

APPENDIX D

IRIS 3DVIEW

D.1 Overview

The IRIS 3DView software is a separately licensed software package available from Vaisala that renders 3D visualizations of IRIS format radar data. The radar data can be rendered using surface or volume rendering over a detailed 3D terrain map of the land and water underneath the weather echoes. Alternatively, the 3D visualization can be rendered over a 2D radar product.

IRIS 3DView allows the rendered scene to be rotated, panned, and zoomed in. Additional detail layers such as radar range rings, latitude-longitude grid, and landmark labels can be added to the view for easy navigation. The user can also store preferred view angles and display states for later use.

The user can view the desired data files (Archive Mode) or configure IRIS 3DView to monitor a data file directory for viewing of the latest radar data (Live Mode). The input radar data may be data collected from a single weather radar, or from an IRIS composite of multiple radars.

The user can export bitmap images of the 3D visualization, and run a background process that automatically renders bitmap images of the incoming radar data.

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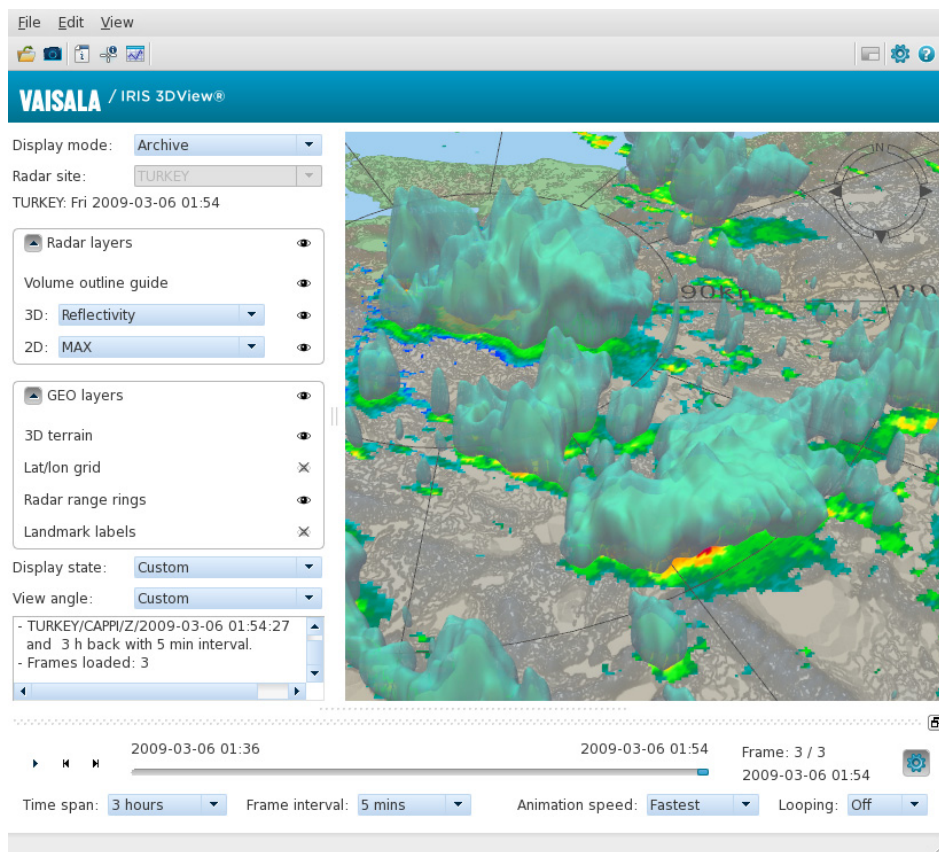


Figure 1 IRIS 3DView User Interface

D.1.1 IRIS 3DView in System Architecture

The IRIS 3DView package fits into the overall architecture of an IRIS system as shown in [Figure 2 on page 3](#). Generally, there is an IRIS/Radar package running the IRIS software at a remote radar site (or perhaps there are multiple remote radar sites). Raw radar base data are fed from the radar sites to a central server computer running IRIS/Analysis software generating many 2D radar products. These products may be viewed directly on this central server computer, or re-distributed to other client computers running the IRIS/Display software package. For 3D functions, the central server computer outputs radar products over the network to the IRIS 3DView workstation. The IRIS 3DView PC receives these data and displays it in the 3D rendering window.

At the 3D rendering window, the operator may manipulate the data by rotating, panning, zooming, etc. During manipulation, the images are viewed in true 3D form. Any 3D image viewed on the IRIS 3DView computer can then be sent back to the central server computer for viewing and distribution to other client computers on the network running IRIS/Display. So in summary the 3D functions (rotation, etc.) are only available

at the IRIS 3DView workstation. However 2D versions of the 3D renderings can be made available to any IRIS workstation on the network.

