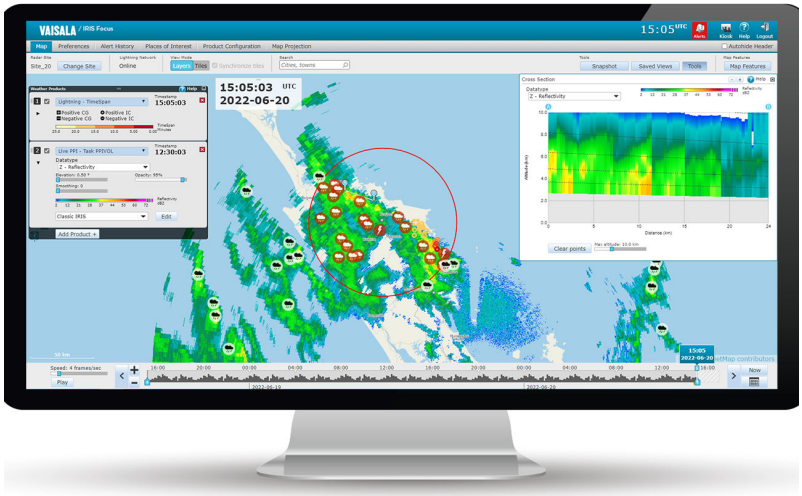
M211849EN-J

RESTRICTED

User Guide

IRIS Focus

Version 7.0



VAISALA

PUBLISHED BY

Vaisala Oyj
Vanha Nurmijärventie 21, FI-01670 Vantaa, Finland
P.O. Box 26, FI-00421 Helsinki, Finland
+358 9 8949 1

Visit our Internet pages at www.vaisala.com.

Table of contents

1. About this document 7
1.1 Version information 7
1.2 Related documents 7
1.3 Trademarks 7
1.4 Documentation conventions 8

2. IRIS Focus overview 9
2.1 IRIS product family for weather radar data 10
2.2 Lightning product generation 11
2.3 IRIS Focus licensing 12

3. Using IRIS Focus 15
3.1 User roles 15
3.2 Map view 17
3.2.1 Map layers 18
3.2.2 Editing base layers 19
3.2.3 Product layers 20
3.2.4 Product layer settings 21
3.2.5 External WMS product layers 22
3.2.6 Map units 23
3.3 Radar sites 23
3.4 Animation timeline 25
3.5 Map tools 26
3.5.1 Cursor tool 26
3.5.2 Color scale editor 27
3.5.3 Cross Section tool 30
3.5.4 Ruler Tool 32
3.5.5 Snapshot tool 32
3.5.6 Tracking Tool 33
3.6 Composites 34
3.6.1 Viewing composites 35
3.6.2 IRIS Focus composite methods 36
3.7 Nowcasting 37
3.7.1 Calculating nowcasting predictions 39
3.7.2 Calculating advected products 40
3.8 User preferences 42
3.9 Saved views 44
3.10 Supported browsers 44

4. Radar products 45
4.1 Measuring radar data 45
4.1.1 Bins, sweeps, and volumes 46
4.1.2 Radar beam 46
4.1.3 Data flow 48
4.1.4 Data types 48
4.2 Radar product codes 50

4.3 Radar product colors....52
4.4 Radar product smoothing....53
4.5 Radar product reflectivity threshold....53
4.6 On-demand radar products....54
4.6.1 On-demand echo base (BASE)....55
4.6.2 On-demand Constant Altitude Plan Position Indicator (CAPPI)....57
4.6.3 On-demand maximum data (MAX)....61
4.6.4 On-demand Plan Position Indicator (PPI)....65
4.6.5 On-demand echo thickness (THICK)....68
4.6.6 On-demand echo tops (TOPS)....70
4.7 IRIS Analysis radar products....72
4.7.1 Supported IRIS Analysis products....73
4.7.2 Motion vector field (MVF)....82
4.7.3 Warning/centroid (WARN)....86

5. Lightning products....89
5.1 TimeSpan....89
5.1.1 TimeSpan product configuration....90
5.2 Network Health....91
5.2.1 Network Health product overview....91
5.2.2 Visualizing Network Health....92
5.3 GLD360....93

6. Weather alerts and places of interest....94
6.1 Weather events and alerts....94
6.1.1 Alerts workflow....94
6.1.2 Alerts on the screen....94
6.1.3 Alert severities....95
6.1.4 Alert notifications....96
6.1.5 Weather event generation....98
6.1.6 Required user roles....98
6.2 Places of interest....99
6.2.1 Creating areas of interest....100
6.2.2 Showing and hiding places of interest on the map....109
6.3 Add events to areas of interest to receive alerts....110
6.4 Showing events and alerts on the map....110
6.5 Acknowledging weather alerts....111
6.6 Alert history....112
6.7 Example weather alert symbols....113
6.8 Pinning locations on the map....113
6.8.1 Showing and hiding pins on the map....114
6.8.2 Removing pins....115

7. Poweruser tasks....116
7.1 Creating weather events....116
7.1.1 Configuring weather events....117
7.1.2 Example events....121
7.1.3 Example weather alert symbols....122

7.2 Configuring radar composites....122
7.2.1 Setting up pre-defined composites....123
7.2.2 Editing pre-defined composites....123
7.2.3 Deleting pre-defined composites....124
7.2.4 IRIS Focus composite methods....124
7.2.5 Max Time Span....124
7.2.6 Viewing a list of IRIS Analysis composites....125
7.3 Configuring nowcasting for weather radar products....126
7.3.1 Configuring MVF....126
7.3.2 Configuring nowcast....128
7.3.3 Starting the Nowcast server....129
7.3.4 Stopping the Nowcast server....129
7.3.5 Restarting the Nowcast server....129
7.4 Selecting map projection....129

8. Configuration....131
8.1 Adding/removing radars....131
8.2 Configuring visualization of hybrid tasks....131
8.3 Scheduling image exports from IRIS Focus....131
8.3.1 Exporting images as .png files....132
8.3.2 Exporting images as .shp files....134
8.3.3 Exporting images as .geotiff files....137
8.4 Importing historical data to IRIS Focus....137

Appendix A: Nowcasting configuration files....139
A.1. nowcast.ini....139
A.2. vsoweb-override.ini....141

Glossary....144

Index....149

Warranty....155

Technical support....155

Recycling....155

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-J	June 2022	IRIS Focus release 7.0
M211849EN-H	November 2020	IRIS Focus release 6.0.
M211849EN-G	July 2020	IRIS Focus release 5.3.
M211849EN-F	April 2019	IRIS Focus release 5.1.

1.2 Related documents

Table 2 Related documents

Document code	Name
M211850EN	*IRIS Focus Administrator Guide*
M211849EN	*IRIS Focus User Guide*
M212545EN	*IRIS Focus Lightning Administrator Guide*
M212544EN	*IRIS Focus Lightning 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.

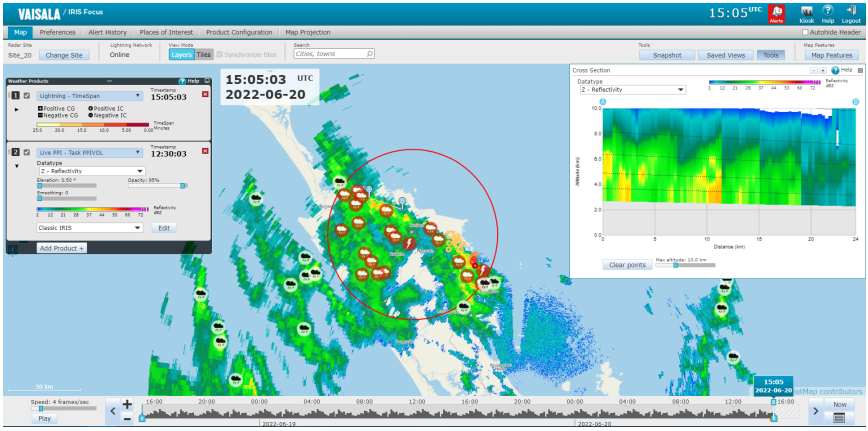
Note highlights important information on using the product.

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



1) Weather radar data: courtesy of Meteorological Service of New Zealand Ltd. Lightning data: courtesy of Transpower New Zealand Ltd.

Figure 1 IRIS Focus main view

IRIS Focus provides user-friendly, browser-based tools for viewing and analyzing weather data received from weather radars or lightning sensors. Weather data is overlaid on a geographical map.

In the case of weather radar data, the map is centered on a selected radar site or composite site. Radar data is gathered from a single weather radar or a network of radar sites.

With the zoomable and draggable animation timeline, you can easily visualize recent, past, or nowcasted 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 thunderstorms, wind shear, or heavy rain are automatically detected and trigger alerts when they enter an area of interest.

Weather products

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

Radar products measure information such as radar signal reflectivity or rain intensity for analysis by meteorologists. Lightning products visualize the type and amplitude of lightning events, for example.

On-demand products	On-demand products are based on raw data from the IRIS back-end systems (IRIS - Interactive Radar Information System and/or TLP - the Total Lightning Processor). IRIS Focus processes data and generates products in real time. On-demand products provide control over the presentation of weather data in the IRIS Focus user interface. For example, you can change the parameter threshold of a selected 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.
Lightning products	Lightning products are based on sensor data that is sent to a central processor, where lightning solutions are created and then sent to IRIS Focus in real-time for product generation and visualization.

More information

- On-demand radar products (page 54)
- IRIS Analysis radar products (page 72)

2.1 IRIS product family for weather radar data

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.

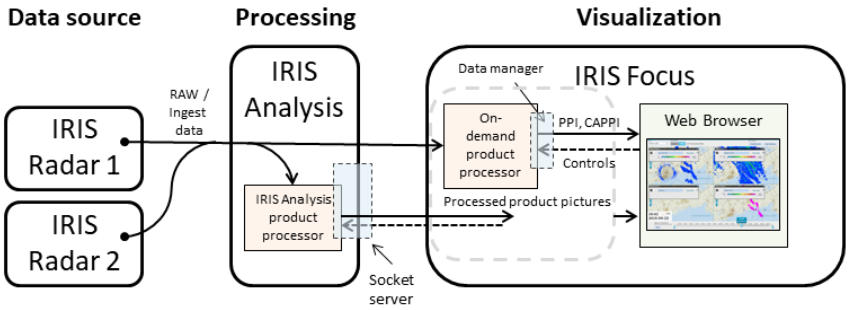


Figure 2 IRIS Focus data flow

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 Lightning product generation

The data for lightning products in IRIS Focus originates from a Vaisala Lightning Detection System which uses multiple, remote sensors to detect signals emitted by lightning discharges, while filtering out the signals from non-lightning sources. Each sensor sends its data to the central processor (the **Total Lightning Processor**, TLP) where lightning locations are determined.

To ensure that the sensor data set applies to the same lightning event, the TLP compares the time at which the event was recorded by each sensor, and then calculates the precise location of the lightning event. The TLP also records several other descriptive characteristics of each lightning event.

The data from the TLP is delivered to IRIS Focus. The data is ingested to the system in real time, after which it can be requested across specific time frames by lightning products.

A single TLP can consume and merge data sets from multiple other TLP systems to produce a superset of data. For example, if organizations from three neighboring countries share TLP data, they can have a superset of lightning solutions from all three countries on each of the TLP systems. From there, they can create subsets of data feeds by lightning characteristics or geographic regions. Each of these subsets can then be fed to a specific Kafka topic on a specific Kafka cluster. Each of these topics can feed several IRIS Focus systems.

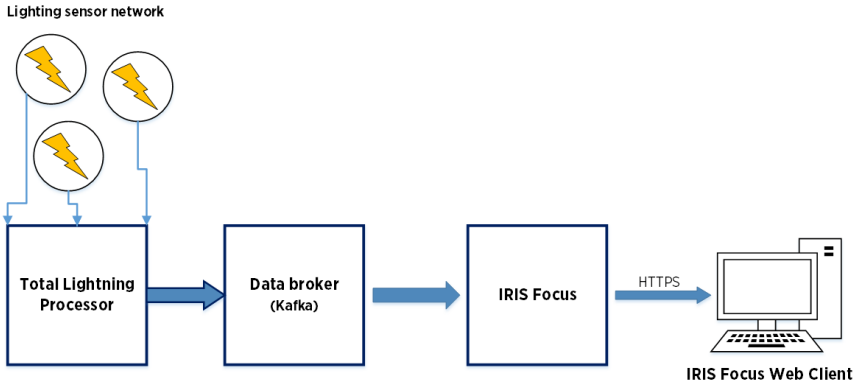


Figure 3 IRIS Focus lightning architecture

2.3 IRIS Focus 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 or the ID of your virtual environment. If your hardware configuration changes and you need to re-install IRIS Focus, you must request a replacement license from your Vaisala representative.

An exception to this is the USB license key. If you have a USB license key, IRIS Focus runs when the USB license key 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

IRIS Focus has a basic license called *IRIS Focus Light*. This license enables users to view certain weather data on the map, but gives limited interaction with the tools. The full license is called *IRIS Focus*. This license provides access to the interactive features of IRIS Focus. The *IRIS Focus* license includes all the features of *IRIS Focus Light*.

There are separate licenses for weather radar data visualization and for lightning data visualization, but users can have access to both licenses. Access to licenses is defined in the user profile.

IRIS Focus Light

IRIS Focus Light licenses have an unlimited number of seats. If there are no *IRIS Focus* license seats available, the user will be logged in with an *IRIS Focus Light* license. If the license is missing, users cannot log in. This could happen, for example, if the USB license key has been removed or if this is a new installation, not from the factory, that requires an e-mail be sent to Vaisala to retrieve the license. Administrators can log in even when the license is missing, but they have no access to the map view.

With an *IRIS Focus Light* license, the user sees the *IRIS Focus Light* map view. The following features are available:

- View one predefined weather product at a time (a non-live radar product or the TimeSpan lightning product)
- View the animation timeline
- Edit color scales
- Change radar site
- Select map features
- Change user preferences

There are two variants of the *IRIS Focus Light* license:

- ***IRIS_Focus_Light_LGT***
  This license is for viewing lighting data.
- ***IRIS_Focus_Light_WR***
  This license is for viewing weather radar data.

IRIS Focus

IRIS Focus licenses are based on a floating seat pool.

There are two variants of the *IRIS Focus* license:

- ***IRIS_Focus_Lightning***
  This license enables users to view the full-scale visualizations of lightning network sensor data, and to use all the related interactive tools.
- ***IRIS_Focus_Weather_Radar***
  This license enables users to view the full-scale visualizations of weather radar data, and to use all the related interactive tools.

Advanced feature licenses

If the license for WMS is provided, then this feature is enabled and becomes available for all users with an IRIS Focus seat.

In addition to the *IRIS Focus Light* and *IRIS Focus* licenses, the following advanced feature licenses are available. The seat pool does not apply to these licenses; if the advanced feature license is present in the system, users can access these features when they have an IRIS Focus seat.

- ***IRIS_WMS***
  With the *IRIS_WMS* license, external WMS layers can be added to the system. Users can then access the layers through the weather product panel.

- ***IRIS_NetworkHealth_LTG***
  With the *IRIS_NetworkHealth_LTG* license you can get the network performance information from the **Total Lightning Processor**, and display the information as **NetworkHealth** product in the product panel. Using this feature also requires the *IRIS_Focus_Lightning* license.
- ***IRIS_Nowcast***
  With the *IRIS_Nowcast* license you get access to the nowcast algorithm for creating forecasts based on weather radar data up to 2 hours into the future. Using this feature also requires the *IRIS_Focus_Weather_Radar* license.

Seat-based license pool

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. For example, if there are 10 users with IRIS Focus privileges configured to the system, and there are only 5 IRIS Focus seats, then the first 5 users to access the system will be given *IRIS Focus* rights, whereas the remaining 5 users will enter the system with *IRIS Focus Light* credential.

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.

Licensing based on the number of weather radars

IRIS_Focus_Light_WR and *IRIS_Focus_Weather_Radar* licenses are valid for a defined number of weather radars. If you have more radars in the network than licenses, you need to define which radars the licenses are applied to. To do this, configure the `vsoweb-override.ini` file.

CAUTION! If you have more radars in the network than licenses, and you have not configured the list of radars to apply the licenses to, the system will not display any radar data.

For detailed instructions, see *IRIS Focus Administrator Guide*.

More information

- User roles (page 15)
- Adding/removing radars (page 131)

3. Using IRIS Focus

3.1 User roles

A user's access to IRIS Focus features depends on the roles assigned to the user. For example, the administration features are available to user accounts with the **administrator** role. A user may have several user roles, and when they log in, they have the features of all their roles available.

User roles can be divided into two categories:

- **Focus** roles are needed for full-scale remote sensing data visualization. Logging in with a **Focus** role reserves a seat from the seat pool.
- System roles are needed for system purposes. They do not reserve seats from the pool, and they do not offer the full-scale features. For full-scale features, the user also needs a **Focus** role.

Focus roles

Focus roles reserve a **Focus** seat from the seat pool when logging in.

Table 3 Focus roles

Focus Weather Radar	Can access the full IRIS Focus feature set for visualizing weather radar data, such as: • Configuring product generation • Using data analysis tools, like Tracking tool • Creating personal areas of interest and monitoring these areas for weather events defined by **poweruser**
Focus Lightning	Can access the full IRIS Focus feature set for visualizing lighting data, such as: • Configuring product generation • Using data analysis tools, like Tracking tool • Creating personal areas of interest and monitoring these areas for weather events defined by **poweruser**

IRIS Focus Light

A user without a **focus** role enters the *IRIS Focus Light* view when logging in.

IRIS Focus Light view consists of a predefined map view with limited features. The following features are available:

- View one predefined weather product at a time (a non-live radar product or the TimeSpan lightning product)
- View the animation timeline
- Edit color scales

- Change radar site
- Select map features
- Change user preferences

IRIS Focus Light view has an unlimited number of seats. If there are no *IRIS Focus* license seats available, the user will be logged in with an *IRIS Focus Light* license. If the licence is missing, users cannot log in. This could happen, for example, if the USB license key has been removed or if this is a new installation, not from the factory, that requires an e-mail be sent to Vaisala to retrieve the license.

Seat allocation and restrictions

A user with a **`Focus Lightning`** role reserves one of the *IRIS_Focus_Lightning* seats associated with the license.

A user with a **`Focus Weather Radar`** role reserves one of the *IRIS_Focus_Weather_Radar* seats associated with the license.

When the user logs out, the seat is released.

If a user with one of the **`Focus`** roles (**`Focus Lightning`** or **`Focus Weather Radar`**) logs in and there are no seats available, the user is directed to the IRIS Focus Light view.

When an *IRIS Focus* license is available, the user is provided with an opportunity to switch to the full-scale IRIS Focus view.

The user is also directed to the *IRIS Focus Light* view in a situation where the user has both **`Focus Lightning`** and **`Focus Weather Radar`** roles, and the system has run out of free *IRIS_Focus_Weather_Lightning* or *IRIS_Focus_Weather_Radar* seats. In other words, both seats have to be available for this user to see the full-scale IRIS Focus.

System roles

System roles are needed for various system management tasks and functionalities. System roles do not reserve a Focus seat from the seat pool.

When logging in, a user that has one or more of these roles, but no **`Focus`** role, enters the *IRIS Focus Light* view.

Table 4 System roles

Role	Description
`administrator`	Can access all administration features, such as: • User and licensing management • Map management and configuration • Alert notification settings (email and SMS) • Dataflow monitoring All administration features are described in *IRIS Focus Administrator Guide*.

Role	Description
`poweruser`	Can access **poweruser** features: • Defining weather events • Creating places of interest that are visible to all users in an organization, and set a weather event watch to monitor these areas. • Can set up and manage pre-defined composites. • Can configure MVFs to be used in nowcasting. • Can select an organization-level map projection. All **poweruser** tasks are described in chapter *Poweruser tasks* in *IRIS Focus User Guide*.
`user`	Can access various features of the base software. This role must be assigned as an additional role to every user account with **focus**, **poweruser**, or **kiosk** role.
`kiosk`	Identical to the **User** role with the exception that an account with the **Kiosk** role will not be automatically logged out after a period of inacivity.

More information

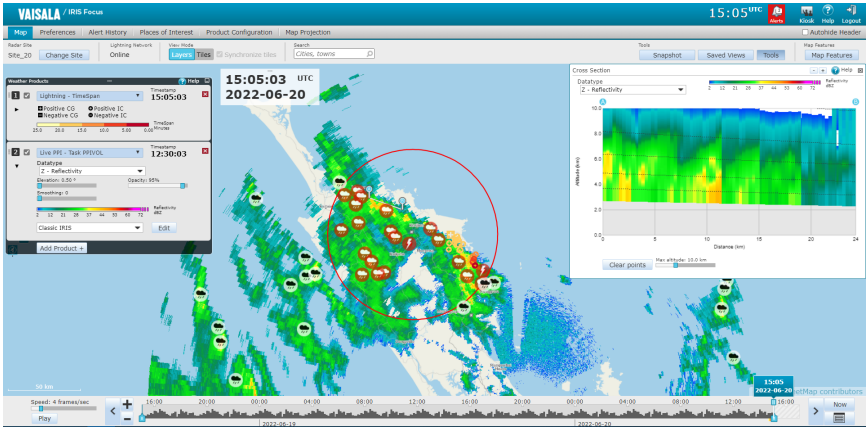
- IRIS Focus licensing (page 12)
- GLD360 (page 93)
- Required user roles (page 98)

3.2 Map view

The IRIS Focus main view is a scrollable map area centered around the selected radar site. By default, 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 and lightning products generated by IRIS software, and optionally WMS layers from external sources.



