MetX – Documentation v2.5

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meteo matics

Contents

1 Introduction

MetX 2 is a web-based tool on top of the API developed by Meteomatics. It visualizes all available meteorological and oceanographic API parameters, such as temperature (see Fig. 1), pressure, humidity, and cloud cover. Maps are generated using several API queries at the same time to quickly visualize weather data even over large areas. In order to use MetX 2, no further installations no prerequisites (apart from a browser) are required.
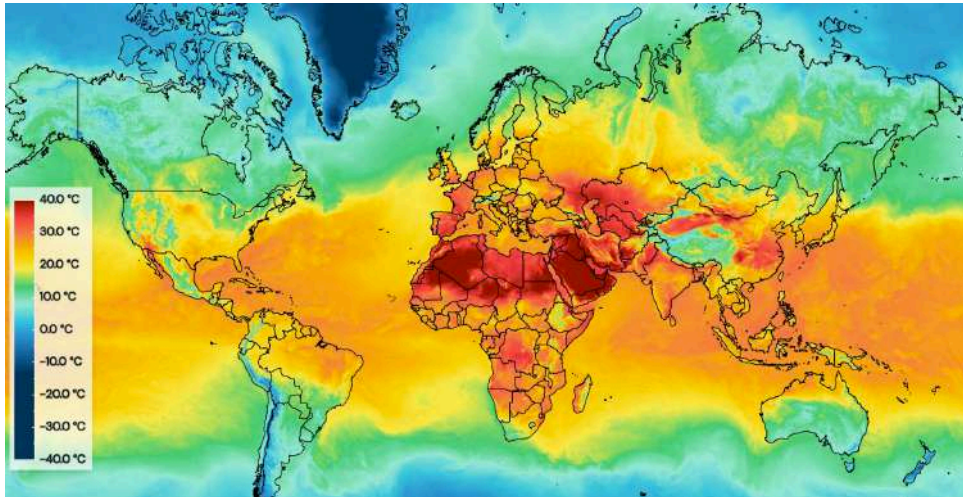

Figure 1: 2m temperature over the entire world.

2 Getting Started

This section gives a general overview over the functionalities within MetX 2 which includes the creation of dashboards and tabs, how to add weather layers, and create maps/plots.

2.1 Log In

The MetX 2 URL is http://metx.meteomatics.com/. When you first visit this page, you will be asked for your login credentials, which should have been given to you by your representative Sales agent. If the login fails, please report immediately to support@meteomatics.com.
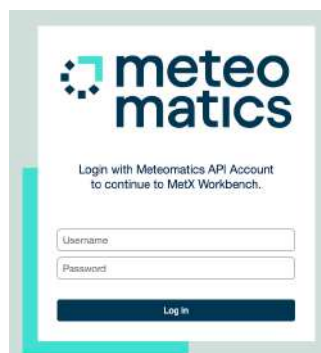

Figure 2: MetX log in screen.

2.2 First Navigation

After a successful login, the user is forwarded to the welcome screen of MetX. On the welcome screen, four default dashboards are already present within the "Your Dashboards" section.

On the top right of the grey-shaded dashboard section, a blank field referred to as "Filter" can be used to find dashboards with a particular name. This feature supports users with many different dashboards in particular. Next to the blank filter field, dashboards can be sorted by title, creation date, and title date. By clicking on "Create Dashboard" a new dashboard can be generated.

Just enter a name, click on the "Apply" button and the new dashboard opens automatically. The default dashboard view shows a basic map with no weather layers on top. By pressing and holding the left mouse button you can change the map extend - in addition, scrolling in and out controls the level of zooming into a map.

Hovering the mouse to either the top or the bottom of your browser window, further buttons will appear on the map. In the top left corner, the name of the dashboard ("New Dashboard") and the tab ("New Tab") can be found. In order to change both names, just double-click either over the dashboard or the tab name.

The + sign next to the tab will open a new tab, which can also be renamed. When you open a new tab two things happen:

1. "x" signs appear which enables the user to close a tab. A confirmation message appears, where the user can either "cancel" or "confirm" to delete the current tab.

2. The user is forwarded to the new tab created where the user can choose between "Add Map" or "Add Plot".
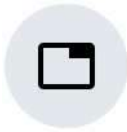

On the top right of the map image above, several buttons appear. Their functionality is briefly described below. Detailed examples (where applicable) are linked in the description.

Button functionality overview:

"Layers" button: This button opens the "Layer Stack", which enables the user to add Weather layers or maps ("cartographic material").

"Tab settings" button: Clicking the "Tab settings" button will open the "General Tab Settings", where the user can change the "Tab Layout". Up to 4 different maps can be combined in one window.

"Account" button: The button will open a window where the user is able to sign out and to change the display language from English to German or French.

"Import / Export" button: The button enables the user to download (=export) or import a Weather dashboards (in a JSON format) as well as export Images and Videos.
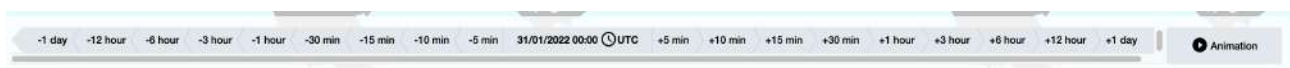
"Save" button: Saves the current MetX 2 dashboard.

"Location" button: Enables the user to look for a specific address or latitude / longitude.

At the bottom of the map view, the user will find several options for time navigation:

| -1 day | -12 hour | -6 hour | -3 hour | -1 hour | -30 min | -15 min | -10 min | -5 min | 31/01/2022 00:00 ⏱UTC | +5 min | +10 min | +15 min | +30 min | +1 hour | +3 hour | +6 hour | +12 hour | +1 day | | ▶ Animation |

Most of the weather layers can be viewed back or forward in time, which is controlled by "-X hour" or "+X min" for example. It is also possible to select a specific date by clicking on the datetime button in the middle, which is referred to as "Display Time":

Choose another date by clicking on the preferred day. "Time" and also "Timezone" can be adjusted to the user's requirements. To quickly navigate to previous/future months and years, the "> / <" and ">> / <<" signs can be used, respectively.

3   Tab Layout

The tab layout specifies how many different maps the user wants to combine in one tab. To get to the tab layout overview, simply click on ▢ ("Tab Settings").

Up to four different panels can be specified, whereas each panel can either contain a map or a plot.
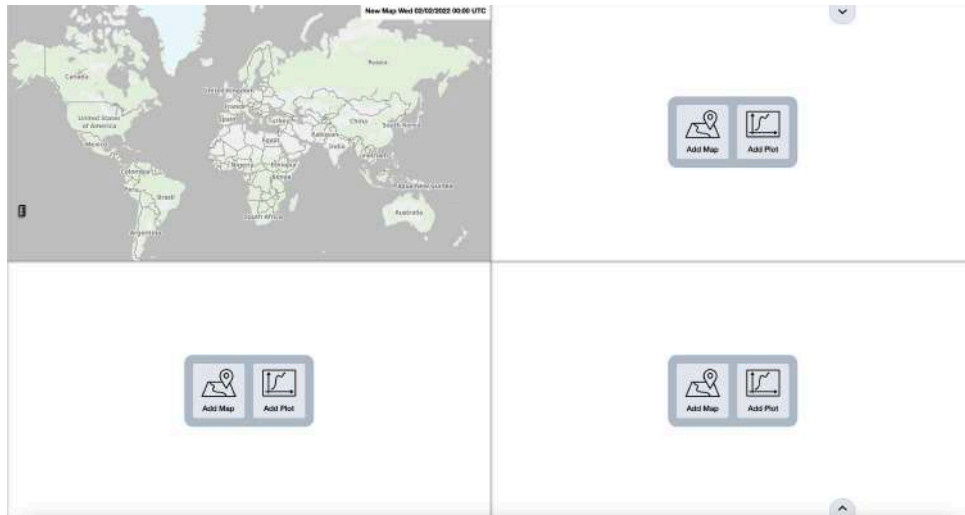
In the end, each panel can be fed with separate weather information, whereas different weather layers can be combined in various ways. Section 4 provides more information on the different weather layers and how to combine them.
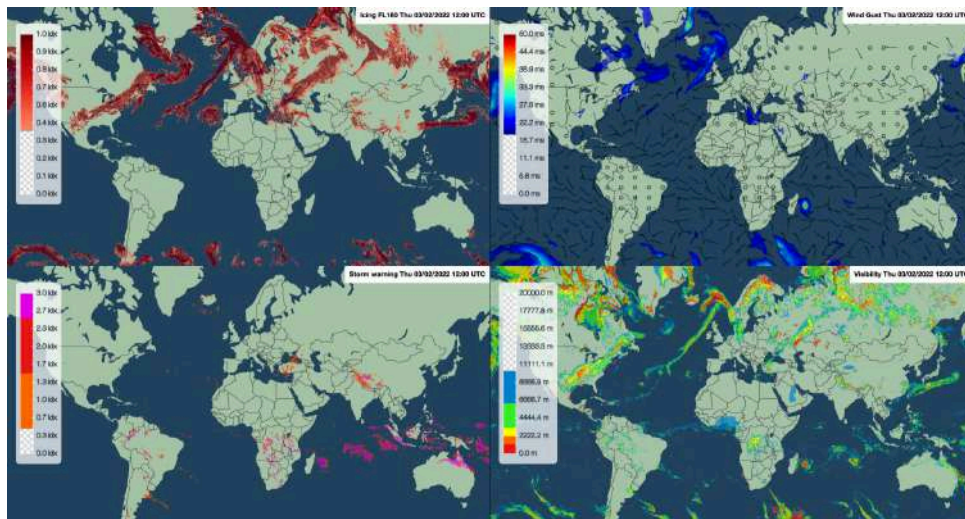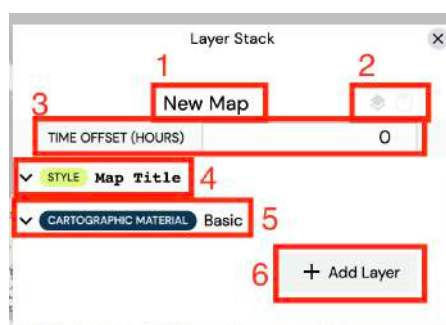

4 Weather Layer Overview

The weather layer overview enables the user to add weather data from multiple sources onto the map or into a plot. To add weather layers in general, simply click on ◈ ("Layers") and the "Layer Stack" will open.

4.1 Layer Stack

When configuring a new dashboard without any weather layers present, the default layer stack layout looks as follows:

The following elements are visible on the layer stack window:

1. Map name "New Map": Clicking on "New Map" and replacing the description with the required name changes the map title.

2. Copy/paste existing layers: Layer stacks can be copied/pasted into current dashboards. Detailed information can be found in Section 5.1.

3. Time offset in hours: The user is able to define a time offset for the displayed map, e.g. when comparing multiple forecast times (see Section 5.4).

4. Map title design: The user can define the appearance of the map title (see Section 5.2).

5. This entry shows the current layer displayed. To see which type of layers are available please refer to Sections 4.2 – 4.14.

6. A button to add weather layers to the map.

The user is able to flexibly drag and drop the layer stack window over the map by clicking and holding the left mouse button near the top. Apart from that, the first layer is already added, which is called "Basic" and belongs to the Cartographic Material (for further information please navigate to the dedicated section). To add one or more weather layers, click on "Add Layer" which will trigger the following window:

In this window the user is able to select the map, where the layer shall be added to. In addition, the user is able to specify different kinds of weather layers, in particular parameter related to Colour Maps, Grids, Isolines, WW Codes, Weather Symbols, Wind and Wave Barbs, Station Data, Points of Interest, Aviation, Pressure System, Lightning Data, and Tropical Cyclones. Each layer has its own possibilities and preferences, which are all described in their dedicated sections. To select a specific layer, click at the dropdown menu "Mode", which shows the following window:
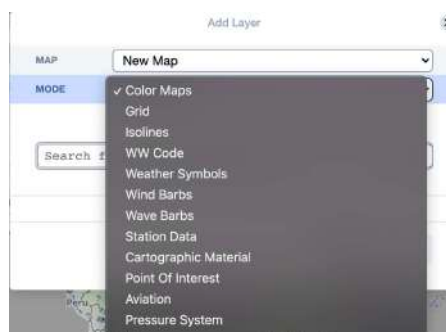
If a weather layer is added, the order of layers can also be changed by dragging and dropping the layer to the top or bottom. Clicking on a layer shows its preferences, whereas the parameter itself can also be changed:

4.2 Colour Maps

Probably the most used layer mode is the color map. Colour maps denote almost any given Meteomatics API parameter as colour contours. To add a weather layer, the user needs to specify API parameter names. If unsure about the parameter names, either refer to the alphabetic parameter list or use the blank field in the "Add layer" window. If a map of the temperature is required, just type "t" into the blank field and a few suggestions will be displayed, from which the user can choose from.

Figure 3: Choice of parameter

To add the layer, a click on the suggested item from the proposed list. In the next window the user can choose the format, unit, and level of the parameter. The parameter formatting is very flexible so the user can query the parameter at various heights or levels, intervals (time ranges), measures (min, max, mean), or type (EFI, SOT).

Kindly note that the parameter formatting is dependent on the parameter's availability and attribute, i.e. precipitation does not have a level because it is recorded at the ground level. If the user is satisfied with the layer adjustments, the button "Apply" will add the layer on the map.

Once the colormap is added, the user is able to change the colormap's preferences regarding the model source, format, unit, level, colors, opacity, and image resolution – given the Layer Stack is opened.
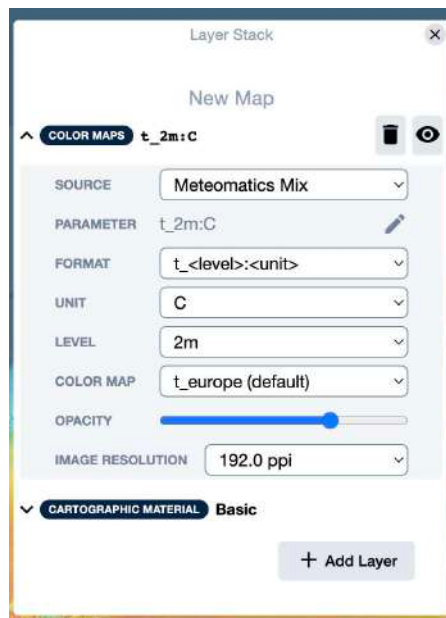

In the lower left corner of the map, the user will find a little legend symbol ▤, where the legend can be activated or deactivated. The latter one is achieved when the user clicks on the legend itself.

4.3   Grids

Apart from color maps, MetX is also able to add grids to the map. In the ◈ section, click "Add Layer" and select "Grid" as layer mode.
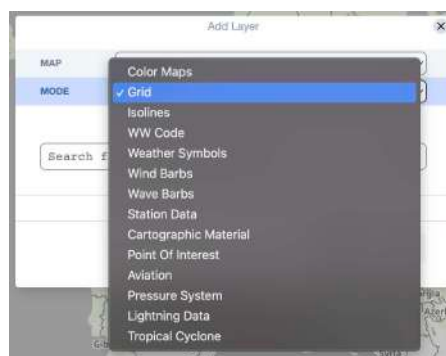
Choose the parameter according to the description around Fig. 3 and click on "Apply". After hitting "Apply", the added grid layer becomes visible in the Layer Stack and in addition to the preferences in the Colour Maps, text color and size can be modified so that the values appear in the required format.
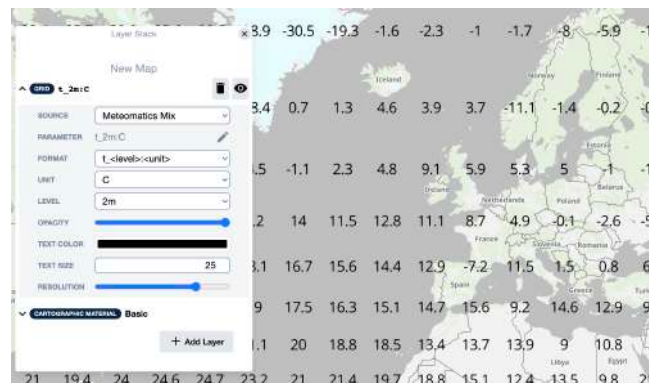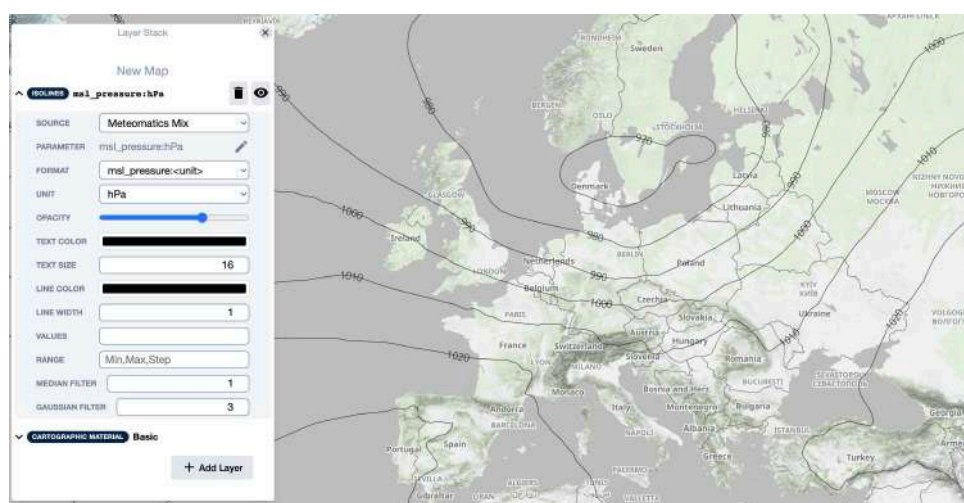

4.4 Isolines

MetX enables the user to display data as isolines. In the ⬦ section, click "Add Layer" and select "Isolines" as layer mode.
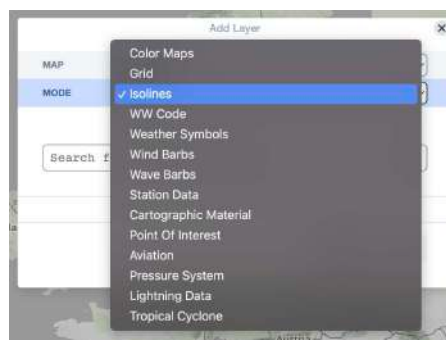
As an example, let's add the mean sea level pressure as parameter by typing "msl" in the blank field below the layer mode (see also Fig. 3). Select the first suggestion, hit "Apply" and the layer is added. In the Layer Stack, click on the msl pressure layer and the following preferences are shown:

In addition to the preferences in the Grids, line color and width, values, range, median and gaussian filter can be modified. While line color and line width change the appearance of the isolines, specific "values" can be specified, i.e. if the user wants to display only isobars of a certain value. Similarly, a user-defined range of isobars can be defined by specifying minimum, maximum and step size, e.g. "970, 1030,4". Median and gaussian filters can be used so smoothen the isolines.
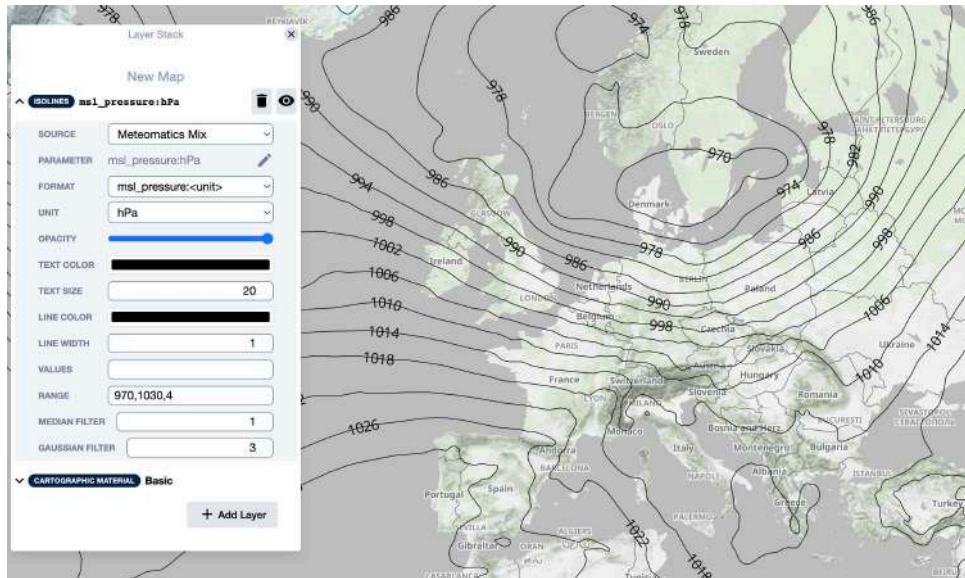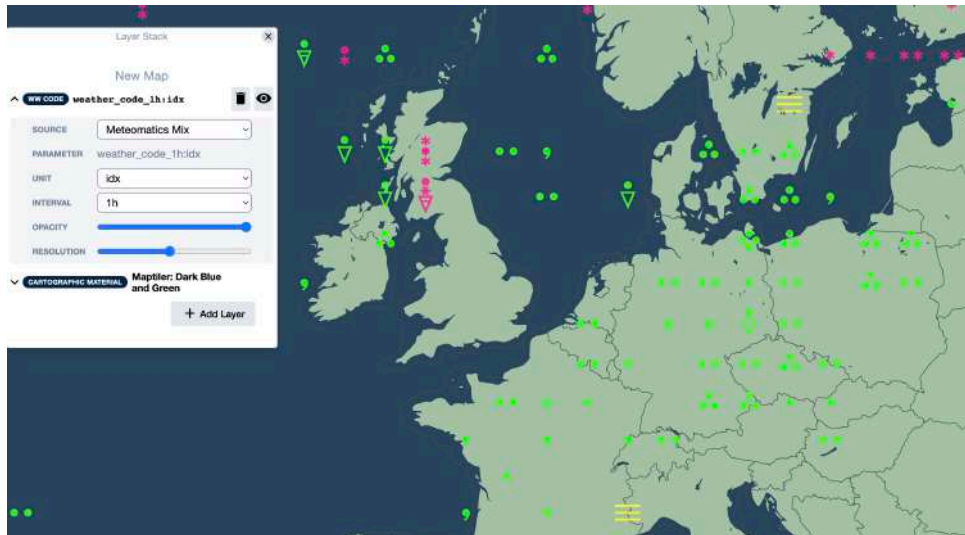
4.5   WW Codes

WW codes usually describe the present and past weather with a reference time (i.e. amount rain within the last 24 hours) at weather stations. On a weather map, ww codes are displayed as symbols, following the convention of the World Meteorological Organization (WMO). An explanation of these symbols can be found within code table 4677 (pp. 356–358) of the WMO library.

Add ww codes in the ⬍ section, click "Add Layer" and select "WW Code" as layer mode.

Meteomatics' Weather API has a dedicated parameter called "weather_code_<interval>:idx", which is why the parameter is already pre-selected. In the "interval" section the user can determine an interval of either 1, 3, 6, 12, or 24h. When the user adds the layer through the "Apply" button, the layer appears in the Layer Stack. A click on the added layer unfolds its adjustable attributes: Source, interval, opacity and resolution.

## 4.6 Weather Symbols

Weather symbols exhibit many similarities with WW Codes: Symbols describe the present and past weather status given a reference time (e.g. presence of rain in the last hour). Like all the other layers, click "Add Layer" and select "Weather Symbols" as layer mode in the ⬦ section. When adding the layer, the same window appears as for the ww codes seen in Figure 4.5 except the mode name being "Weather Symbols". In addition to the intervals in the ww codes, weather symbols can also be shown for 20 and 30 minutes, respectively. When the user adds the layer through the "Apply" button, the layer appears in the Layer Stack. A click on the added layer unfolds its adjustable attributes: Source, interval, opacity and resolution.
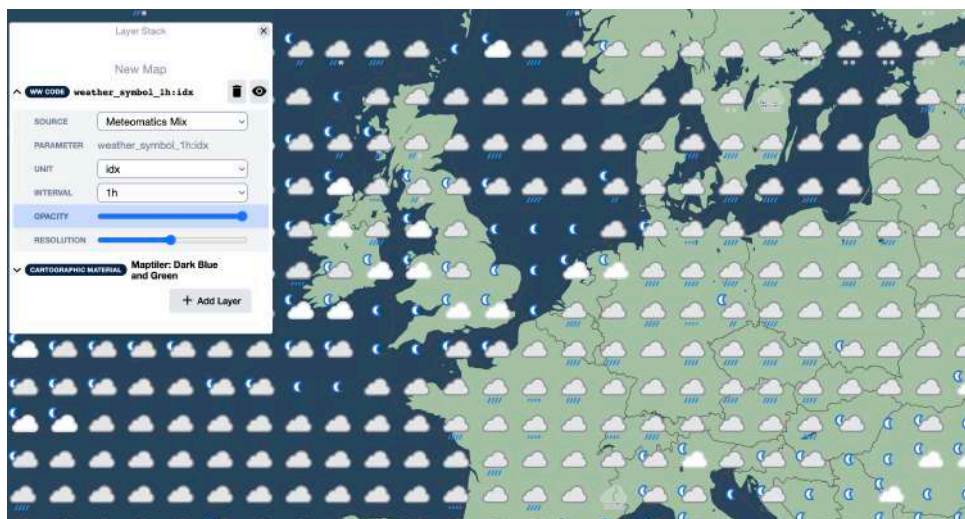
4.7 Wind and Wave Barbs

Winds and waves can also be displayed as barbs in order to condense the information of direction and speed in one symbol. In the ⬦ section click "Add Layer" and select "Wind Barbs" or "Wave Barbs", choose your preferred format, unit and level, and finally hit "Apply".
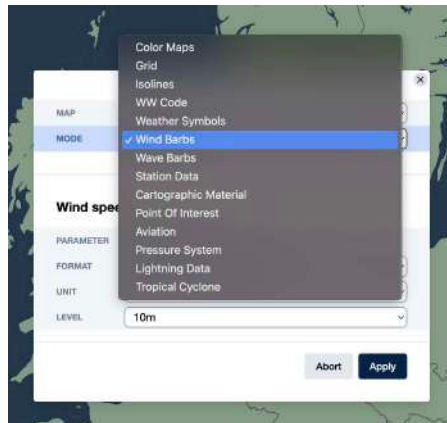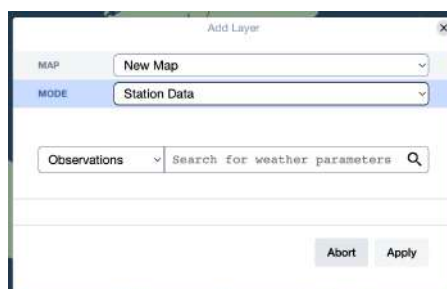
The preferences for wind and wave barbs are the same: Source, format, level, resolution and element color can be modified.
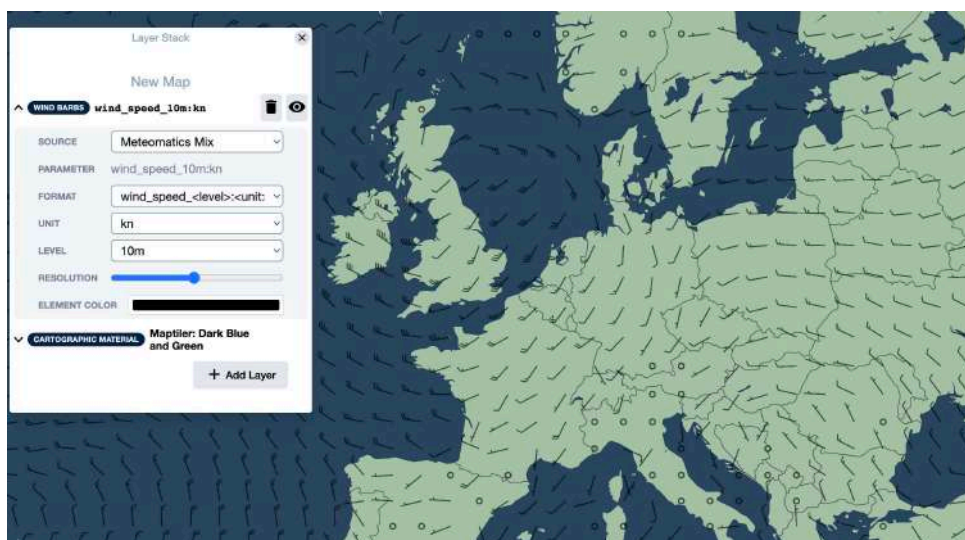

4.8 Station Data

MetX is able to visualize weather station data onto a map. To add station data to your map, click "Add Layer" and select "Station Data" as layer mode in the ⬍ section.

Two fields appear before finally adding the layer: First, the user can choose between "Observations" and "MOS forecasts". If the user wants both, simply add a new layer of station data and select the preferred source. Secondly, the other blank field is dedicated to the required parameter. Please kindly note that not all Meteomatics API parameters can be queried here, because weather stations usually have a limited amount of parameters they capture (e.g. – but not limited to – temperature, precipitation, wind speed). In the blank field, type "t" to get parameter suggestions regarding the "temperature" (also compare Fig. 3). Select the first choice and adjust the "Level" to "2m":
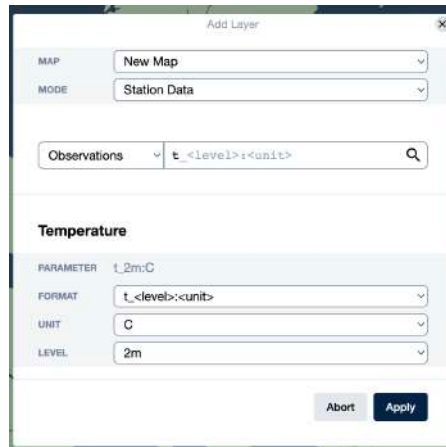
Click on "Apply" to add the 2m temperature station observations to your map. In the Layer Stack the new layer is added, where as source, text size and opacity can be modified.
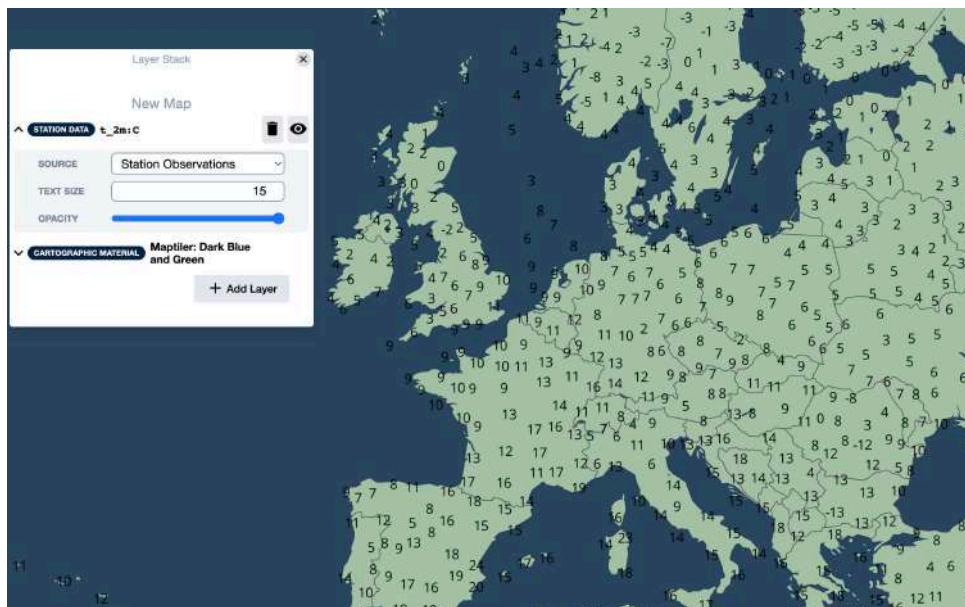

4.9   Cartographic Material

In MetX, a variety of different underlying maps can be selected. To add different maps, click on ⬙ and select "Add Layer", where the user will find "Cartographic Material" in the "Mode" section.
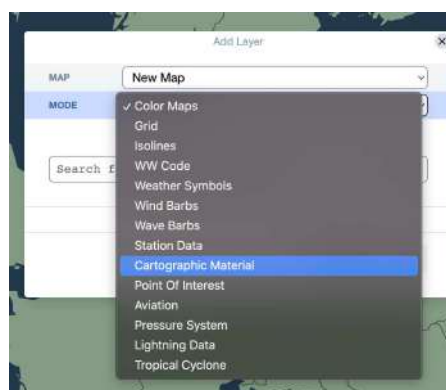

When selecting the "Cartographic Material", another option called "Basemap" will appear and it contains different underlying maps from Maptiler. Of note are the Flight Information Regions over Europe ("Europe FIR"), which are often required in Aviation.
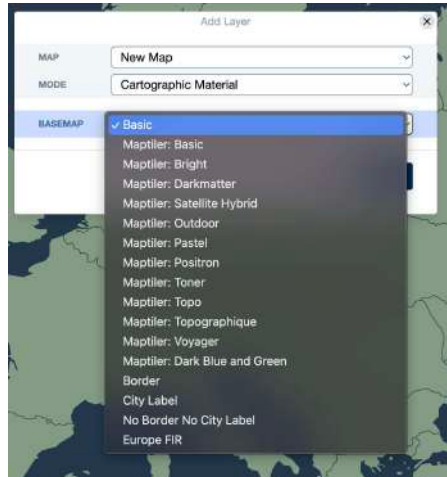
4.10   Points of Interest

Not only weather information can be added to a map, but also certain locations, referred to as "Points of Interests" (POIs). Click on ◈ and select "Add Layer", where the user will find "Points of Interest" in the "Mode" section. The "Apply" button can be hit straight away as no further choice has to be made to add the layer.
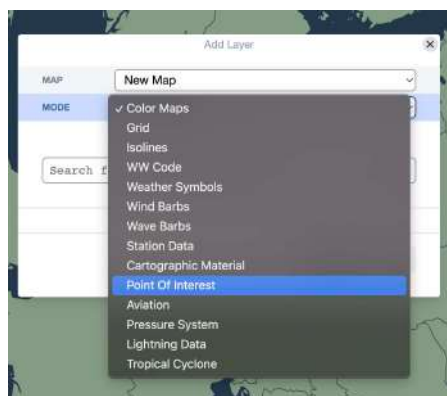

The user can choose the "POI Type" by clicking on either "Icon or "Text". The dropdown menu in the "Icon" section reveals many different choices, e.g. aircraft, house, electricity, ship or power plant symbols. Instead of an icon, a text can also be added by replacing the default "here" in the dedicated field. Default color and symbol size can also be changed. A new feature is the "Threshold by parameter" field, where symbols are assigned a color based on a parameter threshold. For example, if the temperature falls below 0 degrees Celsius, the symbol color can be set to blue. Click on "Threshold by parameter" to add a parameter of your choice. A sophisticated example is shown below:
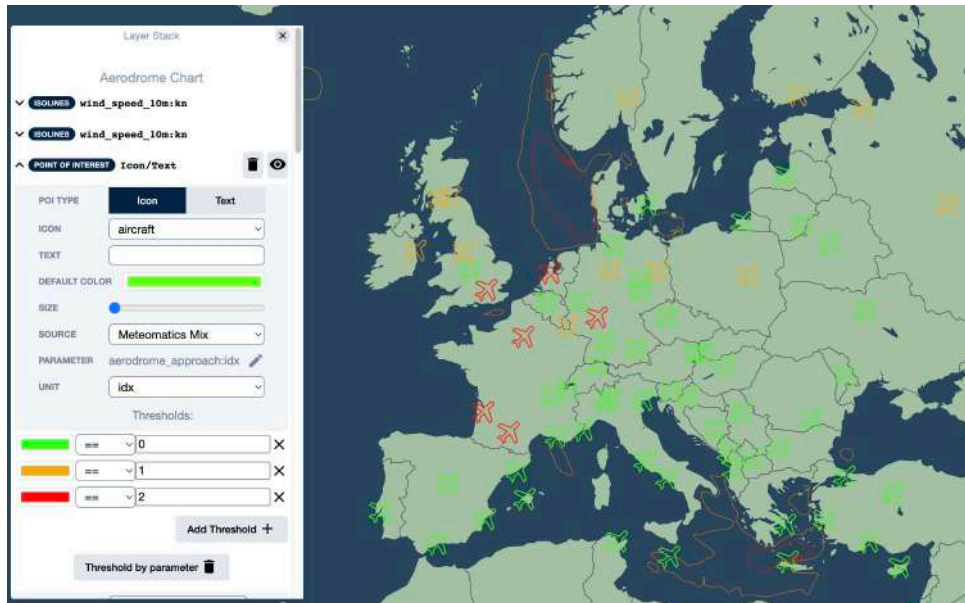
Meteomatics' weather API has a parameter called aerodrome_approach index, which describes significant weather conditions at an airport. In the example above, if the index equals 2, conditions are hostile for an aircraft to land. The user is able to adjust the color, a mathematical operator as well as the value. Based on the weather conditions (i.e. the parameter) the color of the icon will change.
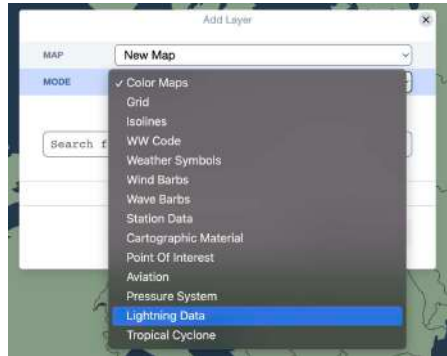
4.11   Aviation

Specifically targeted for the Aviation business, MetX is able to visualize a range of aviation-related data, i.e. (international) SIGMETs, METARs, TAFs, and AIREPs. To display aviation data, click on ⊕, select "Add Layer" and "Aviation" in the "Mode" section.
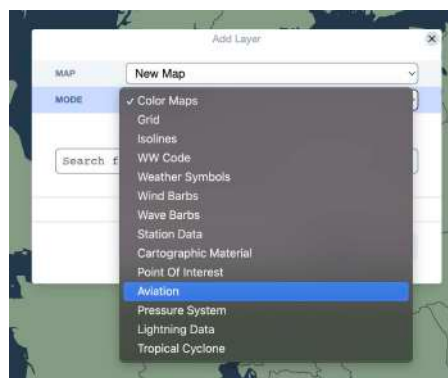

The aviation-related data mentioned above is available as a dropdown list in the "Aviation Data Type" section.
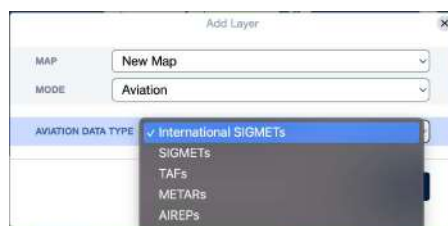
Click on the preferred data source you want to add and hit the "Apply" button. The layer is then added to the Layer Stack, where the aviation data type and text size can be modified once the user clicks on the "Aviation" layer.

