



# User instructions for the LIFE-FROSTDEFEND Tool

Prediction and protection system of fruit crops from frost damage  
An innovative solution for crop frost prevention

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# User instructions for the LIFE-FROSTDEFEND Tool

## 1 General

The LIFE-FROSTDEFEND Tool is a novel monitoring and frost forecasting tool for mitigating frost injury in high yield agriculture crops.

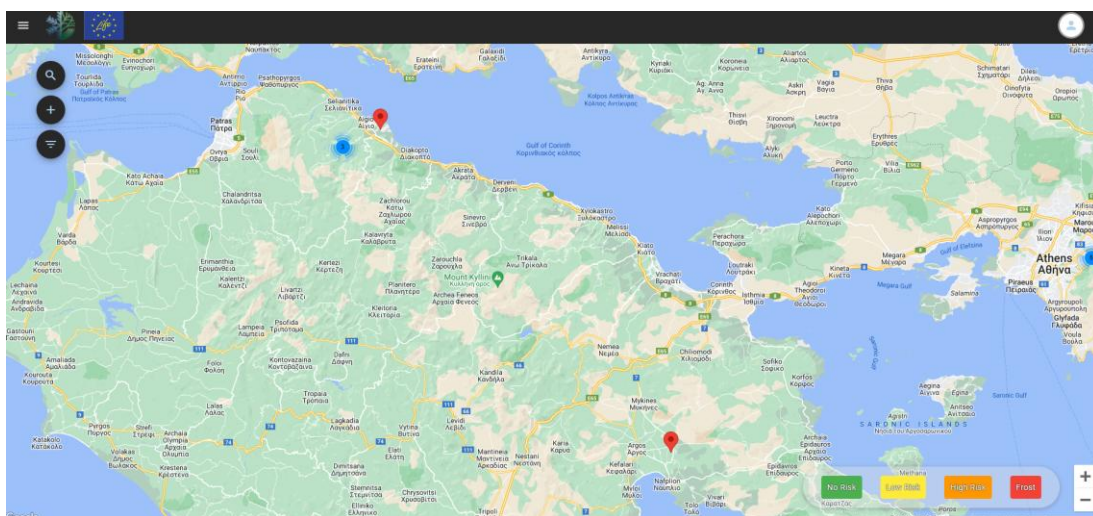
Frost damages on plants depend on several factors. Vegetation is not necessarily damaged when leaf temperatures drop below the freezing point of their cell contents. In the absence of a site nucleating formation of ice crystals, the cell sap remains in a super-cooled liquid state. Ice-nucleation-active bacteria express a particular membrane protein which have the ability to act as a nucleation site, raising the temperature at which ice forms.

A frost event is a meteorological event that causes water in plants to turn from liquid to solid. Crops are extremely sensitive to weather and one “freezing event” can wipe out an entire crop. Frost is one of the main factors of agriculture production losses in Europe.

The LIFE-FROSTDEFEND Tool is using stations equipped with atmospheric sensors to monitor in real time selected relevant atmospheric (aerosol concentration, CO<sub>2</sub>, etc.), meteorological and phenological indicators. The collected data are processed by an innovating algorithm in order for the system to assess and predict the vulnerability and sensitivity of different types of fruit trees to frost events.

## 2 Non registered users

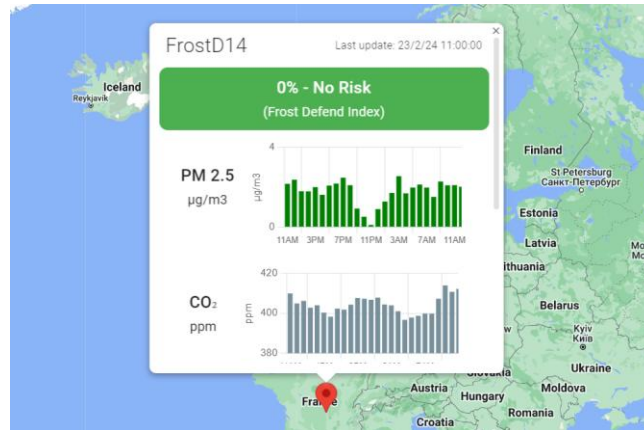
Non registered users are able to see the pins of all publicly available stations on the map. The LIFE-FROSTDEFEND Tool is available at <https://app.frostdefend.eu/>.