1) Weather radar data: courtesy of Meteorological Service of New Zealand Ltd. Lightning data: courtesy of Transpower New Zealand Ltd.

Figure 4 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 are drawn as individual layers and then combined to form an overview of current weather conditions.

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

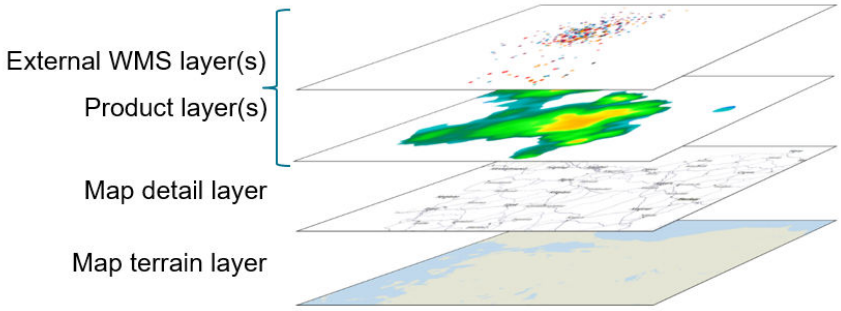


Figure 5 IRIS Focus product layers

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.

Weather product layers

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

External WMS layers

You can add WMS layers from external sources to the map. They are shown as product layers.

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.

You can also load in your own layers to IRIS Focus.

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

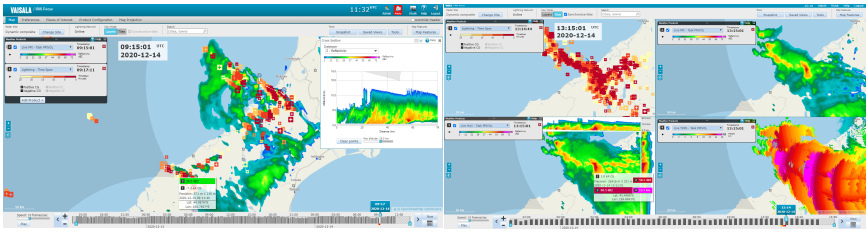
Table 5 Map detail settings

Map detail	National borders	Province borders	Airports	Roads	Labels
None					
Minimal	✔				
Aviation	✔		✔		

Map detail	National borders	Province borders	Airports	Roads	Labels
Roads	✔			✔	
General	✔	✔			✔
Full	✔	✔	✔	✔	✔

3.2.3 Product layers

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



1) Weather radar data: courtesy of Meteorological Service of New Zealand Ltd. Lightning data: courtesy of Transpower New Zealand Ltd.

Figure 6 Layered and Tiled view modes

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

Each additional layer requires more processing capacity from the system. To improve performance, avoid showing unnecessary 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 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 45)

3.2.4 Product layer settings

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

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

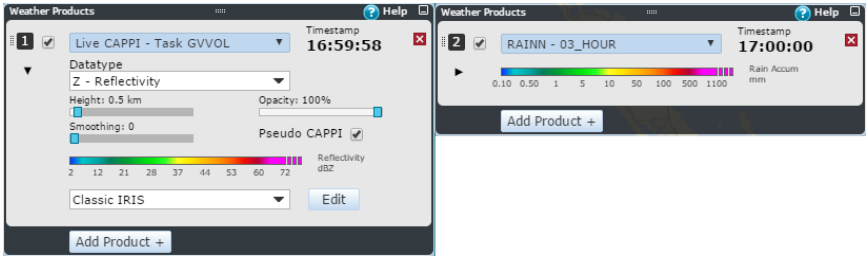


Figure 7 On-demand and IRIS Analysis product settings

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

On-demand product layers include the following attributes:

Table 6 On-demand product attributes

Attribute	Description
Data type	Sets the measured data type.
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.

Attribute	Description
Smoothing	Blends adjacent pixels closer together depending on their distance from each other.
Threshold (**BASE**, **TOPS**, **THICK**)	Defines reflectivity threshold (dBZ) for the amount of data displayed in the image.
Composite Method	When viewing composite data from many radar sites, choose how the display handles overlapping data.

More information

- IRIS Focus overview (page 9)
- Data types (page 48)
- Pseudo CAPPI (page 59)
- Radar product smoothing (page 53)
- Radar product reflectivity threshold (page 53)
- Composites (page 34)

3.2.5 External WMS product layers

WMS layers from external sources, such as satellite images and radar data from an external radar network, 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. You can only view those external WMS layers that support the projection you are currently viewing.

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.

For more information on adding WMS layers, see *IRIS Focus Administrator Guide*.

More information

- GLD360 (page 93)

3.2.6 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
Vertically Integrated Liquid (**VIL**)	mm	inch	inch

More information

- User preferences (page 42)

3.3 Radar sites

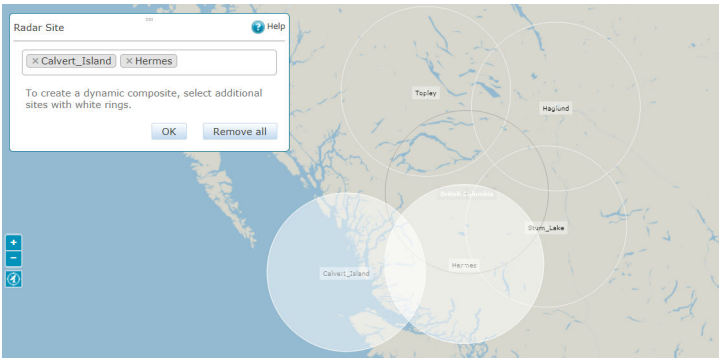
With IRIS Focus, you can view data from any radar in your network.

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

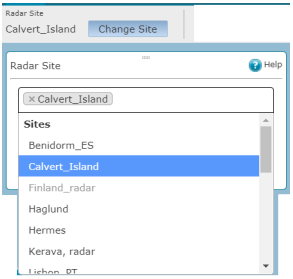
1. In the top menu, select **Change Site**.

   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 34)

3.4 Animation timeline

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

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

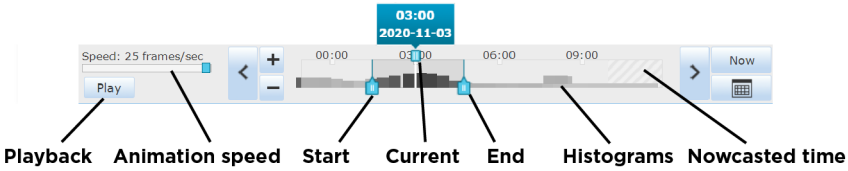


Figure 8 Animation controls

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 start and end time indicators along the time line.
   b. Adjust the animation speed with the controls on the left side of the timeline.
   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.

   The timestamp formatting indicates that the display is showing nowcasted data. For example:

More information

- Nowcasting (page 37)

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 information about product values for that location.

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

Cursor tool for radar products

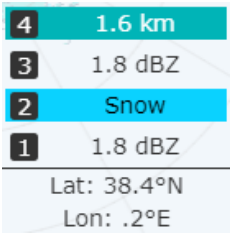


Figure 9 Cursor tool example for 4 radar products

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 always displays the original raster data, not the smoothed data. See chapter *Radar product smoothing* in *IRIS Focus User Guide* for more information.

Cursor tool for TimeSpan

For the **TimeSpan** product, the cursor tool shows information about the latest lightning event when hovering over the icon on the map.

The cursor tool shows the time, location, amplitude, and type of the lightning event. Additionally, the error ellipse is shown, and this represents the location accuracy of the lightning event.

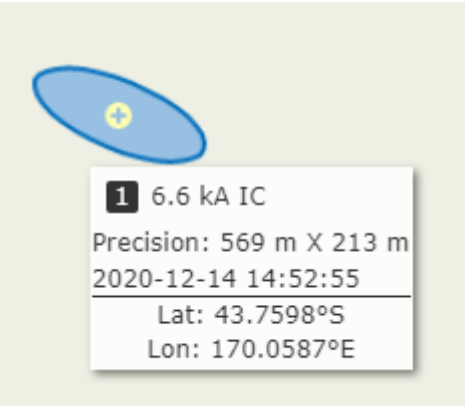


Figure 10 Cursor tool example for TimeSpan

Cursor tool for external WMS layers

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 tool** 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 product pane.

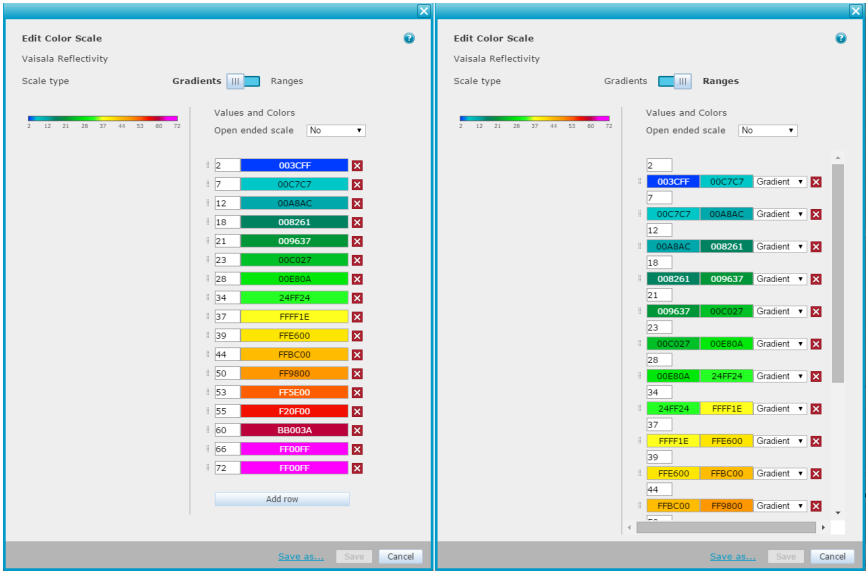


Figure 11 Color scale editor modes for radar products

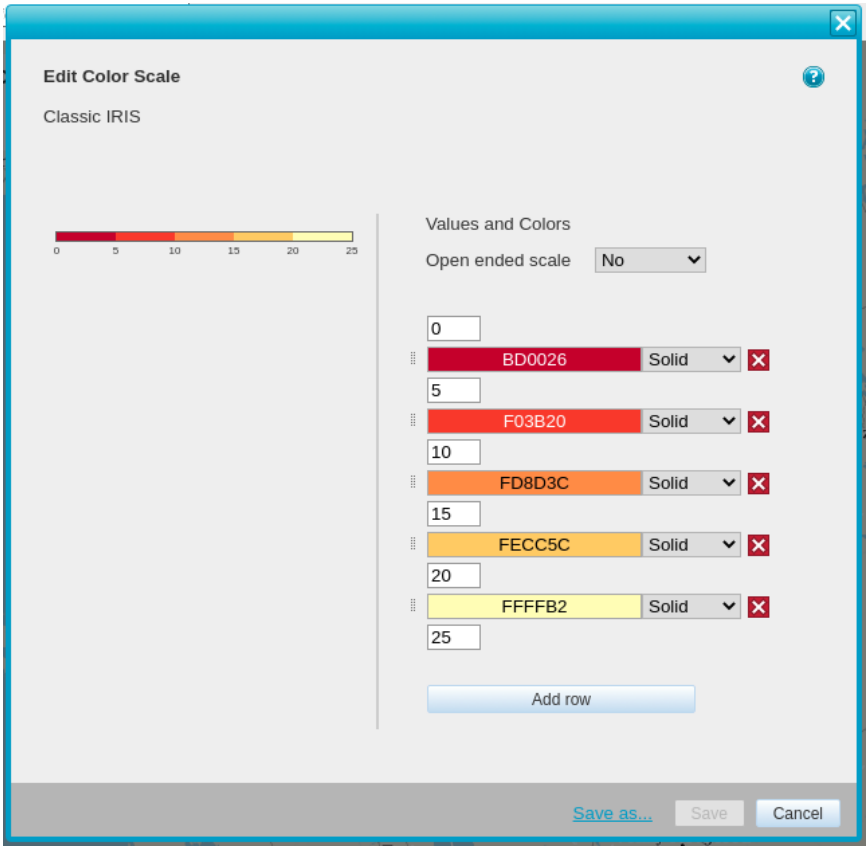


Figure 12 Color scale editor for lightning products

Use the color scale editor to create your own color scales. The editor displays the current color scale gradient and presents a preview on the left. 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.

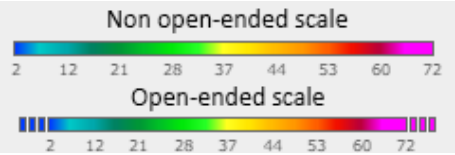


Figure 13 Open and non-open color scales

The open-ended scale and and gradients are not applicable for lightning products.

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

More information

- Radar product colors (page 52)

3.5.2.1 Editing color scales

With the **Gradient** mode, you can set color values for different steps of the scale. The **Ranges** mode allows more fine-tuned options for editing color scales. In this mode, you can set each step between two keypoints on the color scale to be either gradients or single solid color.

1. Choose either the **Gradient** mode or the **Ranges** mode from the **Scale Type** slider.
2. Choose whether or not to use the open ended scale from the **Open Ended Scale** pull-down menu.
3. Click on a keypoint and select a new color from the color picker, or enter a new numerical RGB value directly into the color field.

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.

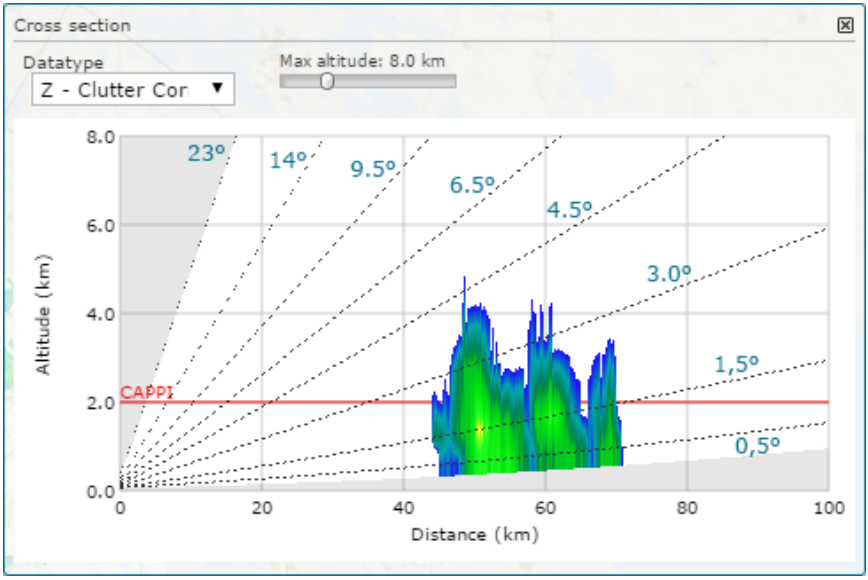


Figure 14 Cross Section tool, **CAPPI** example

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 48)
- On-demand radar products (page 54)
- On-demand Constant Altitude Plan Position Indicator (CAPPI) (page 57)

3.5.4 Ruler Tool

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

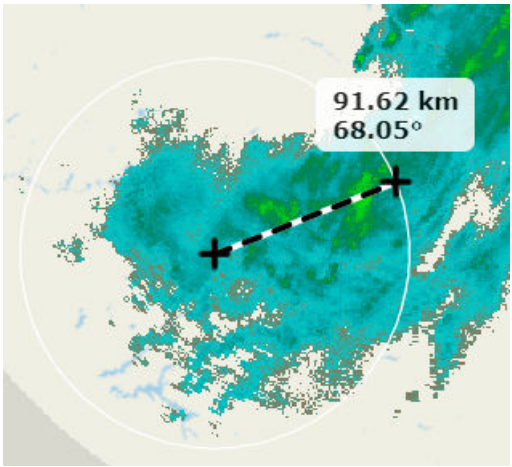


Figure 15 **Ruler Tool** example

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.

> The Snapshot image that IRIS Focus produces may not look exactly like the image in your browser. This is because the Snapshot image is rendered with the server's browser, which may be slightly different from the browser with which you are viewing IRIS Focus.

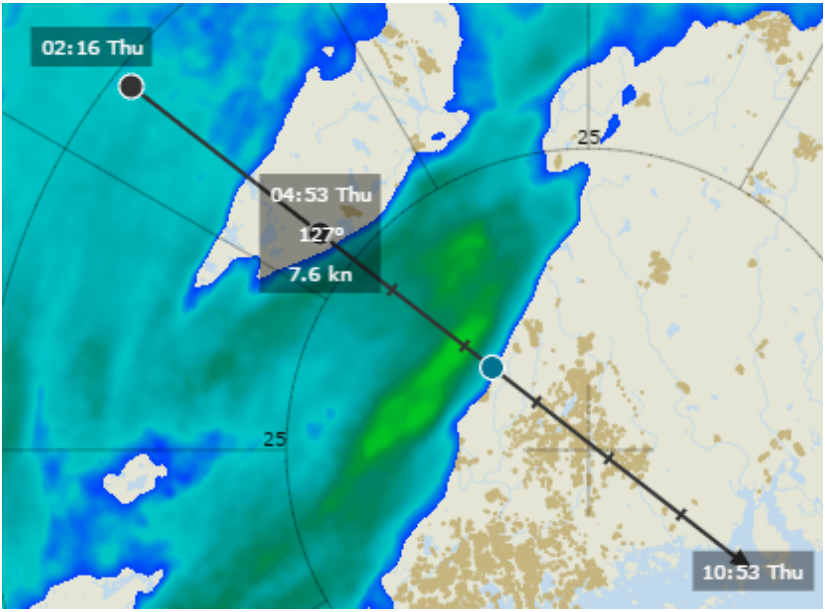
3.5.6 Tracking Tool

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

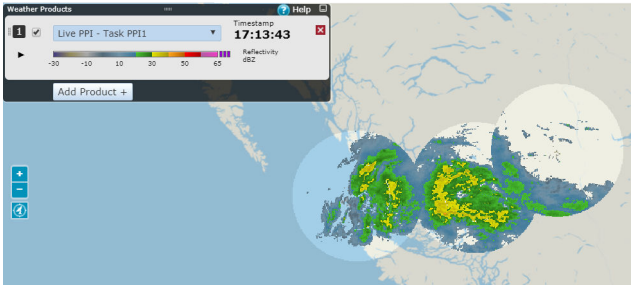


Figure 16 Radar composite example

You can 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 radar composites (page 122)

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.

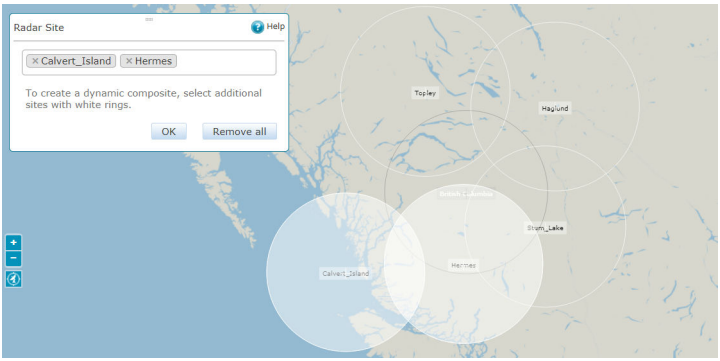
Pre-configured composites, IRIS Analysis composites, and sites that do not support dynamic composites are indicated on the map with black rings. You can view radar data from these sites one at a time.

1. In the top menu, select **Change Site**.

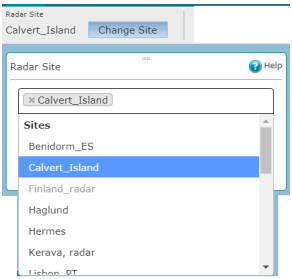
   The radar site selector mode starts, showing:
   - A map view with the available radars and composites shown on the map.
   - A site selector window listing the available radars and composites.

2. To create a dynamic composite, select more than one site.

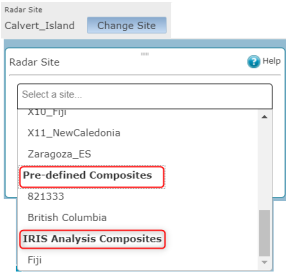
   - On the map, select one or more radar rings.



   - 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 Product layer settings (page 21).

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 36).

6. To view a cross-section of the composite data, select **Cross Section**.

   See Cross Section tool (page 30).

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 motions 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.

