CALIOPE EU: Air Quality

CALIOPE EU air quality forecast application
User Guide

caliope@bsc.es

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1. Description

The CALIOPE EU air quality forecast application has been developed by the Earth Sciences Department of the Barcelona Supercomputing Center and funded by the European Commission in the context of the MYGEOSS EU project. The data displayed in the mobile application is based on the CALIOPE system (www.bsc.es/caliope)

The application provides 48-hour air quality forecast for rural and suburban background stations spread all over Europe and also makes use of the user's device GPS system to find the position and show the forecast air quality level from the nearest air quality station. Thus, the air quality forecast level is shown in five categories: good, acceptable, poor, bad and very bad. Furthermore, CALIOPE EU app shows the hourly maps concentrations of the major pollutants: ozone, nitrogen dioxide, sulfur dioxide and particulate matter dissolved in the atmosphere.

More information about the CALIOPE system is available in chapter 4.

2. Installation

In order to install the CALIOPE EU app, on your smartphone or tablet device running Android 4.0 or higher, go to Google Play store, select "applications", and search for "CALIOPE Europe".

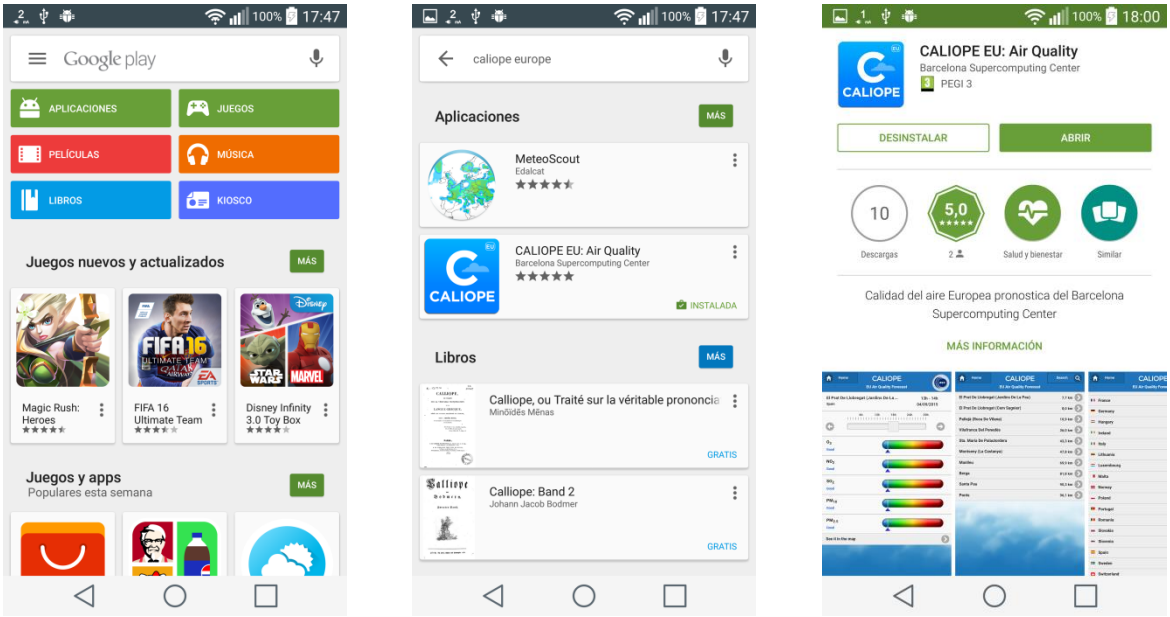

Figure 1. Google play store and CALIOPE searching

Once the results are shown, you only have to press on CALIOPE EU, and once inside the application download screen, press on Install in order to begin with the installation.

In the installation process you will be asked to allow the app to use your device's location service and get information from your Wi-Fi connection. The location service (including the Wi-FI information) will be used by the application in order to find the nearest air quality station according to your position.