4.12   Pressure System

The center of high and low pressure systems are a crucial information on every weather map. With MetX, the user can display these pressure systems with "H" and "L" in addition to the central pressure. To enable highs and lows labeling, click on ⬦, select "Add Layer" and "Pressure System" in the "Mode" section.

Once the layer is added, highs and lows are added to the map.

4.13   Lightning Data

The visualization of lightning strikes is also possible in MetX through a dedicated layer, called "Lightning Data". Click on ⬦, select "Add Layer" and "Lightning Data" in the "Mode" section.

The layer does not have any related parameters, so just hit "Apply" which adds the layer to the Layer Stack. In the layer stack, the user can change the icon color, size, and opacity.
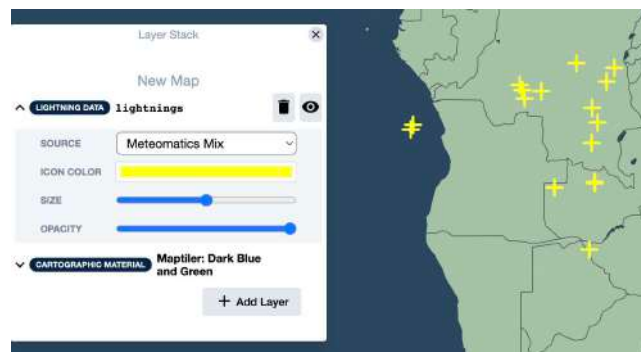
4.14   Tropical Cyclones

Tropical Cyclone (TC) tracks can also be visualized in MetX. To do so, Click on ⬥, select "Add Layer" and "Tropical Cyclone" in the "Mode" section.
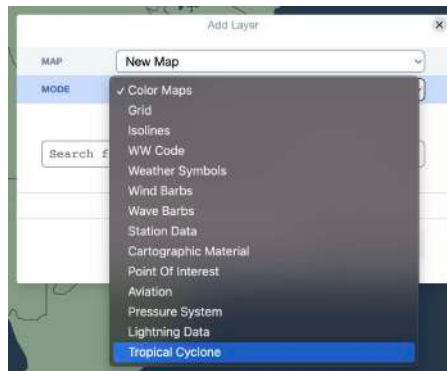
Selecting this layer enables a dropdown menu where the user can select the TC. Please note that TCs in early stages are referred to as tropical disturbances and therefore do not have a name yet. Instead, they get a different naming scheme involving a 2-digit number followed by a letter, e.g. "7OA". Select a TC from the dropdown list and hit "Apply".
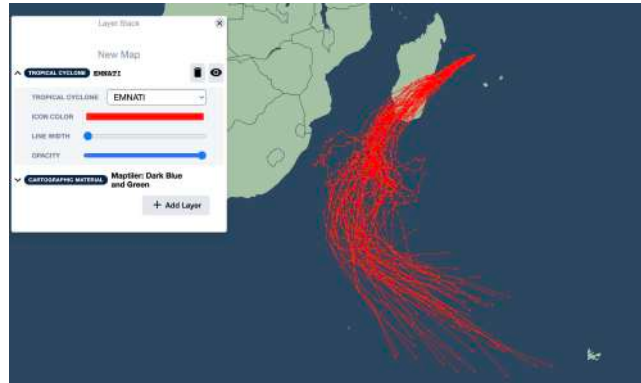
A "Tropical Cyclone" layer is added to the Layer Stack, where the user can either select another TC or change the line color, width, and opacity.

5 MetX Features

The following sections describe useful features in MetX that enable a more efficient user experience.

5.1 Copy/Paste layers

Existing layer stacks can be copied and pasted into current dashboards by using the two icons on the top right of the Layer Stack.
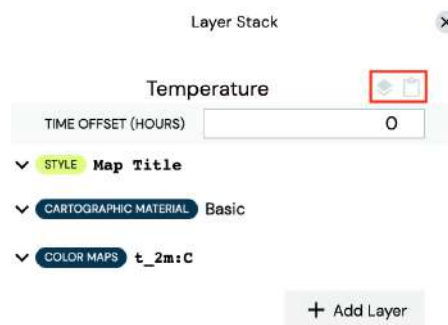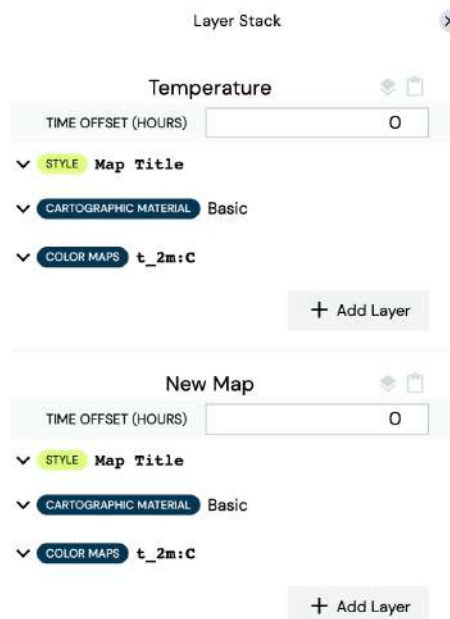

To copy existing layers, click on the left of the two icons. In this example, the 2m temperature color map layer as well as the basic cartographic material layer from the "Temperature" map are copied.
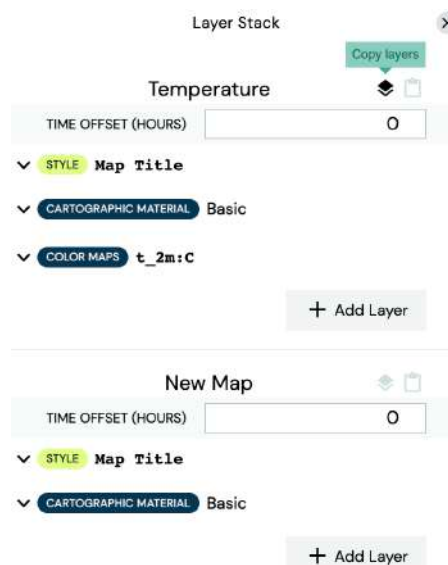
To paste the copied layers e.g. on a "New Map", click on the right icon.
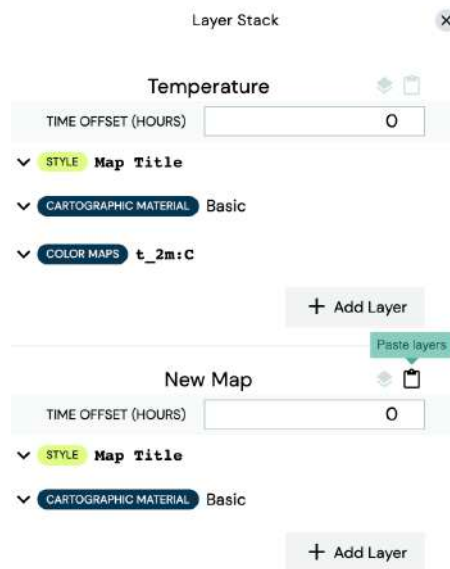
Now, the "New Map" consists of the same layers as the "Temperature" map.

5.2   Map title design

The user can define the appearance of the map title by clicking on the "STYLE Map Title" layer on the Layer Stack. The font color, font size and font style (bold, italic, underline) of the map title can be specified.
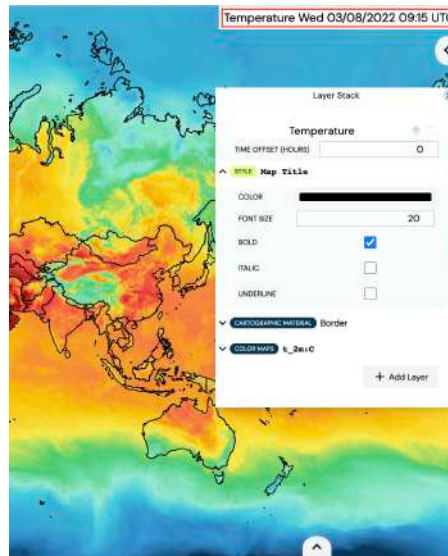
5.3 Operational Mode

The operational mode allows the user to enable automated updates of the current dashboard every 15 minutes. The feature is enabled by checking the box in the date time picker under "Operational Mode".

5.4 Time offset

The user is able to define a time offset for the displayed map. Like this, the user can compare e.g. multiple forecast times for one map. For the initial map, the time is defined as described in the "First Navigation" section. Then, the time offset for each map can be individually specified on the top of the Layer Stack in the respective box. The time offset is given in hours. Use the time slider at the bottom to navigate the same amount of time forward or backward in time on all maps, while keeping the defined time offset constant.
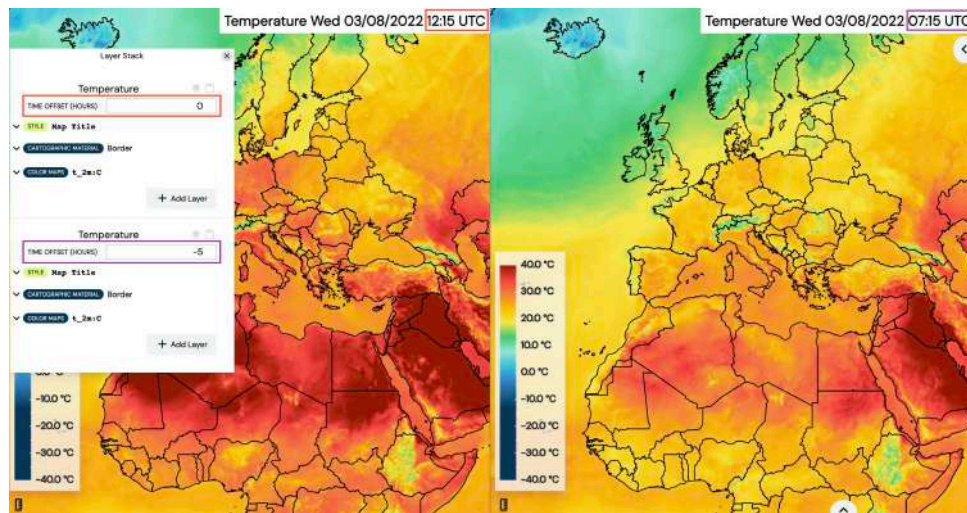
6   Creating Animations
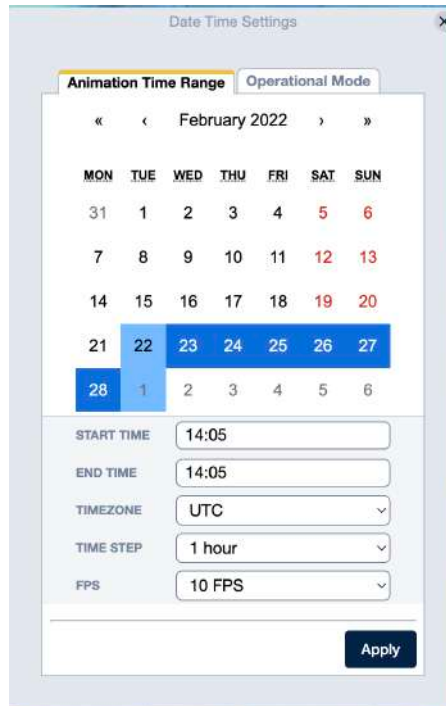
In MetX the user is able to create animations. To do so, add a layer to the map (see section 4) and click on "Animation" in the bottom right corner.
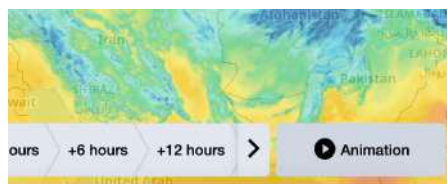
Clicking on the animation button will enable the animation bar, which comes with several options: From right to left, there is a button "Time Navigation", which leads back to time bar (=exits the animation mode), the animation scroll bar, forwards, play, backwards, loop buttons and a date time button.

In the bottom left corner, the date time button enables the user to adjust the animation time range settings, which include start and end time, timezone, time step and frames per second (FPS). Hitting the "Apply" button approves your adjusted preferences.

7 Import / Export

In MetX, the user has the ability to import/export saved weather dashboards as well as images and videos. To import/export MetX 2 dashboards or images and videos, click on ⬇ first.

7.1 Weather dashboards

In order to import/export a weather dashboard, select "dashboard" in the "Import / Export" section and either click on "Download Dashboard" or "Import Dashboard" when you want to download or import a dashboard, respectively.

7.2 Images and Videos

In order to export an image, select "Image/Video" in the "Import / Export" section and click on "Download Image".

8 Plots in MetX

MetX visualizes weather data also through the plot function. When adding a new tab or changing the Tab Layout to more panels, click on "Add Plot" (compare Fig. 2.2 and 3). The default adjustments include an overview of the 2m temperature over the following 7 days.
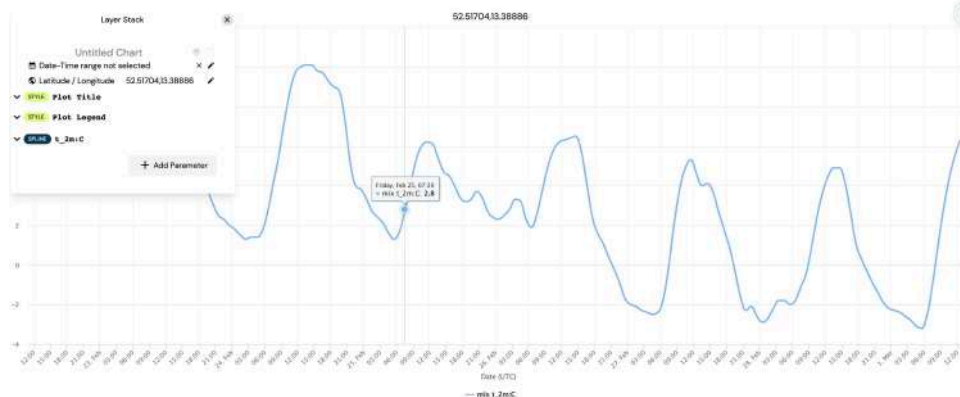
In the Layer Stack, the user can change the title of the chart, select a date–time range and change the location where the weather information is obtained from. The change of the chart title is performed through a click on "Untitled Chart" and a manual input in the blank field that appears. The user can select a specific date and time with the time navigation at the bottom of the map to get a timeseries of the following 7 days of the selected date or the user can define a date–time range by clicking on the little pencil next to the "Date–Time range" right below the chart title. A new window opens, where the user can define the start and end date as well as the start and end time of the plot. Furthermore, the temporal resolution of the displayed parameter can be defined in the interval section.