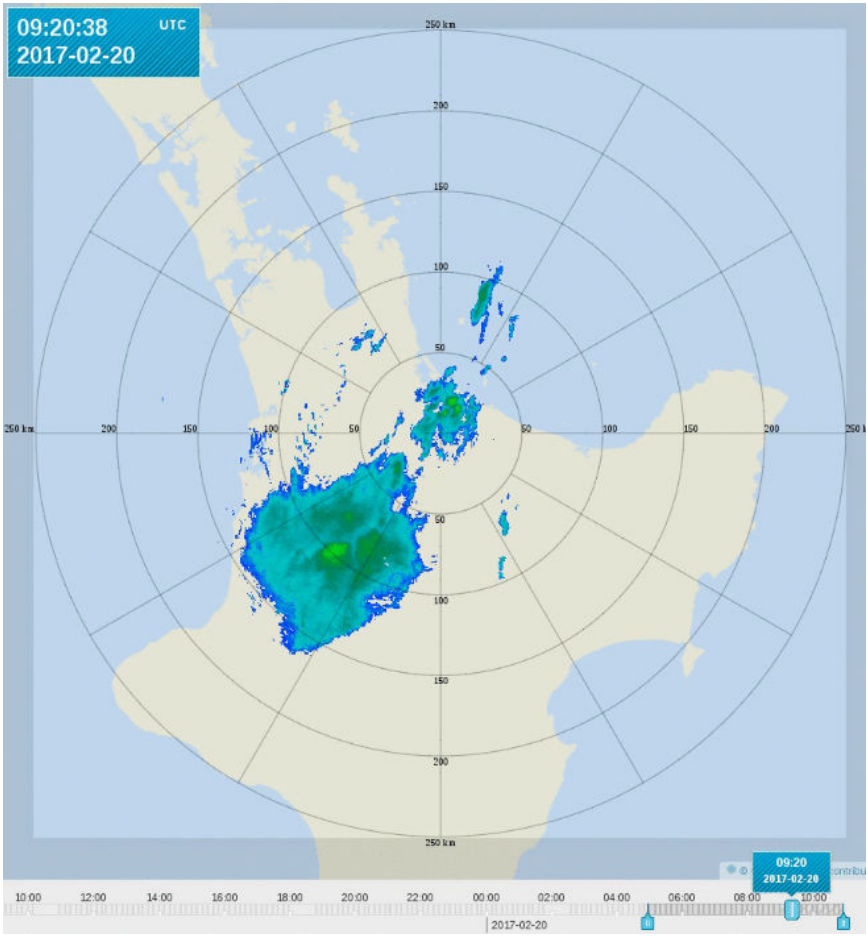


Figure 17 Viewing nowcasted data

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 25)
- Configuring nowcasting for weather radar products (page 126)
- Motion vector field (MVF) (page 82)

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.

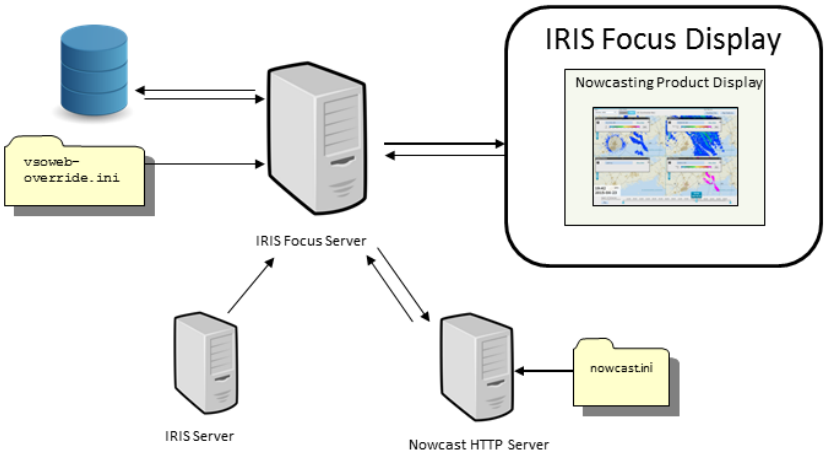


Figure 18 Nowcasting architecture

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 82).
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 40) and Calculating motion velocity (page 84).
5. Display nowcasting predictions in IRIS Focus.
   See Animation timeline (page 25).

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.

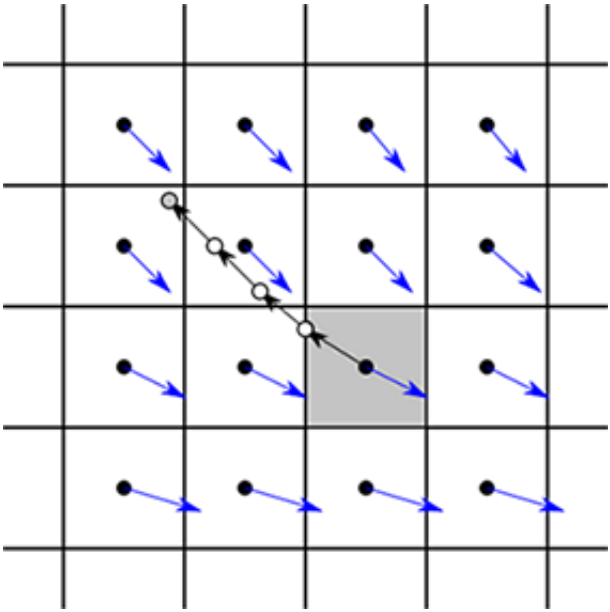


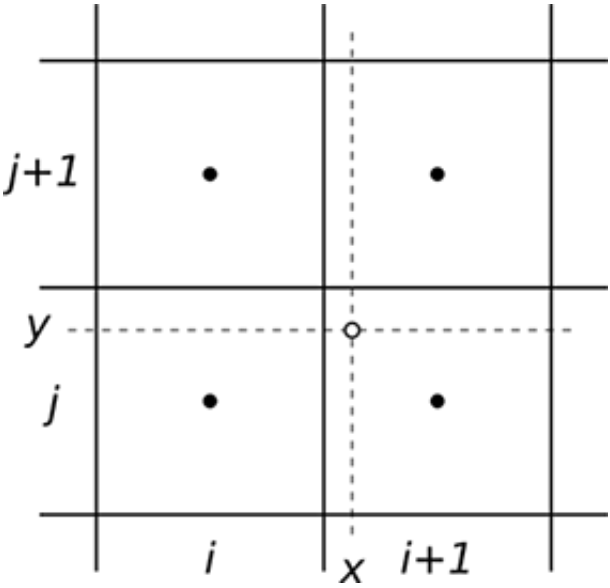
Figure 19 Product advection

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**.

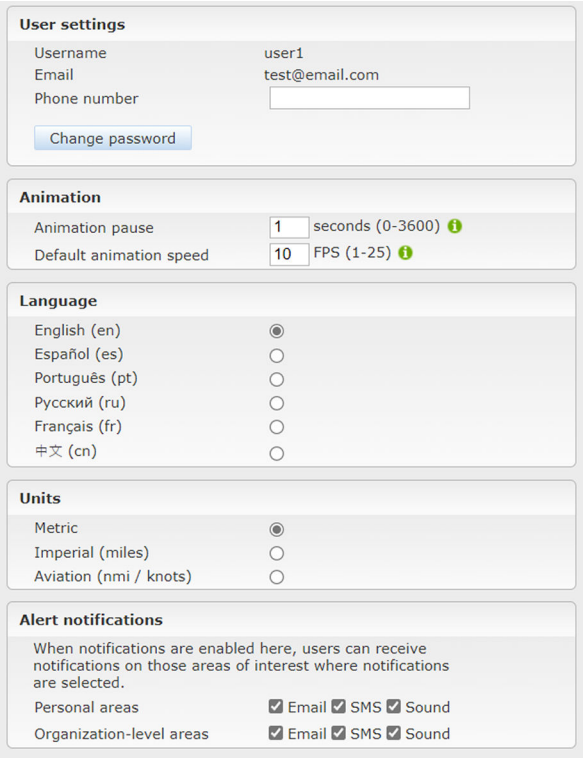


Figure 20 Preferences tab

You can change:

- Your password
- Your phonenumber
- Default animation settings
- Language used in the web interface
- Measurement units used in IRIS Focus
- Alert notification settings

Your email address is set in your user account, created by an administrator.

More information

- Weather events and alerts (page 94)

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.

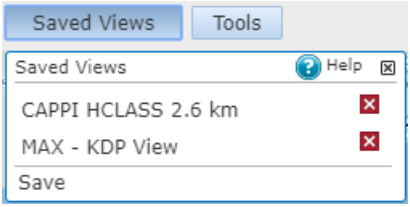


Figure 21 Saved Views example

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. 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 products	On-demand products are based on raw data from the IRIS back-end systems (IRIS - Interactive Radar Information System and/or TLP - the Total Lightning Processor). IRIS Focus processes data and generates products in real time. On-demand products provide control over the presentation of weather data in the IRIS Focus user interface. For example, you can change the parameter threshold of a selected 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.
Lightning products	Lightning products are based on sensor data that is sent to a central processor, where lightning solutions are created and then sent to IRIS Focus in real-time for product generation and visualization.

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*.

4.1 Measuring radar data

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

4.1.1 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, such as rain, hail, or snow. 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.

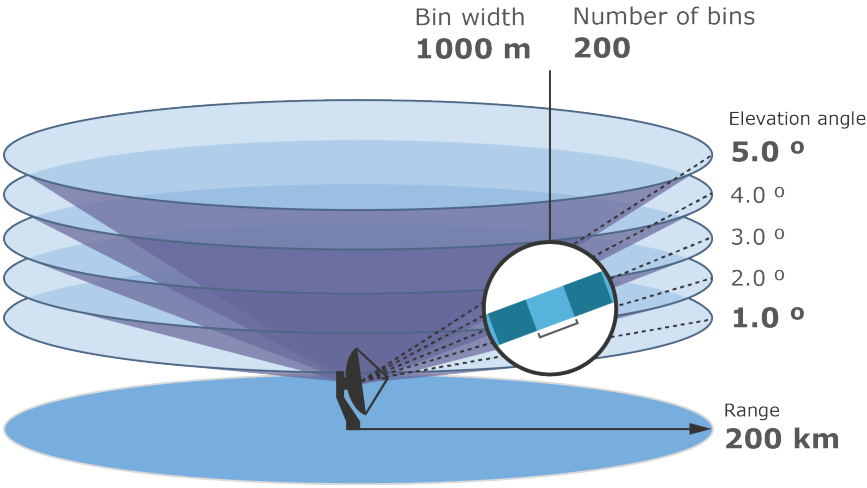


Figure 22 Bins and sweeps

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.

4.1.2 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.

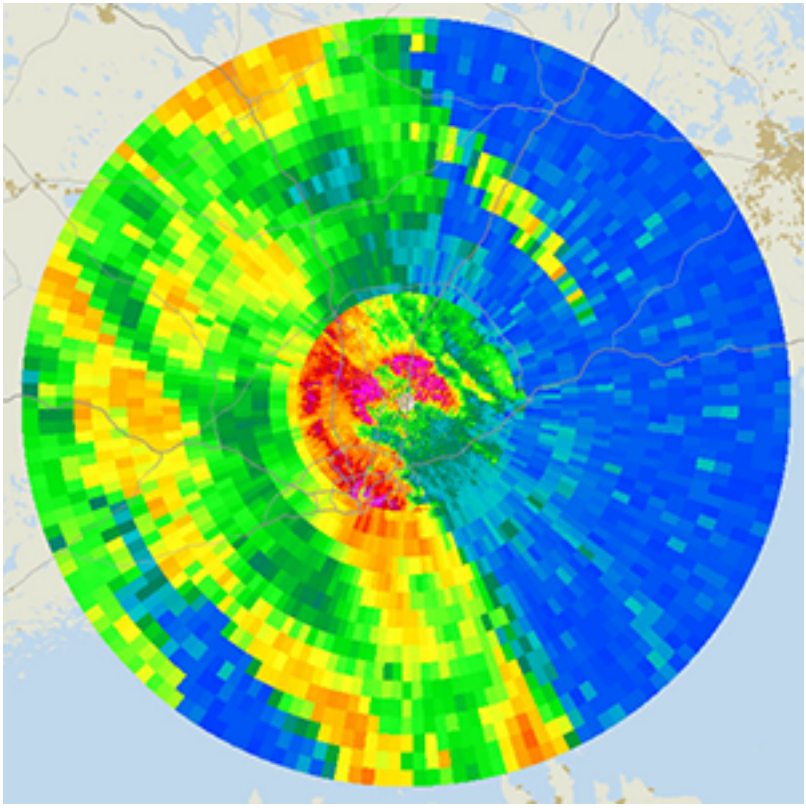


Figure 23 Radar resolution across the detected area

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.

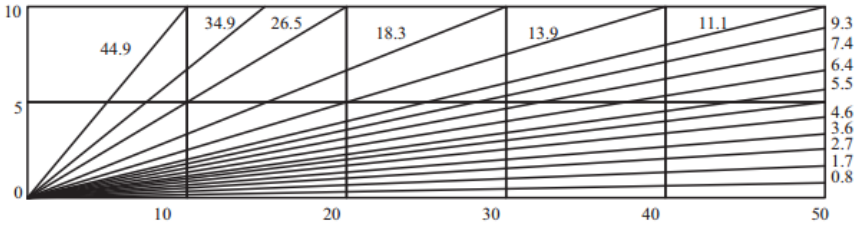


Figure 24 Example of 15-tilt volume scan

4.1.3 Data flow

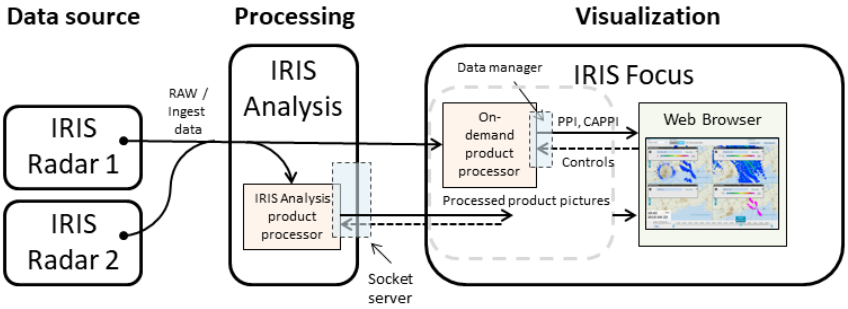


Figure 25 IRIS Focus data flow

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.

4.1.4 Data types

Radar product data types define 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 7 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 50)
- On-demand radar products (page 54)
- IRIS Analysis radar products (page 72)

4.2 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 65).
- **Z**
  Measuring reflectivity in dBZ.
  See Data types (page 48).
- **400**
  Up to horizontal range of 400 km.

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

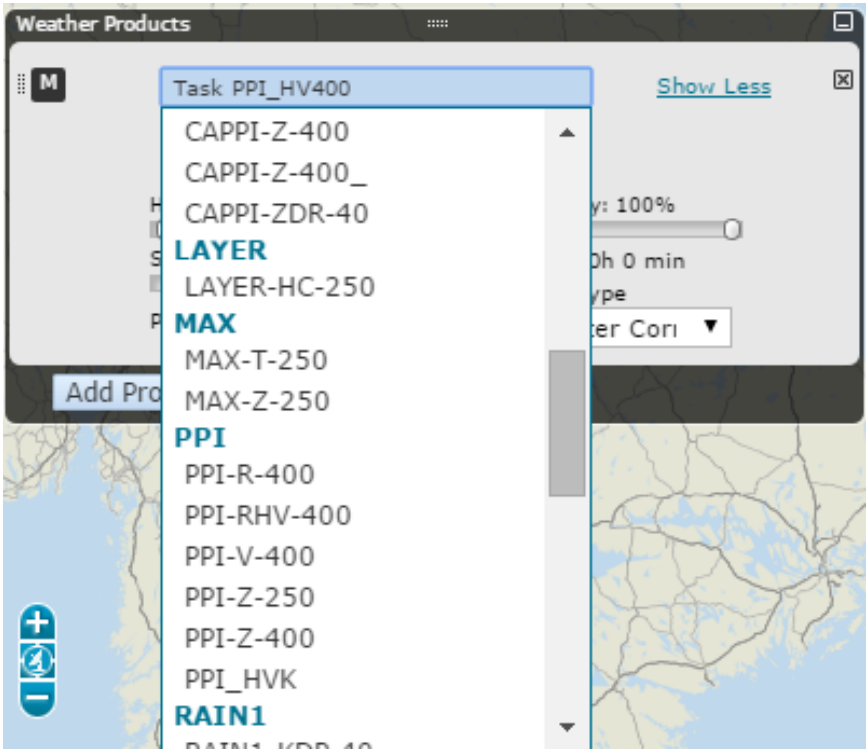


Figure 26 Radar product code examples

More information

- IRIS product family for weather radar data (page 10)
- On-demand radar products (page 54)
- IRIS Analysis radar products (page 72)
- Data types (page 48)

4.3 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.

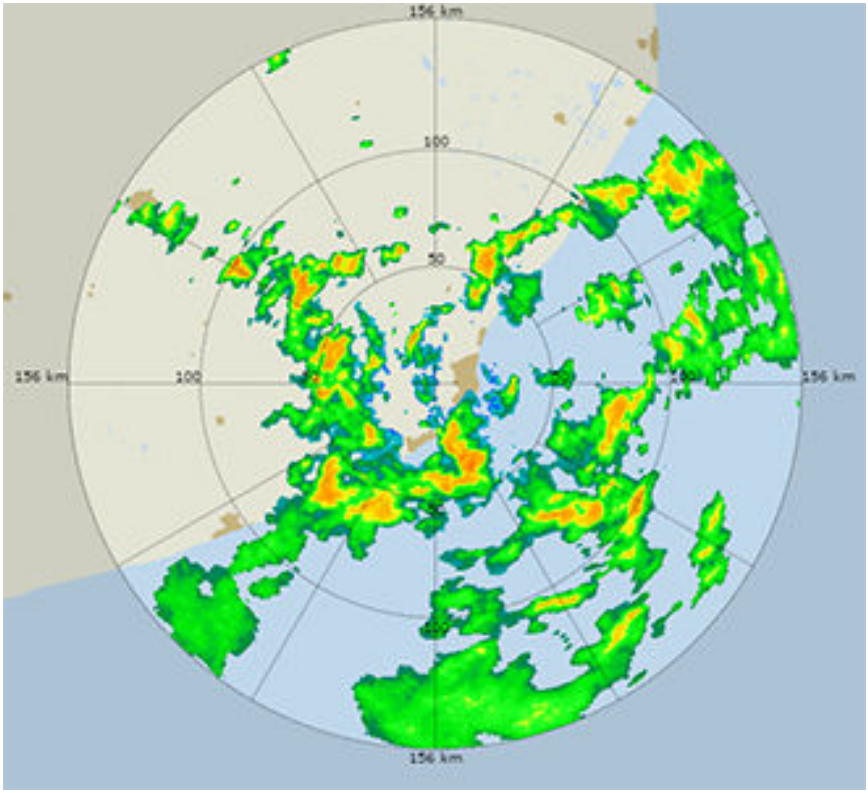


Figure 27 Signal reflectivity in precipitation

More information

- Color scale editor (page 27)

4.4 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.

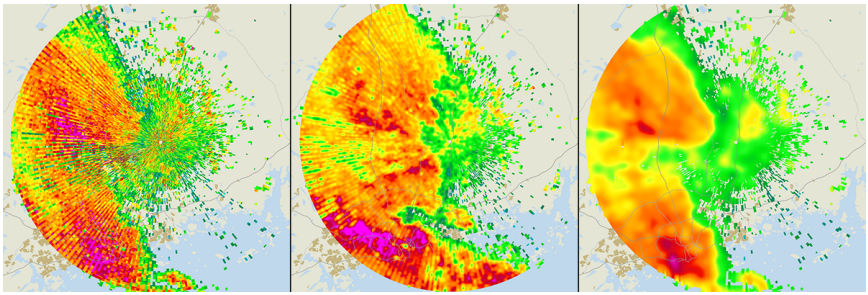


Figure 28 Smoothing level examples

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

More information

- On-demand radar products (page 54)

4.5 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.

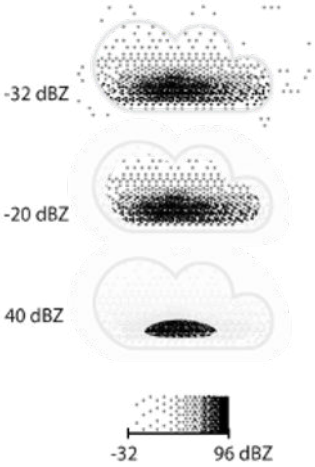


Figure 29 Reflectivity threshold

More information

- BASE threshold value (page 56)
- THICK threshold value (page 68)
- TOPS threshold value (page 71)

4.6 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.

4.6.1 On-demand echo base (BASE)

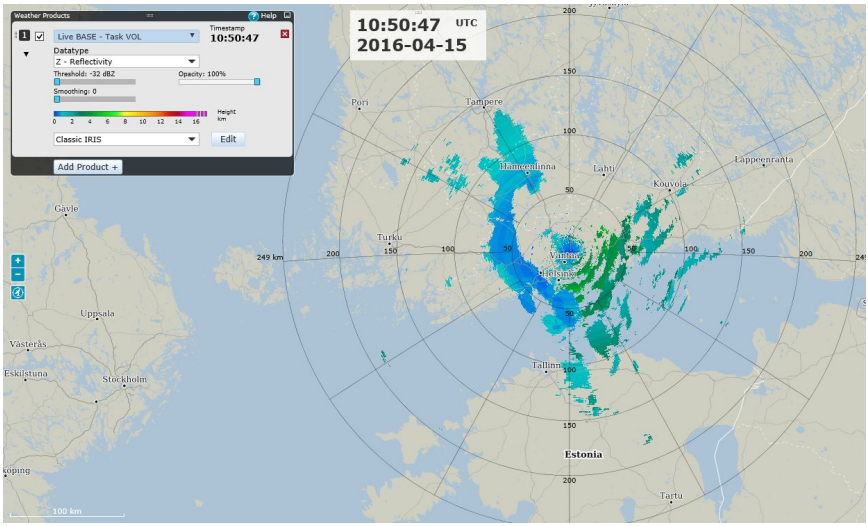


Figure 30 On-demand **BASE** example

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.