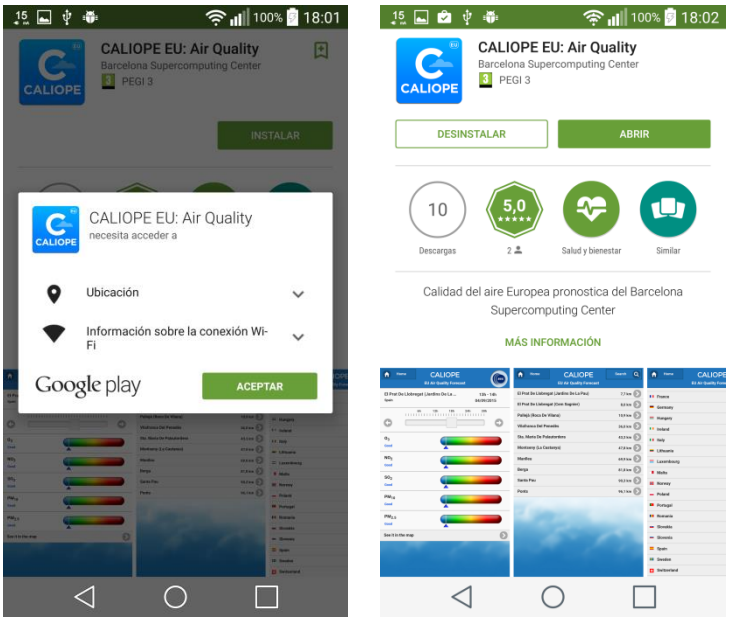

Figure 2. CALIOPE EU installation display

3. User Guide

In the CALIOPE Europe application main page, you will see four options: Air Quality Level, Stations, Map and Information. They will give you access to the different app functionalities that are described below.

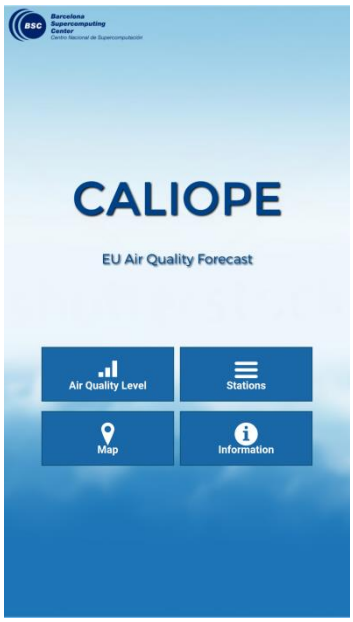

Figure 3. Main menu of the CALIOPE EU application

3.1 Air quality level

This section shows the air quality levels for the nearest station to your location, which is obtained through your device's geolocation.

In the upper part of this screen, you will see the name of the air quality station and the country where it is located, while in the upper-right corner, the date and the timestamp for the displayed forecast are shown. You can move the horizontal slider to see the forecast for the next hour up to 48 hours ahead.

The air quality levels are shown for the following pollutants: ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and particulate matter (PM10 and PM2.5). Each one is represented by a color bar and its name from these five categories: good, acceptable, poor, bad and very bad, as it is shown in the table. A description for each one is displayed in the information section of the app.

Good
Moderate
Poor
Bad
Very bad

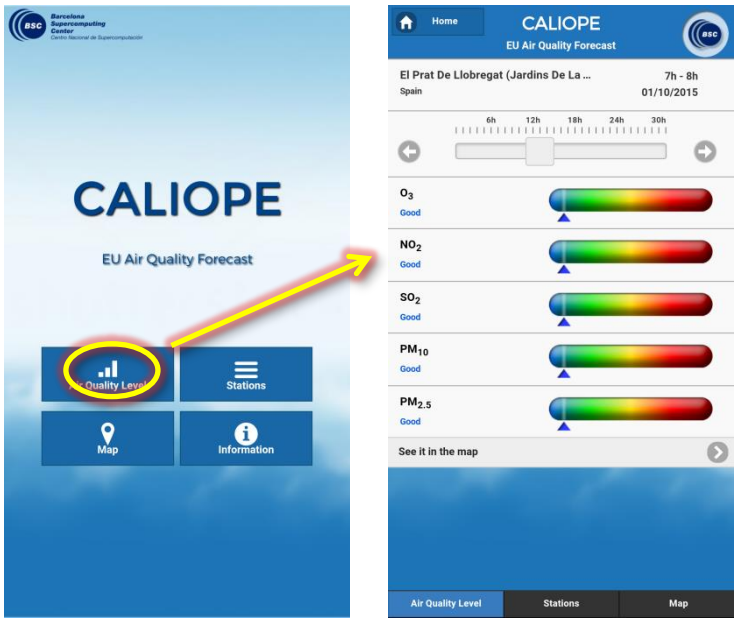

Figure 4. CALIOPE EU app. Air quality level display

3.2 Stations

These view shows a list of the nearest stations to your position. The user can choose any of them to see the air quality levels or using the “Search” button, to find the station by country. Pressing “Search” button will displaya list of the European countries sorted alphabetically. From this list, you can select a country and a new list of the stations for this country will appear. Then you can select a station and see the forecast predicted for its location.

