MECODA
Training & capacity building resources

Cos4Cloud Services

About the MECODA system and user guide

This is a system and user guide to MECODA, an online service that provides a repository of tools that facilitate analysis and visualisation of citizen science data from citizen observatories (COs).

Description

This is a user guide to **MECODA**, a Cos4Cloud service that is a repository of online tools which facilitates analysing and viewing of all sorts of citizen science data from citizen observatories (COs).

MECODA has been developed by project coordinator Instituto de Ciencias del Mar (ICM)-CSIC as part of Cos4Cloud a European Horizon 2020 funded project. The Cos4Cloud project has developed thirteen services boosting citizen science technological services to help increase and improve the quantity and quality of observations.

MECODA (ModulE for Citizen Observatory Data Analysis) is a repository to facilitate analysing and viewing different types of citizen science data, including from citizen observatories. This service aims to break down barriers by helping users explore and conduct their own data analysis without specialist support, create reproducible visual dataflows which can be shared and reused.

Service Coordinator

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The following content has been provided to help guide users of this service.

WHAT IS MECODA?

MECODA (ModulE for Citizen Observatory Data Analysis) is a Cos4Cloud service developed as a repository of accessible tools that can facilitate the analysis and viewing of different types of citizen science data from citizen observatories and other sources. Once data is uploaded to **MECODA** users can view and or access this data for analysis using the online tools available.

WHO IS THIS SERVICE FOR?

MECODA is aimed at scientists, students, citizens, and anyone doing research and training activities associated with citizen science and citizen observatories. It has also been developed to support developers and managers of citizen science data as well as those who contribute citizen science observations including those more experienced as well as those with a general interest. It can be used by citizen observatories that collate different types of citizen science data i.e. biodiversity, environmental etc or other data from other sources. **MECODA** can be used by installing Orange Data Mining, the programming interface integrated, and use the accessible ready-to-use tools available to analyse data and generate visual, user-friendly results. Developers and those with experience can use the code directly.

Bridging gaps which sometimes exist between these different groups and the data generated from observations, **MECODA** allows users to first upload and store data and then conduct their own exploratory visual data analysis without the help of specialised analysts. Integrated tools facilitate visual dataflows which can be used to help share and reuse results.

For example: a researcher studying the butterfly population in a big city can upload their data and use tools available in the **MECODA** repository to create a 'distribution graph' and visualize the number of observations of butterfly species over time. Are they increasing? Are them decreasing? Or a biodiversity group can use **MECODA** to analyse participation (i.e. biological recordings) from a citizen science BioBlitz, this could include the number of observations, identifications, participants, etc.

WHAT ARE THE BENEFITS OF THIS SERVICE?

MECODA aims to make data analysis tools more accessible in doing so it supports the creation of data analysis workflows as well as assembly, processing, visualization, and modelling for those seeking to conduct research, better understand and /or make use of citizen science data.

Benefits of **MECODA** include:

- User-friendly access to various citizen science observatories

- Customisable data-quality control

- Customisable data-analysis methods

- Data-viewing tools

- Tools that facilitate data exports data in different tabular formats

- The possibility to export images locally and the workflows can be saved and reproduced

Based on Orange Data Mining, an open-source visual programming toolbox for data analysis and visualization, **MECODA** uses a targeted approach which can help manage citizen science related data. The system has been designed with specific widgets developed, integrated and made available that directly access data from citizen observatories.

So far **MECODA** facilitates analysis and visualisation of data from six citizen observatories and can be easily adapted and used by other observatories and different citizen science data types.

HOW DOES IT WORK?

MECODA's repository currently includes different widgets that access environmental and biodiversity data from the following COs:

- Minka: collects observations of biodiversity and links these to environmental measurements contributing to research on the SDGs

- OdourCollect: an open App used to report odour observations

- CanAirIO: a citizen science project that uses mobile and static sensors to measure air quality with cell phones and low-cost technology.

- Ictio: Ictio is a database and a mobile App created to register observations of caught fish in the Amazon basin.

- Natusfera: a citizen observatory platform where users from Spain can post observations of biodiversity.

- Smart Citizen: empowers communities to better understand their environment through tools for citizen action in environmental monitoring and methodologies for community engagement and co-creation.

Real-time data from these citizen observatories is linked to the service through requests made to the API. When a user queries the data using the **MECODA** tools it is retrieved in a structured way presented as data tables for further enquiry. This data can then be analysed using the in-built tools. Results can then be saved locally for further use and exploration.

MECODA has integrated tools which can be used to perform the following tasks:

Data analysis methods & graphs

- Use the available tools to do tendency graphs, histograms, participation analysis, species distribution analysis on a map; statistical or image analysis etc.

Data-quality analysis

- Define your own data quality criteria to decide which citizen science data is trustworthy or not (e.g. number of validations, scientific identification, etc.).

Download graphs and data

- Download your work in different formats: .csv, .xlsx, .tab, etc.

Create and share your own tools

- **MECODA** is an open collaborative repository. Create new tools or data sources and share them with the community.

