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USER GUIDE

CL61

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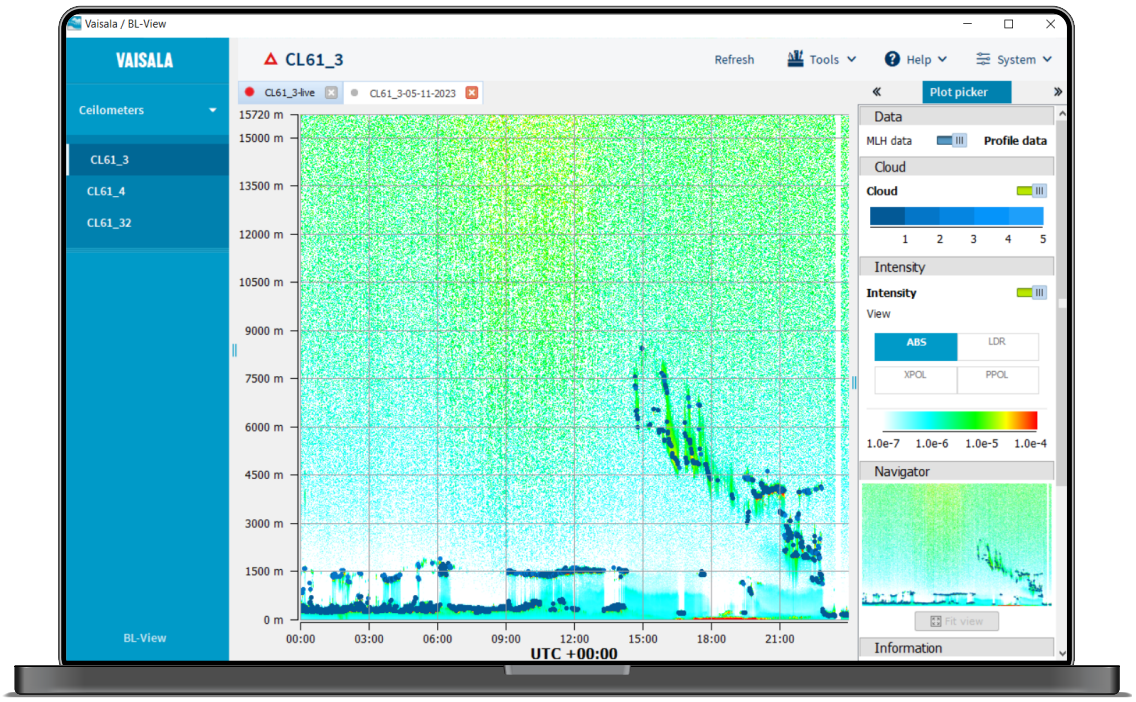
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M212721EN-D

User Guide

Vaisala Boundary Layer View Software
BL-View for CL61



VAISALA

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1. About this document

1.1 Version information

This document provides information for installing, configuring, and using Vaisala Boundary Layer View Software BL-View with Vaisala Lidar Ceilometer CL61.

Table 1 Document versions (English)

Document code	Date	Description
M212721EN-D	April 2024	For BL-View version 3.1.2. • Scheduled snapshot settings updated
M212721EN-C	December 2023	For BL-View version 3.1.1. • Mixing layer height (MLH) data added • L3 file description added • Operating principle added • Snapshot feature added • Installation instructions added • Other minor improvements
M212721EN-B	March 2022	Updates: • File name format and folder structure information • NetCDF file information

1.2 Related manuals



For the latest versions of these documents, see docs.vaisala.com.

Table 2 Related manuals

Document code	Name
M212474EN	Vaisala Lidar Ceilometer CL61 Installation Guide
M212475EN	Vaisala Lidar Ceilometer CL61 User Guide

1.3 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.



Highlights important information on using the product.



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.

1.4 Trademarks

AviMet® is a registered trademark of Vaisala Oyj.

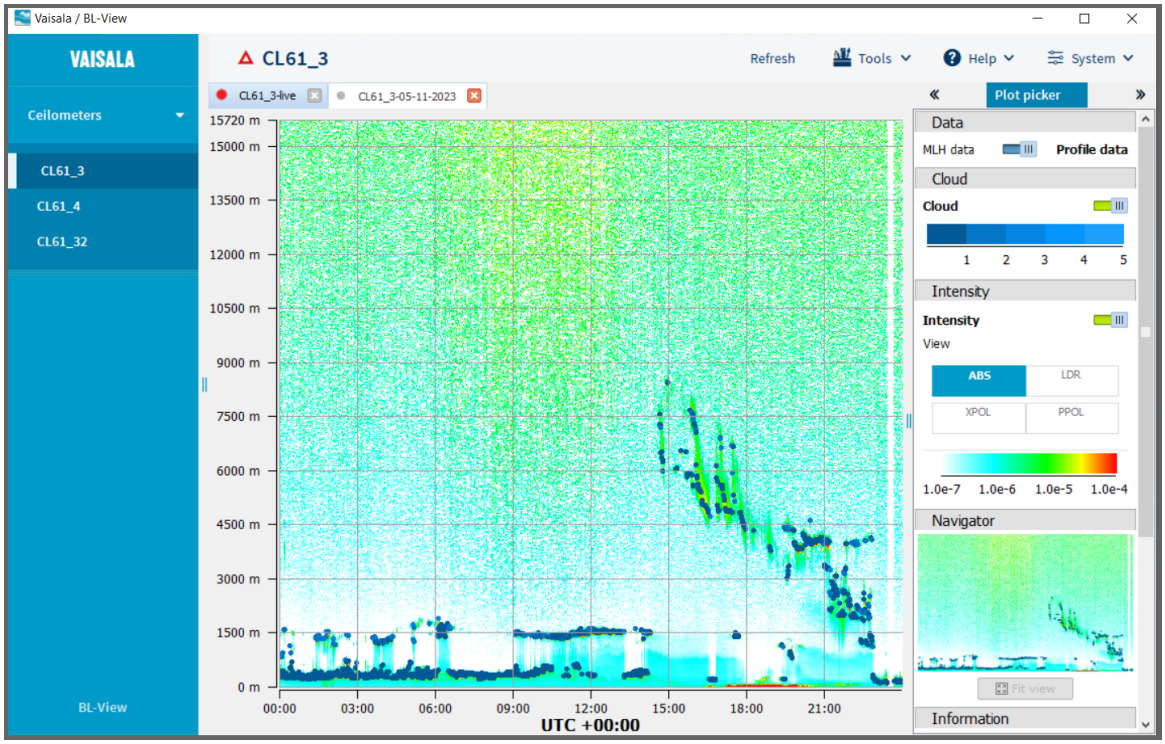
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2. Vaisala Boundary Layer View software BL-View for CL61



Vaisala BL-View is an application software for visualization and analysis of the CL61 profiling and cloud data. It provides an understanding of the current conditions to support faster and more reliable decision-making.

Improved decision-making with accurate visualization

Vaisala Lidar Ceilometer CL61 measures the backscatter profiles of the atmosphere with 2 different polarizations. BL-View generates online visual representations of these profiles, providing you with an immediate understanding of the local conditions. You can view and analyze the logged data while continuing to display online data.

BL-View generates an online visual representation of the mixing layer height (MLH), which provides you with an immediate understanding of the local conditions. You can view and analyze logged data while continuing to display online data. BL-View helps to improve your air quality monitoring and forecasting.

Manage your ceilometer network

BL-View provides a centralized view of CL61 data in the network, facilitating concentrated data analysis. The status information of the individual ceilometers is available in one place, enabling easy identification of possible issues.

Fast data analysis

The ceilometer messages are stored in the netCDF format on the computer hard drive for fast data analysis and easy sharing. The data can be easily transferred to other applications, for example, as inputs to numerical weather prediction models.

2.1 Supported ceilometers

BL-View from version 3.0 onwards supports Vaisala Lidar Ceilometer CL61.

A maximum of 10 ceilometers can be connected.

2.2 Minimum system requirements

Table 3 Minimum system requirements

Component	Minimum requirement
Computer	• Ethernet port • Serial port • USB serial converter
Operating system	Microsoft Windows 10
Memory	2 GB RAM
Hard disk space	For BL-View installation: 600 MB For CL61 BL-View data files: 160 GB / year / ceilometer (typically) Required total hard disk space depends on the number of ceilometers.

Use the default settings for the CL61 data reporting. More frequent data reporting can render your computer inoperable. For details about netCDF data reporting and configuration, see CL61 User Guide (M212475EN).

Do not use BL-View on the same computer as Vaisala AviMet Automated Weather Observing System or Vaisala Observation Network Manager NM10.

2.3 Licensing

BL-View 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, contact Vaisala.

The license is mapped to the hardware. If your hardware changes and you need to re-install BL-View, you must request a replacement license from your Vaisala representative.

The license can include one or several devices. After license activation, you can add devices in BL-View.

For license updates and new licenses, contact Vaisala.

Vaisala License Manager is used for activating the Vaisala software license. The license allows one activation.

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3. Operating principle

3.1 Visualization of measurement profiles

The laser pulse emitted by the ceilometer is scattered by each particle it encounters on its path through the atmosphere. A portion of this light is scattered back towards the instrument and is registered. The rest of the light is either absorbed or scattered in directions not seen by the ceilometer. The portion of backscattered light registered by the ceilometer is called **attenuated backscatter**.

Each particle also interacts with the laser pulse by either maintaining or altering the polarization of the emitted light. The ceilometer registers changes in polarization and reports them as profiles called the **linear depolarization ratio**. The information in these profiles can be used to differentiate between liquid and solid particles.

