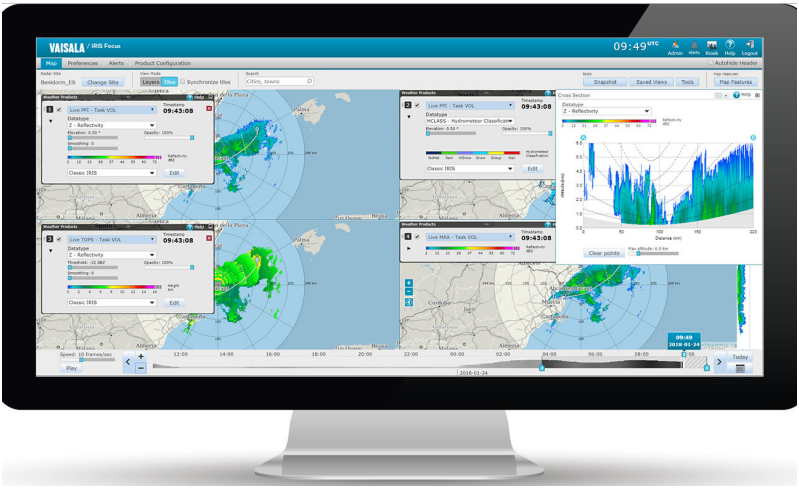
M211849EN-G

CONFIDENTIAL

User Guide

IRIS Focus

Version 5.3



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1. About This Document

1.1 Version information

This document provides information for using IRIS Focus software.

Table 1 Document versions (English)

Document Code	Date	Description
M211849EN-G	July 2020	Seventh version of this document. For release 5.3.
M211849EN-F	April 2019	Sixth version of this document. For release 5.1.
M211849EN-E	August 2018	Fifth version of this document.

1.2 Related documents

Table 2 Related documents

Document code	Name
M211850EN	*IRIS Focus Administrator Guide*
M211849EN	*IRIS Focus User Guide*
M211904EN	*IRIS Focus Release Notes*
M211315EN	*IRIS and RDA Software Installation Guide*

1.3 Trademarks

1.4 Documentation conventions

WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.

CAUTION! Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

Note highlights important information on using the product.

Tip gives information for using the product more efficiently.

Lists tools needed to perform the task.

Indicates that you need to take some notes during the task.

2. IRIS Focus Overview

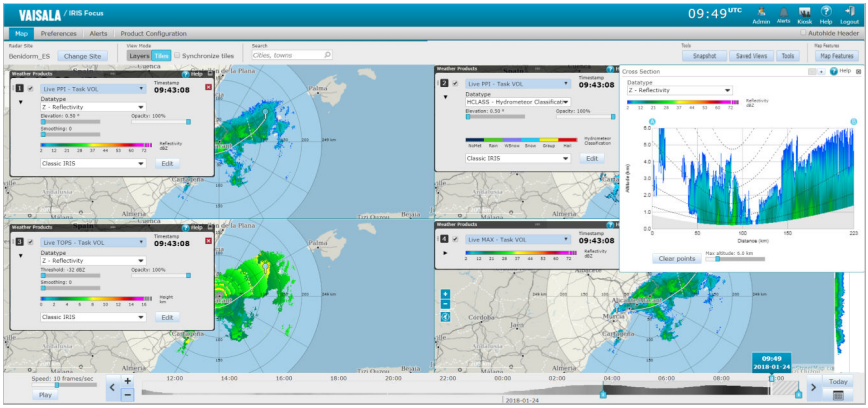


Figure 1 IRIS Focus Main View

IRIS Focus provides user-friendly, browser-based tools for viewing and analyzing weather data received from weather radars.

Weather data is overlaid on a geographical map that is centered on a selected radar site or composite site. Data is gathered from a single weather radar or a network of radar sites.

With the zoomable animation timeline, users can easily visualize and animate current, nowcasted, or historical data.

Nowcasting performs advection calculations on motion data from radar products to predict weather movement and severity up to 2 hours in the future.

Significant weather events such as hail, wind shear, or heavy rain are automatically detected when they enter an area of interest.

Radar Products

The displayed data typically consists of radar products. Radar products are raw signal data from a radar receiver processed to provide information about current weather conditions.

Radar products measure information such as radar signal reflectivity or rain intensity for analysis by meteorologists.

On-demand radar products	On-demand products are based on raw data from the IRIS back-end. IRIS Focus reads raw volume data and generates radar products in real time. On-demand products provide control over the presentation of weather data in the IRIS Focus user interface. For example, users can change the reflectivity threshold of a selected radar product on the fly. IRIS Focus users can create composites of on-demand products by selecting multiple radar sites from the radar site selector.
IRIS Analysis radar products	IRIS Analysis radar products are configured and produced in IRIS Analysis and displayed by IRIS Focus on request.

More information

- On-demand Radar Products (page 75)
- IRIS Analysis Radar Products (page 93)

2.1 IRIS Product Family

IRIS provides an intuitive user experience for professional users, such as meteorologists and analysts. It is closely integrated with Vaisala weather radar systems, where IRIS Focus forms the visualization front-end and other IRIS components handle radar control, radar product generation, and data distribution.

IRIS Focus runs on a web server that users can connect to in an enterprise intranet or from an external location or the Internet. Network connections between IRIS Focus and the data processing back-end go through a socket server, a custom protocol over TCP/IP that delivers radar data from the IRIS back-end services to IRIS Focus. IRIS Focus polls the server for data and displays it on screen using the browser.

The following figure shows a setup where IRIS Focus is used as part of a complete Vaisala weather radar network consisting of 2 radar sites.

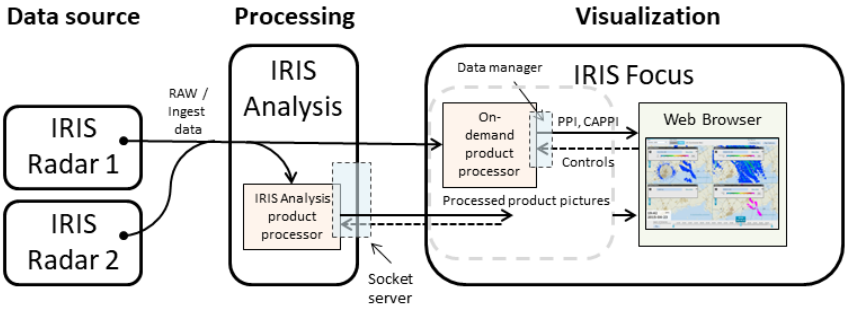


Figure 2 IRIS Focus Data Flow

In this case, IRIS Analysis and IRIS Radar can be considered back-end services for the IRIS Focus front-end interface. IRIS Focus communicates with IRIS Analysis through a socket server connection.

The components have the following functions:

- *IRIS Radar* - Operates the radar site and stores data gathered from the radar signals in RAW format.
- *IRIS Analysis* - Receives RAW data from IRIS Radar through secure connection and processes it into displayable radar products.
- *IRIS Focus* - Polls pre-configured radar products from IRIS Analysis and displays them on the web interface and generates on-demand radar products from RAW data.

2.2 Licensing

IRIS Focus requires a software license to run. To activate the license, you need a product key.

Vaisala delivers the product key when you purchase the software. If you have purchased the software and you have not received the product key, please contact Vaisala.

For server deliveries, Vaisala activates the product key in the factory, and a Vaisala representative sends you the key for future reference.

The license is mapped to the hardware of your IRIS Focus server. If your hardware configuration changes and you need to re-install IRIS Focus, you must request a replacement license from your Vaisala representative, unless you have a USB license key.

If you have a USB license key, IRIS Focus runs when the USB drive is inserted in the server. If you install IRIS Focus on another server, you can move the USB license key to that server.

License Options

The IRIS Focus license includes the following:

- **IRIS Focus Light**
  IRIS Focus Light has an unlimited number of seats and provides access to the map view. If the license is missing, users cannot log in while admins can log in but cannot access the map view.
- **IRIS Focus**
  The IRIS Focus license is required to use IRIS Focus features and products.
  IRIS Focus licensing is based on a floating seat pool.
- **Nowcasting**
  The optional nowcasting feature requires a separate license in addition to an IRIS Focus license.

IRIS Focus Seat-based License

IRIS Focus licenses are available in different configurations. To increase your seat count, you must replace the current license with a new one by contacting your Vaisala representative.

The seat count defines how many users can access IRIS Focus at the same time. When a user logs in, they occupy a seat. When a user logs out, the seat is released and the next user can take it. If a user logs in when all the licenses are reserved, the user is shown IRIS Focus Light until an IRIS Focus license is released.

Nowcasting is only available to users with an IRIS Focus seat and nowcasting license.

Seat counts within a workstation are browser-based. For one license reservation, users may view IRIS Focus in as many instances or tabs of one browser, such as Firefox®, as they like. If a user opens IRIS Focus in a different browser, such as Google Chrome™, they reserve one license for each browser.

3. Using IRIS Focus

3.1 User roles

Access to IRIS Focus features depends on the roles enabled for each user account. Each user account belongs to one or more organizations.

For example, the administration features are available to user accounts with the `administrator` role.

Table 3 IRIS Focus User Roles

Role	Description
`administrator`	Can access administration features.
`focus`	Can access the full IRIS Focus feature set.
`poweruser`	Can access the full IRIS Focus feature set. Can create organization-level event criteria and places of interest that are visible to all users in an organization. Can set up and manage pre-defined composites. Can configure MVFs to be used in nowcasting. Can select an organization-level map projection.
`user`	Can access the limited set of features available with IRIS Focus Light.
`kiosk`	Can only access the non-interactive, full-screen Kiosk mode.

Seat Allocation and Restrictions

Each logged-in user account with a **`focus`** or **`poweruser`** role reserves one IRIS Focus seat from the license pool. When the user logs out, the seat is released.

A user account that has **`user`** or **`administrator`** role, or another role without a **`focus`** role, enters IRIS Focus Light, which has a map view with limited features and does not provide access to features such as cross-section or on-demand radar products.

If a user with a **`focus`** role logs in and there are no IRIS Focus seats available, the user enters IRIS Focus Light. When a seat is available, the user is provided with an opportunity to switch to IRIS Focus.

More information

- Required user roles for event criteria and places of interest (page 40)

3.2 Map View

The IRIS Focus main view is a scrollable map area centered around the selected radar site. The map around the area is drawn using azimuthal equidistant projection that uses the radar site as a point of origin, which means that all distances and directions measured from the radar site are accurate.

In the map view, you can select multiple simultaneous products, and display them on separate tiled windows, or on a combined layer overlay view.

The products include radar products generated by IRIS software, and optionally WMS layers from external sources.

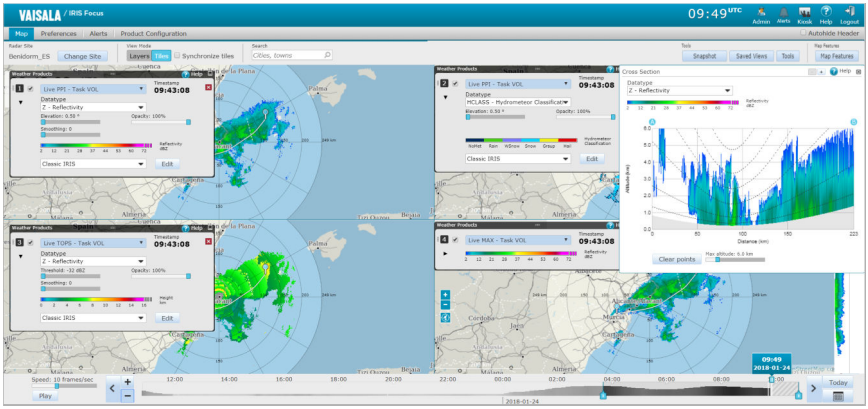


Figure 3 IRIS Focus Map View

The map engine in IRIS Focus runs on the open source GeoServer map server. The map data is gathered from the collaborative OpenStreetMap project, and the JavaScript user interface is built with the OpenLayers library. To improve performance, map data is cached as bitmap tiles with GeoWebCache.

3.2.1 Map Layers

The background map and the weather data visualizations from the radar products are drawn as individual layers and then combined to form an overview of current weather conditions around the radar site.

You can also view WMS layers from external sources, such as satellite image layers, as layers on the map.

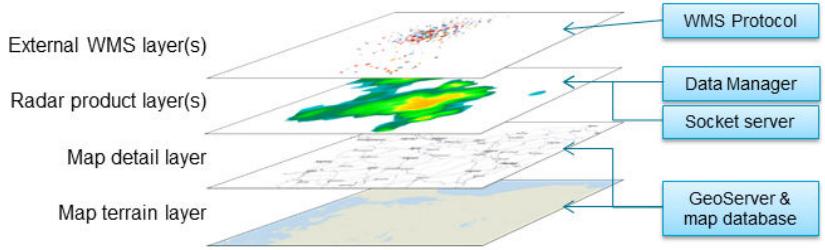


Figure 4 IRIS Focus Product Layers

Base Layers

The background (also known as base) consists of a number of non-interactive layers. At the bottom is a terrain map that can be enhanced with additional layers containing roads, province boundaries, and other similar terrain features.

Radar Product Layers

The interactive radar product layers (1 to 4) are drawn on top of the background layers.

External WMS Layers

WMS layers from external sources, such as satellite images, radar data from an external radar network, or a lighting layer, can be added to IRIS Focus and viewed on the map exactly like other radar product layers. Many characteristics of the external product layers, such as the availability of the color legend, depend on the layer providers.

The external WMS layers are images, and only available in certain projections. To view a WMS layer on the map view from a certain radar site, the radar site must be configured to use the same projection as the WMS layer.

> For example, if the requested WMS layer is only available in Web Mercator projection, and the radar site is configured in azimuthal equidistant projection, the WMS layer will not be shown.

IRIS Focus supports both WMS and WMS-T layers. WMS-T layers are layers with time parameters included in the request.

3.2.2 Editing Base Layers

To manage map settings, styles, and additional map layers, such as roads, select **Map Features** on the top right corner of the UI.

Available **Base Map** styles include:

- **Standard**
  Basic terrain with oceans, lakes, rivers, landmasses, and islands. All waters are blue, and all land areas gray. Cities and dense settlement areas are brown. This is the default map view.
- **Simplified**
  Same as **Standard**, without cities.
- **Terrain**
  Same as **Standard**, with landforms added so mountain ranges and other terrain features are more visible.

Changing from one map style to another takes some time while the new terrain assets are cached.

Table 4 Map Detail Settings

Map Detail	National borders	Province borders	Airports	Roads	Labels
None					
Minimal	✓				
Aviation	✓		✓		
Roads	✓			✓	
General	✓	✓			✓
Full	✓	✓	✓	✓	✓

3.2.3 Radar Product Layers

IRIS Focus supports up to 4 simultaneous radar product layers that can be displayed on top of each other (**Layers** mode) or in separate tiles (**Tiles** mode).

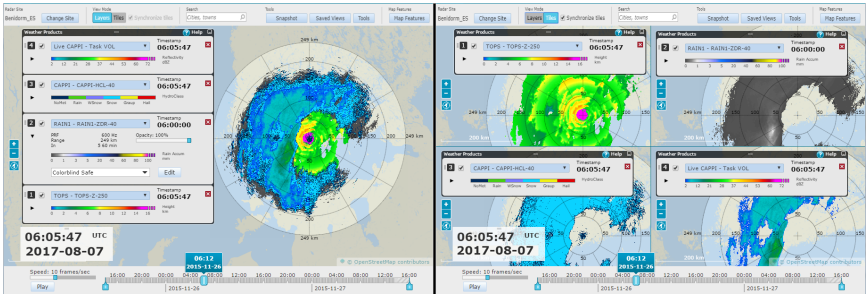


Figure 5 Layered and Tiled view modes

The **Weather Products** pane lists the active radar product layers.

Each additional layer requires more processing capacity from the system. To improve performance, avoid showing unnecessary background or radar product layers on screen.

Tiles Mode

In **Tiles** mode, the tiles are synchronized by default.

When synchronized, all tiles pan and zoom automatically to the same coordinates when you interact with one of the tiles.

To disable the synchronization, deselect the **Synchronize tiles** check box.

Layers Mode

In **Layers** mode, the layers are drawn on the screen in the same order as they are listed on the **Weather Products** pane. The top layer in the pane is also drawn on top in the map view.

To change the order of the layers, drag them to new positions in the pane. IRIS Focus re-draws the radar products on the map view using the new layer order.

In **Layers** mode, the first layer always defines the overall presentation of the map view. For example, the range rings around the radar site are based on layer 1, so if the products on layer 1 and 2 have respective ranges of 100 and 250 km, the range rings on the map view are drawn only up to 100 km, which is the maximum range of the product on layer 1. The weather data from layer 2 is still drawn on the map, even though it "appears" to be outside the radar range. This also affects radar products that include some additional UI elements, such as Maximum Data (**MAX**).

More information

- Radar Products (page 66)

3.2.4 Radar Product Layer Settings

The **Weather Products** pane includes settings for radar product layers.

The contents of the pane depend on the radar product type.

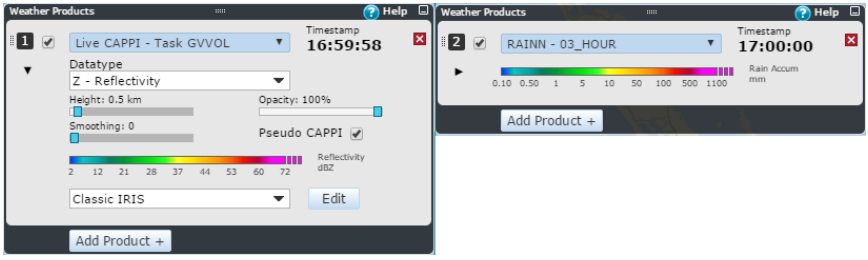


Figure 6 On-demand and IRIS Analysis Product Settings

The opacity value, which sets the transparency of a layer, is available for all radar product layers.

On-demand product layers include the following attributes:

Table 5 On-demand Product Attributes

Attribute	Description
Data type	Sets the measured data type. See Data Types (page 69)
Height (**CAPPI**) Elevation (**PPI**)	Defines the height (measured from sea level) of the horizontal cross section being displayed, or elevation of the current radar beam.
Pseudo **CAPPI**	Toggles Pseudo **CAPPI** on/off. Pseudo **CAPPI** attempts to visualize those parts within the radar range that are not measured with current settings. See Pseudo CAPPI (page 80).
Smoothing	Blends adjacent pixels closer together depending on their distance from each other. See Radar Product Smoothing (page 74).
Threshold (**BASE**, **TOPS**, **THICK**)	Defines reflectivity threshold (dBZ) for the amount of data displayed in the image. See Radar Product Reflectivity Threshold (page 74).
Composite Method	When viewing composite data from many radar sites, choose how the display handles overlapping data. See Composites (page 28).

More information

- IRIS Focus Overview (page 9)

3.2.5 Map Units

IRIS Focus supports the following unit sets. To change them, select **Preferences**.

Unit	Metric	Imperial	Aviation
Distance	km	miles	nmi
Velocity	m/s	mph	kt
Angle change	deg/km	deg/mile	deg/nmi
Altitude	km	ft	ft
Rainfall	mm/h	inch/h	inch/h

Unit	Metric	Imperial	Aviation
Vertically Integrated Liquid (**VIL**)	mm	inch	inch

More information

- User Preferences (page 36)

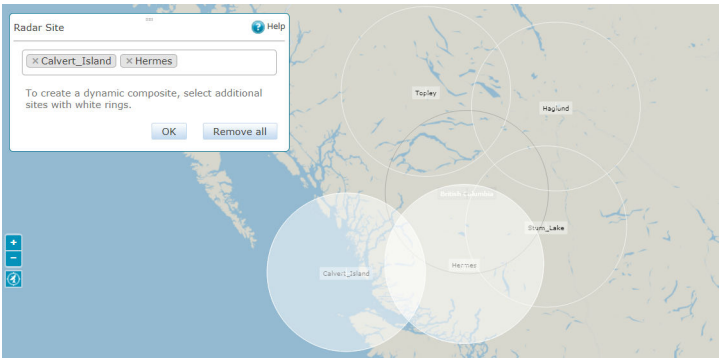
3.3 Radar Sites

With IRIS Focus, you can view data from any radar in your network.

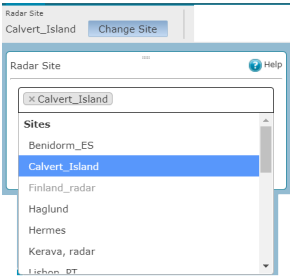
To get a bigger picture, select a pre-defined composite site or create a dynamic composite to view composite data from many weather radars.

1. In the top menu, select **Change Site**.
   The radar site selector mode starts, showing:
   - A map view with the available radars and composites shown on the map.
   - A site selector window listing the available radars and composites.

2. To select one or more radar sites, do one of the following:
   - On the map, select one or more radar rings.



   - In the **Change Site** pane, select the site selection field to show the list of available radars and select one or more radars on the list.



Select radar sites indicated with white rings to create dynamic composites.

The selections are indicated on the map and listed in the **Change Site** pane.

3. Select **OK**.
   The map shows data from the selected site or composite.

You can also press **CTRL** to start or exit the site selector mode.

More information

- Composites (page 28)

3.4 Animation Timeline

With the zoomable animation timeline, users can easily visualize and animate current, nowcasted, or historical data.

The histogram provide at-a-glance information on the amount and intensity of weather for points in time.

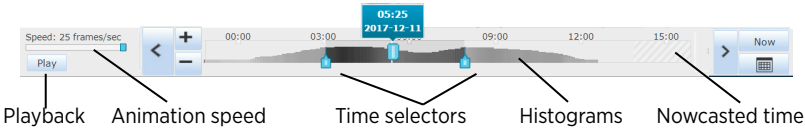


Figure 7 Animation Controls

1. On the animation timeline, select the time of the data you want to view:
   a. To find an approximate time, pan the indicator back and forth.
   b. To zoom in and out on the level of detail, scroll the mouse wheel.
   c. To select a time, select the search icon on the right of the time line.
   d. To return to the current time, select **Now**.
2. To start a looping animation of the data, select **Play**.
   a. Move the beginning and end time indicators along the time line.
   b. To select the animation speed, on the lower left corner of the user interface, select 1 ... 25 frames per second.
   c. To set only a part of the weather history to be animated, drag the start and end points to the desired positions on the timeline. The animation settings update in real time.
   d. By default, the animation stops for 1 second before looping back to the beginning. To change this, select **Preferences**.

   Most radar products have an update interval of 15 minutes, but some are updated every 5 minutes or every 60 minutes. The length of the animation is defined by the update interval of layer number 1, that is, the bottom layer.
3. To view and animate nowcasted data, drag the playback slider along the timeline into the future.
   Nowcasting performs advection calculations on motion data from radar products to predict weather movement and severity up to 2 hours in the future.
   The timestamp formatting indicates that the display is showing nowcasted data. For example:

More information

- User Preferences (page 36)
- Nowcasting (page 31)

3.5 Map Tools

3.5.1 Cursor Tool

When you hover the mouse cursor on the map view, a small overlay box opens next to it. The overlay box contains the coordinates and radar product values for that location.

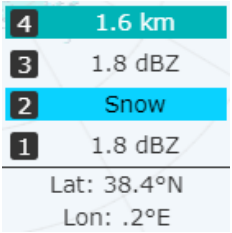


Figure 8 Cursor Tool Example for 4 Radar Products

When you select multiple radar products, the cursor tool lists values for each product in the same order they are displayed on the screen.

The cursor tool works in both layered and tiled modes. In tiled modes, the overlay box displays values for each radar product at the current position, even if the tiles are not synchronized.

The cursor tool always displays the original raster data, not the smoothed data.