By holding the mouse pointer over a pin, the relevant general information for this particular station will be



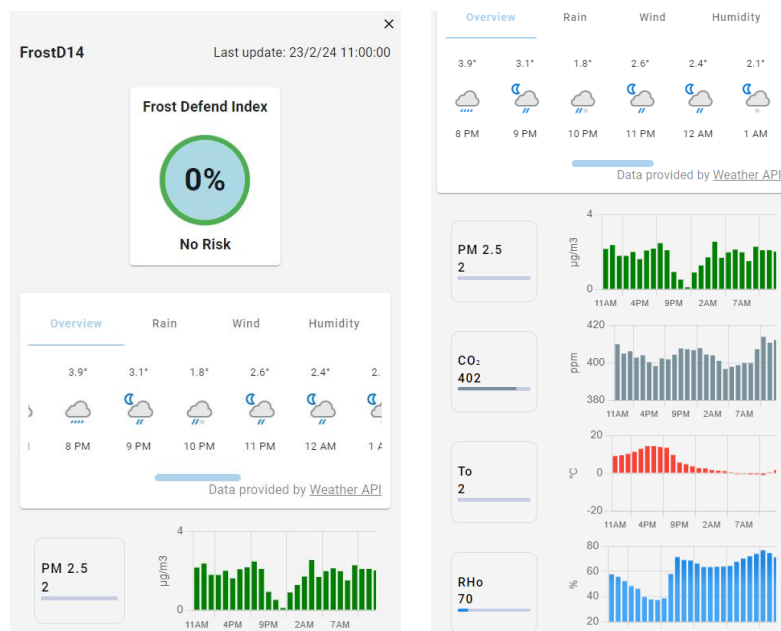
visible. The non-registered users are able to view the frost index of that station and all the information collected by the station's sensors (24 hour bar chart):



The color definitions of the different levels of frost risk are presented at the bottom right corner:



By clicking on a pin, detailed information for this particular station will be visible. The non-registered users are able to see all the available public metrics of this station, the frost risk index and weather data (overview, rain, wind, humidity):



By clicking on a specific metric like , the information of this specific metric will be available as a chart.

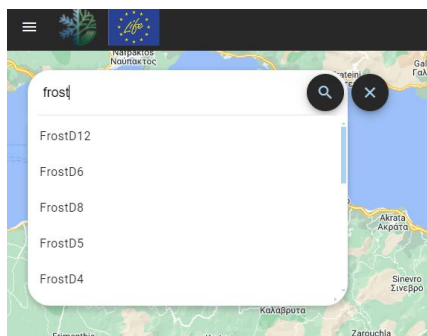


## LIFE-FROSTDEFEND tool

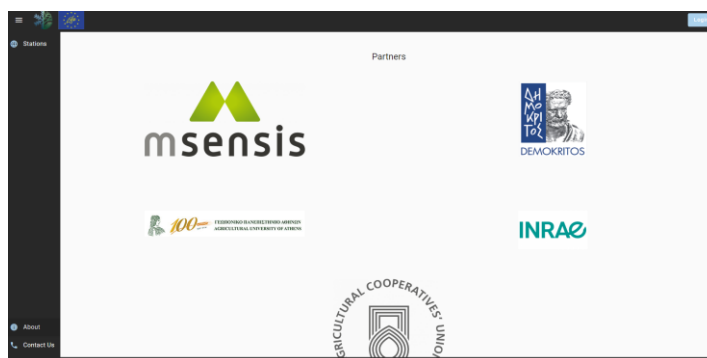
The users are able to choose between live, day, week, month and date range data. By pressing on the button, the users are able to select the desired time interval of the data presentation. By pointing their mouse on a chart, the users are able to drag the relevant chart in all directions and to zoom in and out.



By clicking on the magnifying glass icon, the non-registered users are able to search for publicly available stations:



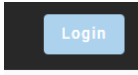
By clicking on the  About button on the main menu, the non-registered users are able to view information about the partners of project. More info regarding the LIFE-FROSTDEFEND project can be found at <https://frostdefend.eu/en/>.

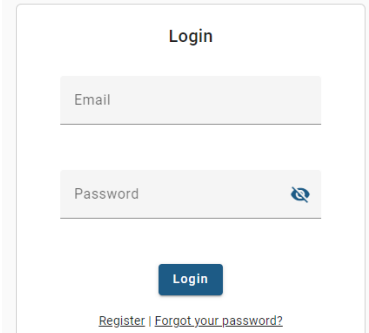


### 3 Registered users

The LIFE-FROSTDEFEND Tool is available at <https://app.frostdefend.eu/>.

