McIDAS-Vis5D

User's Guide

Issued November 1996

includes Nov 1997 update

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Installation

The system administrator or person who installs McIDAS-X will use these installation instructions to install McIDAS-Vis5D.

The McIDAS-Vis5D installation consists of three tasks:

♦ building and installing McIDAS-X 7.3

♦ obtaining McIDAS-Vis5D 4.3

♦ building and installing McIDAS-Vis5D 4.3

♦ removing McIDAS-4.2

If you have questions about the installation, call the McIDAS Help Desk at (608) 262-2455 or send email to *mug@ssec.wisc.edu*.

Building and Installing McIDAS-X 7.3

Before installing McIDAS-Vis5D 4.3, McIDAS-X 7.3 must be built and installed in the **mcidas** account. See the *Installation* chapter in the *McIDAS User's Guide* for more information.

Obtaining McIDAS-Vis5D 4.3

The McIDAS-Vis5D 4.3 package contains the files below.

File name	Description
vis5d-4.3.sh	shell script that does the build/install
vis5d-4.3.sp	disk space requirements file used by vis5d-4.3.sh
vis5d-4.3.tar.Z	compressed tar file containing the source and data files

Obtaining McIDAS-Vis5D 4.3 from the MUG Web Site

1. Use your Web browser to download the files listed above. Access the McIDAS User's Group Web Site at *http://www.ssec.wisc.edu/mug*, and follow the link for the McIDAS-Vis5D software. Each site has its own login and password for downloading files. Contact the McIDAS Help Desk if you can't remember yours.

2. Log on to the McIDAS-X workstation as user **mcidas** and move the downloaded files to the **~mcidas** directory.

3. List the files and check the ownership. If the McIDAS-Vis5D files are owned by user **mcidas**, skip steps 4-6.

   Type: `ls -l ~mcidas/vis5d`

4. Change the ownership to user **mcidas**, if needed. You must have root permission to do this. Switch to user **root**.

   Type: `su root`

5. Change to the **~mcidas** directory.

   Type: `cd ~mcidas`

6. Run the command below for each of the downloaded McIDAS-Vis5D files.

   Type: `chown mcidas` *file*

Building and installing McIDAS-Vis5D 4.3

Next, complete the steps below to build and install McIDAS-Vis5D 4.3. Run each command from the **~mcidas** directory.

1. Log on to the workstation as **mcidas**.

2. Build McIDAS-Vis5D 4.3.

   Type: `sh ./vis5d-4.3.sh make`

   This step uncompresses the data files and source files, and creates the **~mcidas/vis5d-4.3** directory and all subdirectories and files required to build Vis5D. Then it compiles the source code.

   The message below is displayed when the build is successfully completed.

   ```
   ./vis5d-4.3.sh: Make completed normally.
   ```

3. Verify that no McIDAS-Vis5D sessions are running. Then enter the command below to uninstall McIDAS-Vis5D 4.2.

   Type: `sh ./vis5d-4.2.sh uninstall`

   This step removes the hard links between the files in the **~mcidas/vis5d-4.2** directories and the appropriate directories in **~mcidas**. The message below appears when the uninstall is successfully completed.

   ```
   ./vis5d-4.2.sh: Uninstall completed normally.
   ```

4. Install McIDAS-Vis5D 4.3.

   Type: `sh ./vis5d-4.3.sh install`

   This step creates hard links from the files in the **~mcidas/vis5d-4.3** directories to the appropriate directories in **~mcidas**. The message below is displayed when the install is successfully completed.

   ```
   ./vis5d-4.3.sh: Install completed normally.
   ```

Removing McIDAS-Vis5D 4.2

After McIDAS-Vis5D 4.3 is installed, tested, and working properly, remove McIDAS-Vis5D 4.2. Run each command from the `~mcidas` directory.

1. Log on to the workstation as **mcidas**.

2. Remove the **vis5d-4.2** directory tree and its contents.

    Type: **sh ./vis5d-4.2.sh unmake**

    The message below is displayed when the unmake is successfully completed.

    ```
    ./vis5d-4.2.sh: Unmake completed normally.
    ```

3. Remove the following files:
    vis5d-4.2.sh, vis5d-4.2.sp, vis5d-4.2.tar.Z

---

2 Getting Started

Vis5D is a software package that lets you interactively visualize large datasets generated by numerical weather models. Using Vis5D, you can view dynamic processes in three dimensions to see how they act over time. For example, researchers used Vis5D to analyze the dynamic processes of Florida's afternoon thunderstorms, as shown below. This chapter provides an overview of Vis5D and tells you how to start and exit the program. It also provides a sample dataset to get you started.
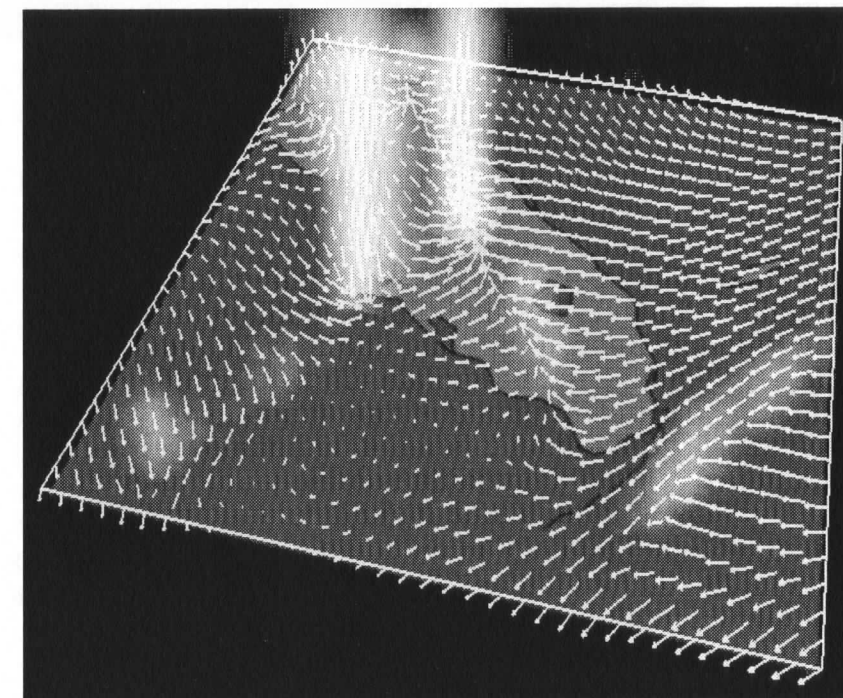
The Vis5D image above shows colliding east and west sea breezes over Florida. The vertical cloud column depicts the resulting thunderstorms.

The three windows of the Vis5D display: the Data Importer/Resampler,
the Control Panel, and the 3-D Display

Overview

Vis5D uses five dimensions to display and interact with data. The first three dimensions are spatial and are organized as rows, columns, and levels, or as latitude, longitude, and height. The fourth dimension is time and the fifth dimension is the placement of multiple physical variables such as temperature and pressure onto the coordinates created by the spatial dimensions. With the five dimensions, you can visualize the properties of a variable at a particular location and time and track how it changes with time and location.

The Vis5D display includes the following three windows, which are shown on the facing page.

♦ Data Importer/Resampler

♦ Control Panel

♦ 3-D Display

The three windows are not displayed simultaneously. The Data Importer/Resampler Window is the only window that appears when you start Vis5D. When you select a dataset and click **Visualize**, the Data Importer/Resampler Window closes and the Control Panel and Display Window appear.

Before you can view a file in Vis5D, you need to import the file and convert the data to the Vis5D format. For example, Vis5D reads all the grids in a McIDAS grid file and reorganizes it into a single file with five dimensions. *Chapter 3 Importing Data* provides instructions for converting files to the Vis5D format.

After the data files are converted to the Vis5D format, you can display the files to view data, such as temperature, in relation to time, geographic location, and altitude. You can make isosurfaces, contoured line slices, colored slices, wind trajectories, and volume renderings. To show the data's dynamic processes, you can rotate and animate the images. *Chapter 4 Using the Control Panel* provides instructions for displaying and interacting with the Vis5D file.
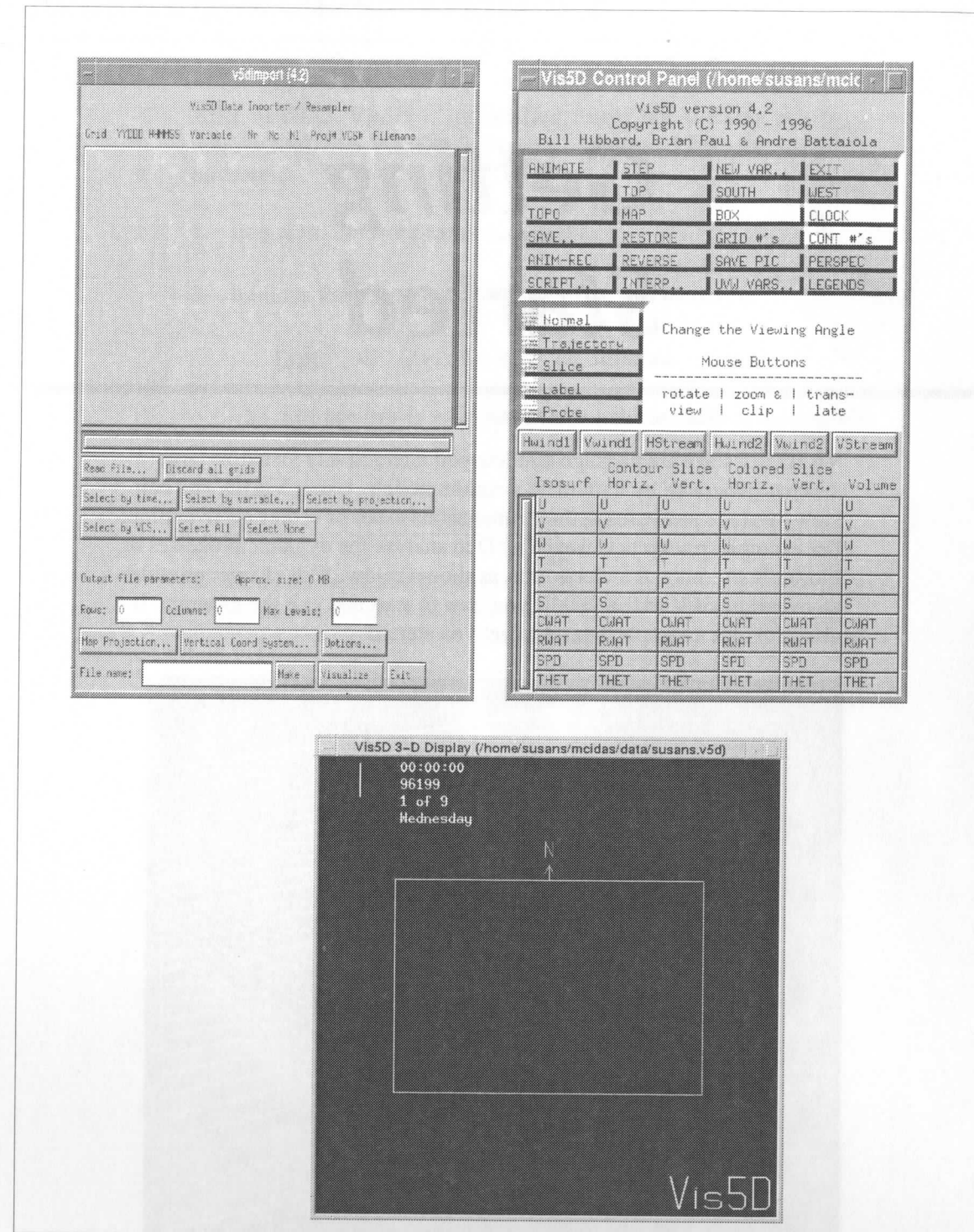
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Starting and exiting McIDAS-Vis5D

This section describes how to start Vis5D from a McIDAS-X session. See the *McIDAS User's Guide* for information about McIDAS-X sessions. You can start Vis5D outside a McIDAS-X session; the README file in the `~mcidas/vis5d-4.3` directory provides more information.

SSEC recommends that you run McIDAS-Vis5D at a workstation console and not an X Terminal because it will run very slowly. If McIDAS-Vis5D is installed on an SGI workstation, it must be run from the console. X Terminals do not work with an SGI.

To start Vis5D

Run the command **VIS5D** from the McIDAS-X Text and Command Window. The Data Importer/Resampler Window is displayed. Vis5D sets its default directory to the first directory listed in the McIDAS-X MCPATH environment variable.

To Exit Vis5D

Click the **EXIT** button in the Data Importer/Resampler Window or the Control Panel, depending on which window is displayed. Vis5D closes, but the McIDAS-X session remains running.

Using a sample dataset

The exercises below will help familiarize you with Vis5D. The exercises use a sample dataset, provided with the Vis5D package, that contains a Limited Area Meso-scale Prediction System (LAMPS) model of an extratropical cyclone. Using this data you will:

♦ start Vis5D and open a file

♦ display an isosurface of wind speed

♦ create interactive wind trajectories

Starting Vis5D and opening a file

Follow the steps below to start Vis5D and open the LAMPS file.