For external WMS layers, the availability of cursor tool data depends on the layer provider. In order for the system to query for the cursor tool data, the **Usable in map cursor** checkbox must be selected in the **Map Layer Information** screen of the admin view.

3.5.2 Color Scale Editor

To access the editor, select **Edit** on a radar product pane.

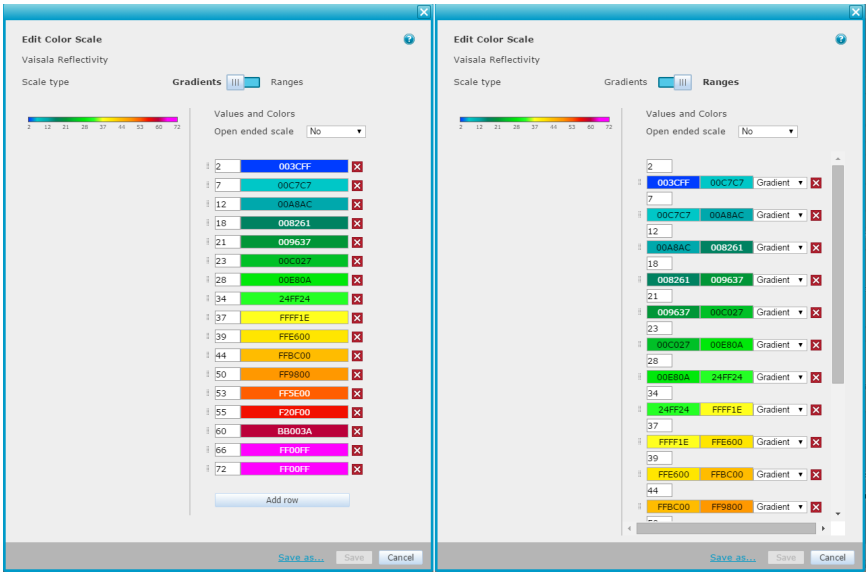


Figure 9 Color Scale Editor Modes

The editor displays the current color scale gradient. On the right side is a list of the keypoints of the color scale. Each keypoint sets the RGB color of a defined value in the radar product, and the values between keypoints are interpolated to make a smooth gradient. By optimizing the keypoints for site-specific conditions, you can make measurement ranges close to each other more distinct, and improve the users' ability to perform visual analysis on the data.

The open-ended scale setting allows you to define how values outside the upper and lower thresholds of the color gradient are displayed on the map. Open-ended scales continue drawing values beyond the thresholds with the same color as the lowest or highest keypoint in the color scale. Non open-ended scales do not draw any values outside the thresholds on the map.

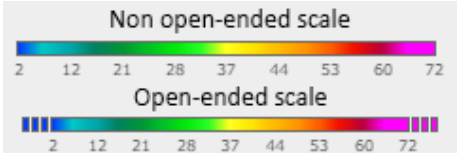


Figure 10 Open and Non-open color scales

Using non-open scales, especially for the low end, is an effective way to remove signal noise or clutter from the radar product layer.

The **Ranges** mode allows more fine-tuned options for editing color scales. On the tab you can set each step between two keypoints on the color scale to be either gradients or single solid color.

To change a color in a keypoint, click on it and select a new color from the color picker, or enter a new numerical RGB value directly into the color field.

More information

- Radar Product Colors (page 73)

3.5.3 Cross Section Tool

IRIS Focus calculates vertical cross sections from the radar product data for all on-demand radar products.

The cross section window shows a vertical slice of the atmosphere on the selected line. The dotted lines are beam center lines that show the altitudes where the radar signal has passed at a given distance. The weather phenomena are drawn with the same colors as in the main view. The area outside radar range is greyed out.

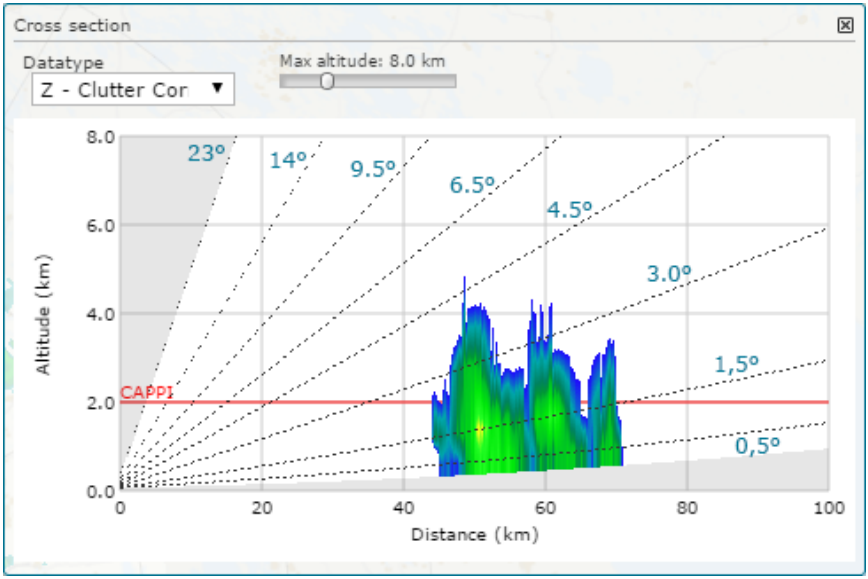


Figure 11 Cross Section Tool, **CAPPI** Example

1. In top right corner of the map view, select **Tools > Cross Section**.
2. Select an on-demand radar product.

3. Select points on the map:
   - Straight line – click on two points on the map to create endpoints for a vertical cross section of the radar product.
   - Curved line – click on the map and drag the mouse cursor to draw a freeform curved line and then release the mouse button.

   The cross section is calculated on a line between those endpoints.
   You can move the curve and the endpoints afterwards.

   > If you are using an on-demand **CAPPI** product, the selected **CAPPI** altitude is drawn with a red line.

4. If you wish, change the product data type from the drop-down menu.

More information

- Data Types (page 69)
- On-demand Radar Products (page 75)
- On-demand Constant Altitude Plan Position Indicator (CAPPI) (page 78)

3.5.4 Ruler Tool

Use the **Ruler Tool** to measure the distance between points on the map.

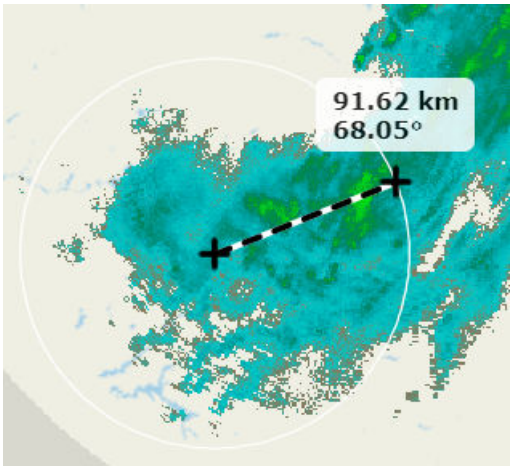


Figure 12 **Ruler Tool** Example

1. On top right of the main UI, select **Tools > Ruler Tool**.

Press **SHIFT**+click to snap to the radar center.

2. On the map view, click the start point, slide the mouse, and click the end point.
   The map shows the distance between the 2 points.
3. When you are finished, on the menu bar, select **Ruler Tool** to disable the tool.

3.5.5 Snapshot Tool

You can use the **Snapshot** tool to capture interesting weather events in an image.

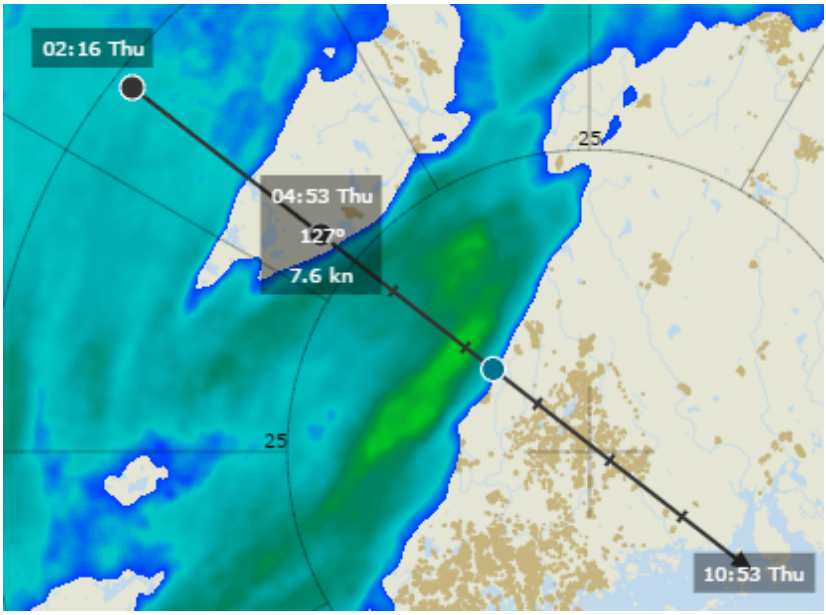
1. On the **Map** view, select **Snapshot**.
   A PNG file of the current screen is downloaded to your computer.

3.5.6 Tracking Tool

Use the **Tracking Tool** to track the movement of weather fronts or other visible elements in radar products.

1. On top right of the main UI, select **Tools > Tracking Tool**.
2. On the animation timeline, drag the playback slider to the time where you want start tracking something.
3. On the map view, click the position you intend to track.
   Usually this is an edge of a weather front or an interesting local weather event.

4. Drag the playback slider forward and add a second tracking point to where the tracked event appears to have moved.
   The **Tracking Tool** draws a line by continuing with the same path and speed. The first 6 estimated hours are always drawn on the screen. To run the tracking point further, drag the playback slider onwards.
   In the following image, the black circles are tracking points and blue is a future estimate point based on the tracking points. The floating overlay box next to the tracking points shows a timestamp.



5. When you are finished or want to start another tracking event, clear the tracking points by selecting **Tracking Tool > Clear tracking points**.

3.6 Composites

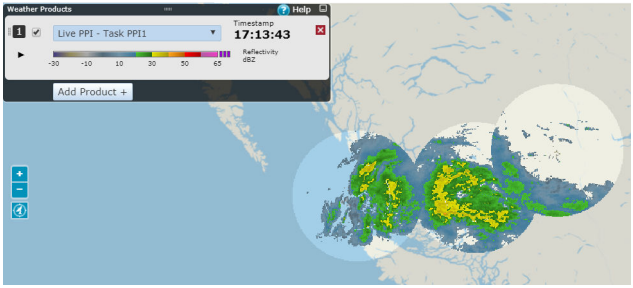


Figure 13 Radar Composite Example

Radar product composites combine data from many radars to provide an expanded area of coverage. This means you can:

- Fill-in blind spots caused by mountains or required sector blanking.
- Fill-in blind spots caused by scan strategy limitations (for example, not scanning to high elevation angles).
- Simplify product management so users do not need to check multiple single-radar images.

With IRIS Focus, you can view the following composite types.

Dynamic Composites

IRIS Focus users can create composites of on-demand products by selecting multiple radar sites from the radar site selector.

Pre-defined Composites

IRIS Focus powerusers can set up and manage pre-defined composites.

Configuring pre-defined composites provides more control than dynamic composites over settings such as the combining algorithm and **Max Time Span**.

IRIS Analysis Composites

IRIS Analysis Composites are set up in IRIS Analysis as IRIS **COMP** products and sent to IRIS Focus much like other pre-configured products.

More information

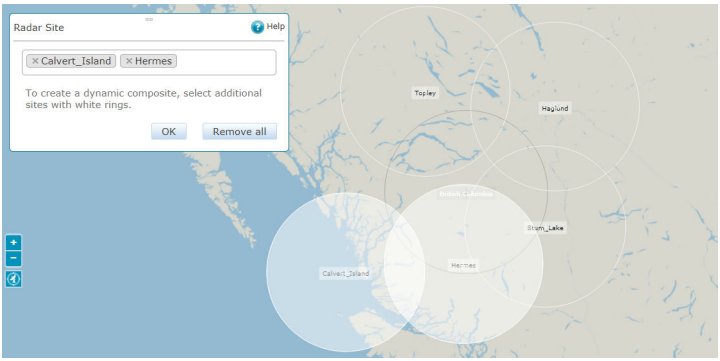
‣ Configuring composites (page 57)

3.6.1 Viewing Composites

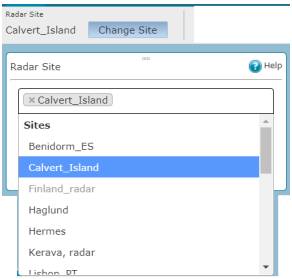
IRIS Focus can create dynamic composites if a radar sends **RAW** data to IRIS Analysis. In site selector mode, these sites are indicated on the map with white rings.

Pre-configured composites, IRIS Analysis composites, and sites that do not support dynamic composites are indicated on the map with black rings. You can view radar data from these sites one at a time.

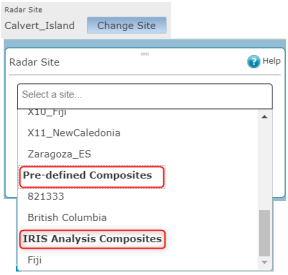
1. In the top menu, select **Change Site**.
   The radar site selector mode starts, showing:
   - A map view with the available radars and composites shown on the map.
   - A site selector window listing the available radars and composites.
2. To create a dynamic composite, select more than one site.
   - On the map, select one or more radar rings.



   - In the **Change Site** pane, select the site selection field to show the list of available radars and select one or more radars on the list.



3. To view a pre-defined or IRIS Analysis composite, scroll down the list of radar sites and select the composite from the list.



If you do not see the composite you want, contact your administrator to configure it for you.

4. On the **Weather Products** pane, select the product and data type.
   See Radar Product Layer Settings (page 17).
5. To change the composite method, on the **Weather Products** pane, select an option under **Composite Method**.
   For dynamic composites, the default composite method is *Maximum*.
   See IRIS Focus composite methods (page 30).
6. To view a cross-section of the composite data, select **Cross Section**.
   See Cross Section Tool (page 24).

3.6.2 IRIS Focus composite methods

For regions where radars overlap, you can select one of the following methods for combining radar data:

- *Maximum*
  Maximum uses the maximum value to combine the data. This is the most common setting.
- *Average*
  Average uses the average of the available data. This is a poor choice if you are trying to cover blocked regions.

IRIS Analysis supports an expanded set of composite methods. For more information, see *IRIS Product and Display Guide*.

3.7 Nowcasting

Nowcasting performs advection calculations on motion data from radar products to predict weather movement and severity up to 2 hours in the future.

In this time range IRIS Focus can predict smaller features such as individual showers and thunderstorms with reasonable accuracy using image advection techniques. As part of the techniques, nowcasting extrapolates storm (echo) motion *n* hours into the future.

Nowcasting does not attempt to imply laws of physics into the model, such as performed in numerical weather prediction (NWP). By using advection extrapolation instead of NWP, nowcasting can include details that cannot be solved by NWP models running over longer forecast periods.

Nowcasting can be used by, for example, road, energy, or airport organizations to provide real-time decision making support.

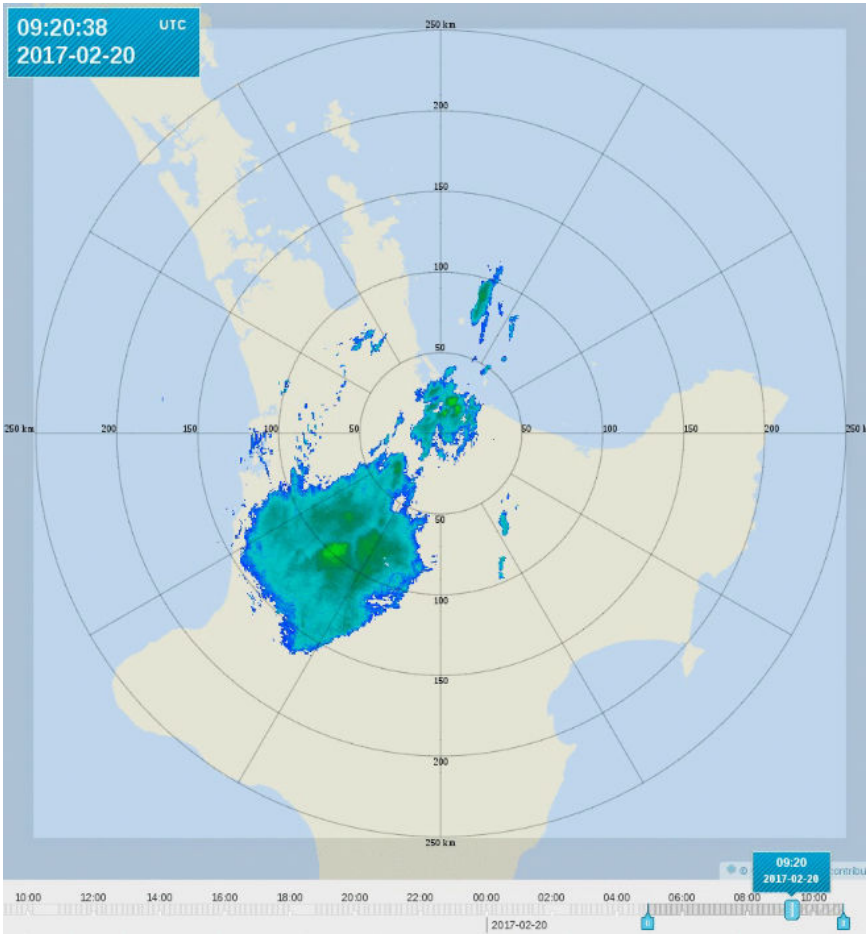


Figure 14 Viewing Nowcasted Data

IRIS Focus nowcasting uses an area-based method in which a motion vector field (MVF) is estimated over the entire observed area to provide insight into many types of precipitation. The IRIS Focus display advects cartesian products into the future.

You can view nowcasted data in IRIS Focus by moving the slider on the animation timeline. When you are in nowcasting mode, the appearance of the timestamps change to indicate that you are viewing nowcasted data.

More information

- Animation Timeline (page 21)
- Configuring Nowcasting (page 61)
- Motion Vector Field (MVF) (page 96)

3.7.1 Calculating Nowcasting Predictions

In nowcasting, a precipitation field is considered a single pattern that can move and change with time. Placing the analyzed area on a grid, the first step in nowcasting is to compute a set of velocity vectors, one for each tile of a fixed size and then use them to predict future movement. Calculations are based on a cross-correlation of patterns.

In IRIS Focus, the motion vector fields (MVFs) calculated to support nowcasting cover the area measured by the radar. Zooming in and out of the display does not change the calculations.

Nowcasting Process

The following process explains how IRIS Focus creates nowcasts of its cartesian products in two steps: first create a motion vector field (MVF) and then use the MVF to advect products into the future.

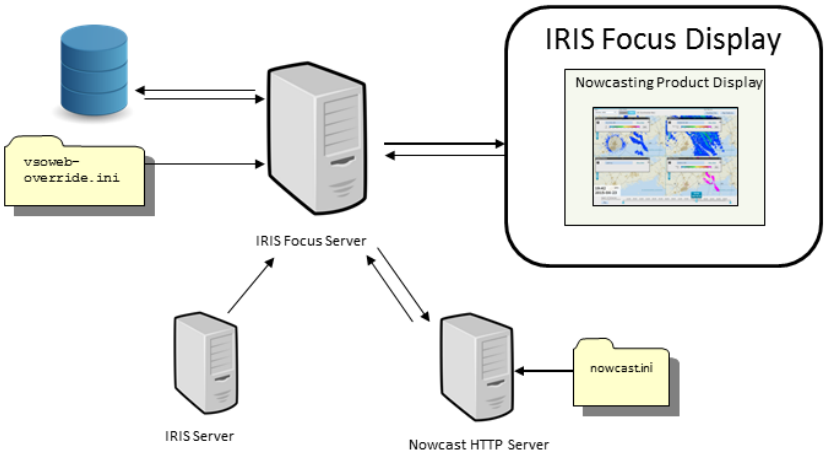


Figure 15 Nowcasting Architecture

1. Read the nowcasting configuration on start-up.
2. Run the radar data sequence.

3. Calculate the current velocity as a motion vector based on configurable settings.
   MVF generation is done in the nowcast server, which by default is installed on the IRIS Focus server. The nowcast server takes requests from the web application and returns MVF products. Advected product generation is done in the web application.
   MVF calculations use the last few products generated of a Cartesian product and passes them through the nowcasting algorithms. Note that since the last generated products are used, depending on the product schedule, it is possible that the first advected image is before the current time.
   The MVFs are visible in IRIS Focus as a separate product and are used by IRIS Focus in nowcasting other radar products.
   See Motion Vector Field (MVF) (page 96).
4. Run the nowcasting advection and velocity calculation algorithms to determine how the precipitation elements in the atmosphere will move in the near future.
   See Calculating Advected Products (page 34) and Calculating Motion Velocity (page 98).
5. Display nowcasting predictions in IRIS Focus.
   See Animation Timeline (page 21).

3.7.2 Calculating Advected Products

When you view nowcasted products by moving the animation slider into the nowcasting region, you see advected products.

IRIS Focus generates advected products using the last motion vector field (MVF) generated for a site along with the last product of the type you are viewing. IRIS Focus generates the advected products on-demand.

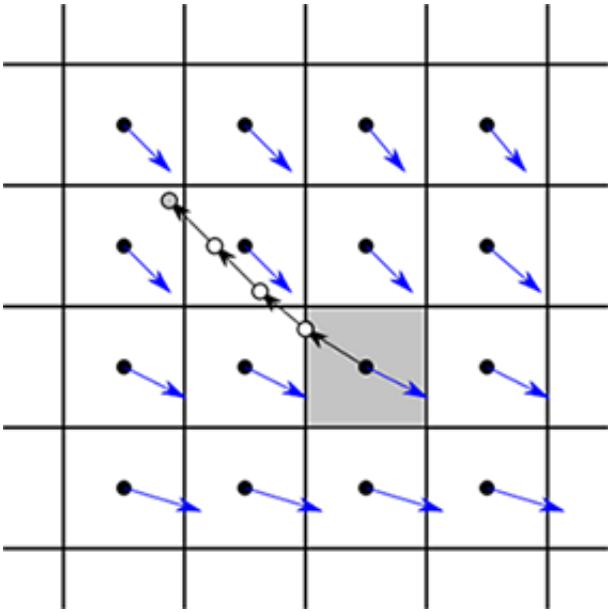


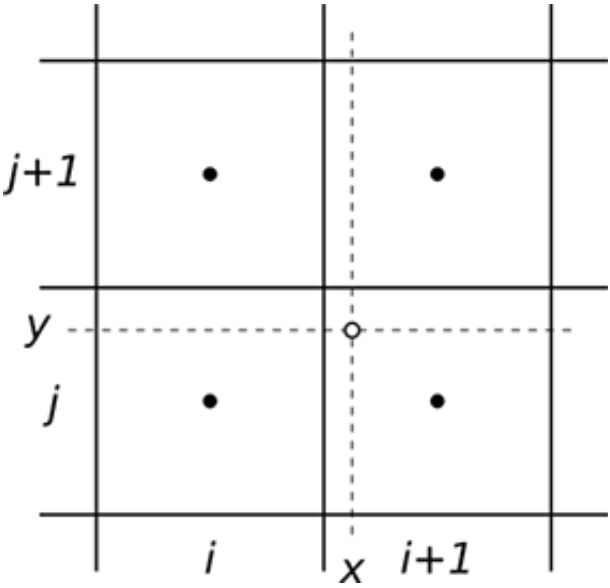
Figure 16 Product Advection

Calculating Advected Products

The advection algorithm back traces each pixel's previous positions. To determine the value of one pixel (shown in gray in the previous image), the algorithm performs the following calculations:

1. Shift the position of the pixel using the MVF point for that pixel, but in the opposite direction.
   The new value is determined by interpolating the raster value at the previous location of the pixel.
2. To determine value for the pixel **N** frames in the future, the algorithm performs the shift **N** times.