Hitting the "Apply" button leads to an output like the following:
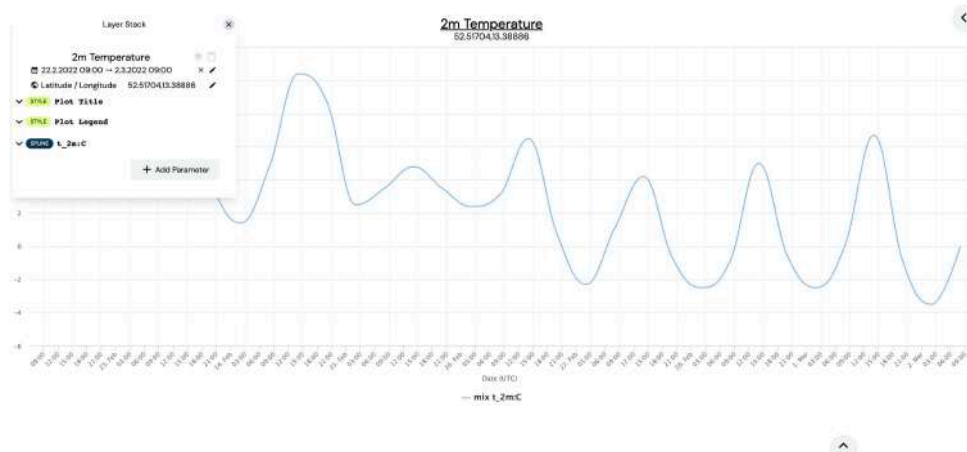
Right below the "Date-Time range", the location can be modified by clicking on the little pencil next to the "Latitude / Longitude" information. A small window opens, where the user is able to enter latitude/longitude or a specific address. Below the location information in the layer stack, there are at least two "Style" options, which enable the user to modify the style of the chart title and legend regarding color, font size and appearance (bold, italic, underline).
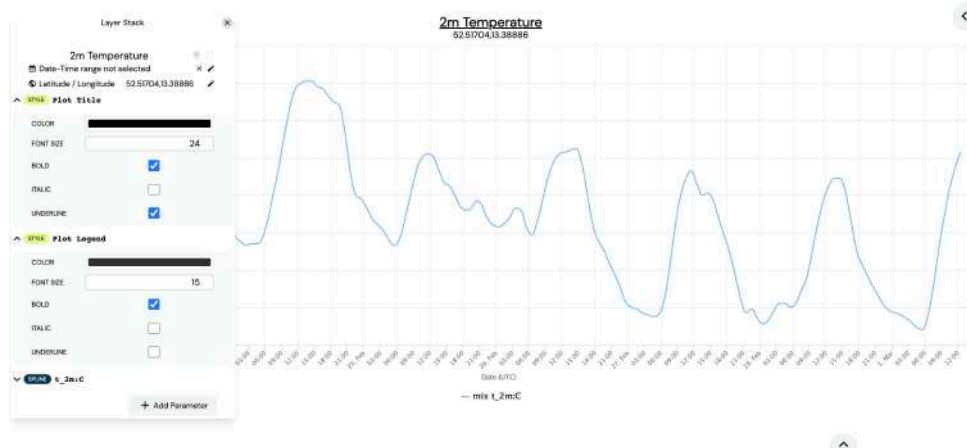
Apart from heading and legend style modifications, the user can also change the appearance of the parameter shown in the plot. Model source, parameter, format, unit, and level are adjustments that are known from the map overview already. In addition, the user can decide to use calibrated data as well as to change the color, series type, line type and the amount of Y-Axis.

The "Thresholds" section adds an additional color based on a threshold, which can be determined by the user. For example, if the 2m temperature falls below 0 degrees Celsius, the temperature line should be red. Thus, check the "Low" box, set the threshold next to it to 0 and choose the colour red.
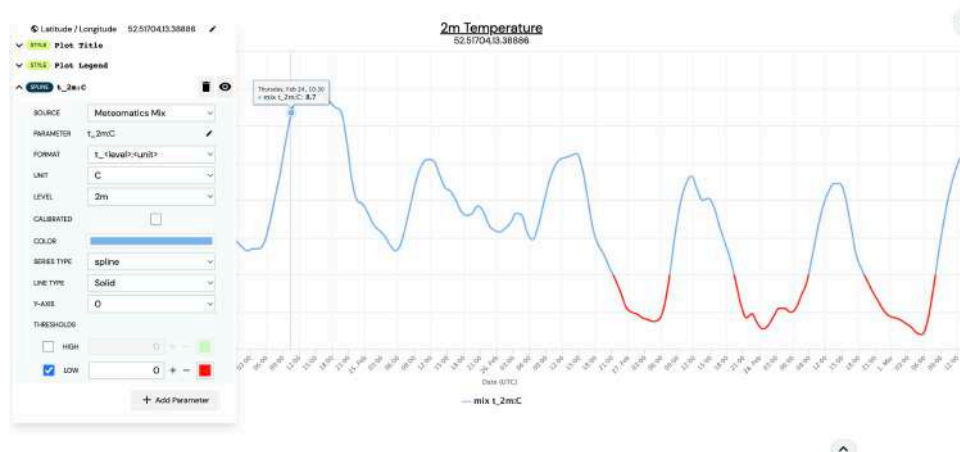
Currently, the user is able to add 2 thresholds.

Plots can have multiple parameters included. This can be done by clicking on "Add Parameter" at the bottom right of the layer stack. Here, each parameter can be adjusted with its own style and thresholds.
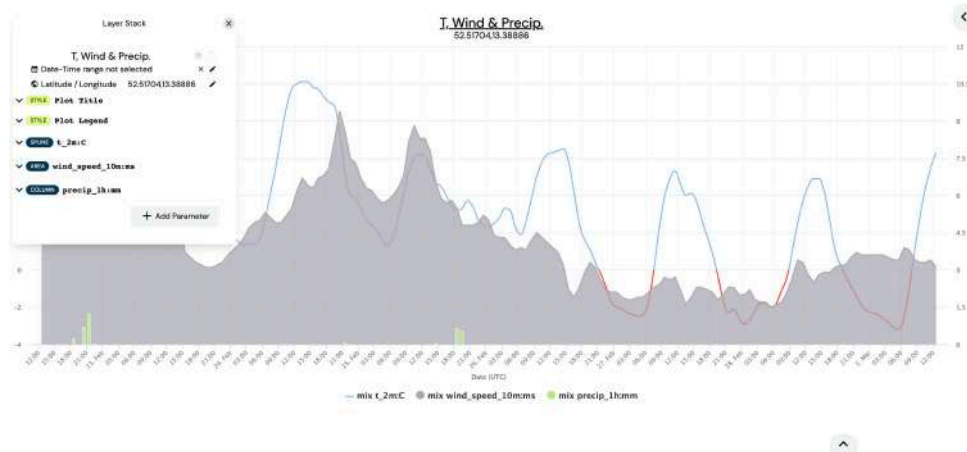
9 Build your own maps in MetX: Examples

The following sections give some examples on how to build your own maps in MetX.
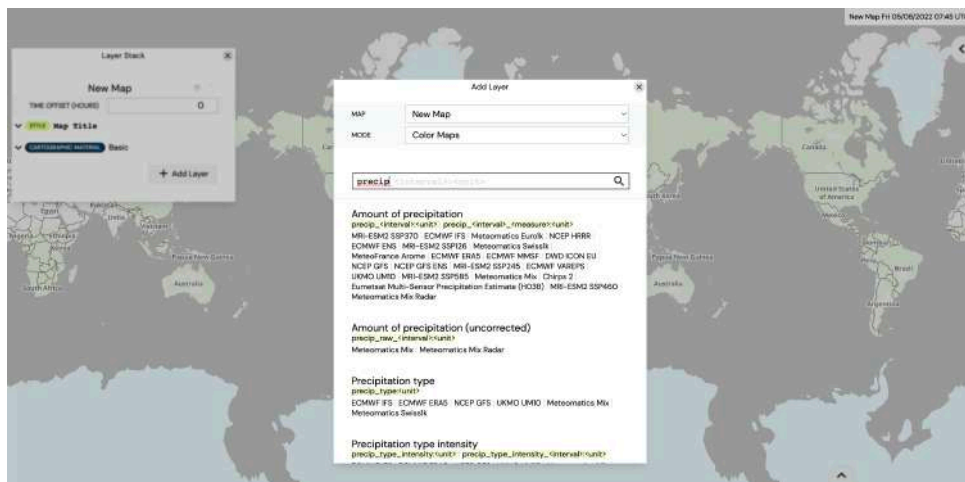
9.1 Weather overview

Let's create a map giving a general weather overview. First, create a new dashboard in the welcome screen. To do so, click on the "Create Dashboard" button, enter the name of your new dashboard e.g. "MetX Examples" and click on the "Apply" button (see section First Navigation). Alternatively, you can open a new tab in an already existing dashboard. Click on [+] and hit the "Add Map" icon (see section First Navigation). In both cases, your screen looks now the following:


Now, the newly created tab can be renamed e.g. with "Weather Overview" by clicking on "New Tab".
In a next step, select the desired parameters. Click on ⬥ to open the Layer Stack.

Hit the "Add Layer" button on the bottom right of the Layer Stack. A new window opens. We want to add a new colormap. Thus, select "Color Maps" as "MODE" (see section Colour Maps). Then, type "precip" in the "Search for weather parameters" box to add precipitation to the map.

Select the parameter "Amount of precipitation" at the very top by clicking on it. Now, you can specify the parameter properties (format, unit and interval).
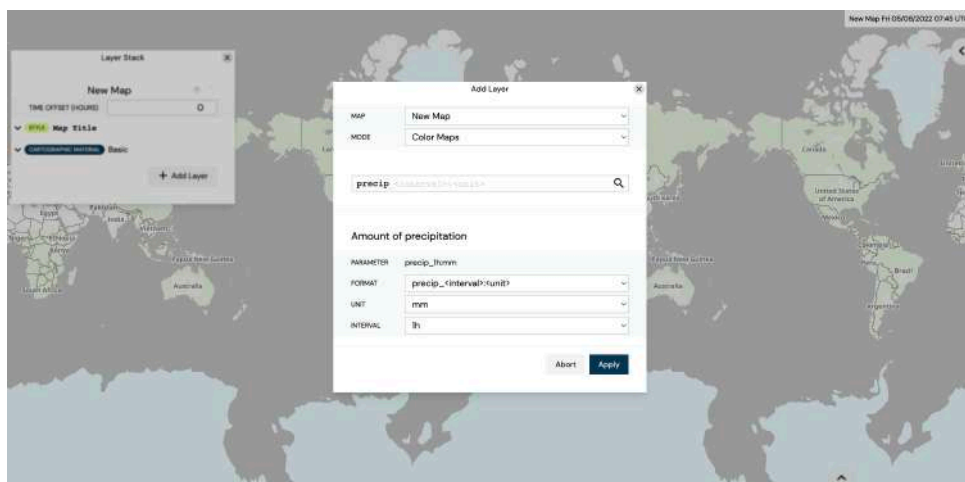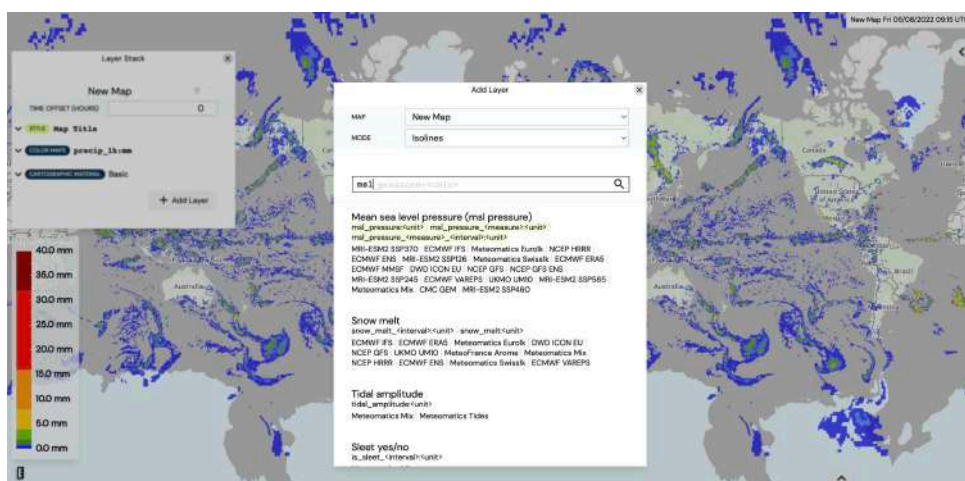

In this example, we choose for the precipitation the format "precip_<interval>:<unit>", the unit "mm" and an interval of 1 hour. Thus, the amount of precipitation in the previous hour in mm is displayed after hitting the "Apply" button. Your map looks now similar to the following:
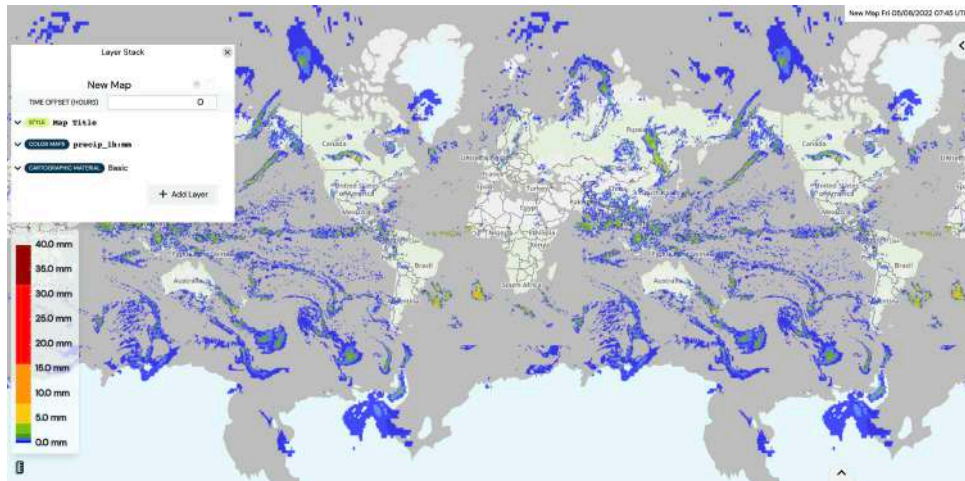
If it is wished, the user can now change the colormap's preferences by clicking on "COLOR MAPS precip_1h:mm" on the Layer Stack (see section Colour Maps). In this example, we stick to the default values.

To insert a second parameter on the same map, click again on the "Add Layer" button on the bottom right of the Layer Stack. Select "Isolines" as "MODE" and type "msl" in the "Search for weather parameters" box to add pressure isolines to the map (see section Isolines).


Select the parameter "Mean sea level pressure" at the very top by clicking on it and specify the parameter properties (format and unit).
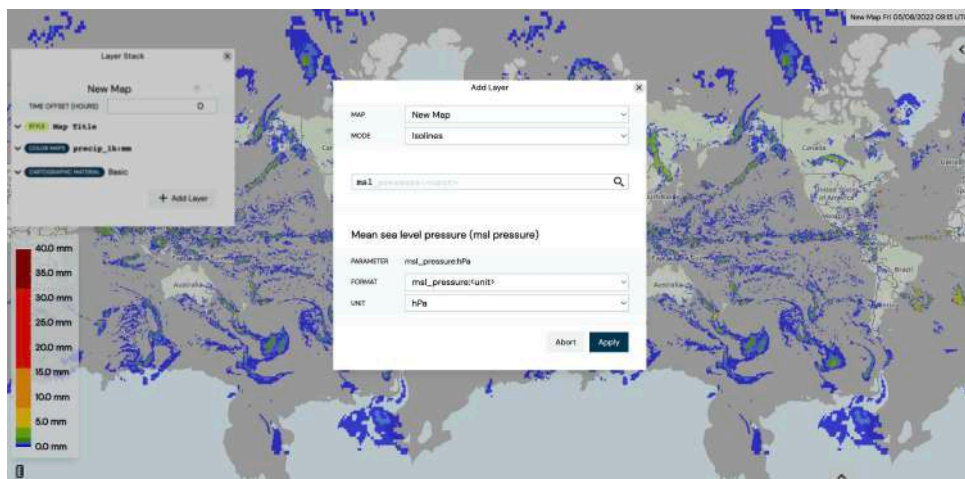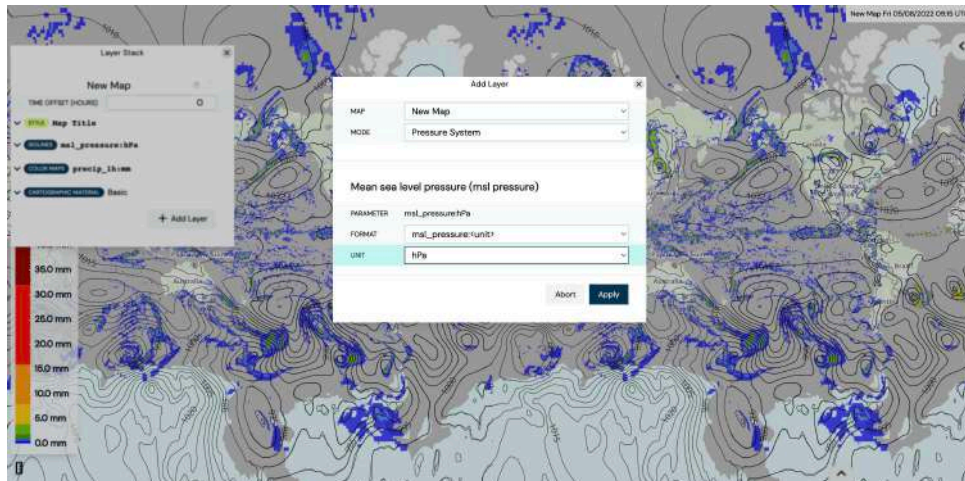
In this example, we choose for the pressure the format "msl_pressure:<unit>" and the unit "hPa". Thus, the mean sea level pressure in hPa is displayed as isolines after hitting the "Apply" button. Your map looks now similar to the following:
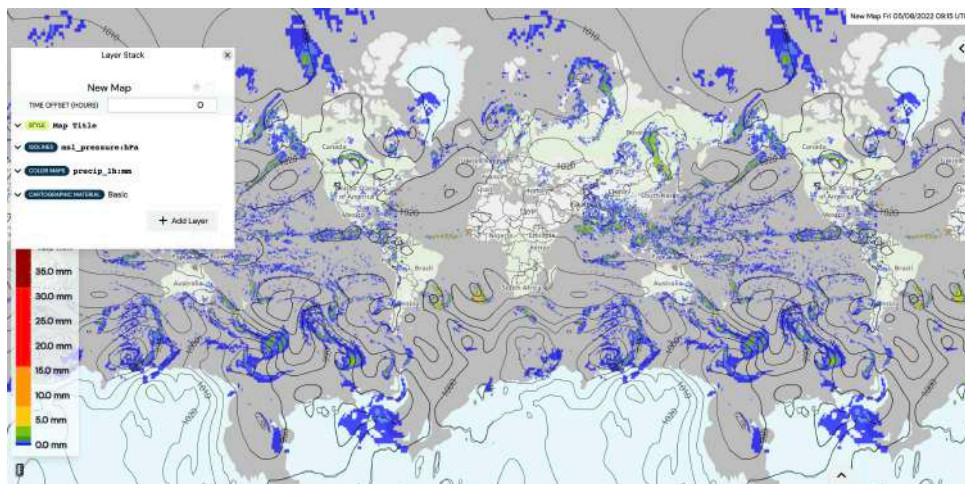
To change the preferences for the mean sea level parameter, click on the Layer Stack on "ISOLINES msl_pressure:hPa". We would like to change the displayed range and spacing of the isolines. Thus, type the minimum, maximum and the step in the "RANGE" box. We choose a minimum of 950 hPa, a maximum of 1050 hPa and a step of 5 hPa (see section Isolines).
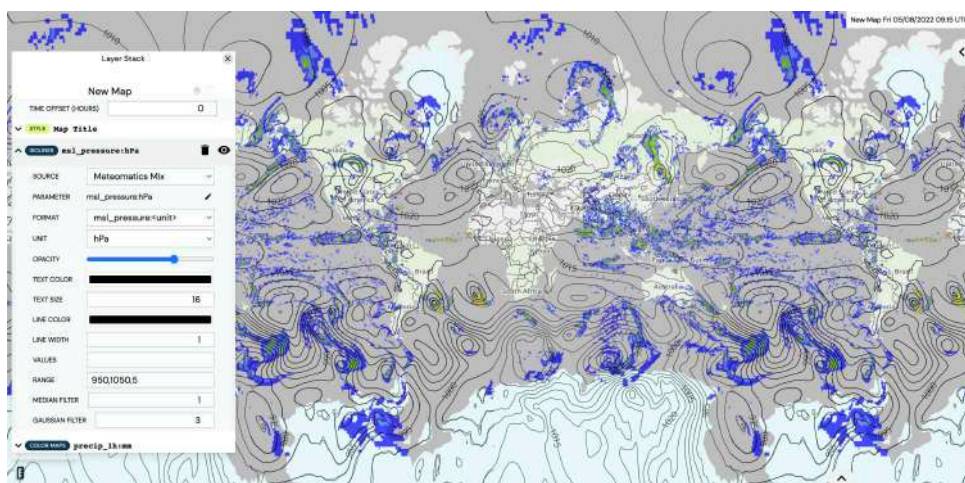

To add the symbols "L" and "H" in the center of the pressure systems, click on the "Add Layer" button on the bottom right of the Layer Stack. Select "Pressure System" as "MODE" and specify the format and unit. In this example, we choose "msl_pressure:<unit>" and the unit "hPa". Click on "Apply" to add the symbols to the map (see also section Pressure System).