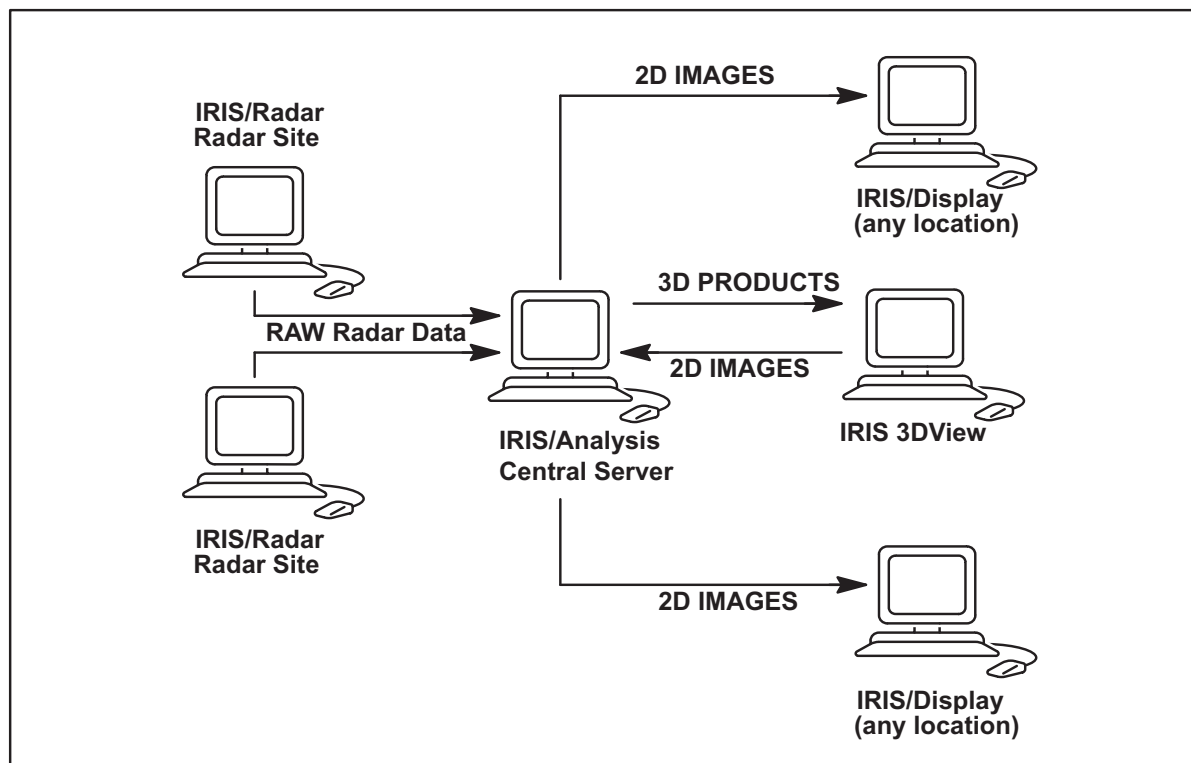


Figure 2 IRIS 3DView Data Flow

D.1.2 System Requirements

IRIS 3DView requires a Linux operating system. The recommended linux distribution is Red Hat Enterprise Linux 5.4. The installation files are delivered in RPM (Red Hat Package Management) format.

IRIS 3DView runs on standard PC hardware. IRIS 3DView must be run on a dedicated computer, since it requires full use of the processor, memory, and graphics subsystems.

The minimum requirements for the hardware are listed below:

- Processor: Intel Core 2 Duo (3.0 GHz, 6MB L2 cache, 1333 MHz FSB)
- Memory: 2GB DDR2 800 MHz
- Graphics card: nVidia GeForce 9600 or equivalent

D.2 Installing IRIS 3DView

There are two ways to install IRIS 3DView: using the graphical installer, or from a shell session.

D.2.1 Installation Using Graphical Installer

1. Log in on the PC where IRIS 3DView is to be installed.
2. Start a new shell session and become root:

```
su -
```

NOTE

If you have sudo rights prepend each command with 'sudo' and enter your own password when requested.

3. Mount the IRIS/RDA release CD-ROM with:

```
mount /dev/cdrom /mnt/cdrom
```

4. Change to the IRIS release directory, and run the install program:

```
cd /mnt/cdrom/RHEL6/iris
```

```
./install
```

If you are installing on RHEL5, use the /mnt/cdrom/RHEL5/iris directory.

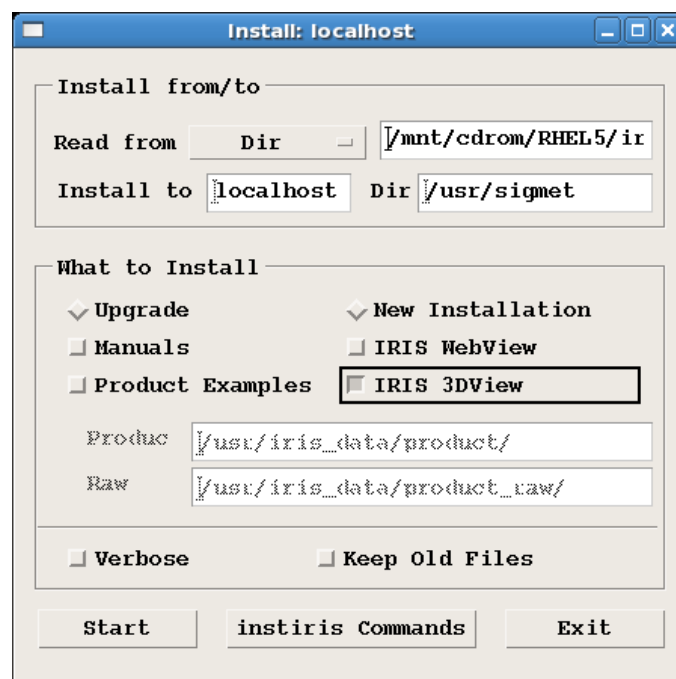


Figure 3 IRIS 3DView Installer GUI

5. Press the button for **IRIS 3DView**, then press the **Start** button.
6. After the installation is done, exit the install program.
7. Unmount the cdrom, and log out from root with:

```
cd /  
eject /mnt/cdrom  
exit
```
8. IRIS 3DView is now installed. Continue with section [D.2.4 Installing the License on page 7](#).

D.2.2 Installation from Shell

IRIS 3DView and the required supporting libraries can be installed from a shell session without the graphical installer. Follow the procedure below:

1. Log in on the PC where IRIS 3DView is to be installed.
2. Start a new shell session and become root:

```
su -
```

NOTE

If you have sudo rights prepend each command with 'sudo' and enter your own password when requested.

