Marine Ecosystem Dynamics and Indicators for North Africa

Guidelines on How to use the Medina e-Infrastructure (Mel)

Partner: University Pablo de Olavide (UPO). Work Package 3.	
Authors	Dr. Gonzalo Malvárez Dr. Emilia Guisado José Luis del Río.
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PART 1 – General Overview

The Medina e-Infrastructure (MeI) is a full SDI based on a compound of web services (compliant with OGC standards) which provides access to the indicators, tools and models produced during the project life, as well as other relevant cartographic information. The Medina SDI is hosted in the web portal www.medinageoportal.eu and has three main components: a **Map Viewer** to visualize maps, a **Data Catalogue** that stores Medina indicators and a **Searching tool** that allows customised searches through the Medina and GEOSS Catalogue. Although the MeI can be used in any browser, is highly recommended to use Google Chrome® or Mozilla to achieve the best performance of the tool.

Using the Map Viewer: basic functions

The Map Viewer constitutes the visible part of the Medina SDI and the main gateway to visualise the indicators and spatial products stored in the Catalogue.

The Map viewer in action:

1. Go to the **Geoportal website** (www.medinageoportal.eu).
2. The **General layout** of the viewer is structured as follows (Figure 1):

   a. A shortcut to the Medina Catalogue and Official Website of the project.

   b. A tool to search indicators and other spatial products through the Medina or GEOSS Catalogue.

   c. A Query tool  to retrieve the information linked to the indicators displayed in the Viewer (e.g. chlorophyll-a concentration).

   d. A measures distance tool 

   e. A set of tools  to enable or disable the split screen mode and synchronisation among both screens 

   f. A tool to zoom in and out into the maps 

   g. A tool to select a base map 

   h. A layers button: Provide access to the table of contents displayed in the Map Viewer and is connected with the Medina Catalogue. As a default, the geographic boundaries of the Pilot Cases and the bathymetric contours of the North-African coast are loaded.

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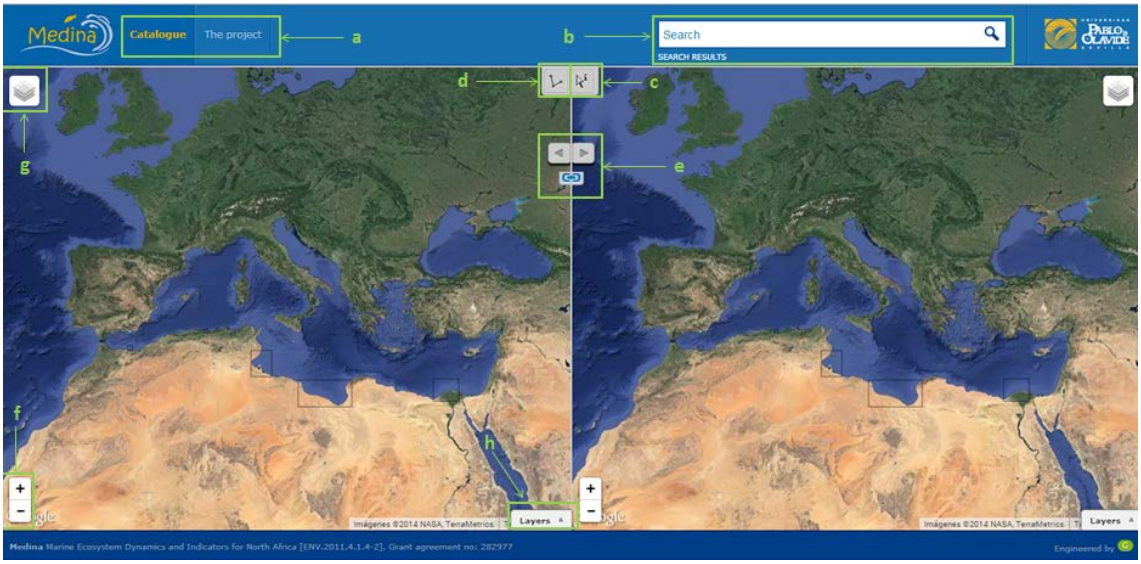

Figure 1. Overview of the Medina Map Viewer.

3. **Query tool**  : Through the use of this tool, users can **access the real value of indicators** at a certain point or pixel (s) depending on the scale of visualisation in which the map is shown. These values are provided in form of numerical values or categories depending on the type of indicator. Once the query tool is activated and the point of interest is selected, a box emerges providing the real value of the indicator corresponding to the selected point (figure 2). It´s important to notice that the activation of this tool is incompatible with the possibility of moving along the map screen, so in that case, users only have to disable the query tool by clicking on it  again.

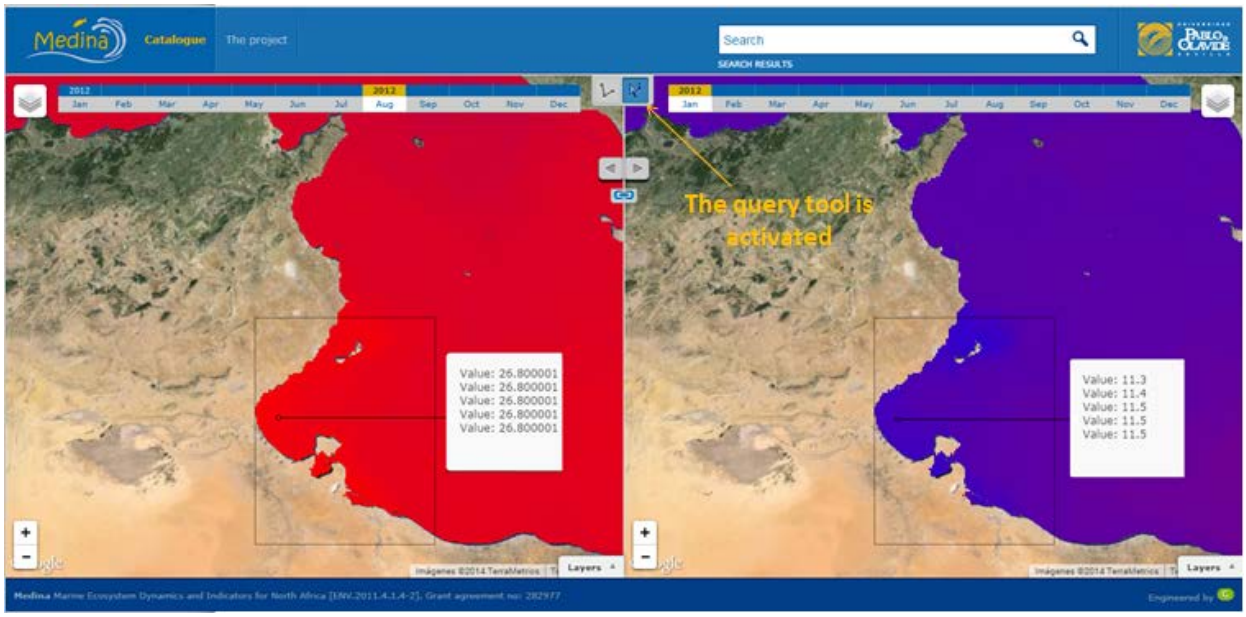

Figure 2. Screenshot of query tool functioning.

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4. **Measures distance tool**  **:**This tool **allows end-users to make rectilinear measures of distances** in kilometres between different locations by clicking at any starting point and then double clicking at the ending one (figure 3).

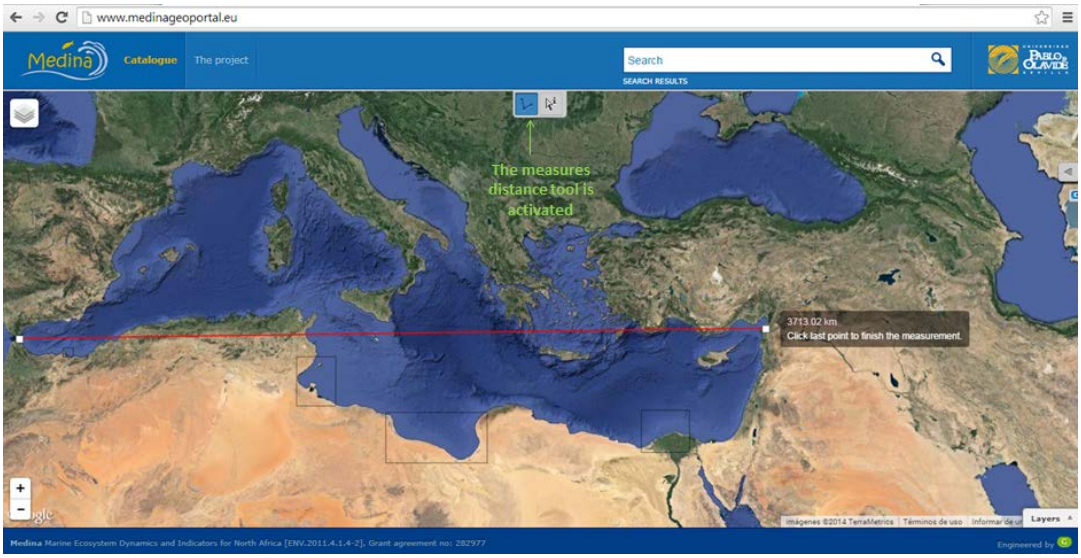

Figure 3. Screenshot of the linear distance from west to east of the Mediterranean basin by using the measures distance tool.

5. **Split screen tool: Allows customise the visualisation mode of the indicators** following two screens (using split screen tool) or one full screen (figure 4). **. This enhances** visualisation and comparisons of indicators.

In this regard:

 Click on right/left arrows to transform the two screens into full screen.

 Click on this button to synchronise/desynchronise both screens (when split screen mode is selected).

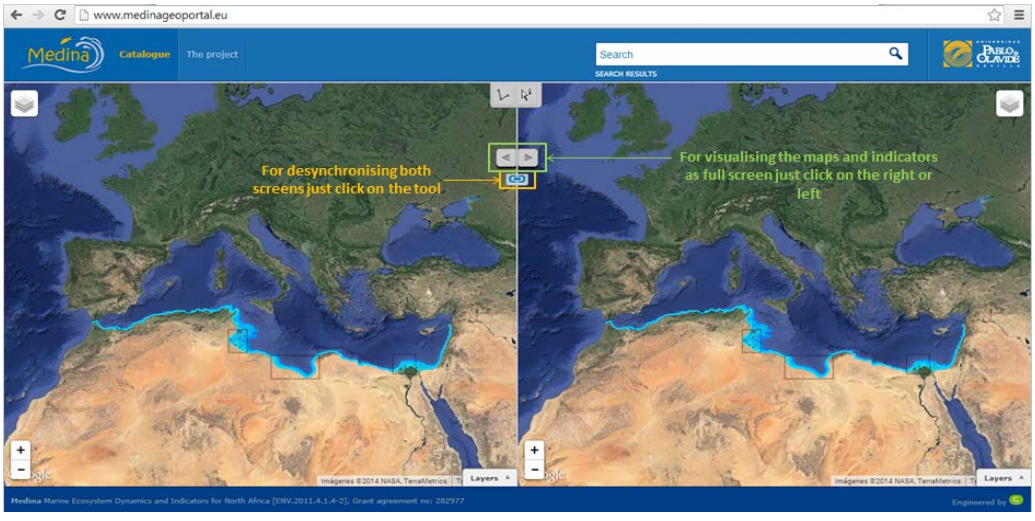

Figure 4. Overview of the split screen tool.