1. Type the command **VIS5D** in the McIDAS-X Text and Command Window. The Data Importer/Resampler Window is displayed.

2. Click the **Read file** button located in the middle of the window. A dialog box listing the files in the first directory of the MCPATH environment variable is displayed as shown below.
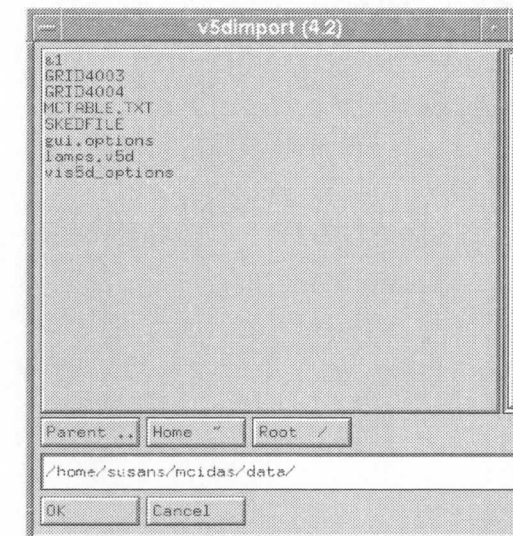
3. Use the **Parent... Home ~** or **Root /** button to change to the **~ mcidas/ data** directory.

4. Highlight the file **lamps.v5d** and click **OK**.

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5. Click **Visualize** in the Data Importer/Resampler Window. The Vis5D Control Panel and Display Window appear.

Displaying an isosurface

Follow the steps below to add a map and topography and to view an isosurface of wind speed.

1. Click the **MAP** button located in the upper-third of the Control Panel. A map of North America is displayed in the Display Window.

2. Click the **TOPO** button in the upper-third of the Control Panel to display topography.

3. Click the **SPD** button in the Isosurface column in the bottom section of the Control Panel. The dialog box shown below is displayed.

4. Move the slider to select a wind speed value near 45.0 meters per second, then click **OK**. The isosurface shown below is displayed.
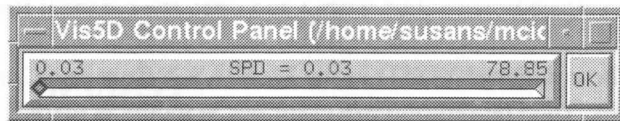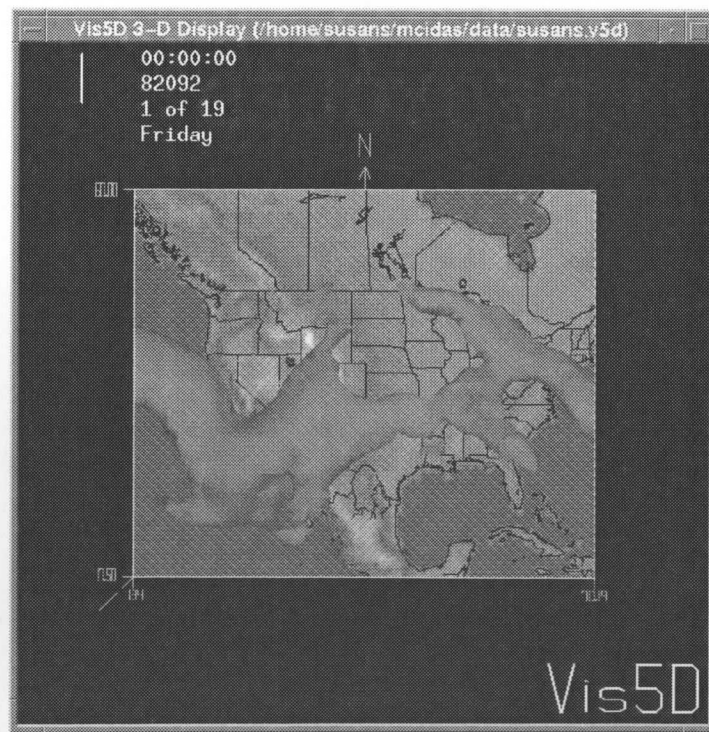

5. Click the **ANIMATE** button in the Control Panel to see how the isosurface changes with each timestep.

6. Click **ANIMATE** to stop looping.

7. Click the highlighted **SPD** button in the Isosurf column to clear the wind speed isosurface.

Creating interactive wind trajectories

Follow the steps below to display wind trajectories.

1. Click the **Trajectory** button located in the middle of the Control Panel. The dialog box shown below is displayed.
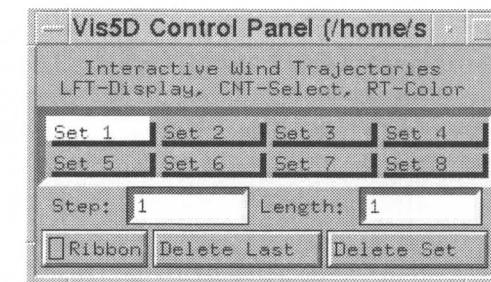
2. Click the **ANIMATE** button in the Control Panel.

3. Move the mouse into the Display Window and press the middle mouse button. A series of white trajectory lines passes through the location you marked.

4. Press the right mouse button to move the cursor, then click the middle mouse button to create more trajectories.

5. Click **Ribbon** and **Set 2** in the dialog box shown above.

6. Move the cursor to the Display Window and press the middle mouse button to create yellow ribbon trajectories.

7. Click the **EXIT** button in the upper-third of the Control Panel to exit Vis5D.

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3 ◇ Importing Data

To display data using the Vis5D software, you must import and convert the data to the Vis5D format. Vis5D organizes data as a five-dimensional rectangle. The first three dimensions are spatial: rows, columns, and levels, or latitude, longitude, and height. The fourth dimension is time and the fifth dimension is the enumeration of multiple physical variables such as temperature, pressure, or water content.

This chapter describes using Vis5D to import McIDAS grids. You can use Vis5D to import data in other formats. See the README file in the `~mcidas/vis5d-4.3` directory for more information.

Importing data consists of the following three steps, which are described in this chapter.

- ◆ reading the data file
- ◆ selecting grids
- ◆ creating and viewing Vis5D files

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The Vis5D Data Importer/Resampler Window shown below is used for all the steps in this chapter.
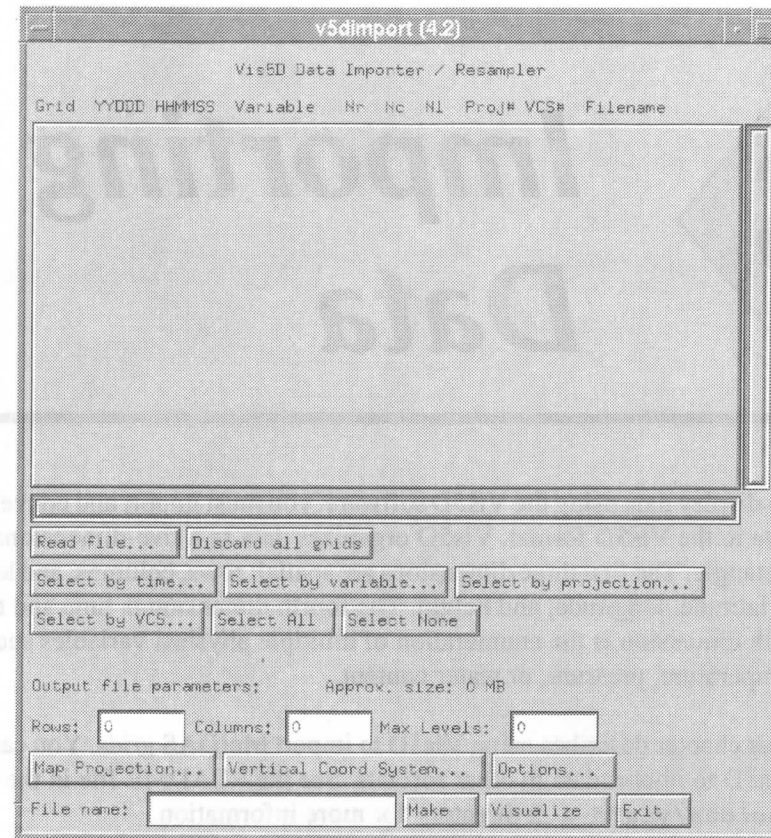
Reading the data file

When importing a data file into Vis5D, you must first read or open the file. Follow the steps below to read the data file.

1. Click the **Read file** button located in the middle of the Vis5D Data Importer/Resampler Window. A dialog box listing the files in the first directory of the **MCPATH** environment variable is displayed as shown below.
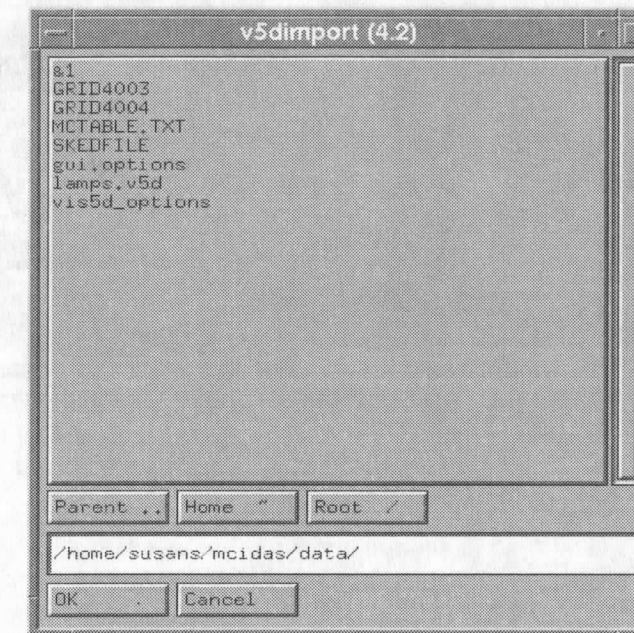
2. Highlight a file and click **OK** to select it from the list. You can select a data file from directories other than the **mcidas/data** directory by clicking the **Parent**, **Home**, or **Root** button or typing the directory name. However, these directories must be specified in the **MCPATH** environment variable. See the MCPATH Appendix in the *McIDAS User's Guide* for more information about .

    The grids stored in the selected file are displayed in the Vis5D Data Importer/Resampler Window as shown on the next page.

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This window lists the grid number, date (YYDDD), time (HHMMSS), variable, number of grid rows (Nr), number of grid columns (Nc), number of grid levels (Nl), the projection number, vertical coordinate system number (VCS#), and the file name for each grid in the file.

Note: If the file is larger than 20 Megabytes, there may be memory problems when running Vis5D.
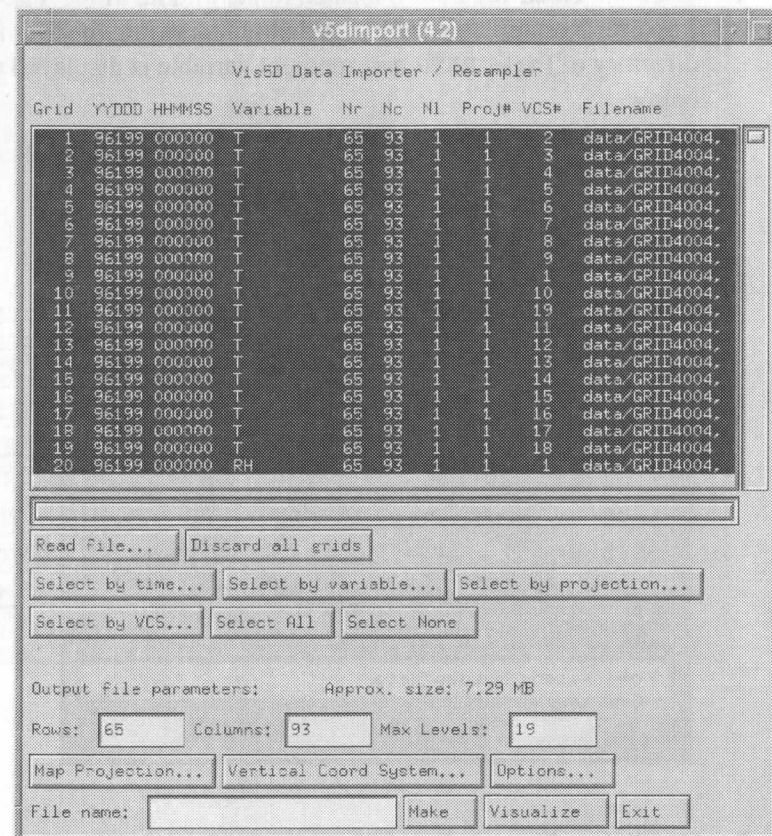
3. Go to the next section, *Selecting grids*.

Selecting grids

Once Vis5D reads the file, you must select grids to write to the Vis5D file. The number of grids you select affects the size of the new Vis5D file. Follow the steps below to select grids.

1. Use the scroll bar to review the parameters in the grids. You should always review the parameters before creating a Vis5D file so the file doesn't include unneeded parameters and is bigger than necessary. Some grids may have odd levels, for example 97 sigma in ETA model output, that cause problems when creating the Vis5D file. You may want to exclude these grids from your Vis5D file.

2. Choose one of the methods described below to select or deselect grids.

3. Go to the next section, *Creating and viewing Vis5D files*.

Selection methods

You can select grids using one of the following methods.

- ◆ select all the grids; this is the default

- ◆ use the selection criteria buttons in the Vis5D Data Importer/ Resampler Window

If you don't use the selection criteria buttons, the new Vis5D file will contain all the grids in the grid file.

Use the selection criteria buttons to select grids according to the following criteria.

- ◆ time

- ◆ variables

- ◆ vertical coordinate system

- ◆ projection

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Each criteria has a corresponding button in the Vis5D Importer/Resampler Window as shown below. You can choose more than one criteria to select grids. For example, you can select all the 12 UTC temperature grids with a Lambert conformal projection to use in the new Vis5D file.

