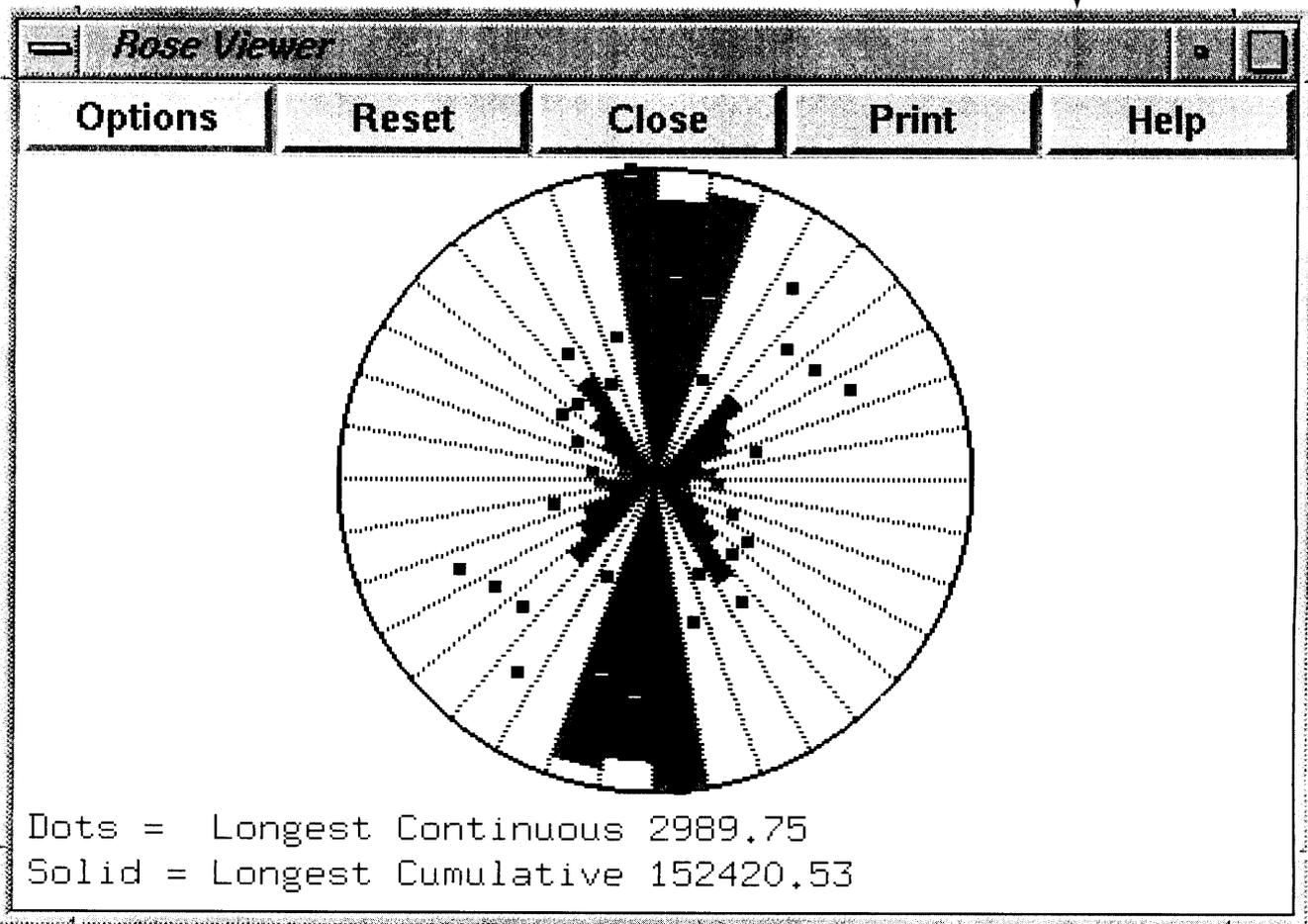
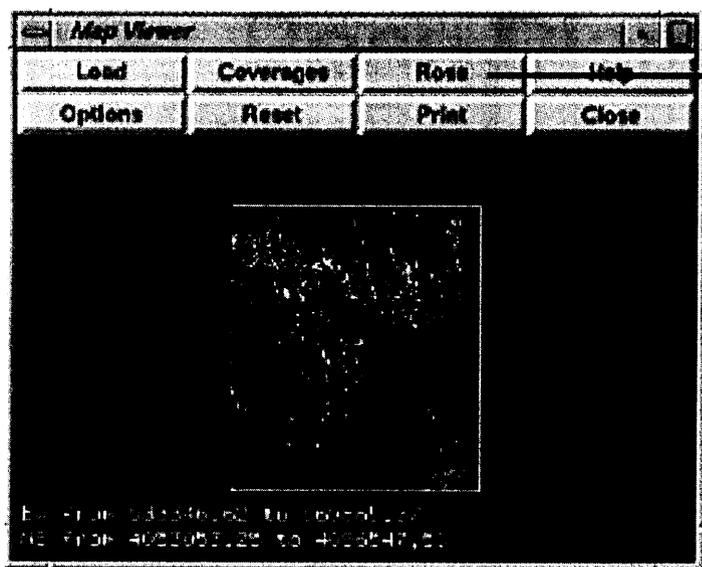
Coverages (cont'd)

Coverages have the same file format as fault traces. To load a coverage, press the **Load** button and a file selector will appear. The name of the coverage is displayed in the coverages tool after being selected. Manipulation of each coverage is done by clicking on the coverage name, then adjusting the color sliders, render mode, line width, and line style. To remove a coverage, select the coverage name and press the **Remove** button.



Rose Diagram

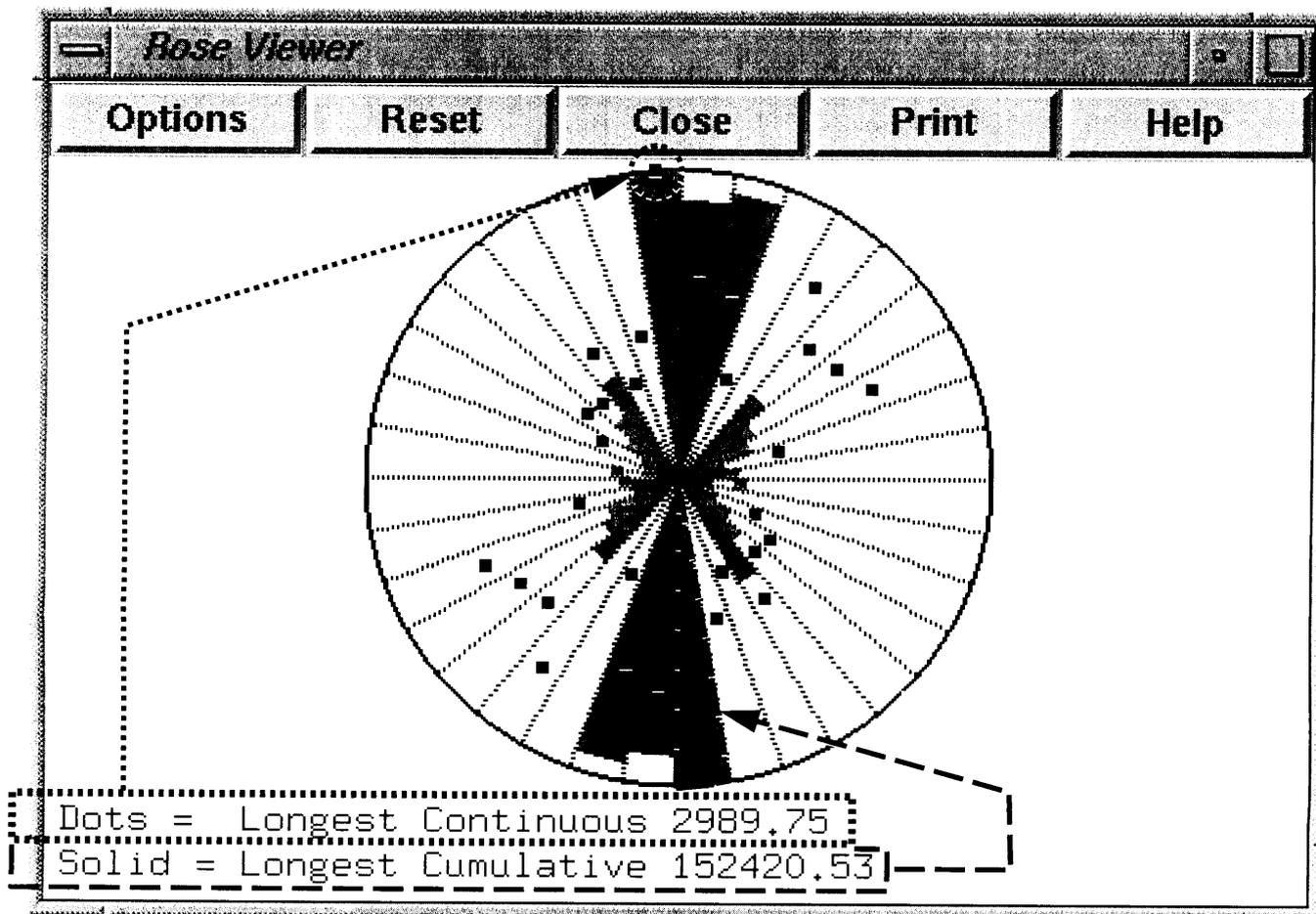
A rose diagram is displayed by pressing the **Rose** button on the map viewer. A rose diagram may only be displayed if a fault trace file is currently loaded.