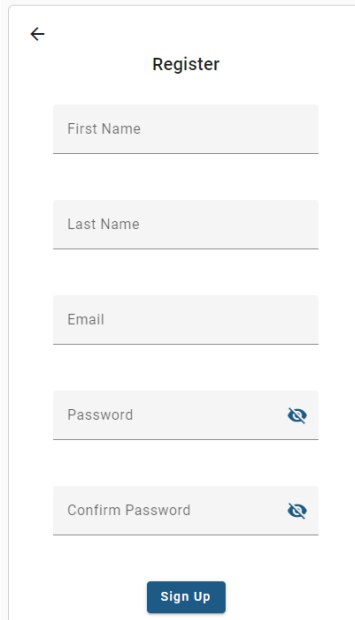
#### 3.1 Login and registration

The logged out users are able to login by clicking on the  button on the top right corner. Then the users will have the option to login, register or reset their password:



The login form is titled "Login". It contains two input fields: "Email" and "Password". The "Password" field has a toggle icon (an eye) to the right of it. Below the input fields is a blue "Login" button. At the bottom of the form, there are two links: "Register" and "Forgot your password?".

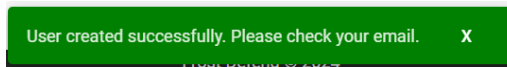
Non-registered users are able to register by clicking on [Register](#) button. During registration the users have to type-in their name, last name, email and password (2 times for confirmation). The registration form is as follows:



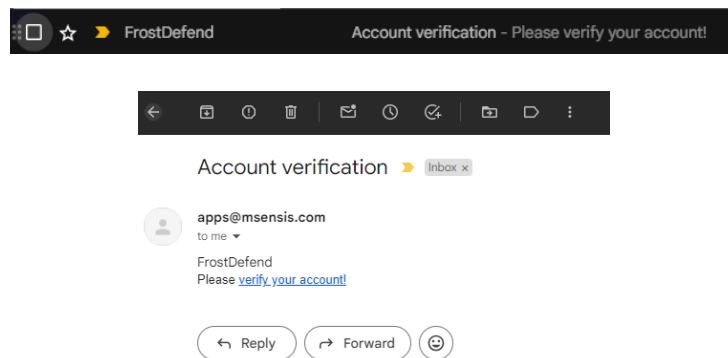
The register form is titled "Register" and has a back arrow icon at the top left. It contains five input fields: "First Name", "Last Name", "Email", "Password", and "Confirm Password". The "Password" and "Confirm Password" fields have toggle icons (an eye) to the right of them. Below the input fields is a blue "Sign Up" button.

After typing in the relevant information and by pressing the “Sign Up” button the users will be informed that a registration email has been sent:





The users then have to check the relevant mailbox for the message received from LIFE-FROSTDEFEND Tool and click on the attached verification link:



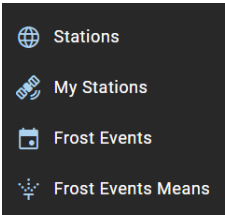
If during the login process the registered users realize that they cannot remember their password, there is available a “Forgot your password” option by pressing on the [Forgot your password?](#) button. Then the users have to type-in the email used during their registration and press the “Send” button. An email with password reset instructions will be send. The password reset form is as follows:

The users then have to check their mailbox for the message received from LIFE-FROSTDEFEND Tool and click on the attached password reset link:

### 3.2 Menu

The registered users can access the menu by pressing the  button on the top left corner.