3. The algorithm determines the MVF vector components at each intermediate location using the same interpolation procedure as for the raster value at the previous location. The interpolation computes a weighted average of raster values in four surrounding points.



3.8 User Preferences

To view and change user-specific settings, select **Preferences**.

You can change:

- Your password
- Default animation settings
- Interface language
- Measurement units used in IRIS Focus. See Map Units (page 18).

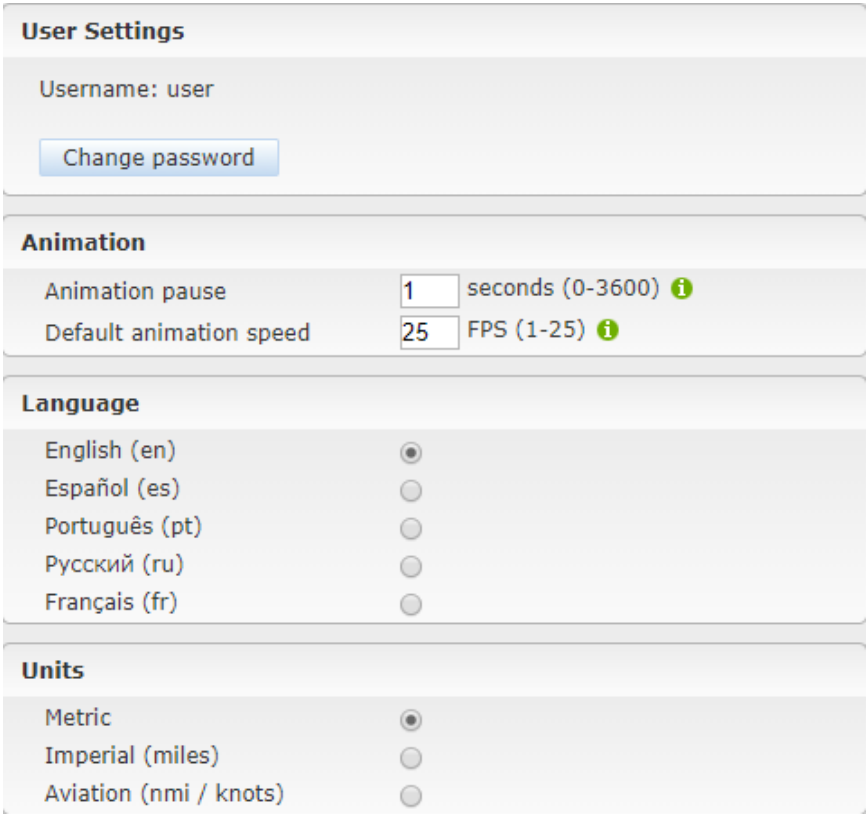


Figure 17 User Preferences

More information

- Animation Timeline (page 21)

3.9 Saved Views

Many IRIS Focus users work from the same **Map** views from one session to the next.

You can use **Saved Views** to save your frequently used views so they are available each time you log in to IRIS Focus.

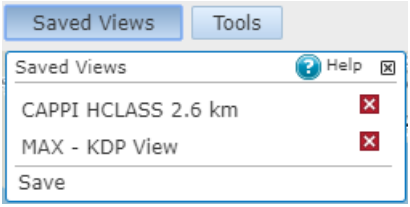


Figure 18 Saved Views Example

1. In the IRIS Focus **Map** view, set-up the view you want to save.
   For example, you can save the settings for:
   - **Weather Products**
   - Map tools such as the cross-section and tracking tools
   - Zoom level
2. Select **Saved Views > Save**.
3. Name the view and select **Save**.
   The new view is added to the **Saved Views** list for your future use.
4. To update a saved view:
   a. Under **Saved Views**, select the view you want to update.
   b. On the **Map**, update the view settings.
      For example, change the zoom level or the product data type.
   c. Select **Saved Views > Save**.
   d. Save the view with the same name as the view you want to update.
5. To delete a saved view, in the list of saved views, select the **X** next to the view you want to delete.

3.10 Supported browsers

IRIS Focus data is available through a secure network connection, and can be displayed on multiple client workstations across your organization.

IRIS Focus supports current Microsoft Edge®, Mozilla Firefox®, and Google Chrome™ browsers.

4. Managing Weather Alerts and Places of Interest

4.1 Alerts for Significant Weather

IRIS Focus can provide alerts for weather phenomena, such as the approach of a severe storm, turbulence, lightning hazard, or flood potential for user-defined areas of interest.

In IRIS Focus, a weather *event* is an occurrence of a configured set of event criteria. The event is shown on the display as an icon.

A weather *event* becomes an *alert* when the configured set of event criteria moves into an area of interest.

When an event becomes an alert, the icon and the border around the area turn red. You can hover over the area to show more information about the alert. For example, you can see which radar generated the data that triggered the alert. The number of active alerts is shown on the **Alerts** icon at the upper right corner of the screen. Click the icon to see a list of active alerts.

In order for IRIS Focus to show events, users need to create *event criteria* for each event they want to see, and attach the event criteria to an area of interest. A `poweruser` can create new event criteria in the system. Both a `poweruser` and a `focus` user can then add the event criteria to areas of interest.

When event criteria is attached to an area of interest, IRIS Focus compares the event criteria to the data received from all the radars in range. If all the criteria are met, an event or alert (depending on the location) is displayed on the screen. If an event criteria is not attached to any area of interest, IRIS Focus does not run comparison checks for that event criteria, and no events are shown.

When you assign event criteria to an area of interest, you receive alerts about that criteria from the current time onwards.

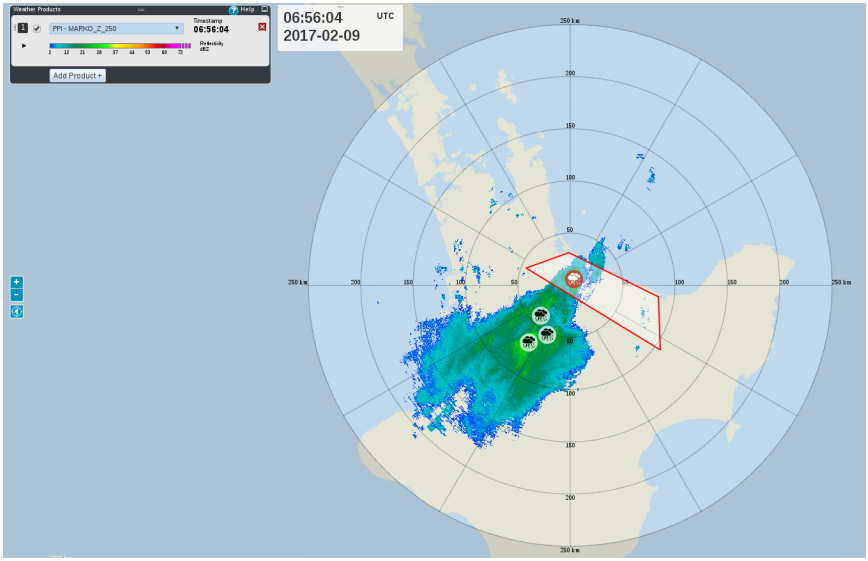


Figure 19 Viewing Events and Alerts

Alerts have a hysteresis period of 20 minutes. If new events of the same type, and in the same area of interest, arrive, IRIS Focus keeps the alert active. Once there have been no new events for 20 minutes, the alert is turned off.

When you are working with historical data, consider the following:

- When you browse historical data, you see information about weather events and alerts that were recorded in real time.
- If you delete an area of interest or some alert criteria, the area and any recorded alerts associated with that area remain visible when browsing historical data.

4.1.1 Required user roles for event criteria and places of interest

Table 6 User Roles for Event Criteria and Areas of Interest

Action	focus	poweruser
Define event criteria See Defining event criteria (page 52).	--	✔
Create, edit, or delete organization-level areas of interest	--	✔
Assign event criteria to organization-level areas of interest	--	✔

Action	focus	poweruser
Create, edit, or delete organization-level pins	--	✓
Create, edit, or delete personal areas of interest	✓	--
Assign event criteria to personal areas of interest	✓	--
Create, edit, or delete personal pins	✓	--
View organization-level areas of interest and alerts	✓	✓
View organization-level pins	✓	✓

Organization-Level Areas of Interest

Users must be assigned a **poweruser** role to be able to create, edit, or delete an organization-level area of interest.

The **poweruser** role also provides the user with the rights to assign event criteria to organization-level areas of interest.

All users receive alerts about weather events occurring within organization-level areas of interest.

Personal Areas of Interest

Users assigned a **focus** role can create personal areas of interest that:

- Are only visible to the user who created the area of interest
- Can be assigned event criteria defined by a **poweruser**
- Generate alarms that are only visible to the user who created the area of interest

More information

- User roles (page 13)

4.2 Places and Areas of Interest

In IRIS Focus, places of interest may be either an area or a single point on the map.

Pins

Pins on a map indicate points of interest with reference points and labels.

Areas of Interest

An area of interest is a geographical area that is monitored for certain weather events.

If the system detects a weather event in an area of interest, it generates an alert.

To receive weather alerts, you must define an area of interest in IRIS Focus and then attach sets of event criteria to that area.

More information

- Pinning Locations on the Map (page 49)

4.2.1 Drawing Areas of Interest

1. Select **Places of Interest**.
   The **Places of Interest** pane opens.
2. Select the type of area you want to create: **Circle** or **Shape**.
3. Give the area of interest a unique name.
4. Define the area settings.
   The settings vary depending on the area type. For example, for a **Circle**, you define the center point and radius.
5. Select if the area is **Enabled**.

   CAUTION! If the area is not defined as **Enabled**, you will not receive weather alerts about significant weather in the area.

6. Select **Show label** to show the area name on the map.
   In the **Places of Interest** view, when enabled, the map also displays the icon for the event criteria assigned to the area interest.
7. Assign event criteria to the area of interest.
   See Assigning Event Criteria to Areas of Interest (page 46).
8. Select **Save**.

IRIS Focus generates an alert when a weather event enters the area of interest.

More information

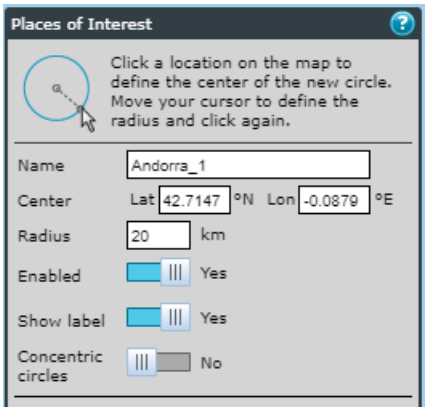
- Working with Circles (page 43)
- Working with Shapes (page 44)
- Viewing Places of Interest on the Map (page 50)

4.2.2 Editing Areas of Interest

1. On the map, click an area of interest.
   The configuration pane for that area opens.
2. Update the configuration settings.
   You can also use the mouse to adjust the dimensions of the area on the map.

3. Select **Save**.

4.2.3 Working with Circles



1. Select **Places of Interest**.
   The **Places of Interest** pane opens.
2. Select **Circle** to create a new area.
3. Give the area of interest a unique name.
4. To define the area using map co-ordinates, use the **Places of Interest** pane:
   a. Define the latitude and longitude of the center of the circle.
   b. Define the radius of the circle.
5. To draw the circle on the map:
   a. Click the location on the map where you want to place the center of the circle.
   b. Drag the mouse to define the radius of the circle.
   c. To move the circle on the map, drag the center point of the circle.
   d. To resize the circle on the map, use the corner points around the circle.
6. To show concentric circles between the center point and the outer edge of the area of interest circle, select **Concentric circles**.
7. To show the name of the area of interest on the map, select **Show label**.

8. To activate the area of interest, select **Enabled**.

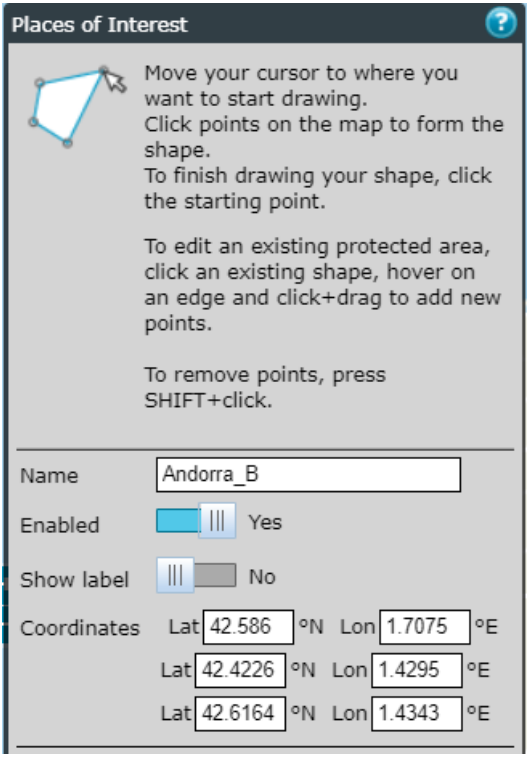
> **CAUTION!** If the area is not defined as **Enabled**, you will not receive weather alerts about significant weather in the area.

9. Select **Save**.

More information

- Drawing Areas of Interest (page 42)

4.2.4 Working with Shapes



1. Select **Places of Interest**.
   The **Places of Interest** pane opens.

2. Select **Shape** to create a new area.
   a. Give the area of interest a unique name.
   b. On the map, move your cursor to where you want to start drawing.
   c. To form the shape, click points on the map.
   d. To close the shape, click the starting point.
3. Continue editing the shape as needed:
   a. To add new points to a shape, hover on an edge and click and drag the mouse.
   b. To move an existing point, hover over it and click and drag the mouse to move it.
4. To show the name of the area of interest on the map, select **Show label**.
5. To activate the area of interest, select **Enabled**.

> **CAUTION!** If the area is not defined as **Enabled**, you will not receive weather alerts about significant weather in the area.

6. Select **Save**.

More information

- Drawing Areas of Interest (page 42)

4.2.5 Enabling or Disabling an Area of Interest

The **Enabled** setting available for each area of interest allows you to manage which areas of interest generate weather alerts.

For example, if you want to monitor severe weather conditions that are only meaningful to an area of interest for a period of time, you can control when you receive weather notifications for that area.

> **CAUTION!** If the area is not defined as **Enabled**, you will not receive weather alerts about significant weather in the area.

1. Select **Places of Interest**.
   The **Places of Interest** pane opens.
2. In the area of interest configuration pane, update the **Enabled** setting.
3. Select **Save**.

More information

- Viewing Places of Interest on the Map (page 50)

4.2.6 Removing Areas of Interest

When you remove an area of interest from IRIS Focus, it is unavailable for tracking significant weather in future. When you browse historical data, the area and any recorded alerts for that area remain in the system.

CAUTION! Take care when removing areas of interest from your map. You cannot undo an action that removes an area of interest.

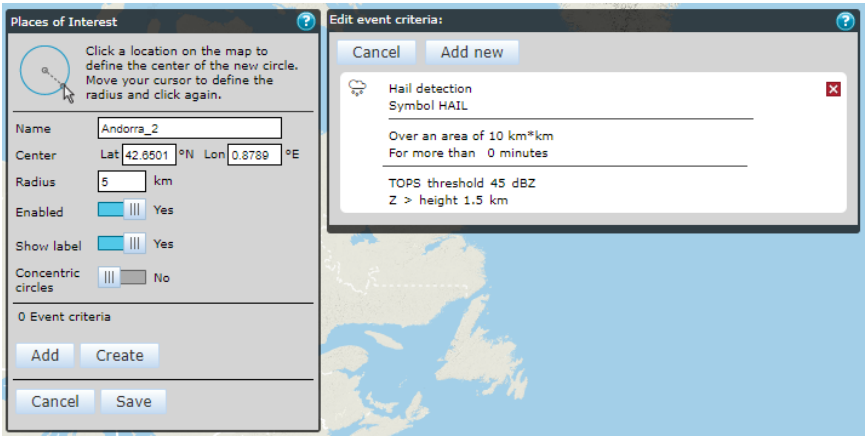
1. To remove the area of interest through the **Places of Interest**:
   a. Select **Places of Interest**.
      The **Places of Interest** pane opens.
   b. In the list of places of interest, select the **x** for the area you wish to remove.
2. To remove the area of interest through the map:
   a. Select the area you wish to remove.
   b. Press **DELETE**.

The area of interest is removed from the IRIS Focus display.

You will no longer be alerted to weather events in this area.

4.3 Assigning Event Criteria to Areas of Interest

To receive alerts about significant weather, you must assign one or more sets of event criteria to an area of interest.



1. Select **Places of Interest**.
   The **Places of Interest** pane opens.
2. In the **Places of Interest** pane, select an area of interest.
   The configuration pane for that area opens.
3. In the **Event Criteria** section, select **Add**.
   The list of available event criteria opens.
4. In the **Event Criteria** pane, click the center of a set of event criteria to attach it to the area.

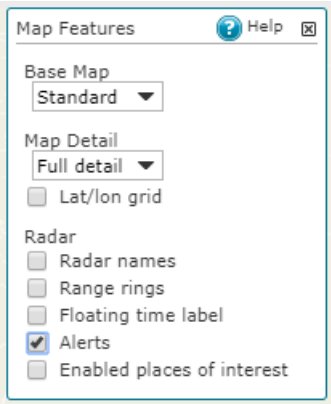
   You can attach many sets of event criteria to an area of interest.

> Make sure the products defined in the criteria are available to the radar site monitoring the area of interest.
> If the products are unavailable, the criteria for triggering an alert cannot be met.

If the area of interest is **Enabled**, you will receive an alert if weather events corresponding to the event criteria occur in the area of interest.

4.4 Displaying Events and Alerts on the Map

You can choose whether or not to display active weather events and alerts on the IRIS Focus map.



> **CAUTION!** If the area is not defined as **Enabled**, you will not receive weather alerts about significant weather in the area.

The alert pane is always active and lists weather alerts even if the **Map Features > Alerts** option not selected

1. Select **Map Features**.
2. Select **Alerts**.
   Active weather events and alerts are displayed on the map.

More information

- Viewing Places of Interest on the Map (page 50)
- Configuring event criteria (page 54)

4.5 Acknowledging Weather Alerts

A weather *event* becomes an *alert* when the configured set of event criteria moves into an area of interest.

When an alert is in an area of interest, both the event icon and the protected area are red and the alarm icon in the menu indicates a new alarm, which you can acknowledge.

1. On the right side of the main menu, select **Alerts > Weather**.
2. In the **Alerts** pane, acknowledge the alert.
   The acknowledgement records who has seen the alert and when.
   Acknowledging alerts has no effect on the alert status.

4.6 Example Weather Alert Symbols

The following table shows some examples of the weather alert symbols available in IRIS Focus. When you configure event criteria, you can assign any icon to the criteria set.

Table 7 IRIS Focus Alert Symbol Examples

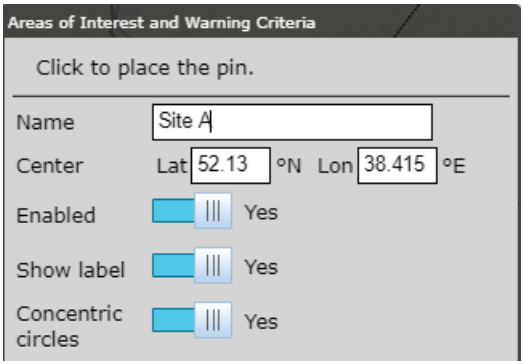
Example	IRIS Focus Event Icon	IRIS Focus Alert Icon
Downburst		
Hail		
Wind		

Example	IRIS Focus Event Icon	IRIS Focus Alert Icon
Other value		

4.7 Pinning Locations on the Map

You can add pins to the map to indicate points of interest with useful reference points and labels.

You cannot attach alert criteria to pins or receive alerts about weather events occuring near pins.



1. Select **Places of Interest**.
   The **Places of Interest** pane opens.
2. Select **Pin** to mark a new point of interest.
3. To add a pin to the map, do one of the following:
   - In the configuration pane, type the latitude and longitude of the pin location.
   - On the map, click the pin location.
4. To show concentric circles around the pin, select **Concentric circles**.
5. To show the name of the pin on the map, select **Show label**.
6. Select **Save**.

More information

- Places and Areas of Interest (page 41)

4.7.1 Enabling or Disabling a Pin

The **Enabled** setting available for each pin allows you to manage which pins are shown on the map. For example, you can hide a pin from view but save it for showing on the map later on.

1. Select **Places of Interest**.
   The **Places of Interest** pane opens.
2. In the pin configuration pane, update the **Enabled** setting.
3. Select **Save**.

4.7.2 Removing Pins

When you remove a pin from IRIS Focus, it is deleted from the system.

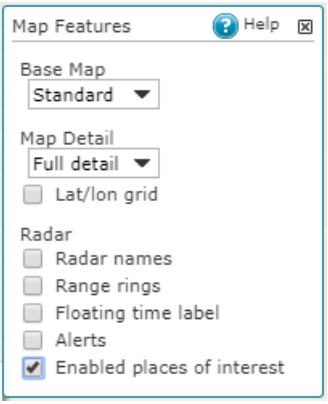
> **CAUTION!** You cannot undo an action that removes a pin.

1. Select the pin you wish to remove.
2. Press **DELETE**.
   The pin is removed from the IRIS Focus map and from the list of pins in the **Places of Interest** pane.

4.8 Viewing Places of Interest on the Map

You can manage whether **Enabled** areas of interest and pins are shown on the map.

If an area of interest is **Enabled**, you will receive weather alerts about significant weather in the area even if the area is not shown on the map.



CAUTION! If the area is not defined as **Enabled**, you will not receive weather alerts about significant weather in the area.

1. Select **Map Features**.
2. Select **Enabled places of interest**.
   IRIS Focus shows enabled pins and areas of interest on the map.

More information

- Drawing Areas of Interest (page 42)
- Enabling or Disabling an Area of Interest (page 45)
- Displaying Events and Alerts on the Map (page 47)

5. Poweruser Tasks

5.1 Defining event criteria

You must define event criteria to detect significant weather in IRIS Focus.

To be effective, weather alert criteria must be based on the local climatology and experience.
Vaisala can work with you to develop such a climatology or to better understand the capabilities and limitations of the criteria.
Vaisala makes no warranty, either express or implied, that the weather alerts can detect all hazardous weather situations. In no event can Vaisala be held liable for damages of any kind for failure of the system to issue a warning, or for false alarms that may be issued by the system.

Example: Detecting Hail

The occurrence of 45 dBZ at 1.5 km above the freezing level is a good indicator of hail in many mid-latitude locations. Assuming that the freezing level is at 4 km, and you run an echo **TOPS** product for the 45 dBZ contour, your configured event criteria could check if:

- The **TOPS** product shows 45 dBZ tops at heights greater than 5.5 km. If yes, there is a high probability of hail.
- To avoid issuing an alarm based on a single pixel, a "threshold region" parameter checks if the region of hail signature at least 10 km^2 .
- The **VIL** for the same region (1 ... 10 km) is greater than 5 mm (or a value determined from the local climatology of hail).

Principles for defining event criteria

Vaisala recommends using up to 3 criteria. The thresholding and smoothing is performed separately for each criterion and then the results are are linked with **AND** operators.

IRIS Focus identifies weather as significant only if the recorded values are smaller or larger than the thresholds defined in the event criteria.

The units of measure depend on the selected product. For example:

- `TOPS` thresholds are specified in km
- `VIL` thresholds are specified in mm.

The following figure shows how IRIS Focus calculates the event criteria to identify significant weather events.