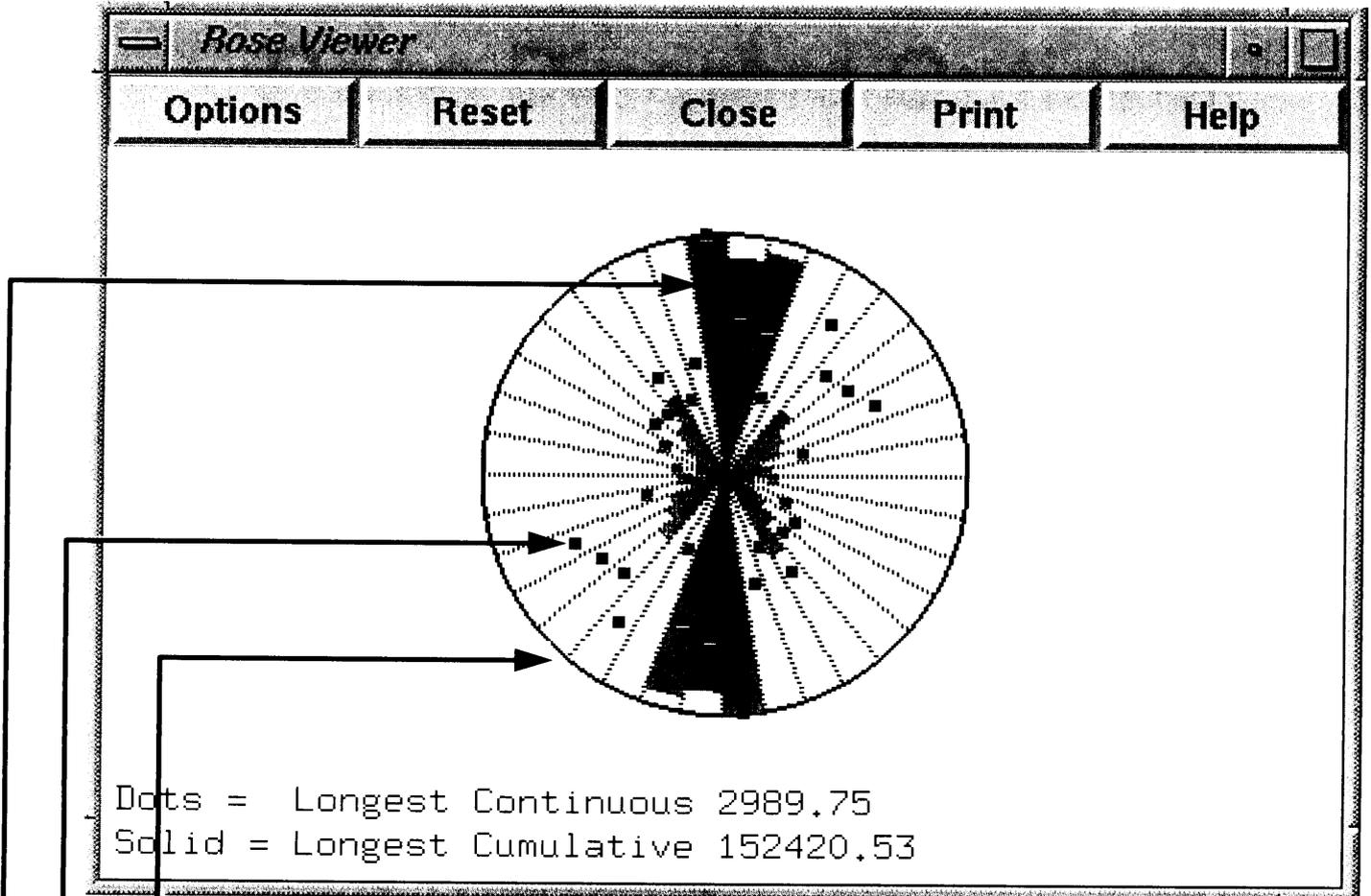
Rose Diagram (cont'd)

The Rose diagram window displays two statistical plots using the currently loaded fault coverage. The solid polygons represent the cumulative lengths of faults for each 10 degree range of strike orientations. The polygons are colored by slip or dilation tendency.

The dots represent the longest continuous fault lengths for each 10 degree range of strike orientations. At the bottom of the window, the maximum values for all fault strike orientations are displayed. The values represent lengths and are in the same units as the currently loaded fault coverage.



Rose Diagram Options



The *Surface Options tool* dialog box contains the following elements:

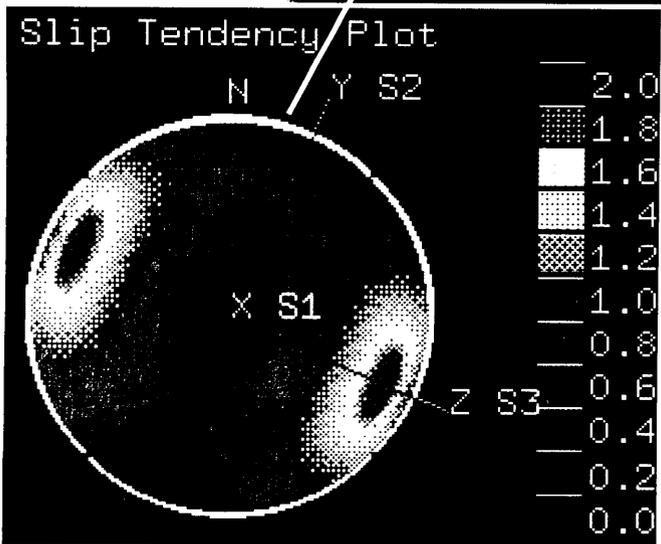
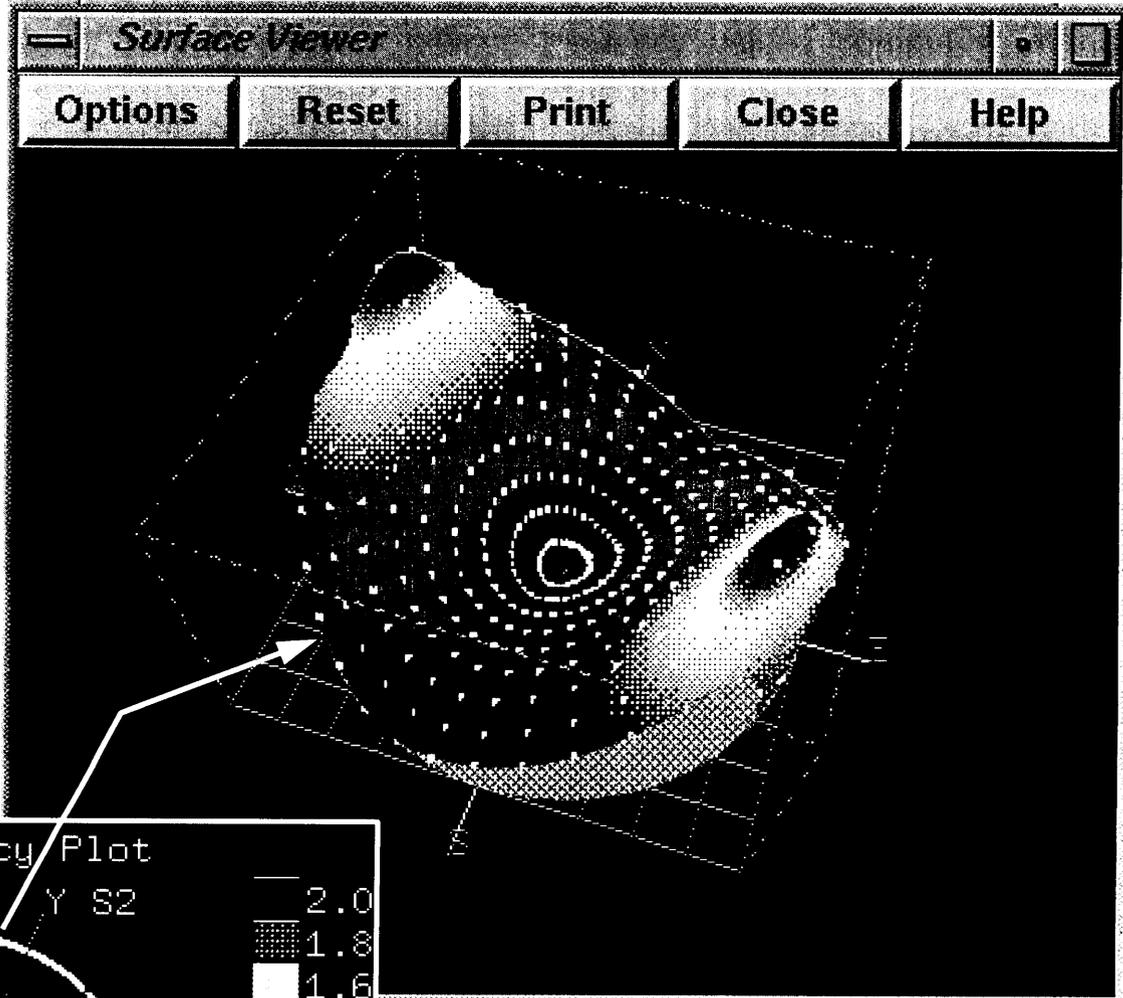
- Bounding Area
- Continuous lengths
- Cumulative lengths
- Point Size: 5
- Close
- Browse Data

Toggle viewing of fields

Change point size of continuous lengths

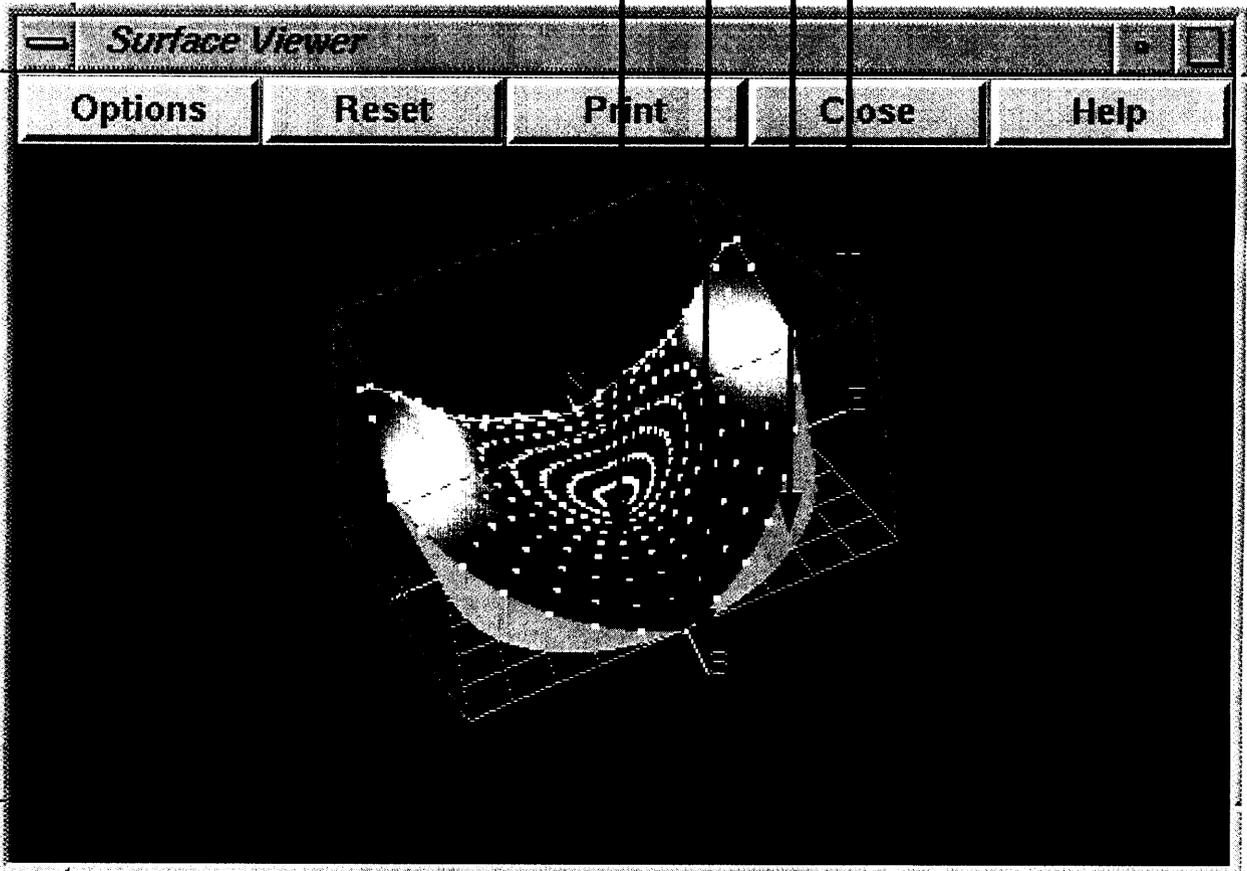
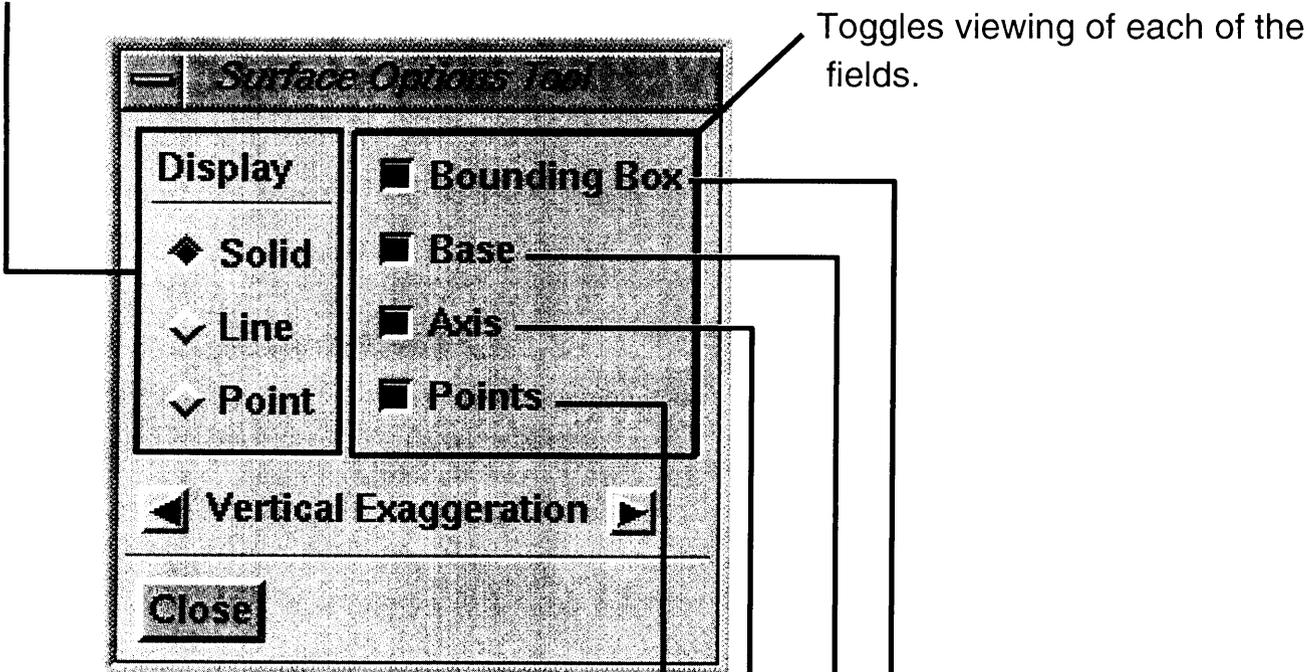
Surface Viewer