3. Remove the old vtk-devel and qt4-devel packages. Do not worry if you get an error because they are not installed:

```
rpm -e vtk-devel  
rpm -e qt4-devel
```

4. **On RHEL6 systems:** go to the directory where the RPM packages are. This could be on the mounted release CD-ROM in `/mnt/cdrom/RHEL6/extras/RPMS` or on a directory with files downloaded from our ftp site. Issue the following commands:

```
rpm -U proj-*  
rpm -U vtk-5.4*  
rpm -U vtk-qt-5.4*  
rpm -U acread-*  
rpm -U iris3dview-1.*
```

5. **On RHEL5 systems:** go to the directory where the RPM packages are. This could be on the mounted release CD-ROM in `/mnt/cdrom/RHEL5/extras/RPMS` or on a directory with files downloaded from our ftp site. Issue the following commands:

```
rpm -U boost-*
rpm -U qt4-4.5*
rpm -U proj-*
rpm -U vtk-5.4*
rpm -U vtk-qt-5.4*
rpm -U acroread-*
rpm -U iris3dview-1.*
```

6. Log out from root with:
`exit`
7. IRIS 3DView is now installed. Continue with section [D.2.4 Installing the License on page 7](#).

D.2.3 Creating User Accounts

IRIS 3DView should be run as a normal user, not root or superuser. If your IRIS 3DView computer has IRIS or RDA installed, then it already has an "operator" account (and maybe others) which you can use for this. In that case continue with section [D.2.4 Installing the License on page 7](#).

If IRIS or RDA is not installed on the computer, follow the procedure below to create a user for IRIS 3DView. You can set the username and password freely - the user "radarop" with password "xxxxxx" below are only examples.

1. Start a new shell session and become root:
`su -`
2. Create the "radarop" user:
`/usr/sbin/useradd -G users -m radarop`
3. Set "xxxxxx" as password for the "radarop" user:
`echo 'xxxxxx' | passwd --stdin radarop`
4. Log out from root with:
`exit`
5. Continue with section [D.2.4 Installing the License on page 7](#).

D.2.4 Installing the License

NOTE

Log in as a normal user (not as root), before starting IRIS 3DView.

Click the icon for IRIS 3DView on your desktop or type `iris3dview` in a shell session.

When you first start IRIS 3DView it will run a license wizard, and prompt you to enter license information. You need to enter a valid license before the software will run. The first screen you will see is shown in [Figure 4 on page 7](#).

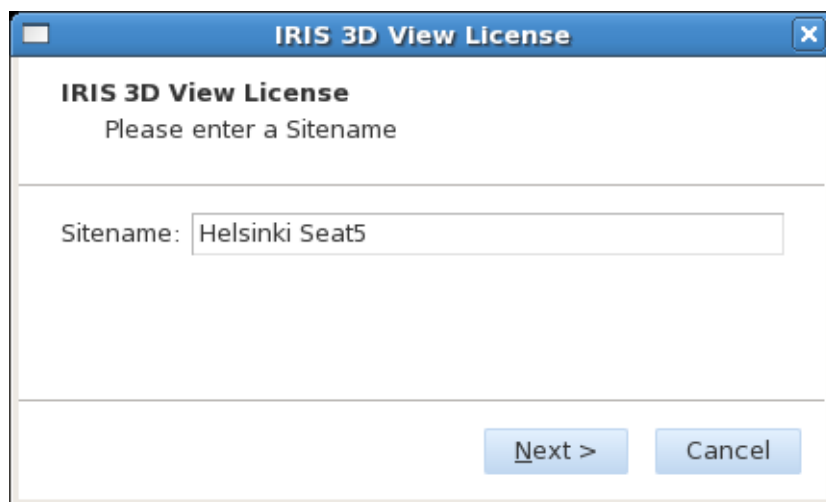


Figure 4 Site Selection During Licence Installation

If your system has an IRIS or RDA system already installed, the dialog will show the sitename for your system. In that case, leave it unchanged. Otherwise enter an informative unique sitename, 16 characters or less. Then press **Next**.

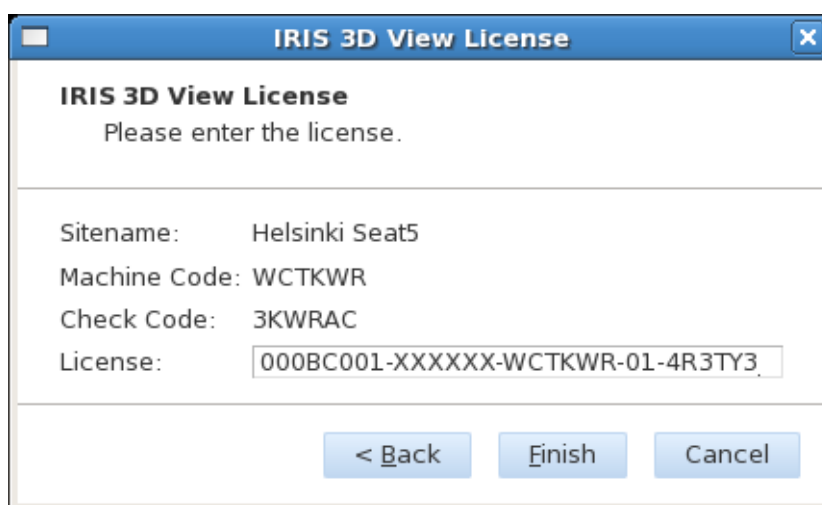


Figure 5 **License String Entered**

The license wizard will now show you the site code and check code. Send all the information shown to Vaisala, and you will be sent back a license string. Enter this in the License field, and press **Finish**.

D.3 Basic Operation

D.3.1 Starting IRIS 3DView

To start the IRIS 3DView software, simply click the icon for IRIS 3DView on your IRIS 3DView PC. Alternatively, you can type `iris3dview` in a shell session.