CL61 is able to report the following vertical profiles:

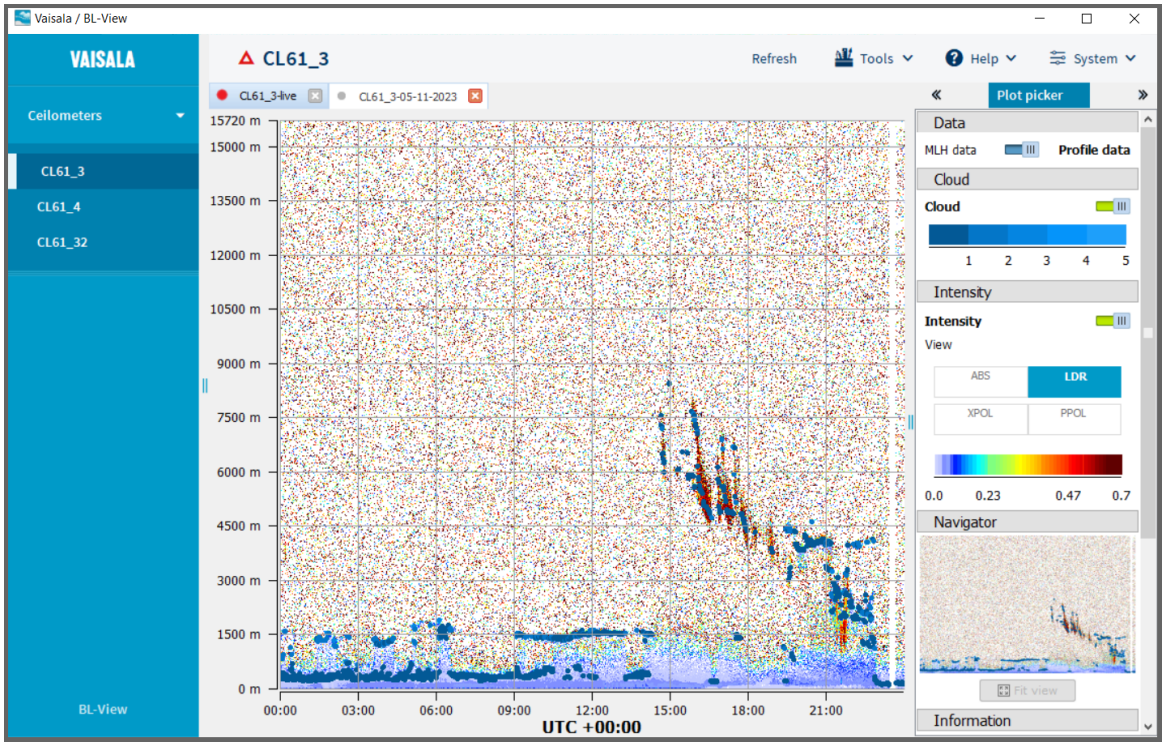
- Parallel-polarized attenuated backscatter profile (PPOL)
- Cross-polarized attenuated backscatter profile (XPOL)
- Total attenuated backscatter profile (ABS = PPOL + XPOL)
- Depolarization ratio profile (LDR = XPOL / PPOL)

Profiles are reported at 4.8 m (15.75 ft) height intervals.

LDR varies between 0 and 1.

In BL-View, you can adjust the depolarization limit (LDR) in **Presets**.

The following figure shows the linear depolarization ratio profile with clouds.



3.2 Operating principle

The planetary boundary layer (or atmospheric boundary layer) is the lowest part of the Earth's atmosphere. It is directly influenced by its contact with the Earth's surface. The planetary boundary layer responds to heat transfer, pollutant emission, and other surface forcings in a timescale of an hour or less.

The depth of the planetary boundary layer depends on, for example, the location, season, time of day, and weather. Typically, the planetary boundary layer extends 50–3000 m (164–9840 ft) from the Earth's surface. Fog, haze, mist, smog, and air pollution are typical phenomena in the planetary boundary layer.

The planetary boundary layer contains several layer types:

- **Convective boundary layer**: Layer of air in which particles mix well due to mechanical and thermal forces. The depth of the convective boundary layer is called the mixing height.
- **Nocturnal boundary layer**: Stable layer of air that forms around sunset. Its top is often marked by a temperature inversion. The layer usually dissolves by convection in the morning hours, but it can also stay during daytime when solar heating is not sufficient to disperse the nocturnal boundary layer.
- **Residual layer**: Layer of air containing the particles left from the previous convective boundary layer after sunset or from long-range transportation by winds.
- **Surface layer**: Layer of air that is situated closest to the ground. Its thickness is typically 50–100 m (164–328 ft), about 10 % of the boundary layer height.

3.3 Diurnal variation in planetary boundary layer

Variations that occur during the day in the planetary boundary layer are called diurnal variation.

The following phenomena affect the formation of the component layers:

- Solar radiation heats the Earth's surface, causing thermals of warm air to rise from the ground.
- Radiative cooling from the clouds at the top of the planetary boundary layer creates thermals of cool air that sink down.
- Wind shear across the top of the convective boundary layer contributes to the generation of turbulence.

During the day, diurnal variation has the following effects on the planetary boundary layer:

1. The turbulence in the air is caused by solar radiation and radiative cooling, both of which occur simultaneously. At night, the radiative cooling of the surface controls the boundary layer, creating the nocturnal layer. The nocturnal layer blocks the interference between the surface layer and the residual layer. Before sunrise, the nocturnal boundary layer height is the mixing height.
2. After sunrise the solar radiation destabilizes the situation on the surface, creating thermals of warm air that rise upwards. The thermals continue to rise until their temperature has dropped to the same temperature as the surrounding air.
   At the same time thermals of cool air sink down from the top of the clouds. The resulting turbulence causes heat, moisture, and particles to mix uniformly in the convective boundary layer. The convective boundary layer reaches its maximum mixing height in the late afternoon.
   The entrainment zone acts as an interface between the convective boundary layer and free atmosphere. Turbulent air from above is mixed into the convective boundary layer in this region of the atmosphere.
   When the convective boundary layer reaches the level of the residual boundary layer, both layers are mixed together. This is an important process for air pollution transportation in time and space. The horizontal dispersion and transportation have a strong influence on the air quality.
3. When the sun sets, radiative cooling causes the convective boundary layer to collapse. A new nocturnal boundary layer is formed, and it is again replaced with a new convective boundary layer during the next day.

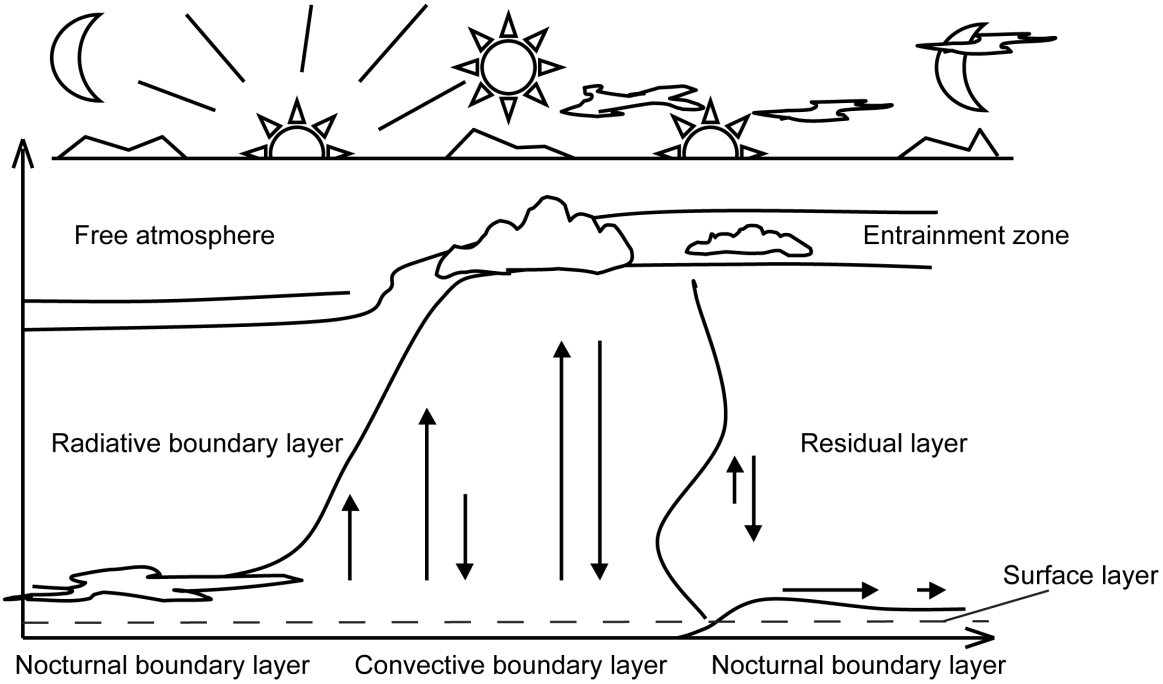


Figure 1 Planetary boundary layer structure and diurnal variation

3.4 Boundary layer analysis

A ceilometer sends out short, powerful laser pulses in a vertical or near-vertical direction. The light reflection caused by haze, fog, mist, virga, precipitation, aerosols, and clouds, known as backscatter, is measured as the laser pulses traverse the sky.

The backscatter profile, that is, the signal strength versus the height, is stored and processed, and the data is used to calculate the cloud bases and the planetary boundary layer structure.

The planetary boundary layer is the portion of the lower atmosphere where wind, temperature, and moisture are strongly influenced by the Earth's surface. The depth of this layer, also known as the mixing height layer, is important for analyzing the state of the atmosphere, for example, for air quality evaluation and aviation.

The backscatter signal is typically stronger in the planetary boundary layer where particle concentration is higher, but weaker in the free atmosphere where the atmosphere typically has fewer particles. BL-View detects the backscatter gradient between the planetary boundary layer and free atmosphere (the mixing height), as well as other atmospheric structures, such as residual boundary layers and elevated smoke or aerosol plumes that may produce strong backscatter gradients.

To reduce sensitivity to noise and transient details in atmospheric structure, BL-View performs vertical and temporal averaging on the ceilometer data.