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6. **Base maps manager tool**  **:** This tool **allows end-users to choose between different maps from Google Corporation®** which are integrated within the Medina viewer as a **Base map.** Currently, users can chose among Google Satellite, Google Roadmap, Terrain and Hybrid as shown in figure 5.

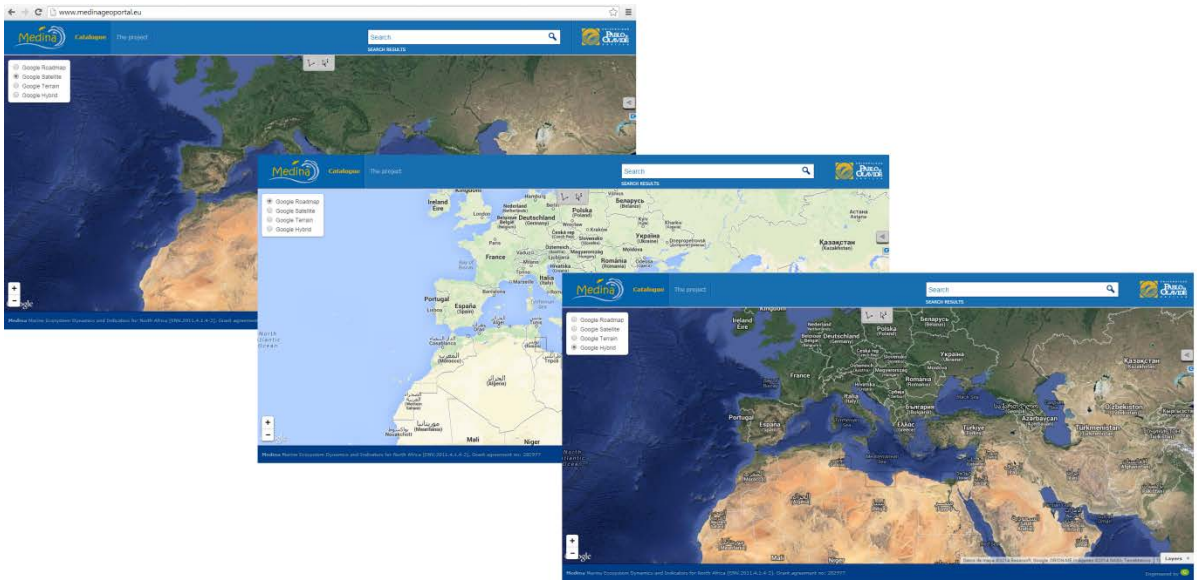

Figure 5. Overview of different base maps from Google Corporation® available on the MeI.

7. **Layers (Table of contents)**: Displays the indicators (previously selected from the Medina or GEOSS Catalogue) active in the viewer.

Usability tips of the tool (see figure 6):

 Click on this button to **select or deselect** a layer.

 Click on this icon to apply **zoom to selected layer**, thus allowing to locate the indicator on the map.

 Click on this tool to visualise the **legend (the legend will popup)**.

 Click on this tool to apply **transparency** to a layer (change opacity).

 Click on the bin icon to **remove** a layer from the table of contents.

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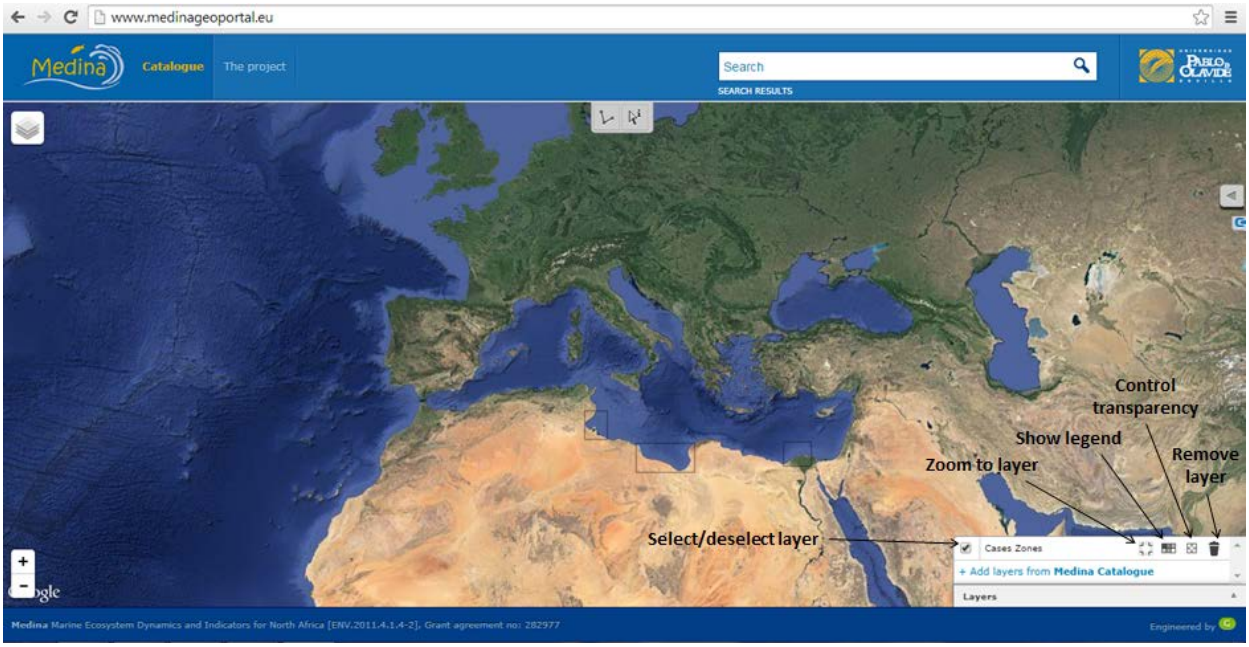

Figure 6. Screenshot of the available tools for managing the selected layers.

The Medina Map Viewer has the capacity to build the **legend** for each indicator in real time, thus constituting an efficient analysis tool. As the query tool, the legend will show numerical values or categories depending on the type of indicator. Further, the legend can be displaced across the map by clicking on it and maintaining the left button of the mouse pressed.

8. **Time slider**: As most of the Earth Observation (EO) and modelling results have temporal variability, the MeI incorporates a tool to visualise the evolution of these indicators (ranging from month to years).

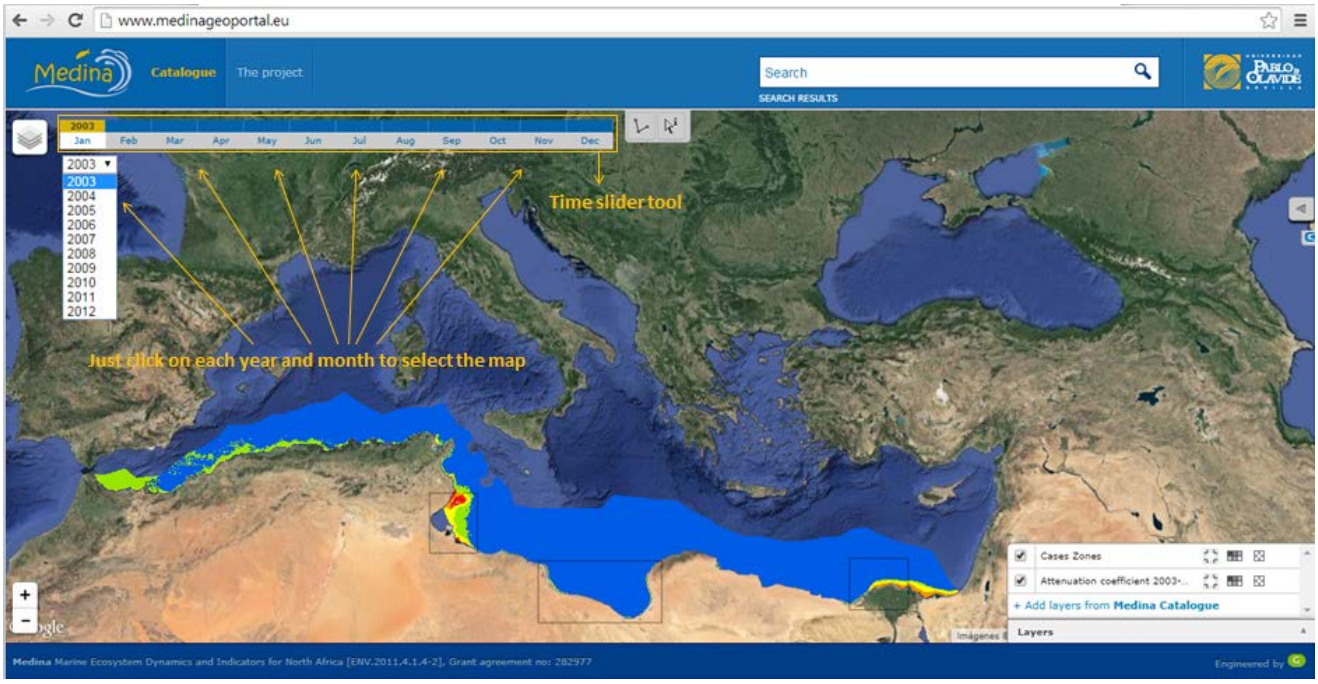

Figure 7. Screenshot of the appearance of the time slider tool.

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- For those variables obtained from the High Resolution Model of Nador, the time slider tool has been replaced by a calendar tool which has the same functionality of the time slider tool but variations of the variables are shown in days as shown in figure 8.

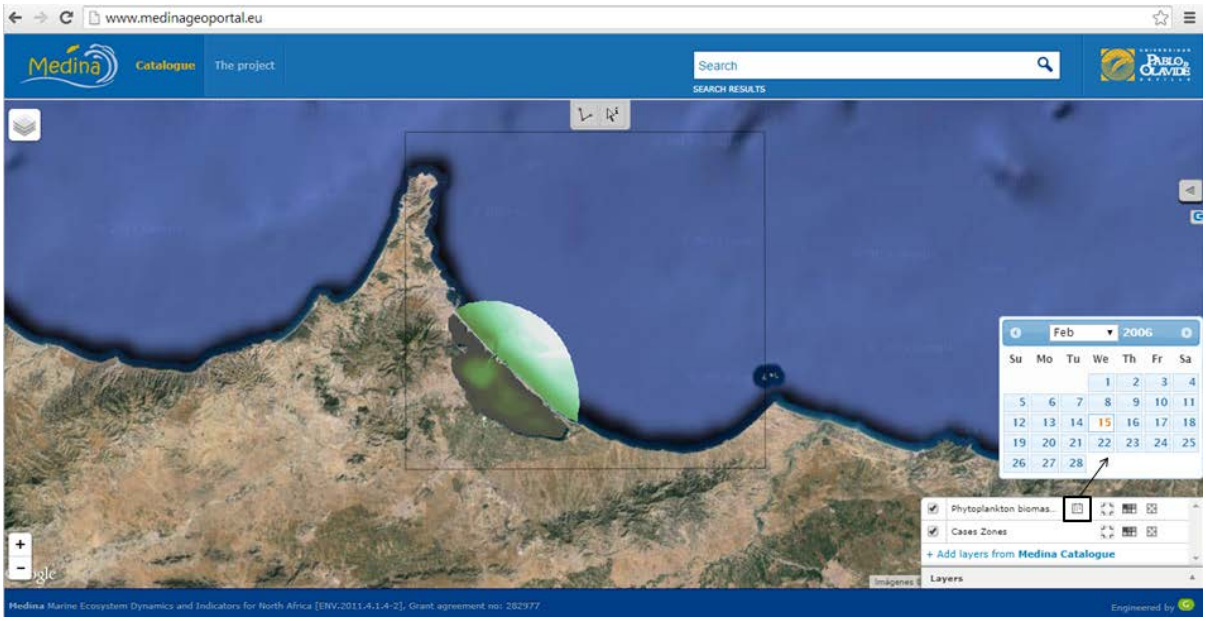

Figure 8. Screenshot of the appearance of the calendar tool.