The surface viewer displays slip or dilation tendency values computed in the Tendency Plot window as a 3D surface. The height and color of the surface represent the computed slip or dilation tendency values. The vertical exaggeration of the surface is controlled by buttons on the Options window. For special keyboard and mouse controls of the 3D surface viewer see the quick help section.



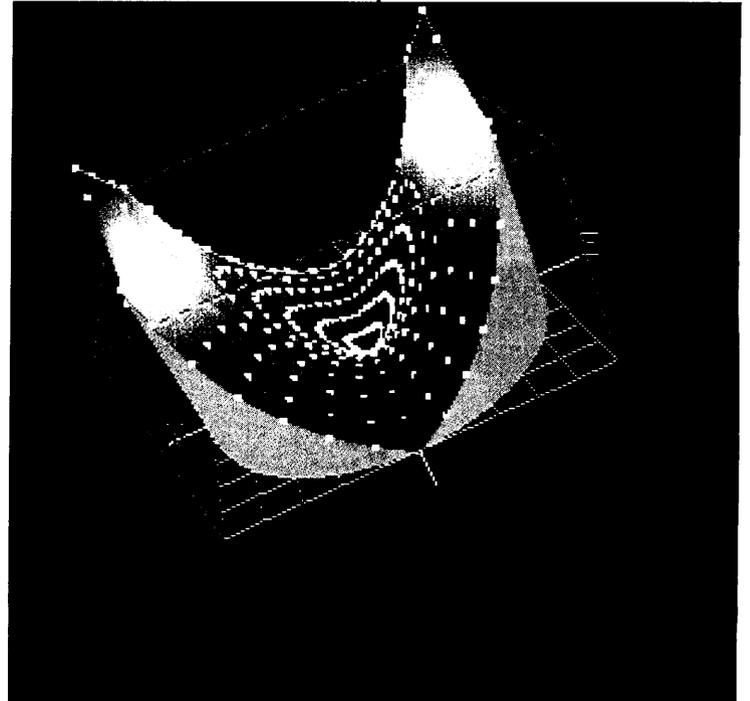
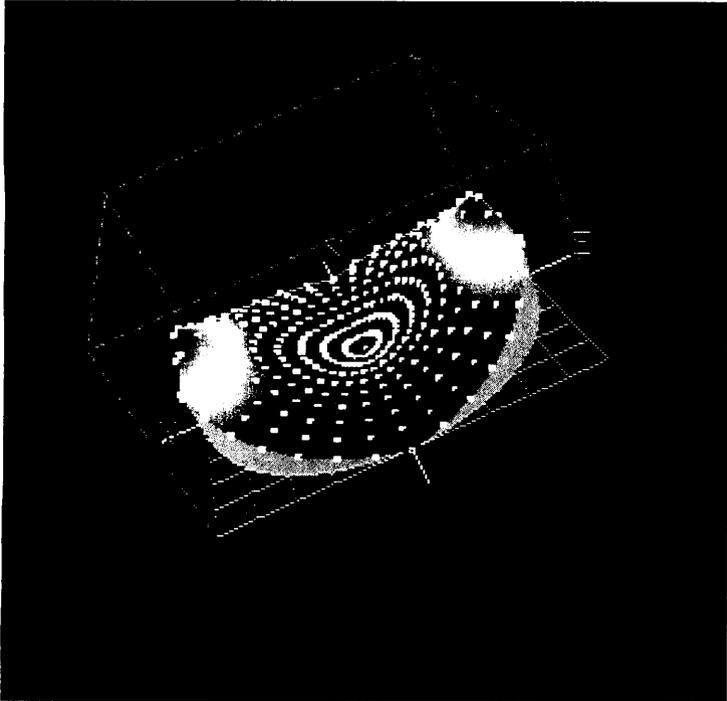
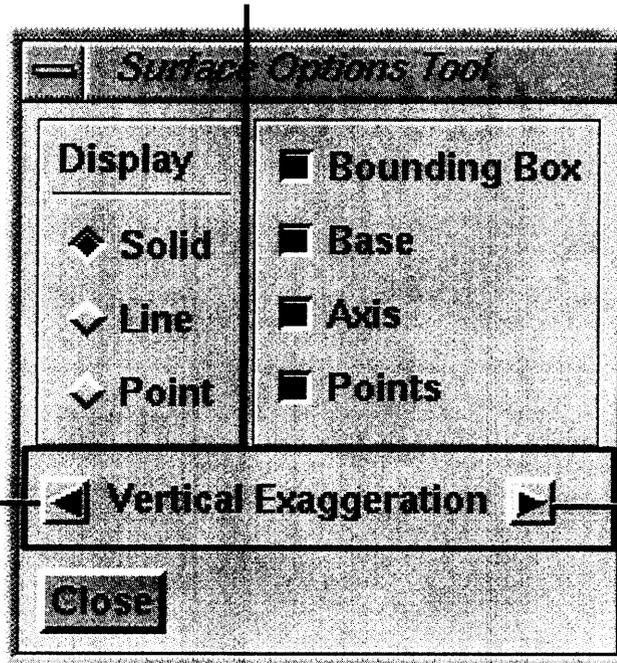
Surface Viewer Options

The display options changes the rendering of the image using either a solid, line, or point style.