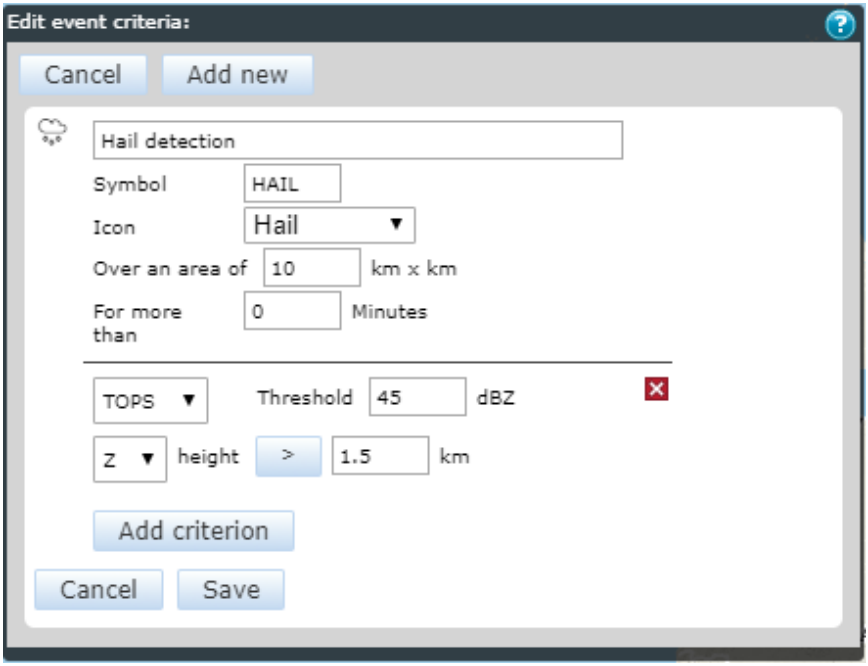


Figure 20 Calculating event criteria - hail detection example

1. Threshold the input product (45 dBZ **TOPS** in the example) so that only points larger than the threshold are considered (for example, >>5.5 km).
   The result is a 2-D binary array.
2. Smooth and connect the significant weather regions that are almost touching, and eliminate any isolated bins.
3. Contiguous regions are identified. The location and size of each region is computed. Regions below the threshold size are discarded.
4. Determine whether any part of any region is in an area of interest.
5. Show the significant weather, hail, as an event outside areas of interest or as an alert within areas of interest.

More information

- Alerts for Significant Weather (page 39)

5.1.1 Example event criteria

The following table shows some examples of event criteria.

Each criterion, surrounded by square brackets above, is one set of event criteria. The results of multiple criteria or event tasks are linked with **AND** operators.

Table 8 Example event criteria

Criteria	Example

Wind shear detection	`[Shear >10 m/s/km at 0.5° EL]`
	`AND`
	`[ ... at 0.7° EL]`
	over an area of 3 km^2

Storm turbulence detection	`[Spectrum Width >6 m/s]`
	`AND`
	`[Reflectivity >20 dBZ]`
	over an area of 10 km^2

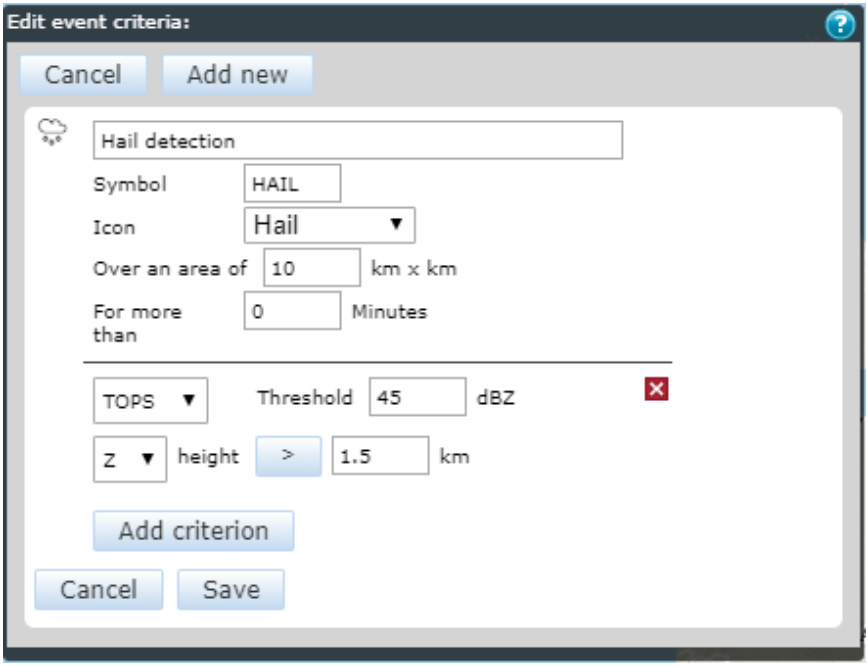
Hail detection	`[45 dBZ TOPS >1.5 km above freezing level]` over an area of 10 km^2
Precipitation surveillance detection	`[1.5 to 14 km VIL >1 mm]` over an area of 10 km^2

Severe storm detection or lightning hazard	`[1.5 to 15 km VIL >10 mm]`
	`AND`
	`[10 dBZ TOPS >8 km]`
	over an area of 10 km^2

Flash flood warning	`[Hourly Rainfall or N-Hour Rainfall >5 mm]` over an area of 25 km^2

5.1.2 Configuring event criteria

You must be assigned a **poweruser** role to configure event criteria.



Alerts to weather events in areas of interest are based on configured sets of event criteria.

Event criteria specify the message, the area of the threshold region, and a number of weather product settings.

1. Log in to IRIS Focus as **poweruser**.
2. Select **Places of Interest**.
   The **Places of Interest** pane opens.
3. Under **Event Criteria**, select **Edit**.
   The weather criteria pane opens.
4. Do one of the following:
   - Select **Add New** to create a new set of existing criteria.
   - Select an existing criteria set to update a configuration.
5. Select an icon from the predefined list of options.
   This icon is shown on the map when an event matching the weather event criteria occurs.
6. Name the set of event criteria.
7. In **Symbol**, specify the text used in the alert messages.
   The messages are available to systems that require this information.

8. Define the first criterion.
   a. Select a product type.
   b. Define the data types and thresholds for the selected product.
      Radar product data type defines what is calculated from the received radar pulse reflections.
      The available data types and threshold criteria vary depending on the selected product.

      The list of product names shows products currently in your system.

      See Data Types (page 69).
   c. In **Over an area of**, enter the minimum size of a thresholded region (note that the unit is km^2).
      Weather events that are smaller than this do not trigger alerts.
   d. In **For more than**, type a time value (minutes).
      The **For more than** value refers to the time interval during which the weather criteria must persist in an area of interest.
      IRIS Focus sends an alert if the event persists in an area of interest for the defined interval or longer. Weather events that last for a shorter time than the defined interval are ignored.
      You must know your task schedule. In general, if all of your product criteria are based on the same task, set the **For more than** time to `00:00:00` so that only data from the same run are used.

On-demand Products	IRIS Analysis Products
IRIS Focus records when the criteria starts and continues monitoring for defined time interval time to check when the time criterion is met.	You must define a time criterion that takes into account the frequency at which the products are sent to IRIS Focus.
IRIS Focus applies the event conditions to all tasks.	IRIS Analysis products are attached to a task, so the event criteria are applied only over those tasks used for IRIS Analysis product generation. IRIS Focus checks the area to and see if a radar is producing the requested IRIS Analysis product.

9. Select **Add Criterion** to add more criteria to the event criteria set.
   Vaisala recommends using up to 3 criteria.

   Additional criteria are included in the event criteria set using the **AND** condition.
   To use the **OR** condition, create another set of event criteria and apply it to the same area of interest.

10. Select **Save**.

You can now assign the event criteria to one or more areas of interest.

You can view events and alerts about the event criteria on the map after you have attached it to an area of interest.

More information

- Displaying Events and Alerts on the Map (page 47)

5.2 Configuring composites

You must be assigned a **poweruser** role to configure pre-defined composites.

There are three types of composites: dynamic composites (created on the fly), pre-defined composites (created in the IRIS Focus admin screen), and IRIS Analysis Composites (created in IRIS Analysis).

IRIS Focus powerusers can set up and manage pre-defined composites.

Configuring pre-defined composites provides more control than dynamic composites over settings such as the combining algorithm and **Max Time Span**.

IRIS Analysis Composites are set up in IRIS Analysis as IRIS **COMP** products and sent to IRIS Focus much like other pre-configured products.

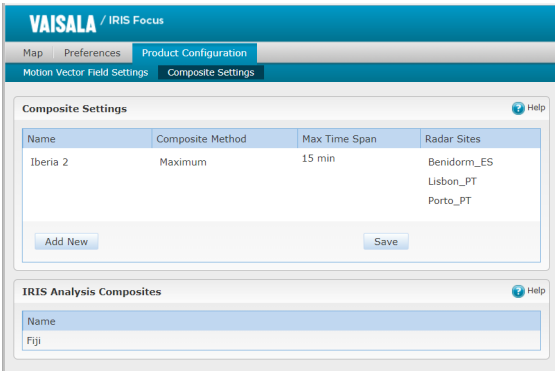


Figure 21 Composite settings

5.2.1 Setting up pre-defined composites

1. Log in to IRIS Focus as **poweruser**.
2. Select **Product Configuration > Composite Settings**.
3. Select **Add New**.
4. Give the composite site a name.
5. Under **Composite Method**, select the algorithm applied to overlapping data.
   See IRIS Focus composite methods (page 30).
6. Define the **Max Time Span** for the composite.
   See Max Time Span (page 59).
7. Under **Radar Sites**, select the sites you want to include in the composite.
8. Select **Save**.

5.2.2 Editing pre-defined composites

1. Log in to IRIS Focus as **poweruser**.
2. Select **Product Configuration > Composite Settings**.
3. Select a composite on the list.
4. Adjust the composite method or time interval as needed.
5. Under **Radar Sites**, select the sites you want to include in the composite.
6. To remove a site from the composite, select the **X** next to the site you want to remove.
7. Select **Save**.

5.2.3 Deleting pre-defined composites

1. Log in to IRIS Focus as **poweruser**.
2. Select **Product Configuration > Composite Settings**.
3. Select a composite on the list and then select **Delete**.
4. Select **Save**.

5.2.4 IRIS Focus composite methods

For regions where radars overlap, you can select one of the following methods for combining radar data:

- *Maximum*
  Maximum uses the maximum value to combine the data. This is the most common setting.
- *Average*
  Average uses the average of the available data. This is a poor choice if you are trying to cover blocked regions.

IRIS Analysis supports an expanded set of composite methods. For more information, see *IRIS Product and Display Guide*.

5.2.5 Max Time Span

Max Time Span is the maximum time (minutes) allowed between the newest and oldest points of data. When new data is processed, points that are older than the specified time span are removed.

The following example shows **Max Time Span** for composite radar data:

- Each radar has a different task schedule with tasks 5, 7, and 10 minutes apart.
- **Max Time Span** the composite calculations is set to 10 minutes.
- Over time, the composite calculation uses **Max Time Span** value when considering which tasks are available within the time span 'window'.

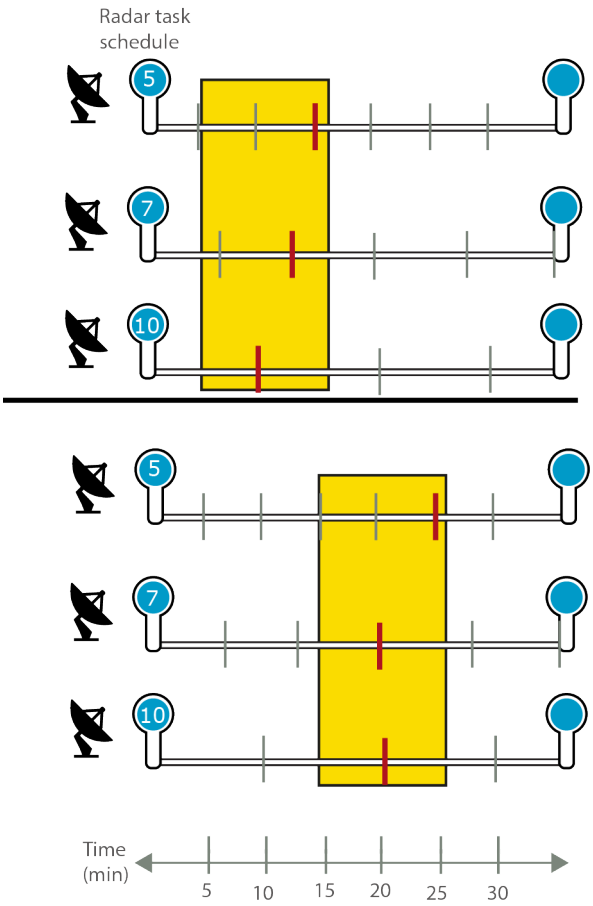


Figure 22 10 minute **Max Time Span**

5.2.6 Viewing a list of IRIS Analysis composites

IRIS Analysis Composites are set up in IRIS Analysis as IRIS **COMP** products and sent to IRIS Focus much like other pre-configured products.

1. Log in to IRIS Focus as **admin**.
2. Select **Product Configuration > Composite Settings**.
3. Scroll down to the **IRIS Analysis Composites** pane.

5.3 Configuring Nowcasting

Nowcasting is enabled by default. However, during installation or later, you can adjust the nowcasting configuration.

Configuring IRIS Focus for nowcasting includes:

- Enabling nowcasting in the IRIS Focus web application and the nowcasting server.
- Configuring MVF and nowcasting criteria.
- Fine-tuning the algorithms.
  Most users do not need to adjust the nowcasting algorithms.

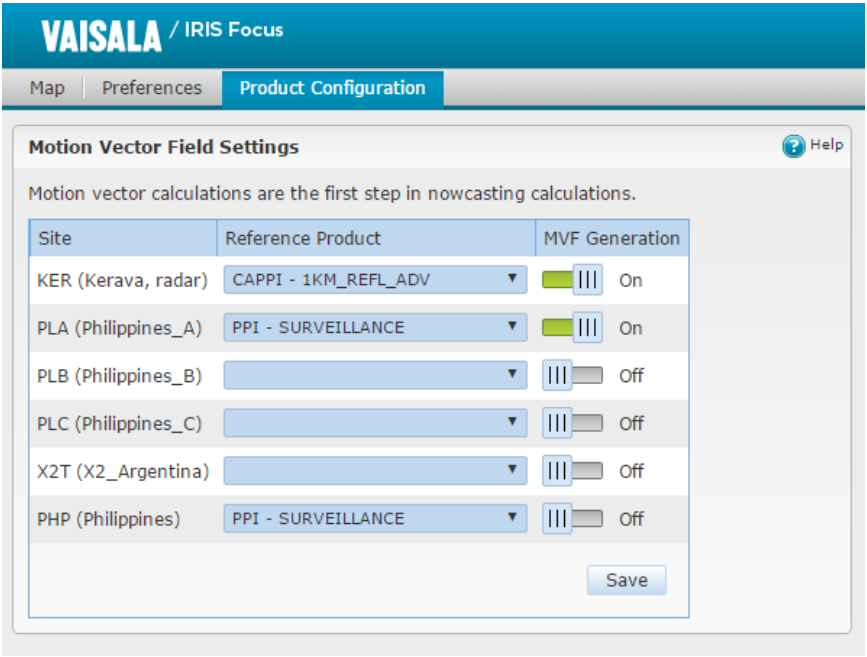
More information

- Configuring MVF (page 61)
- nowcast.ini (page 110)

5.3.1 Configuring MVF

To use nowcasting, for each radar site you must enable motion vector field (**MVF**) generation and pre-configure the **MVF** product to define a product type and product name.

IRIS Focus generates one **MVF** product per site. If meteorological conditions vary across your radar sites, you may wish to use different products for each radar site.



1. Log in to IRIS Focus as **poweruser**.
2. Select **Product Configuration > Motion Vector Field Settings**.
3. For each radar site, select whether **MVF** generation is enabled for that site.
   To maximize the server performance, do not enable **MVF** generation for sites that do not need the nowcasting feature.
4. For the sites with **MVF** generation enabled, select the product used to create **MVF** products.
   The product can be of any data type except V and PHIDP.

   To maximize server performance, avoid:
   - Products that generate too much data, for example, those with large resolutions.
     Vaisala recommends using a **CAPPI** at 2km height at with a 480x480 resolution.
   - Generating the **MVF** product too frequently.
     Vaisala recommends using products that are configured to be created no less than 10 minutes apart.

   For more information on pre-configuring products, see *IRIS Radar User Guide* and *IRIS Product and Display Guide*.

5. Select **Save**.

More information

- nowcast.ini (page 110)

5.3.2 Enabling the Nowcast Server

You must have a nowcasting license to use nowcasting in IRIS Focus.
See Licensing (page 11).

After a default installation, the nowcast server is running by default.

When troubleshooting nowcasting, check that nowcasting is enabled, and that the nowcast server is running.

If you change the configuration, you must restart the nowcast server.

1. Log in as **root**.
2. Go to */etc/vaisala/radarsw/configuration/vsoweb-override.ini*.
3. In the [NOWCAST] section of the **vsoweb-override.ini** file, check that the nowcast server is enabled:

```
nowcast.mvf.run: true
```

4. Check the nowcast server URL:

```
nowcast.http.server.url = http://localhost:34480/api/v1/mvf/
```

If you have not changed **vsoweb-override.ini**, you do not need to restart the **vaisala-radarsw-webapp** server.
The nowcast server is running by default. If you have not changed **nowcast.ini**, you do not need to restart the nowcast server.

5. Restart the **vaisala-radarsw-webapp** service by typing:

```
systemctl restart vaisala-radarsw-webapp
```

6. Start the nowcast server by typing:

```
systemctl start vaisala-radarsw-nowcast-server
```

   a. To verify that the server starts, type:

```
systemctl status vaisala-radarsw-nowcast-server.service
```

   b. Check for the status:

```
Active: active (running)
```

5.3.3 Starting the Nowcast Server

1. Log in as **root**.
2. Start the nowcast server by typing:

```
systemctl start vaisala-radarsw-nowcast-server
```

   a. To verify that the server starts, type:

```
systemctl status vaisala-radarsw-nowcast-server.service
```

   b. Check for the status:

```
Active: active (running)
```

5.3.4 Stopping the Nowcast Server

1. Log in as **root**.
2. Stop the nowcast server by typing:

```
systemctl stop vaisala-radarsw-nowcast-server
```

5.3.5 Restarting the Nowcast Server

1. Log in as **root**.

2. Restart the nowcast server by typing:

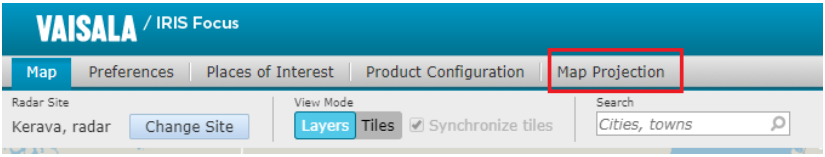
```
systemctl restart vaisala-radarsw-nowcast-server
```

5.4 Selecting map projection

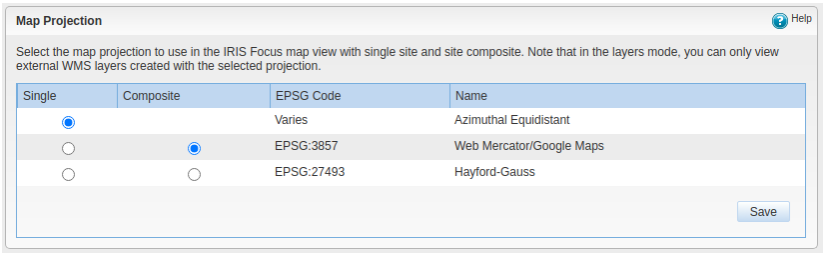
You can select which map projection to use when viewing single radar sites and when viewing composite sites. This setting is organization-wide, so all users will see maps in this projection.

> If you use external WMS layers, you can only view those external WMS layers that were created with the projection selected for the map. For example, if you select an azimuthal equidistant projection, you can only view external WMS layers that were created using the exact same azimuthal equidistant projection.

1. Log in to IRIS Focus as **poweruser**.
2. Select **Map Projection**.



The map selection window opens.



3. Select the projection for single sites and for composite sites.
4. Select **Save**.

6. Radar Products

A weather radar transmits pulse signals outwards to the atmosphere and receives reflected echoes of the signal. As the radar rotates around its vertical and horizontal axes, it gathers raw data by sending and receiving signals.

The raw data can be analyzed for signal properties, such as reflectivity and Doppler velocity, that are affected by the atmospheric conditions in the measured area. For example, a dense precipitation area reflects a stronger echo signal back toward the radar. These signal properties are processed to create radar products that are useful for meteorological purposes.

IRIS Focus is designed for use with dual polarization Doppler radars that transmit and receive both horizontally and vertically polarized pulses. The combination of differential polarization modes allows for detailed analysis of atmospheric events such as detecting different precipitation types.

Radar products are raw signal data from a radar receiver processed to provide information about current weather conditions. IRIS Focus supports:

On-demand radar products	On-demand products are based on raw data from the IRIS back-end. IRIS Focus reads raw volume data and generates radar products in real time. On-demand products provide control over the presentation of weather data in the IRIS Focus user interface. For example, users can change the reflectivity threshold of a selected radar product on the fly. IRIS Focus users can create composites of on-demand products by selecting multiple radar sites from the radar site selector.
IRIS Analysis radar products	IRIS Analysis radar products are configured and produced in IRIS Analysis and displayed by IRIS Focus on request.

For information on the algorithms used to process raw signal data in IRIS, see *IRIS and RDA Dual Polarization User Guide* and *RVP900 Digital Receiver and Signal Processor User Guide*.

6.1 Measuring Radar Data

IRIS Focus uses the data generated by weather radars to detect hydrometeors in the atmosphere such as rain, snow, or hail.

6.1.1 Bins, Sweeps, and Volumes

As the radar rotates around its axis 360° in a sweep, the weather radar transmits microwave pulses into the atmosphere and receives signals reflected off hydrometeors. After a sweep, the radar usually changes its elevation and starts a new sweep.

The reflection measurements from a pulse are sorted into bins. A bin is a single sample of weather data detected at a known direction, altitude, and distance from the radar site. The radial size of a bin increases with distance, so bins further from the radar site cover a larger area than nearby bins. Each sweep typically contains the same number of bins independent of the elevation.

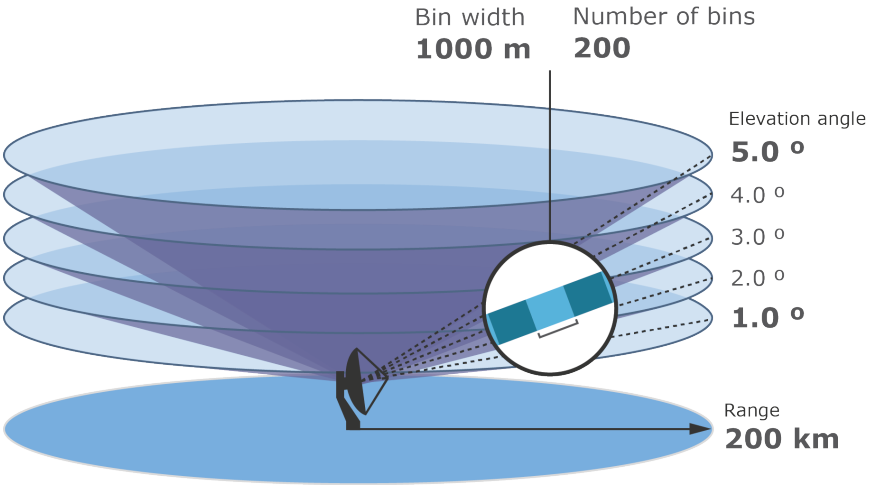


Figure 23 Bins and Sweeps

Volumes, a complete set of raw measurement data collected during sweeps, are used to calculate a model of the atmosphere. The maximum volume is half of a sphere (from 0° elevation upwards), but other shapes are more typical.