PART 2 - Loading maps

Using the Catalogue

1. The Medina viewer is connected to the data catalogue in which all indicators and other spatial products, as well as the metadata information, are stored.
2. There are three ways for accessing the Catalogue (as shown in fugures 9 to 12):
   a. Using the **shortcut to the Catalogue** (see figure 9): The Medina Catalogue easily opens by clicking on the shortcut.
      - Go to the **Geoportal Website** www.medinageoportal.eu
      - Click on the section “Catalogue”, top-left corner.
      - Click on “Back to map” to go back to viewer.

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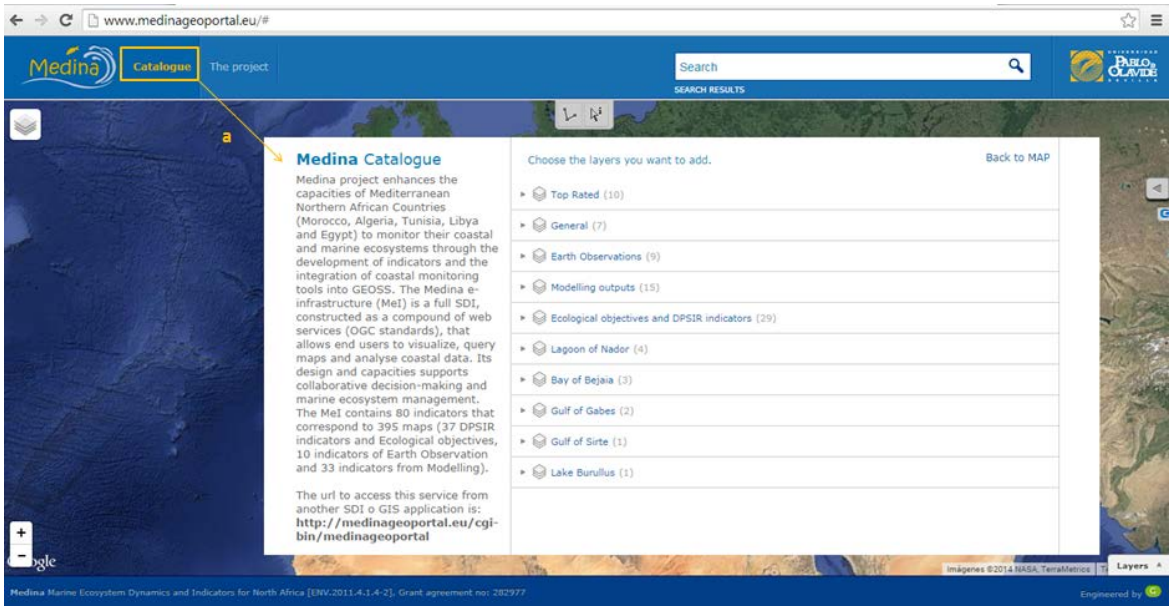

Figure 9. Overview of the Medina Catalogue accessible through the viewer.

b. Through the "**Layers**" section (see figure 10): Users only have to press this button and then on "**Add layers from Medina Catalogue**".

   - Go to the **Geoportal Website.**
   - Click on the "**layers**" section (bottom right corner).
   - Click on "**Add layers from Medina Catalogue**".
   - Click on "Back to map" to go back to viewer.

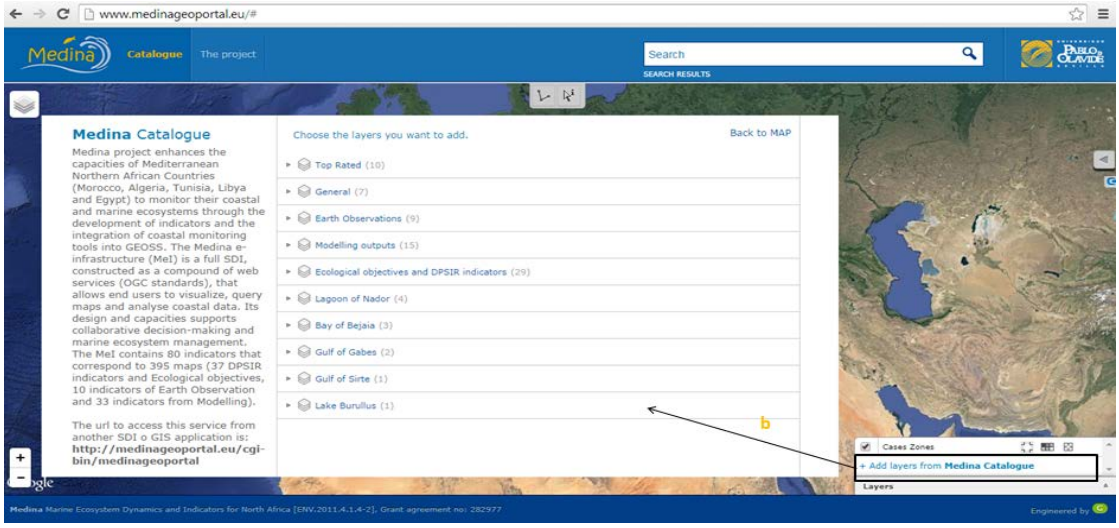

Figure 10. Overview of the Medina Catalogue accessible through the table of contents.

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c. Using the **Searching tool** (see figures 11 and 12): This tool allows searching for indicators both within the Medina and GEOSS Catalogue by typing any words (e.g. location or the title of the variable/indicator) and then press `intro` or the lens icon .

- Go to the **Geoportal Website**.
- Within the white box, located in the upper right side of the viewer, introduce the word "**Chlorophyll-a**" and press enter or the lens icon.
- The viewer offers **32 results from the Medina Catalogue** and **16 from GEOSS**.

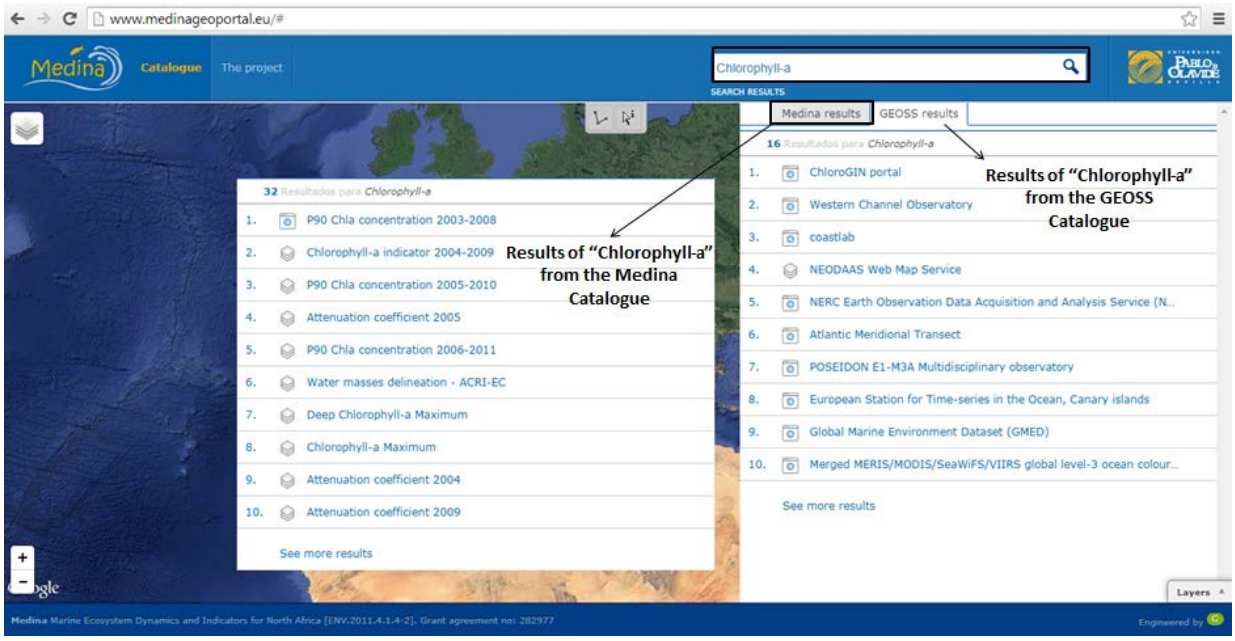

Figure 11. Functioning of the searching tool.

Example:

- Go to the **Geoportal Website**.
- Within the white box, located in the upper right side of the viewer, type the word "**Bejaia**" and then press "enter" in your keyboard or .

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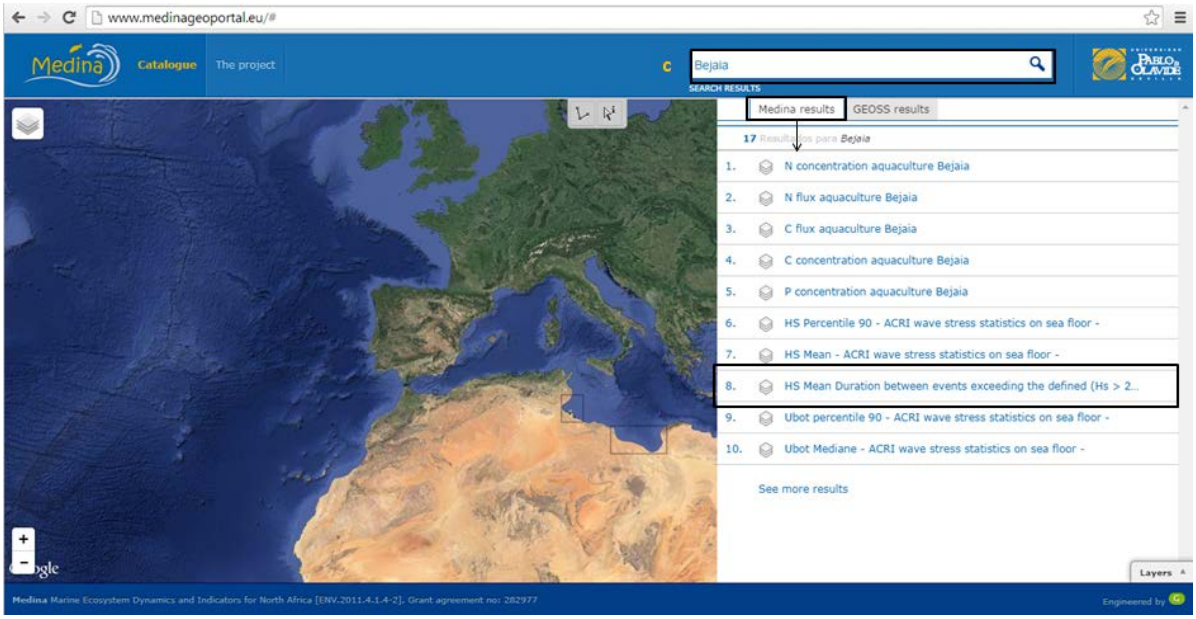

Figure 12. Available indicators from "Bejaia" stored within the Medina Catalogue and accessible through the searching box.