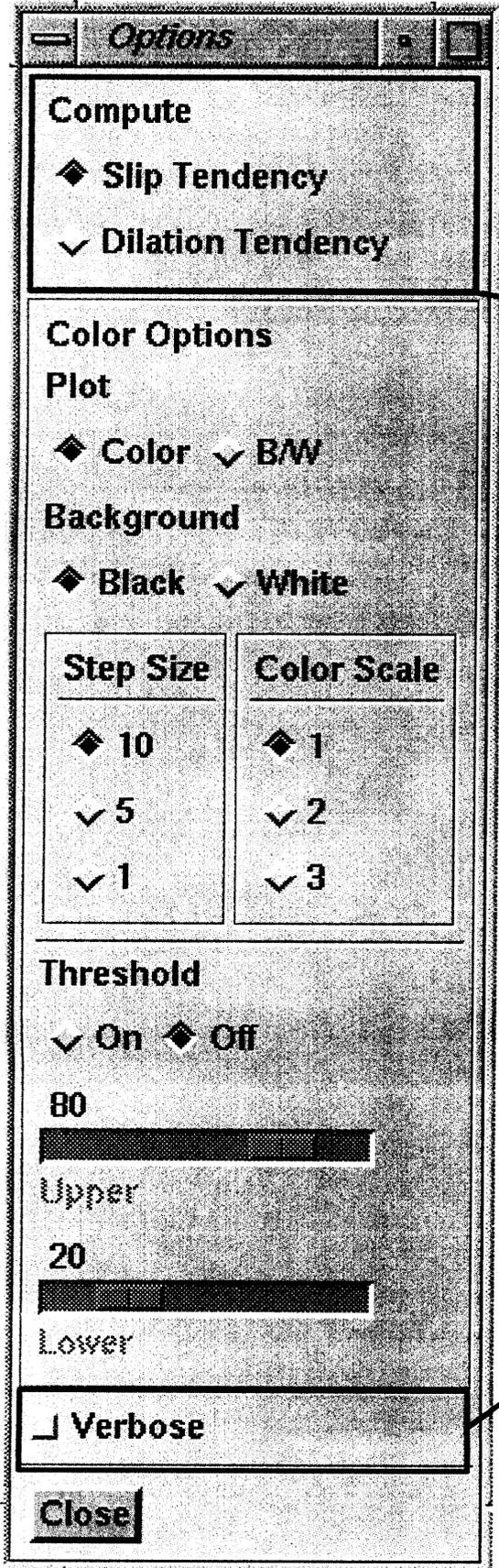


Surface Viewer Options (cont'd)

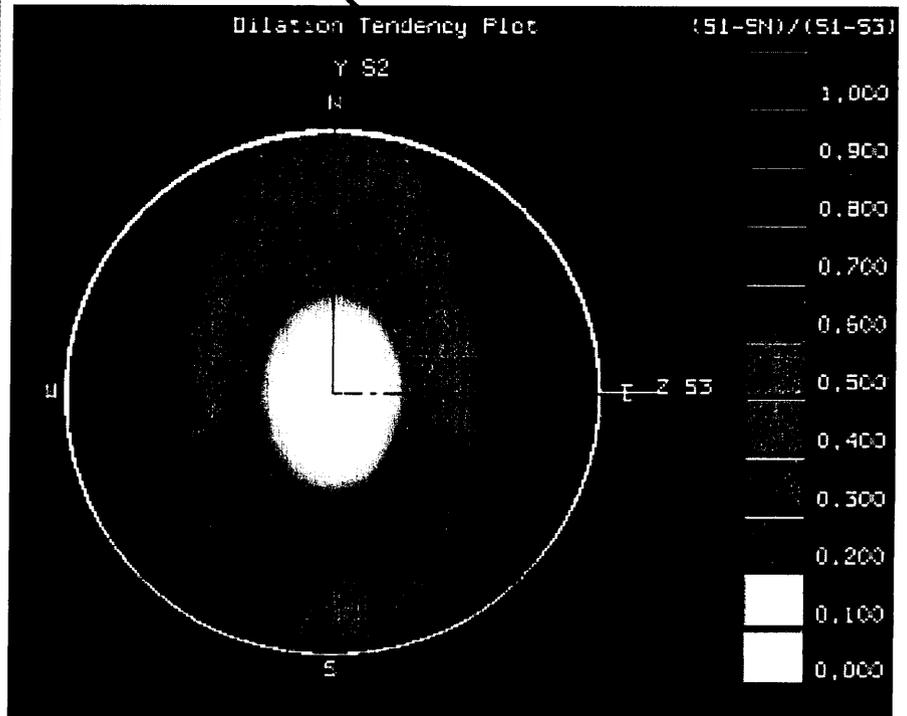
Use the arrows to increase or decrease the vertical exaggeration.