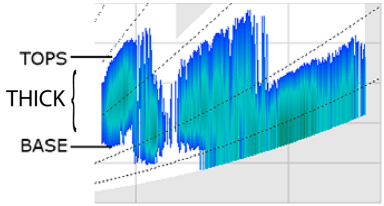


Figure 31 **BASE** and **TOPS** products

More information

- On-demand echo tops (TOPS) (page 70)
- On-demand echo thickness (THICK) (page 68)

4.6.1.1 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.

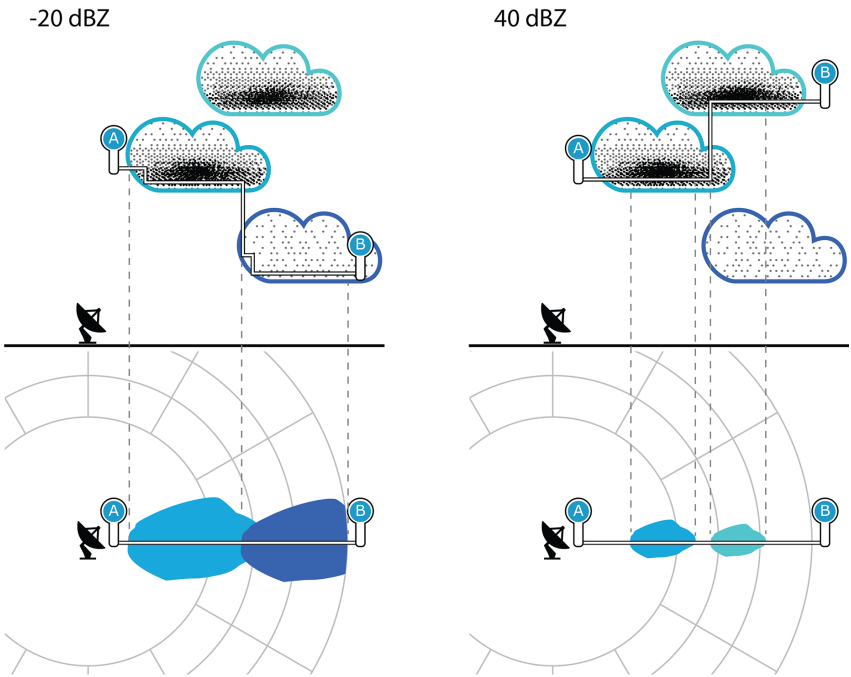


Figure 32 **BASE**, -20 and 40 dBZ thresholds

More information

- Radar product reflectivity threshold (page 53)

4.6.1.2 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.

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

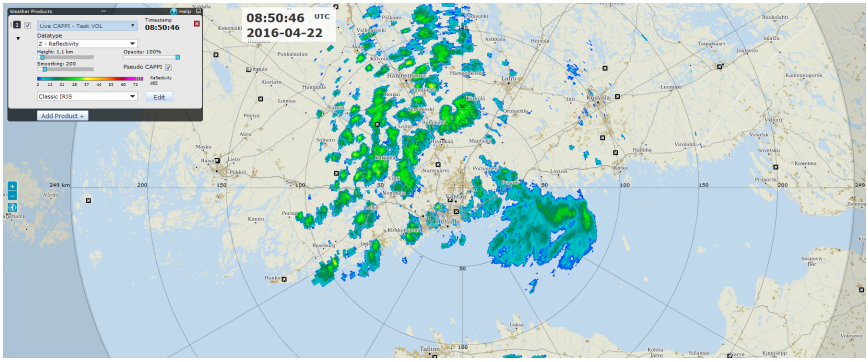


Figure 33 On-demand **CAPPI** example

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.

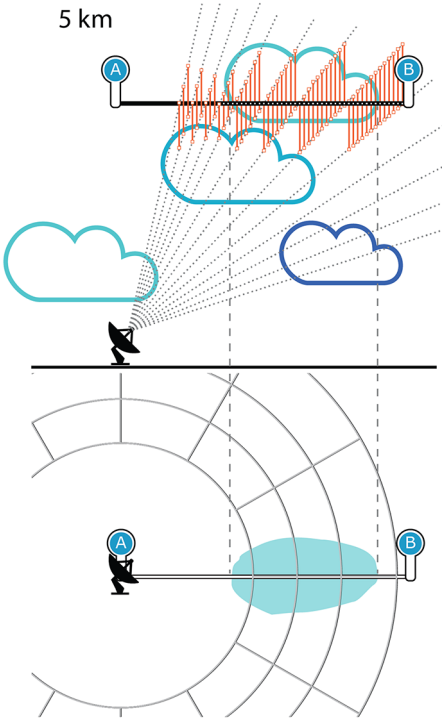


Figure 34 **CAPPI** measuring the defined altitude

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 30)
- On-demand Plan Position Indicator (PPI) (page 65)
- Product layer settings (page 21)

4.6.2.1 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.

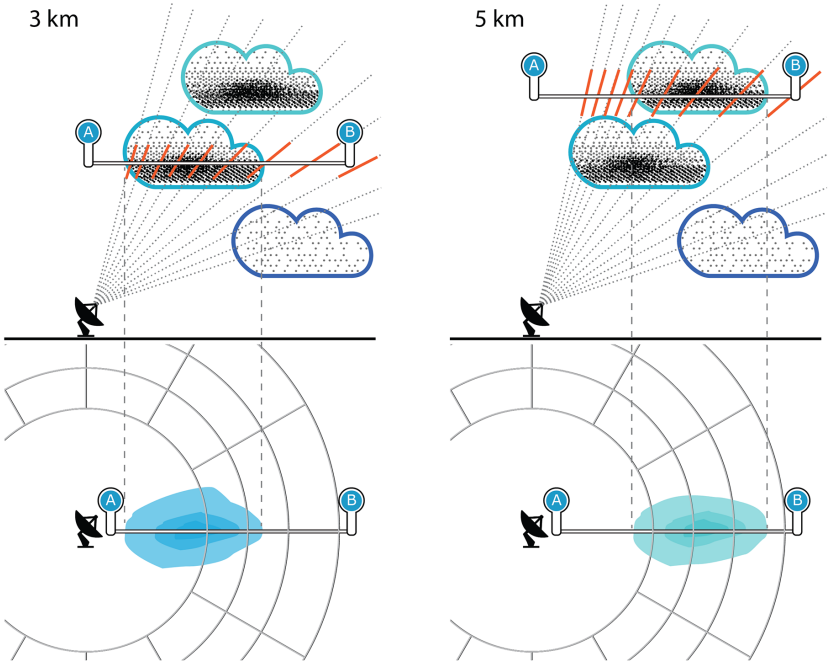


Figure 35 **CAPPI** with 3 km and 5 km heights

4.6.2.2 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.

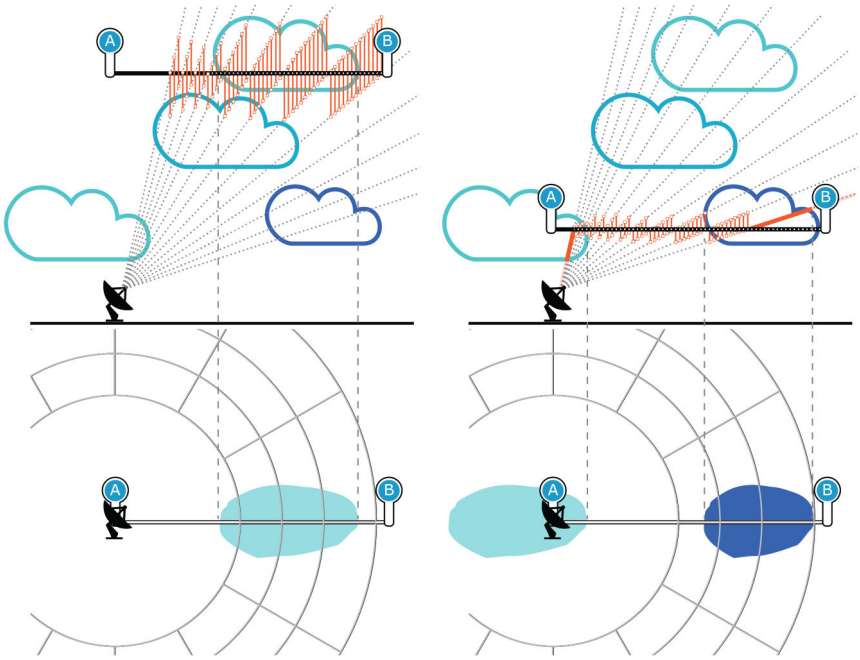


Figure 36 **Pseudo CAPPI** extending from **CAPPI**

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.

4.6.2.3 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.

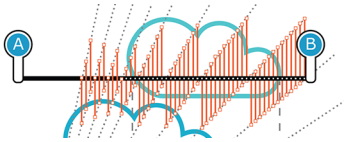


Figure 37 Calculating the `AzEq` cylinder volume from 2 nearest data points

More information

- Calculating on-demand PPI (page 67)

4.6.3 On-demand maximum data (MAX)

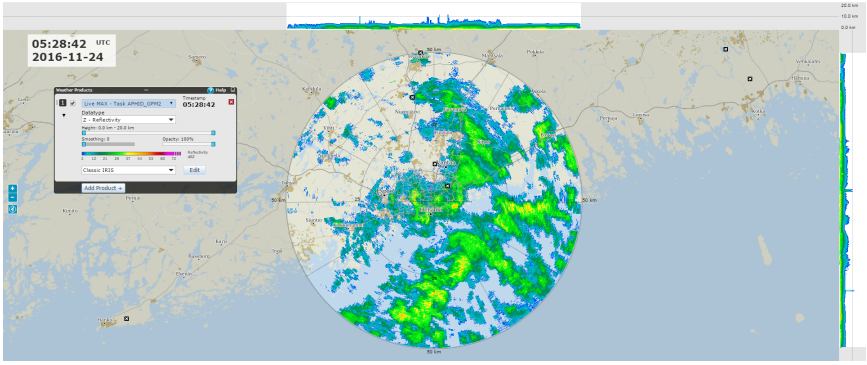
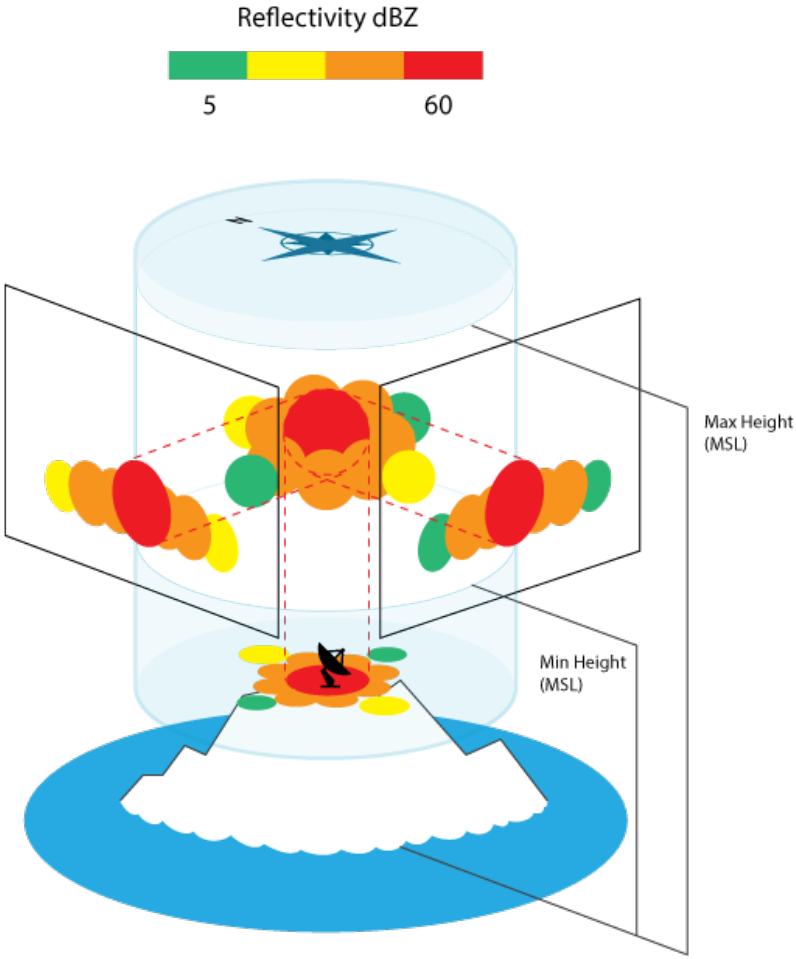


Figure 38 On-demand **MAX** example

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.

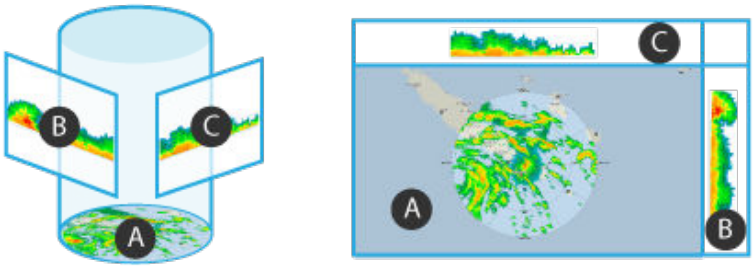
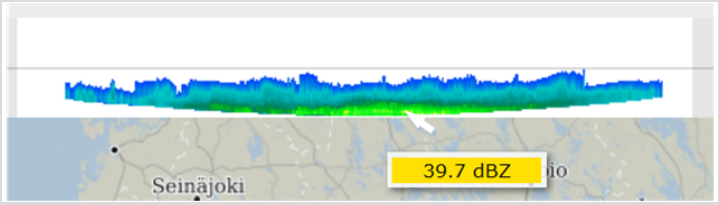


Figure 39 **MAX** views

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.



4.6.3.1 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.

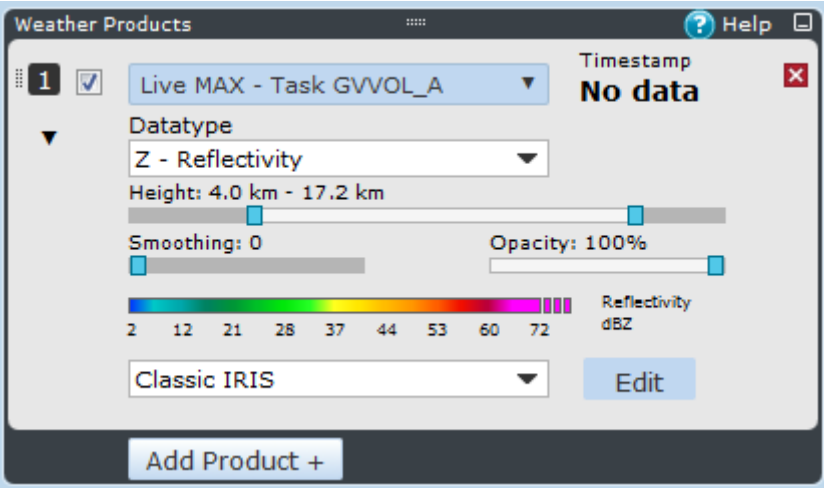


Figure 40 **MAX** settings

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 53)

4.6.3.2 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.

4.6.4 On-demand Plan Position Indicator (PPI)

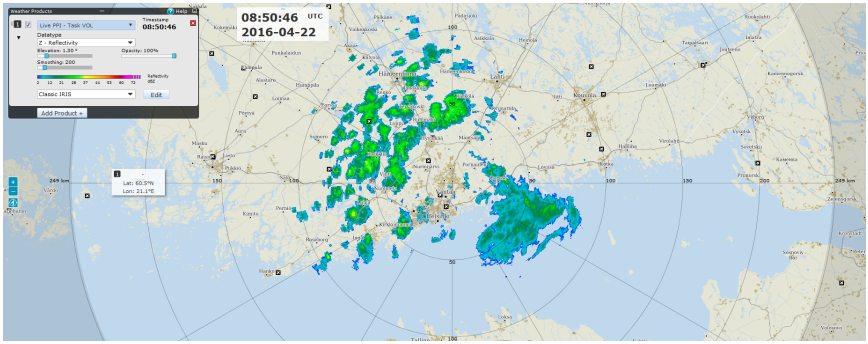
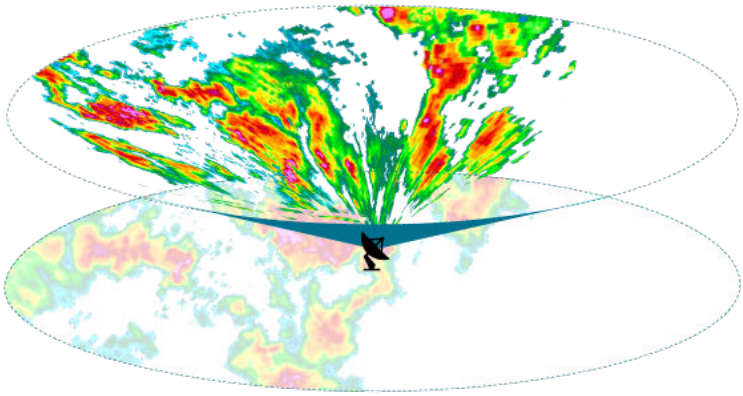


Figure 41 On-demand **PPI** example

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.



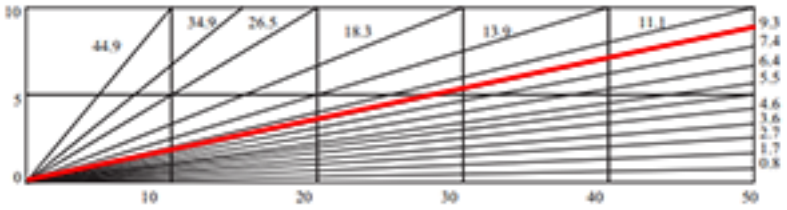


Figure 42 **PPI** measuring the defined elevation

4.6.4.1 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.

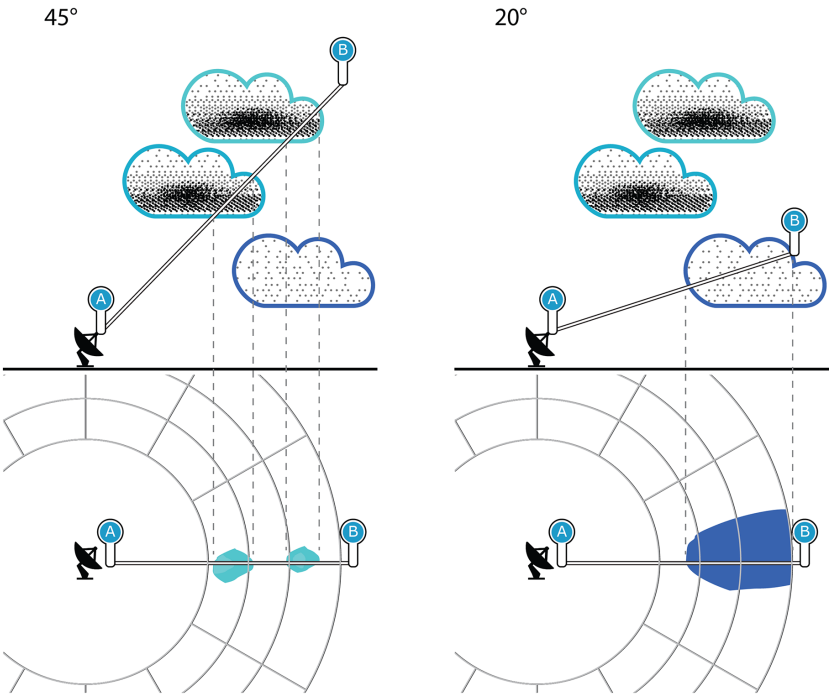


Figure 43 **PPI** with elevation angles of 45° and 20°

4.6.4.2 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.

4.6.5 On-demand echo thickness (THICK)

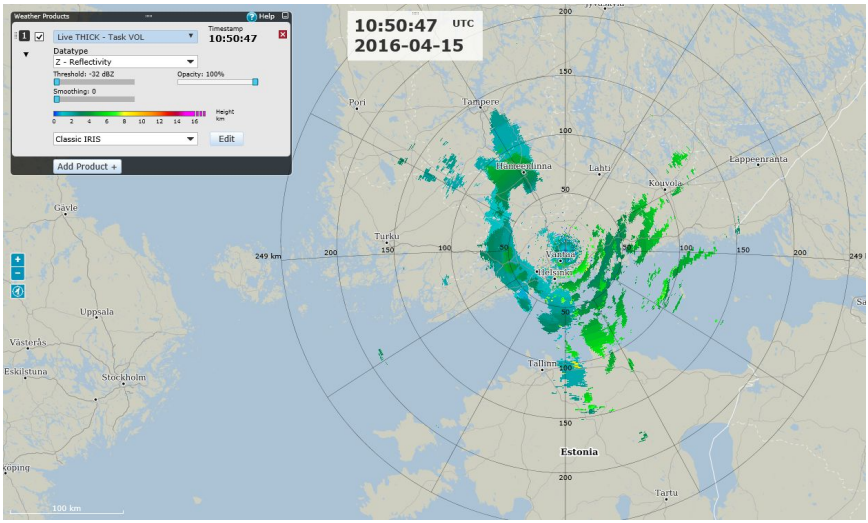


Figure 44 On-demand **THICK** example

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

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

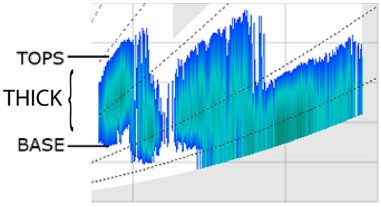


Figure 45 **THICK** with **BASE** and **TOPS**

More information

- On-demand echo base (BASE) (page 55)
- On-demand echo tops (TOPS) (page 70)

4.6.5.1 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.