When the software starts, the main window is loaded. The main window is shown in [Figure 6 on page 9](#). The 3D view takes up most of the window area, with controls for the view on the left. A compass ring is always shown in the top right corner. When the mouse pointer is moved to the right corner, the current view heading and zoom level are also shown.

The File Toolbar and the Dialog Toolbar are placed on top of the window. The bottom of the window is reserved for the Animation toolbar.

The File, Edit, and View menus on the menu bar support standard keyboard shortcuts. On the File menu you can open and close data files, open the export tool, or quit the IRIS 3DView. The Edit menu can be used to access the settings window. The View menu can be used to hide the File, Dialog, and Animation Toolbars.

The IRIS 3DView software is primarily controlled by using the mouse. For a description of the controls in the 3D view, see [D.3.3 Navigating the 3D View on page 10](#).

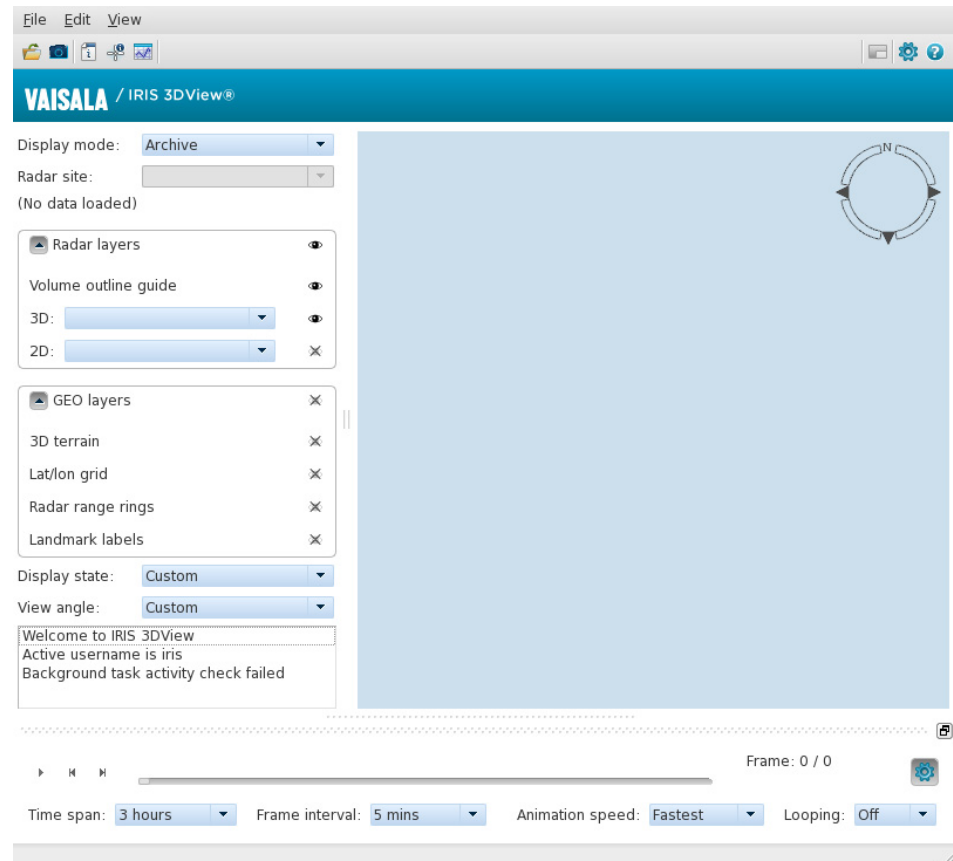



Figure 6 IRIS 3DView Starting View

D.3.2 Opening Data Files

There are two ways to open data files on the IRIS 3DView:

- Click the  button on the File Toolbar or select **Open 3D data** in the File menu. This opens the 3D data selector where you can select the desired data file.
- Select the **Live** mode in the **Display mode** selection drop-down list below the Vaisala logo, on the left side of the main window. In the Live mode, IRIS 3DView automatically opens the latest data file from the radar site that is selected in the **Radar site** drop-down list.

CAUTION

IRIS 3DView cannot find any data files unless their location is configured in the Settings menu. See [D.6.2.1 Settings on page 20](#).

D.3.3 Navigating the 3D View

The view that is always presented when the software starts is a direct downward view. You can think of viewing the data as if looking through a camera. The location of the camera is controlled by the user. At startup, the camera is high in the sky looking straight down on the earth. The volume outline guide (dark lines) are drawn around the rendered area.

The mouse controls in the 3D view are as follows:

- Hold the left mouse button and drag the mouse to move the camera position about the center of the picture. The camera remains aiming at the center, so this effectively rotates the data. Dragging the mouse horizontally rotates the camera about the center. Dragging the mouse vertically moves the camera vertically about the center.
- Hold the right mouse button and drag the mouse to move the camera location. The camera pointing angle remains the same so this pans the data. Holding the left button and shift key does the same.
- Hold the middle mouse button and drag the mouse to move the camera closer or farther from the center. This effectively zooms the data. Rotating the mouse wheel does the same.

NOTE

You can always return to the starting view by selecting the **Default** view angle preset. Use the view angle preset manager to save your own view angle presets.

D.3.4 Rendering Modes

Rendering mode determines the visualization approach that IRIS 3DView takes when creating the 3D model of the radar data. There are two rendering modes, **surface rendering** and **volume rendering**. The choice of rendering mode and the mode-specific options are set in the Settings window. See [D.6.2.1 Settings on page 20](#).

IRIS 3DView uses a full spectrum color scale when rendering the radar data. Blues represent the weakest echoes, building up to greens, yellows, oranges and finally reds. The color scale is NOT absolute, but instead relative. The reflectivity legend on the product information tool window shows the current relationship of colors and reflectivity in decibels (dBZ).

D.3.4.1 Surface Rendering

Surface rendering mode uses what in 3D terminology are called iso-surfaces. In other words, for example, if the threshold of the first iso-surface is set at 30 dBZ, all of the echo that is less than 30 dBZ is removed from the picture and what you see is a shape that represents the outer boundary of the 30 dBZ echo.