- Figure 12 shows the available results concerning the case of "Bejaia".
- Select the indicator "**HS Mean Duration between events exceeding the defined (Hs>2m)**" from ACRI-EC, click on the button "**Expand**" and then press "**Add layer**" as shown in fig. 13 .

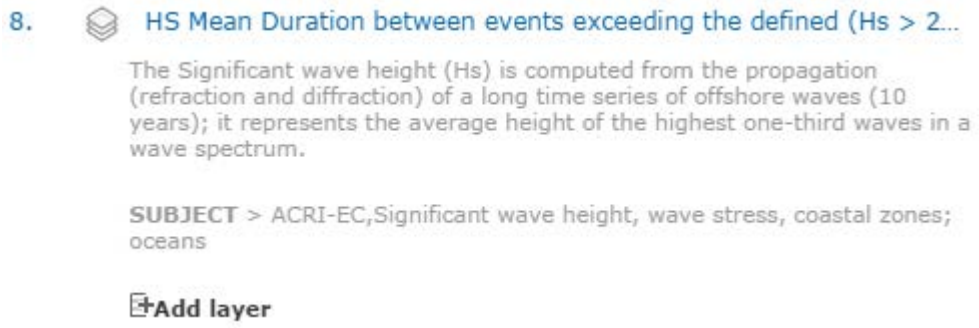

Figure 13. Steps to load an indicator from the Medina Catalogue by using the searching tool.

- The selected layer will be automatically loaded into the Medina Viewer and added to the table of contents.
- For closing the searching box just click on "**Search Results**" again, located at the bottom part of the searching box.

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How indicators are organised within the Medina Catalogue?

Indicators and other spatial data of interest for the project purposes are divided into regional and local products within the Medina Catalogue according to the scale in which have been calculated. In this regard, indicators are organised as follows:

1. Top rated (**10**)
2. General (**7**)
3. Earth Observation (**9**)
4. Modelling outputs (**15**)
5. Ecological objectives and DPSIR indicators (**29**)

Regional indicators

6. Lagoon of Nador (**4**)
7. Bay of Bejaia (**3**)
8. Gulf of Gabes (**2**)
9. Gulf of Sirte (**1**)
10. Lake Burullus (**1**)

Local indicators: Pilot Cases

To **open/close** each section just click on the icon  in the Catalogue.

1. Top rated

This section includes the list of some of the most relevant products produced within Medina, such as Sea Surface Temperature, concentration of Chlorophyll-a, Coastal ports and Euphotic depth among others.

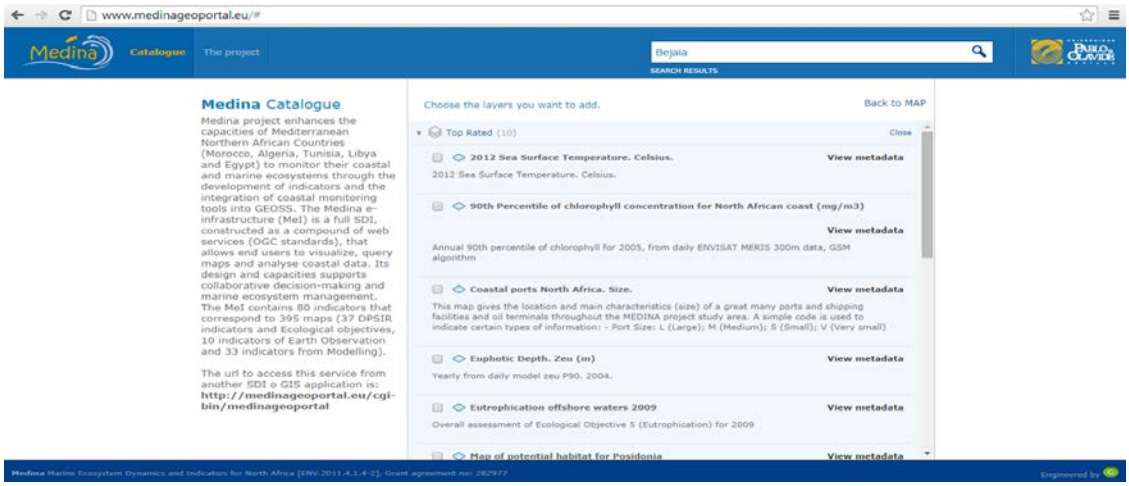

Figure 14. Overview of layers included within the "Top Rated" section of the Medina Catalogue.

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2. General layers

This section provides access to spatial data that are not Medina products by themselves but have a special interest for the project (as well as the geographic boundaries of the Pilot Cases, base maps and the bathymetric contours of the NA coast according to the General Bathymetric Chart of the Ocean, GEBCO).

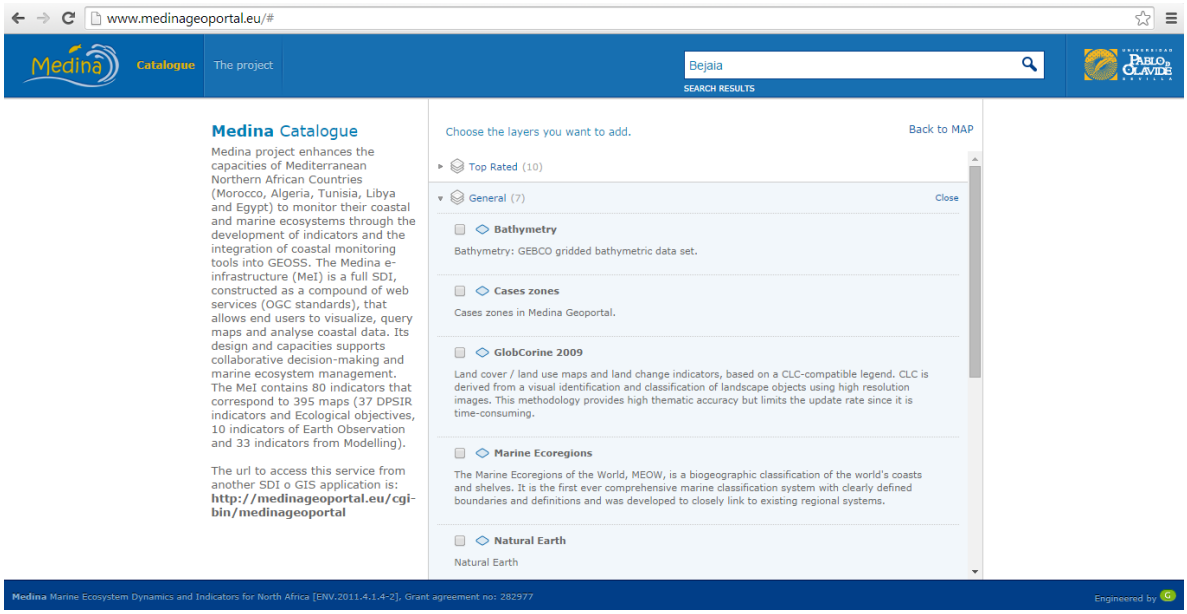

Figure 15. Overview of layers included within the "General" section of the Medina Catalogue.

3. Earth Observation Indicators

It includes the ecological indicators from Earth Observation ocean colour and the associated metadata information.

- Open the **Medina Catalogue**.
- Click on the icon and select the indicator.
- How to add a map to the viewer? First select the indicator you want to add by clicking on the icon and then select **left panel, right panel or both** of them to choose the side of the screen where you want to visualise such map. Finally, to access the metadata information, just click on "**View metadata**".
- The metadata is displayed in a new window where the information of the map (extension, provider, type of data) can be accessed.

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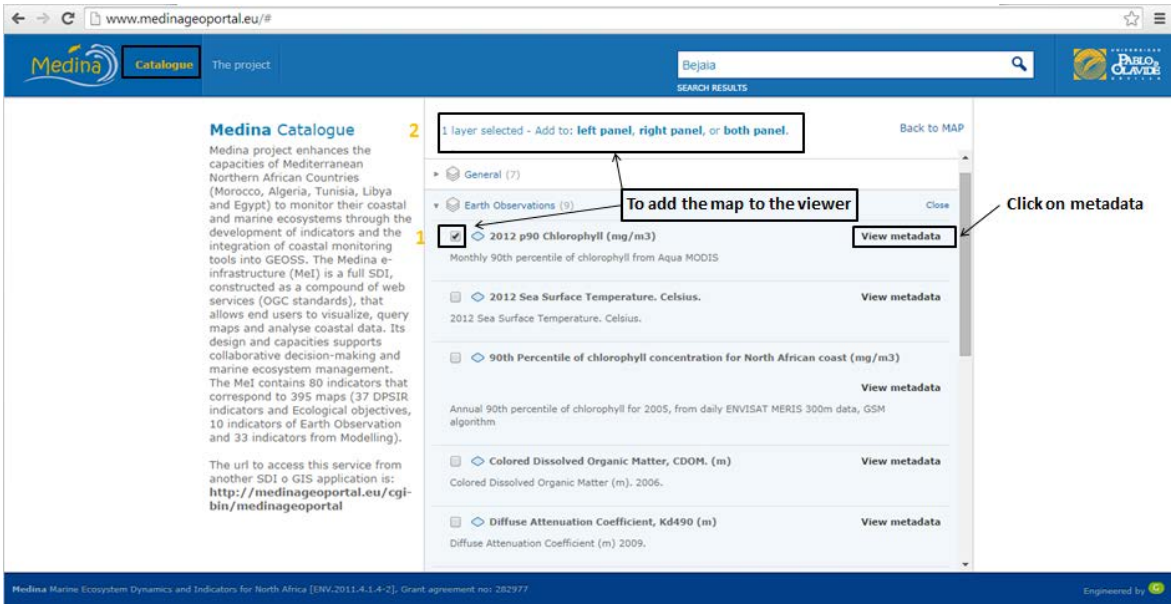

Figure 16. Steps to load an indicator from the "Earth Observation" section of the Medina Catalogue.

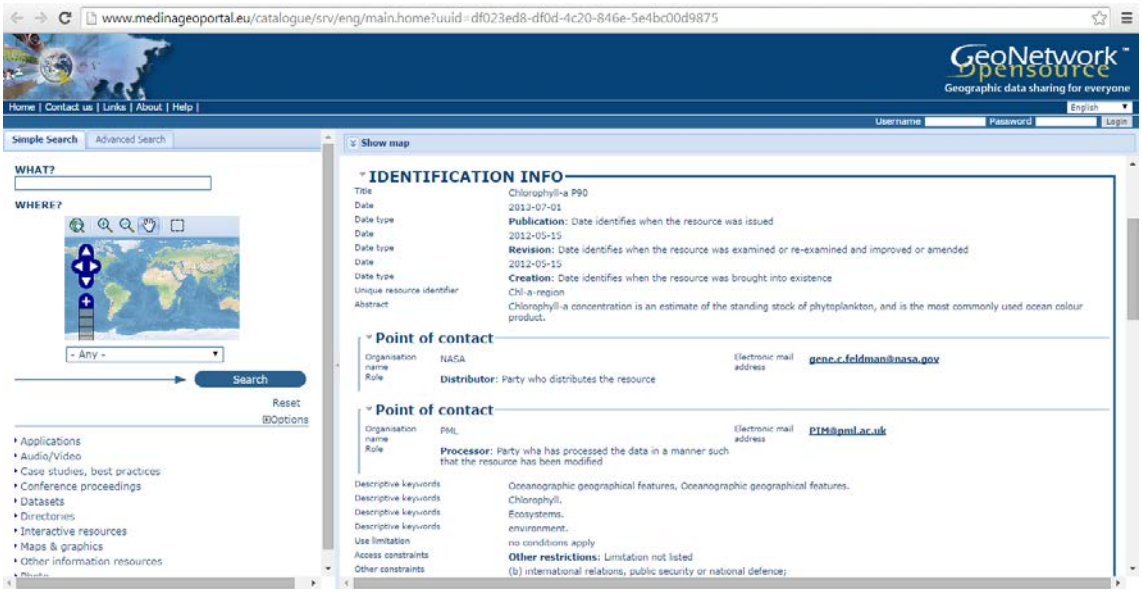

Figure 17. Overview of the metadata output.