6.1.2 Radar Beam

As the distance from the radar site increases, the granularity of the radar beam decreases, which degrades the accuracy of radar products. For example, a 1° wide beam sent at the antenna has a width of 2 km across at 120 km distance. The following image shows how the detected bins grow larger further away from the radar.

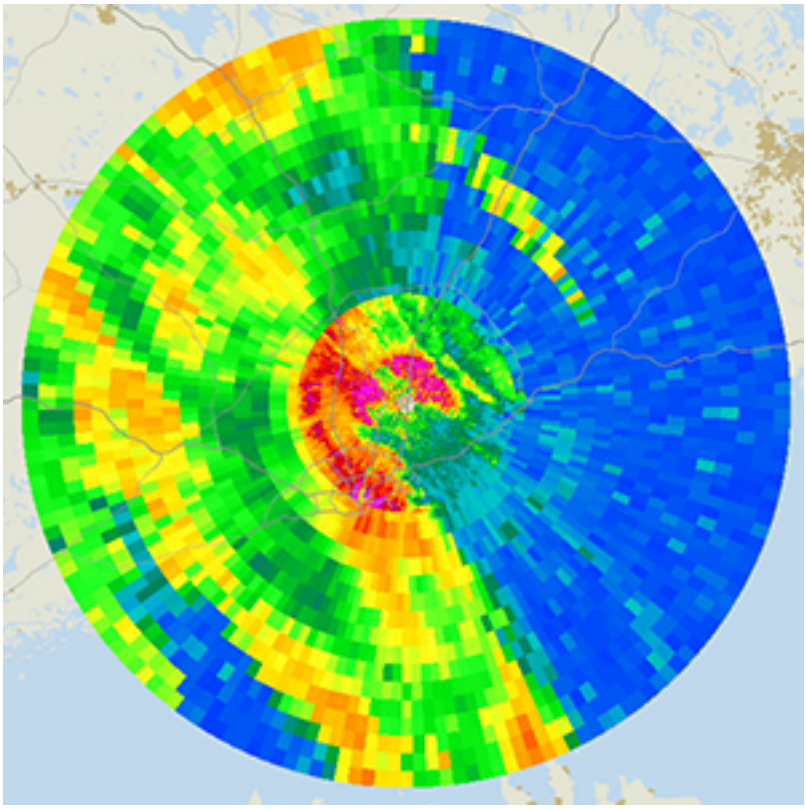


Figure 24 Radar resolution across the detected area

Many radar products are affected by the curvature of the Earth. A radar beam transmitted at a 0° vertical angle from the radar site on a flat environment would be 780 meters above ground at 100 km distance, before accounting for atmospheric refraction. While all IRIS Focus radar products are corrected for curvature and refraction effects, weather phenomena from below the curvature threshold cannot be detected.

The following image shows a vertical cross-section of a typical volume scan action. The image is corrected for earth curvature. Note how the vertical resolution increases with longer horizontal distance. The same applies to horizontal resolution.

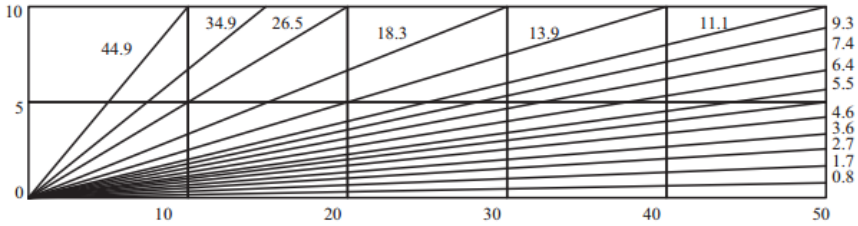


Figure 25 Example of 15-tilt Volume Scan

6.1.3 Data Flow

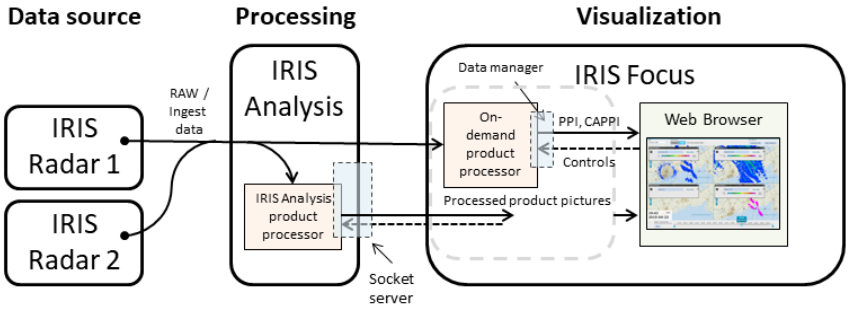


Figure 26 IRIS Focus Data Flow

The IRIS back-end collects data in different configurations, which are defined as *tasks* in IRIS Radar. Tasks are sets of operating parameters for the radar hardware and signal processing components, for example:

- Surveillance **PPI** scan at a single elevation angle
- Complete volume scan at multiple elevation angles
- Wind velocity scan

Each task type provides different source data. Users can select the task type when selecting an on-demand radar product to display in IRIS Focus.

6.1.4 Data Types

Radar product data type defines what is calculated from the received radar pulse reflections.

The data types are used in both IRIS Analysis and on-demand products.

- In IRIS Analysis products, the data type is indicated in the radar product name.
- In on-demand products, you can select the intended data type from the drop-down menu on the **Weather Products** pane.

Data types in IRIS Focus never use letters from the Greek alphabet, and are always written in uppercase, even when signal processing and meteorological conventions use subscript. For example, instead of Φh, IRIS Focus uses PHIH.

Horizontally and vertically polarized pulses are generally abbreviated in the data types as **H** and **V**. Data types that use both sent and received signals as input include a combination of letters **H** and **V** to describe the process. For example, **HV** refers to horizontal transmit and vertical receive.

Table 9 IRIS Focus Data Types

Data type	Definition	Description
HCLASS	Hydrometeor Classification	Estimated hydrometeor type in the precipitation area.
KDP	Specific Differential Phase	An indicator of the rate of change of the phase difference between horizontally and vertically polarized pulses of the radar. A greater horizontal shift results in a positive KDP value, and a greater vertical shift results in a negative KDP value. Typical cause for a high KDP area is heavy rain.
LDRH (**LDRV**)	Linear Depolarization Ratio **H** to **V** (or **V** to **H**).	The ratio of cross-polar to co-polar reflectivity measured in dB.
PHIH (**PHIV**)	Horizontal (or Vertical) Differential Phase	Phase difference for the total round trip between radar and the volume where the signal is reflected. **PHIH** is measured between **HH** and **HV** channels. **PHIV** is measured between **VV** and **VH** channels.
PHIDP	Differential Phase	The phase difference due to propagation between the **HH** and **VV** channels of the radar.
RHOHV (**RHOH**/ **RHOH**)	Correlation coefficient between **HH** and **VV** (or **HH** and **HV** / **VV** and **VH**) channels)	Higher (>0.95) values indicate uniform precipitation areas and lower values more mixed hydrometeor types, such as melting snow, wet snowflakes, or airborne debris.
SNR	Signal to Noise Ratio	Generic measurement of signal-noise ratio in dB.
SQI	Signal Quality Index	A value between 0 ... 1 that measures the signal's Doppler coherency, that is the correlation between the signal and its Doppler lag. • 0 indicates white noise • 1 is the perfect Doppler point target
T	Total Reflectivity	Total power returned to the radar in reflectivity units. It typically represents the horizontal reflectivity without ground clutter correction.

Data type	Definition	Description
TV (TE)	Total Vertical (HV Enhanced) Reflectivity	Total reflectivity from the vertical polarization channel (TV) and combination of the horizontal and vertical channel (TE).
V	Velocity	Average radial velocity (towards or away from the radar) of detected hydrometeor areas.
VC	Corrected Velocity	Same as Velocity, but corrected for effects of range folding and velocity folding.
W	Spectral Width	Variability of Doppler velocity values within the measurement area.
Z	Reflectivity	Usually referred to as dBZ in professional literature. It is the common data type that measures radar signal reflectivity, and is used to estimate precipitation intensity from that. All Z measurements are corrected for ground clutter.
ZV (ZE)	Vertical (HV Enhanced) Reflectivity	Total reflectivity from the vertical polarization channel (ZV) and combination of the horizontal and vertical channel (ZE). Corrected for ground clutter.
ZC	Corrected Reflectivity	Same as Z, but corrected for attenuation and beam blockage effects.
ZDR	Differential Reflectivity	The ratio of SNR in the horizontal channel to the SNR in the vertical channel. Positive values indicate more prominent horizontal echoes and negative values more prominent vertical echoes. Larger hydrometeor sizes are usually identified by high positive ZDR values.
ZDRC	Corrected Differential Reflectivity	Same as ZDR, but corrected for attenuation and beam blockage effects.

More information

- Radar Product Codes (page 71)
- On-demand Radar Products (page 75)
- IRIS Analysis Radar Products (page 93)

6.2 Radar Product Codes

All radar products are identified by a product code that shows the relevant characteristics of that product.

The codes are specified in IRIS Analysis in the following format:

```
[Product type]-[Data type]-[Range]
```

For example, a product called **PPI-Z-400** is:

- **PPI**
  PPI radar product.
  See On-demand Plan Position Indicator (PPI) (page 86).
- **Z**
  Measuring reflectivity in dBZ.
  See Data Types (page 69).
- **400**
  Up to horizontal range of 400 km.

The **Weather Products** pane lists radar products by their product codes.

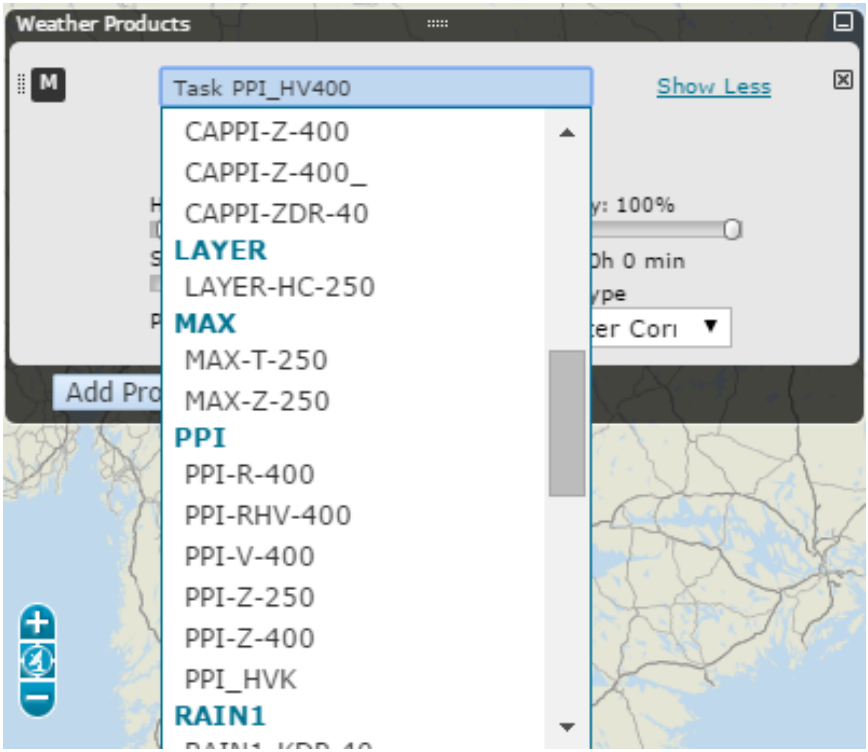


Figure 27 Radar Product Code Examples

More information

- IRIS Product Family (page 10)
- On-demand Radar Products (page 75)
- IRIS Analysis Radar Products (page 93)
- Data Types (page 69)

6.3 Radar Product Colors

All radar product visualizations are drawn on the map using an editable color scale gradient, which illustrates the intensity of the detected weather phenomena or values of the received signal. The default color scales are useful for most conditions, and you can edit them further with the built-in color scale editor.

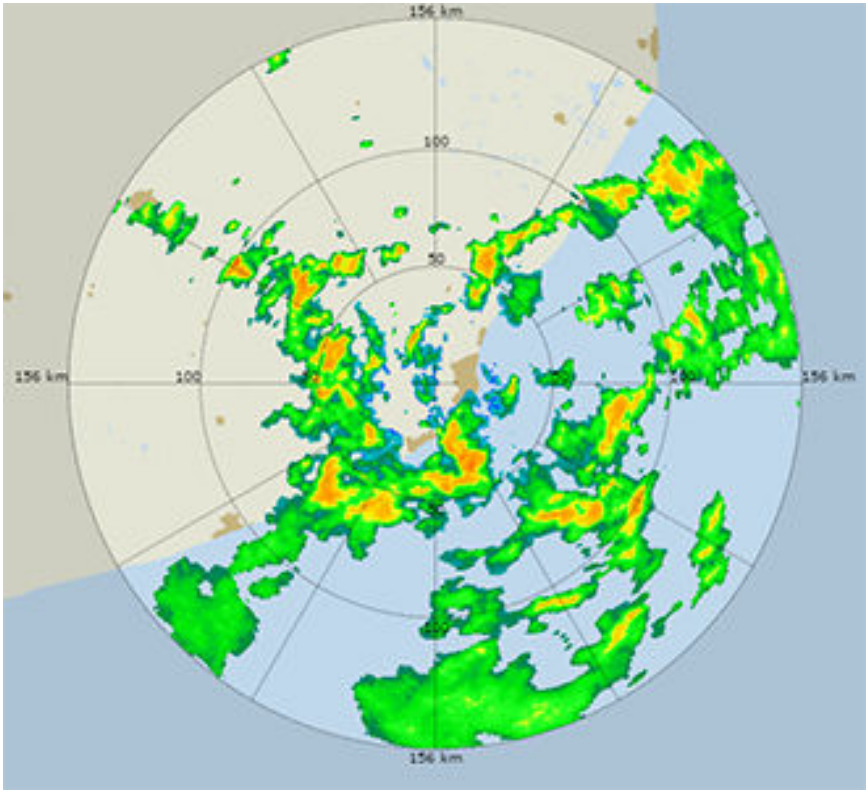


Figure 28 Signal reflectivity in precipitation

More information

- Color Scale Editor (page 22)

6.4 Radar Product Smoothing

As they are processed, all radar products are rasterized as 2D bitmap images to be displayed on top of the map view area. The bitmap image is calculated by interpolation from the whole three-dimensional volume data.

On-demand radar products allow you to set a smoothing effect on the weather data layer. The smoothing value sets how close the radar product pixels must be in meters before their quantitative values are blended together. Larger values result in a heavily smoothed area, while a value of 0 disables smoothing completely.

Smoothing is only performed on the rasterized bitmap data. It does not take the vertical dimension of measurements into account.

The cursor tool always displays the original raster data, not the smoothed data.

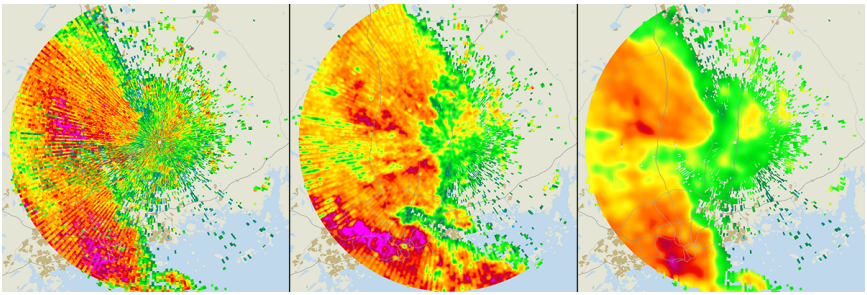


Figure 29 Smoothing Level Examples

Heavy smoothing may lose details that are detectable on lower smoothing levels.

More information

- On-demand Radar Products (page 75)

6.5 Radar Product Reflectivity Threshold

Some on-demand radar products allow you to set a reflectivity threshold (dBZ) for the amount of data displayed in the image.

Use the slider to select a value within the range -32 ... 96 dBZ.

Low reflectivity threshold values display more data, while higher reflectivity threshold values filter out all data with reflectivity below the defined threshold to make it easier to focus on the most important data.

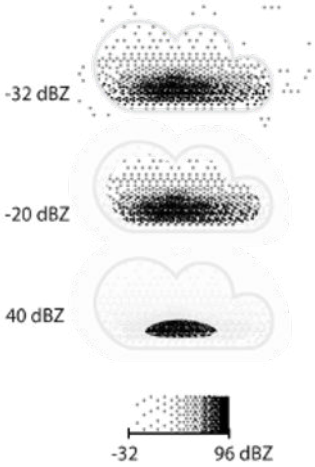


Figure 30 Reflectivity Threshold

More information

- BASE Threshold Value (page 77)
- THICK Threshold Value (page 89)
- TOPS Threshold Value (page 92)

6.6 On-demand Radar Products

On-demand radar products displayed in IRIS Focus receive raw data from IRIS Analysis or IRIS Radar.

The raw volume data from the radar signal processor is stored in the data manager, which makes the data available to the IRIS Focus user interface.

IRIS Focus uses the data manager to read the raw volume data and generate radar products in real-time.

To optimize viewing, as the user pans and zooms the map, the location and size of each pixel changes. The on-demand products recalculate the value of each pixel based on the new geographical definition.

6.6.1 On-demand Echo Base (BASE)

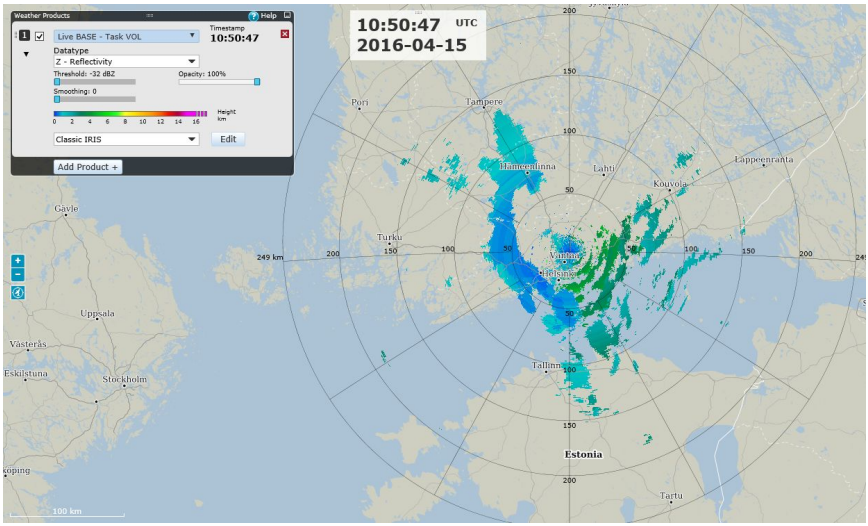


Figure 31 On-demand **BASE** Example

BASE (also known as echo base) is the radar-indicated bottom of an area of precipitation. The system locates the lowest altitude of the defined reflectivity **Threshold** at each pixel location.

BASE displays the base level of detected signal echoes, which usually reflects the bottom of the cloud base or precipitation area.

As the following image shows, the minimum height above ground where echo bases can be detected increases with measurement range due to the curvature of Earth.

The opposite of the **BASE** product is the **TOPS** product.

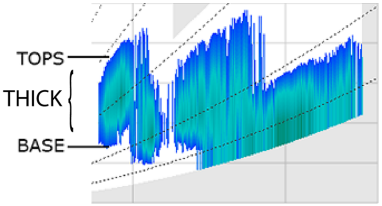


Figure 32 **BASE** and **TOPS** Products

More information

- On-demand Echo Tops (TOPS) (page 91)
- On-demand Echo Thickness (THICK) (page 89)

6.6.1.1 BASE Threshold Value

The configurable threshold value defines the minimum reflectivity that must present to be displayed in the image.

The first of the following images shows **BASE** with a -20 dBZ threshold defined. In this image, the lower, less dense cloud is shown in the displayed image.

In the second image, with a 40 dBZ threshold, the lower cloud is not shown in the displayed image because its reflectivity value is lower than the defined threshold.

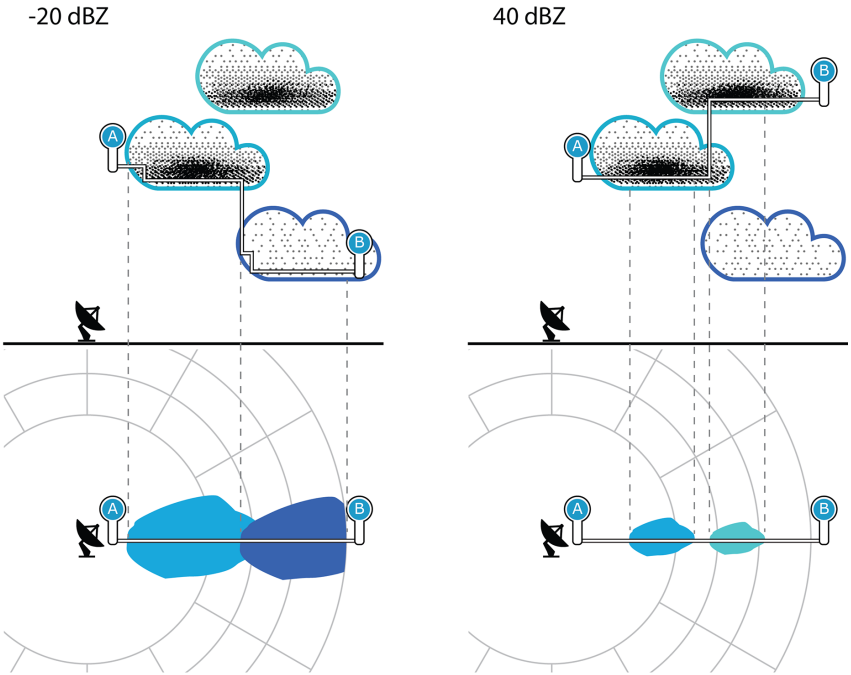


Figure 33 **BASE**, -20 and 40 dBZ Thresholds

More information

- Radar Product Reflectivity Threshold (page 74)

6.6.1.2 Calculating On-demand BASE

For each pixel in the image, the algorithm calculates on-demand **BASE** as follows:

1. Calculates the azimuthal equidistant (`AzEQ`) point around the radar.
2. Uses co-ordinates in `AzEQ` to calculate the distance from the `radar(vector length)`.
3. Checks if the `AzEQ` point is in the radar's range for the **BASE** product.
4. Calculates the azimuth angle to `radar(atan2)`.
5. Determines the lowest sweep with a reflectivity value over the threshold.
6. Optimizes the calculation of the minimum height by calculating the height of the lowest point with reflectivity over threshold from the height of the lowest sweep.
   The calculation uses the `minHeightOfSweep` by calculating downwards until reflectivity is no longer present.

The minimum height of a sweep represents the height with the minimum reflectivity as defined in the threshold.

The algorithm scans downwards until it finds a height for which there is no reflectivity value over the threshold. The last height with a valid reflectivity value is the result.

The final output of the product is a color-coded map of echo BASE heights for the selected dBZ threshold.

