Application User's Manual
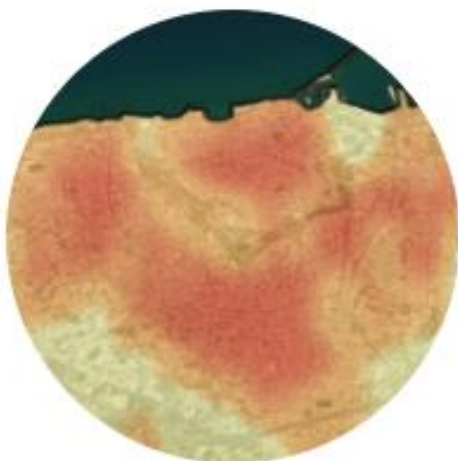
Air-Temperature and Surface Fluxes

Heraklion, January 2023

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Introduction

This web-application provides real-time, as well as time series of high-spatial resolution maps and analytics for air temperature and surface heat fluxes for the city of Heraklion, Greece, based on the Surface Urban Energy and Water Balances Scheme (SUEWS), which has been developed by the University of Reading. The application uses inputs from the RSLab sensors network that includes the Wireless Sensors Network of meteorological stations and the two Flux Towers deployed in Heraklion city center and in a residential area. It uses data from the last 24 hours to model the urban surface energy balance on an hourly basis. The last hour data are used to create air temperature at 2 m, net all-wave radiation and turbulent sensible heat flux maps, at 100 m x 100 m spatial resolution, resampled to 10 m x 10 m. In addition to the latest data, time series may be created hourly, along with analytics for user-defined grid cells and user-defined polygons.

Available Variables

The available variables were estimated using the SUEWS model and include the following:

1. Air Temperature at 2m above the ground (°C)
2. Net all-wave radiation (W/m^2)
3. Turbulent sensible heat flux (W/m^2)
4. Turbulent latent heat flux (W/m^2)
5. Air specific humidity at 2m in (g/Kg)
6. Storage heat flux (W/m^2)

Available Dates and Times

The selection of dates ranges from 1st day of 2020 to present.

The user may choose to load either the current date and time or the mean of the past 1 to 3 hours.Type of Data SelectionThe user can choose one of three categories of data for further analysis:

1. Decide on the point that offers analytics for the chosen pixel.

2. Choose an area, which offers analytics for the desired region.

3. Area-wide, which offers analytics for the entire region.

3. Variable selection

The desired variable may be selected to be loaded into the map in the *"Select Variable"* box.
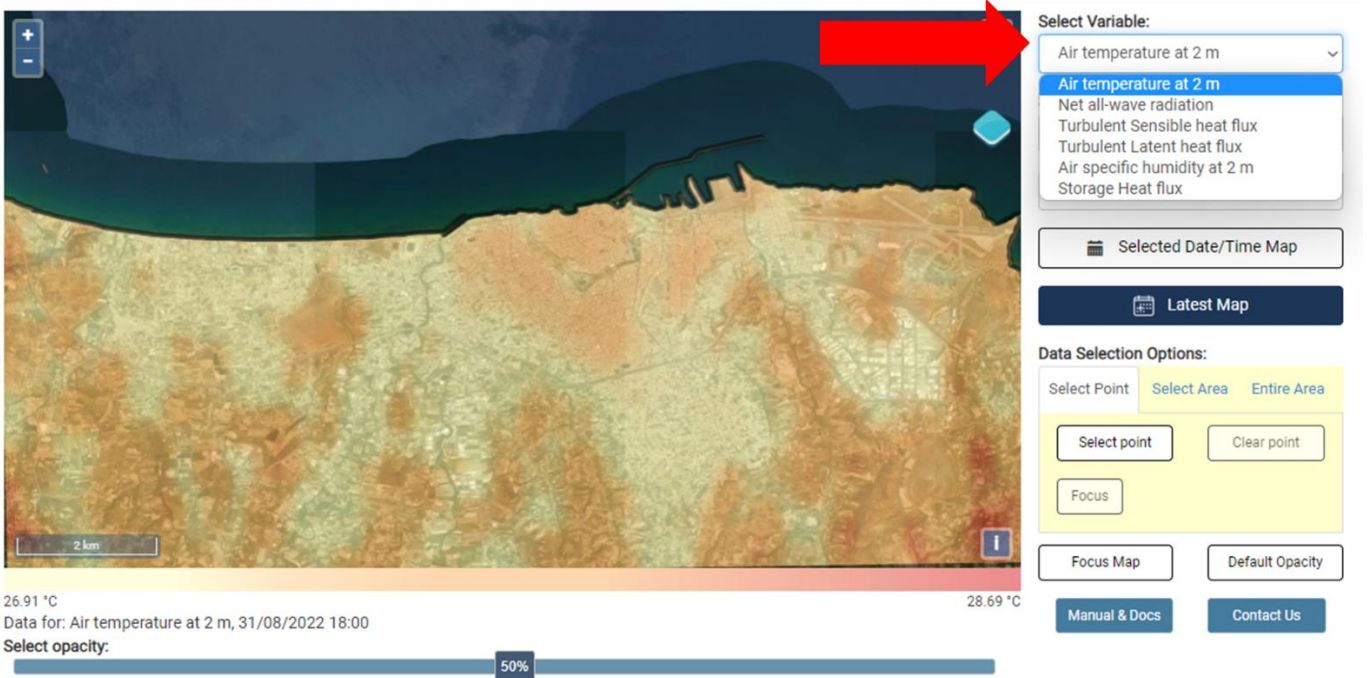
Date & Time selection