Read file...	Discard all grids	
Select by time...	Select by variable...	Select by projection...
Select by VCS...	Select All	Select None
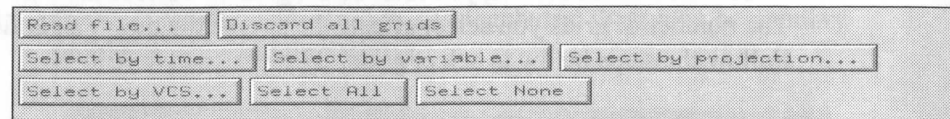
Time

The valid times of grids are called timesteps. To list the timesteps in the open grid file, click the **Select by time** button. The dialog box shown below appears with all the timesteps selected. YYDDD lists the date and HHMMSS lists the time. In the sample below, the grid file contains nine timesteps. Deselect timesteps you want to exclude from the new Vis5D file and then click **Close**.

```
─ v5dimport (4.2)  ─  □

Select grids by timestep

No. YYDDD HHMMSS
  1 96199 000000
  2 96199 060000
  3 96199 120000
  4 96199 180000
  5 96200 000000
  6 96200 060000
  7 96200 120000
  8 96200 180000
  9 96201 000000

 Close
```

Variable

The variables are the types of data in the grid file. Common variables include temperature, relative humidity, and wind values. To list the variables in the file, click the **Select by variable** button. The dialog box below appears listing the variable names in the grid file. Deselect variables you want to exclude from the new Vis5D file, then click **Close**.

```
─ v5dimport (4.2) ─ ▼

Select grids by variable

T
RH
Z
U
V
ABV
W

 Close
```
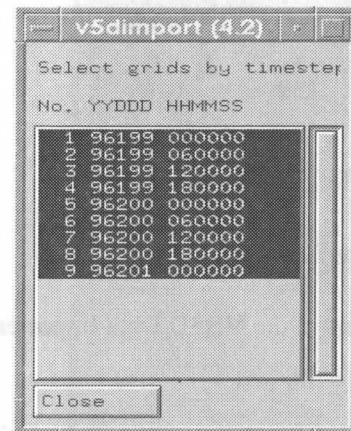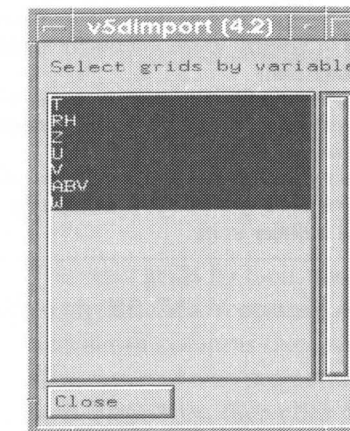
Vertical coordinate system

The vertical coordinate system shows how the data level in each grid corresponds to an altitude or pressure. To select grids according to vertical coordinate system, click the **Select by VCS** button. The dialog box below appears listing the type of coordinate system, the corresponding grid level (Nl) and the VCS coordinate values (Parameters).

```
─            v5dimport (4.2)            ▼ □

Select grids by vertical coordinate system

No. Type                      Nl  Parameters
  1 Equally-spaced Linear km   1   0.0894421 1
  2 Equally-spaced Linear km   1   0.458754 1
  3 Equally-spaced Linear km   1   0.848038 1
  4 Equally-spaced Linear km   1   1.25958 1
  5 Equally-spaced Linear km   1   1.69608 1

 Close
```

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Vis5D accepts four types of vertical coordinates systems which are defined in the table below.

Vertical Coordinate System	Definition
equally spaced linear, generic units	height of the grid levels in equally spaced units; the units don't represent any specific measurements
equally spaced linear, kilometers	height of the grid levels in equally spaced kilometer units
unequally spaced linear, kilometers	height in unequally spaced units measured in kilometers
unequally spaced pressure, millibars	pressure of the grid levels in unequally spaced millibar units

Deselect grids you want to exclude from the new Vis5D file, then click **Close**.

Projection

The projection is the type of map stored with the grid. Vis5D accepts five types of map projections.

- ◆ generic

- ◆ cylindrical equidistant

- ◆ Lambert conformal

- ◆ polar stereographic

- ◆ rotated

To select grids by their map projection, click **Select by projection**. The dialog box below appears. The projection type, number of rows (Nr), number of columns (Nc) and the parameters are listed for each grid with an associated map projection. Deselect grids you want to exclude from the new Vis5D file, then click **Close**.

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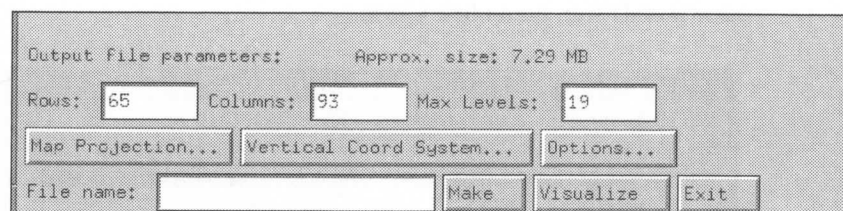Issued 11/96

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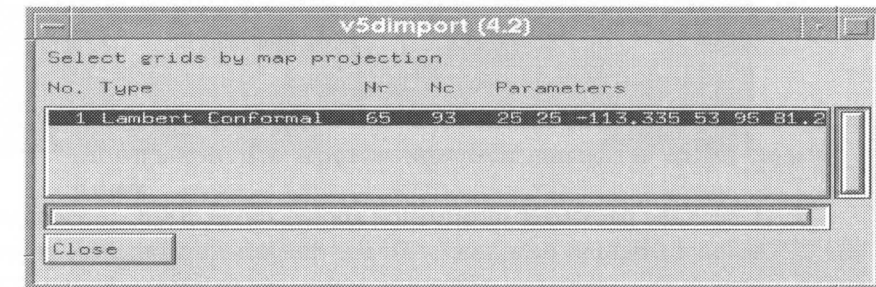
Creating and viewing Vis5D files

Once you've selected the grids to include in the Vis5D file, you can create the Vis5D file using the procedure below. The McIDAS Text and Command Window displays messages as the file conversion occurs. The process stops if errors occur.

Creating a Vis5D file

To make a Vis5D file follow the steps below.

1. Type a name with the extension .v5d in the **File name** field located at the bottom of the Vis5D Data Importer/Resampler Window. If you don't specify a name and click **Visualize**, the file is automatically named *username*.v5d.

```
Output file parameters:        Approx. size: 7.29 MB

Rows:  65    Columns:  93    Max Levels:  19

Map Projection...   Vertical Coord System...   Options...

File name:                      Make   Visualize   Exit
```

2. Check the parameter information shown above. SSEC recommends using the default parameters. To use the default parameters go to step 3. To change any of the parameters, go to the next section titled *Changing the output file parameters* before completing step 3.

3. Click **Make** to create the file or click **Visualize** to create and display the file. If you click **Make**, Vis5D creates the new file, but does not display it. The Data Importer/Resampler Window remains displayed for creating additional Vis5D files.

   If you click **Visualize**, the Vis5D Control Panel and Display Window appear and the Data Importer Resampler Window closes. *Chapter 4, Using the Control Panel,* provides more information about working with the visualized data.

Changing the output file parameters

Although SSEC recommends using the default parameters, you can change the following parameters before creating the Vis5D file.

- grid size
- map projection
- vertical coordinate system
- data location and compression
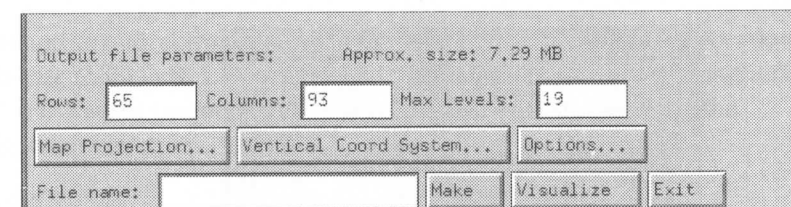
The procedures for changing these parameters are described below.

Changing the grid size

The more grid rows, columns and levels that are written to the new Vis5D file, the larger the file size. By default, the new Vis5D file will contain the same number of rows, columns and levels contained in the selected grid file.

To create a smaller file, follow the procedure below.

1. Enter new values in the **Rows**, **Columns**, and **Max Levels** fields, as shown below. The **Approx. size:** field changes to reflect the new values.

```
Output file parameters:        Approx. size: 7.29 MB

Rows:  65    Columns:  93    Max Levels:  19

Map Projection...   Vertical Coord System...   Options...

File name:                      Make   Visualize   Exit
```

2. Change any other parameters, then click **Make** to create the file or click **Visualize** to create and display the file. If you click **Make**, Vis5D creates the new file, but does not display it. The Data Importer/Resampler Window remains displayed for creating additional Vis5D files.

   If you click **Visualize**, the Vis5D Control Panel and Display Window appear and the Data Importer Resampler Window closes. *Chapter 4, Using the Control Panel,* provides more information about working with the visualized data.

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Changing the map projection

Although you can change the map projection, SSEC recommends using the default map projection, which is copied from the grid file to the new Vis5D file.
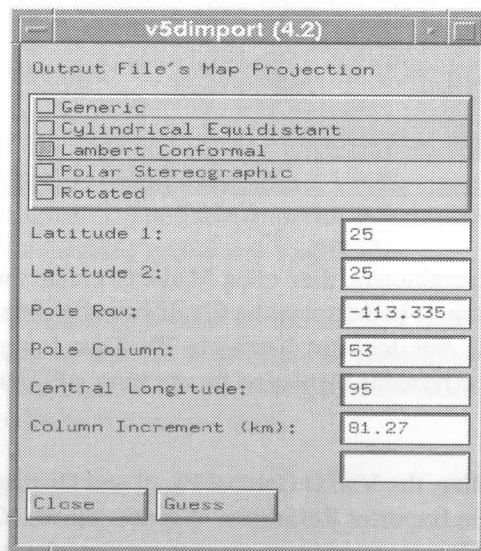
The map projection shows how the rows and columns in the 3-D grid correspond to the latitudes and longitudes of the Earth. Vis5D supports the following five map projections.

◆ generic

◆ cylindrical equidistant

◆ Lambert conformal

◆ polar stereographic

◆ rotated

Each of these map projections and their parameters are discussed below. The map projection is stored in the Vis5D file and is used to set up the topography and map lines and to compute wind trajectories.

To specify a different map projection for the grid, follow the steps below.

1. Click **Map Projection...** The dialog box shown below appears.

```
┌─────────────────────────────────────────┐
│ ═         v5dimport (4.2)          ▫ │▫│ │
│ ┌───────────────────────────────────┐   │
│ │ Output File's Map Projection      │   │
│ │ ┌───────────────────────────────┐ │   │
│ │ │ □ Generic                     │ │   │
│ │ │ □ Cylindrical Equidistant     │ │   │
│ │ │ □ Lambert Conformal           │ │   │
│ │ │ □ Polar Stereographic         │ │   │
│ │ │ □ Rotated                     │ │   │
│ │ └───────────────────────────────┘ │   │
│ │ Latitude 1:        ┌──────────┐   │   │
│ │                    │ 25       │   │   │
│ │                    └──────────┘   │   │
│ │ Latitude 2:        ┌──────────┐   │   │
│ │                    │ 25       │   │   │
│ │                    └──────────┘   │   │
│ │ Pole Row:          ┌──────────┐   │   │
│ │                    │ -113.335 │   │   │
│ │                    └──────────┘   │   │
│ │ Pole Column:       ┌──────────┐   │   │
│ │                    │ 53       │   │   │
│ │                    └──────────┘   │   │
│ │ Central Longitude: ┌──────────┐   │   │
│ │                    │ 95       │   │   │
│ │                    └──────────┘   │   │
│ │ Column Increment (km): ┌──────┐   │   │
│ │                    │ 81.27    │   │   │
│ │                    └──────────┘   │   │
│ │                    ┌──────────┐   │   │
│ │                    └──────────┘   │   │
│ │ ┌─────┐  ┌─────┐                  │   │
│ │ │Close│  │Guess│                  │   │
│ │ └─────┘  └─────┘                  │   │
│ └───────────────────────────────────┘   │
└─────────────────────────────────────────┘
```

2. Click the desired map projection and enter the appropriate parameters, as described in the projection descriptions below. If you're not sure which map projection to choose, click **Guess**.

3. Click **Close.** Change any other parameters, then click **Make** to create the file or click **Visualize** to create and display the file. If you click **Make**, Vis5D creates the new file, but does not display it. The Data Importer/Resampler Window remains displayed for creating additional Vis5D files.

If you click **Visualize**, the Vis5D Control Panel and Display Window appear and the Data Importer Resampler Window closes. *Chapter 4, Using the Control Panel,* provides more information about working with the visualized data.

Generic map projection

The generic map projection is a linear, regularly-spaced coordinate system with no associated measurement units. This projection is useful when the data is not related to Earth science, for example computational fluid dynamics.

The following four parameters define the generic projection.

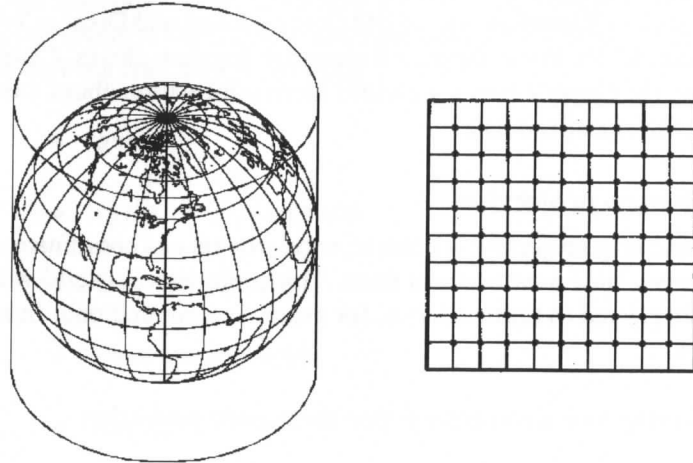| Parameter	Definition
North Bound	northern boundary of the grid
West Bound	western boundary of the grid
Row Increment	spacing between grid columns
Column Increment	spacing between columns

The north/south coordinates increase upward and the east/west coordinates increase to the left. Like McIDAS, Vis5D uses positive west longitude values. You can calculate the south and east boundaries using the following equations.