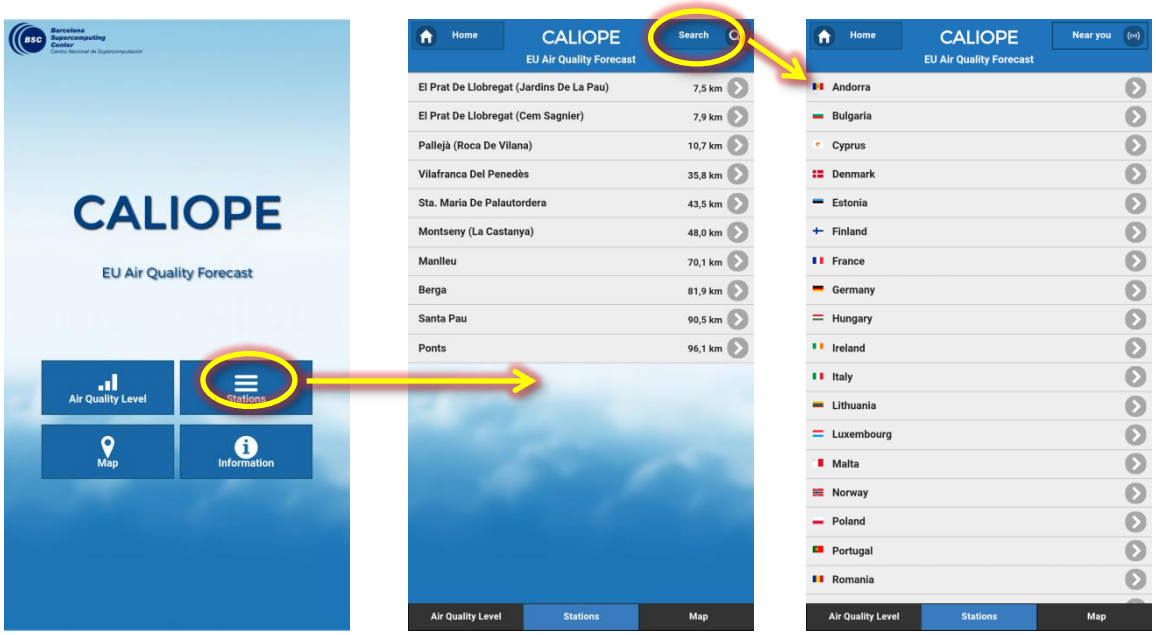

Figure 5. CALIOPE EU app. Nearest station list and searching option by country

3.3 Map

The map option by default shows a map centered on your location containing the nearest air quality stations. For each station, the color of the worst category for the next hour is shown. You can select in the upper-right corner of the window the option “layers” and select on the popping up menu the desired pollutant, to overlay its correspondent concentration map.