Next, select the desired Date and Time from the *"Select date time"* box.

4

Time Periods selection

The user can choose either a date and time they specify, or the average of the past 1 to 4 hours, for the time period selection. The value of the chosen hour and the values of the preceding 1 to 4 hours are used to compute the average.

Adding the date and choosing the opacity

1. Selected Date/Time Map, which offers the chosen date/time maps

2. A map that displays the most recent calculations.

3. Choose the data overlay opacity percentage for the Google map.

Point analysis tool

The point analysis tool can do further analysis on the target pixel. The tool generates hourly time series for the most recent day as well as for a selected time period by the user for the prior 1 week,1 month, 3 months, 6 months, 1 year.
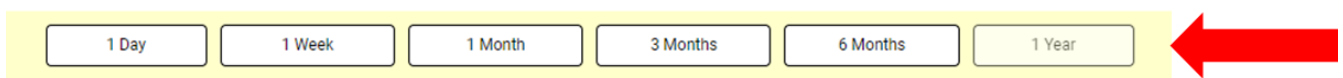
Point selection

By using the button (1.) "*Select point*", and then target the point of interest inside the map (2.). Also the selected point can be erased using the button "*Clear point*" (3.). Using "*Focus*" (4.) button the map is focused on the point.

Timeseries range

The desired time series for the analysis may be chosen from the time series button.

Timeseries results

By choosing the time series, the result of the time series, which displays the date, the hour, and the value that is contained, is loaded below. By clicking the *"Select Date/Time"* button (1.), the chosen time period's picture will appear.
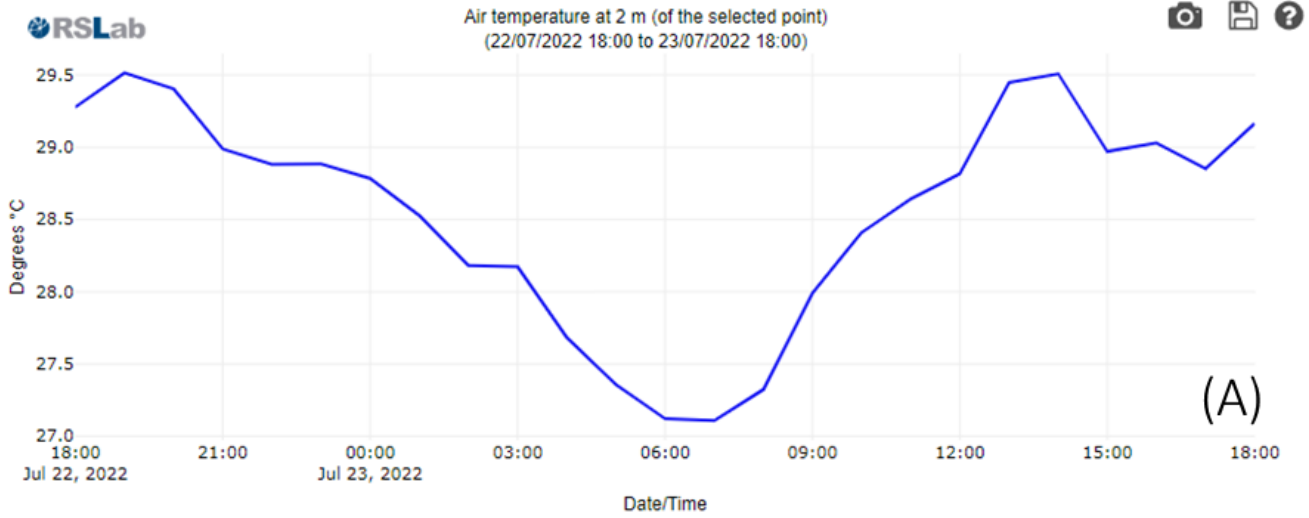