6.6.2 On-demand Constant Altitude Plan Position Indicator (CAPPI)

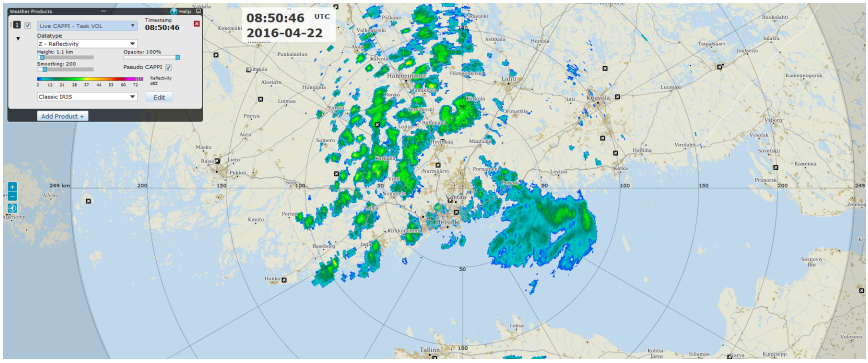


Figure 34 On-demand **CAPPI** Example

On-demand **CAPPI** (Constant Altitude PPI) displays a horizontal cross-section of the signal reflectivity at the selected altitude.

In the following cross-section image, the **CAPPI** product is calculated for a defined 5 km constant altitude. The red lines represent the interpolation from the ray data while the black line represents the constant altitude.

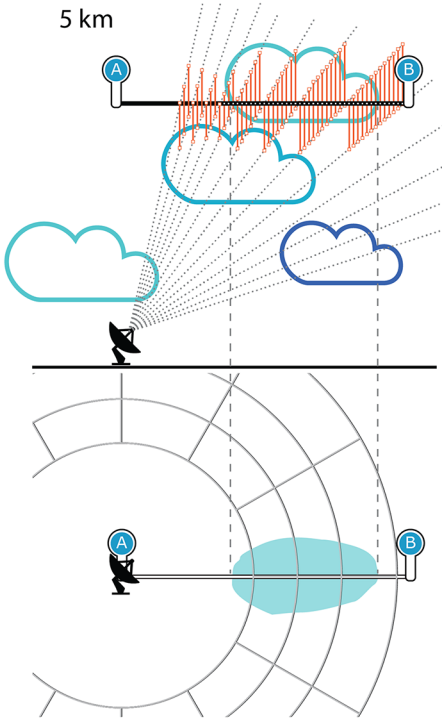


Figure 35 **CAPPI** Measuring the Defined Altitude

The image does not show the cloud reflectivity values that are included in an actual **CAPPI** product.

Optional radar product smoothing is performed on the bitmap image, not on the volume data.

More information

- Cross Section Tool (page 24)
- On-demand Plan Position Indicator (PPI) (page 86)
- Radar Product Layer Settings (page 17)

6.6.2.1 CAPPI Height Value

The configurable height (km) defines the altitude of the cross-section displayed in the image.

Use the **Height** slider to define the displayed **CAPPI** height.

The first of the following images shows the weather displayed in a **CAPPI** with an altitude of 3 km.

The second image shows the weather displayed in a **CAPPI** with an altitude of 5 km.

A and B in the image indicate start and end of a vertical cross section through the radar's scan volume.

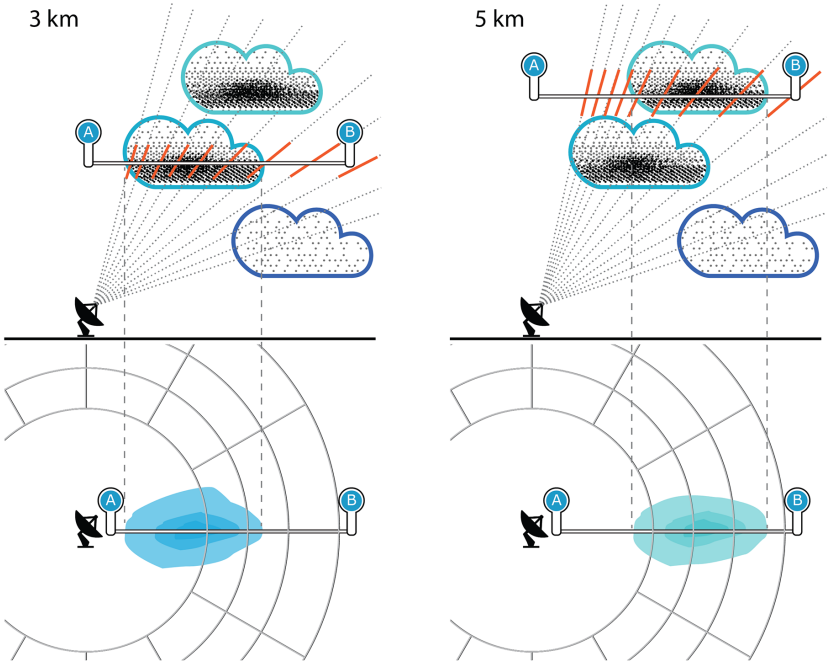


Figure 36 **CAPPI** with 3 km and 5 km Heights

6.6.2.2 Pseudo CAPPI

Select the **Pseudo CAPPI** option to add pseudo **CAPPI** calculations to your **CAPPI** product.

Pseudo CAPPI attempts to visualize those parts within the radar range that are not measured directly, including, for example, the area immediately around the radar, and the volume border with the highest altitude.

In the first cross-section image, the **CAPPI** product is calculated from ray data for a defined constant altitude. The red lines represent the interpolation from the ray data while the black line represents the constant altitude.

The heavy red lines in the second cross-section image indicate how the **Pseudo CAPPI** product uses the value of the closest ray to extend the **CAPPI** product above and below the constant altitude.

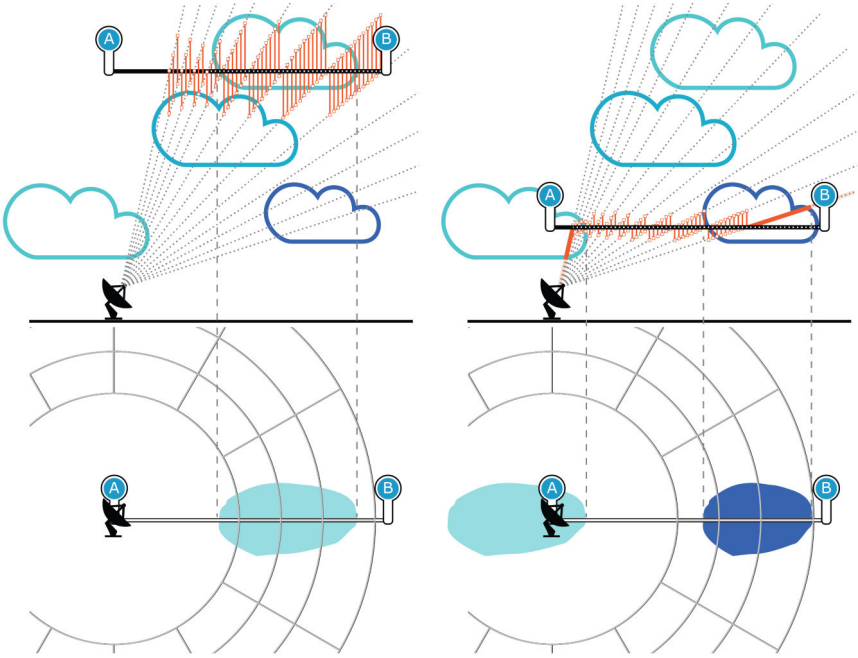


Figure 37 **Pseudo CAPPI** Extending from **CAPPI**

The image does not show the cloud reflectivity values that are included in an actual **CAPPI** product.

For **Pseudo CAPPI**, not all data comes from the **CAPPI** height and may be quite far from the actual height.

6.6.2.3 Calculating On-demand CAPPI

A **CAPPI** product is displayed on screen by reading the whole scan volume data and calculating a horizontal cross-section at the selected altitude. The cross-section is drawn as a rasterized bitmap. The directly measured data is only from the areas where radar pulses intersect the selected altitude layer. The rest of the bitmap is interpolated both horizontally and vertically from known values.

Calculating a **CAPPI** product requires that a full **PPI** volume scan is completed first. A **CAPPI** product is only updated when the whole volume has been scanned and processed.

For each pixel in the image, the algorithm calculates the **CAPPI** product as follows:

1. Checks the Azimuthal Equidistant (`AzEq`) cylinder volume from the 2 nearest (in elevation) volume data points of the **CAPPI** constant altitude plane point.
2. Linearly interpolates the volume data points at the nearest elevations to define a single **CAPPI** plane data point value.

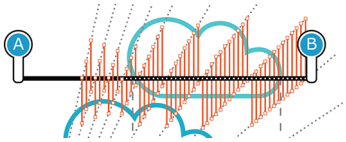


Figure 38 Calculating the `AzEq` Cylinder Volume From 2 Nearest Data Points

More information

- Calculating On-demand PPI (page 88)

6.6.3 On-demand Maximum Data (MAX)

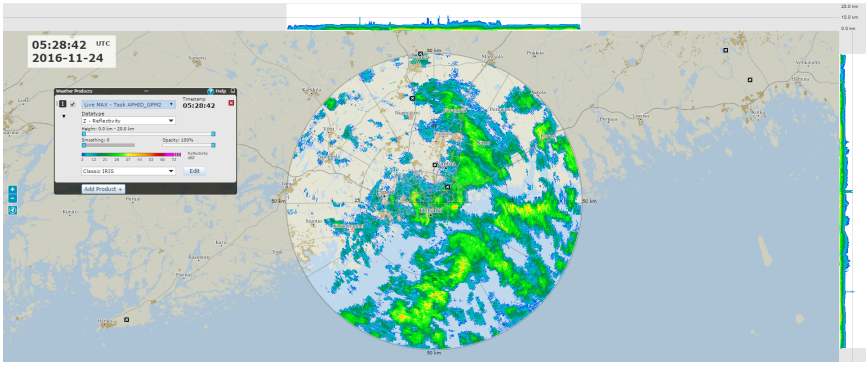
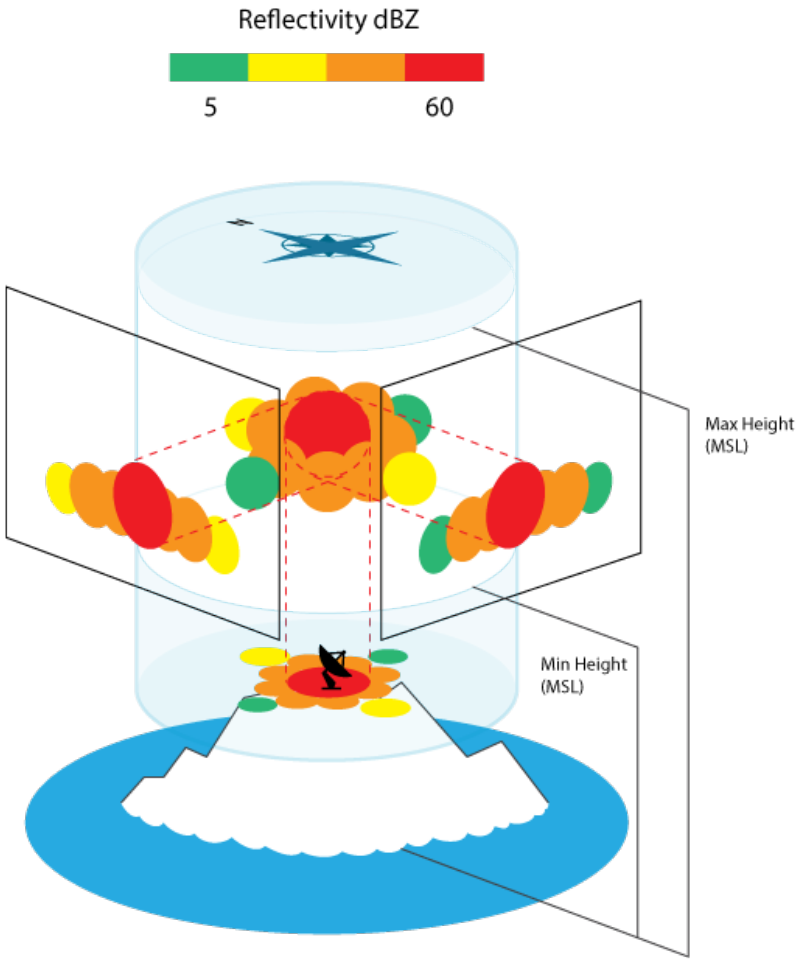


Figure 39 On-demand **MAX** Example

On-demand **MAX** shows the echo height at which the maximum data, such as reflectivity, occurs.

You can use **MAX** when observing areas of severe weather, for example, from the surface to the troposphere, in the layer below the melting level, or in the layer above the melting level.



In the main view, **MAX** shows the maximum data (in dbZ) in all points of the measured area. Top and right side panes show two horizontal projections: north-south and east-west.

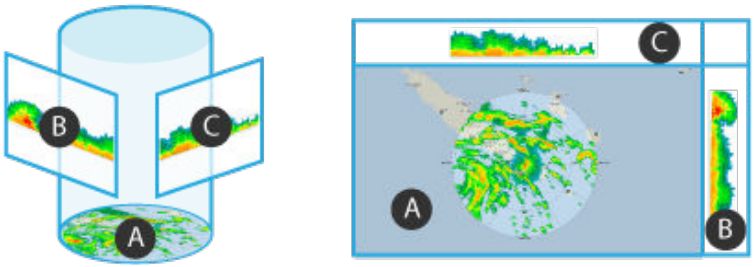
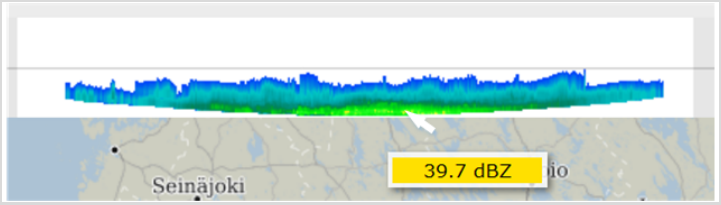


Figure 40 **MAX** Views

A Horizontal maximum projection
B North-South maximum projection
C East-West maximum projection

To show detailed information about the measured area, hover over the measured area in either the map view or side pane.



6.6.3.1 MAX Height Values

The configurable heights defines the measured area above sea level (MSL) for calculating the **MAX** product

Use the **Height** slider to define the displayed **MAX** upper and lower heights.

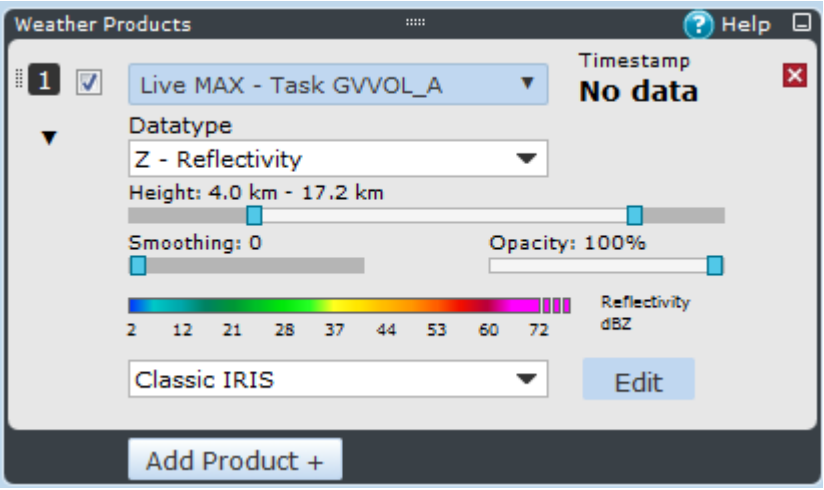


Figure 41 **MAX** Settings

In most cases, do not use smoothing as the maxima can be diminished by the smoothing filter.

You can check the height values in the top right of the display.

More information

- Radar Product Smoothing (page 74)

6.6.3.2 Calculating On-demand MAX

For each pixel in the image, the algorithm calculates **MAX** as follows:

1. Calculates the azimuthal equidistant (`AzEQ`) cylinder volume around the radar.
2. Uses co-ordinates in `AzEQ` to calculate the distance from the radar (vector length).
3. If the point is in the radar's range for that particular product, the algorithm calculates the azimuth angle to the radar.
4. Using the previous calculations, the algorithm calculates the maximum data value of the specific air column.

The horizontal maximum projection is calculated by taking the highest data value in the user-specified layer over each pixel.

The east-west maximum projection is obtained by taking the maximum reflectivity for each pixel along the corresponding north-south line.

The north-south maximum projection is obtained by taking the maximum reflectivity along east-west lines.

6.6.4 On-demand Plan Position Indicator (PPI)

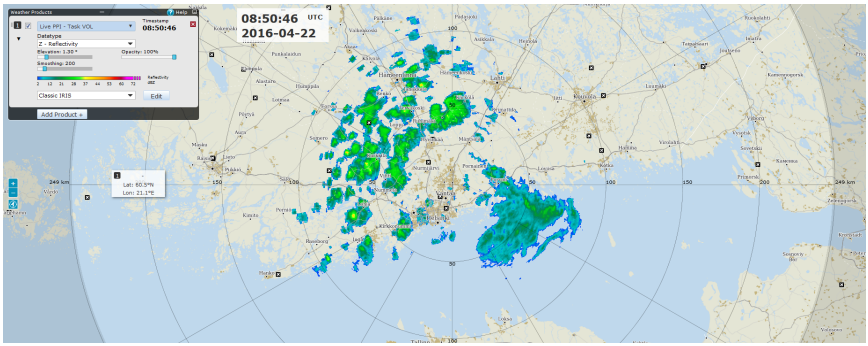


Figure 42 On-demand **PPI** Example

PPI (Plan Position Indicator) displays the signal reflectivity on a surface layer that is formed as the radar performs a full 360° horizontal sweep at a constant elevation.

PPI is the classical radar view that is used for visual weather surveillance and air traffic control, among other uses. The products are refreshed as soon as the sweep is completed instead of waiting for the end of a full volume scan.

In the following image, the **PPI** scan is performed on the highlighted elevation.

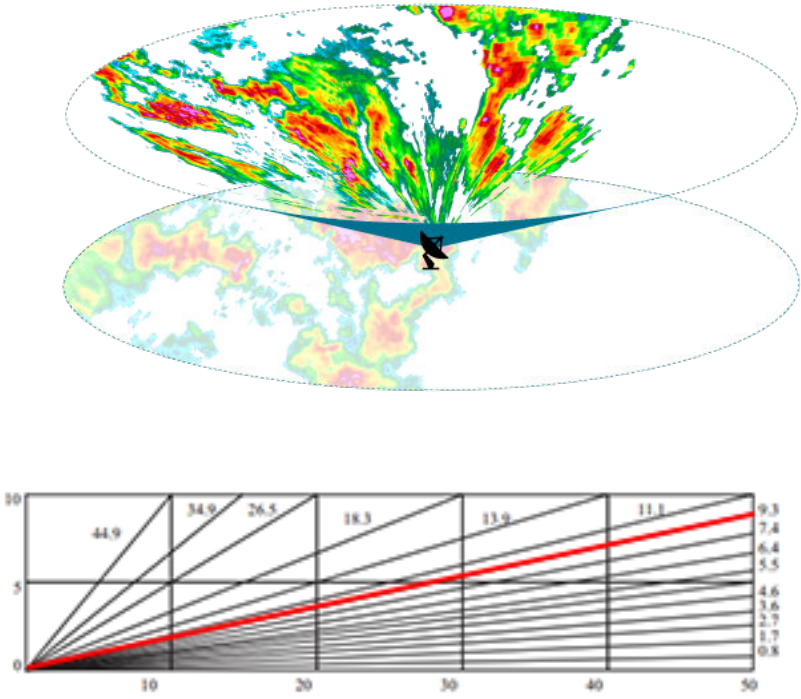


Figure 43 **PPI** Measuring the Defined Elevation

6.6.4.1 PPI Elevation Angle

The configurable elevation angle defines which elevation angle sweep is displayed in the image.

Use the elevation slider to define the displayed **PPI** elevation.

The first image shows **PPI** with a 45° elevation angle defined. In this image, the high-level clouds are displayed in the IRIS product.

The second images shows **PPI** with a 20° elevation angle defined. In this image, the lower-level clouds are displayed in the IRIS product.

A and B in the image indicate start and end of a vertical cross section through the radar's scan volume.

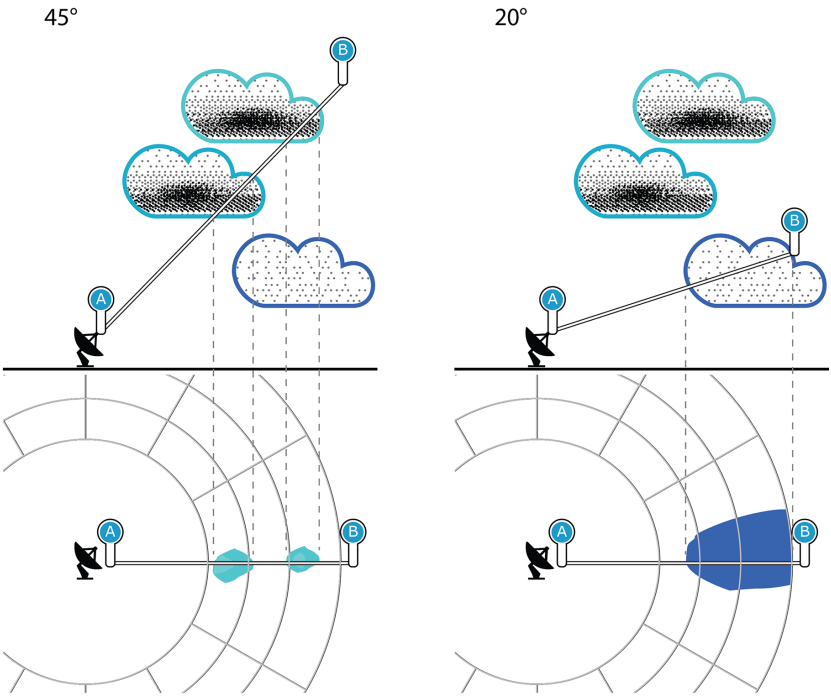


Figure 44 **PPI** With Elevation Angles of 45° and 20°

6.6.4.2 Calculating On-demand PPI

For each pixel in the image, the algorithm calculates on-demand **PPI** as follows:

1. Convert pixel coordinates to map coordinates.
2. Convert the map coordinates to Azimuthal Equidistant (`AzEq`) around the radar.
3. Calculate distance to radar (vector length) and azimuth angle to radar `atan2`.
4. Calculate the actual value at that point using a sweep parameter.

6.6.5 On-demand Echo Thickness (THICK)

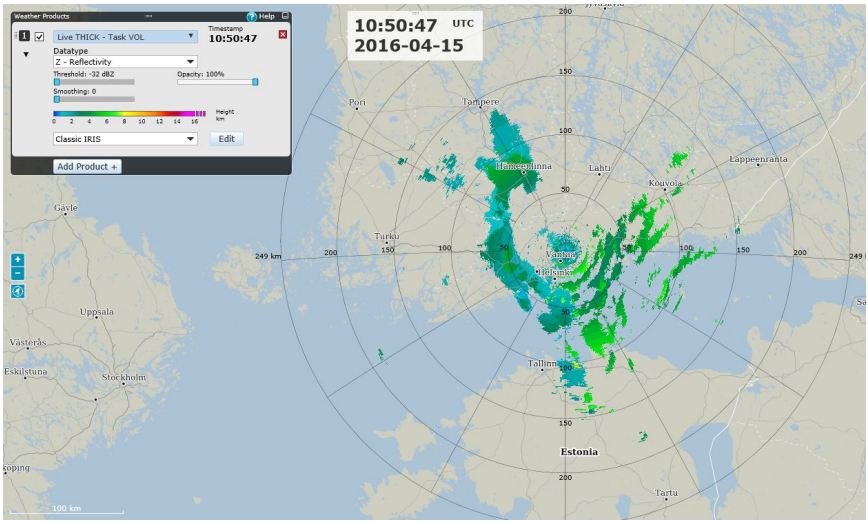


Figure 45 On-demand **THICK** Example

THICK is the radar-indicated cloud cover thickness of an area of precipitation.