4. Modelling outputs

Indicators from modelling, calculated at regional and local scales, are produced from the POLCOMS and FVCOM physical models and the European Regional Seas Ecosystem Model (ERSEM). Standard outputs of POLCOMS and FVCOM are temporal evolutions of 3-dimensional fields of water temperature and salinity, while the standard output of ERSEM is the time evolution of several biogeochemical variables such as inorganic nutrients, organic dissolved and particulate matter or concentration of chlorophyll among others.

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It also includes modelling outputs from SWAN of wave statistics for the Pilot Cases of Gabés, Nador and Bejaia.

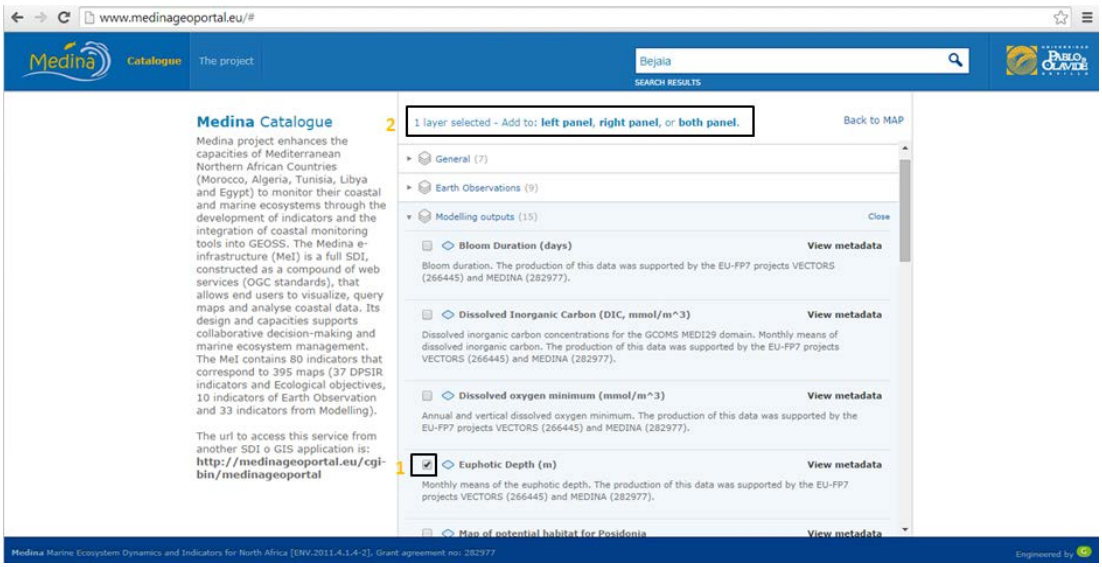

Figure 18. Steps to load an indicator from the "Modelling outputs" section of the Medina Catalogue.

5. Ecological objectives and DPSIR Indicators

Driver/Pressure/State/Impacts and Response (DPSIR) indicators are calculated at Regional and Local scale based on socio-economic and environmental variables. Further, Ecological Objectives Indicators, such as Eutrophication, have been developed to assess the Overall Environmental Status (following EcAp principles) establishing two levels of classification: Good Ecological State (GES) or Non-Good Ecological State (Non-GES).

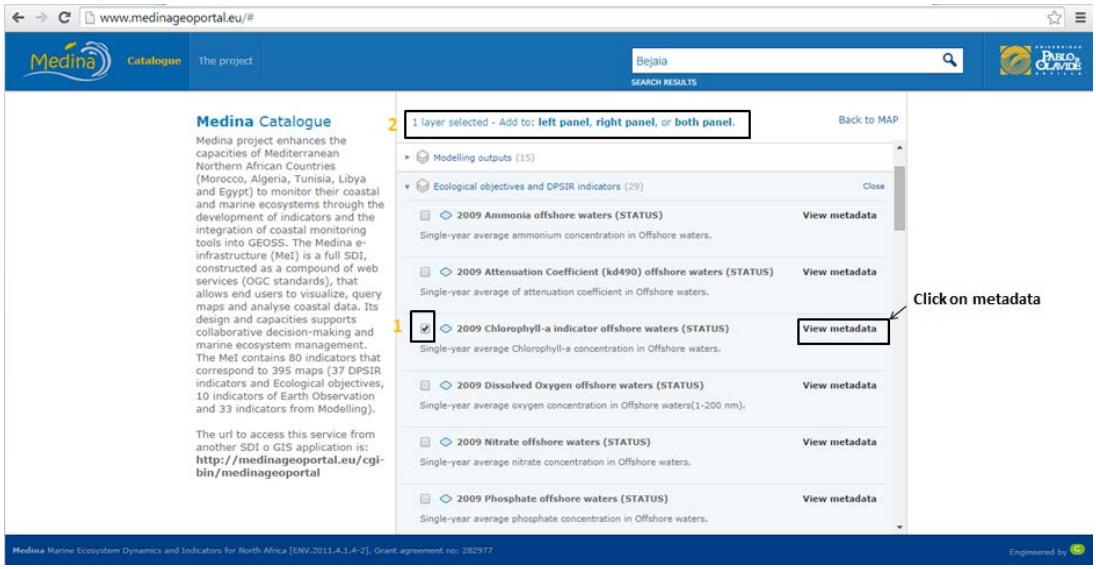

Figure 19. Steps to load an indicator from the "Ecological and DPSIR" section of the Medina Catalogue.

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Practical Exercise 1: MeI in action.

1. Go to **the Geoportal website** www.medinageoportal.eu

2. Choose full screen by clicking the right arrow 

3. Click on **layers** section located at the bottom right of the screen to search for a map and then press "**Add layers from Medina Catalogue**".

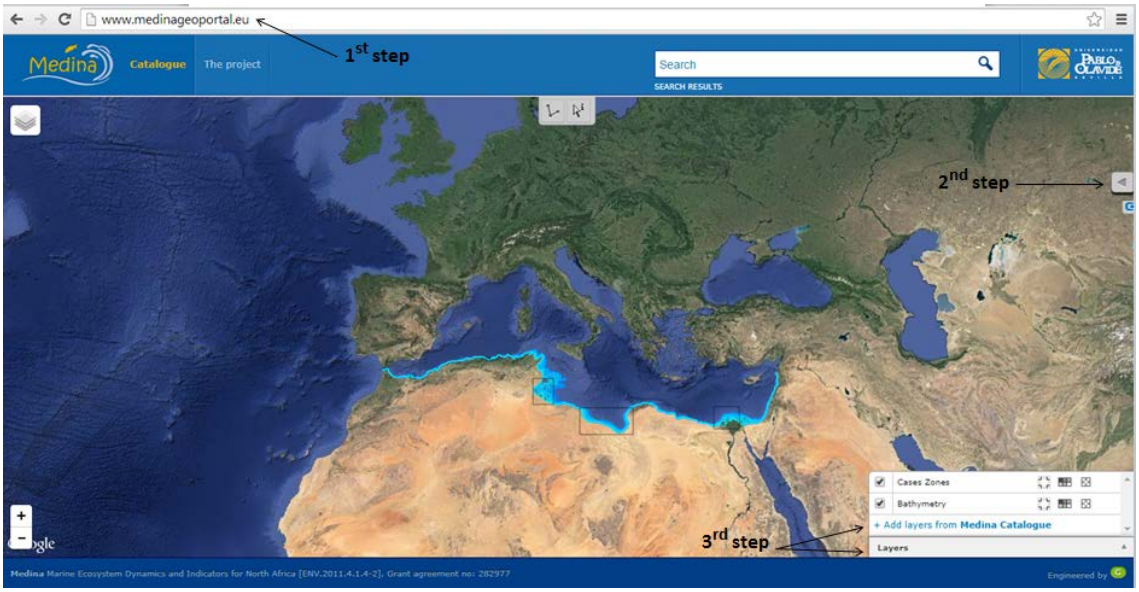

Figure 20. First steps to access and visualise indicators on the Medina viewer.

4. Click on the section "**Earth Observation**".

5. Select the indicator "**Monthly Chl-a from 2002 to 2011 (mg/m3)**" from PML (It consists of 114 monthly maps of Chlorophyll-a from 2002 to 2011) by clicking on the icon  . This indicator results especially interesting for visualising how the time slider tool works.

6. Finally, select **left panel** to automatically load such indicator on the viewer.

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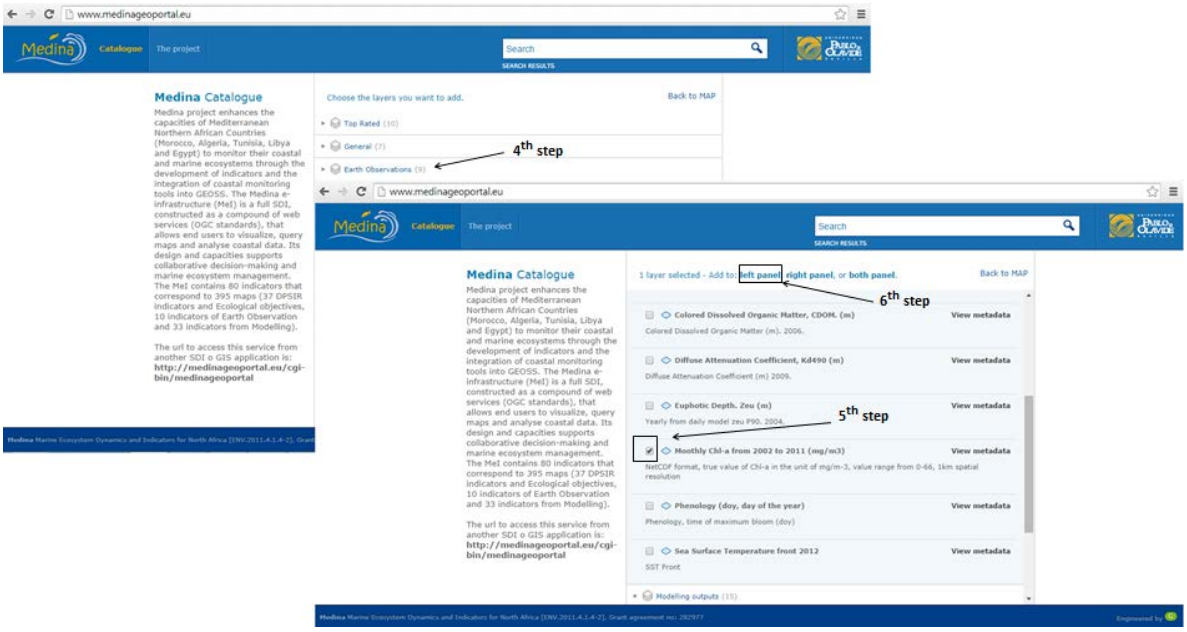

Figure 21. Following steps to visualise indicators on the Medina viewer.