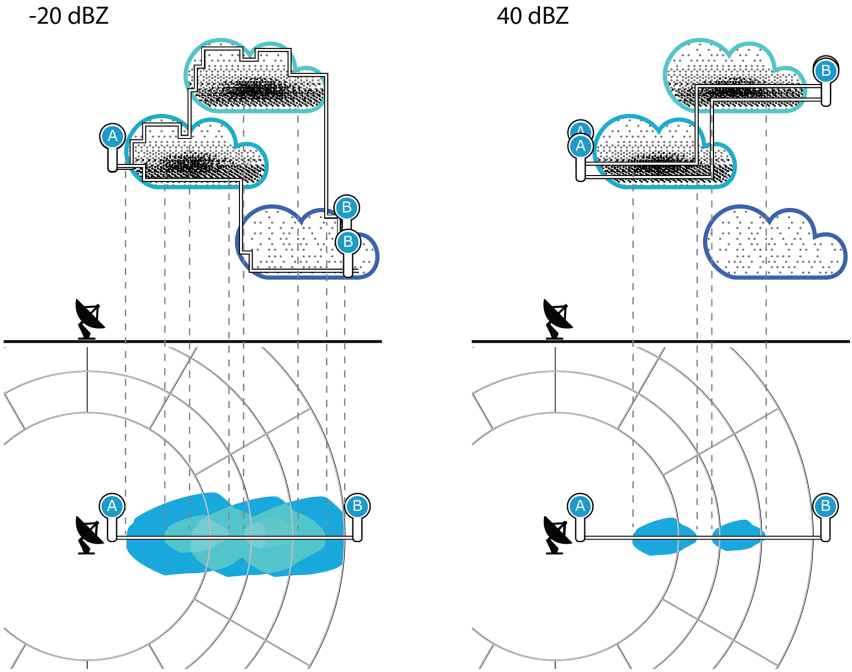


Figure 46 **THICK** with -20 dBZ and 40 dBZ thresholds

More information

- Radar product reflectivity threshold (page 53)

4.6.5.2 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 57)
- Calculating on-demand TOPS (page 72)

4.6.6 On-demand echo tops (TOPS)

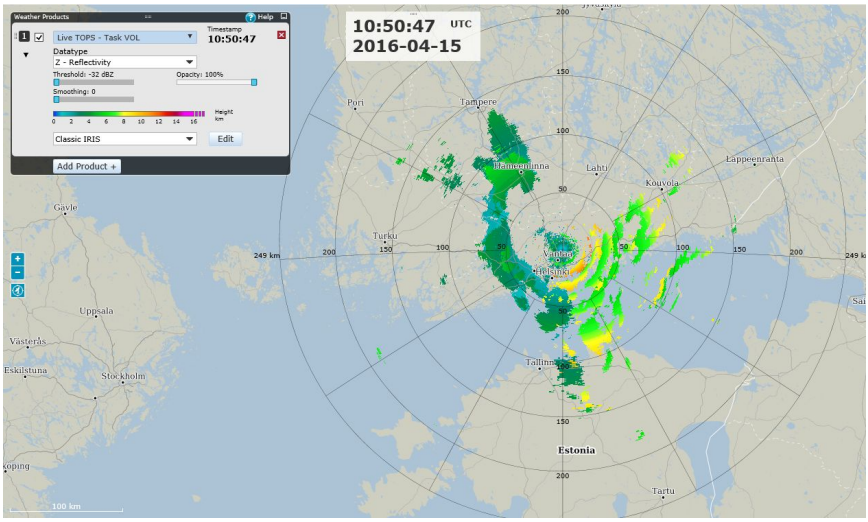


Figure 47 On-demand **TOPS** example

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.

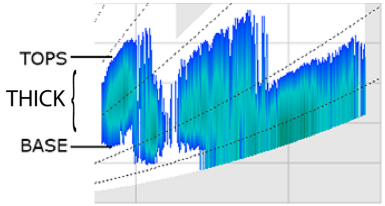


Figure 48 **BASE** and **TOPS** products

More information

- On-demand echo base (BASE) (page 55)
- On-demand echo thickness (THICK) (page 68)

4.6.6.1 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.

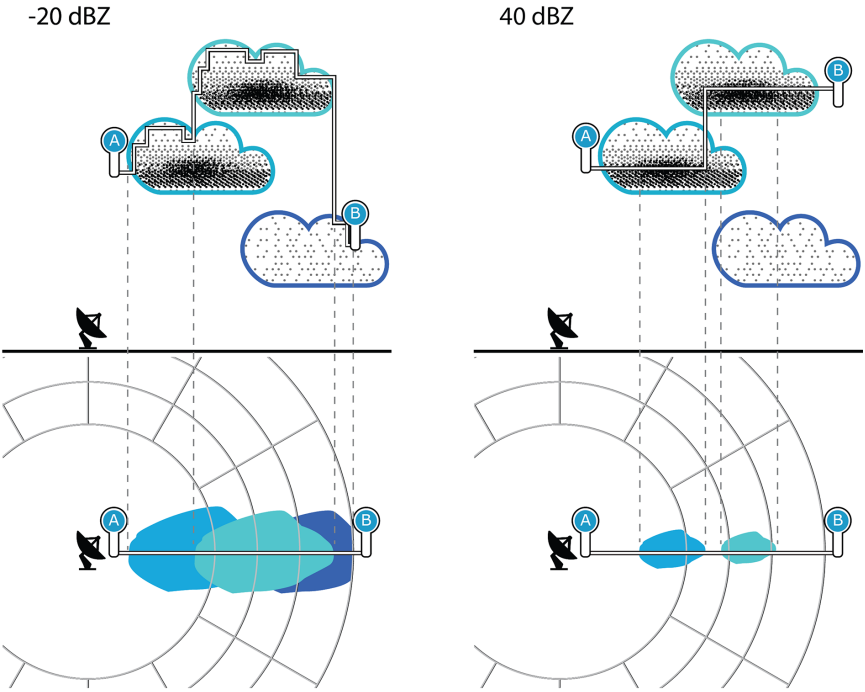


Figure 49 **TOPS** with -20 dBZ and 40 dBZ thresholds

More information

- Radar product reflectivity threshold (page 53)

4.6.6.2 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.

4.7 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 server. The data can be archived to tape or stored on a large disk array.

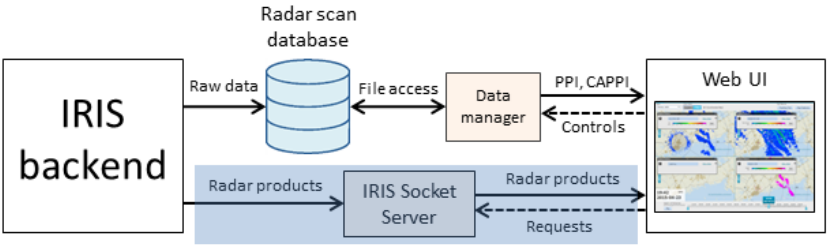


Figure 50 IRIS Analysis product data flow to IRIS Focus

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*.

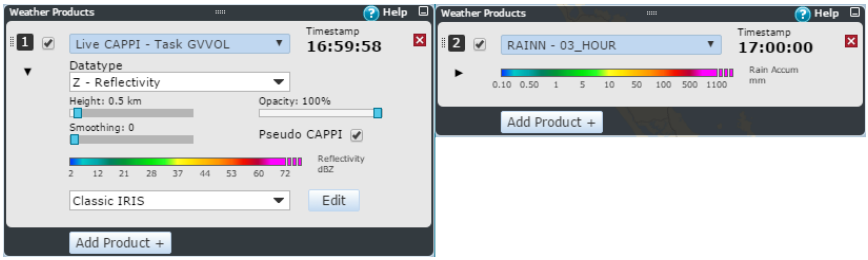


Figure 51 On-demand and IRIS Analysis product settings

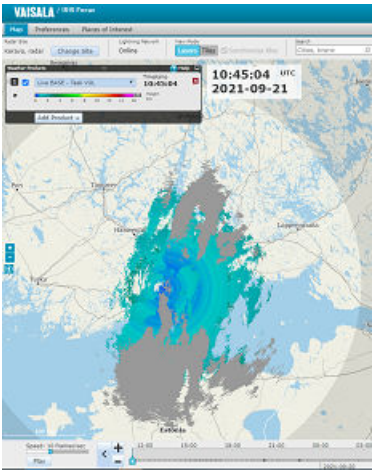
More information

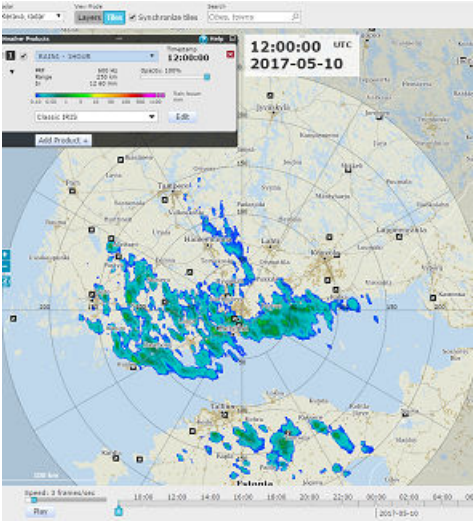
- IRIS Focus overview (page 9)
- Radar product codes (page 50)
- Data types (page 48)

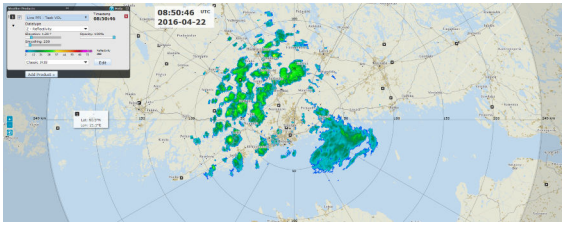
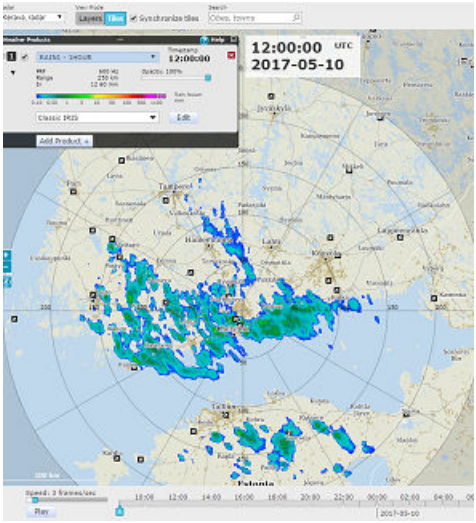
4.7.1 Supported IRIS Analysis products

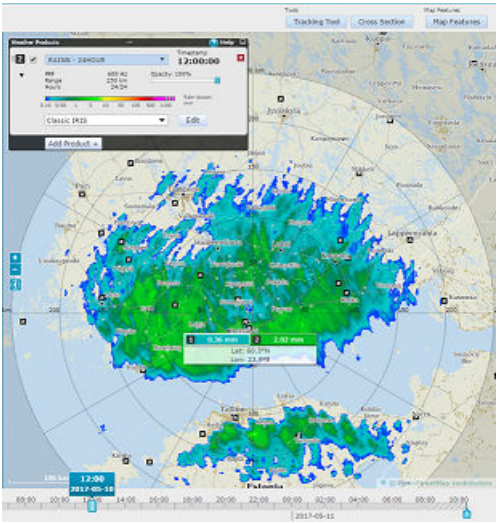
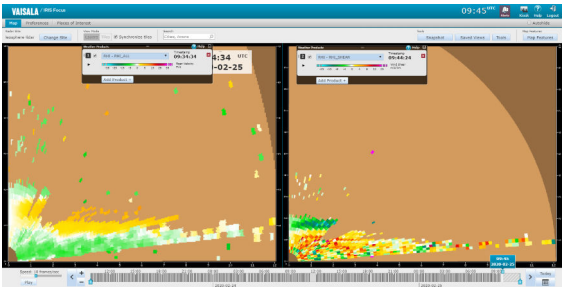
The following tables provide an overview of the IRIS Analysis products supported in IRIS Focus.

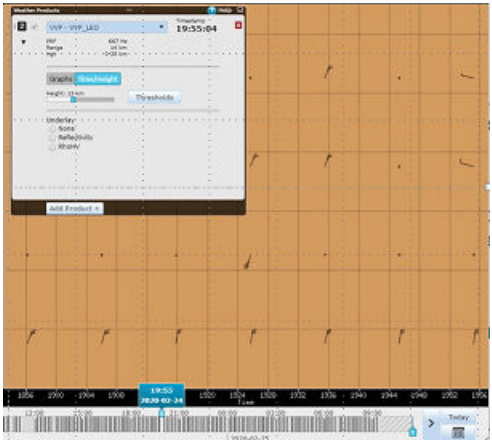
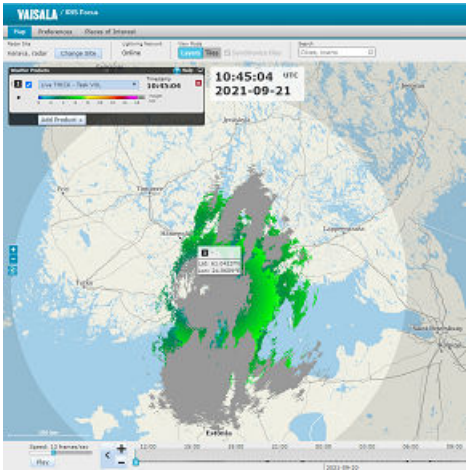
Table 8 IRIS Analysis products supported in IRIS Focus

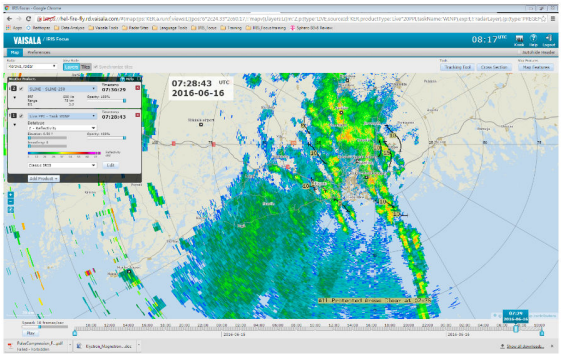
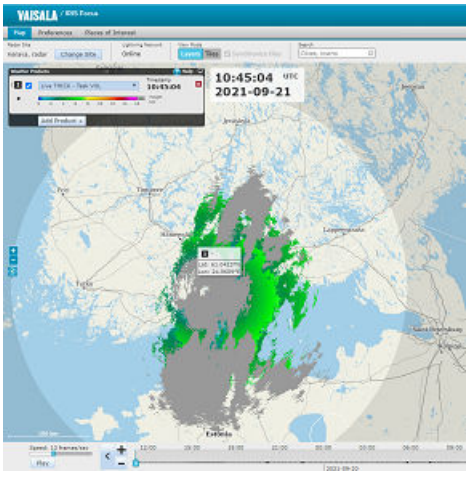
Product	Description
BASE Echo Base	**BASE** is used to determine the base of echoes. 
BEAM Antenna Beam Pattern	**BEAM** is a full screen cross-section format image showing range-averaged intensity in azimuth and elevation coordinates. **BEAM** is used during calibration and alignment and to verify antenna patterns.
CAPPI Constant Altitude PPI	**CAPPI** 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. 
HMAX Height of Maximum Intensity Product	**HMAX** displays the height of the maximum data above each output pixel. This product requires a volume scan.

Product	Description
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.

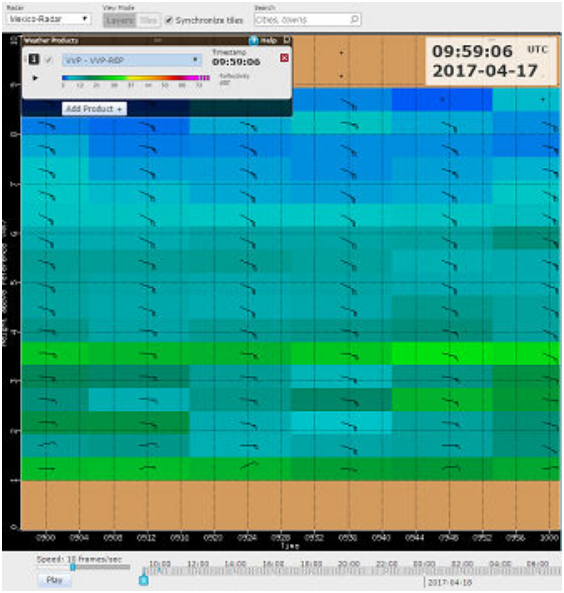
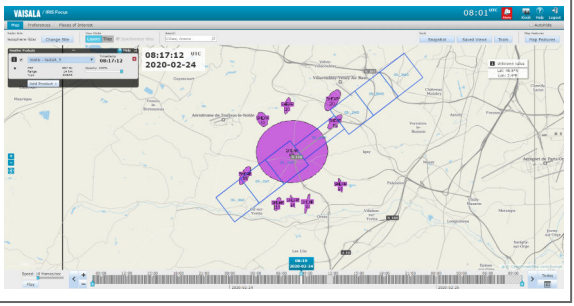
Product	Description
PPI Plan Position Indicator	**PPI** is a full screen image used primarily for weather surveillance purposes. 
RAIN1 Hourly Rain Accumulation	**RAIN1** is hourly rainfall accumulation. 

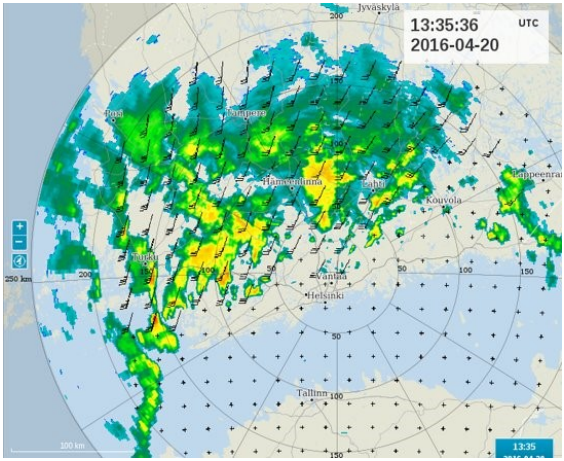
Product	Description
RAINN N-Hour Rain Accumulation	**RAINN** is rainfall accumulation of the last **N** hours, where **N** is selected by the user. 
RHI Range Height Indicator	**RHI** is a full screen image showing the detailed cross-sectional structure of a storm, used for identifying severe storms, hail and bright band. 

Product	Description
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.

Product	Description
SLINE Shear Line (frontal boundary)	**SLINE** marks the transition between two air masses on the image. 
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**. 

Product	Description
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.

Product	Description
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 alerting and centroid plotting. Automatic alerts can be set for areas of interest and user-selectable warning criteria. Output is an alert message and a situation overlay showing the centroid locations of storm features, such as high **VIL** or reflectivity. 

Product	Description
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. 

4.7.2 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.

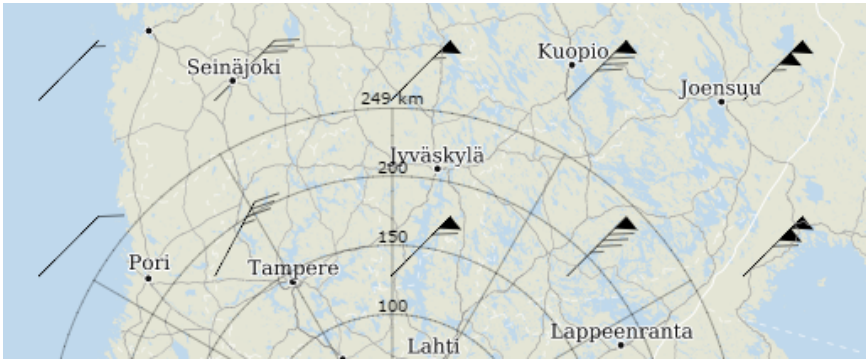


Figure 52 **MVF** example

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 9 **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 37)
- Configuring nowcasting for weather radar products (page 126)

4.7.2.1 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.

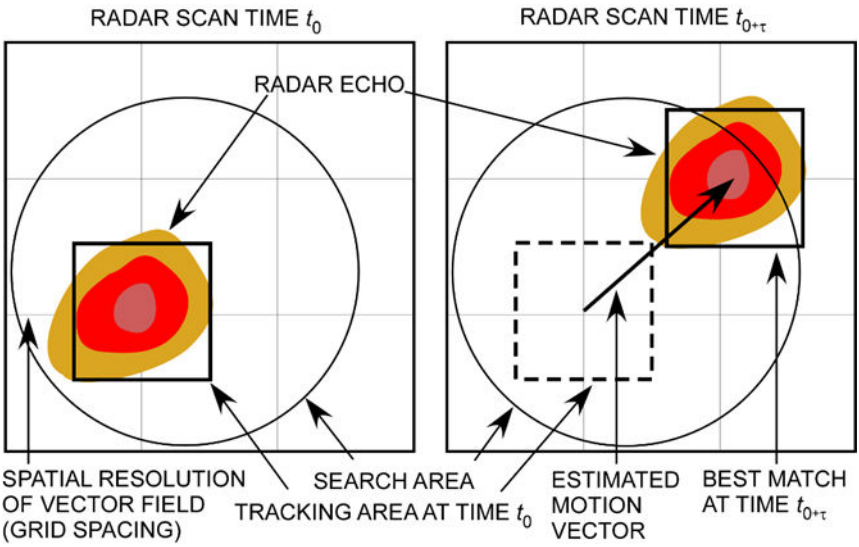


Figure 53 Calculating TREC

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.