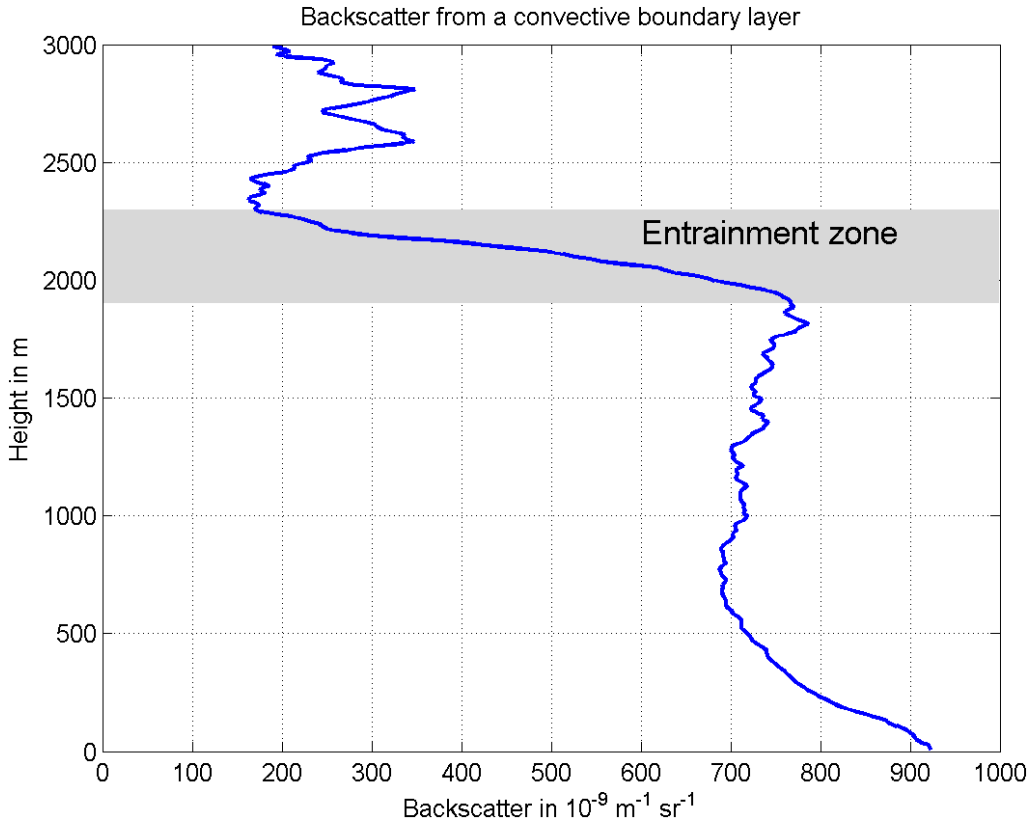


Figure 2 Backscatter profile from convective boundary layer

3.5 Mixing height algorithm

Merged gradient and profile fit method

BL-View uses the gradient method and the profile fit method to produce data. The gradient method can detect up to 3 aerosol layers and performs well in many situations, particularly for shallow nocturnal boundary layers at less than 500 m (1640 ft) above ground level. The profile fit method detects only a single layer, and successfully estimates mixing heights when the aerosol backscatter signal is weak, local gradients are weak and diffuse, and the boundary layer evolves rapidly with time during morning and evening transitions.

The merged gradient and profile fit method merges the strengths of the gradient and profile fit methods, but retains the ability to detect multiple layers in a backscatter profile. The merged method uses the following rules to select the mixing height from the gradient and profile fit retrievals:

- The gradient method's lowest retrieval for cloud profiles and shallow, high quality boundary layers.
- Profile fit retrieval in all other cases (the gradient method's lowest retrieval is not displayed unless it differs by more than 1000 m (3280 ft).
- Second and third gradient retrievals are displayed in all cases, as they may indicate residual layers or other aloft aerosol layers.

The algorithm identifies reliably the various boundary layers, such as the nocturnal, convective, marine, and residual layers, and differentiates the mixed layer from other aerosol layers detected by BL-View. It also provides an outlier removal method, cloud filter, and other changes to improve performance for evening boundary layer transitions and to increase flexibility and robustness for handling data from both ceilometers.

The algorithm determines the mixing height by fitting an idealized backscatter profile to observed range-corrected ceilometer backscatter profiles. Clouds and precipitation produce backscattering profiles that deviate substantially from an idealized profile, which results in poor mixing height estimates. The algorithm can produce valid retrievals even if the backscatter profile deviates significantly from the idealized profile.

When a ceilometer detects multiple aerosol layers, the algorithm attributes 1 aerosol layer as the mixing height. When there are multiple aerosol layers present, the lowest layer is a reasonable first guess for attributing one of these layers as the mixing height.

3.5.1 Cloud and precipitation filter

Cloud filters prevent spurious mixing height retrievals caused by clouds or precipitation in the backscatter profiles, especially below 4000 m (13 123 ft) above ground level.

- In the gradient method, clouds and precipitation produce strong local gradients that may be unrelated to the mixing height.
- In the profile fit method, clouds and precipitation produce backscattering profiles that deviate substantially from an idealized profile, which result in poor mixing height estimates.

The cloud filter significantly improves the mixing height estimate, and eliminates retrievals in the morning when there are clouds and strong backscatter near the ground.

The algorithm does not report a mixing height when one or more of the following circumstances exists:

1. Clouds are present below 160 m (525 ft) above ground level.
2. Precipitation or excessively high backscatter are detected in the backscatter profile.
3. Clouds are present below 4000 m (13 123 ft) above ground level and there is excessive backscatter below 1000 m (3280 ft). Retrievals are still allowed when there are shallow, non-precipitating clouds below 4000 m (13 123 ft), but above 160 m (525 ft).

3.5.2 Variable averaging

Long averaging intervals help prevent false gradient minima hits generated by signal noise. However, this approach reduces the ability of the algorithm to respond to short scale signal fluctuations in space and time. The amount of signal noise depends on the range and time of the day. The gradient method provides variable averaging parameters.

BL-View default settings use 80-m (262-ft) height averaging close to the ground. This interval is gradually increased to 360-m (1181-ft) averaging used at heights above 1500 m (4920 ft).

The selected time averaging interval depends on the signal noise. It varies between 14 minutes during night-time and 52 minutes on a bright, cloudy day.

3.5.3 Variable threshold

Small density fluctuations within a convective boundary layer with a high aerosol load can have lower gradient values than the top of the layer in dry rural surroundings.

BL-View prevents the reporting of these fluctuations as the top of the aerosol layer by using variable threshold values that depend on the average backscatter signal from the boundary layer. A local gradient minimum is only reported if its value is below the threshold.

3.5.4 Outlier removal

Outlier removal filters spurious mixing height retrievals that are caused by instrument noise, transient small-scale aerosol features, or other artifacts that cannot be removed by traditional averaging techniques. However, this retains important details of the boundary layer evolution throughout the day.

To avoid removing valid mixing heights, the algorithm relaxes the figure-of-merit criteria for distinguishing valid retrievals from outliers. For each retrieval, the outlier removal method computes a figure-of-merit score based on proximity (in height) to other retrievals in the preceding 4 minutes. The algorithm deems retrievals with an insufficient number of neighbors (a low figure-of-merit score) as outliers and replaces them by the most recent valid retrieval.

3.6 Impact of weather conditions

The following weather conditions have an impact on the analysis of planetary boundary layer structure.

Precipitation

During precipitation, mixing height or other aerosol layers cannot be reported. This is due to the very high signal from precipitation dominating the backscatter from any remaining aerosol layers, which makes it impossible to distinguish these from the precipitation.

Low-layer clouds

Low-layer clouds appear at height 0–2000 m (0–6560 ft). If there are low-layer clouds, the mixing height is typically situated at the top of the clouds. In these conditions, BL-View does not show the true mixing height due to the measurement principle of Vaisala Ceilometer (LIDAR). In normal conditions, the deviation between the reported local gradient minimum and the top of the cloud is typically less than 200 m (656 ft).

Mid-layer and high-layer clouds

Mid-layer clouds appear at height 2000–5000 m (6560–16 400 ft) and high-layer clouds at height over 5000 m (16 400 ft). Mid-layer clouds and high-layer clouds do not typically create any problems for mixing height measurement. The mixing height is reported normally from the collected data.

Fog or ground-based obscuration

Fog or ground-based obscuration affects the mixing height measurement.

If the fog or ground-based obscuration is too dense, the laser light does not penetrate the layer, which makes it extremely difficult to estimate the mixing height.

In these conditions, Vaisala ceilometers typically report the vertical visibility reading with the highest altitude from which the backscatter signal can be received. If the signal is not strong enough, the mixing height reading is reported automatically.

4. Installation

If you are installing BL-View to a computer that has a previous version of BL-View, perform the following procedures:

1. Back up your data
2. Uninstall BL-View
3. Install BL-View

If you are updating the license, follow the instructions about updating the license.

You cannot use on the same computer both version 2.x and 3.x of BL-View.

More information

- Uninstalling BL-View (page 18)
- Installing BL-View (page 19)
- Updating BL-View license (page 19)

4.1 Uninstalling BL-View

CAUTION! Before you uninstall BL-View, back up BL-View data.

Removing BL-View does not remove the gathered data from your computer.

1. Check the settings in your current BL-View installation and write them down or take screenshots.
2. Select **Start > Control Panel**.
3. Depending on the operating system of your computer, select **Add or remove programs** or similar.
4. Select **BL-View > Uninstall**, and follow the onscreen instructions.

4.2 Installing BL-View

CAUTION! Install BL-View on a computer that does not contain any previous version of BL-View. Otherwise, you may lose existing BL-View files.

To perform installation on your computer, log in as an administrator.

1. Insert the USB drive in a USB port on your computer.

   The BL-View installation program launches automatically in a few seconds. If the installation does not launch automatically, double-click the executable (EXE) file on the USB drive.
2. Follow the onscreen instructions.

   Install BL-View to the following folder: `C:\Program Files (x86)`.
3. To activate BL-View, follow the onscreen instructions in License Manager. Use the product key from the cover letter.
4. To complete and verify the installation, restart your computer and open BL-View: **Start > Vaisala > BL-View > BL-View**.