IRIS 3DView allows up to four of these iso-surfaces to be drawn in the same 3D visualization. The threshold value, color and opacity of each surface is user configurable. This allows a very flexible representation of the radar data.

Proper opacity control of the surfaces is important for good visualization. The more opaque a surface is (higher opacity value), the more difficult it is to see through. The less opaque, the more transparent the surface becomes and it is easier to see through it.

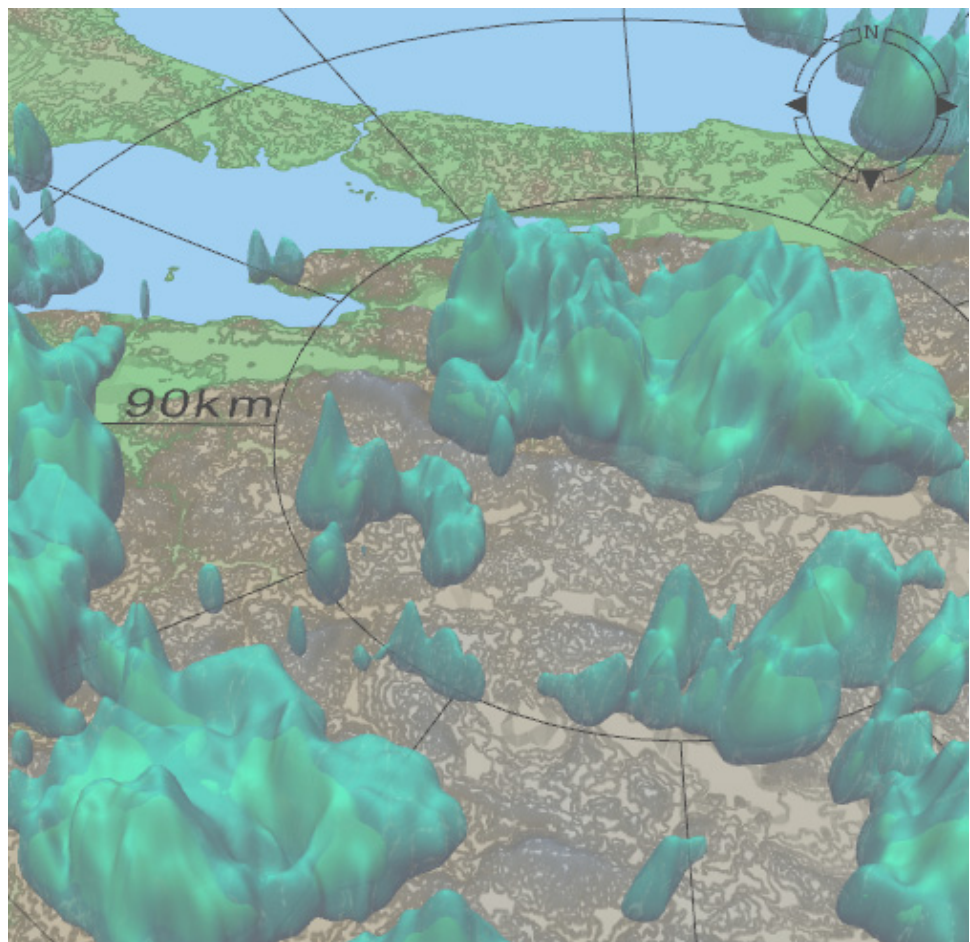


Figure 7 **Example of Surface Rendering**

D.3.4.2 Volume Rendering

In volume rendering mode, IRIS 3DView renders a 3D visualization of the data that is between the minimum and maximum values. All other data outside this range is filtered out and not displayed. Instead of using distinct surfaces, the area is rendered so that it gradually changes from the color and opacity at the minimum value to the color and opacity at the maximum value.

The minimum and maximum values, as well as the color and opacity at the ends of this range, are user configurable.