When the time period is set to average, the results shows the statistics of the point, as Min, Mean, Median, Max of the selected time period.
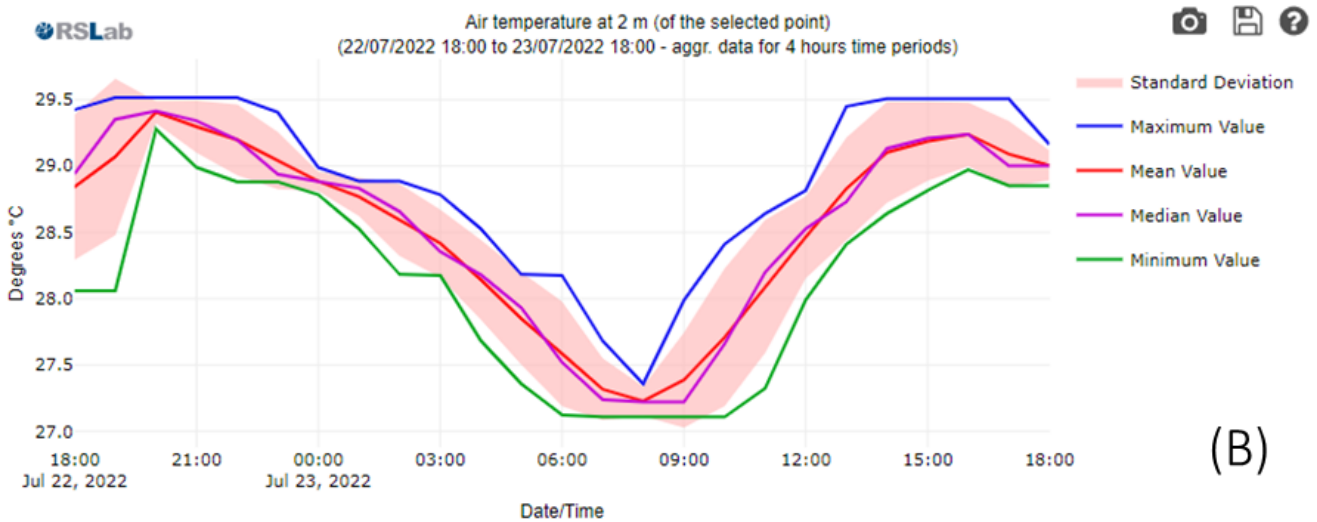

Point Data Chart

Charts for point data and 1-day time series (A.) display numbers from the previous day, whereas charts for other time periods display period statistics for the same time period (B.).