South Bound = North Bound - (Row Increment*(rows-1))
East Bound = West Bound - (Column Increment*(columns-1))

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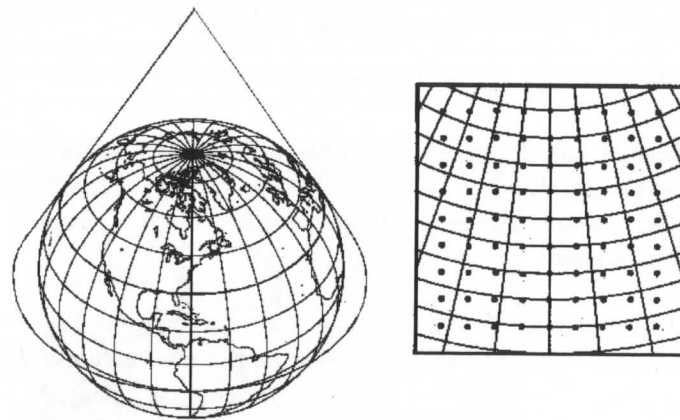Issued 11/96

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Cylindrical equidistant projection

A cylindrical equidistant projection is a rectangular coordinate system that uses latitude and longitude coordinates, as shown below. The four parameters for this projection are identical to the generic map description described above.
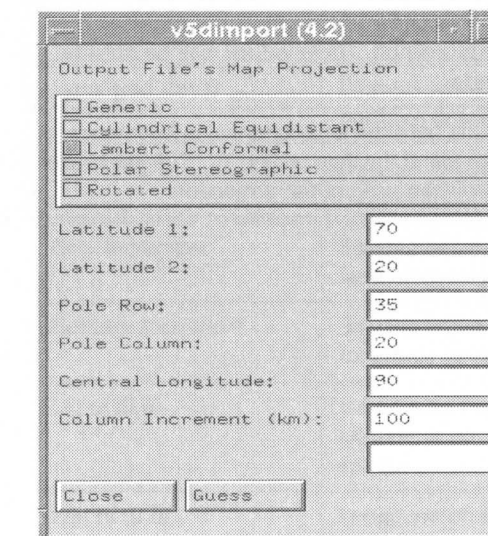

Lambert conformal projection

The Lambert conformal projection is a conic projection as shown in the example below.

The Lambert conformal projection uses the following six parameters.

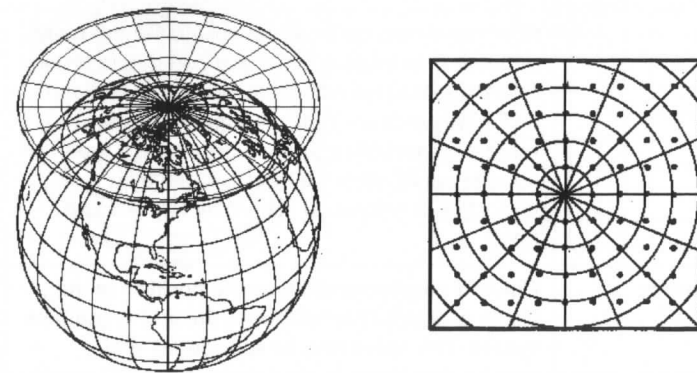| Parameter	Definition
Latitude 1 Latitude 2	First and second latitudes in the range -90° S to 90° N. They define where the imaginary cone intersects the sphere of the Earth. Latitude 1 and Latitude 2 must be both positive or negative. Latitude 1 must be equal to or greater than Latitude 2.
Pole Row	Row coordinate defining the position of the North or South Pole relative to the grid coordinate system. This value may be outside the grid. If Latitudes 1 and 2 are positive, Vis5D orientates the map projection according to the North Pole. If the latitude coordinates are negative, the map projection is orientated according to the South Pole.
Pole Column	Column coordinate defining the position of the North or South Pole relative to the grid coordinate system. This value may be outside the grid.
Central Longitude	Earth longitude that parallels the grid columns.
Column Increment	Grid spacing between grid columns at the central longitude and standard latitudes, in kilometers. This parameter controls the scale of the projection.

For example, to specify a Lambert conformal projection centered over Wisconsin for a grid with 35 rows and 40 columns, you would enter the following values.

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Note: When the pole is visible in a Lambert conformal projection, typically a wedge-shaped region with its apex at the pole will be undefined; that is, the longitude is greater than 180° and less than -180°. No map lines are displayed in this region and the topography is incorrect.

### Polar stereographic projection

The polar stereographic projection is an aximuthal stereographic projection as shown below.

The five parameters listed below define the polar stereographic projection.

Parameter	Definition
Center Latitude Center Longitude	Earth coordinates at the center of the projection. The apex of the imaginary cone will be over these coordinates when the file is displayed.
Center Row and Column	Grid row and grid column at the center of the map projection. These values may be outside the grid.
Column Increment	Spacing between grid columns, in kilometers, at the center of the map projection. This parameter controls the scale of the projection.

For example, if your grid has 40 rows and 40 columns and you want to specify a polar stereographic projection over the North Pole, you would specify the coordinates below.
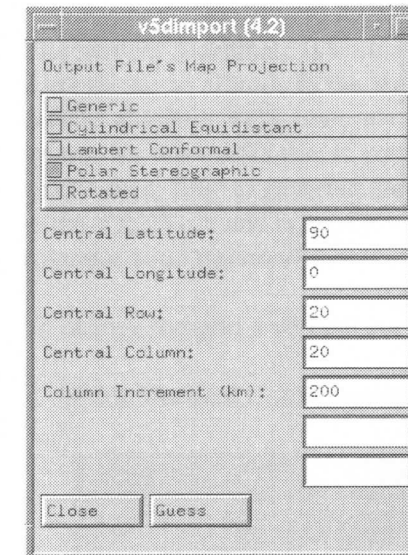

Rotated projection

The rotated projection uses a rectangular latitude/longitude coordinate system on a sphere rotated with respect to the Earth's natural latitude/longitude system. This projection is useful for creating nearly square grids for small scale models. North/south coordinates increase upward on the rotated sphere and east/west coordinates increase leftward on the sphere. The seven parameters below define the projection.

Parameter	Definition
Lat of grid row 0	Degrees latitude of the first grid row at the northern boundary of the grid
Lon of col 0	Degrees longitude of the first grid column located at the western boundary of the grid
Row Increment	Spacing between grid rows in degrees of latitude (greater than zero)
Column Increment	Spacing between grid columns in degrees of longitude (greater than zero)
Lat of (0,0)	Latitude on Earth that corresponds to the latitude at zero degrees on the rotated sphere
Lon of (0,0)	Longitude on Earth that corresponds to the longitude at zero degrees on the rotated sphere
Rotation	Number of degrees the sphere is rotated clockwise about its center point (0,0)

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For example, to generate a map projection with a square grid of 41 rows and 41 columns over a small region of Wisconsin, enter the coordinates below.
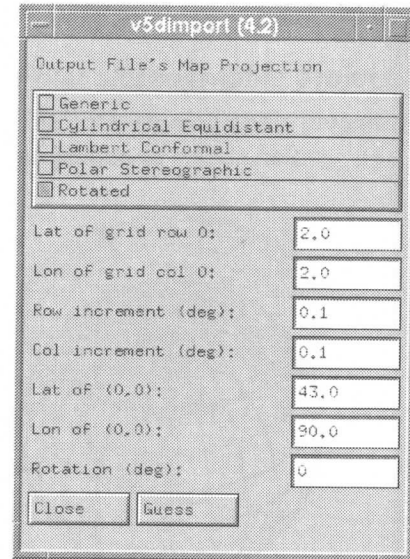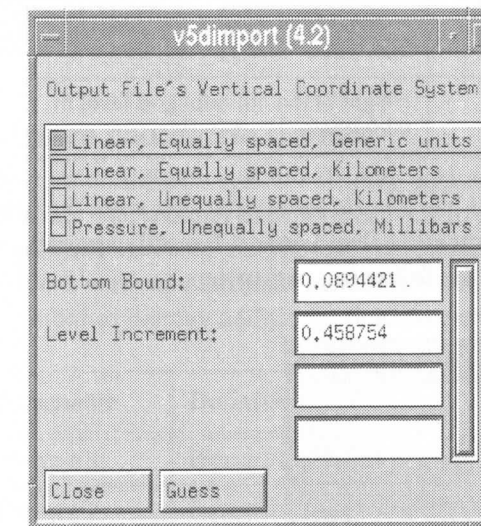

Changing the Vertical Coordinate System

Although you can change the Vertical Coordinate System (VCS), SSEC recommends using the default VCS.

The vertical coordinate system shows how the data level in each grid corresponds to altitude in the atmosphere or depth in the ocean. Vis5D defines a default VCS, but you can specify a different vertical coordinate system for the Vis5D file. If you do specify a different VCS, it may take Vis5D more time to generate the new file. The VCS information is stored in the Vis5D file and is used to set up the topography and map lines, and compute wind trajectories.

To change the grid's vertical coordinate system, follow the steps below.

1. Click **Vertical Coord System...** The dialog box shown below appears.

2. Click the desired vertical coordinate system and enter the appropriate parameters, which are described in the coordinate systems information on the following pages. If you're not sure which coordinate system to choose, click **Guess.**

3. Click **Close.** Change any other parameters, then click **Make** to create the file or click **Visualize** to create and display the file. If you click **Make**, Vis5D creates the new file, but does not display it. The Data Importer/Resampler Window remains displayed for creating additional Vis5D files.

   If you click **Visualize**, the Vis5D Control Panel and Display Window appear and the Data Importer Resampler Window closes. *Chapter 4, Using the Control Panel,* provides more information about working with the visualized data.

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Linear coordinate systems

Linear coordinates are measured in either kilometers or generic units and are used to view data according to height. Generic units have no specific measurements associated with them. Linear vertical coordinate systems can be equally spaced or unequally spaced, with their own parameters, as defined below.

Type	Parameters	Definition
Equally spaced	Bottom Bound	Bottom boundary of the 3-D box in generic units or kilometers
	Level Increment	Spacing between the grid levels in generic units or kilometers (greater than zero)
Unequally spaced	Height 1	Height of the first grid level (bottom) in kilometers
	Height 2	Height of the second grid level in kilometers
	Height *n*	Height of the *n*th (top) grid level in kilometers

For example, if your grid has 20 grid levels and you want 0.5 kilometers between each level, you would select **Linear, Equally spaced, Kilometers** and specify the following parameters.
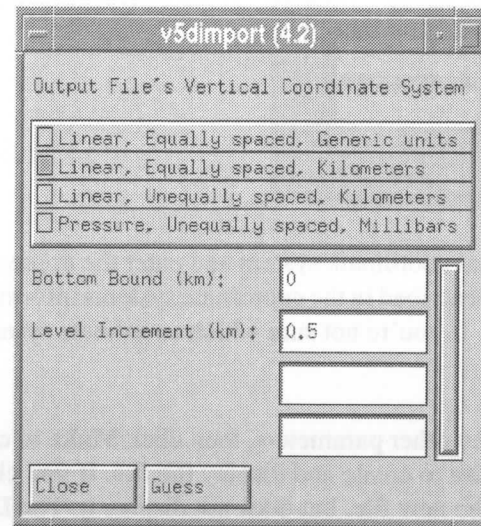
If your grid had 10 levels of data and you want the levels to be more closely spaced at the bottom than the top, you would choose **Linear, Unequally spaced, Kilometers**, and specify the following values.
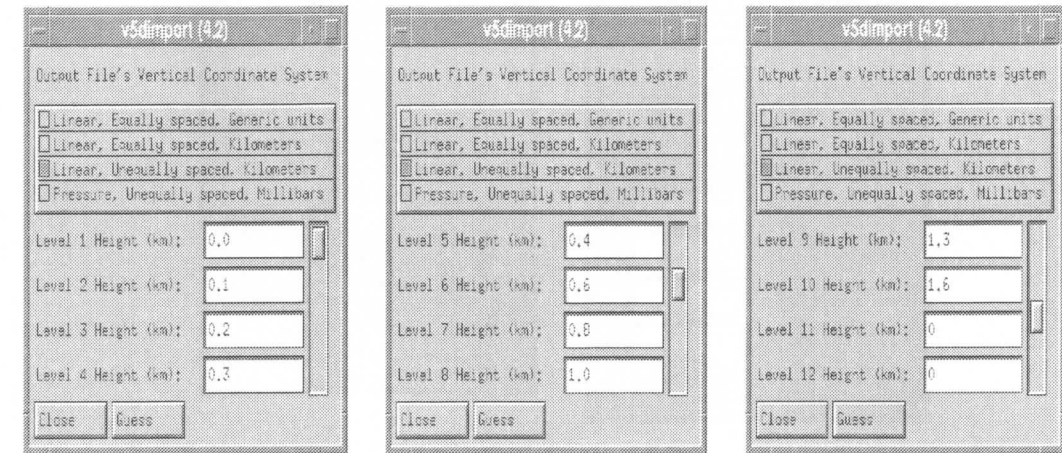

Pressure coordinate systems

Pressure coordinate systems display data according to millibars of pressure. The number of pressure levels in the grid determines the number of pressure levels in the vertical coordinate system. The parameters for a pressure vertical coordinate system are defined in the table below. Use the scroll bar to display additional fields for entering the pressure levels.