HOW TO USE MECODA – A STEP BY STEP GUIDE

Demonstration examples are used throughout the steps below. A data analysis example using data from the citizen observatory OdourCollect is also used to demonstrate how to conduct research using the existing databases in MECODA. Go through the steps to understand how the system works and how to initiate research using data from the COs with data that can be accessed from the system.

MECODA can be used to analyse data from the citizen observatories already integrated in the system that is accessible from widgets already created and available. These widgets can also be used as a model for other interested COs. To find out more about this go to Information and further support - below for the additional MECODA system information.

01 DOWNLOAD MECODA-ORANGE:

MECODA integrates the use of *Orange Data Mining* as the underlying operational system. Integrated widgets enable user analysis of data from citizen observatories added to the system.

To use **MECODA** and the tools it offers you first need to download the latest version of *Orange Data Mining* for your operating system:

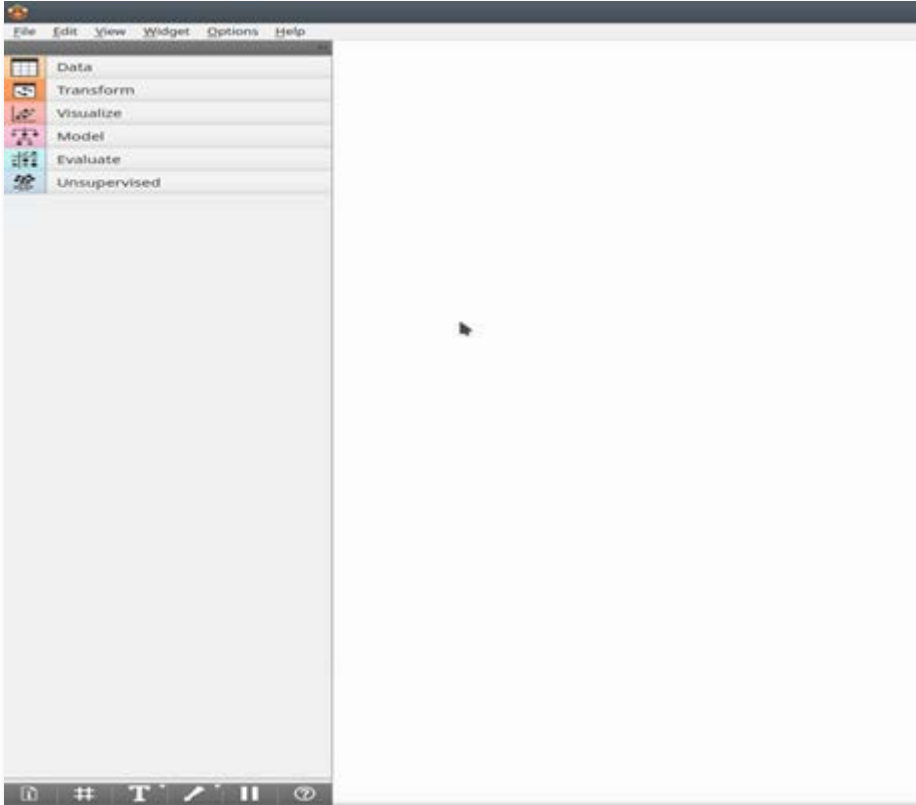**1.1** Go to: https://orangedatamining.com/download

1.2 Click: Download Orange 3.33.0
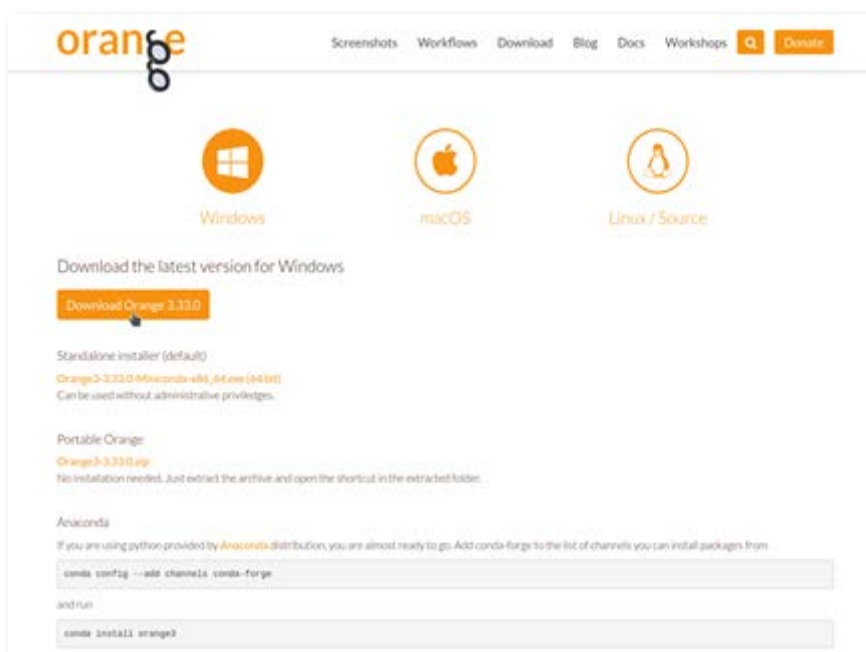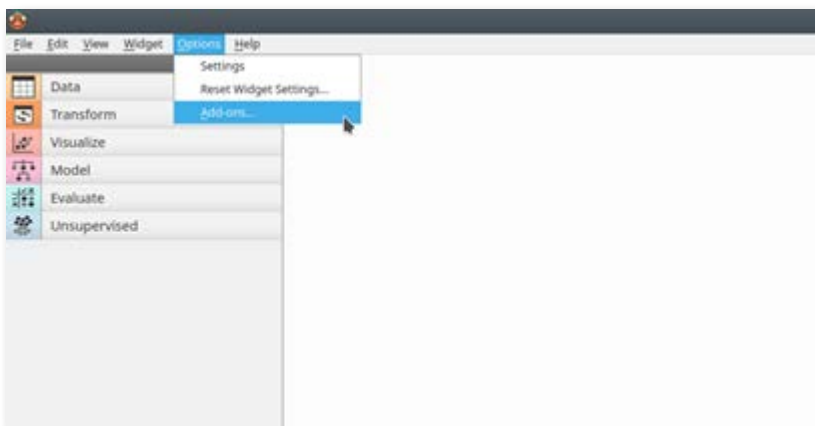
02 OPEN MECODA - ORANGE:

From your computer menu, find and open **MECODA-Orange**, see demo example of how system will appear below:
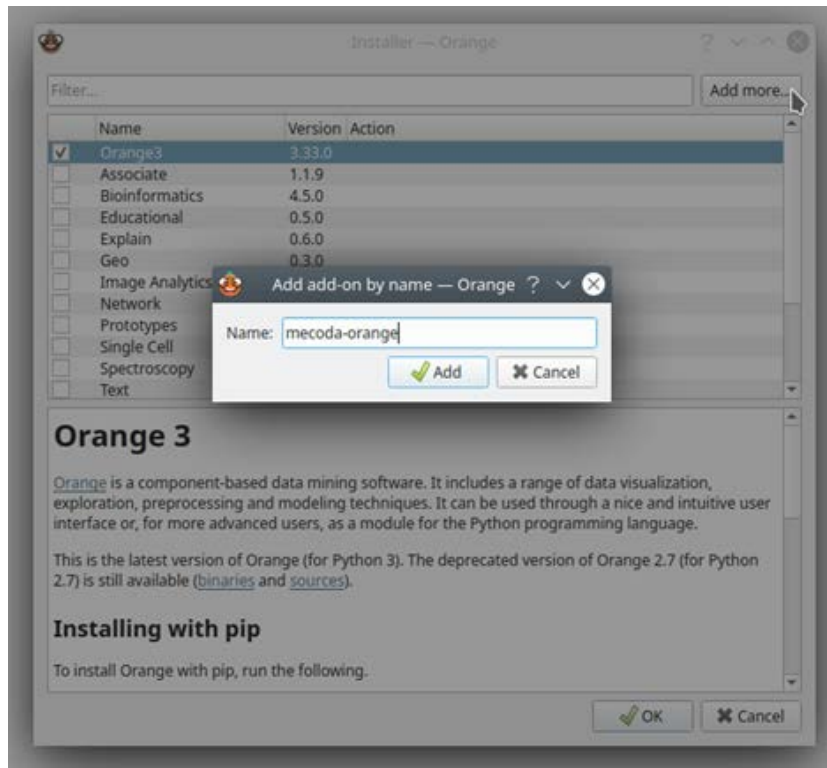

03 PREPARATION FOR INSTALLING MECODA - ORANGE:

**3.1** From the **MECODA-Orange** menu bar go to "Options" and select "Add-ons":

3.2 From the pop-up window which appears click on the "Add more…" button, top right. A search window will appear called "Add add-on by name". Type "mecoda-orange" in the search box and click the "Add" button:

3.3 In preparation for installation, look for **MECODA-Orange**, which will appear in the list of packages available for installation. Check the box beside the name:
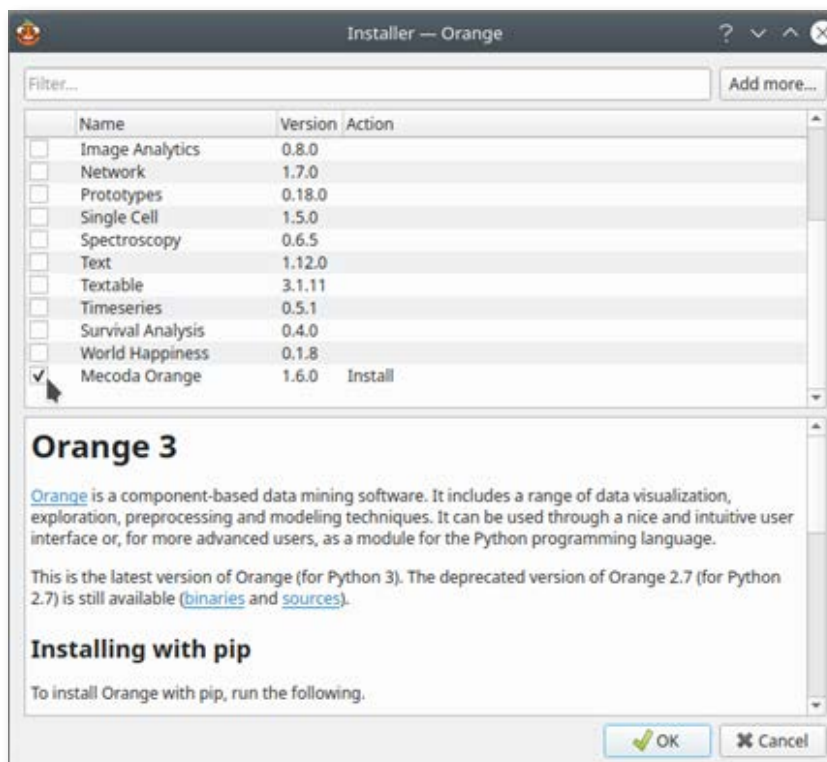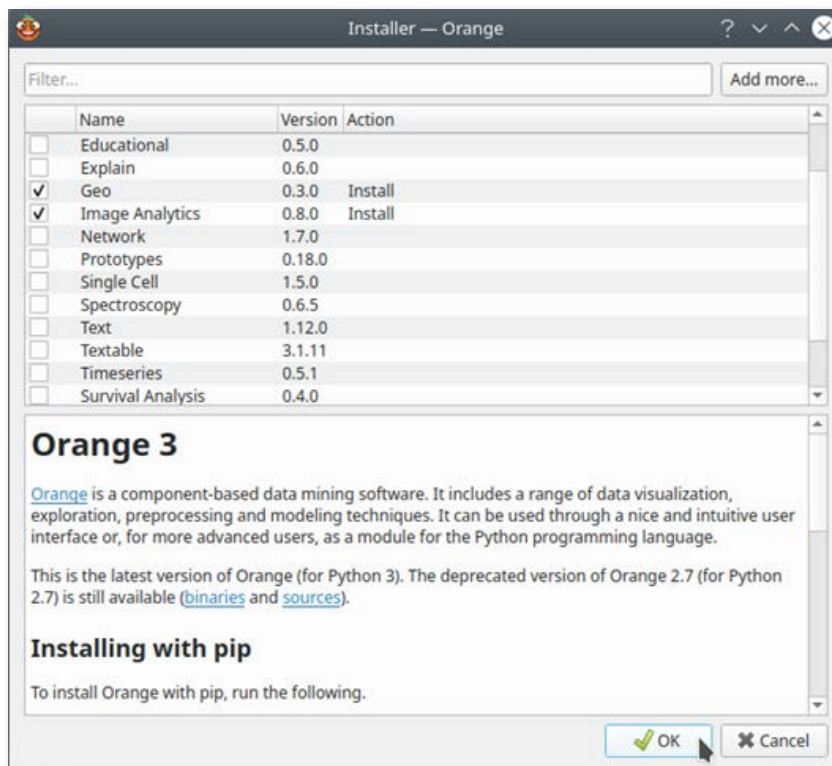
3.4 Additional packages are required to enable functionality to perform image and geographical analysis. Look for *Geo* and , and check the boxes for these packages also:
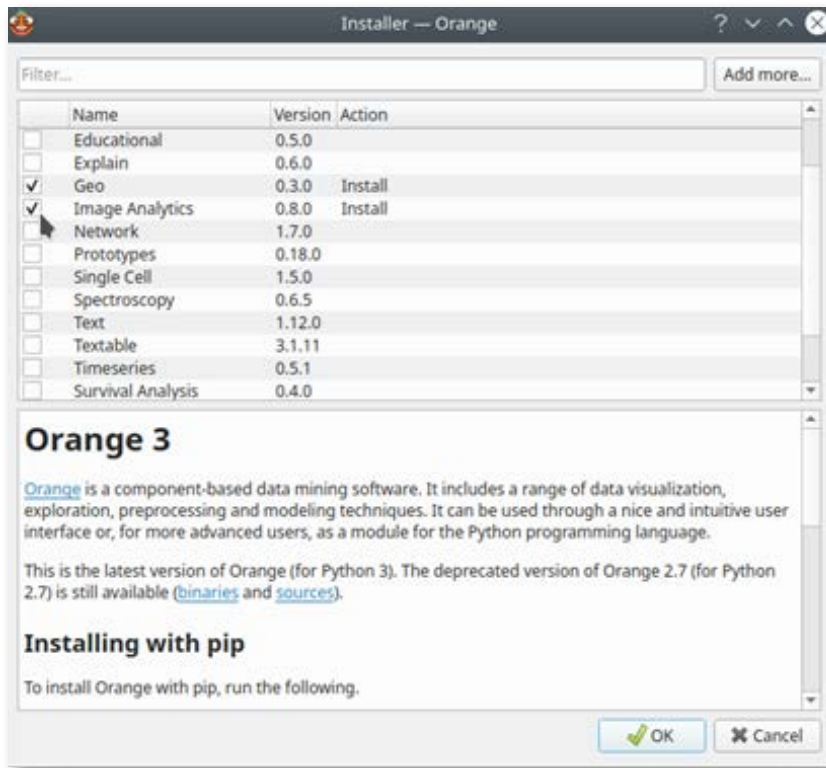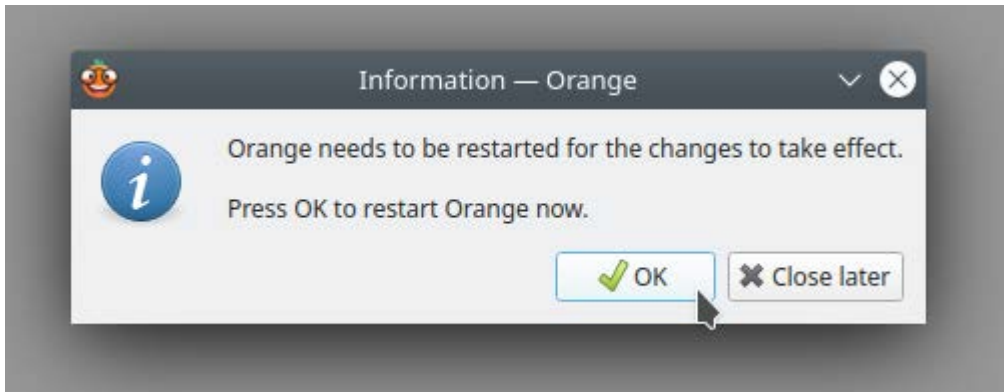