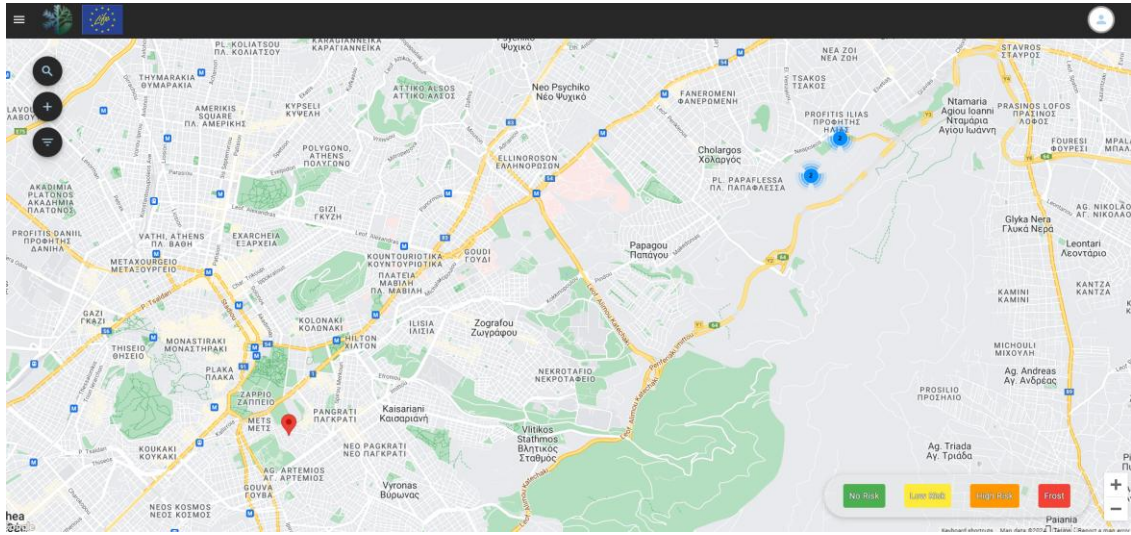




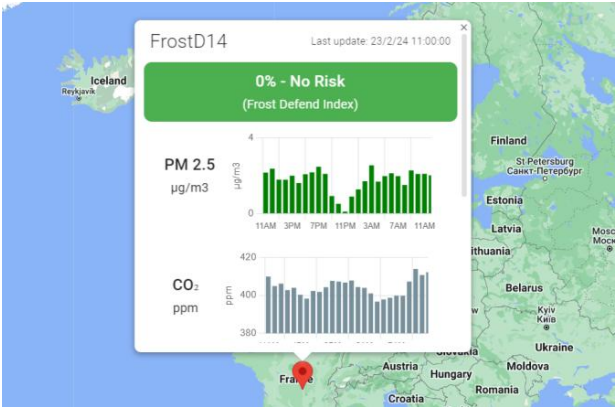
From the menu, the users are presented with four options. View stations on a map (  Stations ), manage their stations (  My Stations ), manage frost events (  Frost Events ), manage frost response methods (  Frost Response Methods ).

### 3.3 Information on the Map

Registered users are able to view the pins of their own stations plus all the publicly available stations.



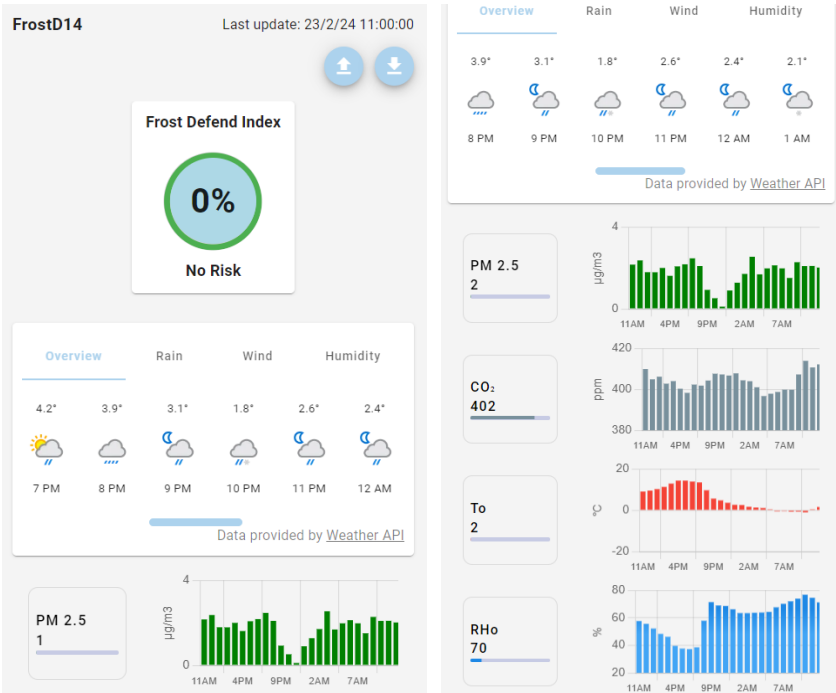
By holding the mouse pointer over a pin, the relevant general information for this particular station will be visible. The users are able to view the frost index of that station and all the information collected by the station's sensors (24 hour bar chart):



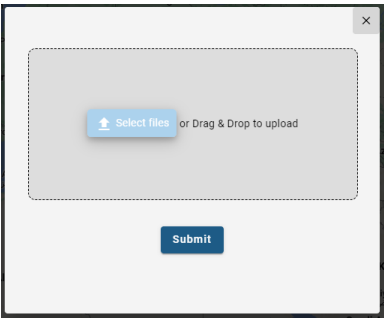
The color definitions of the different levels of frost risk are presented at the bottom right corner:



By clicking on a pin, detailed information for this particular station will be visible. The users are able to see all the available public metrics of this station, the frost risk index and weather data (overall, rain, wind, humidity):

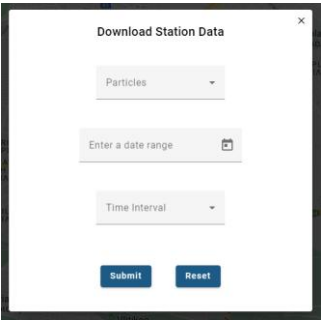


By clicking on the  button the registered users have the option to upload data to the station.



