Ecological Modelling vLab Tutorial

Authors: Alkiviadis Kalampokis, Manos Potiris, George Petihakis

Examples of usage

The Ecological Modeling vLab is addressed primarily to the research community and policy makers, biological resources managers, integrated coastal zone managers and management agencies in general. The simplicity of the interface (1) and the unrestricted access (2) extends the target group to interested individuals and educational organizations.

In this short manual, the functionality of the vLab will be explained through a series of examples of usage.

Main window

The user will reach the vLab via the main LifeWatchGreece portal at Ecological Modeling vLab. The main window of the application, shown in Figure 1, consists of three tabs, named “Surface Plots”, “Cross Section Plots” and “Comparison Plots”. The most intuitive “Surface Plot” is selected by default. All tabs include a standard set of parameters, e.g. “area”, “date”, “depth”, “variable” and “scenario”, and optional parameters, e.g. “lat”, “lon”, “scenario 1” and “scenario 2”, depending on the type of the plot. Plots can be further parameterized by choosing to overlay velocity vectors and a geographical map. The user may also choose between “contour” and “shading” options.

Depending on the parameter, the user will have to (1) set a value in a textbox (that must be inside the range shown right next to the textbox), (2) choose the desired parameter value from a drop-down list and (3) select whether additional layers of information should be superimposed to the plot by clicking on the respective tick box.

The application has a high degree of error tolerance. In case of setting parameter values of the wrong type or out of the available range, the application will set the value of the corresponding parameter to the closest available value or to a default value. Setting the depth to a value different from the depths of the model, the application will interpolate the selected variable at the requested depth.

A short explanation of the parameter meaning is given in Table 1. The main window of the application environment is shown in Figure 1.

Table 1: Explanation of the parameter names of the configuration application window.

Parameter Name	Explanation
Area	Choice of one of the four areas for which the simulation will run (Cyprus, Lesvos, Agrilia and Pagasitikos)
Date	Each simulation covers a certain time period, and the user can choose a specific date to display
Depth	The depth from the surface in meters
Variable	A list with all the simulated variables, and also the two computed indices
Scenario	Different simulation scenarios, options are • Real State (tries to approximate the real state) • No Fish (results if there were no fish) • Double Fish (fish population doubled in comparison to the real state) • Half current speed (sea water circulation velocities reduced to one half) • Half current, no fish (combination of the two)

Plot type	Choice between contour or area plot
Map enable	Simulation results are overlaid on a map of the area