7. At this stage the indicator is already in the viewer so users can use the basic functions of the Map Viewer:

   - Click on the icon to zoom to the extension of the indicator. Notice that the **time slider** tool is active at the top left of the screen.

   - Select the year **2006** within the pop up window located at the bottom side of the time slider tool. Then click on **April** and the corresponding map will be loaded in the viewer.

   - Add the **legend** by clicking the icon and locate it at the most suitable side of the map (by holding down the left button of the mouse).

   - Customize **transparency degree** using the icon .

   - Enable the **query tool** by clicking the icon and select any point within the **Gulf of Gabes** (Case of Tunisia) to retrieve the real value (s) of the indicator corresponding to the selected point. It´s important to notice that the number of values that will be provided by the tool depends on the level of **zoom** applied.

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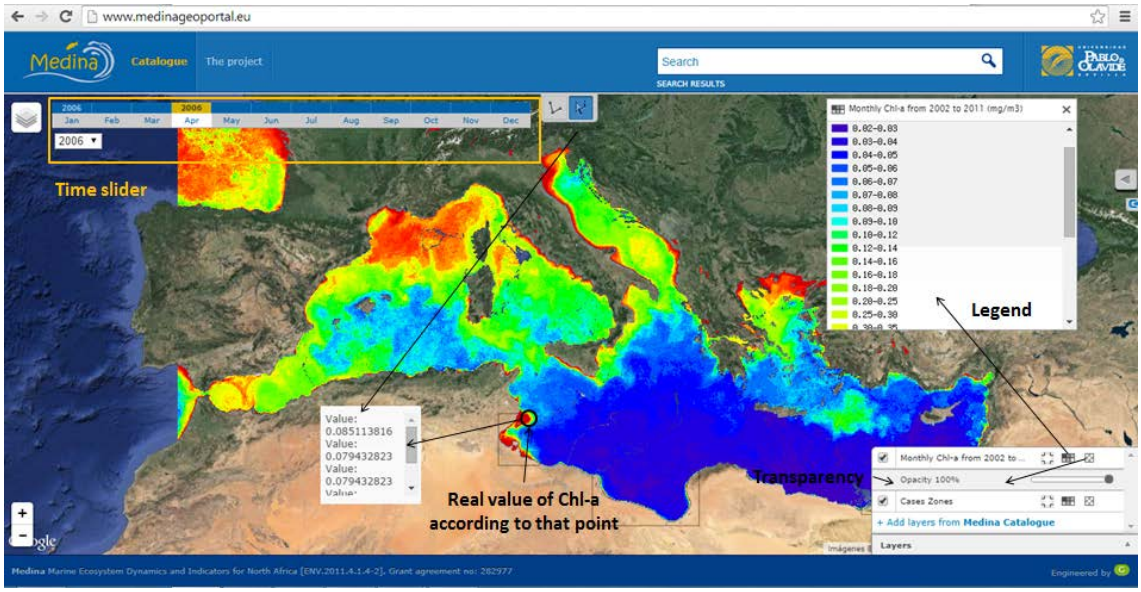

Figure 22. Overview of the visual functions of the Medina viewer.

- Finally, click on the icon and then on "Google hybrid" to see the countries where Pilot Cases are located.

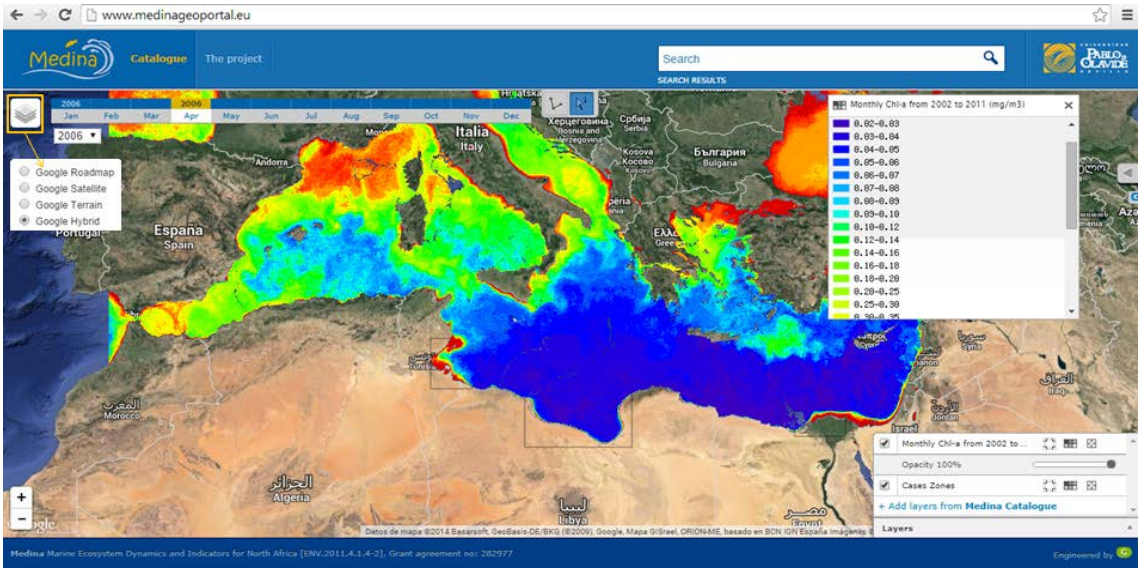

Figure 23. Overview of results when Google Hybrid base map is integrated on the Medina viewer.

8. Exercise 1 is completed. Now prepare the viewer for Exercise 2:

- Close the legend and the query information (at the top right of the boxes).
- Close the opacity tool by clicking again.

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- Disable the query tool 
- Remove the layer by using the icon 
- Enable the split screen by clicking left arrow 
- Click on the base map manager  and select **Google Satellite**.

Practical Exercise 2: Comparing indicators.

The MeI allows comparisons of the same indicator between different time ranges using the time slider or at different locations.

1- Comparing results from one indicator between two different months at the same location.

- The Medina Viewer looks as a **synchronised split screen**.
- Go to the "**Catalogue**" section located at the top left of the screen (beside the Medina logo).
- Click on the section  "**Lagoon of Nador**", within this select "**High Resolution model**" and then the variable "**Bacteria biomass (mg C/m3)**". Once done, click on "**Both panels**".
- Click on "zoom to layer"  to centralise the map on the viewer.
- Remove the layer "Bathymetry" from the table of contents.
- This indicator includes a **calendar tool**  which is located close to the name of the indicator. This tool has the same functionality of the time slider tool.
- Click on the calendar tool. On the left map select the **31st of January** and on the right map select the **15th of August**.
- Click on the icon  to see the **legend** and then locate it at the most suitable place of the screen (The legend will be the same for both maps because corresponds to the same indicator)**.**
- Click on the icon  for retrieve the real value (s) of the indicator at the same location but at different moments.

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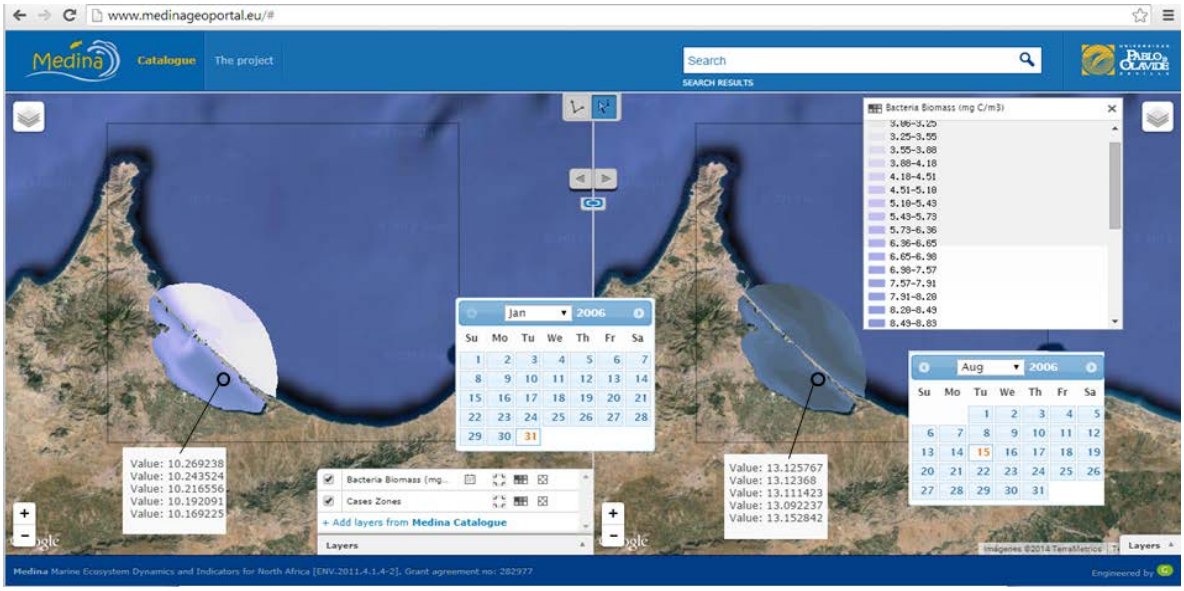

Figure 24. Overview of results from the comparison of one indicator at the same location between different periods of time.

- Finally, close the query tool (by clicking the box at the top right of the box), the legend and, disable the query tool (click on the icon) and remove both layers by clicking the icon of each screen.

2- Comparing results from the same indicator at two different locations (Cases of Gabes and Lake Burullus).

- The Medina Viewer looks as a **synchronised split screen**.
- Press the button located in the middle of the screen **for desynchronising** both maps (the icon will change to grey colour).
- **On the left map**:
  a. Go to the "**Catalogue**" section located at the top left of the screen, beside the Medina logo.
  b. Click on the section "**Ecological objectives and DPSIR indicators**" and select the indicator "**Coastal population density**" from UAB. Then click on "**Both panel**".
  c. Remove the layer "Bathymetry" from the table of contents by clicking on the icon .
  d. **Zoom in** to the **Case of Gabes** in Tunisia.

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- Click on the icon to see the **legend** (The legend will be the same for both maps because user is comparing the same indicator at different locations).

- **On the right map:**

  a. The map is already visible at the right side of the screen as well as at the left side because it has been loaded in **both panels**, so just **Zoom in** to the **Lake Burullus** in Egypt.