If you choose to use the trial license, you see the number of days after which the trial expires when you open BL-View. The trial license supports adding 1 device.

4.3 Updating BL-View license

Make sure that you have the new product key for the license.

If you have a new product key, for example for a new license or an update license for adding more devices to BL-View, you must first uninstall BL-View and License Manager, and then install BL-View and activate the new license.

1. Take a backup of the existing files.
2. Take a snapshot of the device settings (**System > Settings > Devices**) so that you can restore them easily after the new BL-View installation.
3. Uninstall BL-View even if you already have the latest BL-View version. See Uninstalling BL-View (page 18).
4. Uninstall Vaisala License Manager.

   Select **Start > Vaisala License Manager**. Right-click and select **Uninstall** and follow the onscreen instructions.
5. Install BL-View from the USB drive and activate the license. See Installing BL-View (page 19).

5. Configuration

5.1 Connecting to measurement data server

CL61 stores measurement data on a secure file server. For more information, see CL61 User Guide (M212475EN).

Make sure that you have a connection from BL-View to the server to collect the CL61 data for BL-View.

Do not change the filenames because this makes the files unusable in BL-View.

More information

- NetCDF files (page 32)

5.2 Configuring BL-View for CL61

To configure BL-View to receive data from CL61, add the ceilometer to BL-View and define the settings.

1. Make sure that the file server for CL61 measurement data is receiving data from the ceilometer and is connected to the BL-View computer.
2. Select **Start > Vaisala > BL-View > BL-View**.
3. In BL-View, select **System > Settings > Devices**.
4. Select **Add**.

5. For **Device type** select **CL61** and set the following:

   Device name
   Type a descriptive name for the ceilometer, for example **`CL61 Helsinki`**.

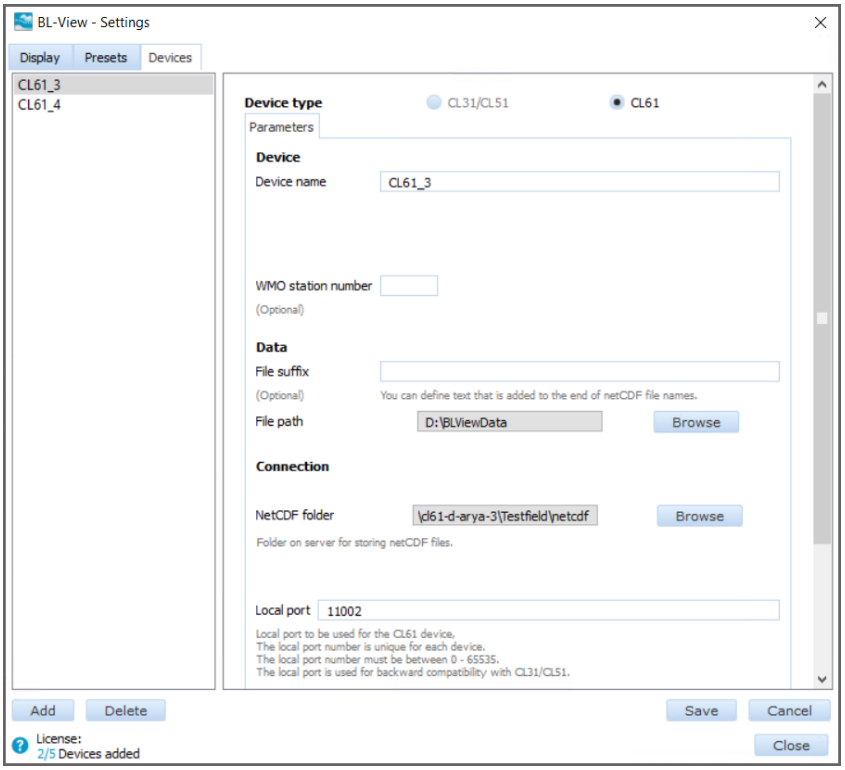
   WMO station number (optional)
   Type the station number that consists of the WMO block number (2 digits) and the station number (3 digits).

   File suffix
   Leave empty. (This setting is available later.)

   File path
   To define where to store the netCDF files, select **Browse**. The default location is *`C:\BLViewData`*. A folder is created in this directory for the specified device name.

   NetCDF folder
   Browse to the folder where you have the original CL61 netCDF data.

   Local port
   Type any unique number value in the internal port. The port number cannot be the same as is already used in any other device connected to BL-View.



6. Select **Save > Close**.

6. Operation

6.1 Using BL-View with CL61

BL-View stores netCDF files on your local hard drive and creates a daily folder structure for the files. Configuration allows you to assign a directory for netCDF storage. For more information, see CL61 User Guide (M212475EN).

BL-View offers views of CL61 data, for example, mixing layer height, data, attenuated backscatter data, polarization data (x-pol and p-pol), and depolarization ratio. You can zoom in for details and view specific conditions by selecting different views from the onscreen data.

1. To open BL-View, select **Start > (> All Programs >) > Vaisala > BL-View > BL-View**.

   BL-View opens and shows live real-time data.
2. Select whether the data in BL-View is shown in meters or feet.

   In BL-View, select **System > Settings > Display**.
   Select the units to use.
3. Select **Save > Close**.

The unit setting is applied to the display data in BL-View. The selection does not affect the data in the netCDF files which is always in meters.

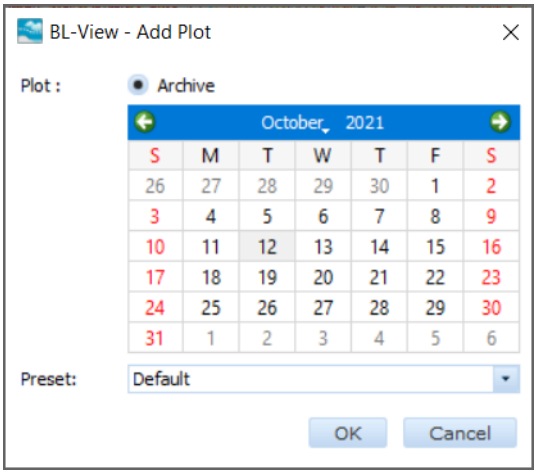
Language of BL-View release 3.x is English only.

6.2 Viewing archive plots

You can create density plots to view archived data from the ceilometer.

You can have 1 live plot and 1 archive plot open at the same time.

1. To open a plot in BL-View, do one of the following:
   - Use the arrows next to **Plot picker** to select and open a plot.
   - Select **Plot picker**, a date on the calendar, and the preset (set of algorithm parameters) for analyzing the data.



   Select **OK**.

2. Wait for the plot to load.

The plot opens with the following name: `<device name>_<date>`. Archive plots have a gray circle in front of the name.

If you want to view the plot with a different preset, first check that you have the preset available or create it (**System > Settings > Presets**). After that, add a plot using that preset.

More information

‣ Modifying plot parameters (presets) (page 30)

6.3 Zooming plots

You can change the time and height range settings of the plot that you are viewing.

1. Select the tab for the plot you want to modify.

2. Use your mouse to zoom in. Zooming is limited to 3 hours and 200 m (656 ft).



When the time range is 9 hours or less, the grid displays all hours in the selected range. When the time range is 12–24 hours, the grid displays every third hour of the selected range.

Data	Maximum height range
MLH data	4500 m (14 760 ft)
Profile data	15 720 m (51 562 ft)

3. To zoom out, right-click and select **Fit view**.
4. You can also select **Refresh** to refresh the screen and show updates to the live plot.

6.4 Reading graphs

In BL-View, information is illustrated on the screen as density plots. You can create plots to view and analyze live and archive data. Each new plot opens as a new tab.

The panel on the right displays the following information:

- **Data** lets you select between mixing layer height data (**MLH data**) and **Profile data**.
- **Cloud** shows the cloud base layers.
- **Legend** shows the boundary layer and cloud base markers.
- **Intensity** shows the intensity scale for the displayed information.
- **Navigator** shows which section of the plot is currently displayed. Use the mouse to zoom in and **Fit view** in **Navigator** to zoom out.
- **Information** shows the device name and the update status of the selected plot.

The following markers are used in the graphs:

- Dark red/yellow/green rectangles: Boundary layer heights. The colors indicate the quality of the data with green being valid and red suspicious.
- Black line: 1-hour average mixing layer height.
- Gray rectangles: Additional boundary layer heights (elevated layers).
- Blue dots: Cloud base heights.