Options



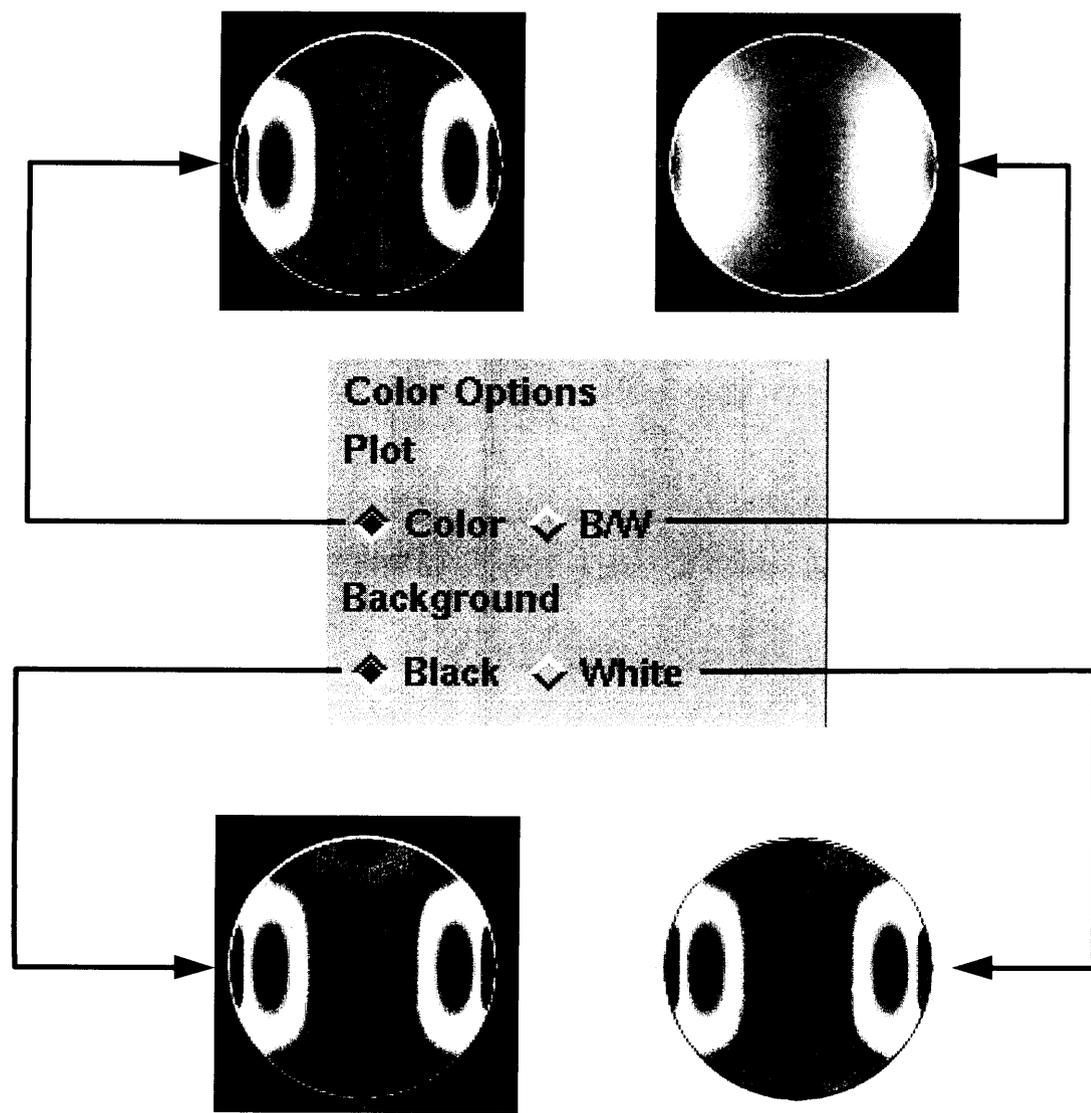
View slip or dilation tendency



Turn 3DStress diagnostic print statements on and off. Values will be printed to the window used to execute 3DStress. This is a diagnostic feature, not required for normal operation of 3DStress.

Options (cont'd)

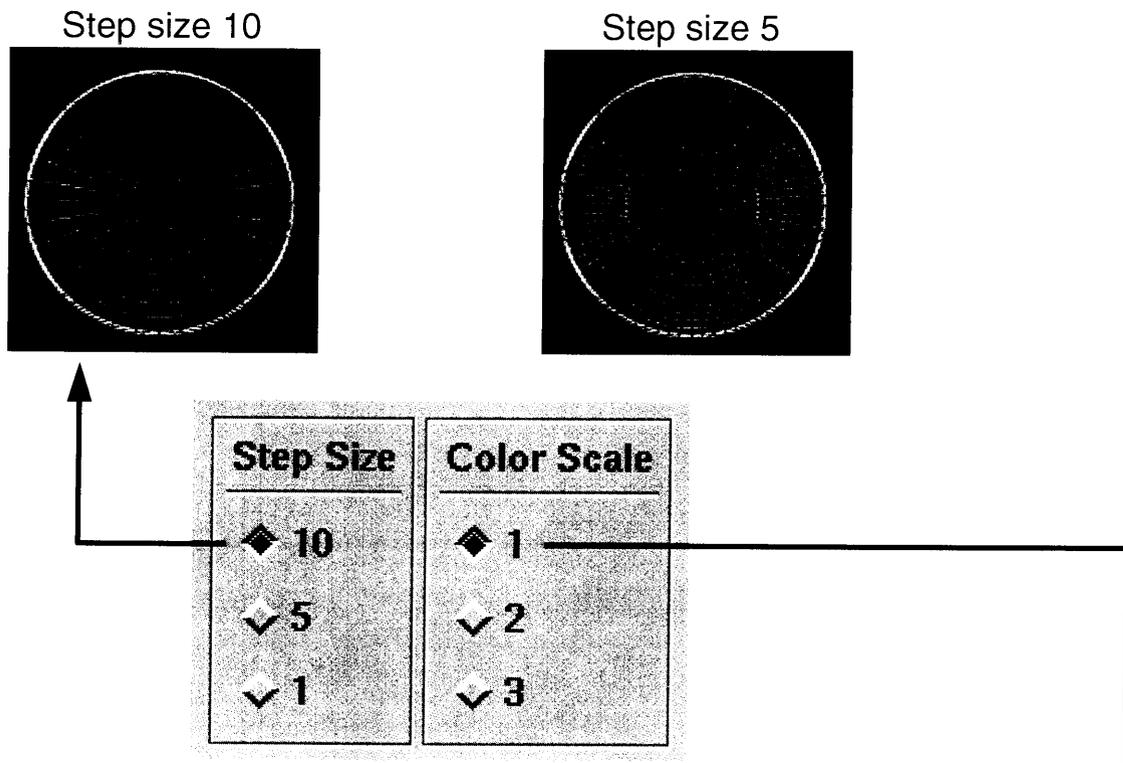
The **plot** option controls the selection of either **color** or **black-and-white** displays.



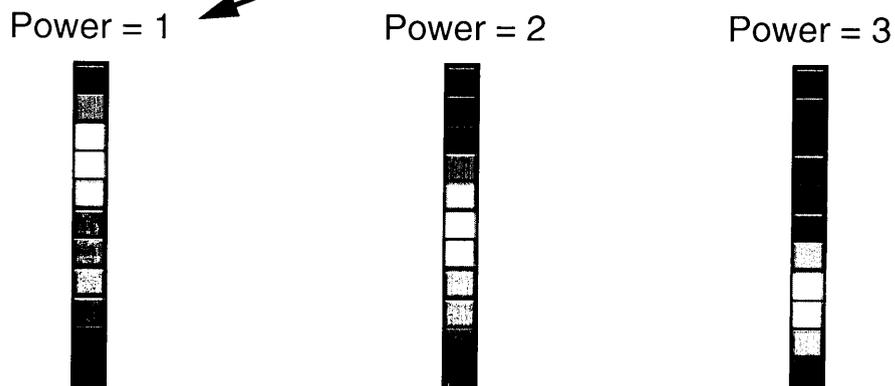
The **background** option controls the selection of either **black** or **white** backgrounds.

Options (cont'd)

The **step size** option determines the spacing between computations on the tendency plot in degrees as shown below.



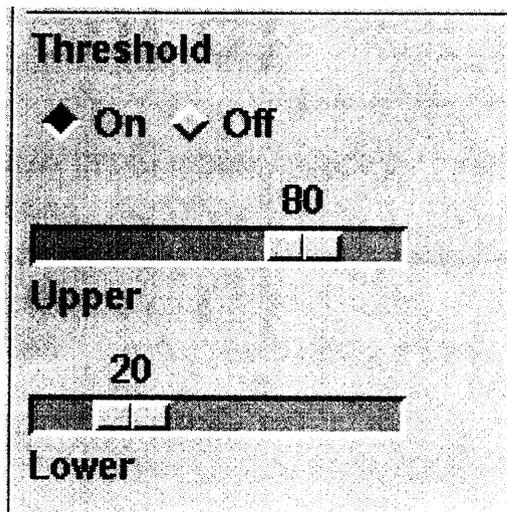
The **color scale power** enables modification of the color scale as shown below.



Options (cont'd)

Use the **threshold** option along with the upper and lower scales to display tendency values within a user specified percentage range.

When using slip tendency mode, values between the upper and lower percentage scales are colored red, the remaining values are colored blue. When using dilation tendency mode, values between the upper and lower percentage scales are colored magenta, the remaining values are colored yellow.