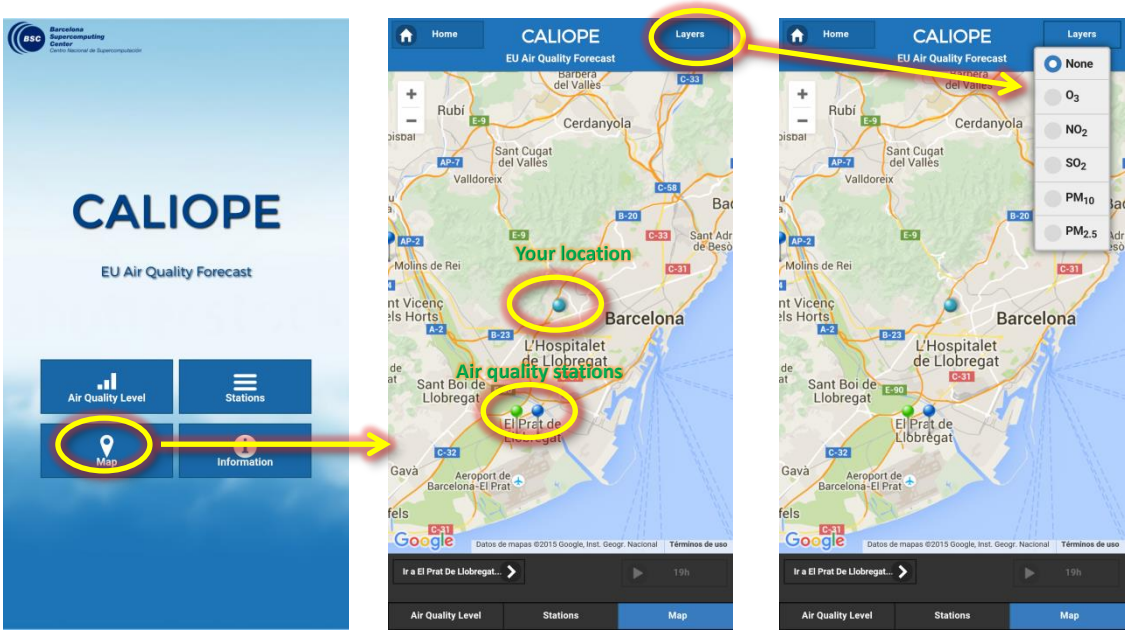

Figure 6. CALIOPE EU app. Display of the maps option: air quality station location and layers maps

The concentration air quality maps are shown for the pollutants O_3, NO_2, SO_2, PM10 and PM2.5 on an hourly basis. The figure 7 shows an example of the O_3 concentration map.

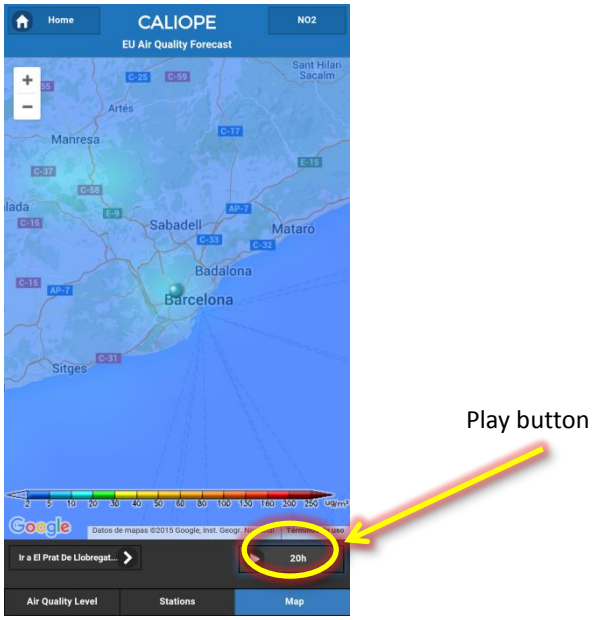

Figure 7. CALIOPE EU app. Display of the maps option: air quality station location and layers maps

By default, the forecast for the current hour is shown but you can use the “play” button to activate the animation of the hourly evolution of the forecast. The animation can be stopped at any time. Changing the pollutant will maintain the forecasted hour until you press the play button again or select another option in the menu.

3.4 Information

By tapping on the information option, the user can find further explanation about the air quality levels provided by the application (with a description of the concentration ranges by pollutant). It also informs about the main characteristics of the air quality pollutants shown in the app and its effects on human health. The limit values for the protection of the human health, according to the Directive 2008/50/CE are also displayed in each pollutant’s section

Figure 8. CALIOPE EU app. Air quality pollution information section

4. CALIOPE Air Quality Forecast System Overview

The CALIOPE Air Quality Forecast System (AQFS) is operated by the Earth Sciences Department of the Barcelona Supercomputing Center (BSC). This system provides an operational air quality forecast for Europe and Spain at high spatial and temporal (1h) resolution. The models used by CALIOPE are: WRF-ARW v3.5.1 meteorological model, CMAQ v5.0.2 chemical transport model (CMAS, 2015), HERMES v2 emission model and BSC-DREAM8bv2 dust model (Figure 9). The system includes a post-process step based on the Kalman filter (KF) bias-correction technique which improves the results over the air quality stations. The KF adjusted results are the basis to generate an air quality index according to five categories.