4.7.3 Warning/centroid (WARN)

WARN is automatic alerting and centroid plotting.

Automatic alerts can be set for areas of interest and user-selectable warning criteria.

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

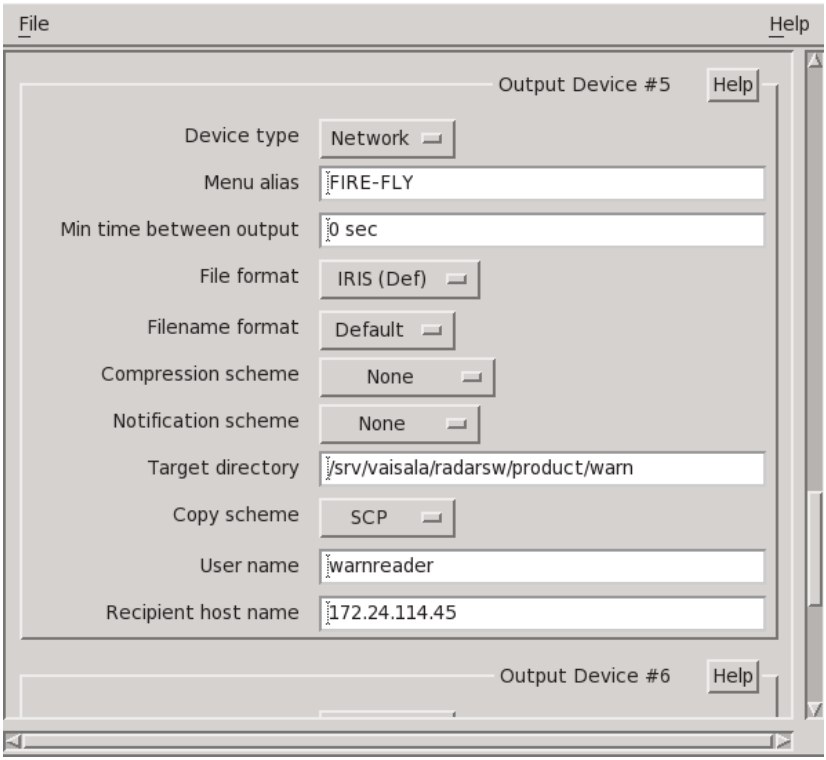
4.7.3.1 Configuring an IRIS output device for WARN products

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.

4.7.3.2 Sending WARN products from IRIS to IRIS Focus

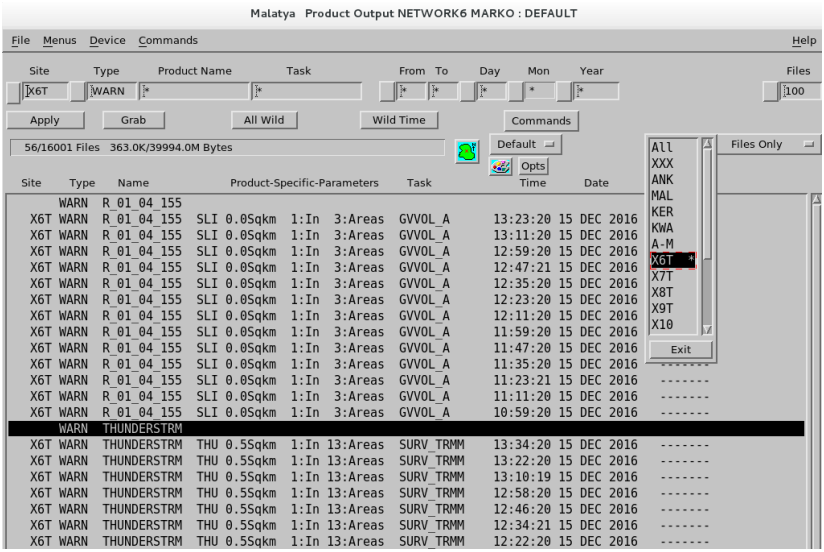
When you have configured and scheduled the **WARN** product, you can start sending **WARN** products over the network to IRIS Focus.

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 86).
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.

5. Lightning products

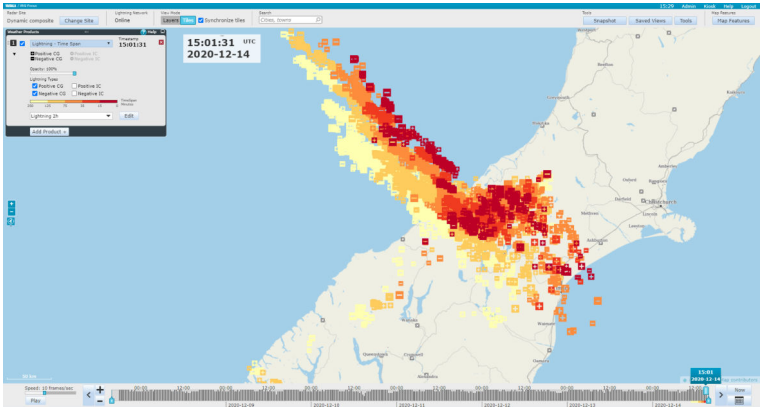
5.1 TimeSpan

The **TimeSpan** product is a data visualization of recent lightning events. It visualizes lightning events as color-coded icons, which change color at user-defined intervals. The size and shape of the lightning icon indicates the type, amplitude, and polarity of the lightning event. You can choose a default or a customized color scheme.

When a new lightning event occurs, it is indicated with an animated circle around the lightning, if you are viewing the current time.

On the timeline, you can view information about lightning events up to 7 days in the past (up to 700k).

The **Total Lightning Processor** can be configured to provide either flashes or strokes to IRIS Focus.



1) Lightning data: courtesy of Transpower New Zealand Ltd.

Figure 54 **TimeSpan** product

More information

- Animation timeline (page 25)
- Color scale editor (page 27)
- Map view (page 17)

5.1.1 TimeSpan product configuration

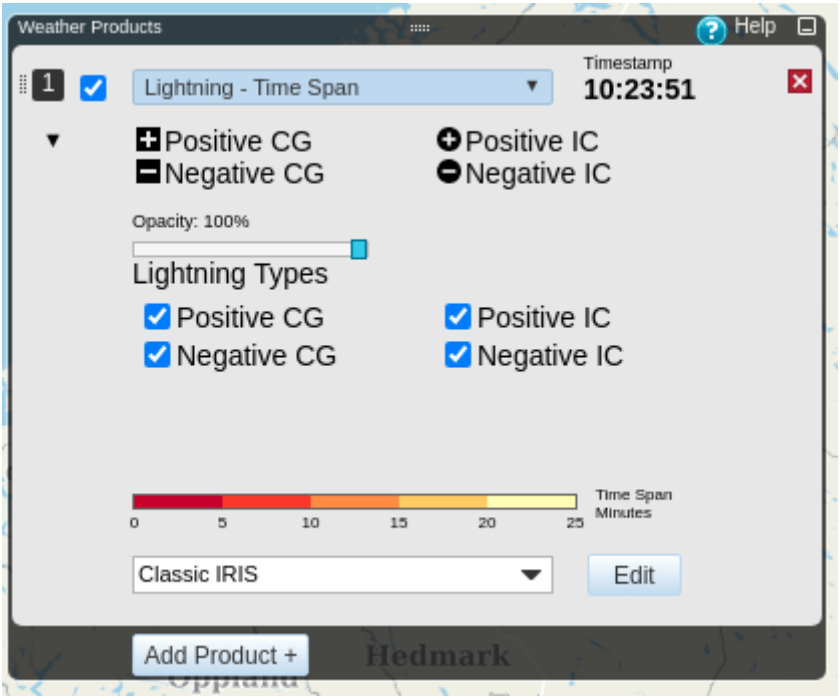


Figure 55 The **TimeSpan** product in the **Weather Products** pane

Choose the product from the **Weather Products** pane.

1. Click **Show details** to show the detailed product settings.
2. Use the **Opacity** slider to adjust the opacity of the TimeSpan layer.

   The opacity can be set in the range of 0 percent (completely transparent) to 100 percent (completely opaque).
3. Choose the lightning types you want to have visualized in **Lightning types**.
4. Choose the color scale from the **Color scale** pulldown bar.

   Click **Edit** to edit the selected color scale.
5. Click **Hide details** to hide the detailed product settings.

5.2 Network Health

5.2.1 Network Health product overview

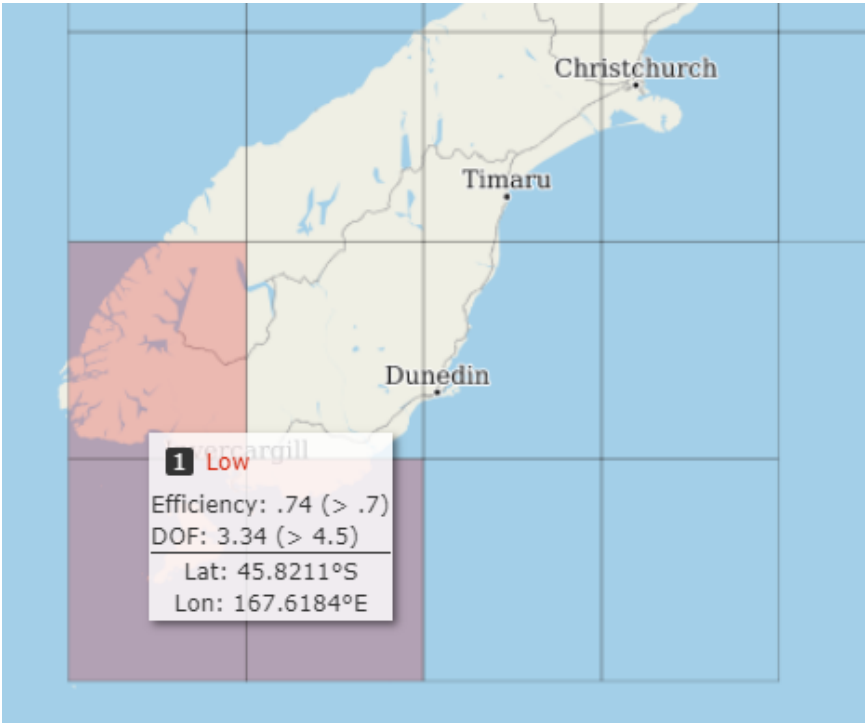
With the **Network Health** product you can visualize the performance of the lightning sensor network. The product uses a color-coded, gridded representation of the performance estimate generated by the **Total Lightning Processor**.

Performance statistics are obtained in two ways:

- If enough lightning is present in a region, performance metrics are obtained from the lightning location data.
- If lightning is not present, sensor status is based on the sensors that can participate in that region.

A full active display IRIS Focus license with an advanced feature IRIS Lightning Network Health license is required to run the **Network Health** product.

The **Network Health** product data is provided by your local **Total Lightning Processor** system. It uses statistical information derived from the lightning data produced by the system, as well as the status and configuration of LF lightning sensors connected to the TLP. **Network Health** is not available for lightning data brought in from external providers such as the **GLD360**.



1) Lightning data: courtesy of Transpower New Zealand Ltd.

Figure 56 **Network Health** visualization

5.2.2 Visualizing Network Health

The lightning **Network Health** product displays a grid of cells and provides a visual indication as to whether the lightning network has a sufficient detection efficiency (DE) and average degrees of freedom (DOF) for lightning occurring in each cell. If the estimated detection efficiency or average degrees of freedom drops below threshold, the cell will be flagged (filled with a color) indicating that it had low DE or low DOF.

Cells that are flagged should be regarded as being less reliable at detecting lightning events. This does not mean that the network is failing to detect lightning events in the region, just that it is more likely that events will be missed.

1. To view **Network Health** on the map, select it on the weather product pane.
2. Hover your cursor over a cell to see a short description of its status.

3. Use the **Opacity** field to adjust the opacity of the colored cells.

   The opacity can be set in the range of 0 percent (completely transparent) to 100 percent (completely opaque).

You can not adjust the colors or thresholds associated with **Network Health**. These values are determined and set by the system administrator in the *vsoweb-override.ini* file based on the number and spacing of lightning sensors in the network. If **Network Health** is always showing down, ask your system administrator to review the threshold settings.

5.3 GLD360

Vaisala Global Lightning Dataset **GLD360** provides real-time lightning data for accurate, early detection and tracking of severe weather. You can view the **GLD360** data in IRIS Focus as an external WMS layer.

The **GLD360** layer is a visualization of weather data provided by a uniform, global network owned and operated by Vaisala. Cloud-to-ground and cloud lightnings are detected instantly, and data is delivered in less than one minute.

You will have access to a 24/7 stream of lightning data from any location you choose. Similarly to the other external WMS layers, the **GLD360** is an image layer which you can combine with other product layers and map layers.

The **GLD360** layer is re-projected as an azimuthal equidistant projection when viewing a single radar site, and as a Web Mercator projection when viewing several sites.

The detection accuracy of the **GLD360** exceeds other long-range systems, including satellite data. It detects about 8 out of 10 cloud-to-ground lightning flashes worldwide and a significant fraction of cloud lightning flashes, with a location accuracy of 2 to 3 km.

To take the **GLD360** layer into use, the IRIS Focus server must be online, and your organization must have an active subscription to **GLD360** data. A system administrator needs to enable the layer.

More information

- User roles (page 15)
- External WMS product layers (page 22)

6. Weather alerts and places of interest

6.1 Weather events and alerts

IRIS Focus can provide alerts for weather events, such as a severe storm, turbulence, or flood potential, for user-defined areas of interest. You can see the alerts on the map and receive notifications as email and SMS.

In IRIS Focus, a *weather event* means a user-defined set of weather-related criteria. When an event occurs on the map, it is shown as an icon.

A weather event triggers an *alert* when it occurs within an area of interest. Users can receive notifications when alerts are triggered.

An *area of interest* is a user-defined area where the user wants to see alerts for certain weather events.

6.1.1 Alerts workflow

First, a **poweruser** creates weather events by defining relevant meteorological criteria. The list of these weather events will be available to all users when they create areas of interest.

Next, users must create areas of interest, and select which weather events to monitor within each area. The selected weather events will trigger alerts when they occur within the area.

When creating an area of interest, the user can select the severity level of the alerts that are triggered within that area.

More information

- Configuring weather events (page 117)

6.1.2 Alerts on the screen

When a weather event triggers an alert, both the weather event icon and area of interest appear in a different color on the map. 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.

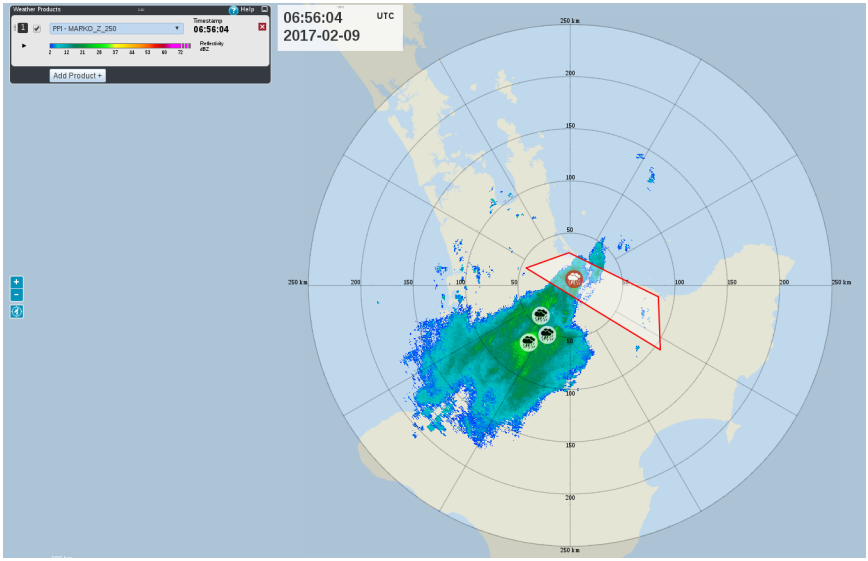


Figure 57 Viewing events and alerts

The number of active alerts is shown on the **Alerts** button at the upper right corner of the screen. Click the button to see a list of alerts.

Figure 58 Alerts button showing 10 active alerts

6.1.3 Alert severities

When creating an area of interest, you can select the severity of the alerts triggered on that area.

The options are:

- Information (blue icon): lowest level of alert
- Warning (yellow icon): middle level of alert
- Alarm (red icon): highest level of alert

For example, on a very critical area, you might want to set the most severe alert, alarm. On the other hand, on a less critical area, you might like to set a less severe alert: a warning or just an information alert. For example, if you are monitoring an airport, you could draw three circles of various sizes around it, and assign a different severity to each of them: the highest severity in the middle, closest to the airport, and lower severities on the edges, further away from the airport.

When alerts are triggered, the area changes color.

Following the progress of a weather event

You can use different alert severities to easily follow the progress of a weather event:

Draw areas of interest around an important location on the map. Select different alert severities for these areas: for example, **Alarm** (highest severity) for the area closest to the location, and **Warning** for an area farther away. Now, as a weather event approaches the location, you will first receive the **Warning**, and then the **Alarm**.

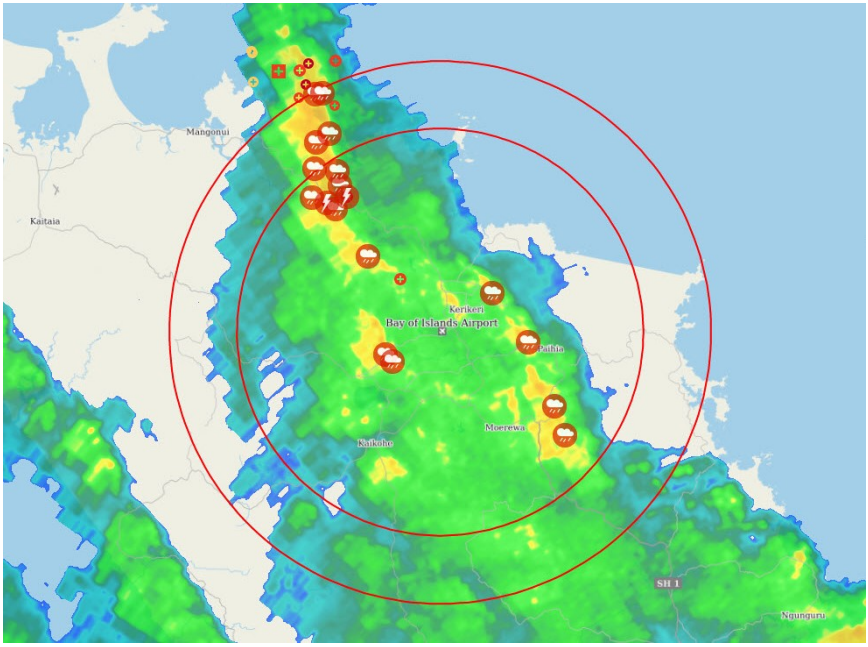


Figure 59 Alerts on areas of interest

More information

- Configuring weather events (page 117)

6.1.4 Alert notifications

IRIS Focus can send notifications to users when an alert is triggered within an area of interest. All users with a **focus** role can configure notifications for their personal areas of interest. Users with **poweruser** role can configure notifications for organization-level areas of interest.

The types of notifications available are sound, SMS, and email.

For personal areas of interest, only the user who created the area will receive notifications. For organization-level areas of interest, the **poweruser** can configure the system to send notifications to selected people.

The user will receive a notification when the area of interest goes into an active alert state, and the user can specify whether to receive a notification when the area is cleared of alerts.

To make sure users hear the sound notifications right away when alerts are triggered, enable the web browser to play sounds by default.

Notification settings for areas of interest

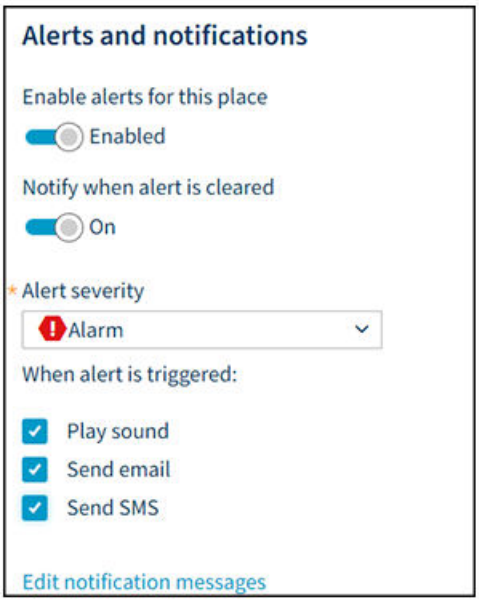


Figure 60 Notification settings in the Area of interest tab

Personal preferences for notifications

You can use the settings in the **Preferences** tab to define whether you will receive alert notifications. For example, you might like to turn the notifications off when you go on a vacation.