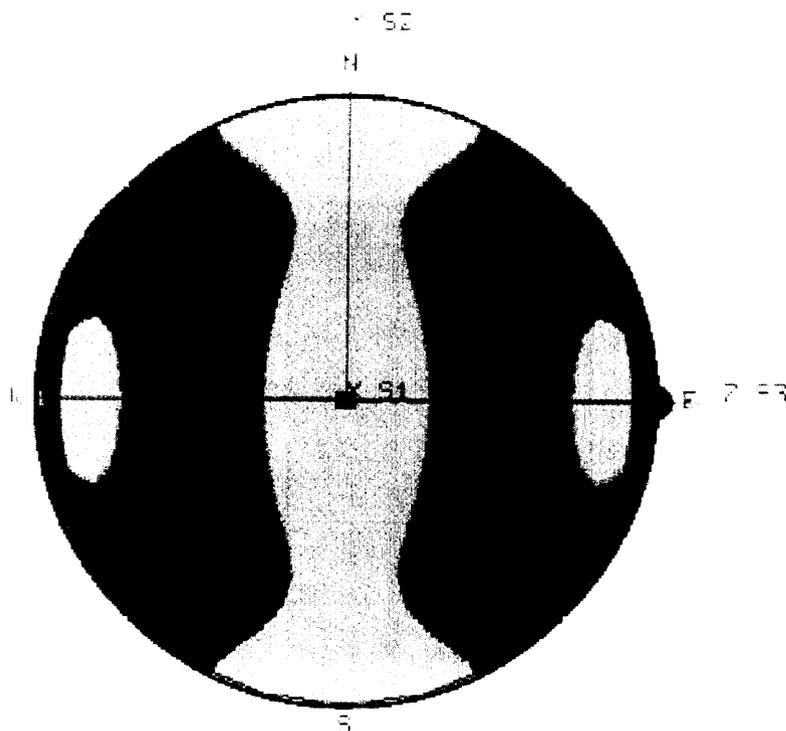


For the threshold values shown to the right, the slip tendency plot is shown below.

$$\text{Color} = \begin{cases} \text{Red, if } (20\% \text{ Tendency}_{\text{max}} \leq \text{Tendency} \leq 80\% \text{ Tendency}_{\text{max}}) \\ \text{Blue, otherwise} \end{cases}$$

FIG. 10. Tendency Plot

FIG. 11. Slip Tendency Scale (15 Steps)



Quick Help

The following tables give the active 3DStress **keys** and their associated actions.

Tendency Plot

| Key | Action |
|---------------|----------------------------|
| n | Decrease fault pole dip |
| m | Increase fault pole dip |
| <Comma> | Decrease fault pole strike |
| <Period> | Increase fault pole strike |
| <Printscreen> | Save window to rgb file |

Stress Ratio Graph

| Key | Action |
|------------------|----------------------------------|
| l (lower case L) | Toggle between log and ln scales |

3D Fault Viewer

| Key | Action |
|---------------|----------------------------|
| o | Zoom out |
| i | Zoom in |
| r | Reset viewer |
| F9 | Toggle showing of axis |
| F10 | Average selected triangles |
| F11 | Toggle rotation mode |
| F12 | Change display mode |
| <Spacebar> | Toggle selection mode |
| <Printscreen> | Save window to rgb file |

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Quick Help (cont'd)

The following tables give the active 3DStress **keys** and their associated actions.

Map Viewer

| Key | Action |
|---------------|-------------------------|
| i | Zoom in |
| o | Zoom out |
| r | Reset zoom |
| <Printscreen> | Save window to rgb file |

Rose Viewer

| Key | Action |
|---------------|---------------------------|
| i | Zoom in |
| o | Zoom out |
| r | Reset viewer |
| F9 | Toggle bounding area |
| F10 | Toggle continuous lengths |
| F11 | Toggle cumulative lengths |
| <Printscreen> | Save window to rgb file |

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Quick Help (cont'd)

The following tables give the active 3DStress **keys** and their associated actions.

Surface Viewer

| Key | Action |
|---------------|--------------------------------|
| i | Zoom in |
| o | Zoom out |
| r | Reset viewer |
| z | Increase vertical exaggeration |
| q | Decrease vertical exaggeration |
| F8 | Toggle bounding box |
| F9 | Toggle base |
| F10 | Toggle axis |
| F11 | Toggle points |
| F12 | Change display mode |
| <Printscreen> | Save window to rgb file |

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Quick Help (cont'd)

The following tables summarize the **mouse button** controls in 3DStress.

Main Window

| Mouse Action | |
|---------------------|---|
| Left mouse | – used to move the fault pole by holding down the button and moving the mouse |
| Middle mouse | – used to select triangles in the 3D Viewer with similar slip tendencies |
| Right mouse | – displays the name of an overlay |

Stress Ratio Graph Window

| Mouse Action | |
|---|--|
| Use left mouse buttons to control stress magnitude ratios. Hold down the left mouse button and move the mouse cursor to the location of the desired stress magnitude ratios and release the button. Use the right button the change between log and ln scales | |

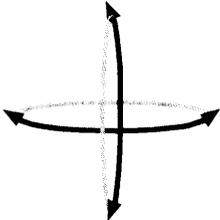
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Quick Help (cont'd)

The following tables summarize the **mouse button** controls in 3DStress.

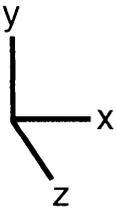
3D Fault Viewer

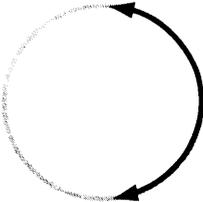
| Mouse Action | |
|--------------|---|
| Left mouse | – changes the position of the viewer, in select mode it is used to select triangles |
| Middle mouse | – zoom in and out |
| Right mouse | – rotates and spins the viewer about the x and y axis |



When the rotate mode is off, the viewer rotates and spins about the z axis.

Window axes:





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Quick Help (cont'd)

The following tables summarize the **mouse button** controls in 3DStress.

Map Viewer

| Mouse Action |
|---|
| Left mouse – changes the position of the viewer |
| Middle mouse – zoom in and out |
| Right mouse – used to select a fault |

Rose Viewer

| Mouse Action |
|---|
| Left mouse – changes the position of the viewer |
| Middle mouse – zoom in and out |

Surface Viewer

| Mouse Action |
|--------------------------------|
| Middle mouse – zoom in and out |
| Right mouse – rotate viewer |

Command Line Options

The following arguments may be used from the command line when running 3DStress:

```
-f followed by a number 1, 2, or 3 will changes the font size (2 is the default)
-b followed by a number changes the button color
-c followed by a number changes the window color
-h displays a brief summary of the command line options
```

The first three options can be used in combination, for example:

```
example% 3dstress -f 3 -b 2 -c 8
```

The next two are for displaying the slip and dilation tendency values for a given state in a non-window environment.