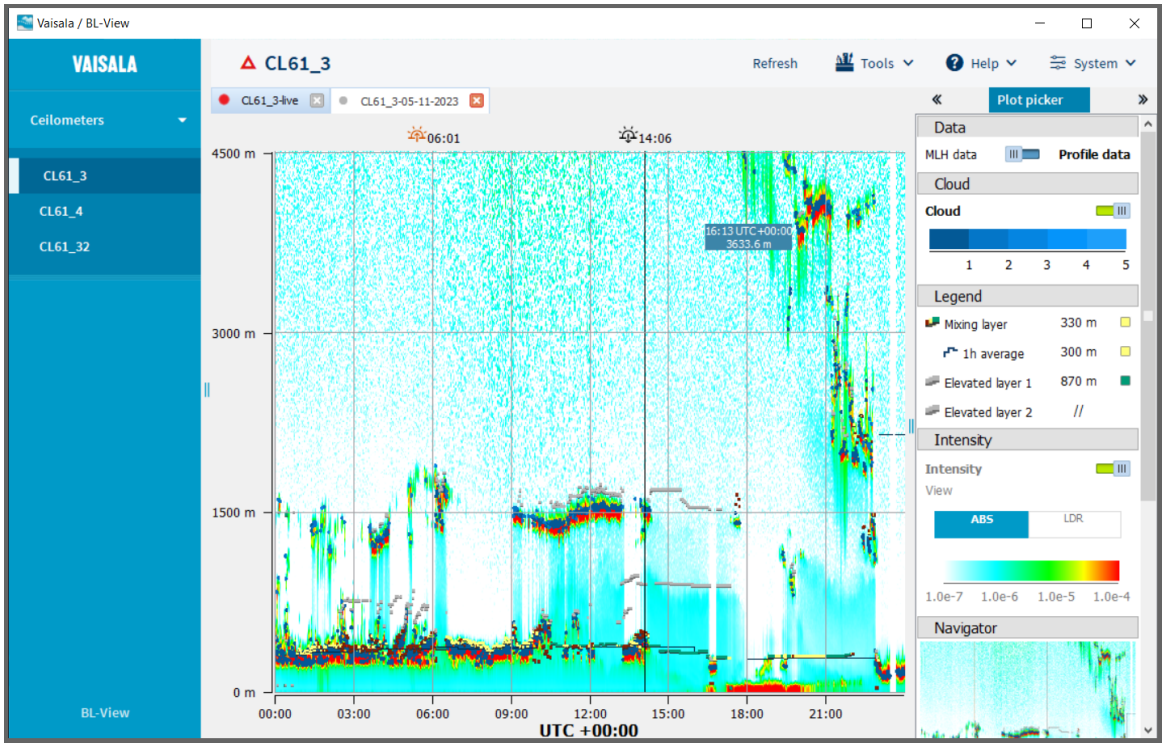


Figure 3 CL61 mixing layer height (MLH) data in BL-View

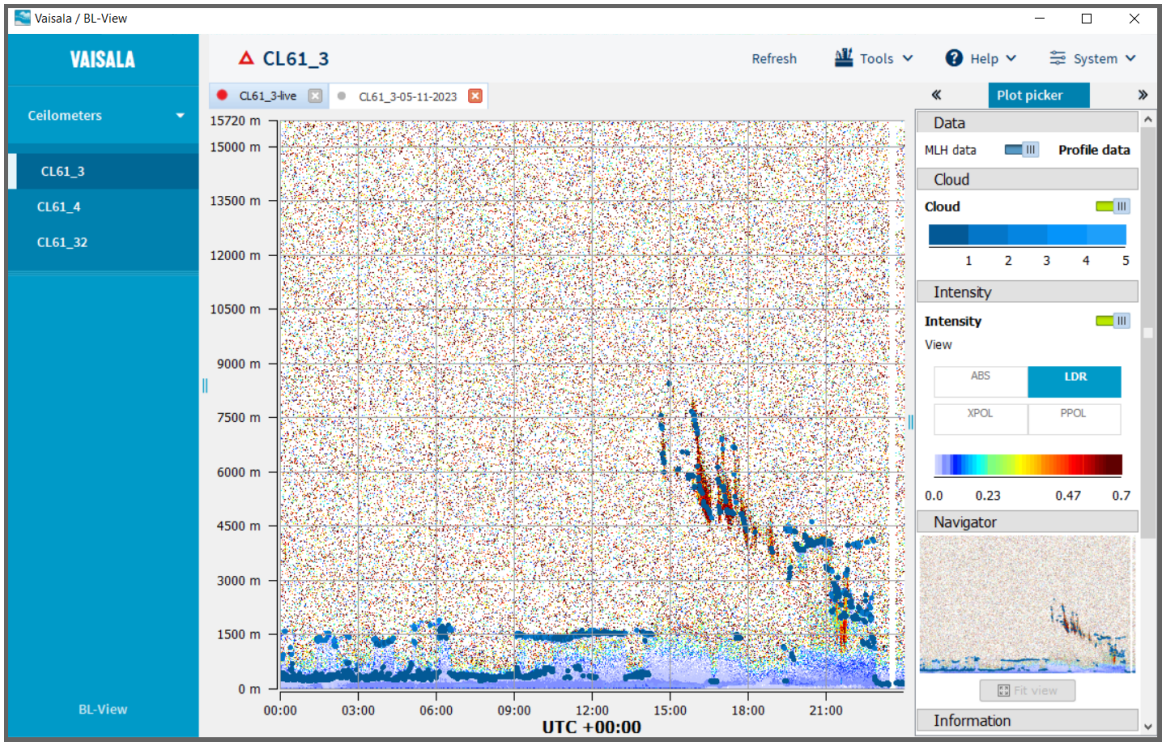


Figure 4 CL61 depolarization ratio data in BL-View

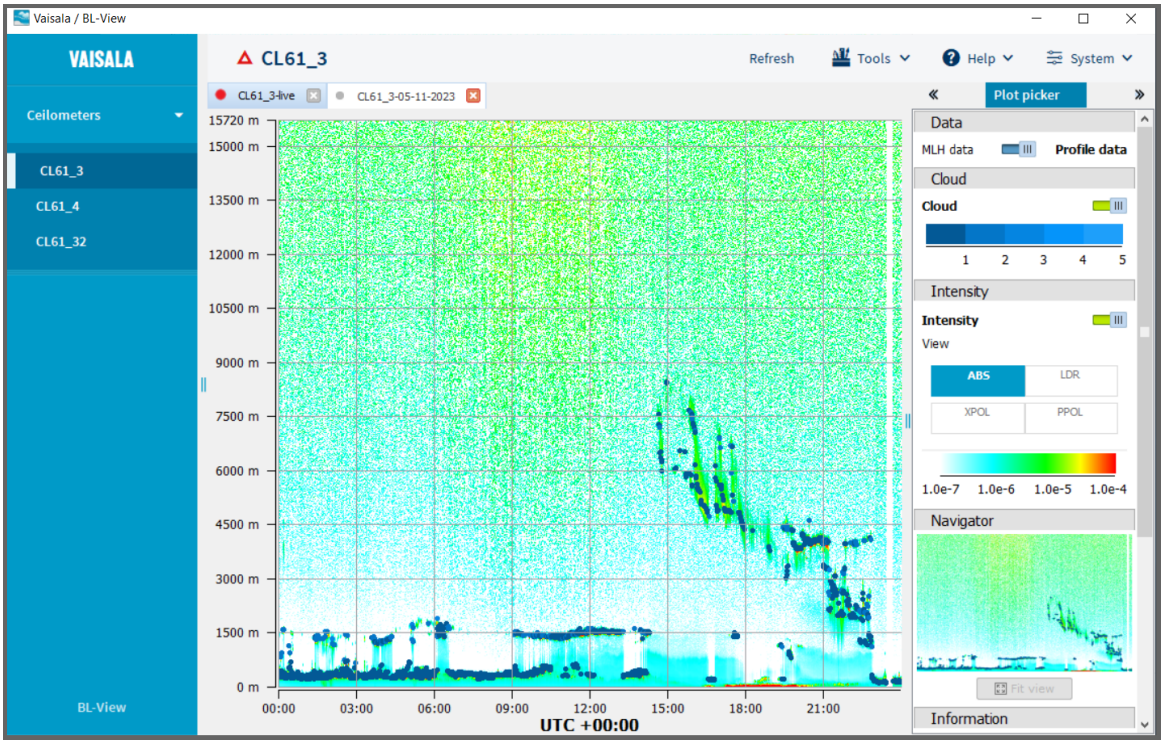


Figure 5 CL61 total attenuated backscatter data in BL-View

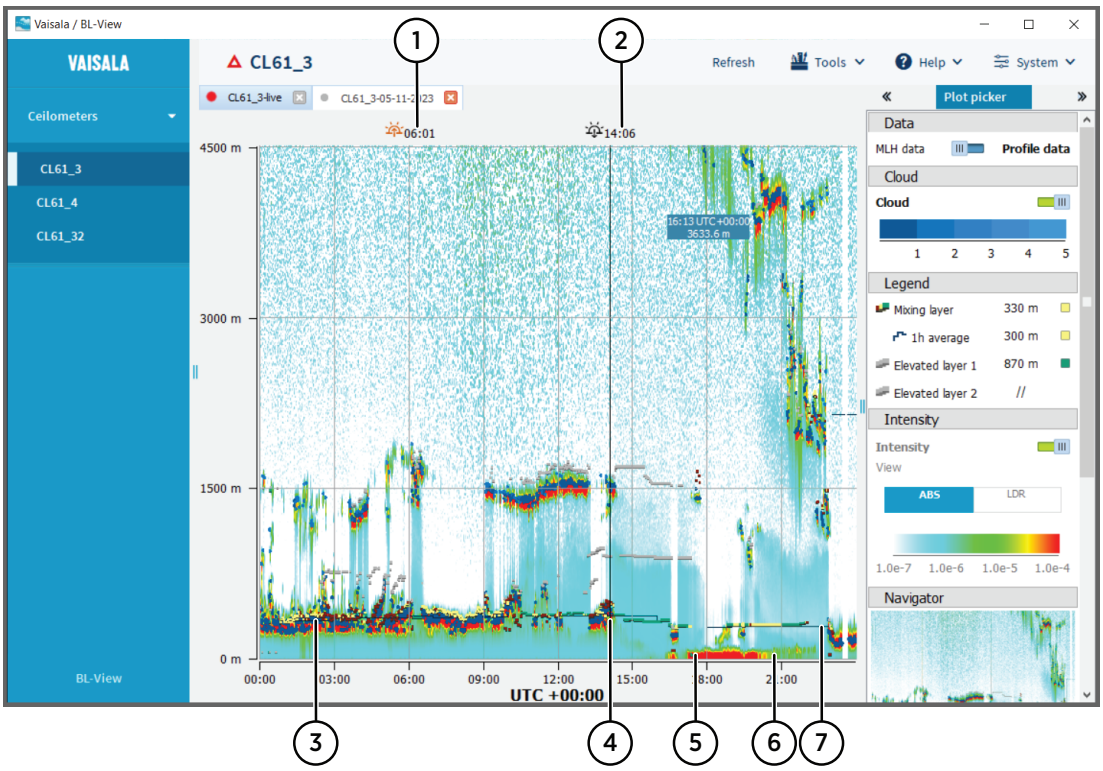
6.5 Reading boundary layer graphs

You can view mixing layer height (MLH) data or profile data in BL-View.

1. To view boundary layer data, select **MLH data** and see **Legend**, which includes:
   - **Mixing layer**: the height of the mixing layer
   - **1h average**: 1-hour average mixing layer height. The information is updated every hour.
   - **Elevated layer 1** and **Elevated layer 2**: elevated aerosol layers

   For **MLH data**, the available intensity view is **ABS**.