THICK calculates the difference between the **BASE** and **TOPS** products.

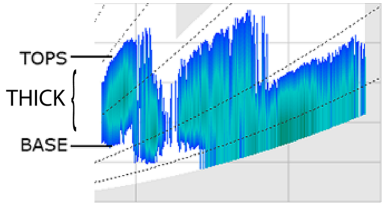


Figure 46 **THICK** with **BASE** and **TOPS**

More information

- On-demand Echo Base (BASE) (page 76)
- On-demand Echo Tops (TOPS) (page 91)

6.6.5.1 THICK Threshold Value

The configurable threshold value defines the minimum reflectivity that must be present to be displayed in the image.

The first of the following images shows **THICK** with a -20 dBZ threshold defined. In this image, more data is displayed in the image, including the lower, less dense cloud content.

In the second image, with a 40 dBZ threshold, a much smaller set of data comprising only cloud cover with a reflectivity of 40 dBZ or higher, is displayed.

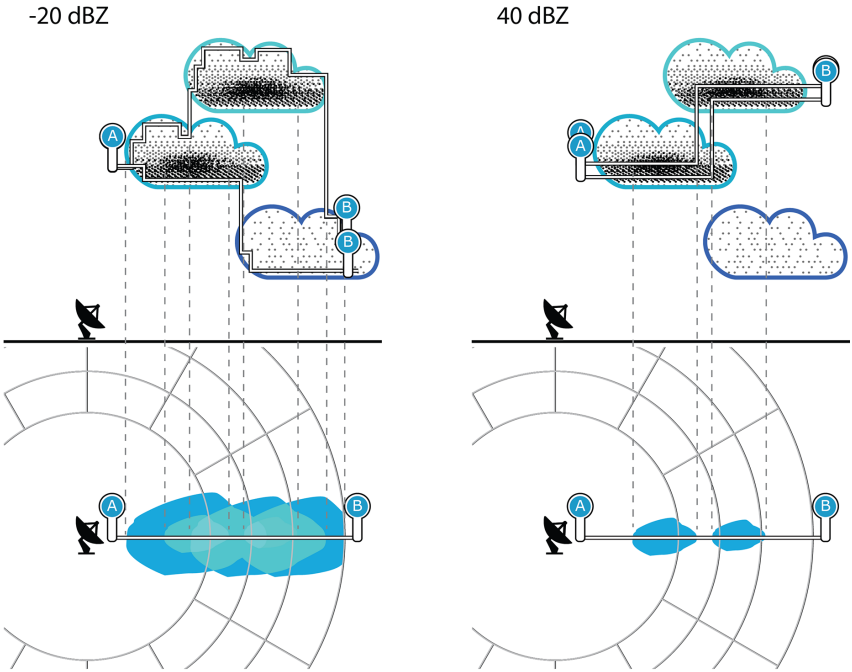


Figure 47 **THICK** with -20 dBZ and 40 dBZ Thresholds

More information

- Radar Product Reflectivity Threshold (page 74)

6.6.5.2 Calculating On-demand THICK

IRIS Focus calculates **THICK** by calculating both **TOPS** and **BASE** at a point and subtracting **BASE** from **TOPS**.

More information

- Calculating On-demand BASE (page 78)
- Calculating On-demand TOPS (page 93)

6.6.6 On-demand Echo Tops (TOPS)

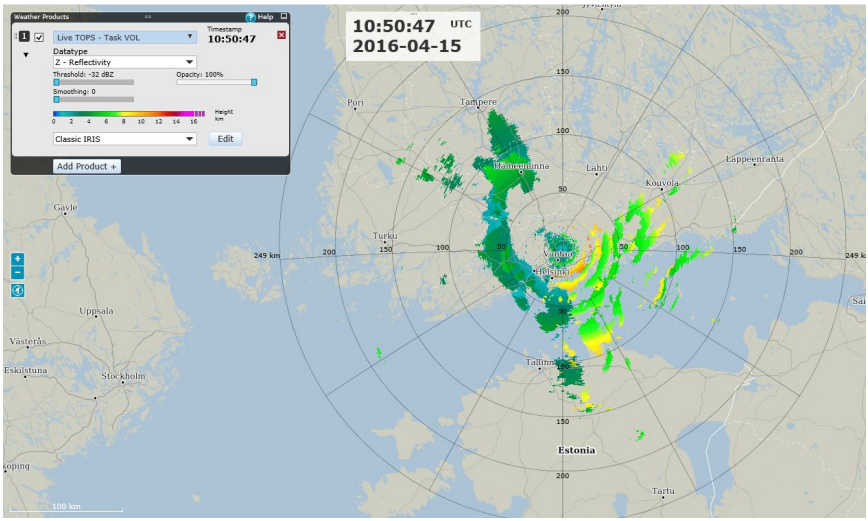


Figure 48 On-demand **TOPS** Example

TOPS (also known as echo tops) is the radar-indicated top of an area of precipitation. The system locates the highest altitude of the defined reflectivity threshold at each pixel location.

TOPS displays the detected signal echoes above the value defined in the **Threshold** (dBZ), which usually measures the top of the precipitation area or cloud cover.

TOPS can be useful when identifying strong updrafts, severe weather, and hail.

The opposite of the **TOPS** product is the **BASE** product.

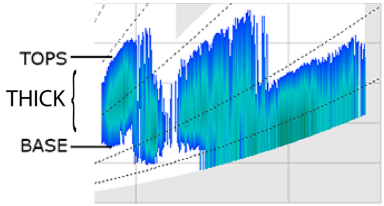


Figure 49 **BASE** and **TOPS** Products

More information

- On-demand Echo Base (BASE) (page 76)
- On-demand Echo Thickness (THICK) (page 89)

6.6.6.1 TOPS Threshold Value

The configurable threshold value defines the minimum reflectivity that must present to be displayed in the image.

The first of the following images shows **TOPS** with a -20 dBZ threshold defined. In this image, the higher, less dense parts of the cloud are shown in the displayed image. In **TOPS**, using lower threshold values can help determine the height of surrounding precipitation. For example, a 50 dBZ TOP 1 km above the freezing level can be produced only by a vigorous convective storm, and is probably caused by the presence of hail.

In the second image, with a 40 dBZ threshold, higher part of the cloud is not shown in the displayed image because its reflectivity value is lower than the defined threshold.

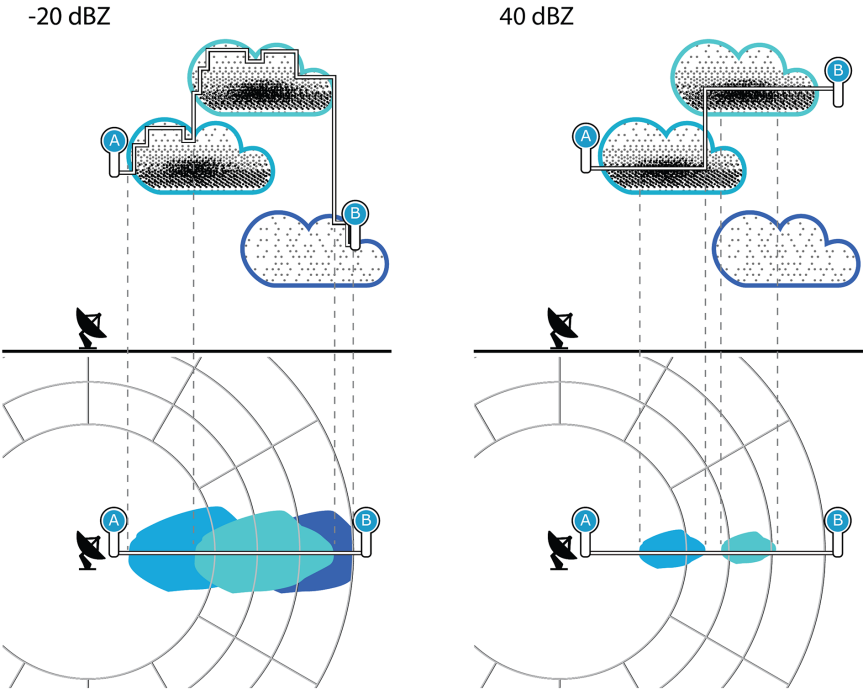


Figure 50 **TOPS** with -20 dBZ and 40 dBZ Thresholds

More information

- Radar Product Reflectivity Threshold (page 74)

6.6.6.2 Calculating On-demand TOPS

For each pixel in the image, the algorithm calculates on-demand **TOPS** as follows:

1. Calculates the azimuthal equidistant (`AzEQ`) point around the radar.
2. Uses coordinates in `AzEQ` to calculate the distance from the `radar(vector length)`.
3. Checks if the `AzEQ` point is in the radar's range for the **TOPS** product.
4. Calculates the azimuth angle to `radar(atan2)`.
5. Determines the highest sweep with a reflectivity value over the threshold.
6. Optimizes the calculation of the maximum height by calculating the height of the highest point with reflectivity over threshold from the height of the highest sweep.
   The calculation uses the `maxHeightOfSweep` by calculating upwards until reflectivity is no longer present.

The maximum height of a sweep represents the height with the minimum reflectivity as defined in the threshold.

The algorithm scans upwards until it finds a height for which there is no reflectivity value over the threshold. The last height with a valid reflectivity value is the result.

The final output of the product is a color-coded map of echo top heights for the selected dBZ threshold.

6.7 IRIS Analysis Radar Products

IRIS Analysis radar products are generated by signal processing components in IRIS Analysis. IRIS Focus reads the list of products, and allows you to select which one to display on the IRIS Focus map view.

The radar products and their settings are pre-configured, and only displayed in IRIS Focus. They cannot be edited in the IRIS Focus map view.

There is no upper limit to the number of pre-configured radar products that IRIS Focus can have.

The raw volume data is stored on a IRIS Analysis machine. The data can be archived to tape or stored on a large disk array.

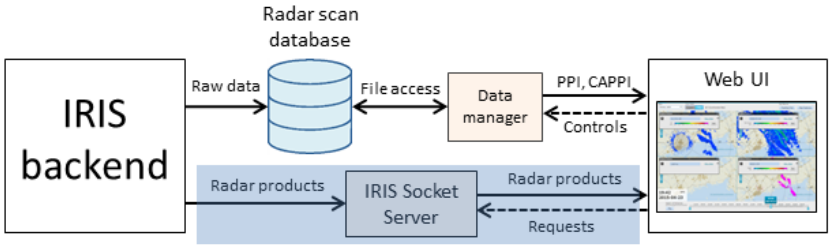


Figure 51 IRIS Analysis Product Data Flow to IRIS Focus

The radar products are rasterized into 2D bitmap images, based on the back-end signal processing settings. The images are sent to the IRIS Focus web user interface through the IRIS Socket Server interface.

When you select a pre-configured product in IRIS Focus, IRIS Focus polls the Socket Server and loads the image.

For information on setting up IRIS Analysis products, see *IRIS Product and Display Guide*.

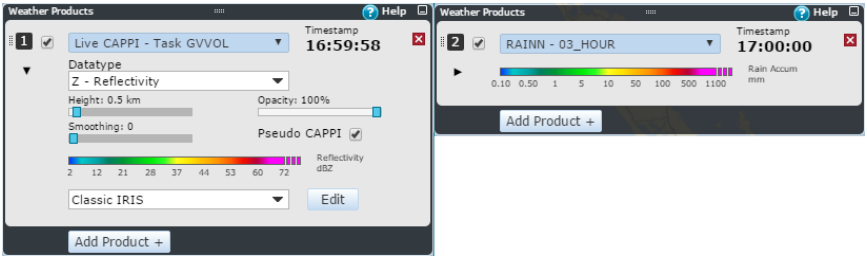


Figure 52 On-demand and IRIS Analysis Product Settings

More information

- IRIS Focus Overview (page 9)
- Radar Product Codes (page 71)
- Data Types (page 69)

6.7.1 Supported IRIS Analysis Products

The following tables provide an overview of the IRIS Analysis products supported in IRIS Focus.

Table 10 IRIS Analysis Products Supported in IRIS Focus

Product	Description
BASE Echo Base	**BASE** is used to determine the base of echoes.
BEAM Antenna Beam Pattern	**BEAM** is a full screen cross-section format image showing range-averaged intensity in azimuth and elevation coordinates. **BEAM** is used during calibration and alignment and to verify antenna patterns.
CAPPI Constant Altitude PPI	**CAPPI** (Constant Altitude PPI) is a horizontal cut at a selected altitude used for surveillance and severe storm identification. It is also useful for monitoring the weather at specific flight levels for air traffic applications.

Product	Description
HMAX Height of Maximum Intensity Product	**HMAX** displays the height of the maximum data above each output pixel. This product requires a volume scan.
LAYER	**LAYER** can compute layer averages of any polar data types in the ingest files. **LAYER** can also convert to liquid first and compute `VIL Density`. When computing `VIL Density`, the output is in g/m**3.
MAX Maximum Data	**MAX** shows the maximum data over each pixel as well as the East-West and North-South maximum projects in side panes.
MLHGT Melting Level Height	**MLHGT** displays a map of the melting layer altitudes.
MVF Motion Vector Field	The motion vector field (MVF) describes the general *motion* of weather in a set of products. IRIS Focus calculates current motion vectors (MVF) as the first step in nowcasting calculations.
PPI Plan Position Indicator	**PPI** is a full screen image used primarily for weather surveillance purposes.
RAIN1 Hourly Rain Accumulation	**RAIN1** is hourly rainfall accumulation.
RAINN `N`-Hour Rain Accumulation	**RAINN** is rainfall accumulation of the last `N` hours, where `N` is selected by the user.
RHI Range Height Indicator	**RHI** is a full screen image showing the detailed cross-sectional structure of a storm, used for identifying severe storms, hail and bright band.
RTI Range Time Indicator	**RTI** displays time along the horizontal axis and the vertical axis displays range from the radar. Often used for manual scans when observing a fixed target.
SRI Surface Rainfall Intensity	**SRI** provides input for the **RAIN1** product to obtain the best possible estimates of accumulated precipitation even at longer ranges from the radar.
SHEAR Wind Shear	**SHEAR** detects wind shear in the atmosphere, allowing the detection of microbursts, gust fronts, mesocyclones, cold fronts, and atmospheric waves.
SLINE Shear Line (frontal boundary)	**SLINE** marks the transition between two air masses on the image.

Product	Description
THICK Echo Thickness	**THICK** shows the thickness of cloud echoes. **THICK** is the same as the difference between the **TOPS** and **BASE** values. The **THICK** product also computes the average reflectivity in the layer identified by the selected **dBZ Contour**.
TOPS Echo Tops Map	**TOPS** is a color-coded contour map of the top of a selected dBZ level. Either Z or ZT can be used as the basis for the estimate.
VAD Velocity Azimuth Display	**VAD** is a display of the mean Doppler velocity at a given range as a function of the azimuth angle as the radar antenna rotates through an azimuth scan at a constant elevation.
VIL Vertically Integrated Liquid	**VIL** is a color-coded map of the estimated depth of water (in mm) contained in a selectable atmospheric layer. This is an excellent indicator of severe storms.
VVP Velocity Volume Processing	**VVP** provides line graphs or time against height cross-sections of wind speed, wind direction and divergence against height.
WARN Warning/Centroid	**WARN** is automatic warning and centroid plotting. Automatic warnings can be set for protected areas and user-selectable warning criteria. Output is a warning message and a situation overlay showing the centroid locations of storm features, such as high **VIL** or reflectivity.
WIND Wind Speed and Direction	**WIND** displays wind speed and direction with either wind bards or wind strings. You can specify the range and height of the data, and the range and azimuth spacing of the lines that are displayed.

6.7.2 Motion Vector Field (MVF)

The motion vector field (MVF) describes the general *motion* of weather in a set of products.

IRIS Focus calculates current motion vectors (MVF) as the first step in nowcasting calculations.

You can check the **MVF** product to check the direction and velocity of precipitation in the atmosphere and to verify the nowcasting configurations.

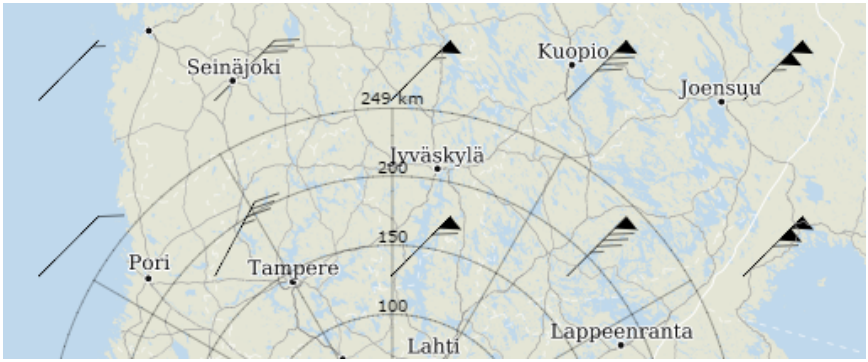


Figure 53 **MVF** Example

Motion Vector Indicators

In IRIS Focus, motion vector fields are illustrated with wind barb symbols. Motion vectors on the display show the direction from which the weather is moving. Short barbs and pennants on the vectors indicate the speed, similar to wind barbs on wind displays. A circle indicates calm conditions.

Table 11 **MVF** Wind Barb Symbols

Symbol	Speed (m/s)	Wind speed (knots)
○	Calm	Calm
—	<1.5	<3
—	2.6	5
—	5.1	10
—	7.7	15
—	10.2	20
—	25.7	50

Symbol	Speed (m/s)	Wind speed (knots)
	38.5	75

IRIS Focus calculates the **MVF** by passing a configurable number of a radar products through a nowcasting algorithm.

Because **MVF** generation can take some time, IRIS Focus generates only one **MVF** product per site. Once this is configured, IRIS Focus generates **MVF** products automatically when a new product of the configured type arrives from IRIS.

You must configure the **MVF** before you can start using nowcasting. Many users perform the configuration during installation, but it can also be done later.

After configuration, IRIS Focus generates the **MVF** automatically when a new product of the configured type arrives from IRIS. **MVF** products are not calculated for historical input products.

More information

- Nowcasting (page 31)
- Configuring Nowcasting (page 61)

6.7.2.1 Calculating Motion Velocity

IRIS Focus nowcasting uses the TREC algorithm to determine the predicted velocity of fields in the motion vector field (**MVF**).

TREC Algorithm

The TREC (tracking radar echoes by correlation) algorithm is an iterative search method based on a maximum cross-correlation criteria used to estimate motion in a vector grid between consecutive images.

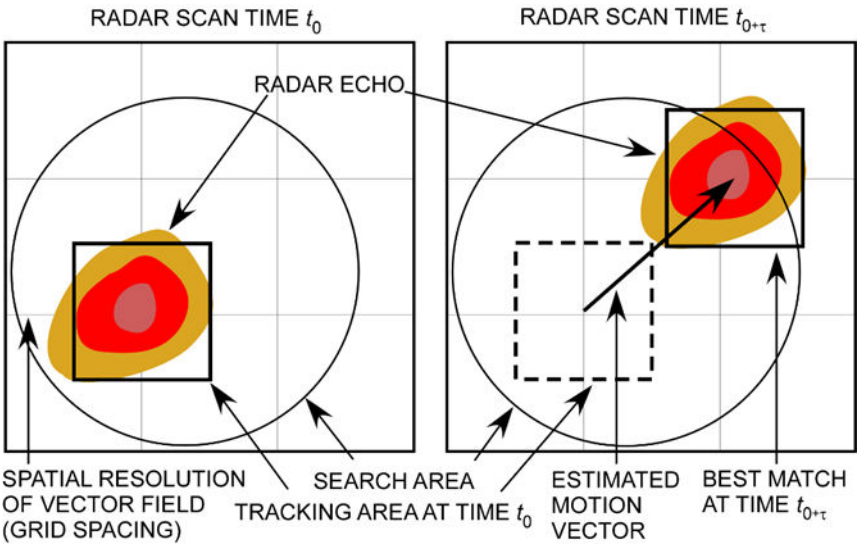


Figure 54 Calculating TREC

t_0 Current time

t_{t_0+T} Nowcasting predicted time

1. Calculate the cross-correlation coefficient corresponding to the data within this subgrid and to a time in the future (T), t_{t_0+T}.
2. Compute a motion vector between these locations.
3. Repeat for each grid point or a subset of grid points in the data field.

References

For more information on TREC calculations, see the publically available references. For example:

- Chornoboy, E. S., A. M. Matlin, and J. P. Morgan, 1994: Automatic storm tracking for air traffic control *Lincoln Labs. J.*, **7**, 427–448.
- Li, L. W., W. Schmid, and J. Joss, 1995: Nowcasting of motion and growth of precipitation with radar over a complex orography. *J. Appl. Meteor.*, **34**, 1286–1299.
- Mecklenburg, S., J. Joss, and W. Schmid, 2000: Improving the nowcasting of precipitation in an Alpine region with an enhanced radar echo tracking algorithm. *J. Hydrol.*, **239**, 46–68.
- Rinehart, R. E., and E. T. Garvey, 1978: Three-dimensional storm motion detection by conventional weather radar. *Nature*, **273**, 287–289.
- Rinehart, R. E., 1981: A pattern-recognition technique for use with conventional weather radar to determine internal storm motions. *Atmos. Technol.*, **13**, 119–134.
- Tuttle, J. D., and G. B. Foote, 1990: Determination of the boundary layer airflow from a single Doppler radar. *J. Atmos. Oceanic Technol.*, **7**, 218–232.

- Wolfson, M. M., B. E. Forman, R. G. Hallowell and M. P. Moore, 1999: The growth and decay storm tracker. Preprints, *Eighth Conf. on Aviation, Range, and Aerospace Meteorology*, Dallas, TX, Amer. Meteor. Soc., 58–62.

6.7.3 Warning/Centroid (WARN)

WARN is automatic warning and centroid plotting.

Automatic warnings can be set for protected areas and user-selectable warning criteria.

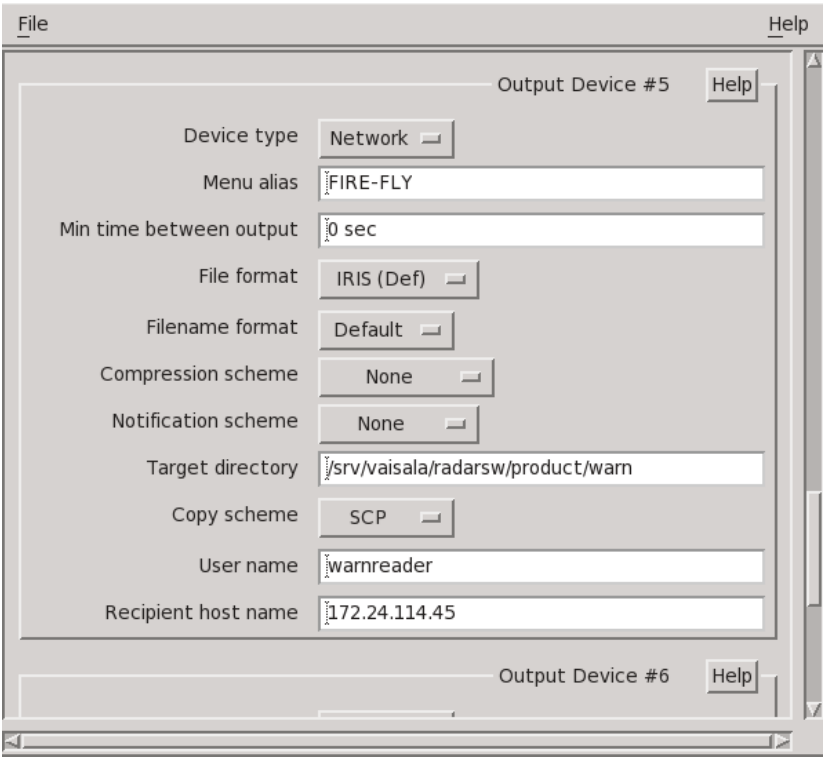
Output is a warning message and a situation overlay showing the centroid locations of storm features, such as high **VIL** or reflectivity.