If you are on a distribution list to receive notifications from organization-level areas of interest, you will receive those notifications even if you have disabled notifications in **Preferences**. This setting only applies to notifications that have your individual email address or phone number as a recipient (such as **`firstname.lastname@organization.com`**), not to notifications that have a distribution list as a recipient (such as **`all-meteorologists@organization.com`**).

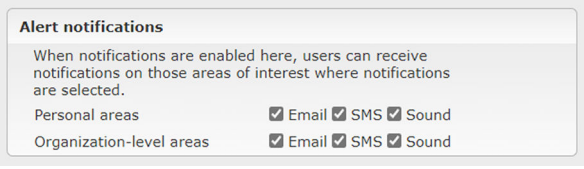


Figure 61 Notification settings in the **Preferences** tab

More information

- Configuring alert notifications (page 103)

6.1.5 Weather event generation

When a weather event is linked to one or more areas of interest, IRIS Focus starts to monitor the weather data to look for conditions where all the criteria of the weather event are met. In the case of weather radar data, IRIS Focus monitors the data received from all the radars in range. When IRIS Focus finds a match, it produces a weather event and shows it on the map.

If a weather event is not linked to any area of interest, IRIS Focus does not run comparison checks for that event, and this, does not display the event icon on the map.

Weather alerts related to radar data 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 cleared.

6.1.6 Required user roles

The table shows the required user roles (**`user/kiosk`**, **`focus`**, or **`poweruser`**) for working with weather events, alerts, and areas of interest.

To see alerts on the map and the alert history, you need to have a **focus** role. For receiving notifications as email or SMS, there are no limitations.

Table 10 Required user roles

Action	user/kiosk	focus	poweruser
Create weather events	--	--	✓
Create, edit, or delete organization-level areas of interest and pins	--	--	✓
Link weather events to organization-level areas of interest	--	--	✓
View organization-level areas of interest and pins	✓	✓	✓
View alerts on map for organization-level areas of interest	--	✓	✓
Create, edit, or delete personal areas of interest and pins	--	✓	--
Link weather events to personal areas of interest to see alerts	--	✓	--
Add recipients for alert notifications for organization-level areas of interest	--	--	✓
Receive alert notifications for organization-level areas of interest	✓	✓	✓
Receive alert notifications for their own personal areas of interest	--	✓	--

If you have the **poweruser** role, all the areas of interest that you create become organization-level areas.

More information

- User roles (page 15)

6.2 Places of interest

In IRIS Focus, a place of interest may be either an *area of interest* or a *pin* (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 you can monitor for weather events.

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

Organization-level areas of interest

Organization-level areas of interest, and alerts triggered in them, are visible to all `focus` users within the organization.

Only users assigned a `poweruser` role can create, edit, or delete organization-level areas of interest, and link weather events to these areas.

`powerusers` can also define a list of recipients who will receive notification when alerts are triggered in an organization-level area of interest.

Personal areas of interest

Users assigned a `focus` role can create, edit, and delete their own personal areas of interest. (Exception: areas created by a user who also has the `poweruser` role become organization-level areas.)

Personal areas of interest are only visible to the user who created them. Alerts triggered on these areas are also only visible to the user who created the area.

More information

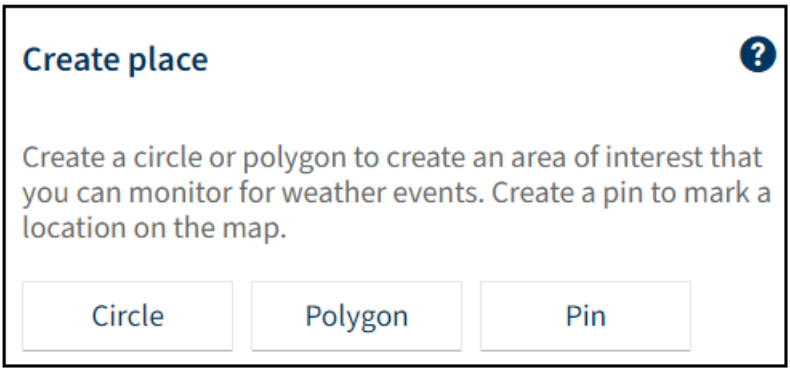
- Pinning locations on the map (page 113)

6.2.1 Creating areas of interest

1. Select **Places of interest**.

   The **Places of interest** pane opens.

2. Select the type of area you want to create: **Polygon** or **Circle**.

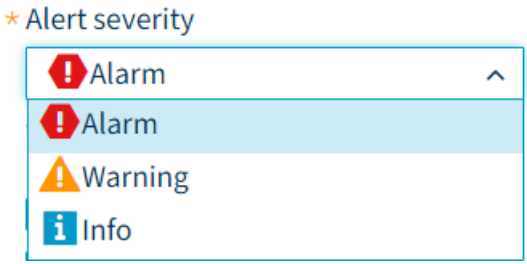


3. Draw the area on the map.
4. Give the area of interest a unique name.
5. If you want to show the area name on the map, select **Show name on map** .

6. Configure alert settings for the area.
   a. Select whether you want to enable alerts within this area.

   CAUTION! If the **Enable alerts in this area** checkbox is not selected, you will not receive weather alerts for the area.

   b. Select the severity of alerts triggered on this area in the **Alert severity** drop-down list.



   The options are:
   - **Information**: lowest level of alert
   - **Warning**: middle level of alert
   - **Alarm**: highest level of alert

   c. Configure **Alert notifications**.

   Select what kind of notification you want to receive for alerts in this area, and fill in the message texts.
   If you are a **poweruser**, you can also add other people as recipients.

7. Select the weather events that you want to monitor in this area. When the monitored weather event occurs in this area, an alert is triggered.

   The weather events are created in the system by `poweruser`.

8. Select **Save**.

More information

- Drawing circles (page 106)
- Drawing polygons (page 107)
- Showing and hiding places of interest on the map (page 109)

6.2.1.1 Configuring alert notifications

You can select the type of notifications you want to receive: sound, SMS, or email. For email and SMS, the administrator has created default content, but you can replace it with your own text.

To receive notifications, you also need to have notifications enabled in your personal **Preferences**.

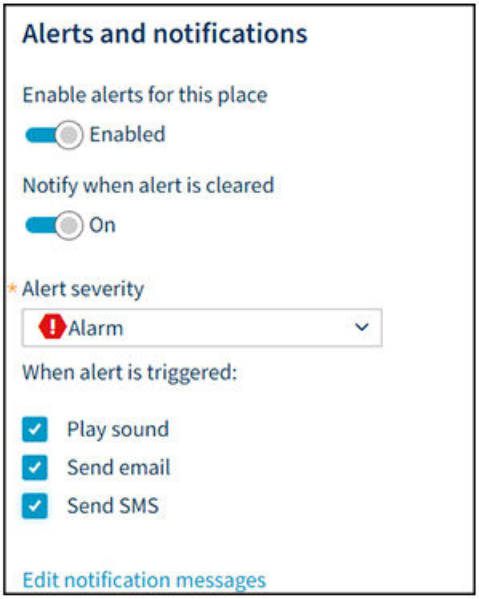


Figure 62 Notification settings in the Area of interest tab

1. Select an area of interest.
2. Select the notifications you want IRIS Focus to send when an alert is triggered.
3. Select whether IRIS Focus sends notifications when the alert is cleared.
4. Select **Edit notification messages**, and fill in the message fields.

   If you do not type in any message, the default content defined by the **admin** user will be used.
5. Select **Save**.

Table 11 Email message field

Field	Description
Email to	Default: the address set for the user account of the user who created the area of interest. If the user only has the **focus** user role, then only the user can receive the notification. If the user has the **poweruser** role, the user can add other recipients.
Email subject	You can use macros to fill in information, such as the severity of the alert and the name of the area of interest.
Email text (HTML)	The content of the email. You can use macros to fill in information.
Email text (plain text)	The content of the email. You can use macros to fill in information. Use this field if the recipients' devices do not support HTML. If you are using an email-to-SMS service, and some recipients' phones do not support HTML formatting, use the SMS message fields instead of the email message fields.
Email subject when cleared	The subject of the email that is sent when the alert is cleared. You can use macros to fill in information.
Email text when cleared (HTML)	The content of the email that is sent when the alert is cleared. You can use macros to fill in information.
Email text when cleared (plain text)	The content of the email that is sent when the alert is cleared. You can use macros to fill in information. Use this field if the recipients' devices do not support HTML. If you are using an email-to-SMS service, and some recipients' phones do not support HTML formatting, use the SMS message fields instead of the email message fields.

Table 12 SMS message fields

Field	Description
Send to	Default: the number set for the user account of the user who created the area of interest. If the user only has the **focus** user role, then only the user can receive the notification. If the user has the **poweruser** role, the user can add other recipients.
SMS text	You can use macros to fill in information, such as the severity of the alert, and the name of the area of interest. Character limit: 160 Messages that exceed the character limit (160 characters) will be broken up into multiple messages.
SMS text when cleared	The content of the SMS that is sent when the alert is cleared. You can use macros to fill in information.

6.2.1.2 Enabling or disabling alerts in an area of interest

The **Enable alerts in this area** 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 **Enable alerts in this area** checkbox is not selected, you will not receive weather alerts for the area.

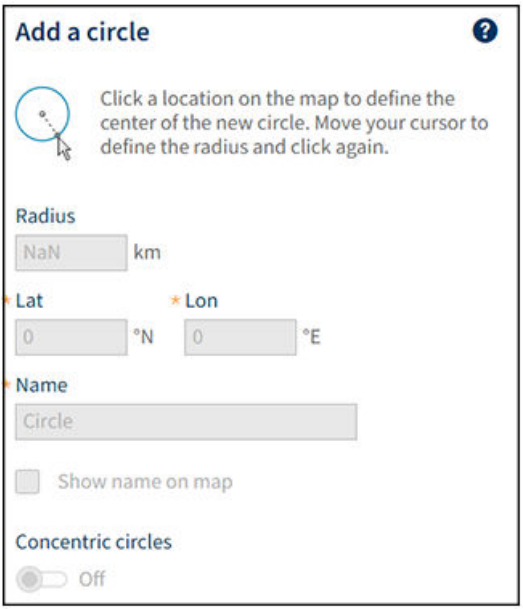
1. Select **Places of interest**.

   The **Places of interest** pane opens.
2. In the area of interest configuration pane, update the **Enable alerts in this area** setting.
3. Select **Save**.

More information

- Showing and hiding places of interest on the map (page 109)

6.2.1.3 Drawing circles



1. Select **Places of interest**.

   The **Places of interest** pane opens.
2. Select **Circle**.
3. 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. Move the mouse to define the radius of the circle, and click again.
   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.
4. After drawing the circle, you can also modify it by filling in the exact radius and coordinates. IRIS Focus uses the WGS84 coordinate system.
5. Give the area of interest a unique name.

6. To show concentric circles between the center point and the outer edge of the area of interest circle, set the **Concentric circles** toggle button On.

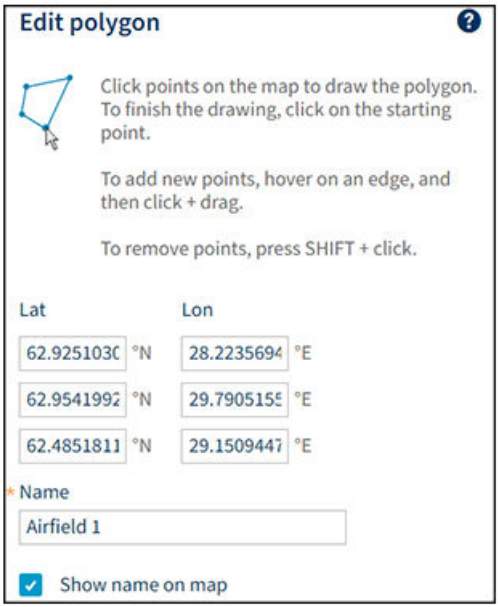
> Concentric circles are a visual aid for viewing the area. They do not have an impact on the alerting functionality.

7. Select **Save**.

More information

- Creating areas of interest (page 100)

6.2.1.4 Drawing polygons



1. Select **Places of interest**.

   The **Places of interest** pane opens.

2. Select **Polygon** to create a new area.
   a. To form the polygon, click points on the map.
   b. To close the polygon, click the starting point.

   After drawing the initial polygon, you can modify the polygon by filling in the exact coordinates. IRIS Focus uses the WGS84 coordinate system.
3. Give the area of interest a unique name.
4. Continue editing the polygon as needed:
   a. To add new points to a polygon, 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.
   c. To remove points, click **X** next to the point coordinates.
5. Select **Save**.

More information

- Creating areas of interest (page 100)

6.2.1.5 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**.

6.2.1.6 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**.

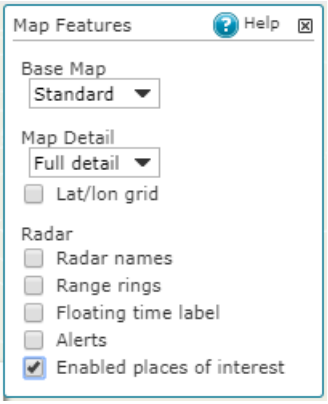
The area of interest is removed from the IRIS Focus display.

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

6.2.2 Showing and hiding places of interest on the map

You can select whether areas of interest and pins are shown on the map.

If alerts are enabled for an area of interest, you will receive weather alerts in the area even if the area is not shown on the map.



To see pins and areas of interest on the map, do the following:

1. Select **Map Features**.
2. Select **Enabled places of interest**.

More information

- Creating areas of interest (page 100)
- Enabling or disabling alerts in an area of interest (page 105)
- Showing events and alerts on the map (page 110)

6.3 Add events to areas of interest to receive alerts

You can select which weather events you want to monitor in an area of interest. The selected weather events will trigger alerts when they occur within the area of interest.

1. Select **Places of interest**.

   The **Places of interest** pane opens.
2. In the **Places of interest** pane, select an existing area of interest, or create a new one.

   A window with settings for the area of interest opens.
3. In the **Events** section, select **Add events**.

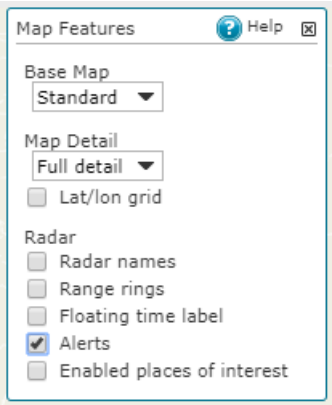
   The list of available weather events opens. These are weather events created for the organization by a **poweruser**.
4. Select the weather events that you want to monitor in this area from the list.

   Make sure the products listed in the weather event criteria are available for the area of interest.
   If the products are unavailable, the criteria for triggering an alert cannot be met.
5. Select **Save**.

6.4 Showing events and alert on the map

If you do not see event icons and alert on the map, check the following:

1. The **Alerts** checkbox must be selected in the **Map Features** pane.



> The **Alert history** pane, which you can open with the **Alerts** button, is always active. It lists weather alerts even if the **Alerts** checkbox is not selected in the **Map Features** pane.

2. In the settings of the area of interest, you must select which weather events you want to monitor on that area. If a weather event is not selected for any area, it is not displayed on the map.
3. The **Enable alerts in this area** checkbox must be selected for the area on interest. If it is not selected, no alerts will be triggered on the area.
4. In case of weather radar data, you must select the correct radar site for the area (not composite), and have the correct task selected for the radar.

More information

- Showing and hiding places of interest on the map (page 109)
- Configuring weather events (page 117)

6.5 Acknowledging weather alerts

The acknowledgement records who has seen an alert and when.

> Acknowledging alerts has no effect on the alert status.

1. Click the **Alerts** button.

The **Alert history** pane opens.

2. In the **Alert history** pane, click **Acknowledge**.

6.6 Alert history

You can view both the currently active and previous alerts in the **Alert history** view. To open the view, select the **Alert history** tab.

You can see alerts from both your personal areas of interest and from organization-level areas of interest. You can search alerts by key words, such as the weather event name, or from a certain period of time. You can filter the list to see either the active or inactive alerts, or all alerts. Click on an alert to see more details about it.

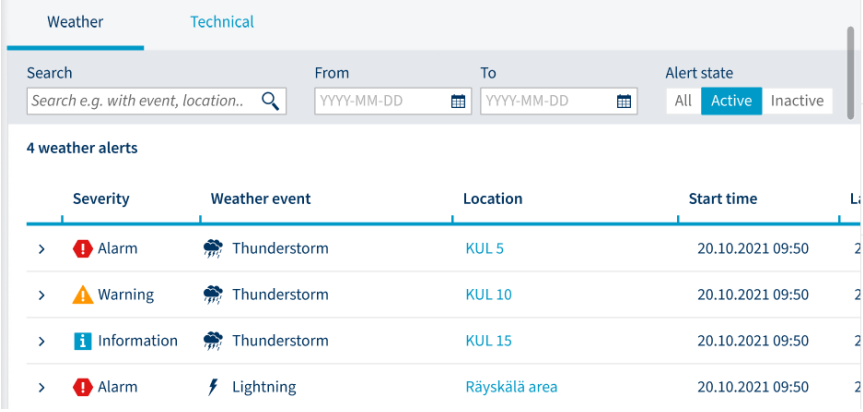


Figure 63 Alert history view

For alerts that were configured by a user with the **`poweruser`** role, the **owner** column says "organization".

By default, the view shows alerts from the past 72 hours.

You can export the alert list into a CSV, XLS, or HTML file.

In addition to weather-related alerts, the history view has a tab for technical alerts. These are mainly intended for system administrators. Technical alerts are related to, for example, dataflow problems.

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 using the event criteria setting at the time the event was recorded.
- 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.

6.7 Example weather alert symbols

The following table shows some examples of the weather event and alert icons available in IRIS Focus. When creating a weather event, the **poweruser** can assign any icon to the event.

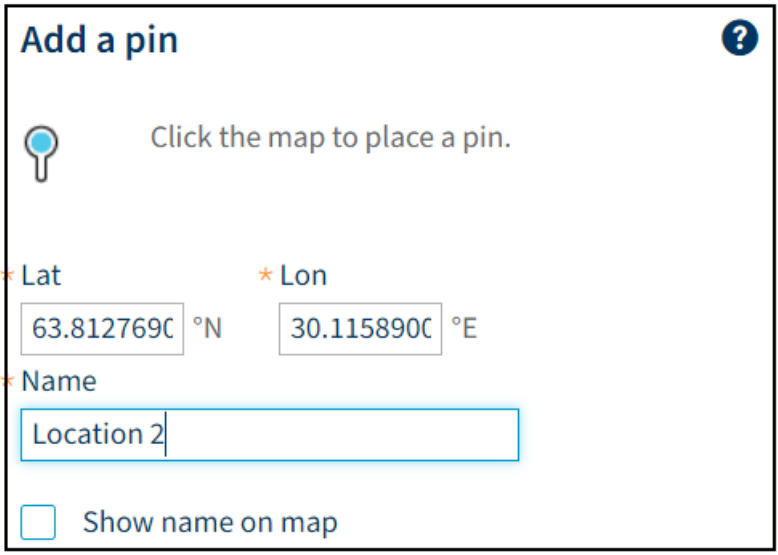
Table 13 IRIS Focus event and alert icon examples

Example	IRIS Focus event icon	IRIS Focus alert icon
Downburst		
Hail		
Wind		
Other value		

6.8 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 monitor pins for weather events 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 name on map**.
6. Select **Save**.

More information

- Places of interest (page 99)

6.8.1 Showing and hiding pins on the map

The **Show pin on map** 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 **Show pin on map** setting.
3. Select **Save**.

6.8.2 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.

7. Poweruser tasks

7.1 Creating weather events

You must create weather events to enable weather alerts in IRIS Focus. Users can then add the weather events to areas of interest, and see alerts when the events occur on the area.

To be effective, weather event 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 alert 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 creating weather events

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

IRIS Focus classifies weather conditions as a weather event only if the recorded values are smaller/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.

For the example above, IRIS Focus calculates the event criteria to identify hail as follows:

1. IRIS Focus thresholds 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. IRIS Focus smoothes and connects the significant weather regions that are almost touching, and eliminates 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. IRIS Focus determines whether any part of any region is within an area of interest.
5. IRIS Focus shows the significant weather, hail, as a weather event outside areas of interest or as an alert within areas of interest.

More information

- Weather events and alerts (page 94)

7.1.1 Configuring weather events

You must be assigned a **poweruser** role to configure weather events.

A weather event is created by defining a set of criteria.

When significant weather occurs so that all the criteria of the weather event are met, the weather event icon is shown on the map. For example, in the case of the weather event in image Figure 64 (page 118), this happens when the defined criteria for both Lightning and CAPPI data types are met.

Figure 64 Weather event "Thunderstorm"

1. Log in to IRIS Focus as **poweruser**.
2. Select **Places of interest > Events**.
3. In the **Events** tab, select **Create event**.
4. Give the event a descriptive name, and a code.

   The code is typically used in the context of aviation.
5. Select an icon from the drop-down list.

   This icon is shown on the map when a weather event occurs.

6. Define the event criteria.
   a. Select a product from the drop-down list (for example: Lightning, PPI, RAINN).

      The rest of the available event criteria depends on the product you select.

   b. Define the other criteria for the product (for example: data type, thresholds).

      See Table 14 (page 119).

      The list of data types shows data types currently available in your system.

7. You can select several products to add more criteria.

   Vaisala recommends using up to 3 products as criteria.