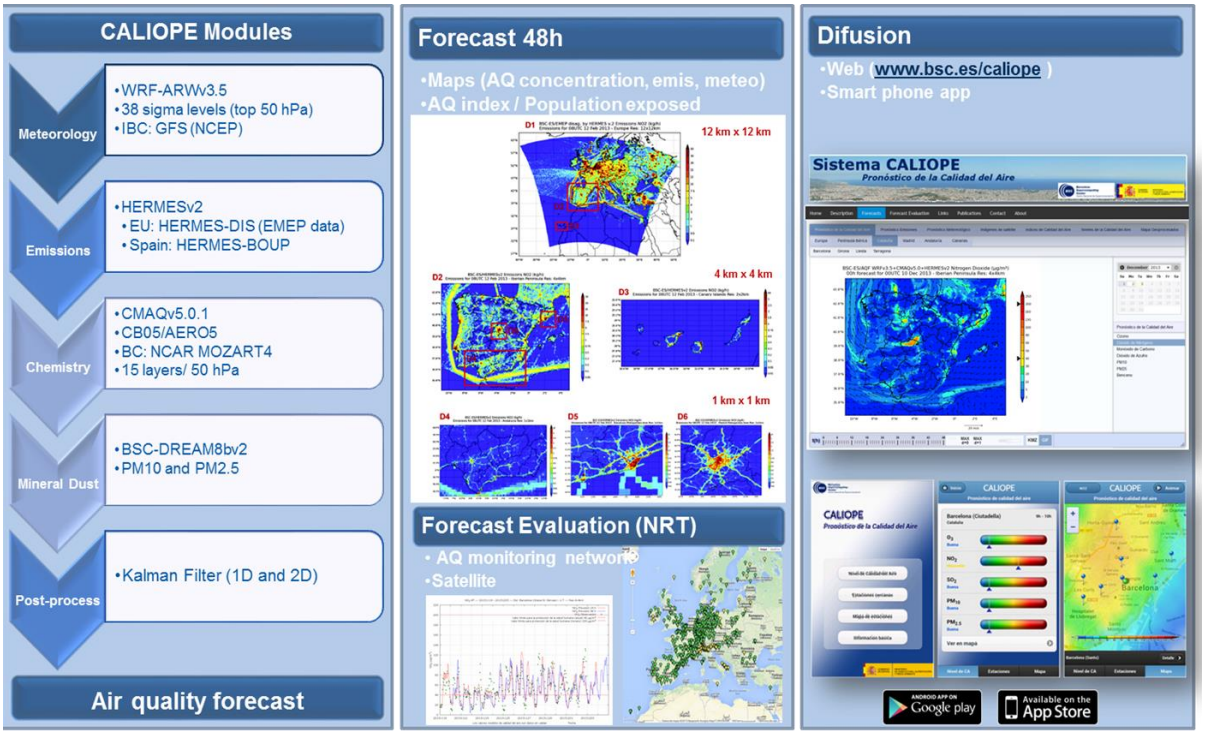

Figure 9. Main elements of the CALIOPE system

The main forecast results, available at www.bsc.es/caliope, can be grouped in three categories of information and products:

Information categories:

- ✓ **Meteorological forecast:** temperature, precipitation, humidity, pressure, cloud cover, wind direction and speed, among others.
- ✓ **Emission forecast:** nitrogen oxides (NO and NO_2), volatile organic compounds (VOCs), carbon monoxide (CO), sulfur dioxide (SO_2) and particulate matter (PM).
- ✓ **Air quality forecast:** Ozone (O_3), NO_2, CO, SO_2, particulate matter (PM10, less than 10µ and PM2.5, less than 2.5µ) and benzene (C_6H_6).

Products categories:

- ✓ **Concentration maps**:
  - Hourly and daily maximum concentration for 24 h and 48 h forecast.
  - Corrected air quality forecast based on measurements.

- ✓ **Air quality levels**
  - Forecasted air quality index maps.
  - Forecasted air quality index at measurement locations.
  - Tables of maximum values of air quality, planned for 24 h and 48h.

- ✓ **Forecast evaluation**

  - Near real-time evaluation at measuring stations (Autonomous Communities, municipalities, AEMET, EIONET).
  - Summary sheets of the annual forecast (statistical and graphics).
  - Satellite Images.
    - Air Quality
    - Weather

5. Troubleshooting

If the app on your device is crashing, won't open or respond, or isn't working properly, one of the troubleshooting solutions below may fix the issue. After each recommended solution, check to see if your issue has been fixed.

Problem	Recommended solution,
The application shows the message "Determining user's location" for a long time or you see a message alerting that is not possible to determine your location.	This message is displayed as long as your device's location service is trying to determine your position. Wait for a while or review your location configuration in your Android options.
The application shows a pop up with the message: "There was an error when connecting to the server"	You are having trouble connecting to the CALIOPE server. Ensure you have a working Internet access.