Charts that display the same hour (C) or time period (D) when the time series is changed for a period longer than a day additionally provide statistics for the time period that may be hidden by clicking the button next to their name (1). The data may be downloaded as a.png picture file using the camera button (2.) or as a.csv table data file using the disk button (3). The question mark button can also be used for further information on how to zoom in and out on the chart (4.).
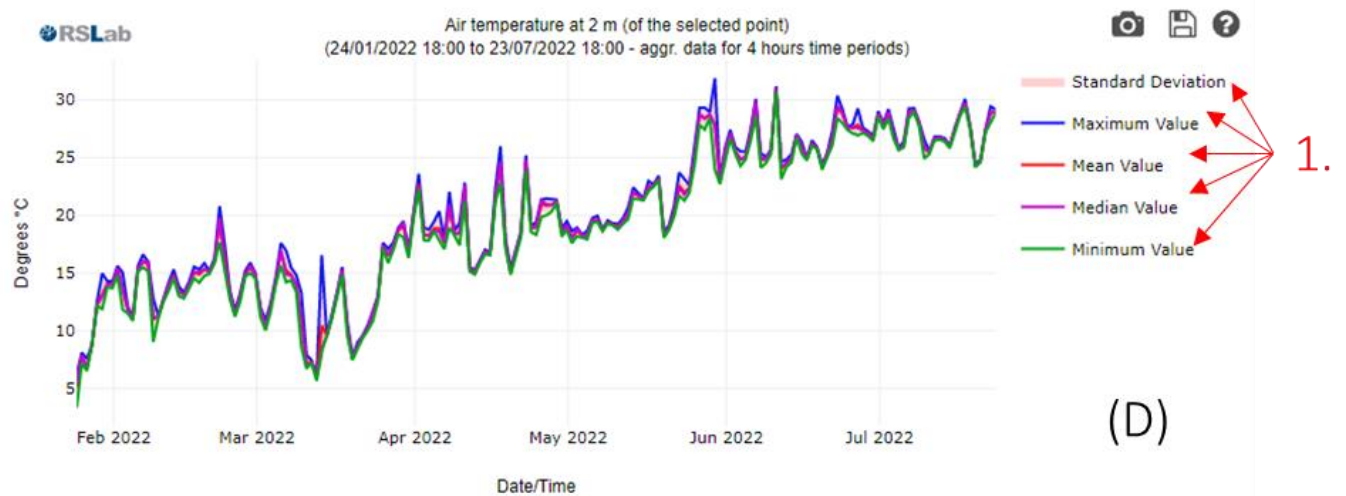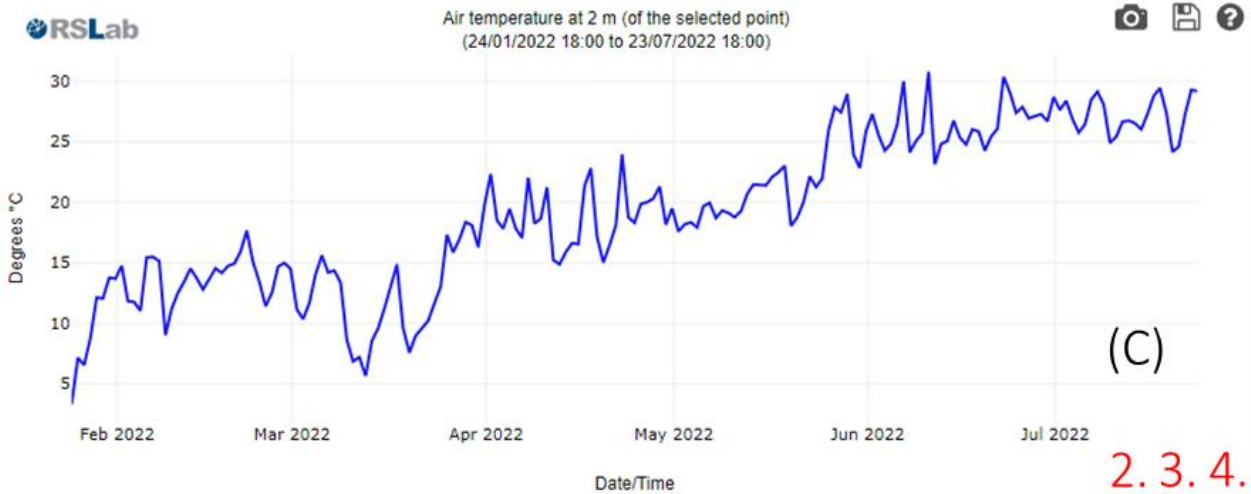
Polygon analysis tool

Choosing the polygon analysis tool to see the tool's tab. There are several options for the tool inside the tool tab, including

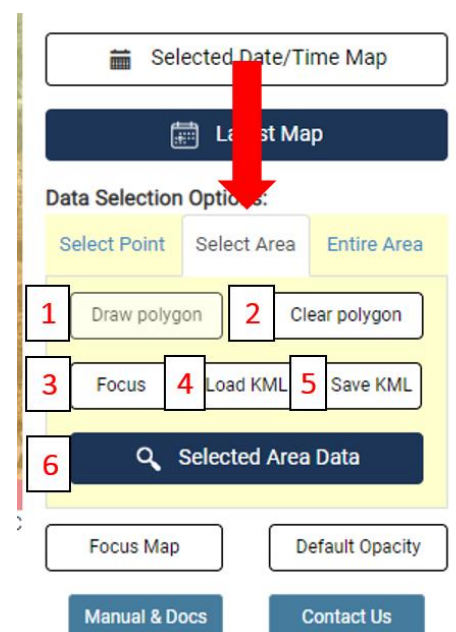1. Create a new polygon by drawing one on the map.