   All the criteria are included in the event using the **AND** condition. That is, all the criteria must be met in order for IRIS Focus to identify a weather condition as a weather event, and trigger alerts.
   To use the **OR** condition, create another event and apply it to the same area of interest.

8. Select **Save**.

Table 14 Descriptions of weather event criteria

Criterion	Description
Minimum area	Minimum size of the event (in km^2). Weather events that are smaller than this do not trigger alerts. This criterion is only applicable for products based on weather radar data. This criterion means the size of the weather event on the map, not the size of a related area of interest. If you set the alert area to 0 km^2, you may see lots of event icons for what is essentially one weather event, as every unconnected pixel exceeds the threshold and is counted as a separate event.

Criterion	Description
Minimum time	Defines how long the weather criteria must persist in an area of interest. IRIS Focus creates 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. This criterion is only applicable for products based on weather radar data. Vaisala recommends setting **Minimum time** value to **0**. If the value is higher than 0, you will not get an alert for the first instance of the event on the area of interest. You will only get the alert when IRIS Focus receives the next instance of the product; this may be in 15 minutes or later, depending on the radar task schedule. This delay may lead to you missing an immediate alert for a significant weather event. You must know your task schedule. In general, if all of your product criteria are based on the same task, set the **Minimum time** time to `00:00:00` so that only data from the same run are used.
Number of lightning strikes	Defines how many lightning strikes must occur within a certain time frame to trigger an alert. Only applicable for TLP-based lightning data. If you create an event for lightning where the alert is triggered after several strikes, then after the alert has been triggered, any further lightning strikes (even just one) will cause the alert to persist. A lightning strike here refers to either a flash or a stroke, depending on the configuration on the TLP.
Time to clear alert after last strike	When there have been no lightning strikes for the time defined in this field, the alert is cleared. If the criteria of a weather events includes both weather radar based products and TLP-based lightning data, the alert clearing time is defined by the weather radar data (default weather radar alert clear time is 20 minutes.)

Table 15 Task schedule considerations

On-demand products	IRIS Analysis products
IRIS Focus records when the event starts and continues monitoring for a 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 see if a radar is producing the requested IRIS Analysis product.

More information

- Showing events and alerts on the map (page 110)

7.1.2 Example events

The following table shows some examples of weather events and their criteria.

In the table, each criterion is surrounded by square brackets. Multiple criteria or event tasks are linked with **AND** operators.

Table 16 Example event criteria

Weather event	Example criteria

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

Weather event	Example criteria
Flash flood detection	`[Hourly Rainfall or N-Hour Rainfall >5 mm]` over an area of 25 km^2

Lightning detection	`[Lightning Positive CG and Negative CG`
	`1 lightning strike to trigger an alert`
	`Time to clear alert after no new strikes 10 min]`

7.1.3 Example weather alert symbols

The following table shows some examples of the weather event and alert icons available in IRIS Focus. When creating a weather event, the **poweruser** can assign any icon to the event.

Table 17 IRIS Focus event and alert icon examples

Example	IRIS Focus event icon	IRIS Focus alert icon
Downburst		
Hail		
Wind		
Other value		

7.2 Configuring radar 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.

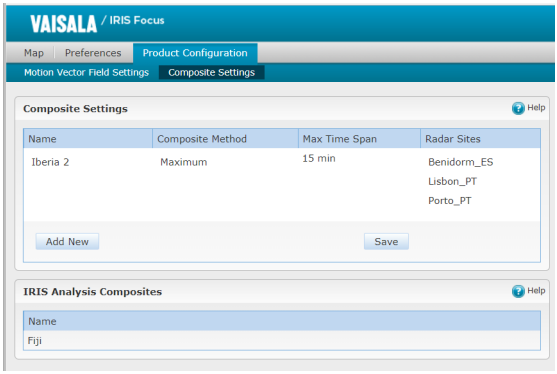


Figure 65 Composite settings

7.2.1 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 36).
6. Define the **Max Time Span** for the composite.

   See Max Time Span (page 124).
7. Under **Radar Sites**, select the sites you want to include in the composite.
8. Select **Save**.

7.2.2 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**.

7.2.3 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**.

7.2.4 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*.

7.2.5 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'.

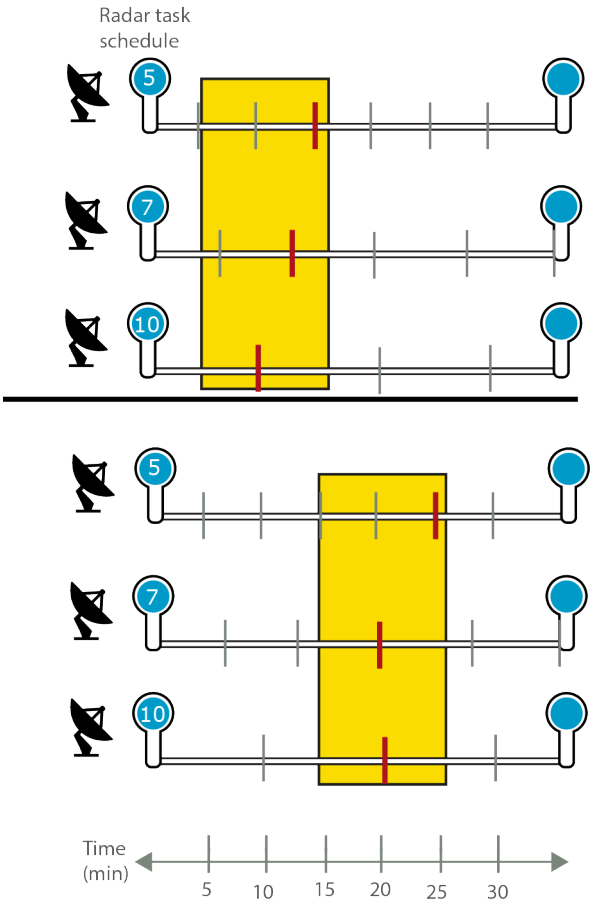


Figure 66 10 minute **Max Time Span**

7.2.6 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.

7.3 Configuring nowcasting for weather radar products

Weather radar data nowcasting is enabled by default with the IRIS Radar Nowcast license. 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.

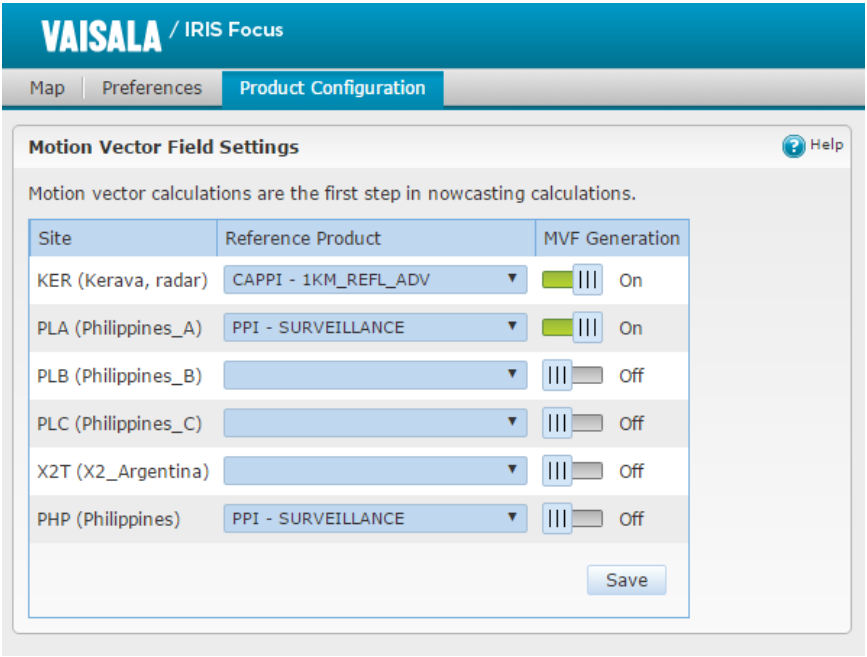
More information

- Configuring MVF (page 126)
- nowcast.ini (page 139)

7.3.1 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 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 139)

7.3.2 Configuring nowcast

You must have a nowcasting license to use nowcasting in IRIS Focus.
See IRIS Focus licensing (page 12).

If you have a license for the nowcast service, you can enable the IRIS Focus web application to make nowcast projections available in the web interface.

To do this, you may need to make changes to the *`vsoweb-override.ini`* file found in the /etc/vaisala/radarsw/configuration directory.

1. Log in to the server as **`root`**.
2. Edit */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:31000/focus-nowcast/api/v2/mvf/
   ```

5. If you made any changes to the **vsoweb-orverride.ini** configuration file, you must restart the web application.

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

7.3.3 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)
```

7.3.4 Stopping the Nowcast server

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

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

7.3.5 Restarting the Nowcast server

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

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

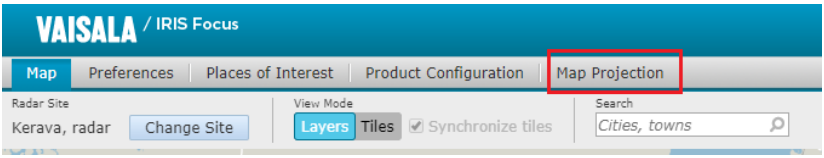
7.4 Selecting map projection

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.

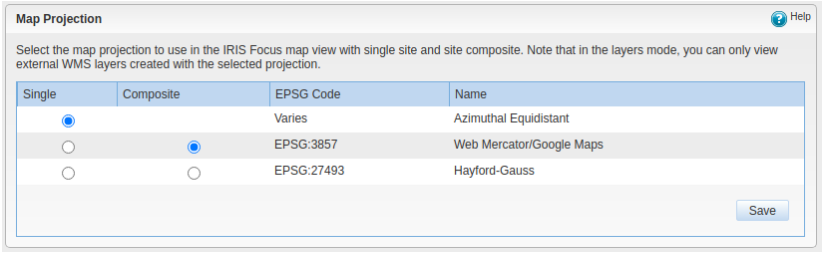
This functionality only works with weather radar products.

WMS layers are only available in certain projections. You can only view those external WMS layers that support the projection you are currently viewing.

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**.

8. Configuration

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

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

More information

- IRIS Focus licensing (page 12)

8.2 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 to display only completed volume scans, follow these steps:

1. Log in to the server 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.

8.3 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.

8.3.1 Exporting images as .png files

Use this procedure to export images as .png files.

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>/focus-webapp/api/v2/image-export/
getImage
@Produces: "image/png"
```

5. Configure the following parameters:

Parameter	Description
`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: `2021-06-18T17:55:23.000Z`
`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 = "/focus-webapp/api/v2/image-export/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.

8.3.2 Exporting images as .shp files

Use this procedure to export images as shape files (.shp). The output is a zip file containing all the files for the shape file.

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 <server-name>/focus-webapp/api/v2/image-export/shp
   @Produces: "application/octet-stream"
   ```

   The image is exported as a zip file.

5. Configure the following parameters:

Parameter	Description
`username`	A valid IRIS Focus username. For security reasons and for smooth user experience, Vaisala recommends that you configure a specific user for exporting images. If you are using the username of an active user, and that user is logged when a scheduled export takes place, the user will get logged out, because a user cannot be logged in from two machines at the same time.
`password`	IRIS Focus password for the user.
`time`	Time, in ISO-8601 format: `2021-06-18T17:55:23.000Z`
`savedViewName`	The name of the saved view you created.
`savedViewUser`	Optional value. Used if you configure a specific user for exporting images (recommended).

6. Instead of steps 4 and 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/python3
from requests.sessions import Session
from datetime import datetime, timedelta

# Change to host name of IRIS Focus if run externally
APP_URL = "https://localhost"

# User account to login with to render image
USERNAME = "image-export"
PASSWORD = "USER_PASSWORD"

# Name of saved view and user account that created the saved view
VIEW = "SAVED_VIEW_NAME"
VIEW_USER = "USER_THAT_SAVED_VIEW"

# You can change these values
OUTPUT_DIR = '.'   # Directory to write output file to
FILE_BASE_NAME = "image-export" # Name of file sans extension
SSL_VERIFY = False # Set to True if you have a valid certificate
TYPE = "shp"       # Can be "shp" or "geotiff"

# Example of backing up 5 minutes from "now" (no data at time causes
404)
TIME = datetime.utcnow() - timedelta(days=0, hours=0, minutes=5)

def main():
    ext = ".tiff"
    if TYPE == "shp":
        ext = ".zip"
    file_path = OUTPUT_DIR + "/" + FILE_BASE_NAME + ext
```

```
    session = Session()
    time_str = TIME.isoformat()
    url  = APP_URL + "/focus-webapp/api/v2/image-export/" + TYPE
    req_params = {"username": USERNAME, "password": PASSWORD,
                  "time": time_str,
                  "savedViewName": VIEW, "savedViewUser": VIEW_USER}
    res = session.post(url, params=req_params, verify=SSL_VERIFY)
    print('{0} response status: {1}'.format(time_str, res.status_code))
    if res.status_code == 200:
        with open(file_path, 'wb') as f:
            f.write(res.content)
        print('Created file: {0}'.format(file_path))

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/python3
        /path/to/script/image-export.py >> /path/to/log/export.log 2>&1
```

This executes the **`image-export.py`** script every 15 minutes and creates a single ZIP file containing the shape file components.

8.3.3 Exporting images as .geotiff files

You can also export images as geoTIFF files.

The procedure is otherwise similar to Exporting images as .shp files (page 134), but to configure your web server to access the IRIS Focus image export service, use the following command:

```
@Request: POST <server-name>/focus-webapp/api/v2/image-export/geotiff
@Produces: "image/tiff"
```

The image is exported as a ***`.tiff`*** file.

Note that you can use the sample Python script shown in Exporting images as .shp files (page 134) to grab geotiff files by setting the TYPE to "geotiff".

8.4 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.

This functionality is only available for weather radar data, not for lightning 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.

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 126)

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 parameters 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:31000/focus-nowcast/api/v2/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 you can monitor for weather events. If the system detects a weather event within 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 Data Manager, which makes the data available to the IRIS Focus user interface. Through 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
See weather event.

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.

k9s
An easy to use tool for exploring and controlling a Kubernetes cluster.

Kubernetes (k8s)
General name for managing a collection of containers (services) running on a computer (conductor of the programs running on the computer).

lightning strike
In IRIS Focus, a *lightning strike* refers to either a flash or a lightning stroke, depending on the configuration of the TLP.

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.

microk8s
The implementation of Kubernetes run on IRIS Focus.

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
See pulse repetition frequency (PRF).

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.

pulse repetition frequency (PRF)
Number of pulses transmitted per second. When measuring PRF, a *pulse* contains transmit, receive, and dead time phases. PRF affects *range folding* and *velocity folding* detection. In Vaisala IRIS products, PRF limits the area displayed in radar images and the maximum measurable wind speed.

radar 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**.

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.

TLP
See Total Lightning Processor.

Total Lightning Processor
Total Lightning Processor (TLP) is the central processor of a Vaisala Lightning Detection System, which uses multiple, remote sensors to detect lightning. Each sensor sends its data to the central processor.

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.

weather event
A user-defined set of weather-related criteria. When an event occurs on the map, it is shown as an icon. When an event occurs within an area of interest, it triggers an alert.

weather product
Weather products are raw signal data from the TLP or from a radar receiver that are processed to provide information about current weather conditions. Weather products are displayed as layers in IRIS Focus.

WMS
Web Map Service protocol

Index

A

alert....9, 94
  area of interest....100, 108, 109
  configure
    event criteria....117
  criteria, examples....121
  history....112
  icon....94
  notifications....96, 103
  setup....94
  severity....95, 100
  view....94, 110
  weather....111, 116
  weather, criteria....117
algorithm
  BASE....57
  CAPPI....61
  MAX....64
  PPI....67
  TOPS....72
animation
  nowcasting....25
  playback....25
  time line....25
area of interest....9, 99
  alert....110
  circle....106
  delete....108
  draw....100
  edit....108
  enable, disable....105
  group....95
  map display....109
  polygon....107
  remove....108
  show....109
  user roles....98
  weather event....110

B

BASE
  calculating....57
  on-demand....55
  threshold....56
base layers
  roads....19
bin....46
browsers....44

C

CAPPI
  calculating....61
  height....59
  on-demand....57
  pseudo CAPPI....57, 59
circle
  area of interest....106
color scale editor....27, 30
composites
  algorithm....36, 124
  dynamic....34
  dynamic, create....35
  IRIS Analysis....34, 125
  max time span....124
  method....36, 124
  pre-defined....34
  pre-defined, delete....124
  pre-defined, edit....123
  pre-defined, set-up....123
  set-up....124
  view....35
composites, IRIS Analysis....122
composites, pre-defined
  configure....122
constant altitude plan position indicator....57
cross section tool....30
cursor tool....26

D
data flow ... 48
data manager ... 54
data type ... 21, 48

E
Earth curvature ... 46
echo base ... 55
echo thickness ... 68
echo TOPS ... 70
event ... 9, 94
  icon ... 94
  view ... 94
event criteria ... 110

H
historical data ... 9, 25, 137
hybrid task
  partial ... 131
  visualization ... 131
hydrometeor ... 45

I
image export
  .geotiff file ... 137
  .png file ... 132
  .shp file ... 134
  schedule ... 131, 132, 134
IRIS
  product family ... 10
IRIS Analysis ... 48
IRIS Analysis products ... 72
  BASE ... 73
  BEAM ... 73
  CAPPI ... 73
  HMAX ... 73
  LAYER ... 73
  MAX ... 73
  MLHGT ... 73
  PPI ... 73
  RAIN1 ... 73
  RAINN ... 73
  RHI ... 73
  RTI ... 73
  SHEAR ... 73
  SLINE ... 73
  SRI ... 73
  THICK ... 73
  TOPS ... 73
  VAD ... 73
  VIL ... 73
  VVP ... 73
  WARN ... 73, 86
  WIND ... 73
IRIS Focus ... 9
  licensing ... 12
  roles ... 15
  users ... 15
IRIS Radar ... 48

L
layer settings ... 21
licensing
  IRIS Focus ... 12
  IRIS Focus Light ... 12
  seats ... 12
lightning products ... 9, 11
  GLD360 ... 93
  layers ... 20
  Network Health ... 91
  TimeSpan ... 89

M
map
  data ... 17
  pin ... 113
  units, aviation ... 23
  units, imperial ... 23
  units, metric ... 23

view ... 17
map features
area of interest
place of interest ... 109
pin ... 109
map layers
base ... 18
editing base layer ... 19
product ... 18
style ... 19
visibility ... 19
WMS ... 22
map projection ... 129
map tools
color scale editor ... 27
cross section ... 30
cursor ... 26
product colors ... 52
ruler ... 32
tracking ... 33
MAX
calculating ... 64
height ... 63
on-demand ... 61
maximum data ... 61
max time span ... 124
motion vector ... 82
configure ... 126
multiple radars ... 34, 35, 125

N

Network Health ... 92
notifications
configure ... 103
nowcasting ... 9, 25, 37
advection ... 40
advection, settings ... 141
algorithms ... 39
configuration file ... 139, 141
configure ... 126, 128
configure MVF ... 126
enable ... 126
motion vector ... 82
MVF, settings ... 141
server start ... 129
server stop ... 129
TREC ... 84, 139
velocity ... 84

O

on-demand products ... 54
BASE ... 55
BASE, calculating ... 57
CAPPI ... 57
CAPPI, calculating ... 61
MAX ... 61
MAX, calculating ... 64
PPI ... 65
PPI, calculating ... 67
pseudo CAPPI ... 59
reflectivity ... 53
smoothing ... 53
THICK ... 68
THICK, calculating ... 69
threshold ... 53
TOPS ... 70
TOPS, calculating ... 72

P

pin ... 99
delete ... 115
enable, disable ... 114
map ... 113
map display ... 109
place of interest ... 113
remove ... 115
view ... 109
place of interest
area ... 99, 113
map display ... 109

pin....99, 113
show....109
plan position indicator....65
playback....25
polygon
area of interest....107
PPI
calculating....67
elevation....66
on-demand....65
pre-configured products
motion vector....82
pseudo CAPPI....21, 57, 59
pulse....46

R

radar beam....46
radar data....45
radar data, import....137
radar products....9, 45
attributes....21
codes....50
colors....52
layers....20
layer settings....21
radars
add....131
remove....131
radar site....23
radar tasks....48
reflectivity threshold....53
related documents....7
role
administrator....15
focus....15
kiosk....15
poweruser....15
user....15
ruler tool....32

S

saved views....44
smoothing....21, 53
snapshot....32
scheduled image export....131, 132, 134
sweep....46

T

THICK
calculating....69
on-demand....68
threshold....68
threshold....21, 53
time line....25
TimeSpan....89
configuration....90
TOPS
calculating....72
on demand....70
threshold....71
Total Lightning Processor....11, 91
tracking tool....33
trademarks....7

U

users
accounts....15
administrator....15
areas of interest....98
manage....15
weather events....98

V

version information....7
volume....46

W

WARN
IRIS Analysis....86
output device....86

send from IRIS..... 87
weather alert
acknowledge..... 111
criteria..... 116
criteria, configure..... 117
criteria, examples..... 121
icons..... 113, 122
monitor..... 110
view..... 110
weather event
configure..... 117
create..... 116
criteria..... 116
examples..... 121
follow progress..... 95
generate..... 98
user roles..... 98
view..... 110

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 according to local regulations.

VAISALA

www.vaisala.com