If it is wished, the user can now change the preferences of the pressure system by clicking on "PRESSURE SYSTEM msl_pressure:hPa" on the Layer Stack (see section Pressure System). In this example, we stick to the default values.

To change the underlying cartographic map, click on the Layer Stack on "CARTOGRAPHIC MATERIAL Basic" and select a "BASEMAP" (see section Cartographic Material). In this example, we choose the "Maptiler: Basic" as "BASEMAP". Your map looks now similar to the following:
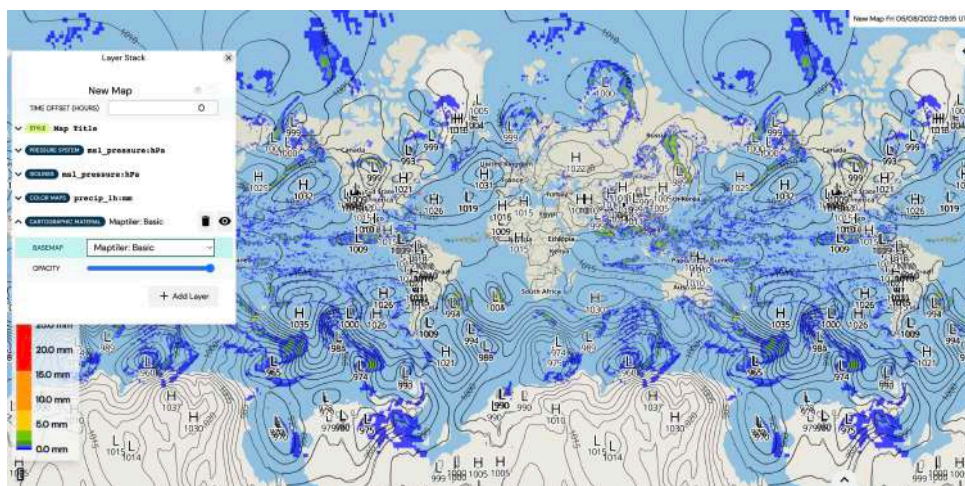

Now, we would like to rename the created map. Click on "New Map" at the top of the Layer Stack and insert a title for your map e.g. "Precipitation and Pressure". The design of the map title can be adapted by clicking on "STYLE Map Title" on the Layer Stack (see section Map title design). You can change the color of the title e.g. to red, change the font size e.g. to 20 and check the box for a bold title. The resulting map looks similar to:
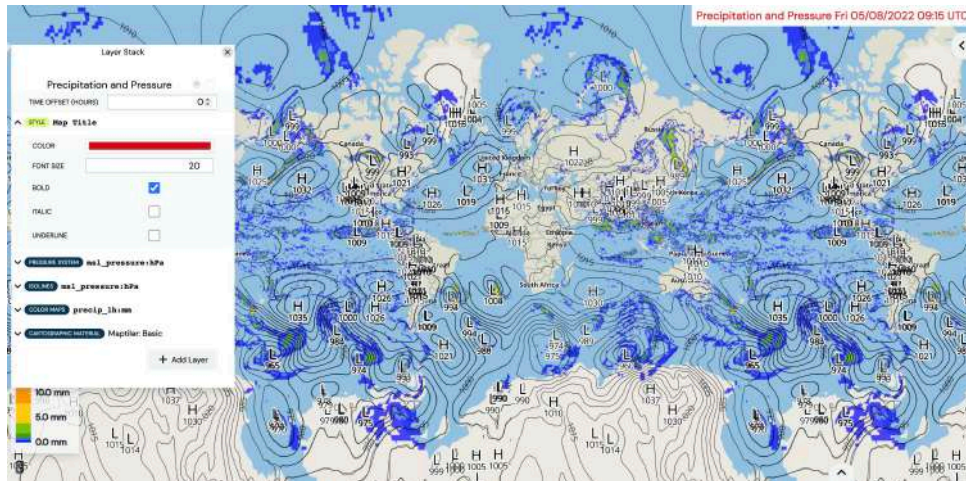
Next, we want to insert a second map. Therefore, click on ▢ to change the general tab settings. Hit the second option at the top to get two maps next to each other (see also section Tab Layout). Set the "MAP SYNC" to "On" and hit the "Add Map" icon.
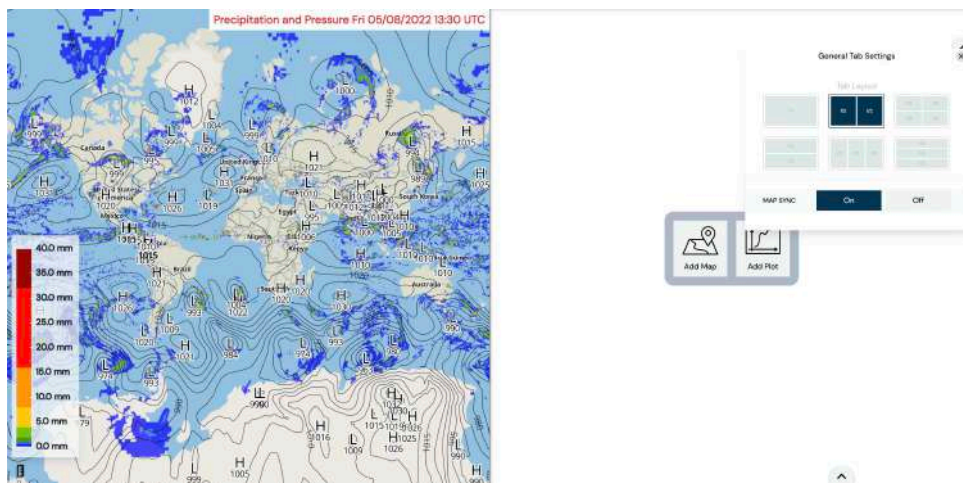

To add parameters on the second map, click on ◆ to open the Layer Stack. On the top of the Layer Stack the displayed parameters of the left map and on the bottom the displayed parameters of the right map are shown. To check which map you are currently adjusting, a turquoise frame appears around the map or plot that belongs to the respective map on the Layer Stack.
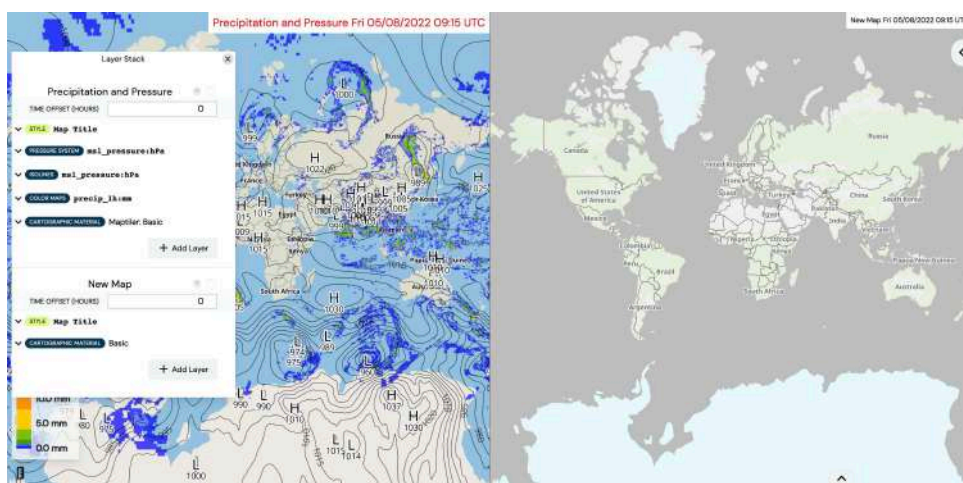


A faster way to add the parameters on the second map is to copy the parameters from the first map and paste them on the second map (see section Copy/Paste layers). Click on ♦ on top of the Layer Stack next

to the title "Precipitation and Pressure" to copy the parameters. Insert the parameters on the second map by hitting 📋 next to the "New Map" title on the Layer Stack. Your screen looks now similar to the following:
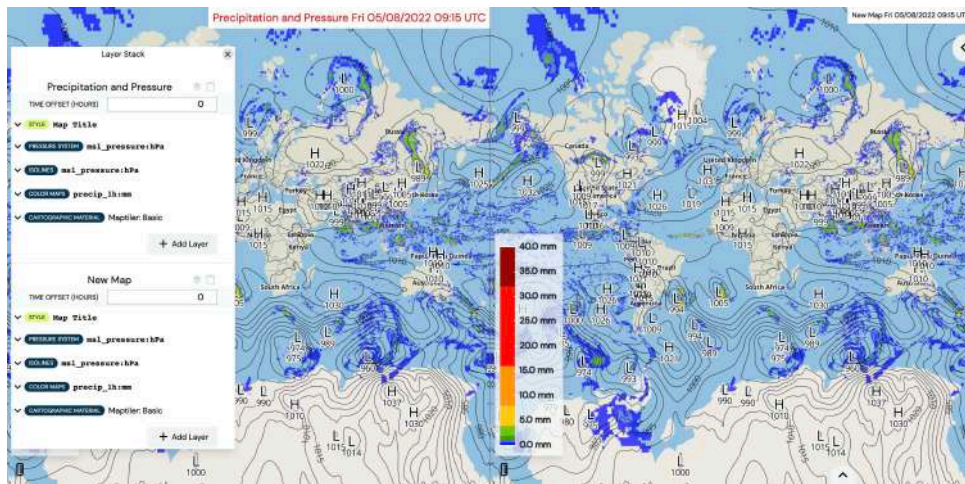

We would like to replace the precipitation by wind barbs. Therefore, click on "Add Layer" (see section Wind and Wave Barbs). Select "Wind Barbs" as "MODE" and specify the format, unit and level. In this example, we choose "wind_speed_<level>:<unit>" as format, "kn" as unit and "10m" as level.
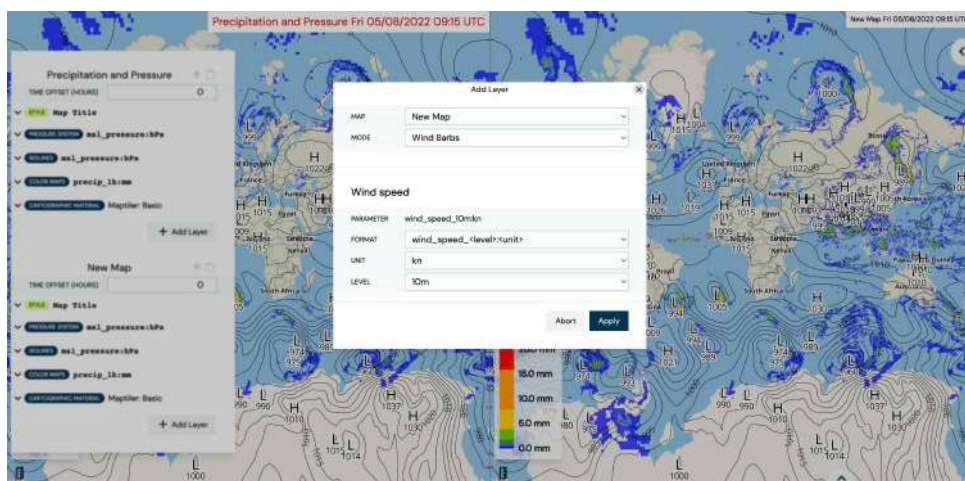

After hitting the "Apply" button, the wind barbs 10 meters above ground are displayed on the second map. The precipitation can either be deleted from the Layer Stack or made invisible. To delete the parameter hit 🗑 next to "COLOR MAPS precip_1h:mm" on the Layer Stack. To make the precipitation parameter invisible click 👁 next to "COLOR MAPS precip_1h:mm" on the Layer Stack. In this example, we keep the precipitation parameter but do not display it on the second map. Your screen looks now similar to the following:
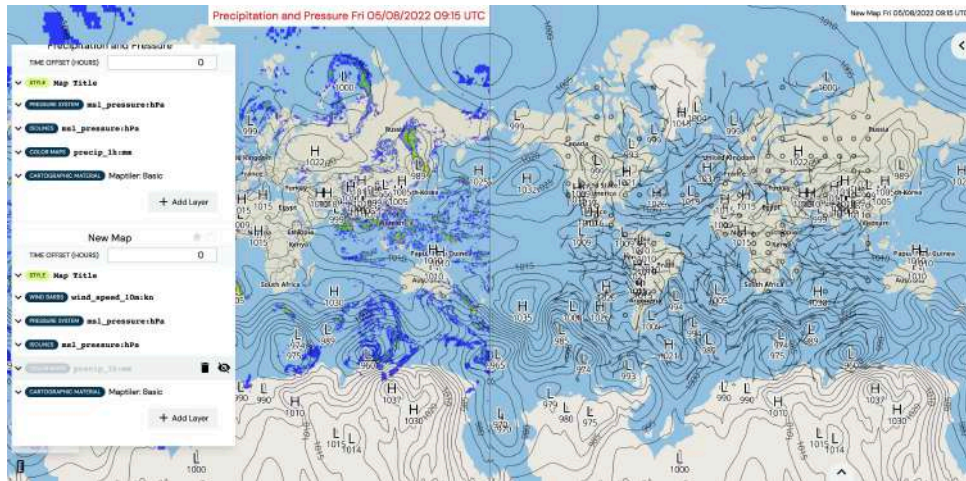
Again, you can replace the title of the second map by clicking on "New Map" on the Layer Stack and typing e.g. "Wind and Pressure" in the box. And you can adapt the design of the title by hitting "STYLE Map Title" on the Layer Stack (see section Map title design). The two maps look now similar to:
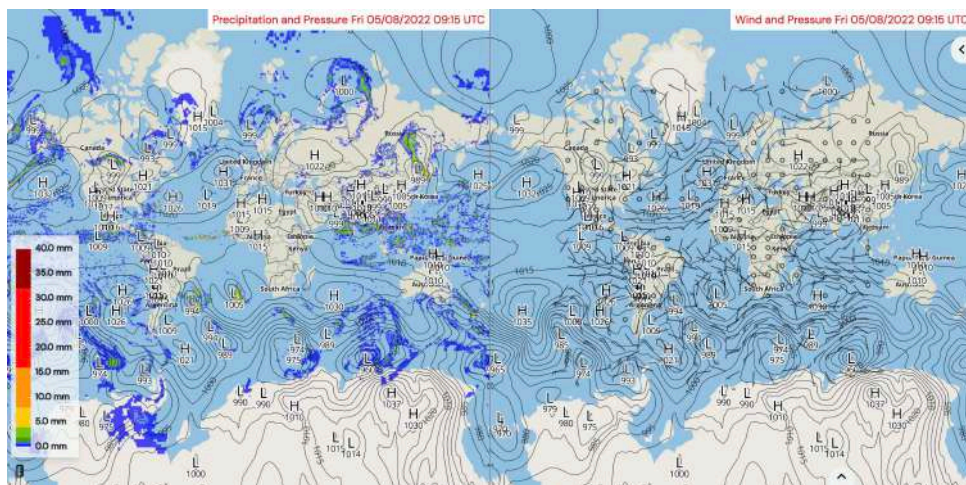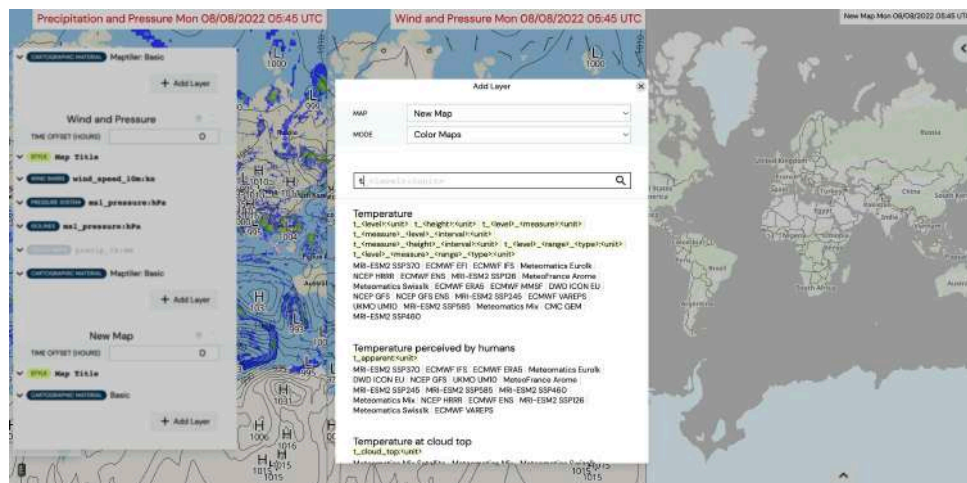