2. The following markings are used.

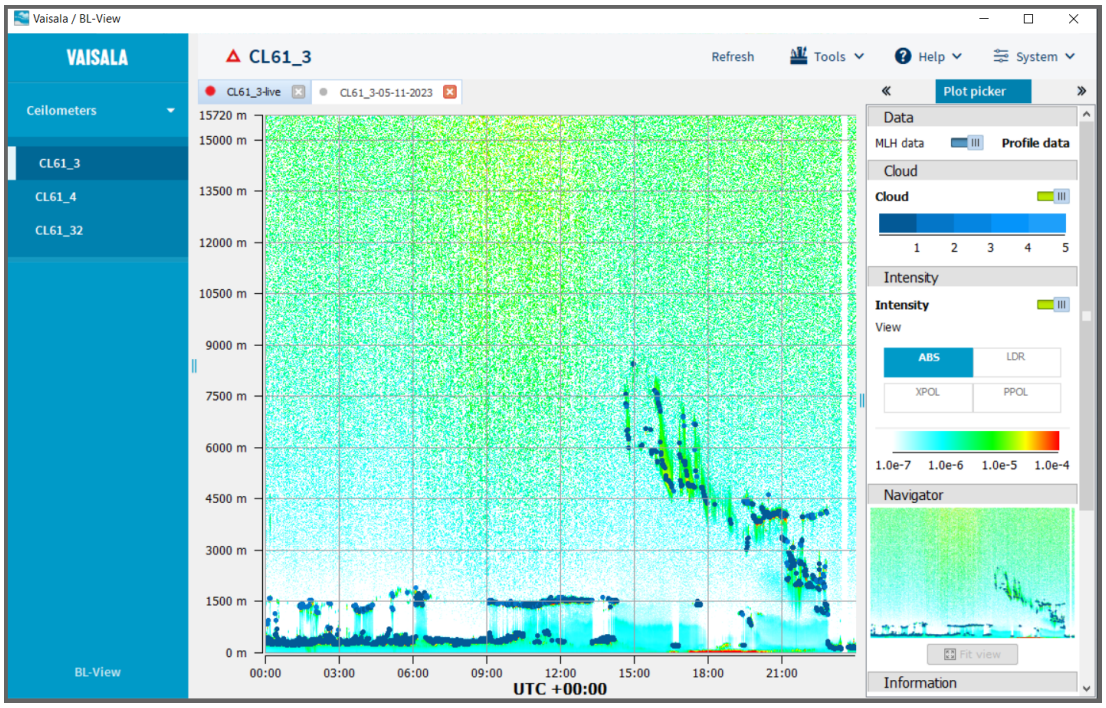


1 Sunrise indicator (yellow)
2 Sunset indicator (black)
3 Cloud base heights (blue dots)
4 Boundary layer heights (dark red/yellow/green) and elevated layers (gray)
5 Signal from clouds and precipitation (red)
6 Aerosol backscatter signal (light blue to yellow)
7 1-hour average mixing layer height (black lines)

With a live plot, if a valid parameter is not correctly measured, its value is replaced with 2 slash characters (//).

3. To view the whole profile with cloud base data, select **Profile data**.

   The available intensity views are: **ABS**, **LDR**, **XPOL**, and **PPOL**.



6.6 Reading cloud detection graphs

Cloud bases detected by CL61 are shown on the plot area as blue dots, with up to 5 overlapping layers in progressively lighter shades. The legend in the sidebar explains the shading.