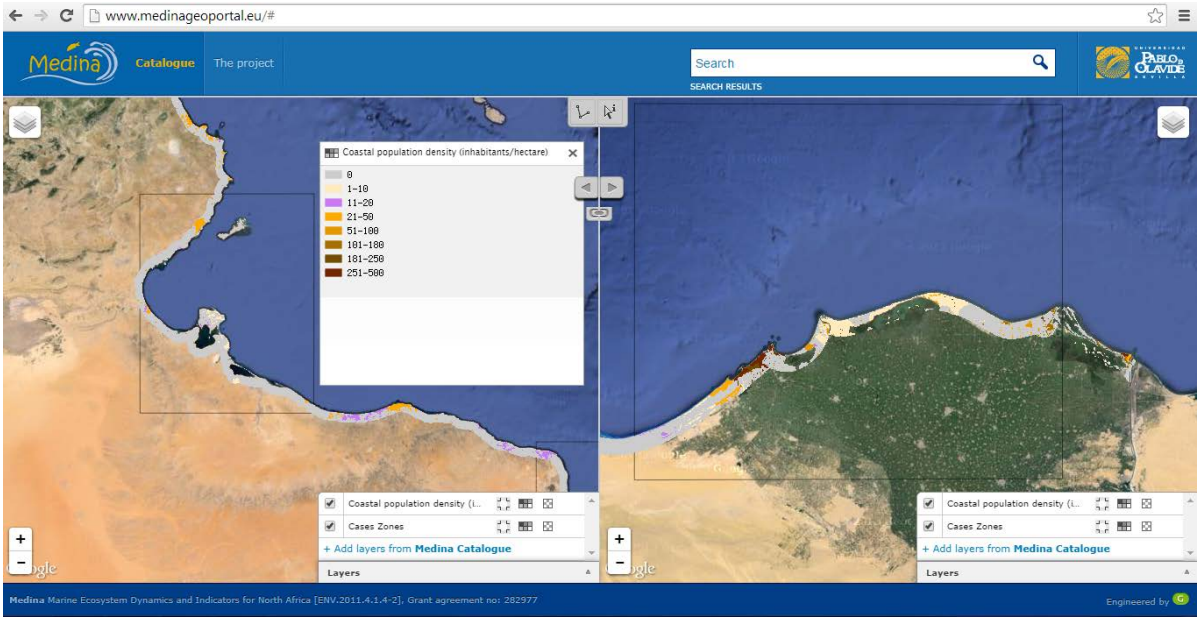

Figure 25. Overview of results from the comparison of one indicator at two different locations.

As observed in fig. 25, the North-African coastal zones evidence different patterns of population occupancy. The image on the left represents the population density in the Gulf of Gabes, in Tunisia, characterized by low population density whereas the population density observed in Egypt is greater, mainly concentrated in the city of Alexandria.

- Finally, to go back to general extension, just refresh the webpage.

3- Comparing two different indicators: One of the main advantages of the Medina e-Infrastructure resides on its capacity to allow the visualisation, analysis and comparison of complex datasets along different locations of the North-African coast. As is shown in fig. 27, users can compare and relate different indicators at any location. This could support a better knowledge of the environmental behavior of specific indicators and variables contributing to the decision-making process.

- The Medina Viewer looks as a **synchronised split screen.**

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- **On the left map:**

  a. Click on "Search tool" (top right corner) and type "**Posidonia**" in the white box and enter.

  b. Select "**Average probability of presence of Posidonia oceanica (PoDM model)** " from UNIVE and click on "expand". Then click on "**Add layer**".

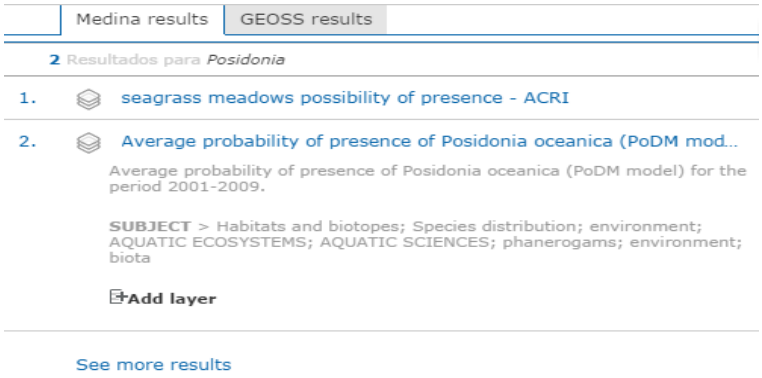

Figure 26. Location of the selected indicator within the Medina Catalogue by using the searching tool.

  c. Click on the icon to see the **legend** and locate it at the most suitable place at the left side of the screen.

- **On the right map:**

  a. When users load a layer from the searching tool automatically the layer is loaded on both side of the screen, therefore the first step is to remove the indicator "**Summary – Probability of presence of P. oceanica (NA coast)**" from the right screen by clicking the icon .

  b. Go to "**Layers**" section and click on "**Add layers from Medina Catalogue**".

  c. Click on the section "**Earth Observation**", scroll down and select the indicator "**Euphotic depth, Zeu (m)**" by clicking on the icon . After that, select "**Right panel**".

  d. Click on the icon to see the **legend.**

  e. Finally, zoom in to the Case of Gabes in Tunisia. We will notice that both maps are located at the same place, because the synchronisation tool is enabled.

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f. At this stage, users are able to analyse the relationship between the possible presence of Posidonia oceanica meadows and the Euphotic depth (light penetration) in the Gulf of Gabes (see figure 27).

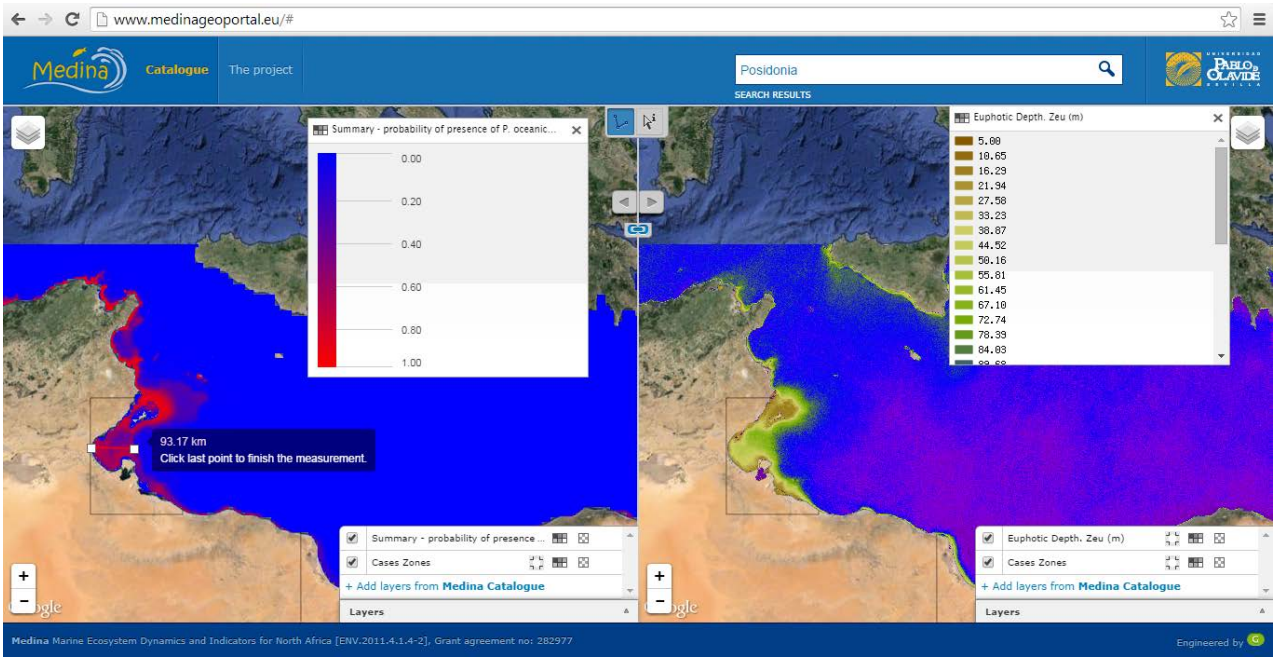

Figure 27. Screenshot evidencing the relationship between two different indicators.

Figure 27 represents de direct relationship existing between the penetration capacity of sunlight (Euphotic depth) through the water column (image on the right) and the possible presence of Seagrass meadows (Posidonia oceanica). Thus the comparison evidences how the light availability in the water column, dependant of the water turbidity (presence of suspended particles or contaminants) influences the probability of presence of this endemic specie, acting as a limiting factor.

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PART 3 - MEDINA results on Google Earth®

(**Before starting, please change the language of Google Earth® into English if it is not selected by default**)

One of the main advantages of transforming Medina results into interoperable Web Services (Web Map Services, WMS) is that they can be accessed through different apps for mapping, such as any desktop GIS software or Google Earth®.

In this activity, we are going to integrate Medina results as WMS services from the Medina Catalogue into Google Earth®, a free desktop application easily downloadable at any location of the world that combines satellite images and maps, thus allowing users to navigate planet Earth from multiple views.

Selecting a WMS service from the Medina e-Infrastructure

1. Go to the Medina Geoportal http://www.medinageoportal.eu/

2. Click on the **Catalogue** section, located at the top left corner of the window.

3. Look for the URL´s, within which Medina products are stored.

4. Copy the URL for Medina Catalogue to access the dataset:

http://medinageoportal.eu/cgi-bin/medinageoportal?

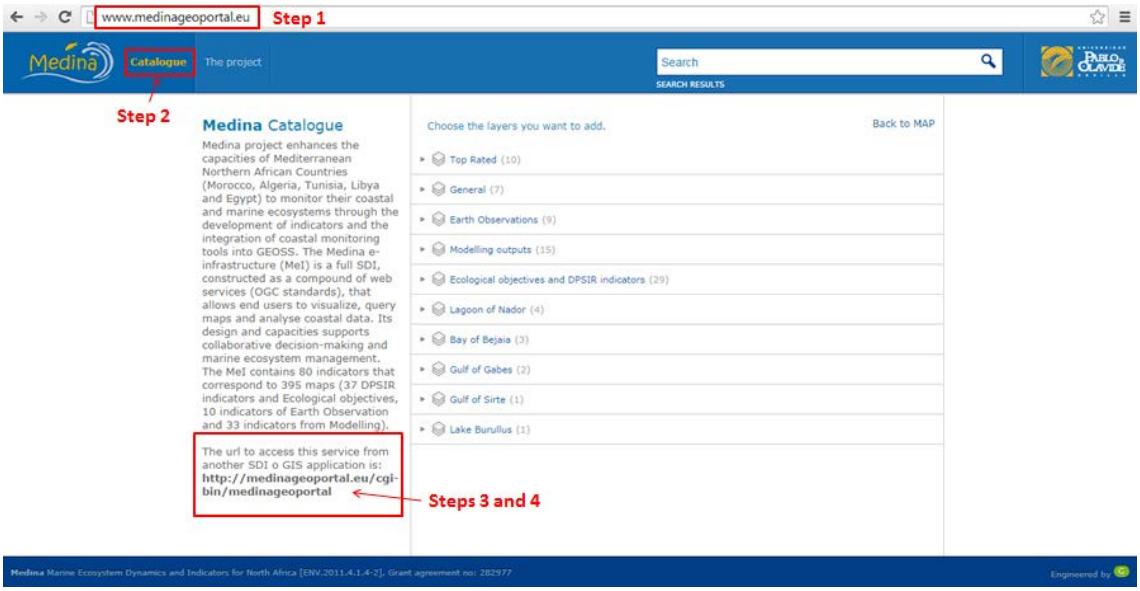

Figure 28. Needed steps to locate the WMS Url for the Medina Catalogue.

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Loading a WMS service on Google Earth®

1. Open **Google Earth®** by clicking on the icon 

2. Click on the icon  to **overlay any Medina product** on the general map.

3. A new window will pop up, within which users will be able to type a title at their convenience (a possible title could be the name of the user or image), as well as to manage the degree of transparency applied on the map and introduce the selected WMS service.