Let's add a last map to complete our weather overview with a temperature chart. Click on 🖵 to change the general tab settings. Hit the second option at the bottom to get three maps next to each other (see also section Tab Layout). Set the "MAP SYNC" to "On" and hit the "Add Map" icon.
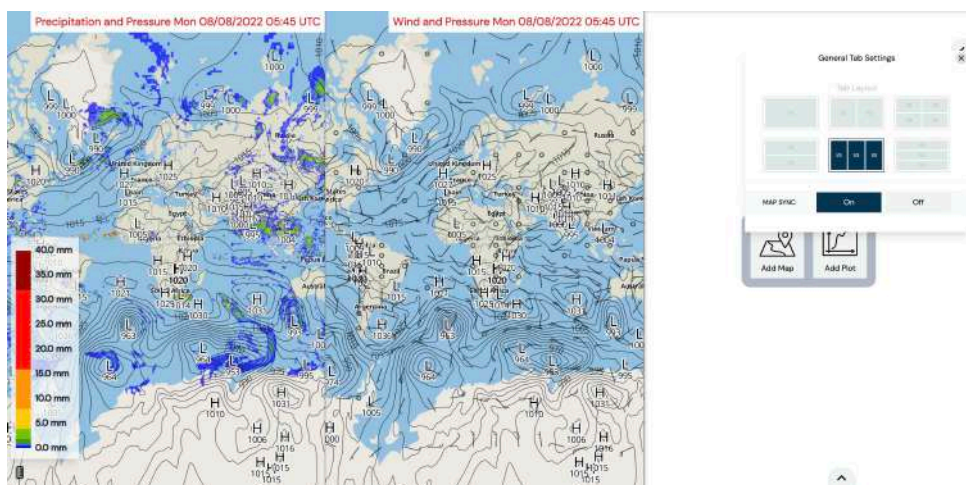

Again, to add parameters on the third map click on ◈ to open the Layer Stack. On the top of the Layer Stack the displayed parameters of the left map, in the middle the displayed parameters of the middle map and on the bottom the displayed parameters of the right map are shown. You can check that by hovering
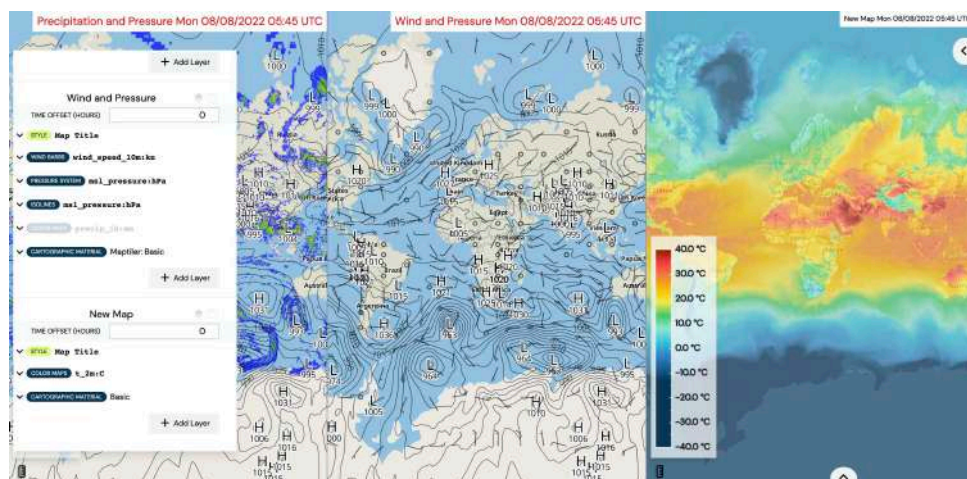
the mouse on the parameters on the Layer Stack. The respective map is framed with a turquoise frame. Scroll down to the bottom on the Layer Stack to the "New Map" to add the temperature on the third map. Click on "Add Layer". Select "Color Maps" as "MODE" and type "t" in the "Search for weather parameters". Click on "Temperature" at the very top of the suggested parameters.

Now, you can specify the parameter properties (format, unit and level). In this example, we choose "t_<level>:<unit>" as format, "C" as unit and "2m" as level to get the temperature 2 meters above the ground in °Celsius after hitting the "Apply" button.
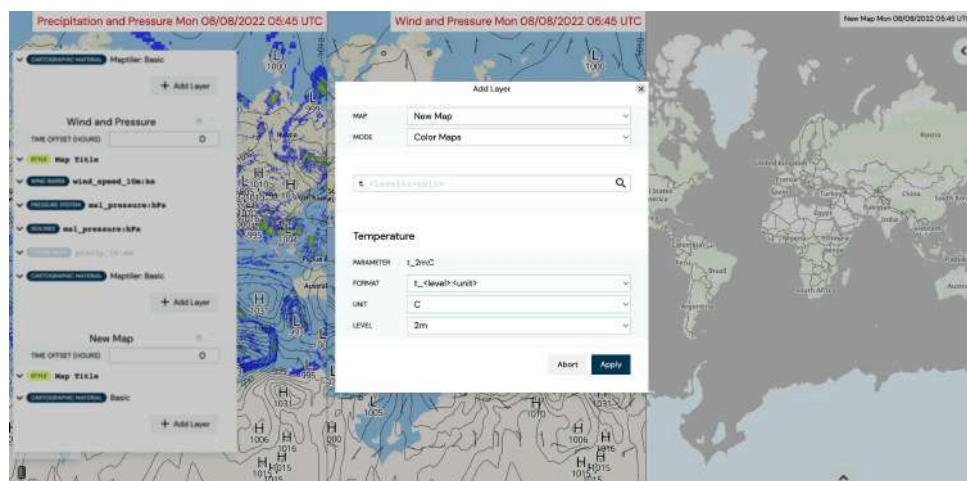

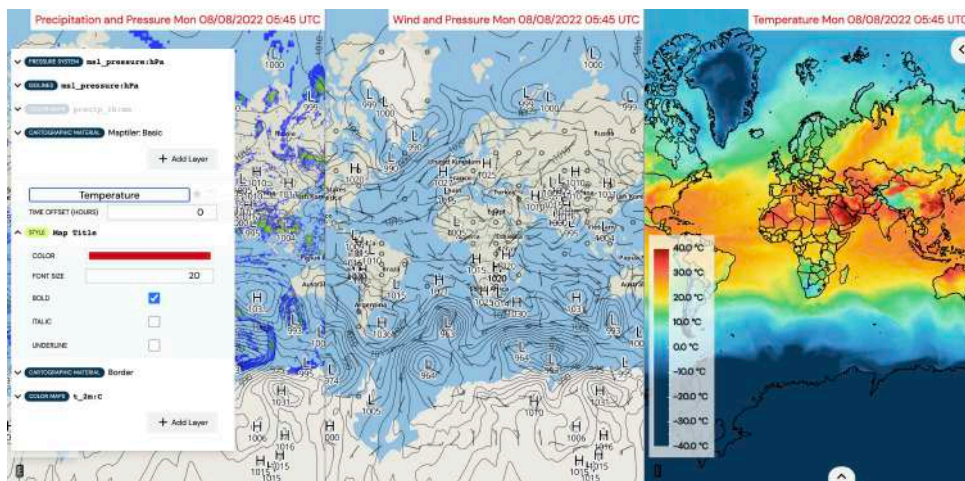Your map looks now similar to the following:

If it is wished, the user can now change the preferences of the temperature by clicking on "COLOR MAPS t_2m:C" on the Layer Stack (see section Colour Maps). In this example, we change the "OPACITY" to 100% and for the rest we keep the default values.

To change the underlying cartographic map, click on the Layer Stack on "CARTOGRAPHIC MATERIAL Basic" and select a "BASEMAP" (see section Cartographic Material). In this example, we choose the "Border" as "BASEMAP". Also, you can put the cartographic map above the temperature parameter to make the borders a bit more visible. Click on "CARTOGRAPHIC MATERIAL Border" and pull it above the "COLOR MAPS t_2m:C" on the Layer Stack Your map looks now similar to the following:
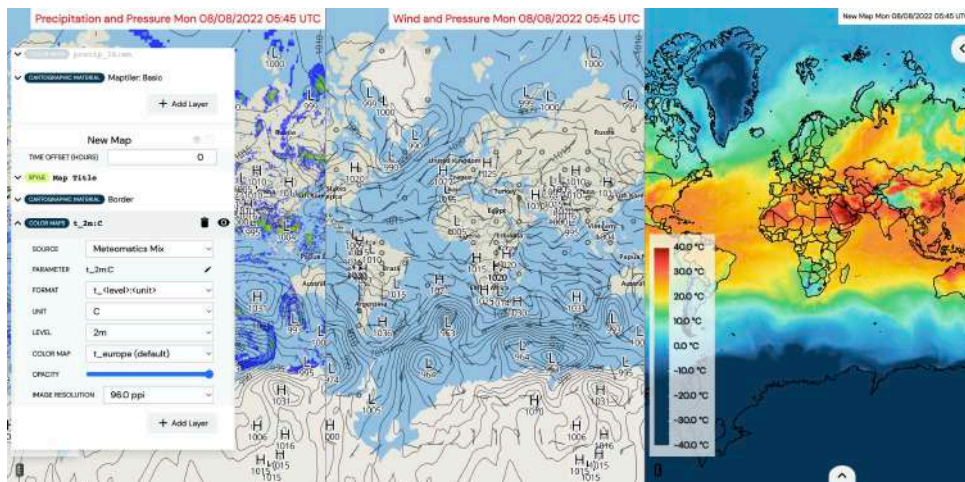

Change the title of the third map by clicking on "New Map" on the Layer Stack and typing e.g. "Temperature" in the box. Hit the "STYLE Map Title" on the Layer Stack to adapt the design of the title (see section Map title design). In this example, we choose the same setting as for the two other map titles.


Your final three maps look now similar to the following:
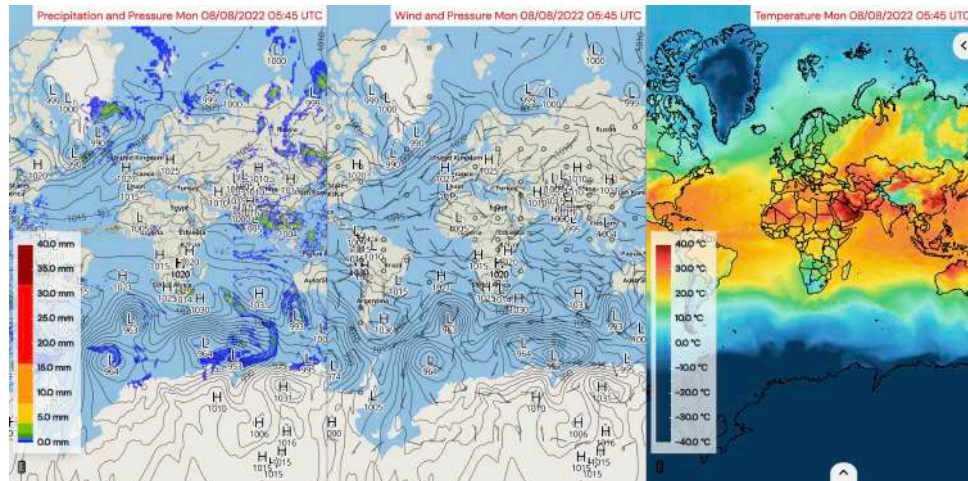
To have a closer look at a certain region, you can zoom in e.g. to Europe. Press and hold the left mouse button to change the map extend – scrolling in and out controls the level of zooming into a map. Due to the enabled "MAP SYNC" all three maps show the same extend after zooming or moving the map.
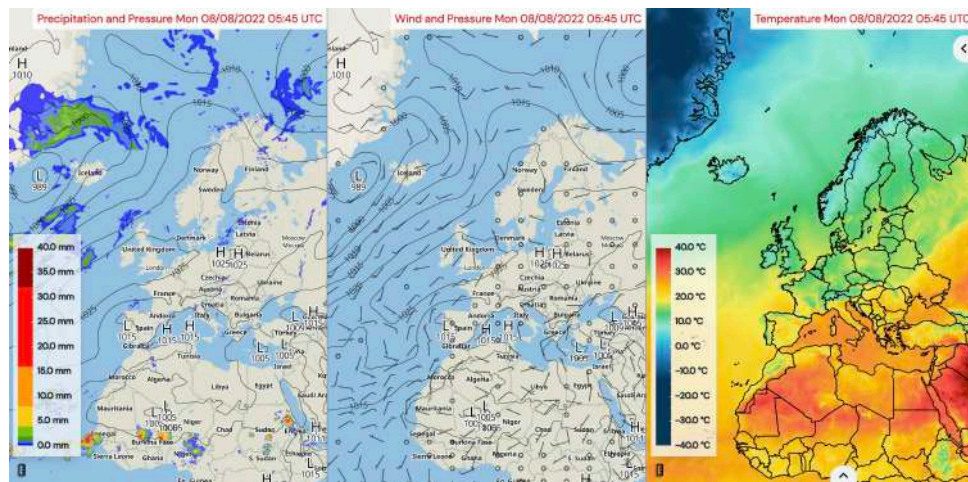

Click on a specific location in the map to see the evolution of all displayed parameters in your map at this specific location.
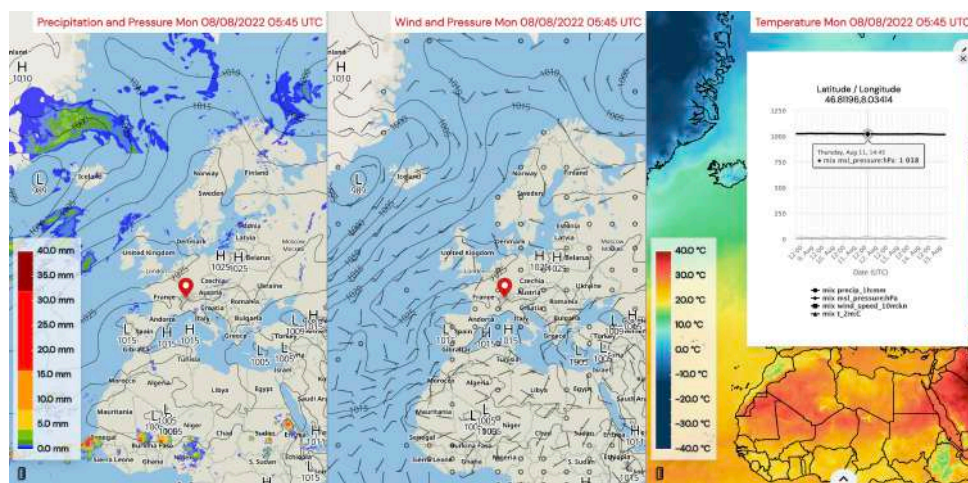

To see the evolution of all displayed parameters in the whole map extend, use the time navigation at the bottom of the map. Click on e.g. "+1 hour" to navigate 1 hour forward in time (see section First Navigation).
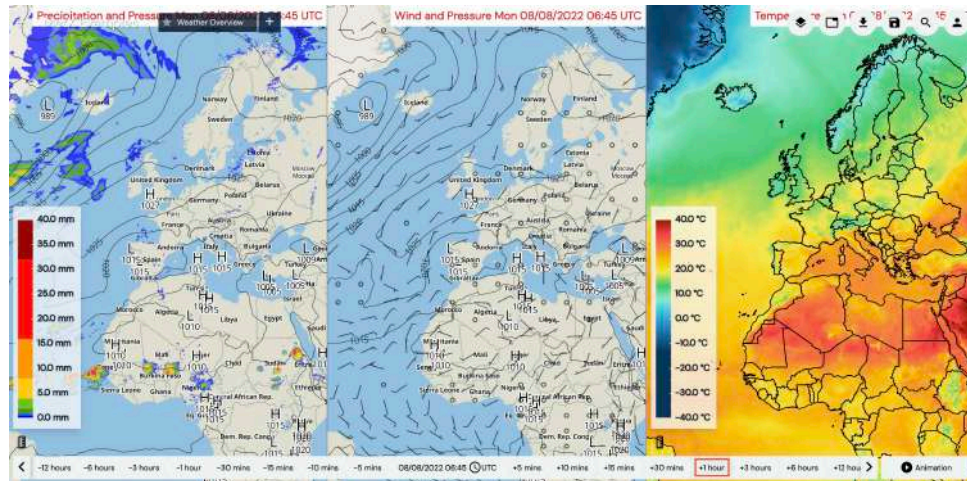
Finally, let's make an animation to see the whole weather evolution during the next five days (see section Creating Animations). Click on "Animation" on the time navigation on the right hand side at the bottom of the map. Then, click on the current date and time on the left hand side on the time navigation at the bottom to open the "Date Time Settings". Select the desired time range, the start and end time, the timezone, the interval and the frames per second (FPS). In this example, we choose the time range of 5 days, 09:00 UTC as start and end time, the timezone UTC, an interval of 3 hours and 10 FPS.
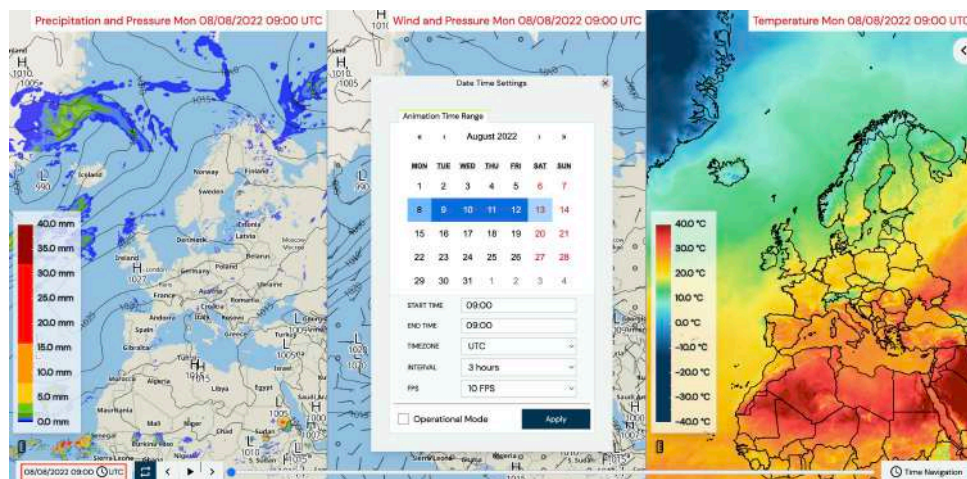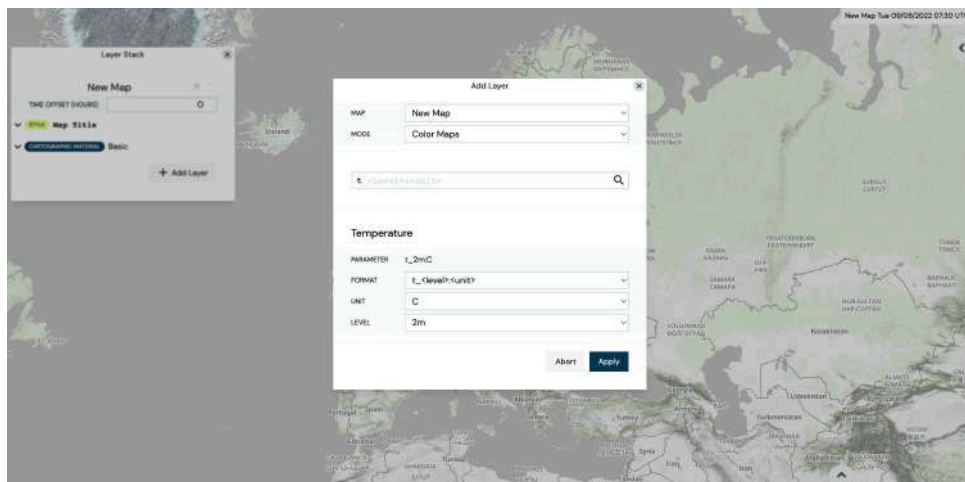