To remove a polygon from a map, use the clean polygon command.

3. Pay attention to the map and the polygon.

4. Load KML to open a KML file that contains a polygon.

5. Save KML to store the map's drawn polygon in a KML file.

6. Selected Area Data, which loads the polygon's data for further study.

Polygon Area selection

The image shows a drawn polygon of an urban block.

Timeseries range

From the time series button can be selected the preferred time series for the analysis.


Timeseries results

The outcomes display the time, the statistics, the time, and the date/hour for the time series for the polygonal region. The application provides hourly time series for the most current day in addition to a user-selected time period for the previous week, month, quarter, third quarter, and full year. The device functions as a Point analysis tool.

1 Day	1 Week	1 Month	3 Months	6 Months	1 Year

| Date	Time	Min / Mean / Median / Max	Select
23/07/2022	18:00	29.1 °C / 29.2 °C / 29.2 °C / 29.2 °C	Select Date/Time
22/07/2022	18:00	29.2 °C / 29.3 °C / 29.3 °C / 29.4 °C	Select Date/Time
21/07/2022	18:00	27.2 °C / 27.2 °C / 27.2 °C / 27.3 °C	Select Date/Time
20/07/2022	18:00	24.5 °C / 24.6 °C / 24.6 °C / 24.7 °C	Select Date/Time
19/07/2022	18:00	24.1 °C / 24.2 °C / 24.2 °C / 24.2 °C	Select Date/Time