Parameter	Definition
Pressure 1	Pressure of the first (bottom) grid level
Pressure 2	Pressure of the second grid level
Pressure 3	Pressure of the third grid level
Pressure *n*	Pressure of the *n*th grid level

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For example, if the grid contains four levels of pressure data and you want them more closely spaced at the bottom, you would choose **Pressure, Unequally spaced**, **Millibars** and enter the following parameters.
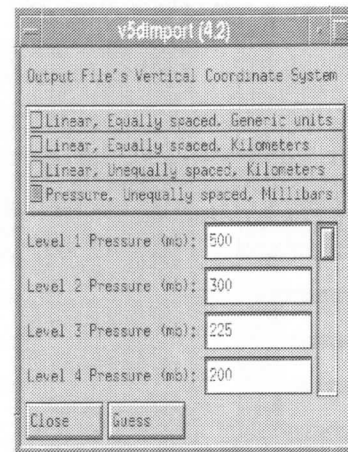

Compressing and Co-locating Data

You can also control the size of the Vis5D file by compressing or scaling the data. By default, the data in a single grid point is scaled to occupy one byte. This enables Vis5D to store entire datasets in memory and is generally adequate for weather data. To increase the data's resolution, you can scale the data so that two bytes are required to store the data in a single grid point. To make the most precise data, select a four-byte floating point value. This option creates the largest file sizes and is often used for atmospheric chemical concentrations. SSEC recommends using one-byte compression to optimize performance and rescaling the data only if precision suffers.

Co-locating data uses data from one grid or averages data when selected grids have the same values. It does not use all the data from the selected grids. For example, the grids you've selected may have the same time and location values. Instead of using the data from both grids, you can choose the data value from the higher resolution gird or use the average of all grid values at that grid location.

To co-locate or compress the data, follow the steps below.

1. Click **Options**. The dialog box appears as shown below.
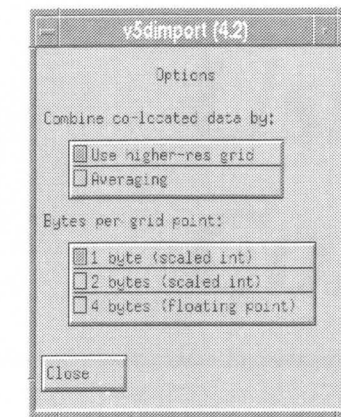
2. Click the appropriate co-located data option or click the desired number of bytes per grid point to compress the data.

3. Click **Close.** Change any other parameters, then click **Make** to create the file or click **Visualize** to create and display the file. If you click **Make**, Vis5D creates the new file, but does not display it. The Data Importer/Resampler Window remains displayed for creating additional Vis5D files.

   If you click **Visualize**, the Vis5D Control Panel and Display Window appear and the Data Importer Resampler Window closes. *Chapter 4, Using the Control Panel,* provides more information about working with the visualized data.

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4 Using the Control Panel

Once you've made Vis5D files, you can view and interact with them using the Control Panel. The Control Panel provides the tools to perform the following tasks.

- change the 3-D box display

- animate data

- display isosurfaces, data values, and volume rendering

- create slices, wind trajectories, and new variables

- add maps, topography, and labels

- save and restore graphics settings

- save and print images

- display vertical soundings and skew T diagrams

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When you display a file from the Vis5D Importer/Resampler, the Control
Panel and Display Window appear as shown below.

The Vis5D Control Panel
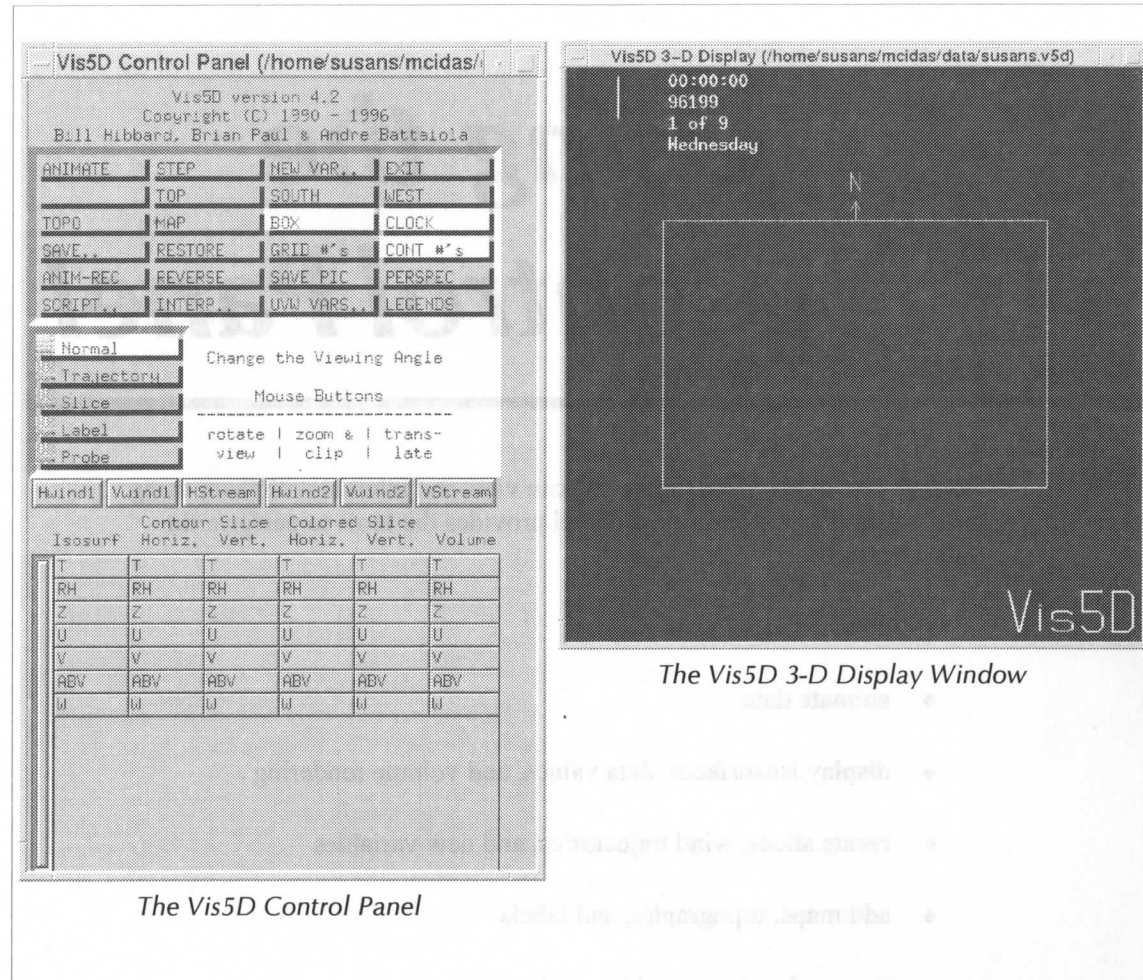
The Vis5D 3-D Display Window

Changing the 3-D box display

The 3-D box in the Display Window provides a framework to help you
view and orientate your data. You can change the following display
options for the 3-D box to make data easier to view or to create better
printouts.

♦ hide the box and clock

♦ change the view

♦ display grid numbers

♦ reverse the colors

Hiding the box and clock

Sometimes you may want to view data without the 3-D box or the clock on
the screen. To hide them, click the **BOX** and **CLOCK** buttons located in
the upper-third of the Control Panel. To redisplay them, click the buttons
again.

Changing the view

Vis5D starts with the 3-D box displayed from the top so no other sides are
visible. The top points toward the north, as shown on the previous page.
Using the mouse and the Control Panel you can:

♦ change to a north, south, east, west, top or bottom view

♦ rotate the box and reposition it on the screen

♦ zoom

Use the instructions in the table below to change the view. The buttons described in the table are located in the upper-third of the Display Window.

View	Action
south	click **SOUTH** with the left mouse button
north	click **SOUTH** the middle or right mouse button
west	click **WEST** with the left mouse button
east	click **WEST** with the right mouse button
top	click **TOP** with the left mouse button
bottom	click **TOP** with the right mouse button
rotated	move the cursor to the Display Window, then press the left mouse button and drag the 3-D box
zoom in	move the cursor to the Display Window, then press the middle mouse button and drag the mouse away from you using a sideways motion; the front of the box is cut away (clipped)
zoom out	move the cursor to the Display Window, then press the middle mouse button and drag the mouse toward you using a sideways motion
reposition box on screen (translate)	press the right mouse button and drag the box to a new location

Displaying grid coordinates

The coordinates of the dataset are displayed in kilometers. However, you can change to coordinates to display grid numbers for the data points by clicking the **GRID #'S** button.

Reversing the colors

When Vis5D starts, the 3-D box and clock are drawn in white on a black background. To reverse the colors and draw the box in black on a white background, click the **REVERSE** button. This is useful for printing images.

Animating data

Datasets with more than one timestep can be used to create an animation loop in the Display Window. For example, if the dataset has data from six different times, the Display Window has six timesteps of data. You can step through each timestep manually or automatically.

To manually step

Click the **STEP** button to advance to the next timestep.

To automatically step

Click the **ANIMATE** button to loop the timesteps. To decrease the animation speed, press the **S** key on the keyboard with the cursor positioned in the 3-D Display Window. To increase the animation speed, press the **F** key with the cursor in the Display Window. Click **ANIMATE** again to stop looping.

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Displaying isosurfaces

An isosurface is a three-dimensional surface showing all the data points for a variable having the same value. For example, the sample below shows an isosurface of all the temperature values at 282° in the Vis5D file. You can display more than one type of isosurface at a time; for example, temperature and relative humidity. However, you can't display multiple isosurfaces for the same variable unless you clone the variable. See the section *Creating new variables* in this chapter for more information.
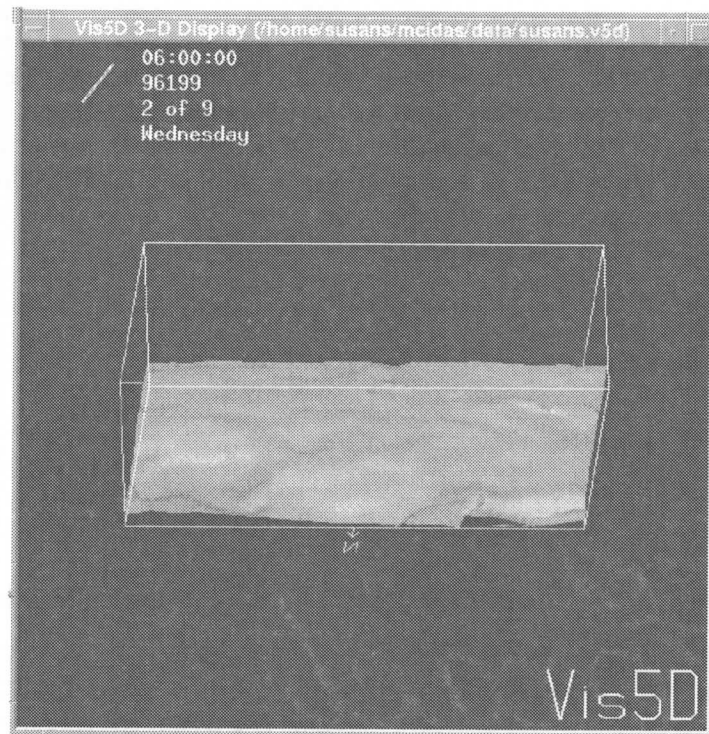

Follow the steps below to display an isosurface.

1. Click a variable button in the Isosurf column as shown below. The types of variables vary with the information in each grid file. A dialog box for the isosurface is displayed as shown in the next step.

2. Move the slider to the left or right to select a value for the isosurface. The example dialog box below is for a relative humidity isosurface.
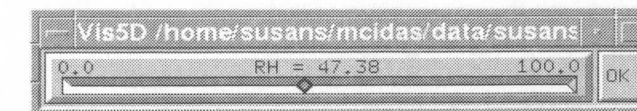

3. Click **OK**. The isosurface is displayed in the Display Window. After you display an isosurface, you can make the following modifications.

   ◆ change the color and opacity

   ◆ color an isosurface of one variable according to the values of another variable

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Changing the color and opacity

Follow the steps below to change the color and opacity of the isosurface.
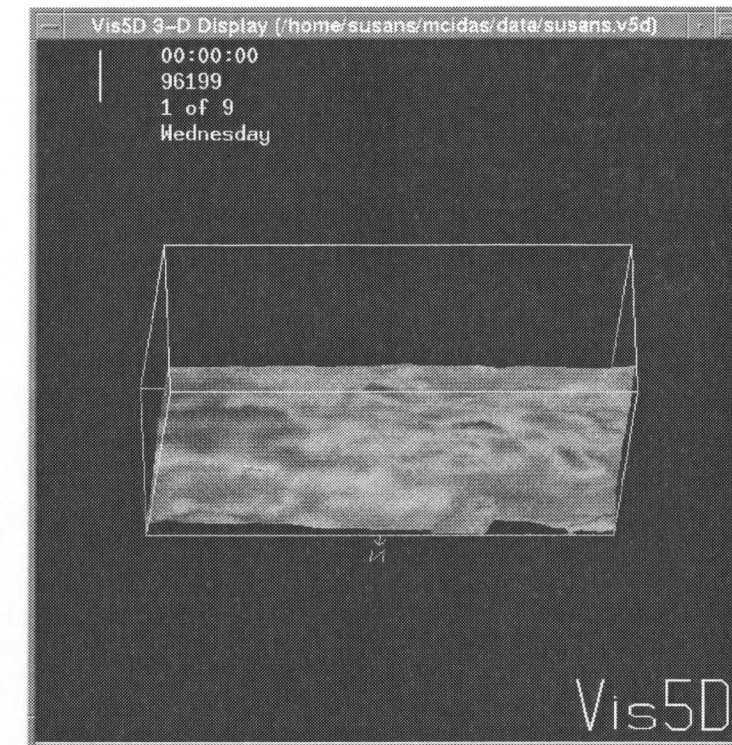
1. Click the right mouse button on the variable in the Isosurf column corresponding to the isosurface you want to change. The dialog box shown below is displayed.
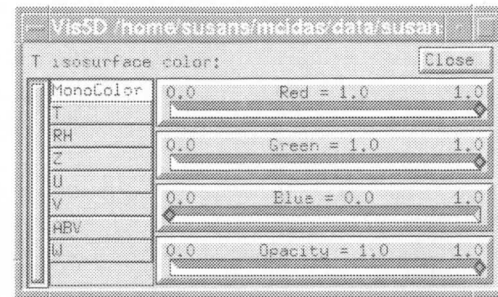
2. Move the Red, Green, Blue and Opacity sliders. The isosurface in the Display Window changes to show the new color and opacity values.
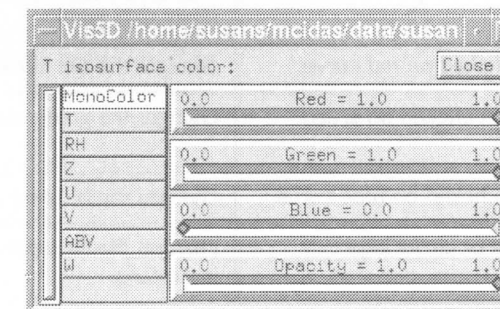
Coloring according to another variable

You can color an isosurface of one variable according to the values on another variable to show the relationship between the two at that timestep. The example below shows a temperature isosurface colored according to values of relative humidity. You can adjust the values that the colors represent.