After hitting the "Apply" button, press ▶ to start the animation. The animation can be run in a loop if ⇄ is enabled. Save your map and animation by clicking on ⊟. To export your map as an image, click on ↧, select "Image/Video" and click on "Download Image" (see section Images and Videos). Alternatively, you can download the whole dashboard in a json format by clicking on "Profile" and "Download Profile" (see section Weather dashboards).
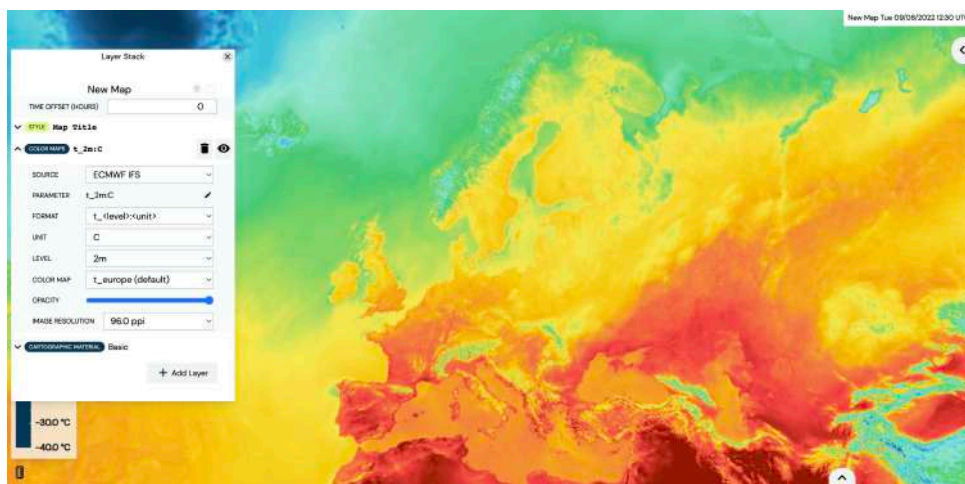
9.2 Aviation

In our second example, we create an aviation map. You can use the dashboard from the previous example (Weather overview) and open a new tab by clicking on + and hitting the "Add Map" icon or you can create a new dashboard in the welcome screen (see section First Navigation). To create a new dashboard, click on the "Create Dashboard" button, enter the name of your new dashboard e.g. "MetX Examples" and click on the "Apply" button. In both cases, your screen looks now similar to the following:

Now, the newly created tab can be renamed e.g. with "Aviation" by clicking on "New Tab".
To have a closer look at a certain region, you can zoom in e.g. to Europe. Press and hold the left mouse button to change the map extend and scrolling in and out controls the level of zooming into the map.

In a next step, select the desired parameters. Click on ◈ to open the Layer Stack.

Hit the "Add Layer" button on the bottom right of the Layer Stack. A new window opens. Select "Color Maps" as "MODE" and type "t" in the "Search for weather parameters". Click on "Temperature" at the very top of the suggested parameters.

Now, you can specify the parameter properties (format, unit and level). In this example, we choose "t_<level>:<unit>" as format, "C" as unit and "2m" as level to get the temperature 2 meters above the ground in °Celsius after hitting the "Apply" button.

If it is wished, the user can now change the preferences of the temperature by clicking on "COLOR MAPS t_2m:C" on the Layer Stack (see section Colour Maps). In this example, we change the "SOURCE" to "ECMWF IFS" and the "OPACITY" to 100% (move the slider to the right hand side). For the rest, we keep the default values.

The medium cloud cover is the next parameter that we want to add to our map. Click on "Add Layer" on the bottom right of the Layer Stack. Select "Color Maps" as "MODE" and type "me" in the "Search for weather parameters". Click on "Medium cloud cover" at the very top of the suggested parameters.

Specify the parameter properties (format and unit). In this example, we choose "medium_cloud_cover:<unit>" as format and "octas" as unit.

Click on "Apply" so that the medium cloud cover in octas is displayed on the map. Now, the preferences of the medium cloud cover can be changed by clicking on "COLOR MAPS medium_cloud_cover:octas" on the Layer Stack (see section Colour Maps). In this example, we change the "SOURCE" to "ECMWF IFS" and the "COLOR MAP" to "gray_transparent". For the rest, we keep the default values.

The next parameter that we want to add is the low cloud cover. Again, click on "Add Layer" on the bottom right of the Layer Stack. Select "Color Maps" as "MODE" and type "lo" in the "Search for weather parameters". Click on "Low cloud cover" at the very top of the suggested parameters.

Specify the parameter properties (format and unit). In this example, we choose "low_cloud_cover:<unit>" as format and "octas" as unit.

Click on "Apply" so that the low cloud cover in octas is displayed on the map. Now, the preferences of the low cloud cover can be changed by clicking on "COLOR MAPS low_cloud_cover:octas" on the Layer Stack (see section Colour Maps). In this example, we change the "SOURCE" to "ECMWF IFS" and keep for the rest the default values.

As a next parameter we add the precipitation type and intensity to the map. Click on "Add Layer" on the bottom right of the Layer Stack. Select "Color Maps" as "MODE" and type "precip" in the "Search for weather parameters". Scroll down and click on "Precipitation type intensity".

Specify the parameter properties (format, unit and interval). In this example, we choose "precip_type_intensity_<interval>:<unit>" as format, "idx" as unit and "30min" as interval.

Click on "Apply" to add the precipitation type and its intensity on the map. Now, the preferences of the precipitation can be changed by clicking on "COLOR MAPS precip_type_intensity_30min:idx" on the Layer Stack (see section Colour Maps). In this example, we change the "SOURCE" to "ECMWF IFS" and the "OPACITY" to 100% (move the slider to the right hand side). For the rest, we keep the default values.
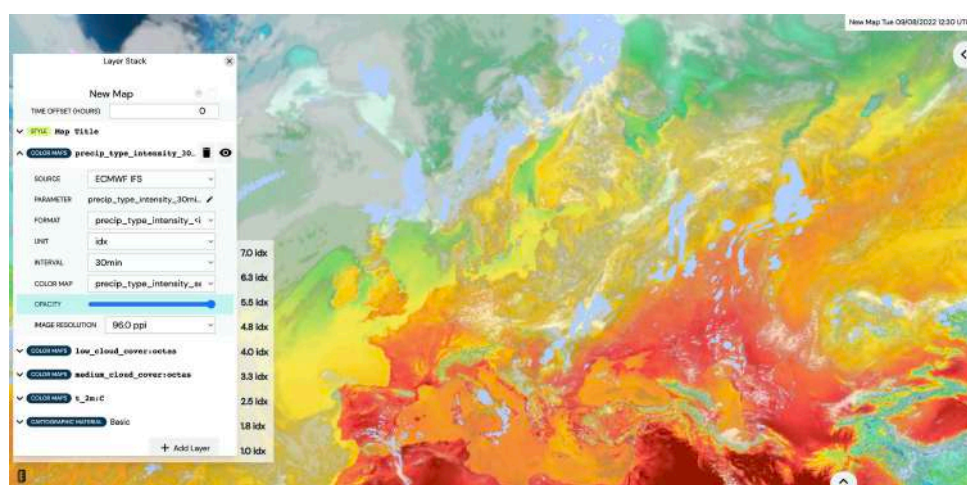
The last parameter that we add as color map on this map is the fog index. Click on "Add Layer" on the bottom right of the Layer Stack. Select "Color Maps" as "MODE" and type "fog" in the "Search for weather parameters". Click on "Fog yes/no" at the very top of the suggested parameters.

Specify the parameter properties (unit and interval). In this example, we choose "idx" as unit and an interval of "30min".

Click on "Apply" so that the fog index is displayed on the map. Now, the preferences of the fog index can be changed by clicking on "COLOR MAPS is_fog_30min:idx" on the Layer Stack (see section Colour Maps). In this example, we change the "COLOR MAP" to "lightning_europe_transparent" and the "OPACITY" to 100% (move the slider to the right hand side). For the rest, we keep the default values.
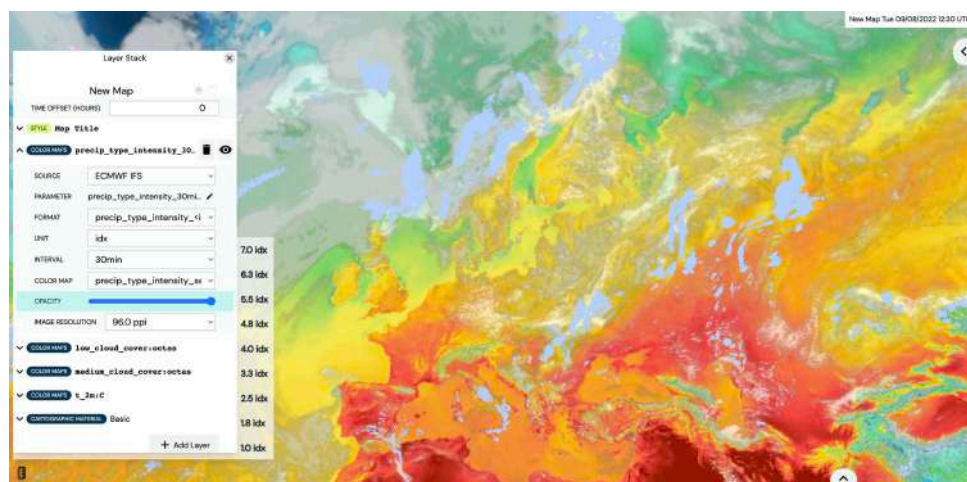
Next, we want to insert the isolines of the mean sea level pressure. Click on the "Add Layer" button on the bottom right of the Layer Stack. Select "Isolines" as "MODE" and type "msl" in the "Search for weather parameters" box to add pressure isolines to the map (see section Isolines). Select the parameter "Mean

sea level pressure" at the very top by clicking on it and specify afterwards the parameter properties (format and unit).

In this example, we choose for the pressure the format "msl_pressure:<unit>" and the unit "hPa". Thus, the mean sea level pressure in hPa is displayed as isolines after hitting the "Apply" button.

To change the preferences for the mean sea level parameter, click on the Layer Stack on "ISOLINES msl_pressure:hPa". In this example, we change the "SOURCE" to "ECMWF IFS". Furthermore, we would like to change the displayed range and spacing of the isolines. Thus, type the minimum, maximum and the step in the "RANGE" box. We choose a minimum of 940 hPa, a maximum of 1060 hPa and a step of 4 hPa. In addition, we set the "MEDIAN FILTER" as well as the "GAUSSIAN FILTER" to 5 (see also section Isolines).

To add the symbols "L" and "H" in the center of the pressure systems, click on the "Add Layer" button on the bottom right of the Layer Stack. Select "Pressure System" as "MODE" and specify the format and unit. In this example, we choose "msl_pressure:<unit>" and the unit "hPa". Click on "Apply" to add the symbols to the map (see also section Pressure System).
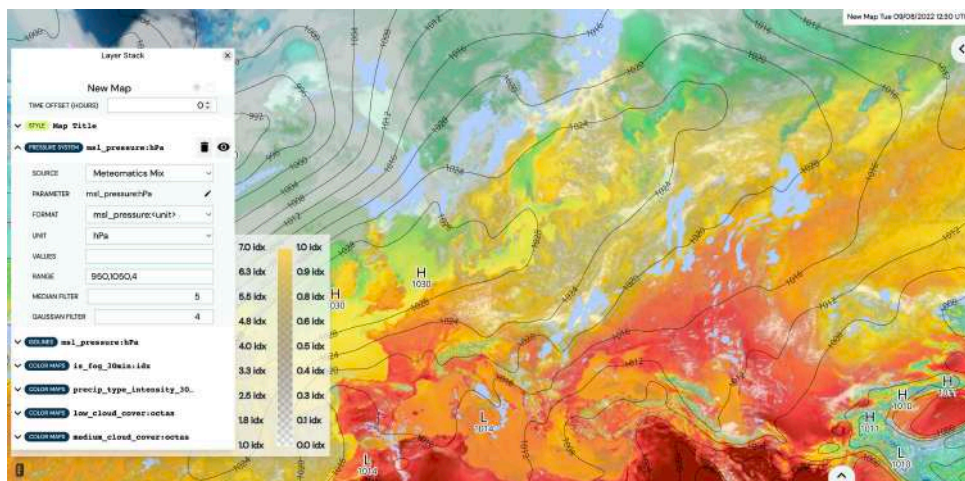

Change the preferences of the pressure system by clicking on "PRESSURE SYSTEM msl_pressure:hPa" on the Layer Stack (see section Pressure System). In this example, we change the "MEDIAN FILTER" and set it to 5 and change the "GAUSSIAN FILTER" and set it to 4.

To change the underlying cartographic map, click on the Layer Stack on "CARTOGRAPHIC MATERIAL Basic" and select a "BASEMAP" (see section Cartographic Material). In this example, we choose the "Border" as "BASEMAP". We put the cartographic map above all other parameters to make the borders more visible. Click on "CARTOGRAPHIC MATERIAL Border" and move it right below the "STYLE Map Title" on the Layer Stack.

Finally, you can add typical aviation-related data such as (international) SIGMETs, METARs, TAFs, and AIREPs (see section Aviation).
Hit the "Add Layer" button on the bottom right of the Layer Stack. Select "Aviation" in the "MODE" section and "TAFs" in the "AVIATION DATA TYPE" section. Hit the "Apply" button so that the TAFs are displayed on your map.


If it is wished, the user can change the preferences of the TAFs by clicking on "AVIATION Aviation Data TAFs" on the Layer Stack (see section Aviation). In this example, we keep the default setting. Also, you can

see there the legend of the symbols that are displayed on the map.

As a last step, we change the title of the map by clicking on "New Map" on the Layer Stack and typing e.g. "Consolidated Aviation Map" in the box. Hit the "STYLE Map Title" on the Layer Stack to adapt the design of the title (see section Map title design). In this example, we keep the default setting.
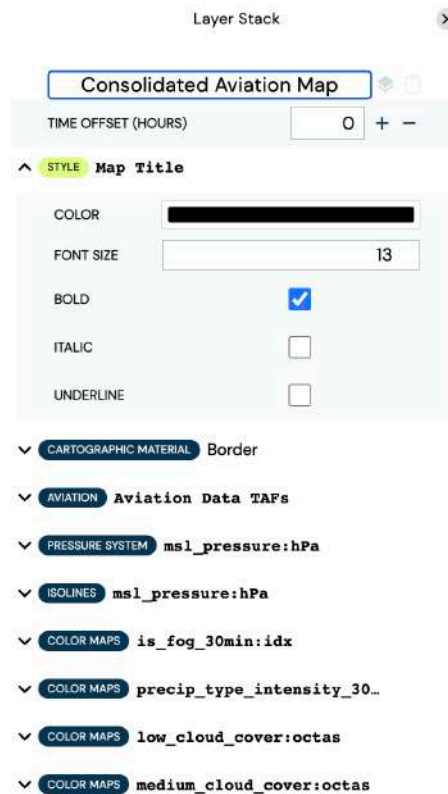
By clicking on a legend in the lower left corner of the map it disappears. To show it again, click on the legend symbol .

Your final map looks now similar to the following:
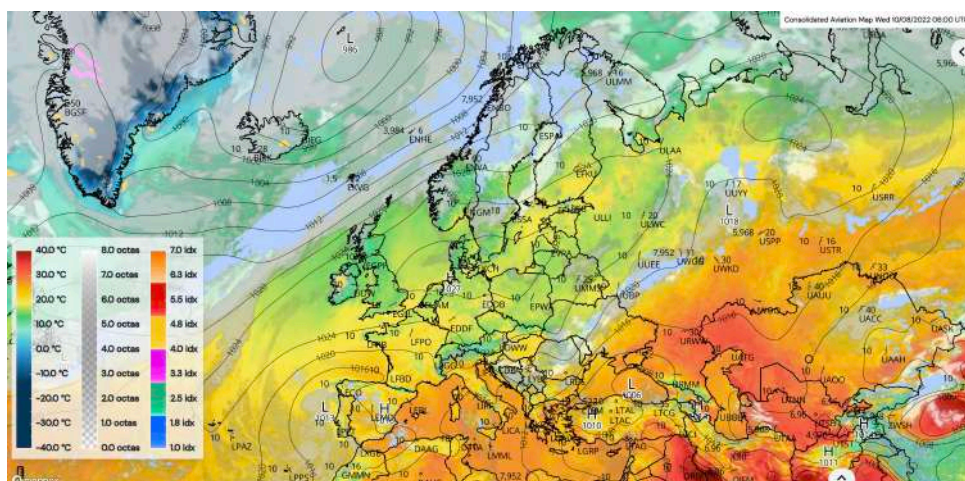
Save your map and animation by clicking on . To export your map as an image, click on , select "Image/Video" and click on "Download Image" (see section Images and Videos). Alternatively, you can download the whole dashboard in a json format by clicking on "Profile" and "Download Profile" (see section Weather dashboards).