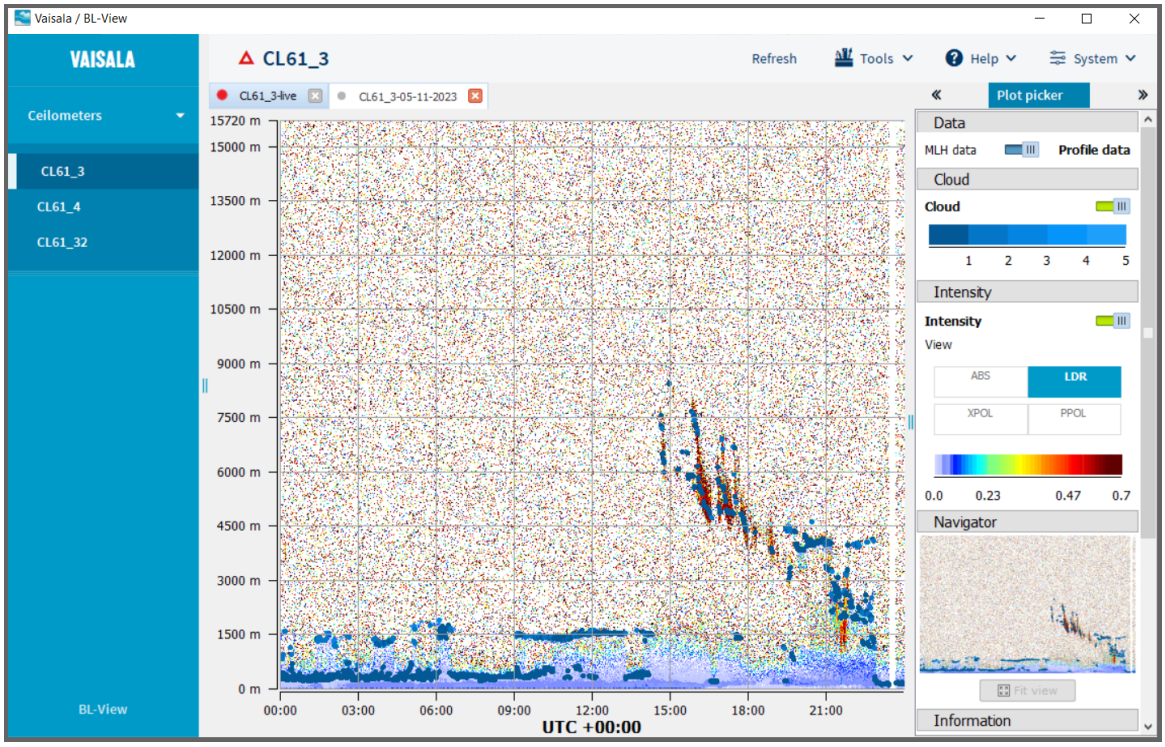


Figure 6 CL61 depolarization ratio data with clouds toggled ON

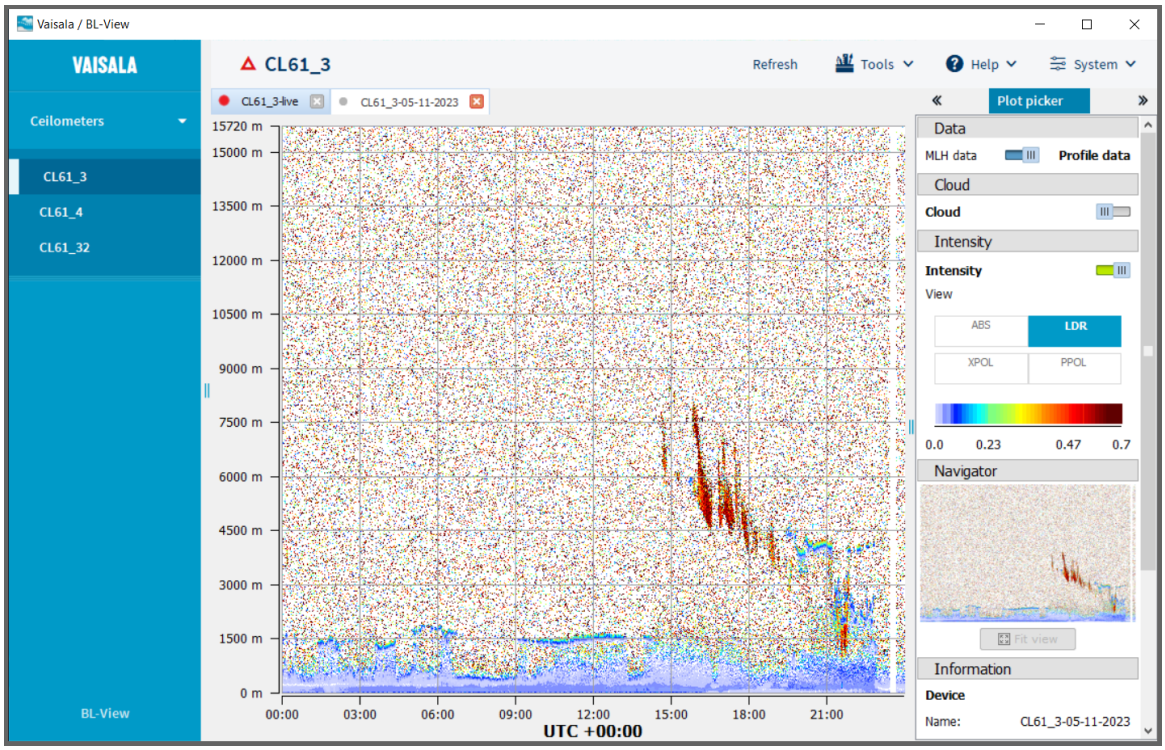


Figure 7 CL61 depolarization ratio data with clouds toggled OFF

1. To show and hide the cloud bases, use the **Cloud** toggle switch at the top of the sidebar.

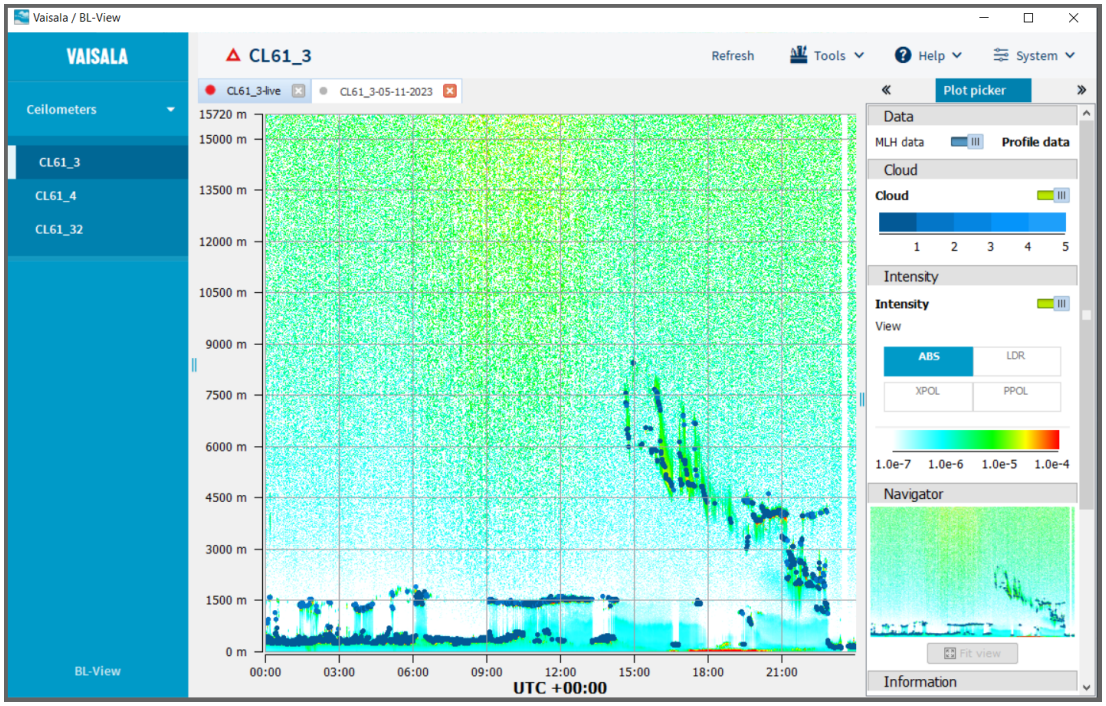
   The underlying intensity graph can be independently shown or hidden with another toggle.

6.7 Reading cloud intensity graphs

The intensity information indicates the intensity of the signal. The legend on the sidebar explains the shading.

For MLH data, intensity information cannot be switched off.

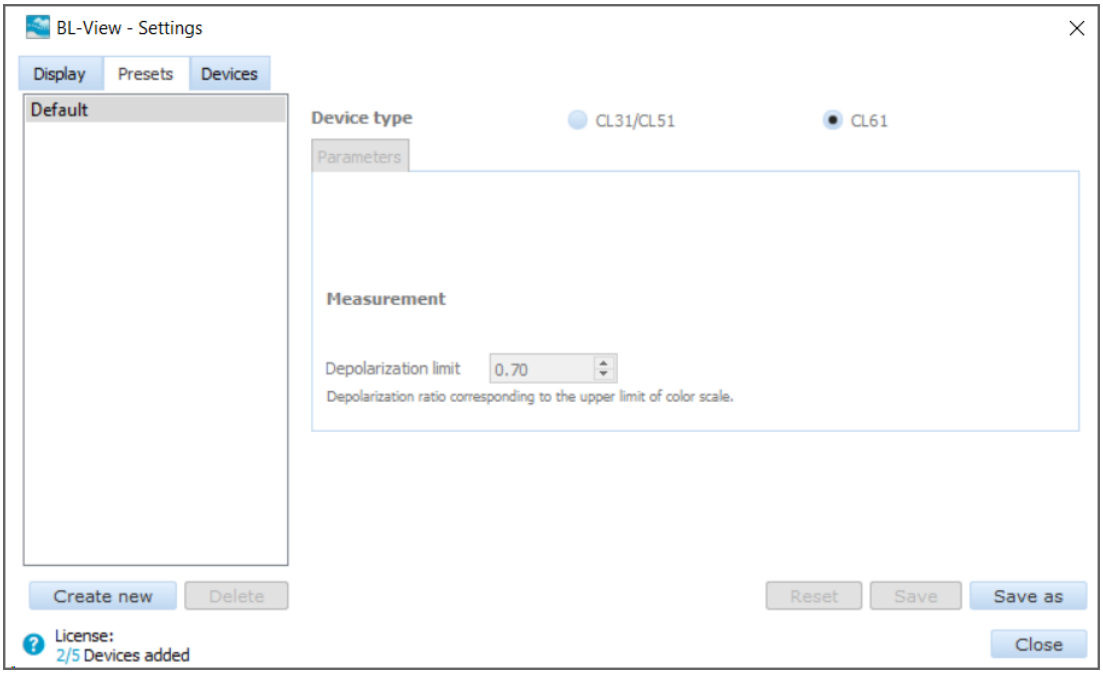
1. To show and hide the intensity data in plots, select **Profile data**.
2. Use the **Intensity** toggle switch on the sidebar, and choose one of the views: **ABS**, **LDR**, **XPOL** (for **Profile data** only), or **PPOL** (for **Profile data** only).



6.8 Modifying plot parameters (presets)

If you want to view an archive plot with a different preset (algorithm settings), create a preset and define the depolarization limit.

1. Select **System > Settings > Presets**.



2. Select **Create new**.
3. The **Device type** is set to **CL61**.
4. Define the **Depolarization limit**.

   The default is 0.70.
   While the LDR range is 0–1, the upper limit may remain clearly below 1 in typical atmospheric conditions. Depolarization limit allows the adjustment of the LDR color scheme to match the prevailing conditions so that the full color range is in use. If the LDR profile colors rarely reach the high end, or often remain at maximum, use **Depolarization limit** to adjust the color range to match the conditions of your particular device.
5. Select **Save > Close**.

After you have defined a new preset, open an archive plot and select the preset for it.

More information

- Viewing archive plots (page 22)

7. Data outputs

BL-View shows netCDF files that CL61 has generated.

In addition, BL-View generates the following files:

- L3 netCDF files
- PNG files

7.1 NetCDF files

Network Common Data Form (netCDF) is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array oriented scientific data.

NetCDF data access libraries are available for Python, Java, and other programming languages.

For more information about netCDF, see https://www.unidata.ucar.edu/software/netcdf/.

The netCDF file format allows the grouping of data types into a single file. A netCDF file is made of one or several variables. Each variable consists of:

- Data: value or a multidimensional table
- Metadata: data that characterizes the data

For information about the netCDF conventions, see https://cfconventions.org/latest.html.

7.2 Files generated by CL61

The netCDF format used in CL61 is built on netCDF-4 which is built on Hadoop Distributed File System (HDFS). You can open and read CL61 netCDF files with any HDFS or netCDF-4 reader, for example, Panoply.

CL61 netCDF files are sent using the SSH file transfer protocol (SFTP) to a customer server. The ceilometer is defined as a secure client using a key-based scheme.

The files contain the following data:

- Atmospheric attenuated backscatter and polarization profiles
- Cloud heights and vertical visibility
- Total cloud cover (sky condition)
- Cloud layer specific covers and heights (sky condition)
- Cloud penetration depth or cloud thickness
- Precipitation detection (binary)
- Fog detection (binary)
- Measurement metadata (for example, tilt angle and gain type)
- Diagnostics data (status, monitoring)
- Metadata, including:
  - Interface version
  - Device identity and location
  - Device status and monitoring data

For details about the netCDF file that CL61 produces, see CL61 User Guide (M212475EN).

7.3 Files generated by BL-View

7.3.1 NetCDF L3 file format

The netCDF L3 data file contains level 3 (L3) data that has gone through the calculation service and includes all the data from the algorithms, including mixing layer height values and quality index data.

The file contains L3 data from archive plots.

The netCDF filename is the following.

L3_OFFLINE_<STATION_NUMBER>_YYYYMMDDHHMM_<ParameterKey>.nc

Table 4 Fields of L3 filenames

Name	Description
L3	Identification of the data level
OFFLINE	Identification of the L3 file type
STATION_NUMBER	WMO station number, if defined in **System > Settings > Devices**.
YYYYMMDDHHMM	UTC time
ParameterKey	Identification of the advanced algorithm settings. See the table below for an explanation.

Example filename:

L3_OFFLINE__202311290056_1_360_1_3120_10_30_4000_3_0_1_500_1000_4000_60.nc

Example parameter key:

```
1_360_1_3120_10_30_4000_3_0_1_500_1000_4000_60
```

Table 5 Calculation parameters in parameter key

Example value	Description	Value/Range
1	Automatic height averaging	1 = yes
360	Height averaging interval (Automatic: Max. height averaging interval)	The default value is 360 m (1181 ft).
1	Automatic time averaging	1 = yes

Example value	Description	Value/Range
3120	Time averaging interval in s (Automatic: Max. time averaging interval in s)	The default value is 3000.
10	Algorithm sensitivity	The default value is 5.
30	Boundary layer min	The default value is 30 m (99 ft).
4000	Boundary layer max	The default value is 4000 m (13 120 ft).
3	Number of boundary layers	The default value is 3.
0	Algorithm method	`0` = merged
Profile fit settings	**Profile fit settings**	
1	SNR	The default value is 1.
500	SNR average window	The default value is 500 m (1640 ft).
1000	Night profile length	The default value is 1000 m (3280 ft).
4000	Day profile length	The default value is 4000 m (13 120 ft).
60	Outlier removal strength	The default value is 60.

The L3 files contain the following dimension, variable, and global attribute information.