By clicking on the  button the registered users are able to download the station's data. The users have the option to select the metrics, the date range and the time interval of the data to be included in their download.

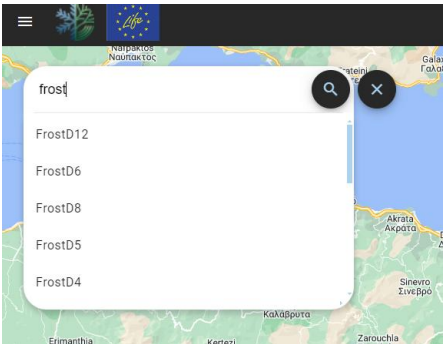




By clicking on a specific metric , the information of this specific metric will be available as a chart. By pressing on the  button, the users have the option to select the desired time interval of the data presentation. By pointing their mouse on a chart, the users are able to drag the relevant chart in all directions and to zoom in and out.

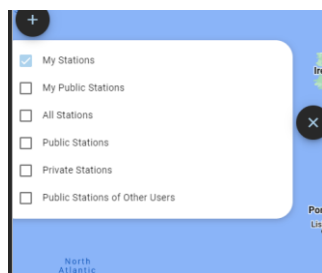


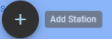
By pressing the  button, the registered users can export the data presented by the chart. By clicking on the magnifying glass icon, the registered users can search for stations:

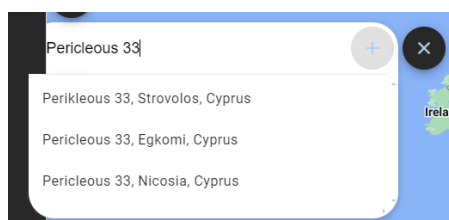


The users are able to select the type of stations that will appear on their map, by pressing the  button. From there, they can select to see all theirs stations, their public stations, their private stations, all public stations, all public stations of other users and all their stations and all public stations together.





The registered users have the option to add a new station directly from the map (the other option is from the relevant button on the main menu) by pressing the  button. The new station is added by typing the station's address.



### 3.4 Profile info

The users have the option to change their account information (name, password, email, mobile phone) and view the API key that will be used when configuring their stations. The user's communication info will be used when the platform is sending notifications to frost events produced by frost prediction algorithm (based on the information received by the user's stations).

Basic Info

Name
Antonis Vlamis

Communication Info

Email
c.kannos@msensis.com

Phone
6980157548

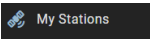
Password

Change Password

Api Key

Api Key

### 3.5 Stations

From the menu the registered users can view, edit and delete information of all their stations by pressing the  button.



## LIFE-FROSTDEFEND tool

| Stations |                                      |         |                |            |           |          |                                                       |                    |                      |                        |                                                              |       |        |
|----------|--------------------------------------|---------|----------------|------------|-----------|----------|-------------------------------------------------------|--------------------|----------------------|------------------------|--------------------------------------------------------------|-------|--------|
| Location | Station ID                           | Comment | Region         | Latitude   | Longitude | Altitude | Timezone                                              | Contact Name       | Contact Email        | Applications           | Metrics                                                      | Crops | Status |
| FrostD12 | 37b8ac50-1a75-434c-b0dc-086c0d09e948 |         | Agia Paraskevi | 37.99521   | 23.815879 | 50       | Europe/Athens - Eastern European Standard Time(GMT+2) | Antonios Vlamis    | c.kannos@msensis.com | airsensis frost-defend | PM2.5<br>CO3<br>C1<br>C5<br>C10<br>PM1<br>PM10<br>RH<br>To T | Lemon | Public |
| FrostD6  | a72a2b1f-3ae7-4c45-b0db-086c0d09e948 |         | Nafplio        | 37.627083  | 22.809694 | 30       | Europe/Athens - Eastern European Standard Time(GMT+2) | Antonios Vlamis    | c.kannos@msensis.com | airsensis frost-defend | CO3<br>C05<br>C1<br>C5<br>C10<br>PM1<br>To T                 | Lemon | Public |
| FrostD8  | a2c068da-cb55-4606-b0dc-086c0d09e948 |         | Algaliaia      | 39.204206  | 22.02535  | 30       | Europe/Athens - Eastern European Standard Time(GMT+2) | Prodomos Fetzatzis | c.kannos@msensis.com | airsensis frost-defend | PM2.5<br>CO3<br>C05<br>C1<br>C5<br>C10<br>PM1<br>To T<br>RH  | Lemon | Public |
| DEMst    | bdab42c3-e8f2-4462-b0dc-086c0d09e948 |         | Agia Paraskevi | 37.9952307 | 23.815876 | 200      | Europe/Athens - Eastern European Standard Time(GMT+2) | Prodomos Fetzatzis | c.kannos@msensis.com | airsensis frost-defend | PM2.5<br>CO3                                                 | Lemon | Public |