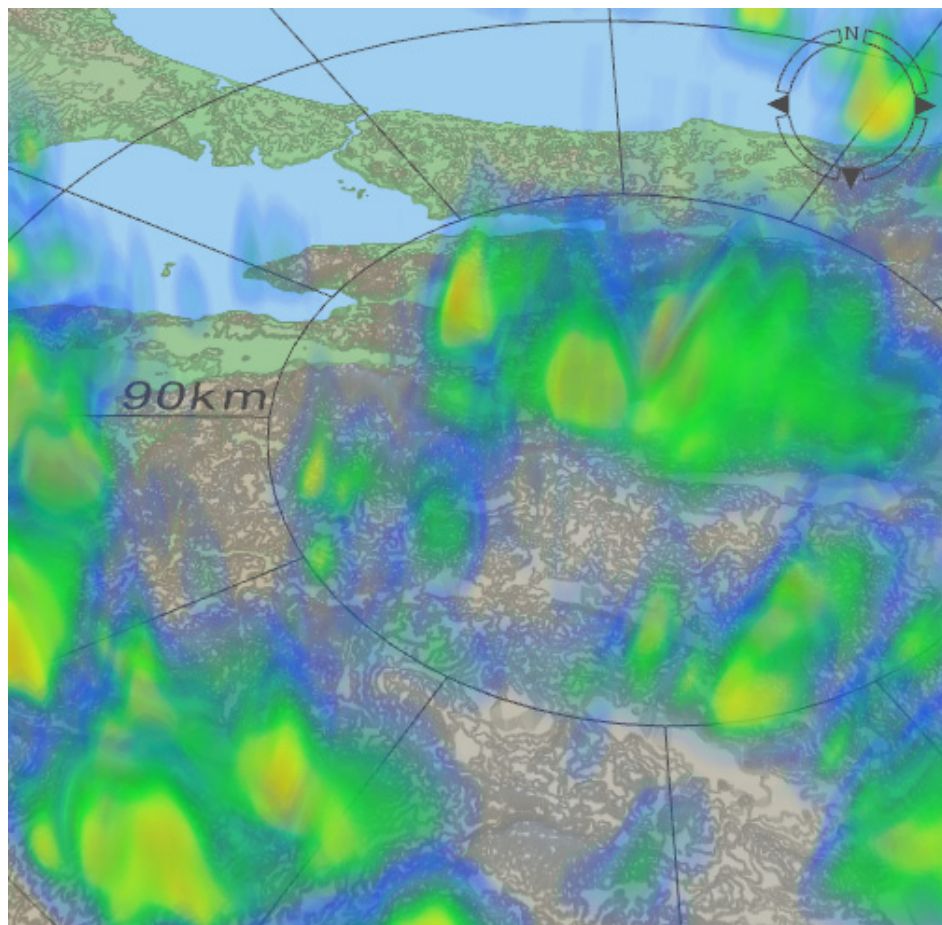


Figure 8 **Example of Volume Rendering**

D.4 Display State Controls

The controls on the left side of the main window determine what is rendered in the 3D view. There is a text window at the bottom of the controls, which displays a running log of the configuration changes. The right side of the control area has a handle that can be dragged to expand the control area. See [Figure 9 on page 14](#) for a picture of the display controls. Many of the controls have "eye" icons that can be clicked to toggle the visibility of the controlled visual element or layer.

Display Mode

Selects between the Archive Mode and the Live Mode. See [D.5 Archive Mode and Live Mode on page 15](#).

Radar Site

Drop-down list for selecting the monitored radar site. Only selectable in the Live Mode. The radar site and timestamp of the currently loaded data file are shown below this control.

Radar Layers

Here you can toggle the **Volume outline guide** on or off (the dark lines around the rendered area), and select the 3D and/or 2D radar products that are rendered.

GEO Layers

Here you can control if the following geographical information layers are shown:

- 3D terrain
- Latitude-longitude grid
- Radar range rings
- Landmark labels

Display State

Select the desired display state preset from the drop-down list, or select **Manage presets** to open the preset manager window. In the preset manager, you can store the current display state options as a preset, and manage existing presets.

View Angle

Select the desired view angle preset from the drop-down list, or select **Manage presets** to open the preset manager window. In the preset manager, you can store the current view angle as a preset, and manage existing presets.

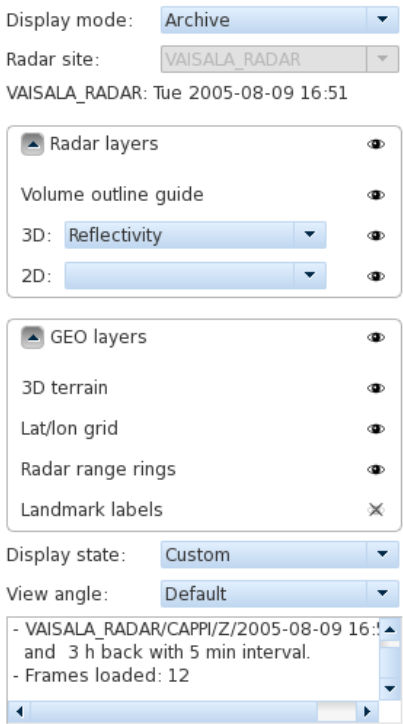


Figure 9 Display State Controls

D.5 Archive Mode and Live Mode

The IRIS 3DView software has two modes of operation: Archive Mode and Live Mode.

D.5.1 Archive Mode

The Archive Mode is a manual mode where the user loads radar data files and creates visualizations without any automatic functions taking place.

D.5.2 Live Mode

In the Live Mode the IRIS 3DView software continuously monitors the input directory. As soon as a new radar data file comes in from the central server computer, IRIS 3DView automatically loads it. If the background process has been configured and enabled, it will render 2D images of the radar data in the background, using preset view angles and display states. The background process requires some setup (i.e., setting of a pre-defined view point, etc.), but no interaction is required at runtime.

D.6 Tools and Toolbars

D.6.1 File Toolbar

The File Toolbar contains the following icons:



Opens a file selection dialog for selecting a new radar data file. See [D.3.2 Opening Data Files on page 9](#).



Opens the export tool. See [D.6.1.1 Export Tool on page 15](#).



Opens the product info tool. See [D.6.1.2 Product Information Tool on page 17](#).



Opens the cursor tool. See [D.6.1.3 Cursor Tool on page 19](#).



Opens a second 3D window that can be moved, resized, and navigated independently of the main window.

D.6.1.1 Export Tool

The export tool is used to save 3D views as bitmap images. On the **Export** tab, the currently rendered 3D view is shown with a reflectivity legend. Click the **Save a image** button to save the image as a file.

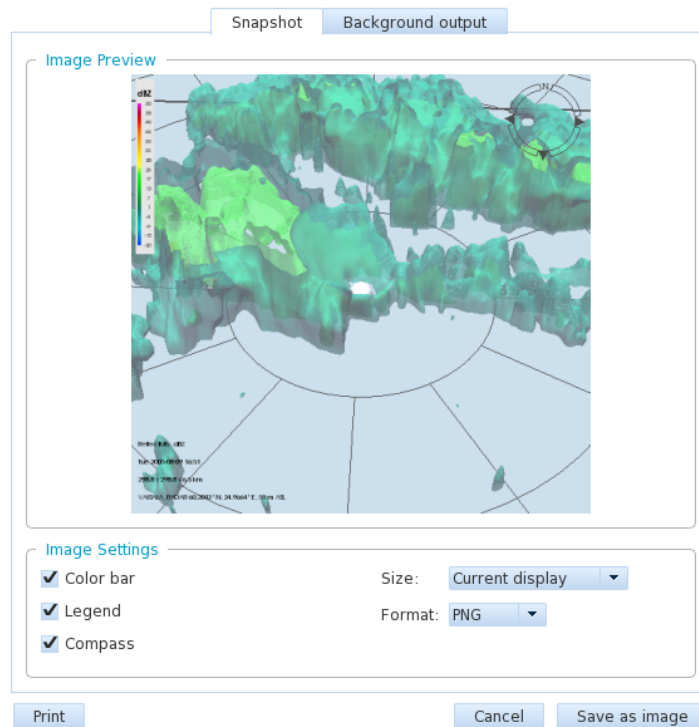


Figure 10 Export Tool

On the **Background output** tab, you can configure the background rendering process which outputs 2D images using pre-defined options. If you want to enable the background rendering, perform the following steps:

1. Using the controls on the main window, create and save a preset for the **display state** that you want to use in the background rendering.
2. Create and save a preset for the desired **view angle**.
3. Open the **export tool** and switch to the **Background output** tab.
4. Click the **Copy settings to background** button to make the presets available for selection.
5. Set the desired output generation options:
 - Output directory
 - File format
 - Display state preset
 - View angle preset
 - Image size
6. Check the **Activate background image generation** checkbox and click the OK button to exit to the main view.

Snapshot Background output

This tab is for controlling the background image generation process. When active, the background process automatically generates visualizations from incoming data into its output directory.

First define presets for display state and view angle in the main window, as well as product rendering settings using the product information tool. Then copy your settings to background process using the button below.

Copy settings to background

After you have copied settings to background, you can select active presets and set image parameters below. Note that preset lists come from background settings. Image generation starts when the check box is checked and the dialog accepted. If you do not have privileges to change background settings these fields are inactive.

☐ Activate background image generation.

Directory: ... ☐ 8%

Image: Format: TIFF Size: 1600x1200 px

Display state: Default

View angle: Default

2D products: Reflectivity SRI Radial velocity SRI

Spectrum width SRI Rainfall rate SRI

Default settings Cancel Ok

Figure 11 IRIS 3DView Background Output Configuration Window

D.6.1.2 Product Information Tool

The product information tool provides the following information about the currently selected 3D data product:

- **Data:** data type being displayed
- **Time:** timestamp of the data file
- **Volume:** size of the radar data volume
- **Radar:** Name and location of the radar that produced the data file
- Color legend for the 3D view

In addition to the above information, you can set the following options that define how the data product is rendered in the 3D view:

- **Color map:** Allows selection from a short list of pre-configured color scales.
- **Rendering mode:** Rendering mode of the 3D visualization. Options are: Surface rendering and Volume rendering.

- **Isosurface parameters:** These options are visible if surface rendering has been selected as the rendering mode. Using these options you can define the following options for surface rendering:
 - Number of isosurfaces (1...4)
 - Threshold value for each isosurface
 - Opacity of each isosurface
 - Color of each isosurface
- **Volume parameters:** These options are visible if volume rendering has been selected as the rendering mode. Using these options you can define the following options for volume rendering:
 - Low and high value of the rendered range
 - Opacity at the low and high end of the rendered range
 - Color at the low and high end of the rendered range

Click **Apply** to save your changes to the settings, or **Revert to previous** to restore the previous settings. Clicking **Reset to defaults** will select the surface rendering mode with the default isosurface settings.

Click the small arrow below the color legend to minimize the product information tool window. In the minimized form, the product information tool shows only the color legend.

The screenshot displays the 'Product Information Tool' interface. It is divided into two main sections: '3D Data' and 'Isosurface parameters'. The '3D Data' section includes fields for Data (Reflectivity, dBZ), Time (Tue 2005-08-09 16:51), Volume (298.8 x 298.8 x 6.5 km), Radar (VAISALA_RADAR (59 m ASL) 60.2043° N, 24.9664° E), Color map (Winter), and Rendering mode (Surface rendering). The 'Isosurface parameters' section features a table with columns for 'Value' and 'Opacity', and a color swatch for each isosurface. The first three isosurfaces are checked and have values of 0.0, 20.0, and 40.0 respectively, all with an opacity of 75. The fourth isosurface is unchecked and has no values. To the right of the isosurface parameters is a vertical color legend labeled 'dBZ' with a scale from -20 to 60. At the bottom of the tool are three buttons: 'Reset to defaults', 'Revert to previous', and 'Apply', followed by a small arrow icon.

	Value	Opacity	Color
<input checked="" type="checkbox"/> Isosurface 1	0.0	75	Dark Green
<input checked="" type="checkbox"/> Isosurface 2	20.0	75	Bright Green
<input checked="" type="checkbox"/> Isosurface 3	40.0	75	Orange
<input type="checkbox"/> Isosurface 4			Grey

Figure 12 Product Information Tool

D.6.1.3 Cursor Tool

The cursor tool displays information about the current home location, and the current cursor position in relation to the home position. You can also change the current home position by selecting a radar site from the drop-down list, or clicking the **Set home with cursor** button.

When the cursor tool window is open, a round cursor with yellow axis lines appears on the 3D view area. You can move this cursor around the view area by dragging with the mouse: position the mouse pointer above the cursor or one of the axis lines, hold down the left mouse button, and move the mouse. As the cursor moves, the cursor tool window is updated with the location and value information at the cursor position.

NOTE

To move the cursor only on horizontal or vertical axis, hold down the shift key when moving the cursor.

Click the small arrow at the bottom right corner of the cursor tool window to minimize it. In the minimized form, the cursor tool only shows the information for the current cursor position.