Follow the steps below to color an isosurface according the values of another variable.

1. Click the right mouse button on the variable in the Isosurf column corresponding to the isosurface you want to color. The dialog box below is displayed.

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2. Click the variable you want to use to color the isosurface. The isosurface dialog box may display different variables than the ones shown, depending on the data in your Vis5D file. A color editing dialog box is displayed as shown below.
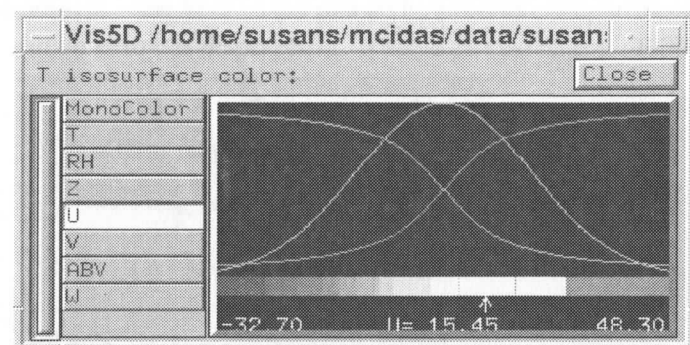
3. Use the arrow keys or the mouse to change the correlation between the data values and the colors, as described in the table below. The isosurface colors shown in the Display Window change to reflect the new values. You can display a color bar indicating the value correlations in the Display Window by clicking the **LEGENDS** button in the top section of the Control Panel.

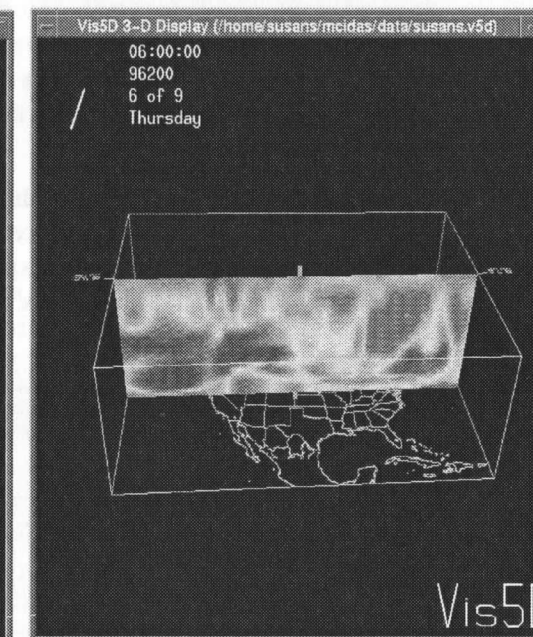| Key or Action	Function
right arrow key	shifts the color spectrum to the right so that the colors represent increased data values; the curve distribution remains the same
left arrow key	shifts the color spectrum to the left so that the colors represent decreased data values; the curve distribution remains the same
up arrow key	broadens the curve distribution to use more data values
down arrow key	narrows the curve distribution to use fewer data values
left mouse button clicked on red curve	changes the red curve
middle mouse button clicked on green curve	changes the green curve
right mouse button clicked on blue curve	changes the blue curve
shift key plus mouse or arrow keys	changes the transparency of the isosurface

Creating slices

A slice shows a cross section of data at a particular height or level. Slices can be orientated either horizontally or vertically. Using Vis5D, you can create four types of slices.

- ♦ contoured slices
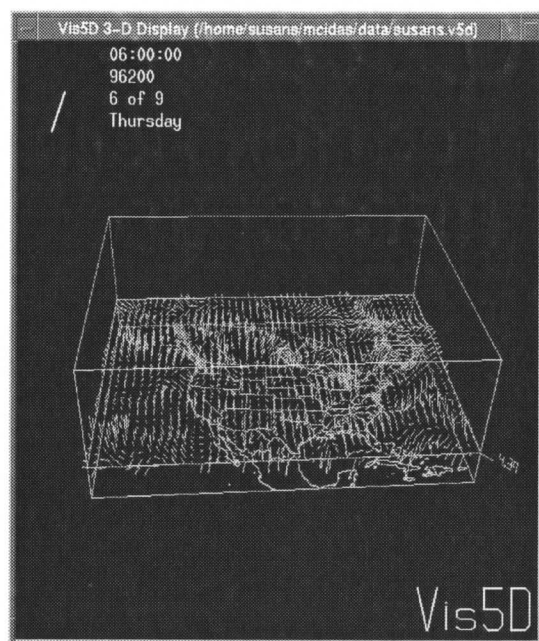
- ♦ colored slices

- ♦ wind vectors

- ♦ wind streamlines

Below are examples of each type.
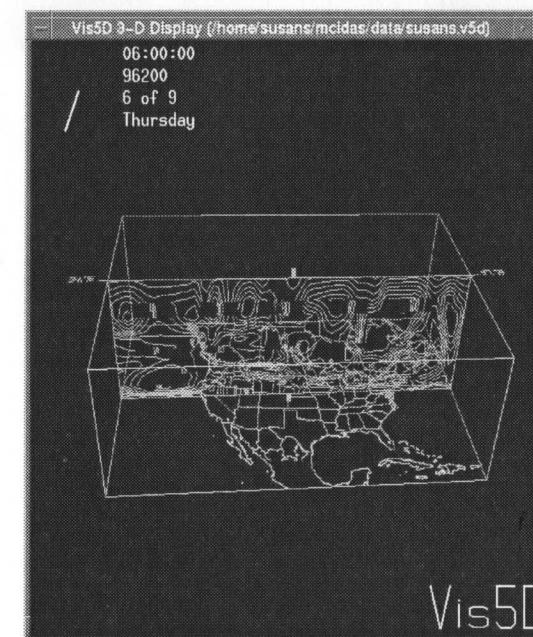
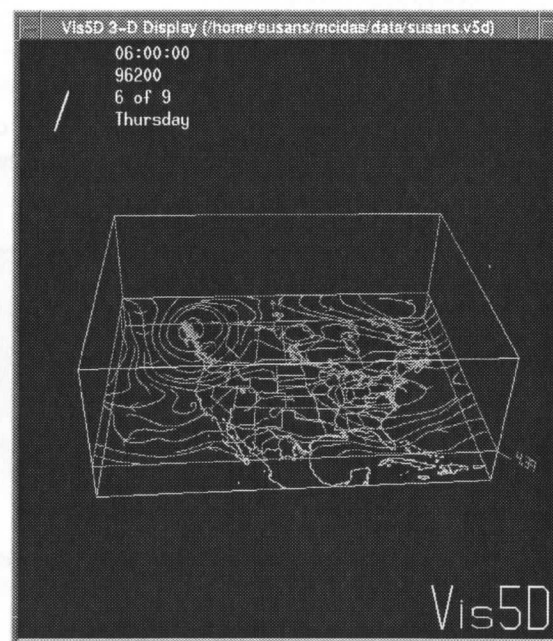*Vertical contoured slice of relative humidity data*

Vertical colored slice of relative humidity data

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Horizontal wind vectors

Horizontal windstreams

When creating slices, you'll use the slice buttons located in the bottom third of the Control Panel. The slice buttons are highlighted in the example below. The Control Panel may display different variable buttons depending on the data in your Vis5D file.

The steps for creating slices are provided below. After you've displayed a slice, you can make the following modifications.
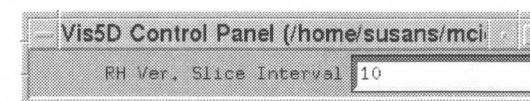
♦ change the color

♦ rotate and move slices

Contoured slices

Contoured slices plot data values for a variable at a particular height. After the slice is displayed, you can change the interval between contours and toggle the display of the contour numbers by clicking the **CONT #'s** button located in the upper-third of the Control Panel.

Follow the steps below to create a horizontal or vertical contoured slice.

1. Click a variable button in the Vertical or Horizontal Contour Slice column. The slice is displayed in the Display Window and an interval dialog box appears indicating the interval used for the contour, as shown below.
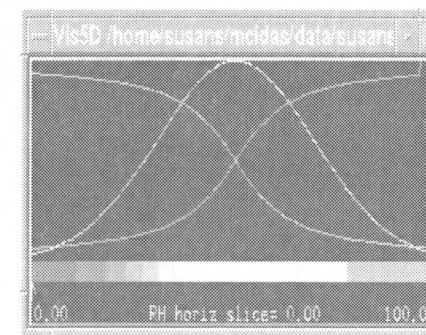

2. Enter a number in the Interval field to change the contour slice interval. Decreasing the interval number draws more contour lines. Increasing the contour interval creates sparser lines. To close the dialog box, click the selected variable with the middle mouse button.

Colored slices

Colored slices use color to depict data values for a variable at a particular height. After the slice is displayed, you can change the correlation between the data values and the colors.

Follow the steps below to create a vertical or horizontal colored slice.

1. Click a variable button in the Colored Slice column. The slice is displayed in the Display Window and the dialog box shown below appears indicating the data value that each color represents.

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2. Use the arrow keys or the mouse to change the correlation between the data values and the colors, as described in the table below. The slice colors displayed in the Display Window change to reflect the new values. You can display a color bar indicating the value correlations in the Display Window by clicking the **LEGENDS** button in the top section of the Control Panel.

The table below lists the keyboard controls for changing the slice colors.

Key or Action	Function
right arrow key	shifts the color spectrum to the right so that the colors represent increased data values; the curve distribution remains the same
left arrow key	shifts the color spectrum to the left so that the colors represent decreased data values; the curve distribution remains the same
up arrow key	broadens the curve distribution to use more data values
down arrow key	narrows the curve distribution to use fewer data values
left mouse button clicked on red curve	changes the red curve
middle mouse button clicked on green curve	changes the green curve
right mouse button clicked on blue curve	changes the blue curve
shift key plus mouse or arrow keys	changes the transparency of the slice

Wind vectors

Wind vectors show the wind direction and strength. If your Vis5D file contains U, V, and W wind data at all levels, you can draw both horizontal and vertical wind vectors. You can also change the length and number of the wind vectors drawn.

Follow the steps below to draw wind vectors.

1. Click the **Hwind1**, **Vwind1**, **Hwind2**, or **Vwind 2** button, depending on the type of wind vectors you want to display. The wind vectors are drawn in the Display Window and the dialog box shown below appears.

```
Vis5D /home/susans/mcidas/data/susan
H-Wind 1 Scale: 1      Density: 1
```
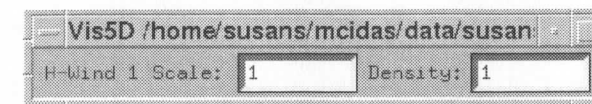
2. Enter values in the Scale and Density fields to change the length and number of wind vectors. To double the length of wind vectors drawn, enter 2.0 in the Scale field. To halve the length, enter .5. The default is 1.0. To decrease the number of wind vectors drawn by one-half, enter 0.5 in the Density field. The density can only be between zero and one.

Streamlines

Streamlines show the path of the wind as connected line segments. If your Vis5D file contains wind data, you can draw streamlines on both horizontal and vertical planes. You can also control the density of the streamlines.

To draw steamlines, follow the steps below.

1. Click the **HStream** or **VStream** buttons in the Control Panel. If your Vis5D file contains only horizontal wind data (u and v winds), only one horizontal streamline can be displayed. The streamlines are drawn in the Display Window and a dialog box similar to the one below appears depending on the type of wind stream you selected.

```
Vis5D /home/susans/mcidas/data/susan
HStream 1 Scale: 1      Density: 1
```
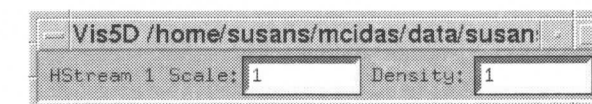
2. Enter values in the Density field to change the number of streamlines. To decrease the number of streamlines drawn by one-half, enter 0.5; to double the number of streamlines, enter 2.0. The Scale field is not used for streamlines.

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Changing colors

Except colored slices, the color of the slice button matches the contour slice shown in the Display Window. For colored slices, the slice button matches the color of the tick mark indicating the slice height.

Follow the steps below to change the color of a slice.

1. Click the right mouse button on the slice button corresponding to the slice you want to change. The dialog box shown below is displayed.
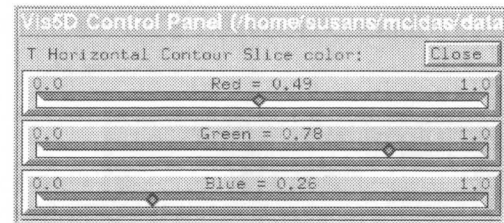
2. Move the Red, Green, and Blue sliders to change the color. The color of the slice changes in the Display Window.

Moving slices

Initially, Vis5D positions slices in the middle of the 3-D box. A tick mark near the corner of each slice indicates the exact latitude, longitude or elevation.