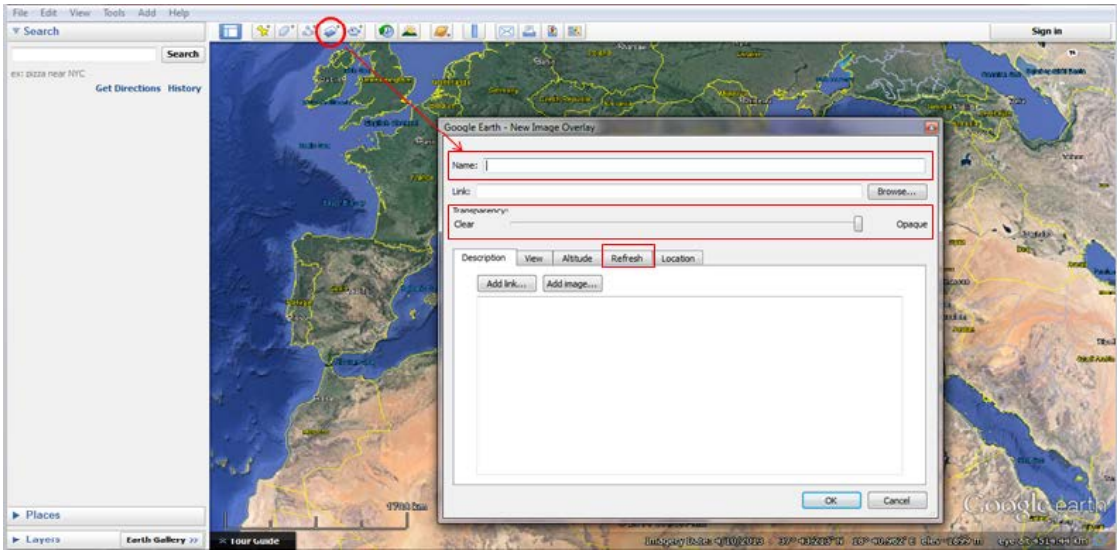

Figure 29. Overview of how to overlay any Medina product on Google Earth®.

4. Click on **Refresh** and then on **WMS Parameters.**

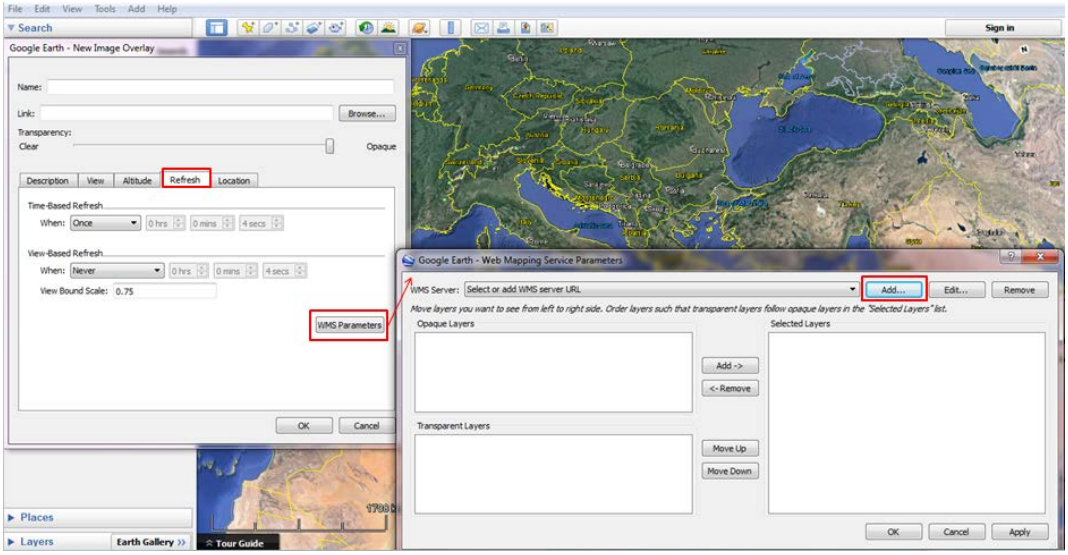

Figure 30. Overview of the first steps to integrate the WMS Url for the Medina Catalogue on Google Earth®.

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5. A new window will pop up, through which users will be able to visualise all stored maps within the selected WMS service.

6. Click on **Add** button and then paste the previously copied WMS URL within the white box. Finally, press **OK**.

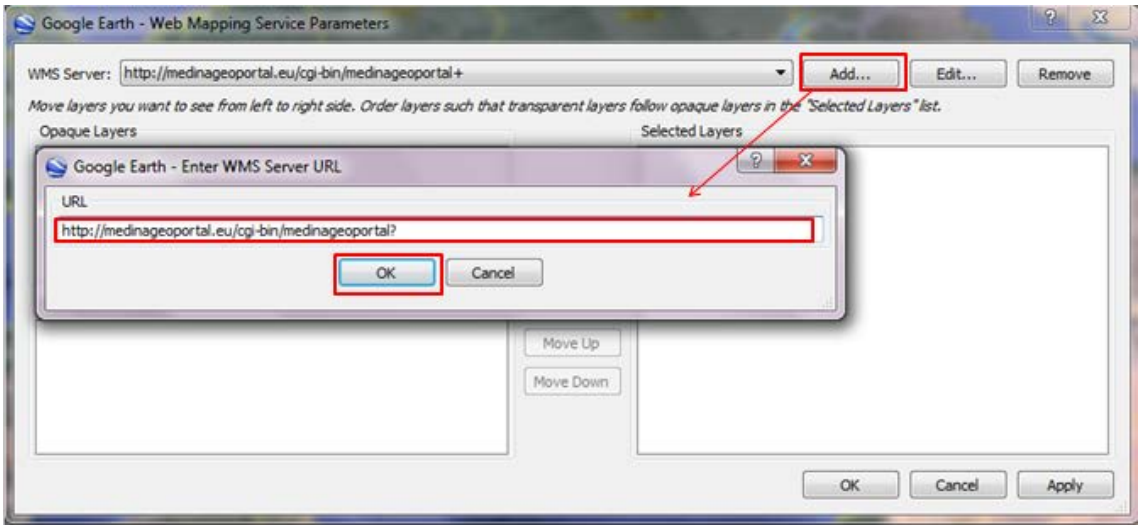

Figure 31.Overview of the final step to load Medina results on Google Earth®.

7. After a brief period of time, all products from the WMS you selected will be visible within the section "Transparent Layers" to be loaded at your convenience.

8. From the list of "Transparent Layers", please select "**September 2012 sea surface temperature. Celsius**" and then click on **Add** button. After that, such layer will be visible within the section "Selected Layers". Finally, press **OK**.

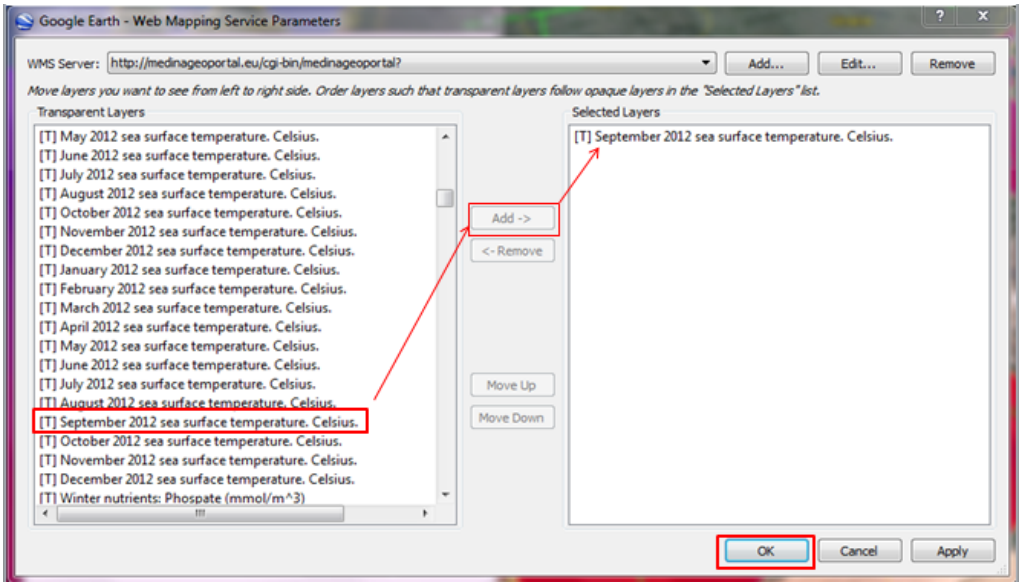

Figure 32. Overview of Medina products already integrated on Google Earth®.

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9. After a brief period of time, selected layer(s) will be loaded within the general interface of Google Earth®. Several layers can be added, removed or organised at the convenience of the user by clicking on **Add**, **Remove**, **Move Up** or **Move Down**. Thereby, the final result is as follows:

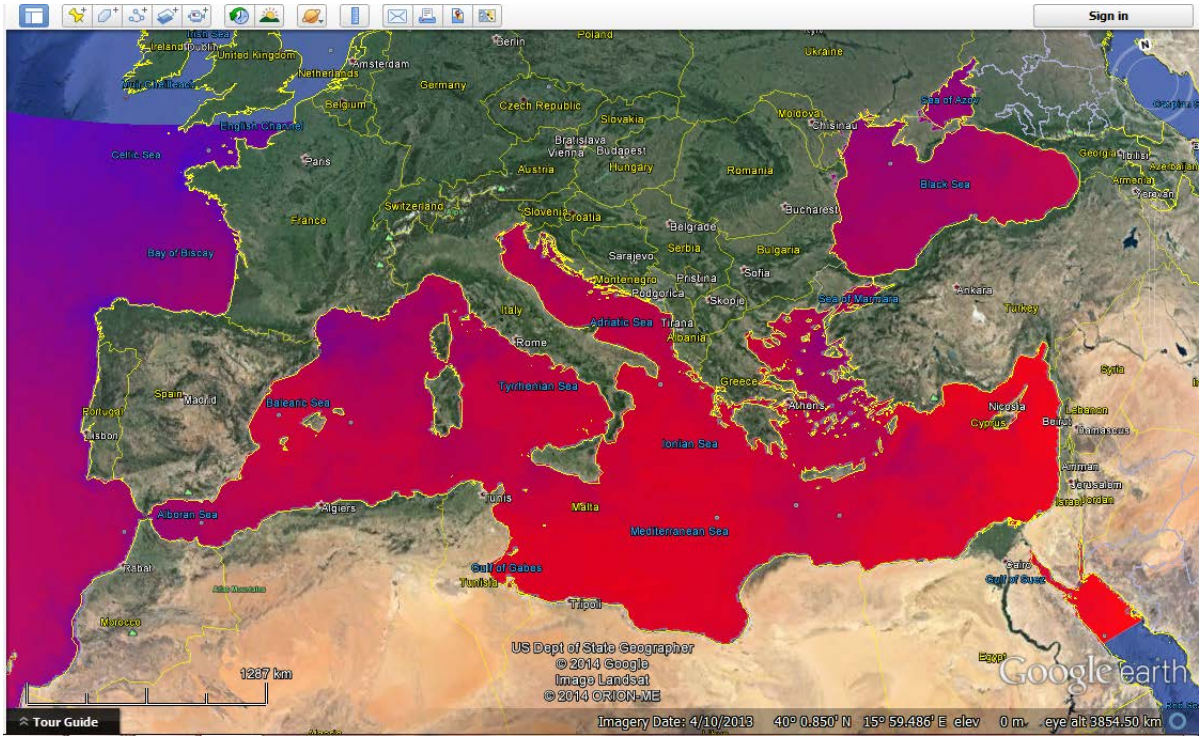

Figure 33. Result of "Sea Surface Temperature" from the Medina Catalogue already visible on the Google Earth® interface.

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