6.7.3.1 Configuring an IRIS Output Device for WARN Products

In IRIS, you must configure the IRIS Focus server as an output device to which IRIS copies **WARN** product files. The output device configuration would look something like the following, except the *Menu alias* and *Recipient host name* fields would be filled in with a name for the output device and with the network address of the FIRE server (don't forget to save and restart IRIS after making changes to output device configurations):

1. In the IRIS terminal window, type: **`setup&`**
   The IRIS **Setup** utility starts.
2. In the IRIS **Setup** utility, select **Output**.
3. In **Number of Output Devices**, raise the number of devices by 1.

4. Scroll down to the first unconfigured output device and begin configuring the device for IRIS Focus **WARN** products.



   a. For **Device type**, select **Network**.
   b. For **Menu alias** type the name of the output device.
      The image shows an example.
   c. **Recipient host name** type the network address of the IRIS Focus Server.
      The image shows an example.

5. Save your changes and restart IRIS to take the changes into effect.

6.7.3.2 Sending WARN Products from IRIS to IRIS Focus

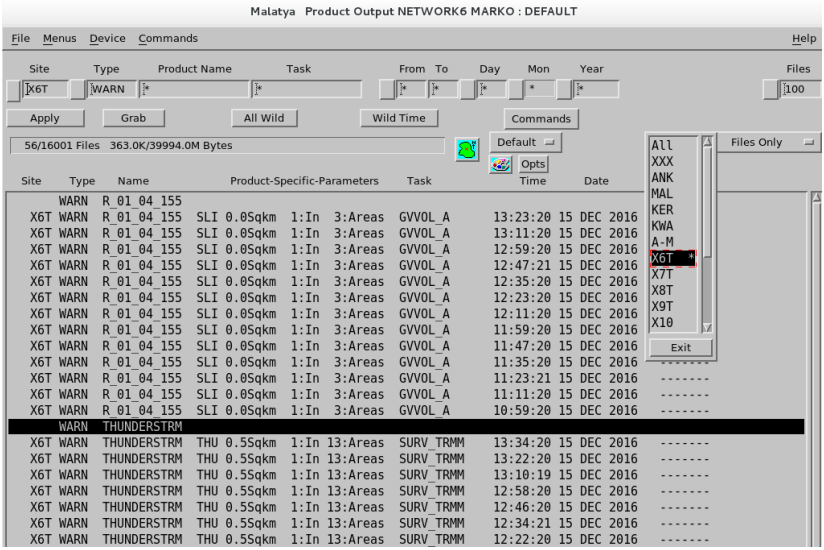
When you have configured and scheduled the **WARN** product, you can start sending **WARN** products over the network to IRIS Focus.

1. In the IRIS terminal window, type: **iris&**
   The IRIS Radar application starts.

2. Select **Menus > Product Output**.
3. In the **Device** menu, select the IRIS Focus device you want to send products to.

This is the device you configured in Configuring an IRIS Output Device for WARN Products (page 100).

4. Filter the list of output products:



   a. For the **Site** field, select the correct radar site.
   b. For the **Type** field, select `WARN`.
   c. Select **Apply**.

   The `WARN` products that are generated for this radar site.are shown.

5. Right-clicking the **Request** column and select the site you want to start sending the product to.
   In the example above, the `THUNDERSTRM WARN` product will be sent to the `X6T` site.

7. Configuration

7.1 Adding/Removing Radars

When new radar sites are added or removed as data sources on the IRIS Analysis server, radar settings on the IRIS Focus server must be re-syncronized. Settings requiring updates include updating the radar site location in GeoServer and calculating new map projections.

1. Run radar site setup script:

   ```
   rsw-basemap-site-setup --socket-server [socket_server_host_name]
   ```

2. Stop and restart the IRIS Focus web application service:
   a. Type the command:

      ```
      systemctl stop vaisala-radarsw-webapp
      ```

   b. Wait until the process has stopped and the command prompt is ready for the next command.
   c. Type the command:

      ```
      systemctl start vaisala-radarsw-webapp
      ```

7.2 Setting up housekeeping for events and alerts database

You can set IRIS Focus to clean the alerts database when it is getting full, and to give an alert when the database load is approaching the database size limit. By default, this feature is enabled. The database size limit is set automatically depending on the partition/disk size reported by the operating system during the installation, but you can change this limit. The default is 10% of the hard disk partition. By default, the database is installed in the */srv* partition.

You can select the limit that triggers the alert. The default is 90% of the size limit. You can also set the clean-up target. The clean-up target tells how many of the latest alerts will be kept in the database.

If you want to save the old alerts, do one of the following when you get the alert about the approaching clean-up:

- Take a manual backup of the database.
- Add disk space to the partition. Restart the webapp after this.
- Increase the configured database size limit (%). Restart the webapp after this.

1. Log in as **root**.
2. Go to the *vsoweb-override.ini* file in the */etc/vaisala/radarsw/configuration* directory.
3. Set the maximum percentage of disk partition to use (database size limit) by setting the value:

   ```
   events.alerts.housekeeping.trigger.partition.percentage
   ```

4. Set the limit that triggers the alert (percentage of the maximum number of alerts) by setting the value:

   ```
   events.alerts.housekeeping.alert.percent.full
   ```

5. Set the clean-up target by setting the value:

   ```
   events.alerts.housekeeping.target.limit
   ```

6. If you want to disable the database housekeeping, set the following key to **false**:

   ```
   events.alerts.housekeeping.do.housekeeping = false
   ```

7. If you want to disable the alerts for housekeeping, set the following key to **false**:

   ```
   events.alerts.housekeeping.alert.before = false
   ```

8. Restart the web application.

7.3 Configuring visualization of hybrid tasks

When you use hybrid tasks, you can select whether partially finished hybrid scans are displayed on IRIS Focus or not. By default, partial hybrid scans are displayed.

If you want that only completed volume scans are displayed, follow these steps:

1. Log in as **root**.
2. Go to the *vsoweb-override.ini* file in the */etc/vaisala/radarsw/configuration* directory.
3. Set the **HYBRID_PRODUCT_TIMES** parameter to **false**:

   ```
   use.partial.hybrid.times = false
   ```

4. Restart the web application.

If you want to reset IRIS Focus to display partial hybrid scans, reset the `HYBRID_PRODUCT_TIMES` parameter to **`true`**, and restart the web application.

7.4 Scheduling Image Exports from IRIS Focus

If you want to share interesting weather events on, for example, your website, use a `REST POST` method to schedule image exports from IRIS Focus saved views.

CAUTION! Depending on setup of the target website, the image export can be a bit slow. Take this into account when planning your export volumes and schedules.

1. In the IRIS Focus **Map** view, set-up the view you want to save.
   For example, you can save the settings for:
   - **Weather Products**
   - Map tools such as the cross-section and tracking tools
   - Zoom level
2. Select **Saved Views > Save**.
3. Name the view and select **Save**.
   The new view is added to the **Saved Views** list for your future use.
4. Configure your web server to access the IRIS Focus image export service:

```
@Request: POST <your IRIS Focus URL>/imageExport/getImage
@Produces: "image/png"
```

5. Configure the following parameters:

Parameter	Description
`username`	A valid IRIS Focus username.  For security reasons, Vaisala recommends that you configure a specific user for exporting images.
`password`	IRIS Focus password for the user.
`time`	Time, in ISO-8601 format: `2019-01-18T17:55:23.000Z`
`widthPx`	Width of the exported image, in pixels.
`heightPx`	Height of the exported image, in pixels.
`savedViewName`	The name of the saved view you created in step 3.
`savedViewUser`	Optional value. Used if you configure a specific user for exporting images (recommended).

6. Instead of step 4 and step 5, you can run the export from the command line by creating a script and setting-up a **cron** job. For example:
   a. Create a Python script for the image export such as the following:

```
#!/usr/bin/python
# -*- coding: utf-8 -*-
```

```
from requests_futures.sessions import FuturesSession
import datetime
```

```
APP_URL = "your_url_here"
IMAGE_EXPORT_LOC = "/imageExport/getImage"
FILE_PATH = "/path/to/image.png"
USERNAME = "username_here"
PASSWORD = "password_here"
TIME = datetime.datetime.utcnow().isoformat()
WIDTH = "1000"
HEIGHT = "700"
VIEW = "view_name_here"
```

```
def main():
    session = FuturesSession()

    req_params = {"username": USERNAME, "password": PASSWORD, "time":
TIME, "savedViewName": VIEW, "widthPx": WIDTH, "heightPx": HEIGHT}

    future_one = session.post(APP_URL + IMAGE_EXPORT_LOC,
params=req_params)

    # wait for the request to complete, if it hasn't already
    res = future_one.result()
    print('{0}  response status: {1}'.format(TIME, res.status_code))

    if res.status_code == 200:
      with open(FILE_PATH, 'wb') as f:
          f.write(res.content)

if __name__ == '__main__':
    main()
```

   Although the example **image-export.py** script saves only one snapshot, you can edit it to loop a set number of times and get multiple snapshots at a time.

   b. Type **crontab -e** in the terminal and add, for example, the following line to the *crontab* file (add your own paths and arguments).

```
*/15 * * * * /usr/bin/python
        /path/to/script/image-export.py >> /path/to/log/export.log 2>&1
```

   This executes the **image-export.py** script every 15 minutes and saves a single snapshot as a PNG file to the server.

7.5 Importing Historical Data to IRIS Focus

You can import historical data into IRIS Focus to use the same IRIS Focus visualization and analytical tools available for current data.

To import the data, use one of the following import methods:

- Transfer **RAW** product data from IRIS Analysis on the IRIS back-end to the IRIS Focus machine.
- Import a data archive by sending a collection of IRIS **RAW** products over the network using an SCP command. See the following steps.

1. Set up public key authentication for the machine you are copying from:
   On the **_my.iris.focus.server** machine, add the key from the source machine to the **radardminput** user's *~/.ssh/authorized_keys* file .
2. Use SCP to copy all the files from */storage/raw/archive/* to the IRIS Focus Server. For example:

   ```
   find "/storage/raw/archive" -type f -exec scp {}
   radardminput@my.iris.focus.server:/srv/vaisala/radarsw/datamanager/input;
   ```

   The Data Manager input service expects only IRIS **RAW** files. Make sure you do not copy a directory or zip file.

3. To monitor the data import, or troubleshoot if the data does not appear on the IRIS Focus web interface, check the Data Manager input service log:

   ```
   journalctl -u vaisala-radarsw-data-manager-input-service -f
   ```

The Data Manager input service imports the files to Data Manager for use in IRIS Focus.

7.6 Enabling Lightning Layer

To take the lightning layer into use, the IRIS Focus server must be online and your organization must have an active subscription to GLD360 data. For information on subscribing to GLD360 data, contact Vaisala Lightning Data Services.

1. Log on to the IRIS Focus server as root.
2. Type the command:
   rsw-lightning-configure -r [admin username] -p [admin password] -s https://storm.vaisala.com/geolegends/ltg_combined_25.sld

3. Edit the configuration file *vsoweb-override.ini:nano /etc/vaisala/radarsw/configuration/vsoweb-override.ini* to contain a reference to the Vaisala GLD360 URL you received:

```
lightning.wms.url = [URL from GLD360]
```

4. Stop and restart the IRIS Focus web application service:
   a. Type the command:

```
systemctl stop vaisala-radarsw-webapp
```

   b. Wait until the process has stopped and the command prompt is ready for the next command.
   c. Type the command:

```
systemctl start vaisala-radarsw-webapp
```

Appendix A. Nowcasting Configuration Files

A.1. nowcast.ini

The following example shows the *nowcast.ini* configuration file for configuring the nowcasting HTTP server.

```
; Algorithm to use.
correlator=trec
```

TREC

```
[trec]
; Number of decimals to keep in data when converting to integers.
; Range:  [0 ; 3]. Default: 2.
input_precision=2
```

```
; The value in image that declares a missing/invalid value.
; Default: -999.0.
missing_value=-999.0
```

```
; The value in image that declares a not-scanned pixel, outside the aperture
area.
; Default: -900.0.
not_scanned_value=-900.0
```

```
; Minimum measurement aperture coverage (%) in correlation region.
; Range:  [0.0 ; 1.0]. Default: 0.60.
aperture_coverage_threshold=0.60
```

```
; Minimum signal value for the pixel to be 'active' and used.
; Default: 10.0.
signal_threshold=10.0
```

```
; Feature box size.
; Range:  > 0 Default: 14
field_feature_box_width=14
```

```
; Amount of skip when calculating field values.
; Range:  > 0.  Default: 1 (no skip).
field_feature_box_spacing=1
```

```
; Minimum fraction (%) of active pixels in feature box needed to trigger
correlation analysis.
; Range:  [0.0 ; 1.0] Default: 0.10
field_signal_coverage_threshold=0.10
```

```
; Minimum allowable cross-correlation coefficient.
; Range:  [0.0 ; 1.0] Default: 0.55
correlation_threshold=0.55
```

```
; Maximum storm movement between images, search region radius.
; Range:  > 0  Default: 15
speed_limit=15
```

```
; Spatial smoothing factor, exp(-d/decay). Used for spreading effect
; of local motion vector to its surroundings.
; Range:  >= 0 (0 == no spatial smoothing) Default: 6
field_spatial_decay=6
```

```
; Spatial filtering flag. Whether to discard points that differ from global
average.
; Range:  0 == NO; 1 == GLOBAL; 2 == LOCAL . Default: 1(GLOBAL)
field_use_spatial_filtering=1
```

```
; Feature box size for local spatial thresholding (applied only when using
local spatial thresholding).
; Range:  > 0   Default: 9
field_spatial_filtering_box_width=9
```

```
; Maximum allowed direction difference from mean motion (applied only when
using spatial filtering).
; Range: [0 ; 180]  Default: 90
field_spatial_direction_threshold=90
```

```
; Maximum allowed speed (mgt*mean_motion) above mean motion (applied only when
using global spatial filtering).
; Range:  >= 1.0  Default: 3.0
field_spatial_magnitude_threshold=3.0
```

```
; Global vector weight applied to local values.
; Range:  [0.0 ; 1.0] (0.0 = no global weighting). Default: 0.25
field_global_weight=0.25
```

```
; Method for temporal smoothing.
; Range: 0 == NO_TEMPORAL_SMOOTHING; 1 == HISTORY_WEIGHTING; 2 ==
CHANGE_WEIGHTING.
; Default: 1(HISTORY_WEIGHTING)
temporal_smoothing_method=1
```

```
; History weight factor (applied when temporal smoothing is made by using
HISTORY_WEIGHTING).
; Range:  ]0.0 ; 1.0]  Default: 0.25
temporal_smoothing_history_weight=0.25
```

```
; Change weight factor (applied when temporal smoothing is made by using
CHANGE_WEIGHTING).
; Range:  ]0.0 ; 1.0] Default: 0.33
temporal_smoothing_change_weight=0.33
```

More information

- Configuring MVF (page 61)

A.2. vsoweb-override.ini

The *vsoweb-override.ini* configuration file contains setting for managing the **MVF** (motion vector field) product and advection used in nowcasting.

Vaisala has carefully chosen good defaults for the nowcasting configuration. The raster product, such as **PPI**, **CAPPI**, of any intensity moments like Z, R, KDP, or **rhoHV** that is used as an input for MVF generation should have:

- As little as possible of ground clutter and the near-radar clear air or particulates (such as dust) returns.
- The bounding box not smaller than any other raster product produced from this site's data.

Because the two conditions are contradictory, the easiest way to satisfy first condition is to use a true (not pseudo) **CAPPI** product with a height of 1.5 ... 2km , but the longest range (biggest bounding box) product is a raster product generated from the survey scans, which usually consist of just one **PPI** scan and cannot be used to generate true **CAPPI** products. You must balance these two conditions.

If there are not enough valid products to generate an MVF request, the iteration is skipped and the system waits for the next product to arrive from IRIS.

Basic Settings

nowcast.mvf.run defines if MVF generation is enabled in IRIS Focus. By default, MVF generation is enabled (**true**).

```
[NOWCAST]
nowcast.mvf.run = true
```

The nowcast server URL dentifies where the nowcast HTTP server runs. The default value is for a fully local installation, which is the default installation configuration.

```
nowcast.http.server.url = http://localhost:34480/api/v1/mvf/
```

The *netCDF* directory stores MVF generation requests and responses to the Nowcast HTTP Server in netCDF format as well as internal representations of MVF serialized to disk. This directory is cleaned periodically by default.

```
nowcast.netcdf.dir = /srv/vaisala/radarsw/product/nowcast/
```

Advanced Settings

nowcast.mvf.request.num.rasters defines the number of products sent to the nowcast server for generating the MVF. Default is 2.

```
nowcast.mvf.request.num.rasters = 2
```

nowcast.mvf.product.age.limit.minutes defines the maximum number of minutes (5 ... 1000) the system goes back in time to find valid products (of the type used to define MVF generation for a site) to use in generating the MVF. Default is 100.

```
nowcast.mvf.product.age.limit.minutes = 100
```

nowcast.mvf.max.gap.minutes defines the maximum acceptable gap in minutes (1 ... 1000) between products for MVF generation. Default is 30.

MVF is a shift in pixels per time interval between frames of the product which was used to generate MVF. The interval between advected products may be different from the interval between advected frames. For example, if MVF was generated from the product which was available every 5 minutes but the interval between advected frames has to be 10 minutes, the MVF shift should be doubled. That MVF scaling is taken into account by a scaling shift in every iteration.

```
nowcast.mvf.max.gap.minutes = 30
```

nowcast.product.times.age.limit.minutes defines the time range for calculating advected product times (2 ... 2880 mininutes. 2880 is the entire two-day range). Default is 100

Advected product times must be evenly spaced (due to the calculation). The time is derived by dividing the last number of minutes defined in this property by **n** products found in that period.

The spacing is used as the time gap between advected products. In most cases, set this value to match the value in **nowcast.mvf.product.age.limit.minutes**.

```
nowcast.product.times.age.limit.minutes = 100
```

`nowcast.advection.mvf.age.limit.minutes` is the maximum number of minutes to go back in time to find an MVF when generating advected products. If an MVF is not found in the time span given, the iteration is skipped and Focus waits for the next product to arrive from IRIS. Range: 5 ... 1000 minutes. Default is 30.

```
nowcast.advection.mvf.age.limit.minutes=30
```

`nowcast.advection.time.span.minutes` defines the time limit when extending nowcasted products into the future (minutes). The normal range is 1 ... 3 hours. Default is 120.

You can raise the time span to up to 6 hours but this is not recommended as accuracy decreases as time extends into the future.

```
nowcast.advection.time.span.minutes=120
```

Glossary

advection
The transfer of a property of the atmosphere, such as heat, cold, or humidity, by the horizontal movement of an air mass. Advection calculations are used to perform some of the nowcasting calculations.

alarm
An alarm is an alert of highest severity.

alert
Alert is a state that requires user intervention or recognition. Different types of alerts include alarms, warning, and informational alerts.

area of interest
An area of interest is a geographical area that is monitored for certain weather events. If the system detects a weather event in an area of interest, it generates an alert.

bin
A single sample of weather data detected at a known direction, altitude, and distance from the radar site. The radial size of a bin increases with distance, so bins further from the radar site cover a larger area than nearby bins.

composite
Composites combine data (for example, a group of **CAPPI**, **VIL**, **PPI**, or **TOPS** products) from many radars in one image.

data manager
The raw volume data from the radar signal processor is stored in the data manager, which makes the data available to the IRIS Focus user interface. Through the data manager, IRIS Focus can read raw volume data and generate on-demand radar products in real-time.

dynamic composite
A radar composite of on-demand products created by selecting multiple radar sites on the fly. The combining criteria are based on standardized settings.

event
Event is a record of a momentary change of state or an occurrence produced by a source or some other entity. An event can indicate an error or a warning or can be just for information.

hybrid task
A group of up to 3 tasks with the same scan type which are scheduled together and used together to make products. This allows flexibility of volume scanning schemes.

hydrometeor
A particle of condensed water vapor in the atmosphere. Rain, snow, and hail are examples of hydrometeors.

Max Time Span
Max Time Span is the maximum time (minutes) allowed between the newest and oldest points of data. When new data is processed, points that are older than the specified time span are removed. Used in, for example, composites of radar data.

MSL
Mean sea level. An average level for the surface of the sea or ocean.

NDOP product
Dual-Doppler velocity product. Combines the velocity measurements from 2 or more radars to get the wind direction and speed.

nowcasting
Weather forecasting up to the next 2 hours.

NWP
Numerical weather prediction

on-demand product
On-demand products are based on raw data from the IRIS back-end. IRIS Focus reads raw volume data and generate radar products in real-time. Users can manipulate product criteria in the user interface in real time.

pin
Pins on a map indicate points of interest with reference points and labels.

place of interest
A location on the map that is either a single point (pin) or a larger area. See area of interest and pin.

pre-configured products
Pre-configured products are products with default settings used for advanced data visualization such as nowcasting, warnings, or multilayer products.

pre-defined composite
A pre-defined radar composite with customized settings such as the combining algorithm.

PRF
Pulse Repetition Frequency measured in Hz (pulses per second). When measuring PRF, a *pulse* contains transmit, receive, and dead time phases. PRF affects *range folding* and *velocity folding* detection. Normal PRF values for Doppler radars are up to 1000 Hz. Vaisala radars generally operate around 400-700 Hz. In Vaisala IRIS products, PRF limits the area displayed in radar images and the maximum measurable wind speed.

product
Radar products are raw signal data from a radar receiver processed to provide information about current weather conditions. Radar products are calculated from ingest files that are collected during the execution of radar tasks. Products may be data, pictures, or text. For example, **PPI** and **RHI**.

pulse
A short burst transmission signal sent by the radar, used to measure the weather activity in atmosphere. The reflection measurements from a pulse are sorted into bins.

radar product
See product.

range folding
Detection of the 2nd trip echoes, which are radar signal echoes from outside the radar maximum range. Range folding causes them to be incorrectly displayed within the radar measurement area. Also called range aliasing.

RAW product
Spherical coordinate data product obtained directly from the raw ingest data. The data are stored in compressed format so they can be recorded on tape or sent to a workstation for further processing.

ray
A group of pulses processed together according to configuration rules. See also pulse.

signal processor
A programmable device for digitizing and processing video signals from the radar receiver.

sweep
A collection of pulses at a constant elevation as the radar rotates around its axis 360°. After a sweep, the radar usually changes its elevation and starts a new sweep. Each sweep typically contains the same number of bins independent of the elevation.

task
A set of instructions to the radar and signal processing systems including, but not limited to, the scan type (PPI or RHI), PRF, pulse width, signal processing data types, time and range averaging criteria. For example, a PPI volume scan at multiple elevation angles or an RHI at a single azimuth. Also called radar task.

velocity folding
Erroneous readings due to particles in the measurement area exceeding the maximum velocity detection threshold of the radar system. The measured velocity "wraps around" to the other end of the scale, resulting in discontinuous readings. Also called velocity aliasing.

volume
Complete set of raw measurement data collected from sweeps, that is used to calculate a model of the atmosphere. The maximum volume is half of a sphere (from 0° elevation upwards), but other shapes are more typical.

warning
A warning is an alert of medium severity.

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Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.
Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Technical support

Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information as applicable:

- Product name, model, and serial number
- Software/Firmware version
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For more information, see www.vaisala.com/support.

Recycling

Recycle all applicable material.

Follow the statutory regulations for disposing of the product and packaging.

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