By pressing the  button, the registered users have the option to add a new station. For the new station the users have to type-in the location of the station, the status (private/public), relevant comments, the region, latitude, longitude, altitude, timezone, contact, contact's email, metrics and type of crop.

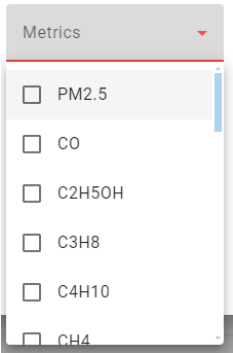
### Add Station Details

By pressing the  button, the registered users can edit an existing station:

| Location             | Station ID                                         | Comment | Region                   | Latitude             | Longitude              |
|----------------------|----------------------------------------------------|---------|--------------------------|----------------------|------------------------|
| Location<br>FrostD12 | Station ID<br>37b8ac50-1a75-434c-b0dc-086c0d09e948 | Comment | Region<br>Agia Paraskevi | Latitude<br>37.99521 | Longitude<br>23.815879 |

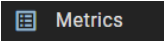
When editing the metrics, the users are able to select what metrics will be publicly available through the map interface.

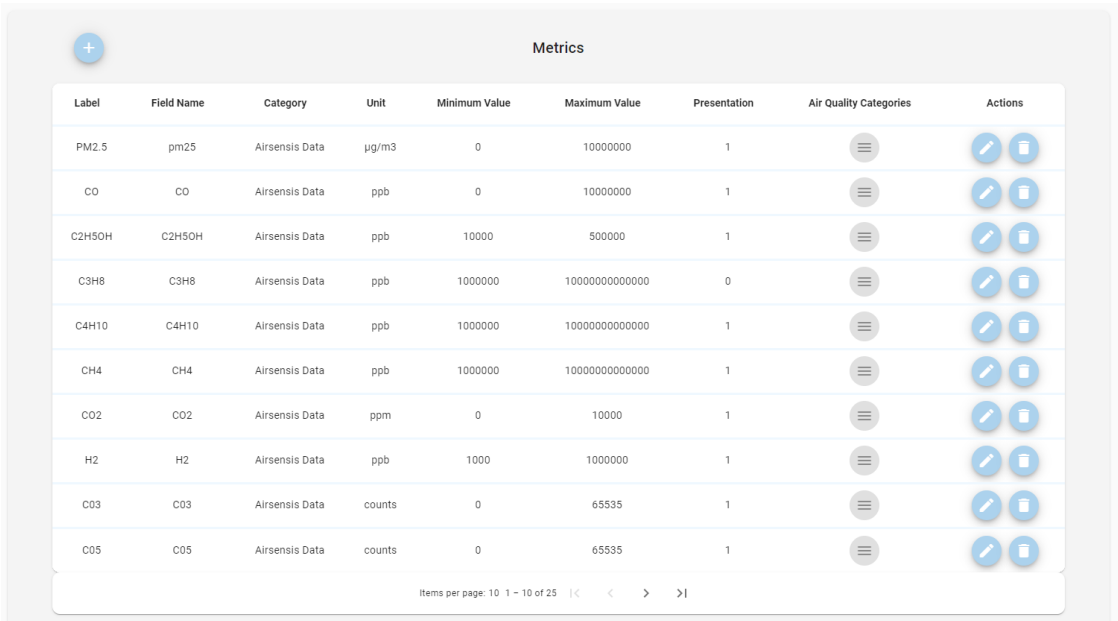




By pressing the  button, the registered users have the option to delete an existing station.

### 3.6 Metrics

By pressing on the  button from the main menu, the users are able to view, edit and delete the metrics available to their stations.