Polygon Area Charts

The first chart shows the percentage of each value inside the polygon for the selected time period and time series.
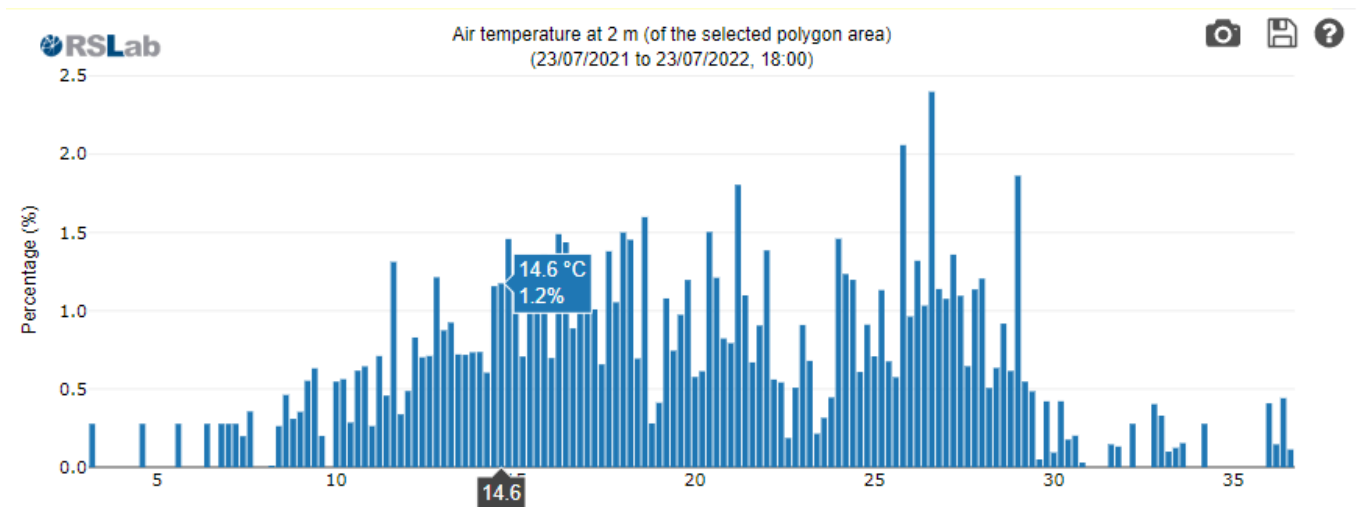
The second graph displays the chosen time series for the chosen value's time period. One-day time series displays the previous 24 hours for the chosen time period, whereas other time series display the daily value of the chosen variable and the chosen time period for the chosen hour, as in point tool chart D.
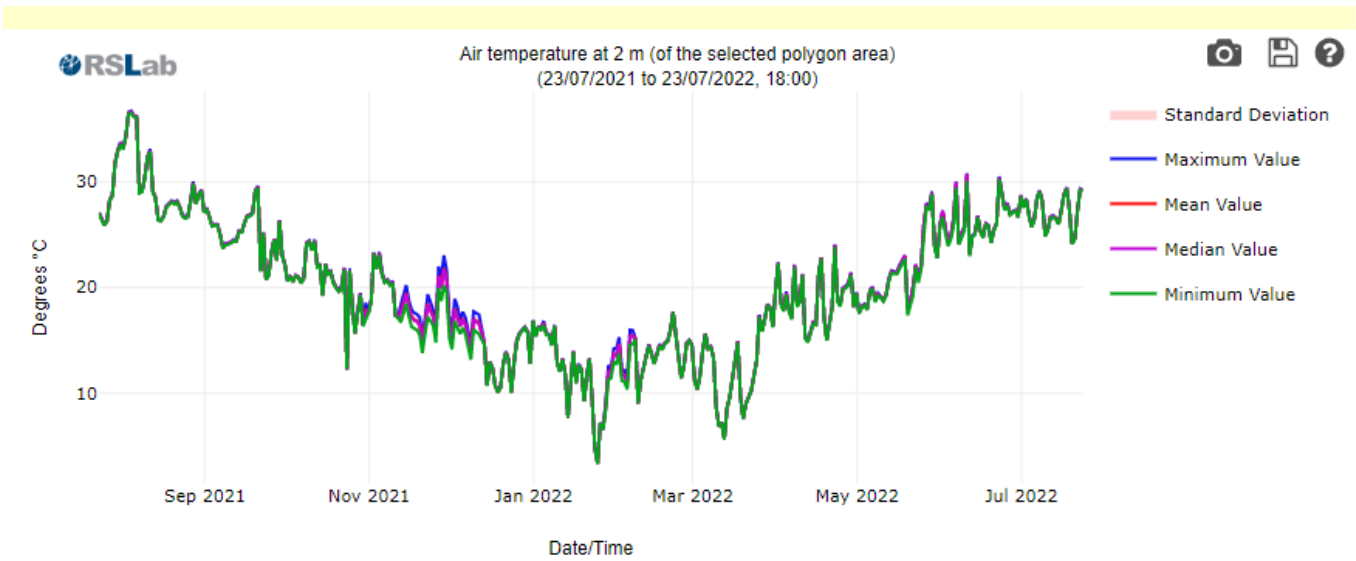
Boxplot chart shows the same as above using boxplot format. Each box is form average minus standard deviation to average plus standard deviation, the line inside is the median and min/max are drawn out of the box.
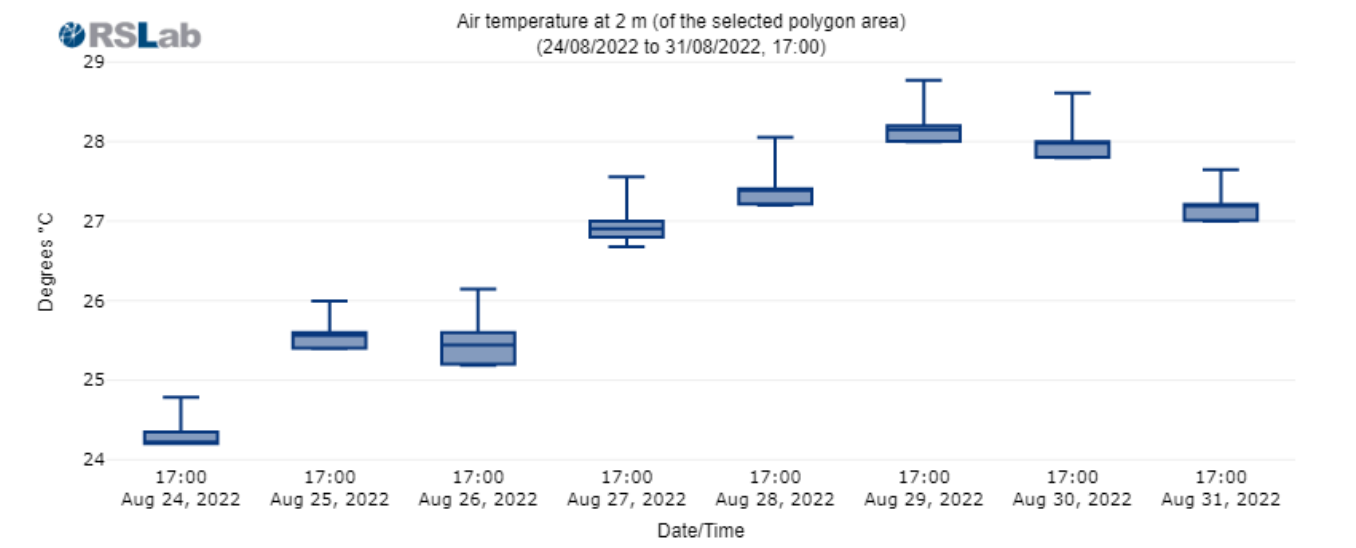