To move a horizontal slice, position the mouse on a corner, press the right mouse button and drag the slice to a new location. You can also move vertical slices by dragging the top or bottom edge of the slice.

Creating wind trajectories

Wind trajectories trace the motion of air through the 3-D volume. They show the paths of air parcels passing through a single point in space. If trajectories are created while Vis5D is in ANIMATE mode, paths of all air parcels through the selected point are shown. Otherwise, the trajectory shows the path of a single air parcel, which passes through a selected point at a given timestep. The sample below shows forecast model output winds.
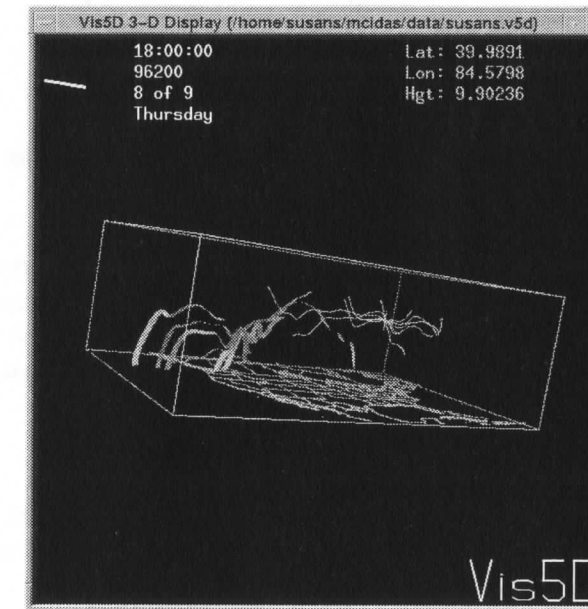
Vis5D organizes wind trajectories according to sets. Each set can be individually displayed, colored, or deleted. Wind trajectories can appear as line segments or as ribbons, which are thicker than line segments. The example above shows the trajectories as both ribbons and line segments. As you create new trajectories, group them according to location or time. To create wind trajectories, your data must contain three wind variables: u, v, and w, for example.

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Follow the steps below to create a set of wind trajectories.

1. Click the **Trajectory** button located in the middle of the Control Panel. A 3-D cursor appears inside the 3-D box. The Interactive Wind Trajectories dialog box is displayed as shown below.
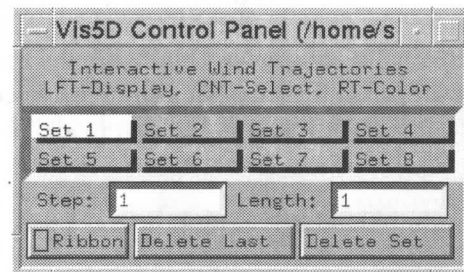
2. Assign a set number to the trajectories by clicking one of the **Set** buttons. Each set may be displayed in a different color.

3. Click the **Step** button in the Control Panel to advance through the timesteps until you see the time for which you want to draw wind trajectories. When the trajectory is drawn, Vis5D traces the wind data forward from the current timestep, then backward through time to the first timestep.

4. Specify a **Step** value in the dialog box shown above. SSEC recommends using the default value. The step value controls the step size used in the trajectory tracing algorithm. A smaller step value provides more precise trajectory calculations but increases the calculation time.

5. Specify a **Length**. You cannot change the length once you've drawn the trajectory. The length value is a multiplier; the default is 1. To double the length of the trajectories, enter a value of 2. To draw trajectories half the size of the default, enter the value 0.5. You can specify a different length for each set of trajectories.

6. Click **Ribbon** if you want the wind trajectory to appear as a ribbon, otherwise it appears as a line segment.

7. Press the right mouse button and move the 3-D cursor in the box to the location where you'd like to create a wind trajectory. The 3-D cursor moves in a 2-D plane parallel to the plane of the projection so the cursor always stays at a constant depth. You can change the depth by rotating the view box using the **TOP**, **SOUTH**, and **WEST** buttons on the Control Panel. See the section *Changing the 3-D box display* at the beginning of this chapter for more information.

8. Press the center mouse button to create a wind trajectory at the current cursor location and timestep.

9. Click **ANIMATE** to see how the winds move through the trajectory point you selected. If you click the center mouse button while the data is animating, Vis5D creates a trajectory for each time step.

After you've created a set of wind trajectories, you can make the following modifications.

♦ change the trajectory color and opacity

♦ color trajectories according to the value of a variable

Changing the trajectory color and opacity

Follow the steps below to change the trajectory color and opacity.

1. Click the right mouse button on the **Set** button for the trajectory set you want to change. The dialog box shown below is displayed.
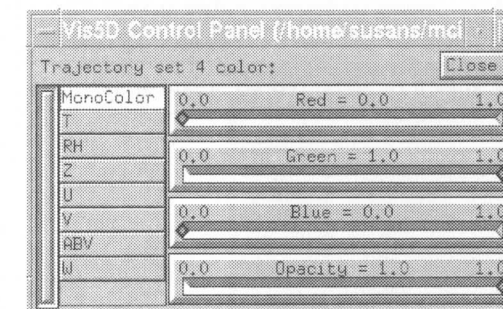

2. Click **Monocolor** and move the Red, Green, Blue, and Opacity sliders. The trajectory color changes in the Display Window as you move the sliders.

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Coloring trajectories according to variables

You can color trajectories according to the value of a variable to show the relationship between the variable and the air motion. For example, you can color the trajectory according to temperature values. Follow the steps below to display colored variables as part of the trajectory set.

1. Click the right mouse button on the **Set** button for the trajectory you want to color according to a variable. The dialog box is displayed as shown below.
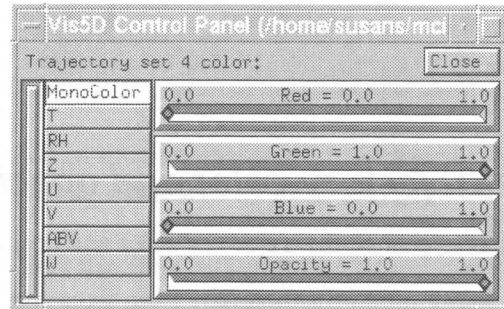
2. Click a variable. The dialog box for the Temperature variable is shown below.
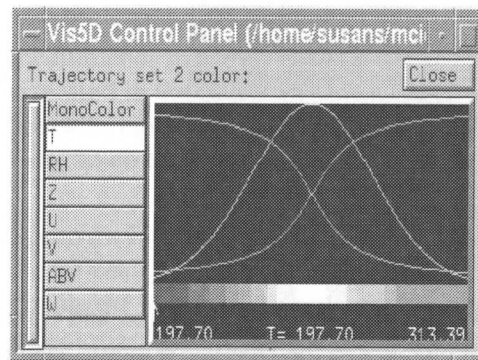
3. Use the arrow keys or the mouse to change the correlation between the data values and the colors as described in the table below. The colors of the trajectories in the Display Window change to reflect the new values. You can add a color bar indicating the value correlations by clicking the **LEGENDS** button in the top section of the Control Panel.

Key or Action	Function
right arrow key	shifts the color spectrum to the right so that the colors represent increased data values; the curve distribution remains the same
left arrow key	shifts the color spectrum to the left so that the colors represent decreased data values; the curve distribution remains the same
up arrow key	broadens the curve distribution to use more data values
down arrow key	narrows the curve distribution to use fewer data values
left mouse button clicked on red curve	changes the red curve
middle mouse button clicked on green curve	changes the green curve
right mouse button clicked on blue curve	changes the blue curve

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Listing data values

You can list the data values for points in the 3-D box. The information appears in the bottom-left corner on the Display Window as shown below. If you clicked the **GRID #'s** button to display grid numbers, the probe is limited to integer grid coordinates and does not interpolate data values between grid points. The cursor snaps to the nearest grid point.
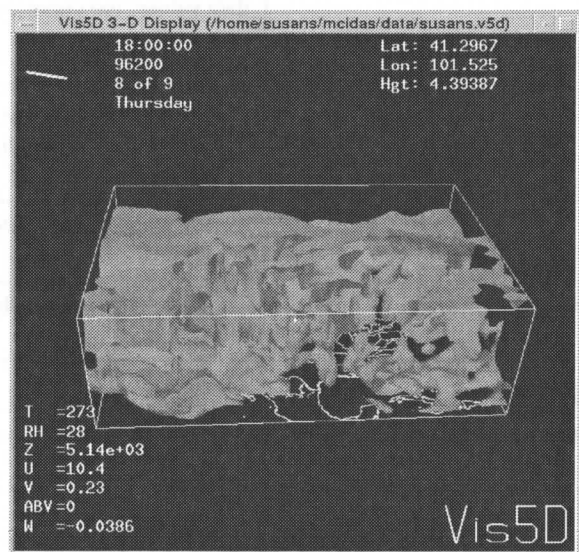
Follow the steps below to list individual data values.

1. Click the **Probe** button on the Control Panel. A 3-D cursor appears in the Display Window.

2. Press the right mouse button and move the cursor to the point where you want to see data values. The data values appear in the lower-left corner of the Display Window.

Creating new variables

You can add new physical variables to the dataset and add corresponding buttons to the Control Panel. You can then display isosurfaces, slices, and volume rendering for the new variables. There are two methods for creating new variables:
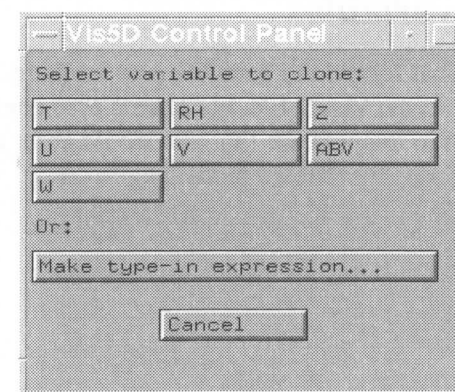
♦ cloning existing variables

♦ computing new variables

Cloning existing variables

Vis5D only lets you view one isosurface, contour, or slice for each variable; however, cloning provides a way for drawing additional isosurfaces at different values. For example, if you display an isosurface for the temperature values at 0°, you can't add another isosurface for the Temperature variable. However, if you clone Temperature and make a Temperature Prime (T') variable, you can add an isosurface at a different temperature value, for example -20°.

Follow the steps below to clone variables.

1. Click **NEW VAR..** in the Control Panel. The dialog box shown below is displayed.

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2. Click a variable to clone. The dialog box displayed on screen may have different variables than shown in the example below. A new button displaying the variable name plus the prime symbol is added at the bottom of the Control Panel with the other variable buttons. This example shows the new variable RH'.

Computing new variables

You can enter a mathematical formula to compute new variables using variables already available in the Vis5D file. For example, to compute the ratio of the dew point (TD) to temperature (T), you would enter the following formula in the dialog box shown on the page 4-26.
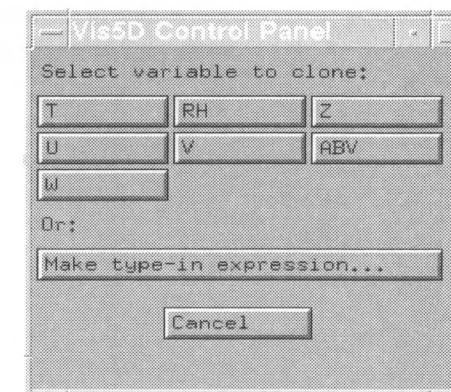
RATIO=TD/T

When entering your formulas, use the names of existing variables and the arithmetic operators and functions listed below.

Operator or Function	Description
+	addition
-	subtraction
*	multiplication
/	division
**	exponentiation
SQRT	square root
EXP	exponent (Base e)
LOG	logarithm
SIN	sine
COS	cosine
TAN	tangent
ATAN	arc tangent
ABS	absolute value
MIN	minimum of two values
MAX	maximum of two values

Follow the steps below to compute a new variable.

1. Click **NEW VAR..** in the Control Panel. The dialog box shown below is displayed.

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2. Click **Make type-in expression...**. The dialog box shown below is displayed.
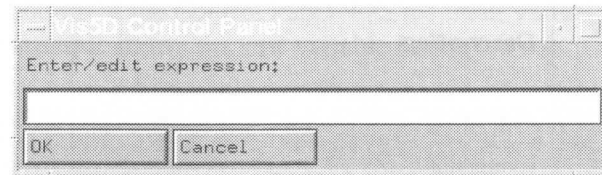
3. Enter the formula, then click **OK**. A button with the formula's name is added to the bottom of the Control Panel. If you used nonexistent variables or operators, an error message is displayed. Once you create a formula, you can edit it from the same dialog box used to create them.

Displaying volume rendering

A volume rendering is a 3-D colored fog representation of a variable. Unlike slices, which only provide a two-dimensional representation of data at one plane, volume rendering displays all of the data points for a variable inside the entire area of the 3-D box. Volume renderings are most effective for providing an overall quantitative representation for data. The example below shows a volume rendering of wind vorticity from a storm in March 1993.
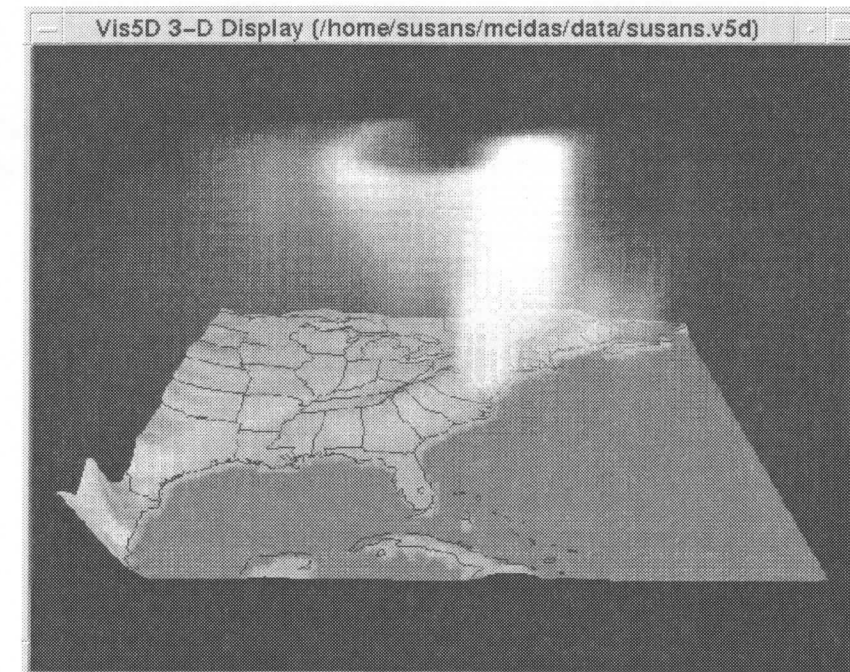

If your system doesn't have 3-D graphics hardware (for example if you use the Mesa graphics library) or if you are using an X terminal, volume rendering is very slow.