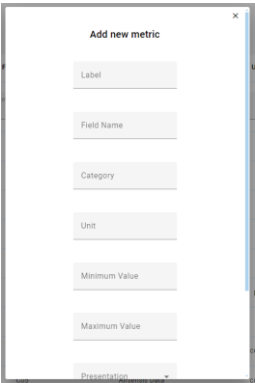


The screenshot shows a web interface for managing metrics. At the top left is a blue circular button with a white plus sign and the text '+ Metrics'. Below this is a table with the following columns: Label, Field Name, Category, Unit, Minimum Value, Maximum Value, Presentation, Air Quality Categories, and Actions. The table contains 10 rows of metrics. Each row has a menu icon in the 'Air Quality Categories' column and edit/delete icons in the 'Actions' column. At the bottom of the table, there is a pagination bar that reads 'Items per page: 10 1 - 10 of 25'.

| Label  | Field Name | Category       | Unit   | Minimum Value | Maximum Value    | Presentation | Air Quality Categories | Actions                                                                                                                                                                     |
|--------|------------|----------------|--------|---------------|------------------|--------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PM2.5  | pm25       | Airsensis Data | µg/m3  | 0             | 10000000         | 1            | ≡                      |   |
| CO     | CO         | Airsensis Data | ppb    | 0             | 10000000         | 1            | ≡                      |   |
| C2H5OH | C2H5OH     | Airsensis Data | ppb    | 10000         | 500000           | 1            | ≡                      |   |
| C3H8   | C3H8       | Airsensis Data | ppb    | 1000000       | 1000000000000000 | 0            | ≡                      |   |
| C4H10  | C4H10      | Airsensis Data | ppb    | 1000000       | 1000000000000000 | 1            | ≡                      |   |
| CH4    | CH4        | Airsensis Data | ppb    | 1000000       | 1000000000000000 | 1            | ≡                      |   |
| CO2    | CO2        | Airsensis Data | ppm    | 0             | 10000            | 1            | ≡                      |   |
| H2     | H2         | Airsensis Data | ppb    | 1000          | 1000000          | 1            | ≡                      |   |
| CO3    | CO3        | Airsensis Data | counts | 0             | 65535            | 1            | ≡                      |   |
| CO5    | CO5        | Airsensis Data | counts | 0             | 65535            | 1            | ≡                      |   |

By pressing the  button, the users can add a metric. For the new metric the users have to type-in the label, field name, category, unit, minimum value, maximum value, presentation (integer/decimal).





A screenshot of a web form titled "Add new metric". The form contains several input fields: "Label", "Field Name", "Category", "Unit", "Minimum Value", and "Maximum Value". At the bottom, there is a "Presentation" dropdown menu. The form is enclosed in a light gray border with a close button (X) in the top right corner.

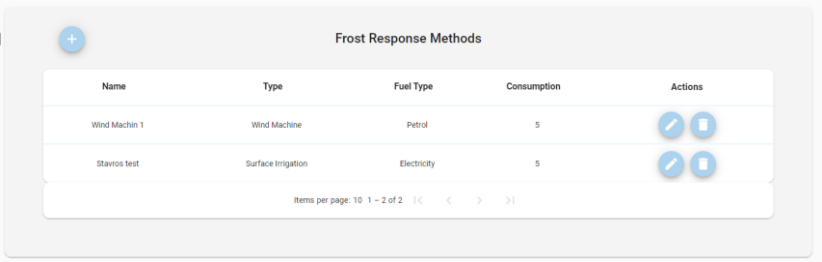
By pressing the  button, the registered users have the option to edit an existing metric:

| Label          | Field Name         | Category                   | Unit          | Minimum Value      | Maximum V                 |
|----------------|--------------------|----------------------------|---------------|--------------------|---------------------------|
| Label<br>PM2.5 | Field Name<br>pm25 | Category<br>Airsensis Data | Unit<br>µg/m3 | Minimum Value<br>0 | Maximum Value<br>10000000 |

By pressing the  button, the registered users can delete an existing metric.

### 3.7 Frost Response Methods

By pressing on the  **Frost Response Methods** button from the main menu, the registered users are able to view, edit and delete their methods for handling frost events.



A screenshot of the "Frost Response Methods" interface. It features a table with columns: "Name", "Type", "Fuel Type", "Consumption", and "Actions". There are two rows of data. The "Actions" column contains edit and delete icons for each row. Above the table is a "+" button. Below the table is a pagination bar showing "Items per page: 10 1 - 2 of 2".

| Name          | Type               | Fuel Type   | Consumption | Actions                                                                                                                                                                     |
|---------------|--------------------|-------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Wind Machin 1 | Wind Machine       | Petrol      | 5           |   |
| Stavros test  | Surface Irrigation | Electricity | 5           |   |

By pressing the  button, the users can add a new method. For the new method the users have to type-in the method's name, type, fuel type and consumption in kW.