Polygon Area Charts data download (.png, .csv)

Each graph and data that have been loaded can be downloaded using the same buttons as in point tool chart D.

# Entire Area of Interest analysis tool

Working on the complete area, the entire area tool offers statistics as mean, min, or max. Aggregation function selection. The three selection choices (2.). are available on the Entire Area tool's tab

(1.). When one of the three options is selected and *"Entire Area mean values"* is chosen (3.), a map of the chosen statistics for each map pixel for the chosen time period is produced.
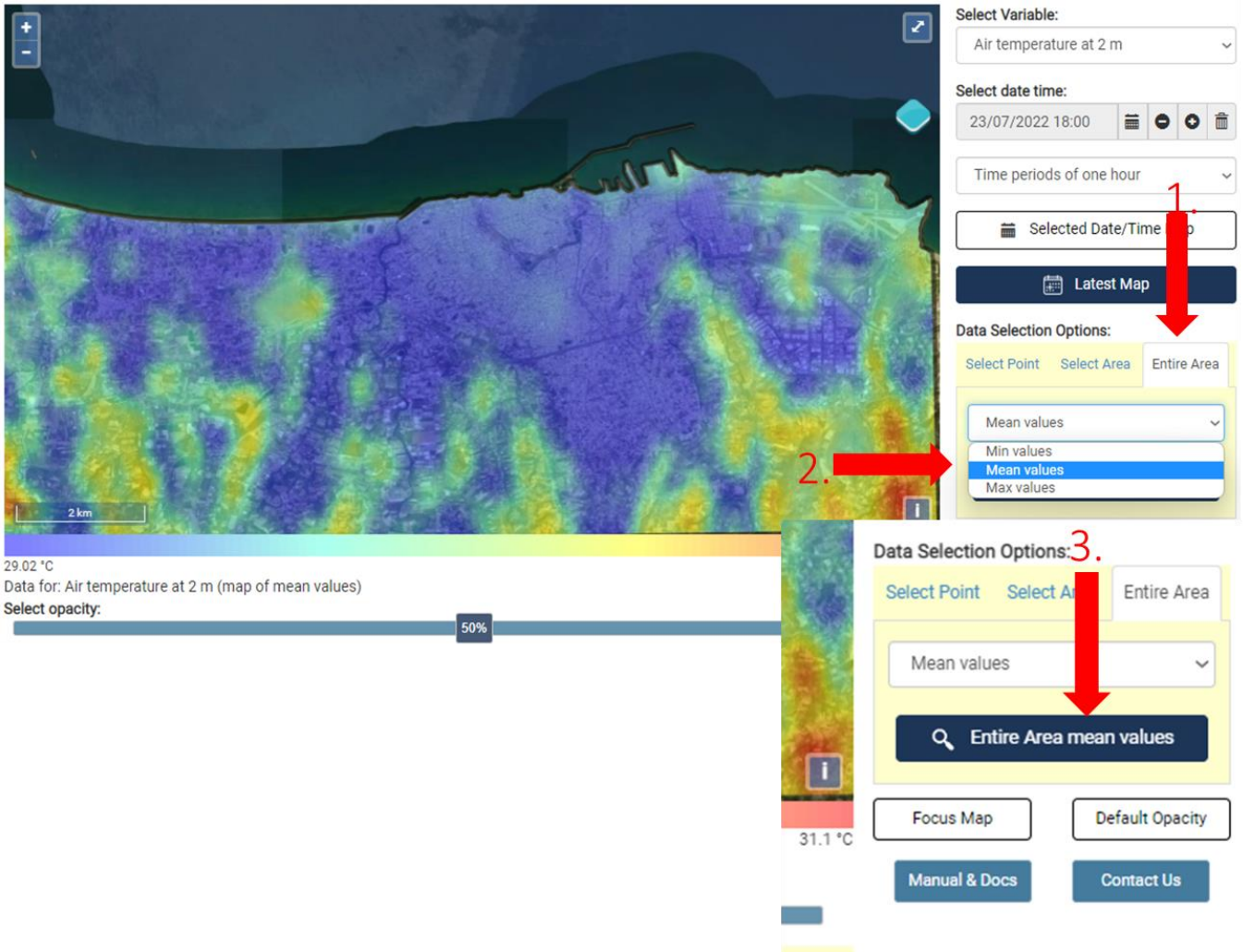
Timeseries range