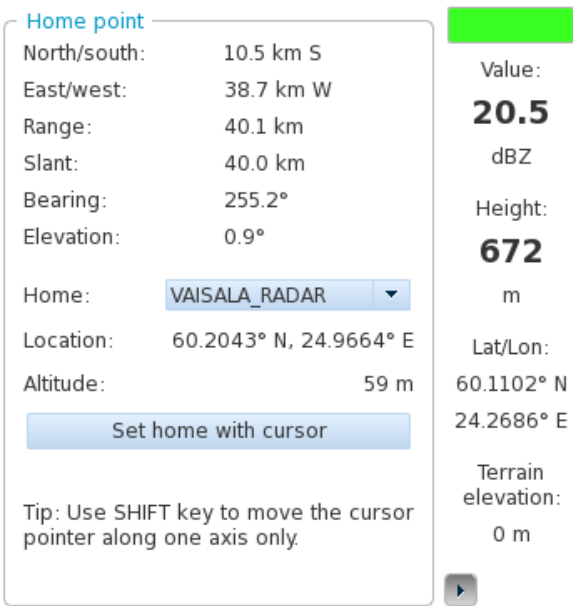


Figure 13 Cursor Tool

D.6.2 Dialog Toolbar

The Dialog Toolbar contains the following icons:



Toggle between a fullscreen mode and the normal windowed mode.



Toggle between bright and dark colour schemes.



Open the settings window. See [D.6.2.1 Settings on page 20](#).



Open the IRIS 3DView help.

D.6.2.1 Settings

The settings window contains the general settings for the IRIS 3DView software.

Time

Select 12-hour clock or 24-hour clock.

Default Units

Select English or Metric units.

Lat/Lon unit

Select the units for latitude and longitude. The available options are:

- Decimal degrees (dd.dddd°)
- Degrees, decimal minutes (DD° mm.mmm')
- Degrees, minutes, decimal seconds (DD° MM' ss.s")

Vertical scale

Set the vertical scale of the 3D rendering. A higher value will produce higher peaks, a low value will produce a flatter rendering.

Data Resolution

Set the horizontal and vertical resolution that is used for rendering. Lowering the resolution will speed up the generation of the 3D model, but will produce a less detailed rendering.

Options for horizontal resolution:

- Full
- Half
- 1/3x
- 1/4x

Options for vertical resolution:

- Full
- Half

NOTE

Lower the resolution for a smoother playback of animation frames.

Data Smoothing

Increase data smoothing to remove some fine detail from rendered object, creating a smoother model. The smoothing value can be selected using a slider between 0 and 3 data pixels, at increments of 0.1 pixel.

NOTE

Data smoothing is not the same as anti-aliasing of screen pixels. The smoothing is applied to the 3D model, removing some of the model complexity.

Data Location Directories

Set the correct directories for the data files:

- **GEO data location:** the directory where IRIS 3DView looks for 3D terrain data.
- **3D data location:** the directory that IRIS 3DView scans for 3D radar data.
- **2D data location:** the directory that IRIS 3DView scans for 2D radar data.

Time: ☐ 12-hour clock ☒ 24-hour clock

Default units: ☐ English ☒ Metric

Lat/Lon unit: Set English unit system

Vertical scale:

Data resolution: Horizontal: Vertical:

Data smoothing: 2.2 px

GEO data location: ... ☐ 8%

3D data location: ... ☐ 8%


2D data location: ... ☐ 8%

Figure 14 IRIS 3DView Settings Window

D.6.3 Animation Toolbar

The animation toolbar controls the playback of data frames. The top of the toolbar shows the timestamps of the first and last frames of the currently loaded data file, the number of the current frame, and the total number of frames currently created from the data file. The number of frames is affected by the amount of data in the file, and the animation settings that are active on the toolbar, such as **Time span** and **Frame interval**.

The most prominent feature on the animation toolbar is the slider that selects the currently rendered frame. You can drag the selector using the mouse. The playback controls on the left side of the slider consist of the play button which will play the animation from the current frame to the end, and buttons for jumping to the next and previous frames. The animation toolbar can also be separated from the main window by pressing the icon on the top right corner of the animation toolbar.

The toolbar has the following settings which can be hidden and shown by clicking the settings icon  on the toolbar.

Time Span

This setting determines the maximum time selectable using the animation slider. The options are:

- 3h back
- 6h back
- 12h back
- 24h back

Frame Interval

This setting determines the minimum frame interval. If there are more frequent data files on disk, then some will be skipped to reach this minimum. The larger the frame interval, the faster the animation will proceed through the time span.

- 5 minutes
- 15 minutes
- 30 minutes
- 60 minutes

Animation Speed

Sets an additional delay between displayed frames. Does not affect the rendering time. Options are:

- Fastest (no delay)
- 1 second
- 3 seconds
- 5 seconds
- 10 seconds

Loop mode

This setting determines whether the animation will only **Play once**, or **Loop** endlessly until stopped.

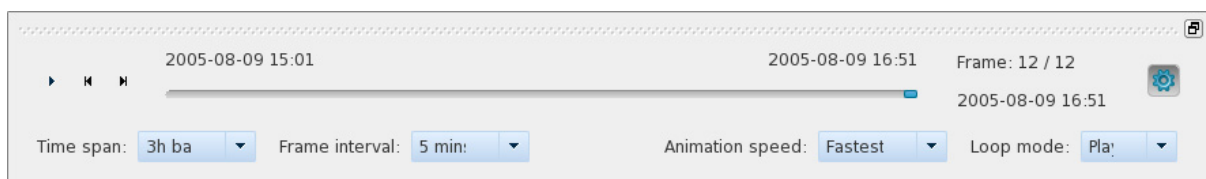


Figure 15 IRIS 3DView Animation Toolbar

NOTE

The typical bottleneck for animation playback is speed is CPU power, i.e. the time it takes for IRIS 3DView to calculate the 3D model of the frame. If the animation playback speed is unsatisfactory, set the **Animation speed** to Fastest, render in a smaller window, and consider lowering the data resolution in the Settings window.