Add Method

Name

Type

Fuel Type

Consumption

Submit

Reset

For the method type and fuel type the following options are available for now:

Type

Wind Machine

Windbreak

Surface Irrigation

Misting

Spraying with plant protection products

Fuel Type

Oil

Electricity

Petrol

By pressing the  button, the registered users have the option to edit an existing method.



Frost Response Methods

| Name                                     | Type                                    | Fuel Type                              | Consumption                         | Actions                   |
|------------------------------------------|-----------------------------------------|----------------------------------------|-------------------------------------|---------------------------|
| <div>Name</div> <div>Wind Machin 1</div> | <div>Type</div> <div>Wind Machine</div> | <div>Fuel Type</div> <div>Petrol</div> | <div>Consumption</div> <div>5</div> | <div>✓</div> <div>✕</div> |
| Starros test                             | Surface Irrigation                      | Electricity                            | 5                                   | <div>✎</div> <div>🗑</div> |

Items per page: 10 1 - 2 of 2 < > >>

By pressing the  button, the registered users can delete an existing method.

### 3.8 Frost Events

By pressing on the  **Frost Events** button from the main menu, the registered users are able to view the frost events recorded from the platform.



Frost Events

| Creation Date       | Station  | Notifications | Events Actions | Frost Index | Creator     | Editor | Edit Date | ID                                   | Actions |
|---------------------|----------|---------------|----------------|-------------|-------------|--------|-----------|--------------------------------------|---------|
| 23/02/2024 12:13:35 | FrostD13 |               |                | 0           | fai-service |        |           | a32dd011-1f08-440b-1a50-08dc34581875 |         |
| 23/02/2024 12:13:35 | FrostD   |               |                | 0           | fai-service |        |           | ff9fe9e3-ffe0-44dc-1a51-08dc34581875 |         |
| 23/02/2024 12:13:35 | FrostD14 |               |                | 0           | fai-service |        |           | 64b4821b-b066-4b67-1a52-08dc34581875 |         |
| 23/02/2024 12:13:35 | FrostD17 |               |                | 0           | fai-service |        |           | 79245f7e-4a2c-42d2-1a53-08dc34581875 |         |

Frost events are created either by the system or by the user. For frost events created by the system (through the frost prediction algorithm), the users can view the relevant notifications sent by pressing on the button.

Notifications

| Date                | Name  |
|---------------------|-------|
| 23/02/2024 14:13:59 | Email |

Items per page: 10 0 of 0

By pressing the button, the registered users can add a new frost event (report a frost event that was not predicted by the frost prediction algorithm). For the new metric the users have to type-in the name of the station where the frost event took place.

Add Event

Station

SubmitReset

| Creation Date       | Station | Notifications | Events Actions | Frost Index | Creator         | Editor | Edit Date | ID                                   | Actions |
|---------------------|---------|---------------|----------------|-------------|-----------------|--------|-----------|--------------------------------------|---------|
| 23/02/2024 14:05:11 | FrostD6 |               |                | 0.9         | Antonios Vlamis |        |           | 05b62095-a3f3-4299-6fd4-08dc3467b05a |         |

In frost events reported by the users, no notifications are send.

By pressing the button, the users can edit an existing frost event.

| Creation Date               | Station            | Notifications | Events Actions | Frost Index        | Creator                    |
|-----------------------------|--------------------|---------------|----------------|--------------------|----------------------------|
| Creation Date<br>23/02/2024 | Station<br>FrostD6 |               |                | Frost Index<br>0.9 | Creator<br>Antonios Vlamis |

In an existing frost event, the users are only allowed to edit the action they took as a response to this specific frost event. This is done by pressing on the button. From there the registered users can add, delete and edit



event actions.

Event Actions

| Action | From                      | To                        | Method       | Count | Actions                           |
|--------|---------------------------|---------------------------|--------------|-------|-----------------------------------|
| Test   | Feb 14, 2024, 10:00:00 PM | Feb 22, 2024, 10:00:00 PM | Stavros test | 3     | <div><div></div><div></div></div> |

Items per page: 10 0 of 0 < > >|

By pressing the  button, the users can add an event action to this specific frost event. The users have to type-in the duration of the action, the method and the number of those methods used.

Add

From

To

Method

Count

Submit

Reset

From the methods tab, the users have to select a method from those declared at the frost response methods tab on the main menu.

Method

Wind Machin 1

Stavros test

By pressing the relevant  button, the users can delete an existing frost event or an event action.