Statistics for various time series may be obtained by adjusting the time period. For the chosen time series, each option creates a map of the chosen hour and time period.
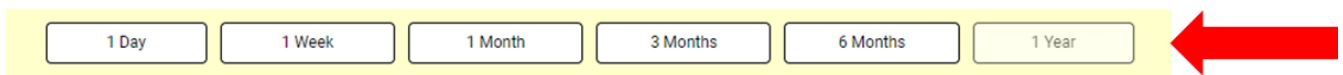
Entire Area of interest Chart
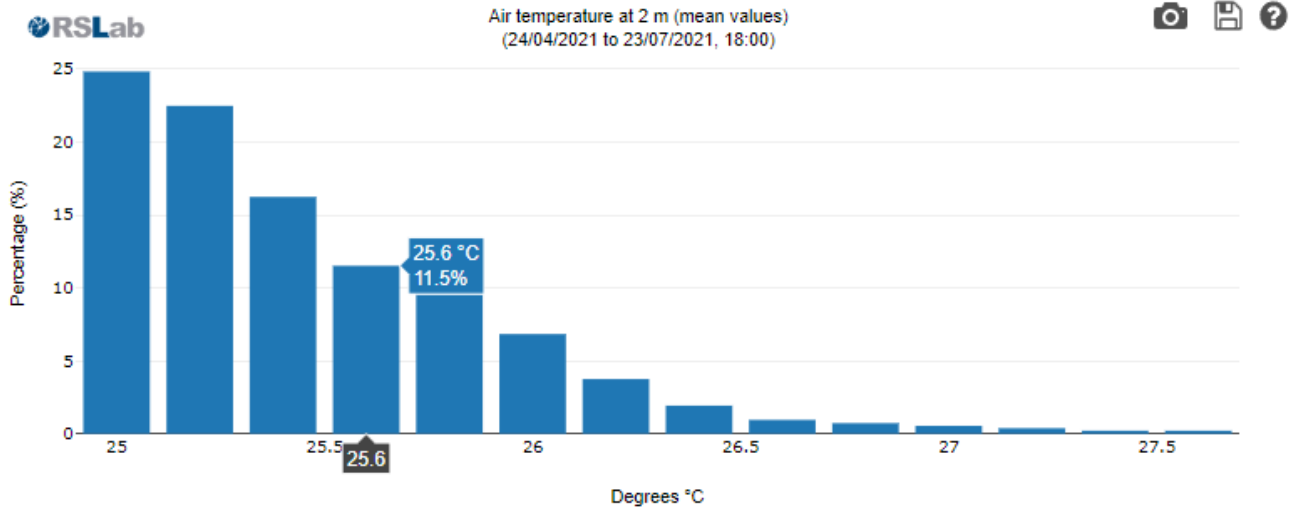
The app offers the computed map and charts. The graphs display how frequently each value appears in the   map.

This data can also be downloaded using the buttons as previous point tool.

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