04

INSTALLING MECODA - ORANGE:

4.1 After selecting these three packages, click OK to install them:

4.2 MECODA-Orange should now be installed; however, a restart is required for it to take effect. When the pop-up box appears click "OK":

4.3 Once your computer has restarted, the installed packages will appear and **MECODA-Orange** is ready for use. When opened the installed packages will appear in the left-hand side column:
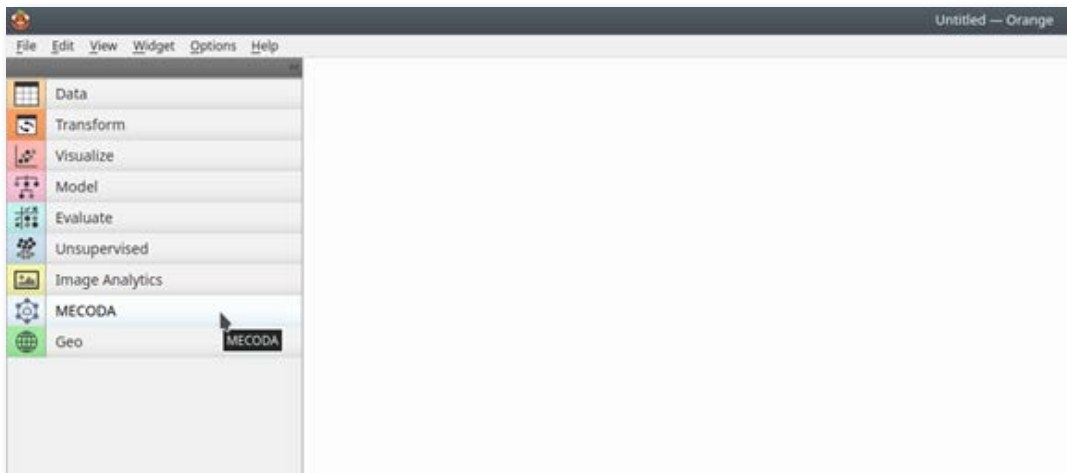

PLEASE NOTE: If **MECODA** does not appear in the Orange interface, as demonstrated above, the software will need to be removed and reinstalled. Close the system and remove the cache/Orange folder from your computer. Follow the installation STEPS above. If it still does not appear remove and install it again.

05 HOW TO USE MECODA: USING AND ANALYSING CITIZEN OBSERVATORY DATA (OdourCollect example)

This step will take you through **MECODA** with a demo example using data from the environmental citizen observatory OdourCollect (see more here: https://odourcollect. eu/).