Table 6 L3 dimensions

Dimension	Description
`timeDim`	Number of profiles
`nameDim`	–
`date_stampDim`	–
`message_typeDim`	–
`periodDim`	–
`Mean_Layer_HeightDim`	–
`Mean_Layer_QualityIndexDim`	–
`Mean_Layer_Calculation_TimeDim`	–
`cloud_statusDim`	–
`cloud_dataDim`	–
`bl_height_lengthDim`	–
`bl_indexDim`	–
`bl_heightDim`	–

Dimension	Description
Bs_prof_lengthDim	–
Ng_prof_lengthDim	–
Ec_prof_lengthDim	–
Ec_prof_rangeDim	–
Ec_prof_opacityDim	–
vrb_height_averagingDim	–
vrb_time_averagingDim	–
Height_averaging_paramDim	–
Time_averaging_periodDim	–
algorithm_sensitivityDim	–
boundary_layer_minDim	–
boundary_layer_maxDim	–
number_of_boundary_layersDim	–
Location_latitudeDim	–
Location_longitudeDim	–
Location_altitudeDim	–
location_utc_offsetDim	–
Algorithm_MethodDim	–
parameter_keyDim	–
sunrise_utcDim	–
sunset_utcDim	–
LevelTwoCountDim	–
range	Number of vertical bins

Table 7 L3 variables

Type	Variable	Attributes	Description
int	time	Units = seconds since 1970-01-01 00:00:00.000 Type = double Dimension = time axis = T	Unix time
string	name	Dimension = timeDim	Data identifier (ceilometer name) as defined in **System > Settings > Devices**

Type	Variable	Attributes	Description
string	date_stamp	Dimension = timeDim	Measurement timestamp in textual form (yyyy-mm-dd hh:mm:ss)
int	message_type	Dimension = timeDim	Ceilometer data message type
int	period	Dimension = timeDim	Sending frequency of ceilometer data message in seconds
int	Mean_Layer_Height	Dimension = timeDim	Average mixing layer height for the period of 1 hour
int	Mean_Layer_QualityIndex	Dimension = timeDim	Average mixing layer quality index for the period of 1 hour
int	Mean_Layer_Calculation_Time	Dimension = timeDim	Average layer calculation time for the 1-hour interval
int	cloud_status	Dimension = timeDim	0 = no significant backscatter/some obscuration but determined to be transparent 1 = 1 cloud layer 2 = 2 cloud layers or full obscuration (vertical visibility and highest signal detected) 3 = 3 cloud layers
int	cloud_data	Dimension = timeDim	Cloud bases or vertical visibility/highest signal detected (meters or feet)
int	bl_height_length	Dimension = timeDim	Number of boundary layer height candidates found (0–3)
int	bl_index	Dimension = timeDim	Quality indices for boundary layer height candidates
int	bl_height	Dimension = timeDim	Boundary layer height candidates (meters)
int	Bs_profile_length	Dimension = timeDim	Number of samples in ceilometer signal backscatter profile (450)
int	Bs_profile_data	Dimension = timeDim, range	Ceilometer signal backscatter profile in units of 10^{-9} m^{-1} sr^{-1} (10-m / 33-ft resolution, 450 samples up to height of 4500 m / 14 764 ft)
int	Ng_profile_length	Dimension = timeDim	Number of samples in negative gradient profile (450)

Type	Variable	Attributes	Description
int	Ng_profile_data	Dimension = timeDim, range	Negative gradient profile (10-m / 33-ft resolution, 450 samples up to height of 4500 m / 14 764 ft)
int	Ec_profile_length	Dimension = timeDim	Number of samples in ceilometer signal extinction coefficient profile (450)
int	Ec_profile_data	Dimension = timeDim, range	Extinction coefficient (EC) profile in units of 10^{-4} m^{-1} (10-m / 33-ft resolution, 450 samples up to height of 4500 m / 14 764 ft)
int	Ec_prof_range	Dimension = timeDim	Range in meters to which the extinction coefficient (EC) profile data is valid. Above that range data is 0
int	Ec_prof_opacity	Dimension = timeDim	Opacity (or aerosol optical depth, AOD) of the extinction coefficient (EC) profile in units of 0.01; it is the integral of EC up to that range
int	vrb_height_averaging	Dimension = timeDim	1 = True, variable height averaging (default) 0 = False, user-defined constant height averaging
int	vrb_time_averaging	Dimension = timeDim	1 = True, variable time averaging (default) 0 = False, user-defined constant time averaging
int	Height_averaging_param	Dimension = timeDim	Height averaging parameter (40–600 m, default 360 m / 131–1969 ft, default 1181 ft) Used only if vrb_height_averaging = false
int	Time_averaging_period	Dimension = timeDim	Time averaging period (60–3000 seconds, default 3000) Used only if vrb_time_averaging = false
int	algorithm_sensitivity	Dimension = timeDim	Algorithm sensitivity (0–20, default 10) Smaller value means higher sensitivity

Type	Variable	Attributes	Description
int	boundary_layer_min	Dimension = timeDim	Minimum height for a boundary layer height candidate (30–500 m, default 30 m / 99–1640 ft, default 99 ft)
int	boundary_layer_max	Dimension = timeDim	Maximum height for a boundary layer height candidate (200–4000 m, default 4000 / 656–13 123 ft, default 13 123 ft)
int	number_of_boundary_layers	Dimension = timeDim	Maximum number of boundary layer height candidates to be reported (1–3, default 3)
float	location_latitude	Dimension = timeDim	Latitude of measurement site. Based on ceilometer location as defined in **System > Settings > Devices**
float	location_longitude	Dimension = timeDim	Longitude of measurement site. Based on ceilometer location as defined in **System > Settings > Devices**
float	location_altitude	Dimension = timeDim	Altitude of measurement site. Based on ceilometer altitude as defined in **System > Settings > Devices**
float	location_utc_offset	Dimension = timeDim	UTC offset of each measurement. Based on ceilometer location as defined in **System > Settings > Devices**
int	Algorithm_Method	Dimension = timeDim	0 = Merged gradient and profile fit 1 = Gradient 2 = Profile fit
string	parameter_key	Dimension = timeDim	See Table 5 (page 33).
float	sunrise_utc	Dimension = timeDim	UTC sunrise time in hours
float	sunset_utc	Dimension = timeDim	UTC sunset time in hours
int	LevelTwoCount	Dimension = timeDim	Number of level 2 (L2) samples used to create level 3 (L3) sample
int	range	Dimension = range	4500 m (14 764 ft), values with 10 m (33 ft) resolution meaning 450 samples

Table 8 L3 global attribute

Attribute	Description
`site_location`	Device name from BL-View device settings

7.3.2 Image files (PNG)

BL-View supports the creation of image files from onscreen data.

You can easily save the view in a PNG image file.

The saved image displays the device name, date, and information about the used algorithm at the top of the image.



Image file support is available later for CL61.

8. Working with files

8.1 Sharing netCDF files

BL-View automatically stores live and archive data to netCDF files.



You can share netCDF files with other users for viewing on different computers and in BL-View.

1. To access the netCDF files, go to folder that you have specified as the storage location. The default storage location is `C:\BLViewData`. Each device has a separate folder for the files.
2. Select the files to share and send them to other users.
3. To change the netCDF storage location, select **System > Settings > Devices** in BL-View. In **Data** and **File path**, select **Browse** to define where to store the netCDF files.

   A folder is created in this directory for the specified device name.

8.2 Taking instant snapshots (PNG files)

You can take snapshots to export the current plot as an image file (PNG).

1. In BL-View, select **Tools > Snapshot > Instant**.
2. Type a name for the image and select the directory where you want to save it.
3. Select **Save**.

   The saved image displays the device name, date, and information about the used algorithm at the top of the image.
   If you have zoomed in the density plot, the image contains the enlarged view.

8.3 Scheduling snapshots (PNG files)

You can schedule snapshots to be taken at specific intervals. The plots are saved as image files (PNG).

1. In BL-View, select the ceilometer.
2. If you want to schedule the snapshots for a custom plot, open a custom live plot.
3. Select **Tools > Snapshot > Scheduled**.

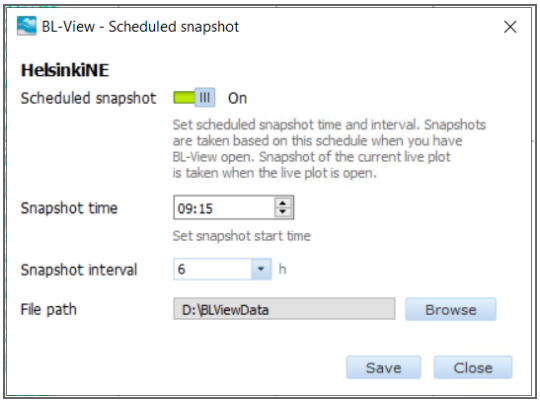
4. In **Scheduled Snapshot**, set the following:

   Scheduled snapshot
   Select **On**.

   Snapshot time
   Select the time for the first snapshot of the day.
   The setting is applied at the start of every 24-hour period.

   Snapshot interval
   Select how often to take snapshots.
   The available values are: 1, 2, 3, 4, 6, 8, 12, and 24.
   For example, if you set the snapshot time to 9.15 and snapshot frequency to 6, the first image is taken at 9.15, the next ones 15.15, 21.15, and 03.15, and then again at 9.15 the next day.

   File path
   Select the directory where to save the snapshots.
   In the directory that you specify, a folder named *`Snapshot`* is created, in which each device has a separate folder for the files.
   The *`Snapshot`* directory is used for the scheduled snapshots of all devices and live plots.
   The default directory is *`C:\BLViewData`* where also netCDF files are saved.
   Changing the file path here does not affect the storage location of the netCDF files.



5. Select **Save**

   The saved image displays the device name, date, and information about the used algorithm at the top of the image.
   If you have zoomed in the density plot, the image contains the enlarged view.

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.

Writing a problem report

When troubleshooting the product, write a problem report including:

- What failed (what worked / did not work)?
- Where did it fail (location and environment)?
- When did it fail (date, immediately / after a while / periodically / randomly)?
- How many failed (only one defect / other same or similar defects / several failures in one unit)?
- What was done when the failure was noticed?
- What was connected to the product and to which connectors?
- Input power source type, voltage, and list of other items (such as lighting, heaters, and motors) that were connected to the same power output.
- Are all parts connected and grounded properly? Take a photo to help the troubleshooting.

This information is helpful if you need to contact Vaisala support.

Open source software (OSS)

For licenses for the open source software (OSS) used in this product, see the product user interface.

You may request a copy of certain open source code as required by certain applicable OSS licenses by sending an email to opensourcesw@vaisala.com with the following subject line: *OSS source code request*.

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