9.3 Agriculture

In our third example, we create an agricultural map. You can use the dashboard from the previous examples (Weather overview or Aviation) and open a new tab by clicking on ⊞ and hitting the "Add Map" icon or you can create a new dashboard in the welcome screen (see section First Navigation). To create a new dashboard, click on the "Create Dashboard" button, enter the name of your new dashboard e.g. "MetX Examples" and click on the "Apply" button. In both cases, your screen looks now similar to the following:
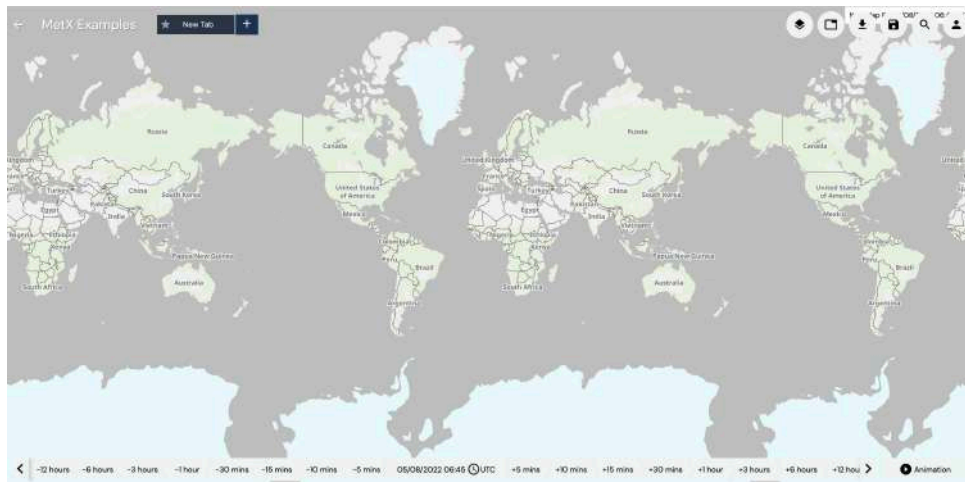

Now, the newly created tab can be renamed e.g. with "Agriculture" by clicking on "New Tab".
To have a closer look at a certain region, you can zoom in e.g. to the Netherlands. Press and hold the left mouse button to change the map extend and scrolling in and out controls the level of zooming into the map.

We want to add parameters on four parallel maps. Click on ▣ to change the general tab settings. Hit the third option at the top to get four maps next to each other (see also section Tab Layout). Set the "MAP SYNC" to "On" and hit the "Add Map" icon for the map at the bottom left, and for the two maps on the right click on the "Add Plot" button.

In a next step, select the desired parameters. Click on ◆ to open the Layer Stack.
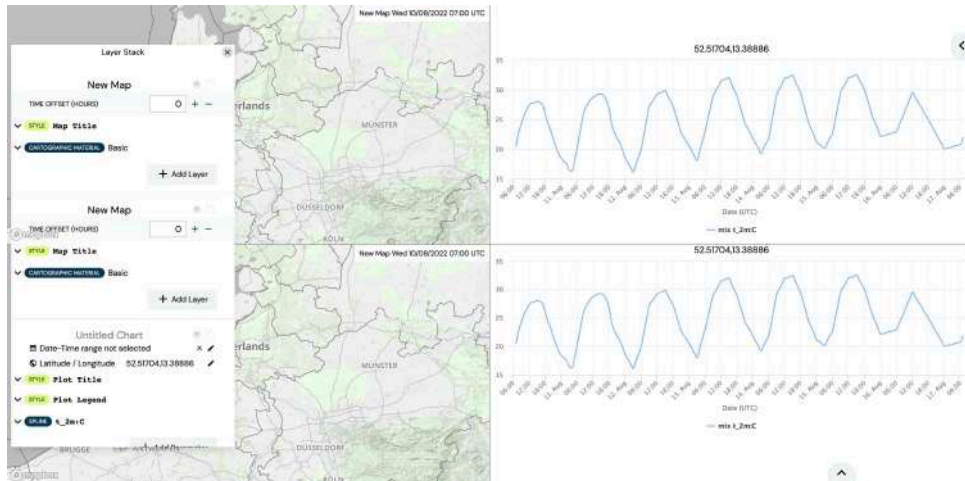
The stack at the top shows the parameter layers for the map in the top left corner (you can check that by moving the cursor over the respective parameter layers – a turquoise frame appears on the map or plot you are working on), the second stack the ones for the map in the lower left corner, the third stack the ones for the map in the top right corner and the last stack shows the parameter layers for the map in the lower right corner (however, this order might vary as it depends on the order in which the maps were added). Hit the "Add Layer" button on the bottom right of the Layer Stack of the first map in the upper left corner. A new window opens. Select "Color Maps" as "MODE" and type "t" in the "Search for weather parameters". Click on "Temperature" at the very top of the suggested parameters.

Now, you can specify the parameter properties (format, unit and level). In this example, we choose "t_<level>:<unit>" as format, "C" as unit and "2m" as level to get the temperature 2 meters above the ground in °Celsius after hitting the "Apply" button.

If it is wished, the user can change the preferences of the temperature by clicking on "COLOR MAPS t_2m:C" on the Layer Stack (see section Colour Maps). In this example, we decrease the "OPACITY" a bit (move the slider slightly to the left hand side). For the rest, we keep the default values.

In a next step, we add the isolines of the 2 meter temperature to the first map in the upper left corner. Click on the "Add Layer" button on the bottom right of the Layer Stack of the first map. Select "Isolines" as "MODE" and type "t" in the "Search for weather parameters" box to add temperature isolines to the map (see section Isolines). Select the parameter "Temperature" at the very top by clicking on it and specify afterwards the parameter properties (format, unit and level).

In this example, we choose "t_<level>:<unit>" as format, "C" as unit and "2m" as level to get the isolines of the temperature 2 meters above the ground in °Celsius after hitting the "Apply" button

To change the preferences for temperature isolines, click on the Layer Stack on "ISOLINES msl_pressure:hPa". In this example, we decrease the "OPACITY" a bit (move the slider slightly to the left hand side). Furthermore, we change the "TEXT COLOR" and "LINE COLOR" to orange-red, the "TEXT SIZE" to 15 and add a "RANGE". For the minimum value we insert -20 °Celsius and for the maximum 30 °Celsius using a step of 1 °Celsius (see also section Isolines). For the rest, we keep the default values.

To change the underlying cartographic map, click on the Layer Stack on "CARTOGRAPHIC MATERIAL Basic" and select a "BASEMAP" (see section Cartographic Material). In this example, we choose the "Maptiler:Basic" as "BASEMAP".

As a last step, we change the title of the first map by clicking on "New Map" on the Layer Stack and typing e.g. "Temperature 2m" in the box. Hit the "STYLE Map Title" on the Layer Stack to adapt the design of the title (see section Map title design). In this example, we keep the default setting.

Next, we want to set up the second map on the lower left side. Click on the "Add Layer" button on the bottom right of the Layer Stack of the second map (in this case the one below the Temperature 2m). We want to add a new colormap. Thus, select "Color Maps" as "MODE" (see section Colour Maps). Then, type "precip" in the "Search for weather parameters" box to add precipitation to the map. Select the parameter "Amount of precipitation" at the very top by clicking on it.

Now, you can specify the parameter properties (format, unit and interval). In this example, we choose for the precipitation the format "precip_<interval>:<unit>", the unit "mm" and an interval of 1 hour. Thus, the amount of precipitation in the previous hour in mm is displayed after hitting the "Apply" button.


If it is wished, the user can change the colormap's preferences by clicking on "COLOR MAPS precip_1h:mm" on the Layer Stack (see section Colour Maps). In this example, we stick to the default values.

To change the underlying cartographic map, click on the Layer Stack on "CARTOGRAPHIC MATERIAL Basic" and select a "BASEMAP" (see section Cartographic Material). In this example, we choose the "Maptiler:Basic" as "BASEMAP".

As a last step, we change the title of the second map by clicking on "New Map" on the Layer Stack and typing e.g. "Precipitation" in the box. Hit the "STYLE Map Title" on the Layer Stack to adapt the design of the title (see section Map title design). In this example, we keep the default setting.

Your final two maps on the left hand side look now similar to the following:
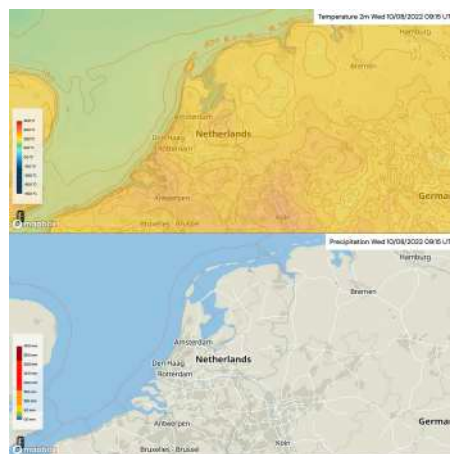
In a further step, we set up the plot on the upper right side (see section Plots in MetX). First, click on the little pencil next to the "Latitude / Longitude" section of the third map (in this case the one below the Precipitation) on the Layer Stack. A window called "Location Search" at the upper right side of the map appears. Specify in the "Search" field the desired coordinate. We want to investigate Utrecht in the Netherlands and thus type Utrecht in the "Search" box and click on the first suggestion.

Now, we want to add several temperature timeseries on the plot. As default, there is already the 2 meter temperature displayed on the map. We change this parameter into the –15cm temperature. Click on "SPLINE t_2m:C" on the Layer Stack. Change the "LEVEL" to –15cm and the "COLOR" to green.

Let's add the minimum, maximum and the 10 year mean 2m temperature to the plot. Click on the "Add Layer" button on the bottom right of the Layer Stack. Type "t" in the "Search for weather parameters" box and click on the first suggestion.

t_ <level>:<unit> 🔍

Temperature
t_<level>:<unit> t_<height>:<unit>
t_<level>_<measure>:<unit>
t_<measure>_<level>_<interval>:<unit>
t_<measure>_<height>_<interval>:<unit>
t_<level>_<range>_<type>:<unit>
t_<level>_<measure>_<range>_<type>:<unit>
MRI-ESM2 SSP370 ECMWF EFI ECMWF IFS
Meteomatics Euro1k NCEP HRRR ECMWF ENS
MRI-ESM2 SSP126 MeteoFrance Arome
Meteomatics Swiss1k ECMWF ERA5
ECMWF MMSF DWD ICON EU NCEP GFS
NCEP GFS ENS MRI-ESM2 SSP245
ECMWF VAREPS UKMO UM10 MRI-ESM2 SSP585
Meteomatics Mix CMC GEM MRI-ESM2 SSP460

Temperature perceived by humans
t_apparent:<unit>
MRI-ESM2 SSP370 ECMWF IFS ECMWF ERA5
Meteomatics Euro1k DWD ICON EU NCEP GFS

Now, you can specify the parameter properties (format, unit, measure, level and interval). In this example, we choose the format "t_<measure>_<level>_<interval>:<unit>", the unit "C", the measure "max", the level "2m" and an interval of 1 hour. Thus, the maximum temperature 2 meters above the ground in the previous hour is displayed after hitting the "Apply" button.

Add Parameter ✕

t_ <level>:<unit> 🔍

Temperature

PARAMETER	t_max_2m_1h:C
FORMAT	t_<measure>_<level>_<inte ⌄
UNIT	C ⌄
MEASURE	max ⌄
LEVEL	2m ⌄
INTERVAL	1h ⌄

Abort **Apply**

Change the preference of the newly added maximum temperature by clicking on "SPLINE t_max_2m_1h:C" on the Layer Stack. We change the "COLOR" to orange and keep the rest as it is.

Next, we add the 10 year mean 2m temperature by clicking on the "Add Layer" button on the bottom right of the Layer Stack. Type "t" in the "Search for weather parameters" box and click on the first suggestion.

Now, you can specify the parameter properties (format, unit, measure, level and interval). In this example, we choose the format "t_<level>_<measure>:<unit>", the unit "C", the measure "10y_mean" and the level "2m". Thus, the 10 year mean temperature 2 meters above the ground is displayed after hitting the "Apply" button.

Add Parameter

Temperature

PARAMETER	t_2m_10y_mean:C
FORMAT	t_<level>_<measure>:<unit>
UNIT	C
MEASURE	10y_mean
LEVEL	2m

Abort   Apply

Change the preference of the newly added 10 year temperature by clicking on "SPLINE t_2m_10y_mean:C" on the Layer Stack. We change the "COLOR" to black and keep the rest as it is.

SPLINE t_2m_10y_mean:C

SOURCE	Meteomatics Mix
PARAMETER	t_2m_10y_mean:C
FORMAT	t_<level>_<measure>:<uni
UNIT	C
MEASURE	10y_mean
LEVEL	2m
CALIBRATED	
COLOR	
SERIES TYPE	spline
LINE TYPE	Solid
Y-AXIS	0
THRESHOLDS	
HIGH	0 + −
LOW	0 + −

+ Add Parameter

Finally, we add the minimum 2 meter temperature to the plot by clicking on the "Add Layer" button on the bottom right of the Layer Stack. Type "t" in the "Search for weather parameters" box and click on the first suggestion.

Now, you can specify the parameter properties (format, unit, measure, level and interval). In this example, we choose the format "t_<measure>_<level>_<interval>:<unit>", the unit "C", the measure "min", the level "2m" and an interval of 1 hour. Thus, the minimum temperature 2 meters above the ground in the previous hour is displayed after hitting the "Apply" button.

Change the preference of the newly added minimum temperature by clicking on "SPLINE t_min_2m_1h:C" on the Layer Stack. We change the "COLOR" to blue, the "SERIES TYPE" to "column", the "Y-AXIS" to 1, check the "LOW" box in the "THRESHOLDS" section and set the value to -1. For the rest, we keep the default setting.

In our last step, we change the title of the plot. Click on "Untitled Chart" on the Layer Stack and type e.g. "Utrecht Temperature" in the box. Hit the "STYLE Plot Title" on the Layer Stack to adapt the design of the title. In this example, we change the font size to 20 and check the "bold" box. Also, you can change the design of the legend by clicking on "STYLE Plot Legend" on the Layer Stack. In this example, we keep the default setting.

Now, let's create our last plot on the lower right side. Again, change the coordinate by clicking on the little pencil next to the "Latitude / Longitude" section of the fourth map (in this case the one at the bottom) on the Layer Stack. A window called "Location Search" at the upper right side of the map appears. Specify in the "Search" field the desired coordinate. We still want to investigate Utrecht in the Netherlands and thus type Utrecht in the "Search" box and click on the first suggestion.

As default, there is already the 2 meter temperature displayed in the plot. We change this parameter into the evapotranspiration. Click on "SPLINE t_2m:C" on the Layer Stack. Click on the little pencil next to the "PARAMETER" and type "ev" in the "Search for weather parameters" box and click on "Evapotranspiration" (the second suggestion).

You can now specify the parameter properties (unit and interval). In this example, we choose the unit "mm" and an interval of 1 hour. Thus, the evapotranspiration in the previous hour is displayed after hitting the "Apply" button.

If wished, you could now change the preferences of the evapotranspiration by clicking on "SPLINE evapo-transpiration_1h:mm" on the Layer Stack. In this example, we stick to the default setting.

The next parameter that we add to this plot is the soil moisture index at a depth of 15cm. Click on the "Add Layer" button on the bottom right of the Layer Stack. Type "soil" in the "Search for weather parame-ters" box and click on "Soil moisture index" (the second suggestion).

Add Parameter   ✕

soil_moisture_deficit:<unit>   🔍

Soil moisture deficit
soil_moisture_deficit:<unit>
Meteomatics Mix | ECMWF IFS | ECMWF ERA5

Soil moisture index
soil_moisture_index_<level>:<unit>
Meteomatics Mix | ECMWF ERA5 |
Meteomatics Swiss1k | ECMWF IFS

Soil type
soil_type:<unit>

You can now specify the parameter properties (unit and level). In this example, we choose the unit "idx" and a level of –15cm. Thus, the soil moisture index in a depth of 15cm is displayed after hitting the "Apply" button.

Add Parameter   ✕

soil_moisture_deficit:<unit>   🔍

Soil moisture index

PARAMETER	soil_moisture_index_–15cm:idx
UNIT	idx ⌄
LEVEL	–15cm ⌄

                                    Abort   Apply

If wished, you could now change the preferences of the soil moisture index by clicking on "SPLINE soil_moisture_index_–15cm:idx" on the Layer Stack. In this example, we stick to the default setting.

The final parameter that we add to this plot is the volumetric soil water. Click on the "Add Layer" button on the bottom right of the Layer Stack. Type "vo" in the "Search for weather parameters" box and click on "Soil water content (volumetric soil water)" (the first suggestion).

Add Parameter   ✕

volumetric_soil_water_<level>:   🔍
<unit>

Soil water content (volumetric soil
water)
volumetric_soil_water_<level>:<unit> |
volumetric_soil_water_<measure>_<level>_<interval>:
<unit>
Meteomatics Mix | ECMWF ERA5 |
Meteomatics Swiss1k | ECMWF IFS

Polar vortex
polar_vortex_<level>:<unit>
ECMWF IFS | ECMWF ERA5 | ECMWF MMSF |
DWD ICON EU | NCEP GFS | UKMO UM10 |
Meteomatics Mix | NCEP HRRR | ECMWF ENS |
Meteomatics Swiss1k | ECMWF VAREPS

You can now specify the parameter properties (unit and level). In this example, we choose the unit "m3m3" and a level of –15cm. Thus, the soil water content at a depth of 15 cm is displayed after hitting the "Apply" button.

If wished, you could now change the preferences of the soil water content by clicking on "SPLINE volumetric_soil_water_–15cm:m3m3" on the Layer Stack. In this example, we stick to the default setting.

Finally, we change the title of the plot. Click on "Untitled Chart" on the Layer Stack and type e.g. "Utrecht Soil Moisture" in the box. Hit the "STYLE Plot Title" on the Layer Stack to adapt the design of the title. In this example, we change the font size to 20 and check the "bold" box. Also, you can change the design of the legend by clicking on "STYLE Plot Legend" on the Layer Stack. In this example, we keep the default setting.

Your final map looks now similar to the following:

Save your map and animation by clicking on ⊟. To export your map as an image, click on ⬇, select "Image/Video" and click on "Download Image" (see section Images and Videos). Alternatively, you can download the whole dashboard in a json format by clicking on "Profile" and "Download Profile" (see section Weather dashboards).