5.1 Access *OdourCollect* data: Open Orange, click on the **MECODA** package, and then click on the *OdourCollect Obs* widget:
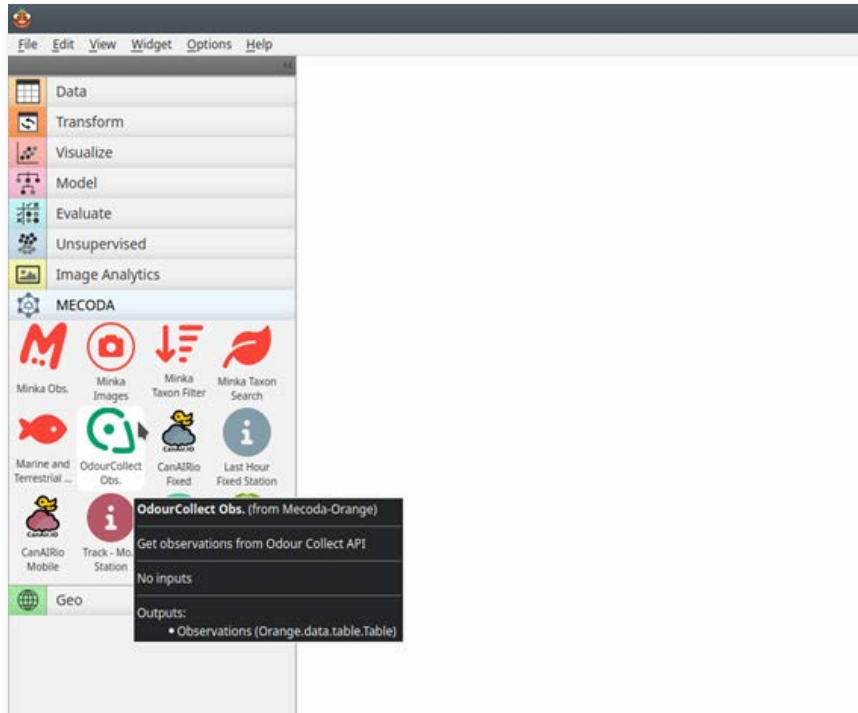
5.1.1 The *OdourCollect Obs* widget will appear on the white canvas space on the right-hand side. It allows the user to get observations directly from the Odour Collect API.
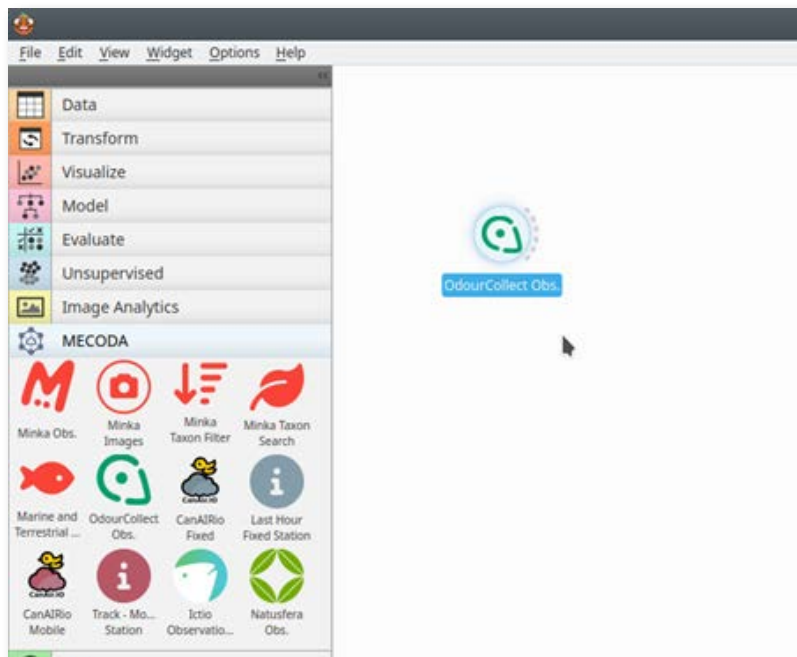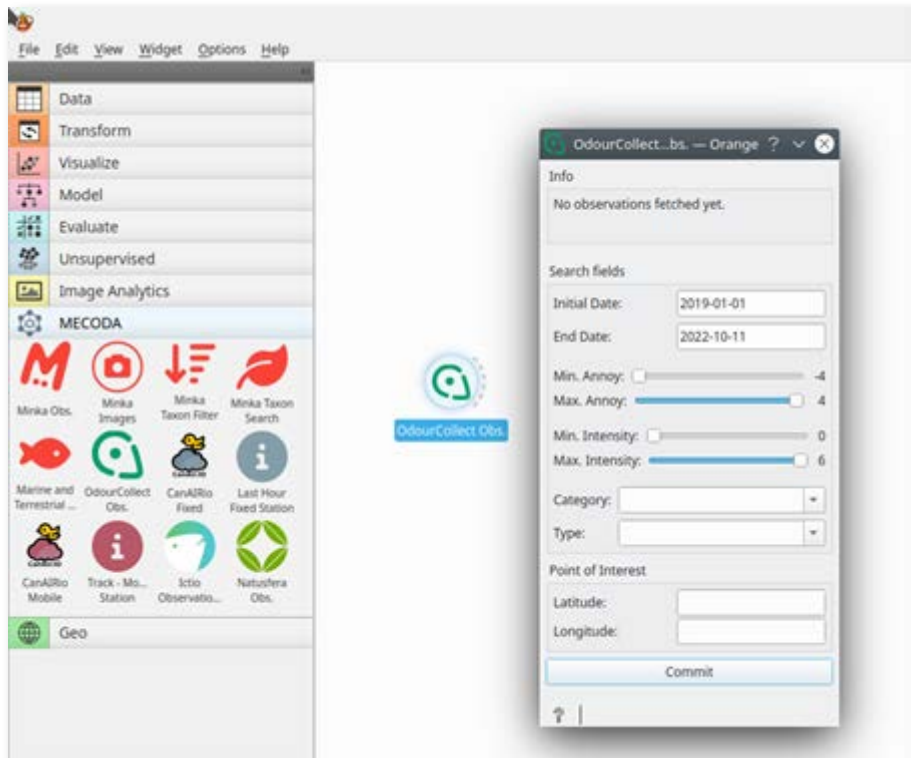
5.2 Download *OdourCollect* data:

5.2.1 Double click on the *OdourCollect* widget this opens a pop-up window showing information about the data available and the selection / search fields to facilitate a data download.

The widget has different search fields: date, annoy level, intensity level, category and type. Observations can also include distance, i.e. from a Point of Interest, if this is set.

5.2.2 The "Initial Date" and "End Date" search fields provide details on the range of the dataset of *OdourCollect* observations available i.e. 2019 to today. To adjust this, enter the dates for the timeline required, see below:

5.2.3 Click "Commit" to initiate a data request, from the *OdourCollect API*. In the example below this request has downloaded a data set of 11,700 observations:
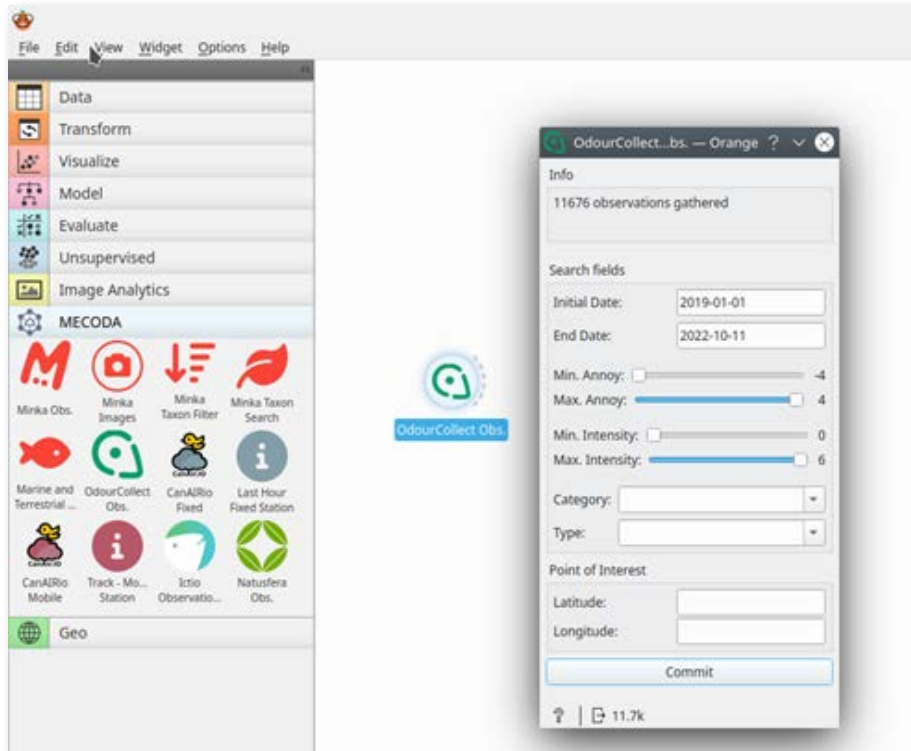
5.3 Analyse *OdourCollect* Data: The Table widget allows viewing and manipulation of the selected dataset.

5.3.1 To access this put your mouse over the right-hand side of the *OdourCollect* widget, a pointed curve appears. Drag this curve and a line will appear, release to show a pop-up menu of options:
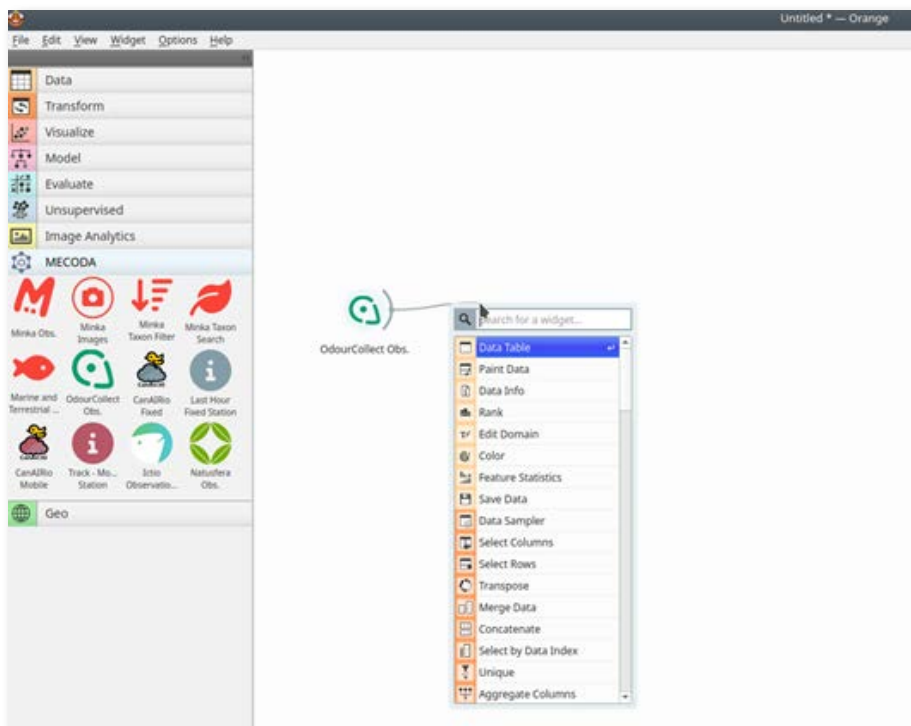
5.3.2 This shows the different options available to connect with the dataset. For the purposes of this demo. "Data Table" is selected. The result is a Table with data fields for further analysis that can include:

field	description
user	OdourCollect's user ID of the citizen that registered the observation.
date	Observation date in yyyy-mm-dd format.
time	Observation time in HH:mm (24h) format, UTC timezone.
week_day	Observation day of week. This field is extra data calculated by PyOdourCollect to help the analyst in finding patterns. Please bear in mind that this calculation is based on UTC, not local time, so it could be misleading in some edge cases.
category	First tier of odour classification. In OdourCollect webapp, this is called "type". It provides complementary classification nuances that can be safely ignored for basic analysis. See the full table below for better understanding.
type	Second tier of odour classification. In OdourCollect webapp, this is called "subtype". It provides the richest odour classification criteria. See the full table below for better understanding.
hedonic_tone_n	Hedonic tone of odour observation (numeric representation). Hedonic tone is the subjective measurement of how annoyant an odour is, from -4 (`Extremely unpleasant`) to +4 (`Extremely pleasant`). Zero is used to report nor annoyance nor pleasure. This scale is based on the VDI 3940:2006 standard for odour impact assessement.
hedonic_tone_t	Text description version of the former metric.
intensity_n	Intensity of odour observation (numeric representation). Intensity is the measurement of how intense and noticeable an odour is, from 1 (`Very weak`) to 6 (`Extremely strong`). Zero (`Not perceptible`) is also used, but only to report absence of odour in observations. This scale is based on the `VDI 3940:2006` standard for odour impact assessement.
intensity_t	Text description version of the former metric.
duration	Metric informing for how much time an odour has been perceived by reporter. Categorical text data with following self-explanatory options: (`No odour`),`Punctual`,`Continuous in the last hour` and `Continuous throughout the day`

field	description
latitude	GPS coordinates of observation. Latitude.
longitude	GPS coordinates of observation. Longitude.
distance	Distance in Kms (with an accuracy of 0.01 Kms.) between the point of observation and a configurable Point of Interest (POI). This extra data is calculated by PyOdourCollect when the data analyst provides a set of coordinates for a given suspicious activity that motivates his/her analysis. In case that no POI coordinates are provided, this field is missing.
time_hour	Observation time in HH (24h) format, UTC timezone.
time_mins	Observation time in mm (0-60') format, UTC timezone.
time_secs	Observation time in ss (0-60") format, UTC timezone.

If you are interested in analysing data from *OdourCollect* and other citizen observatories see links to further details in the Information and further support below.

ⓘ INFORMATION AND FURTHER SUPPORT

Introduction to this Cos4Cloud service: https://cos4cloud-eosc.eu/services/mecoda-data-analysis-package/

MECODA-Orange github repository: https://github.com/eosc-cos4cloud/mecoda-orange (includes demonstrations on how to access **MECODA-Orange** data from all integrated citizen observatories and other documentation.)

Installation and user guide: https://github.com/eosc-cos4cloud/mecoda-orange/blob/master/docs/installation_and_user_guide.md

More help analysing citizen observatory data: For further assistance analysing data from the integrated citizen observatories i.e. *OdourCollect* go to the detailed user example here: https://github.com/eosc-cos4cloud/mecoda-orange/blob/master/docs/installation_and_user_guide.md

Help adding data from other citizen observatories: **MECODA** can be used to analyse data from other citizen observatories:

- *Create a Widget:* for each citizen observatory modelled from the existing ones in the system. See the code to develop similar widgets in the Github repository, and make a pull request to integrate inside **MECODA** package: https://github.com/eosc-cos4cloud/mecoda-orange

- *How to add data:* data can be uploaded directly to the Orange platform and connected to other widgets created in Orange to perform analysis and visualization. To use this path, you can go directly to the Orange learning materials directly (no need to use **MECODA**): https://orangedatamining.com/docs/

Help and other information (Pypi package): https://pypi.org/project/Mecoda-Orange/

Orange Data Mining Platform: https://orangedatamining.com/

Get the Cos4Cloud infographic for this service: MECODA Infographic

Additional resources: About the Cos4Cloud Toolbox and Evidence Hub