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Follow the steps below to display volume rendering. You can only display volume rendering for one variable at a time. Use the variable buttons under the Volume column as shown below.

Isosurf	Contour Slice Horiz.	Vert.	Colored Slice Horiz.	Vert.	Volume
T	T	T	T	T	T
RH	RH	RH	RH	RH	RH
Z	Z	Z	Z	Z	Z
U	U	U	U	U	U
V	V	V	V	V	V
ABV	ABV	ABV	ABV	ABV	ABV
W	W	W	W	W	W

1. Click a variable button in the Volume column. The volume rendering is drawn in the Display Window and a color editing dialog box appears as shown below.
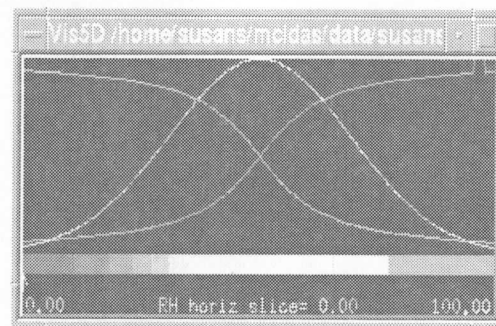
2. Press the arrow keys or the mouse button to change the curve as described in the table below.

Key or Action	Function
right arrow key	shifts the color spectrum to the right so that the colors represent increased data values; the curve distribution remains the same
left arrow key	shifts the color spectrum to the left so that the colors represent decreased data values; the curve distribution remains the same
up arrow key	broadens the curve distribution to use more data values
down arrow key	narrows the curve distribution to use fewer data values
left mouse button clicked on red curve	changes the red curve
middle mouse button clicked on green curve	changes the green curve
right mouse button clicked on blue curve	changes the blue curve
shift key plus mouse or arrow keys	changes the transparency of the volume rendering

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Adding maps, topography, and labels

You can add maps, topography, and text labels to annotate a Vis5D image. Maps provide a location reference for the data. The topography shows the variable values according to location. Labels are typically used for making presentation graphics. For example, you can add a title or your name to the data, highlight a feature of the data, or document the meaning of the data in the window.

Maps

Follow the steps below to add a map and change its color.

1. Click the **MAP** button located in the upper-third of the Control Panel. Vis5D displays the map projection stored in the file. The MAP button is not displayed if the current path doesn't contain a map file. To erase the map, click **MAP** again.

2. Click **MAP** with the right mouse button to change the map color. The dialog box shown below is displayed.
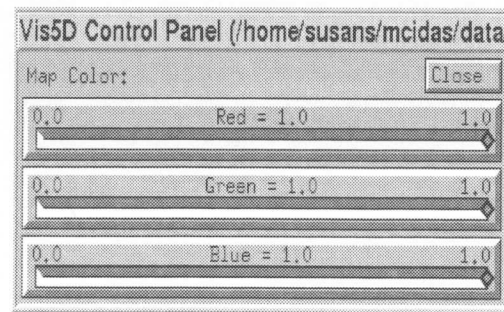
3. Move the Red, Green, and Blue sliders to change the map color.

Topography

Follow the steps below to display the topography, or change the color for the topography. By default, Vis5D uses height to display topography.

1. Click the **TOPO** button located in the upper-third of the Control Panel. Vis5D displays the topography stored in the file EARTH.TOPO. The TOPO button is not displayed if the current path doesn't contain a topography file.

2. Click **TOPO** with the right mouse button to adjust the topography color. The dialog box shown below is displayed.
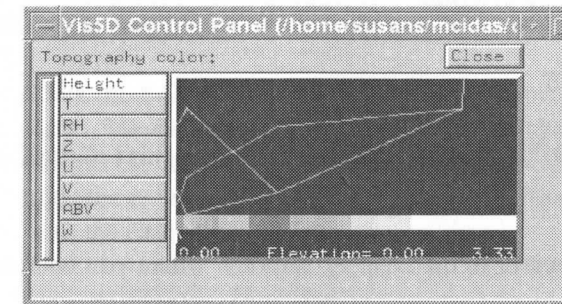
3. Select **Height** or a different variable to use for coloring topography.

4. Click and drag the colored lines or press the arrow keys to change the values that the colors represent as described in the table below. You can display a color bar indicating the value correlations in the Display Window by clicking the **LEGENDS** button in the top section of the Control Panel.

Key or Mouse Button	Function
Right arrow key	shifts the color spectrum to the right so that the colors represent increased data values; the curve distribution remains the same
Left arrow key	shifts the color spectrum to the left so that the colors represent decreased data values; the curve distribution remains the same
Up arrow key	broadens the curve distribution to use more data values
Down arrow key	narrows the curve distribution to use fewer data values
left mouse button clicked on red curve	changes the red curve

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Key or Mouse Button	Function
middle mouse button clicked on green curve	changes the green curve
right mouse button clicked on blue curve	changes the blue curve

Labels

Labels are helpful for adding titles, your name, or the date to the data, or highlighting particular features of the data. You can add, move, and delete labels in the Display Window.

Adding labels

1. Click the **LABEL** button located in the upper-third of the Control Panel.

2. Position the cursor in the Display Window where you want to add a label.

3. Press the left mouse button. The cursor changes to a text cursor.

4. Type the text for the label; you can use the backspace key to correct errors. Press **Enter**.

Moving labels

1. Move the cursor to the label.

2. Press and hold the middle mouse button and drag the mouse.

3. Release the mouse button at the new location.

Deleting labels

Vis5D does not prompt you for verification before deleting. Once a label is deleted, you can only restore it by retyping.

1. Move the cursor to the label.

2. Press the right mouse button. Vis5D deletes the label without prompting you for verification.
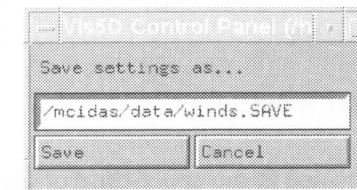
Saving and restoring graphics

The graphics settings, such as labels, maps, and topography, are not automatically saved when you close the Vis5D file. Unless you save them, they will be lost. Saving the graphics settings for a Vis5D file saves all graphics displayed, such as isosurfaces, wind trajectories, and slices for each timestep.

Saving graphics

Follow the steps below to save the graphics displayed in your Vis5D file.

1. Click the **SAVE...** button located in the upper-third of the Control Panel. The dialog box shown below is displayed. Vis5D automatically assigns the graphics file the same name as the displayed Vis5D file and adds the extension .SAVE. To change the filename, type a new name with the extension .SAVE.
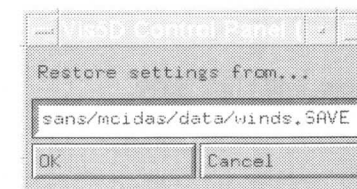

2. Click **Save**. The file is saved in the same directory as the displayed Vis5D file.

Restoring graphics

Follow the steps below to restore a saved graphics file.

1. Click the **RESTORE** button in the Control Panel. The dialog box shown below is displayed with a graphics file listed. To restore a different graphics file, enter the directory location and name in the dialog box.

2. Click **OK**.

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Saving and printing images

You can save and print your Vis5D images, including the maps and labels. Depending on your workstation, you can save Vis5D images in the following formats and view them using the display programs listed.

Format	Extension	Display Program
X Window Dump	.xwd	xwud or xv
SGI image file	.rgb	ipaste or xv
Graphics Interchange Format	.gif	xv and many other programs
PostScript	.ps	Ghostview and other postscript viewers

Saving an image

Follow the steps below to save an image.

1. Display the image in the Display Window.

2. Click the **SAVE PIC** button located in the upper-third of the Control Panel. The dialog box shown below is displayed. The available file formats are workstation dependent.
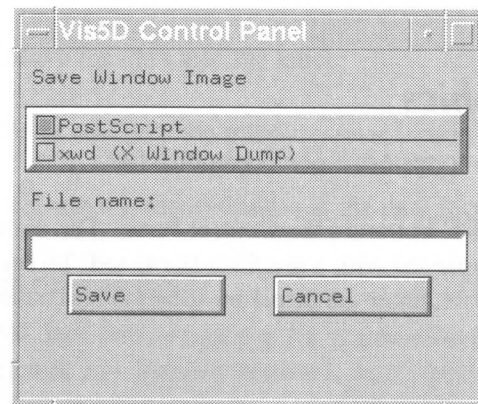
3. Select a format, enter a file name, and click **Save**.

Printing an image

Follow the steps below to print an image. To create better printouts, you may want to reverse the colors by clicking the **REVERSE** button. The 3-D box will be drawn in black on a white background.

1. Position the cursor in the Display Window and press the **P** key. The dialog box shown below is displayed.
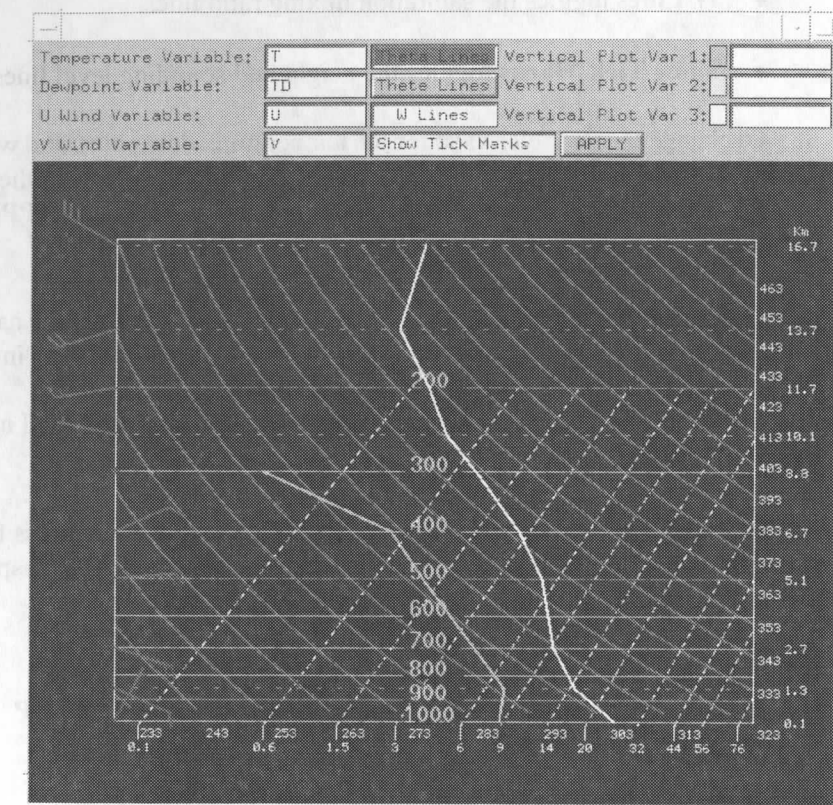

2. Click **OK** to print. The file is sent to the default printer or the printer specified by the PRINTER environment variable. If you have problems printing, try saving the image as a PostScript file and then print from the Unix prompt using the **lpr** or **lp** command.

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Displaying vertical soundings

Vertical soundings measure data for a single location at various levels down through the atmosphere. By displaying a skew T diagram of a vertical sounding, you can see how temperature, for example, changes with altitude.

When you select the Sounding mode, Vis5D displays a Vertical Sounding window similar to the sample below. By default, temperature, dew point, and wind speed and direction are plotted in the skew T diagram. Using the vertical line cursor in the 3-D box, you can change the location for the sounding.

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Follow the steps below to display a skew T diagram of a vertical sounding.

1. Click the **Sounding** button located in the middle of the Control Panel. The Vertical Sounding window appears and a vertical line cursor appears in the 3-D box. The default skew T diagram uses variables named T, TD, U, and V if they exist in the dataset.

2. To display backgrounds for the diagram, click the buttons in the upper middle section of the vertical sounding window.

   ◆ **Theta Lines** toggles the dry adiabats.

   ◆ **Thete Lines** toggles the saturation adiabats.

   ◆ **W Lines** toggles the saturation mixing ratio lines.

   ◆ **Show Tick Marks** toggles the height and sounding level lines.

3. To change the variables used for the temperature, dew point, and wind fields, enter a variable name from the dataset into the boxes in the upper-left corner of the Vertical Sounding window. Click the **APPLY** button.

4. To create a vertical plot of other variables in the dataset, enter the name of a variable in one of the three boxes labeled **Vertical Plot Var** in the upper-right corner of the Vertical Sounding window. Click the **APPLY** button. The plot and scale appear in the color indicated next to the variable box.

5. To display a diagram for a sounding at a different location, press the right mouse button and move the vertical line cursor in the 3-D display box. A plot for the cursor location automatically appears.

6. If the dataset has more than one timestep, you can see how the variables change over time by clicking the **ANIMATE** or **STEP** button in Control Panel.