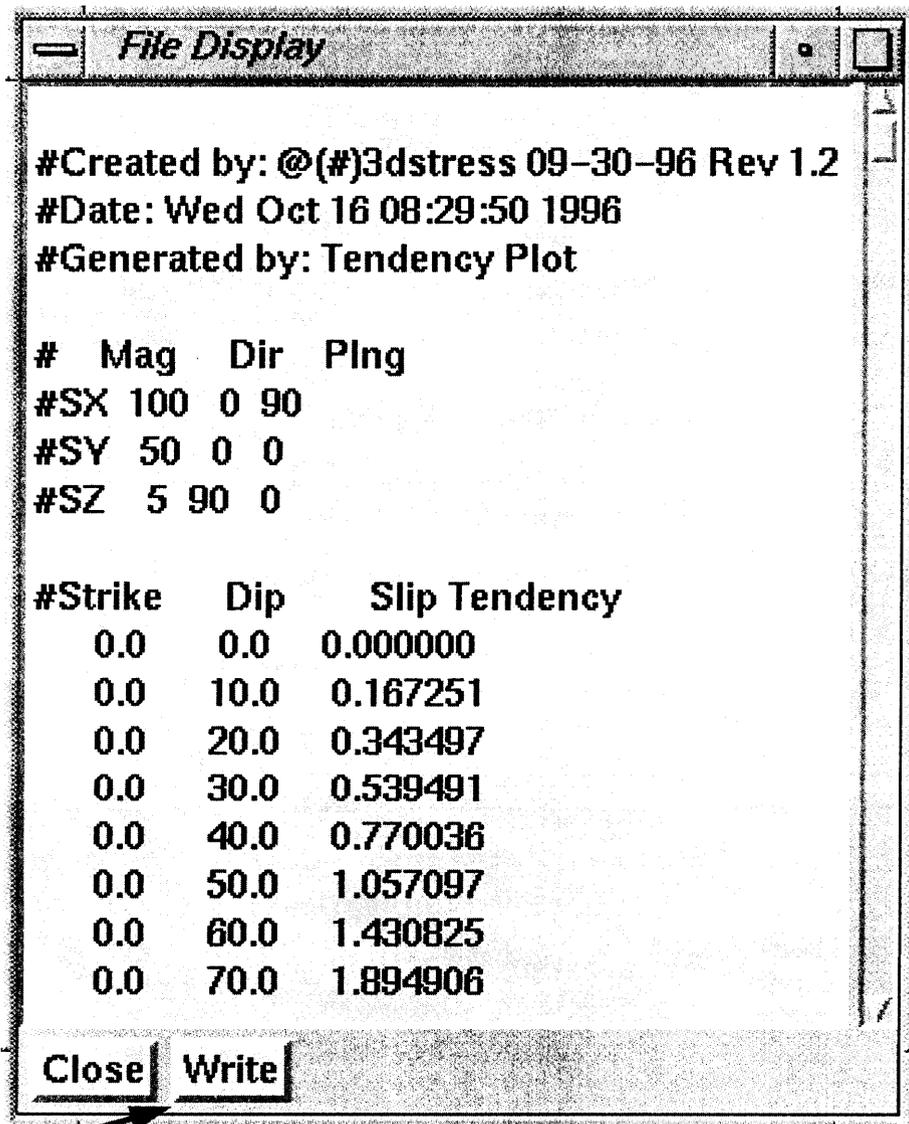
```
-s sx sy sz rx ry rz fstrike fdip
-d sx sy sz rx ry rz fstrike fdip
```

```
example% 3dstress -s 63 71 53 0 0 90 145.2 88.7
sxyz=63 71 53 rxyz=0 0 90 flt=145.2 88.7 slip=325.107 4.08132 sliptend=0.0834825
```

```
example %3dstress -d 63 71 53 0 0 90 145.2 88.7
sxyz=63 71 53 rxyz=0 0 90 flt=145.2 88.7 diltend=0.81866
```

Browse Data Option

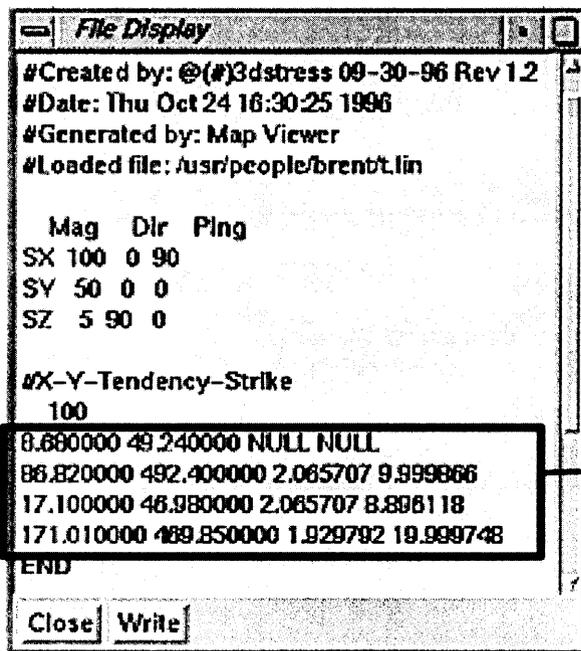
The **browse data** button found in the option windows of the **Tendency Plot**, **3D Fault Viewer**, **Map Viewer**, and **Rose Viewer** is used to display data specific to that window. A window similar to the one below is displayed when the **browse data** button is pressed.



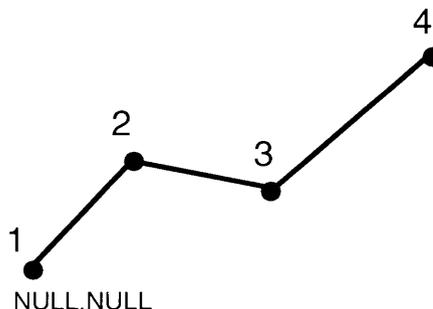
Pressing the **write** button allows the data to be written to a file.

Browse Data Option (cont'd)

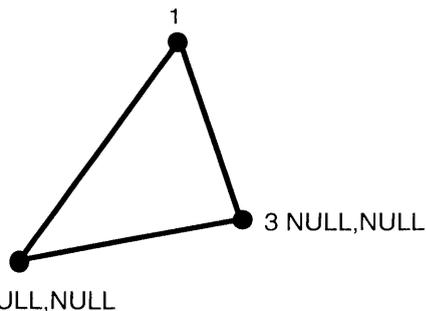
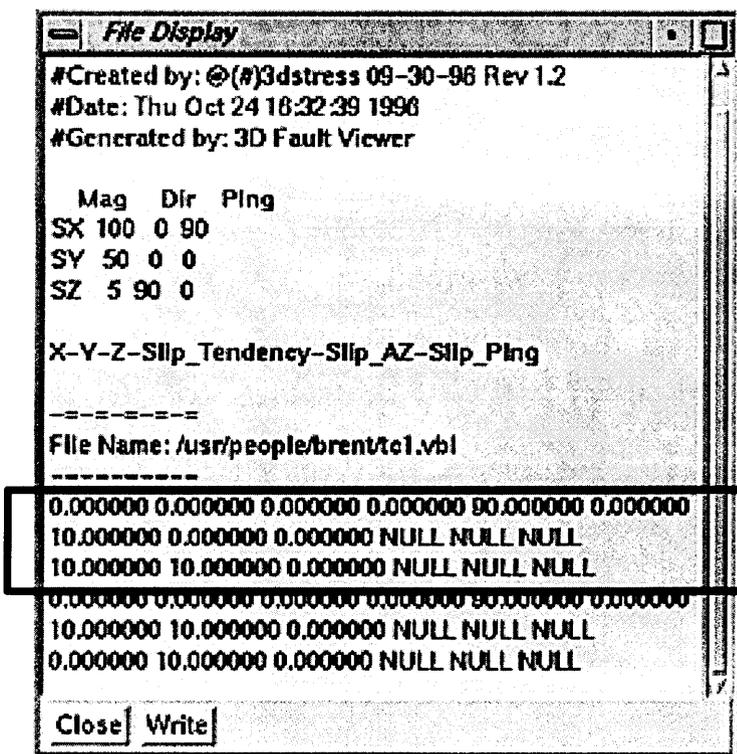
An example from the **Map Viewer** window is shown below.



The first vertex in a line segment does not have a tendency or strike value so a NULL is written to the file.



An example from the **3D Fault Viewer** window is shown below.



The tendency and slip vector data for a triangle are only written for the first vertex, the other two vertices have a NULL written to the file.

3DStress Files

3DStress has two files, 3dstress (the executable) and .3dstress_help (the help file). The help file is a showcase file and for 3DStress to locate it when executed, it looks for the environmental variable 3DSTRESS_HOME to indicate the path of the file. The environmental variable can be set on the command line with the command:

```
prompt% setenv 3DSTRESS_HOME <directory containing help file>
```

The name of the help file does not need to be included in the path name. For example, if the help file is located in the /usr/local/bin directory, then enter the following command:

```
prompt% setenv 3DSTRESS_HOME /usr/local/bin
```

Technical Support

For technical support for 3DStress contact:

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