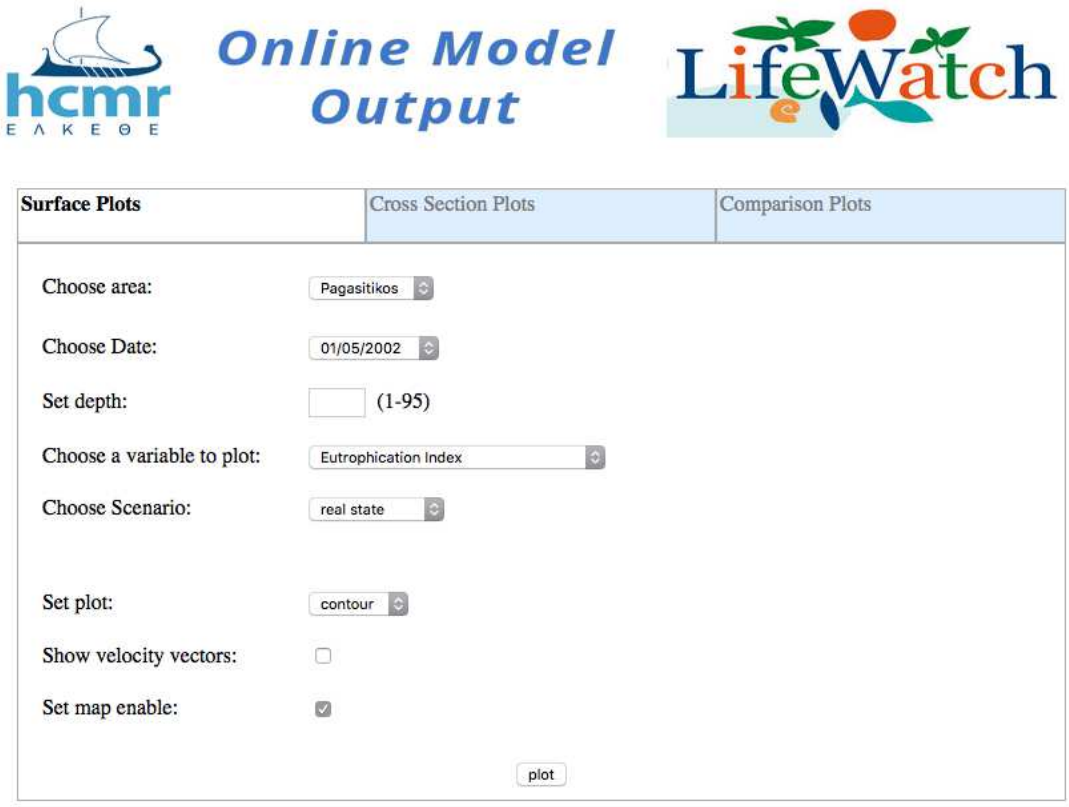

Figure 1: The main window of the application environment.

Surface plots

Two sample surface plots with the same parameter configurations and with different visualization configurations are shown in Figure 2. Surface plots produce geographical maps. After requesting a plot, the application will create and display it, together with the parameter configuration on the top of the application window to facilitate the visual inspection. The user may choose to download the plot or navigate back to the main window to create a new plot, by selecting the respective link found at the bottom of the plot window. The surface plots are restricted to the appropriate area according to the selected depth. Figure 3 is such an example, showing the chlorophyll concentration of Pagasitikos Gulf inside the 60m isobaths.

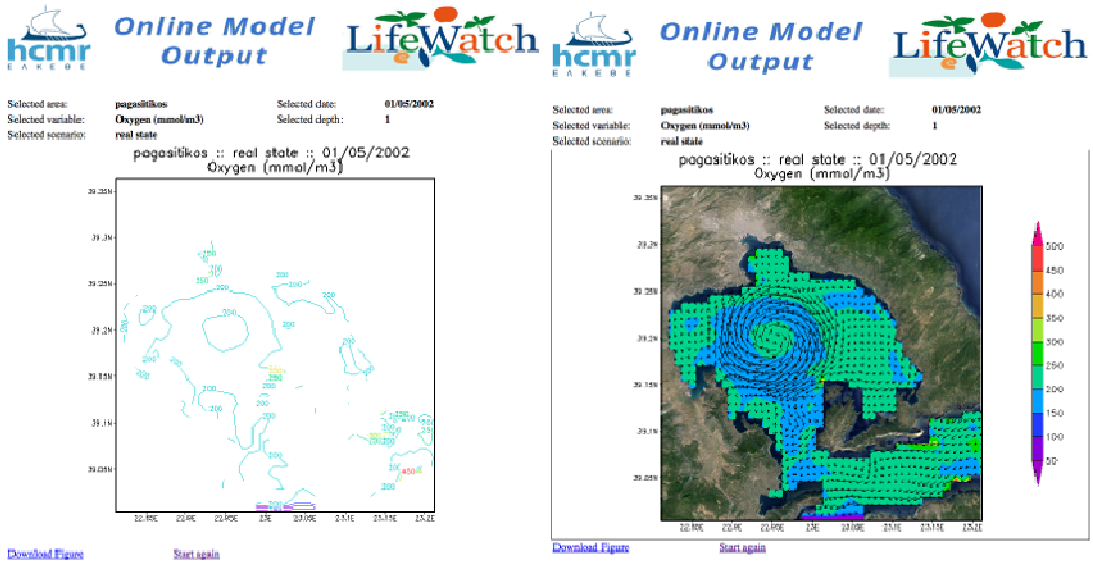

Figure 2: Surface contour (left) and shaded (right) plot of the oxygen concentration of Pagasitikos Gulf at 1m depth under a real state scenario on 01 May 2002.

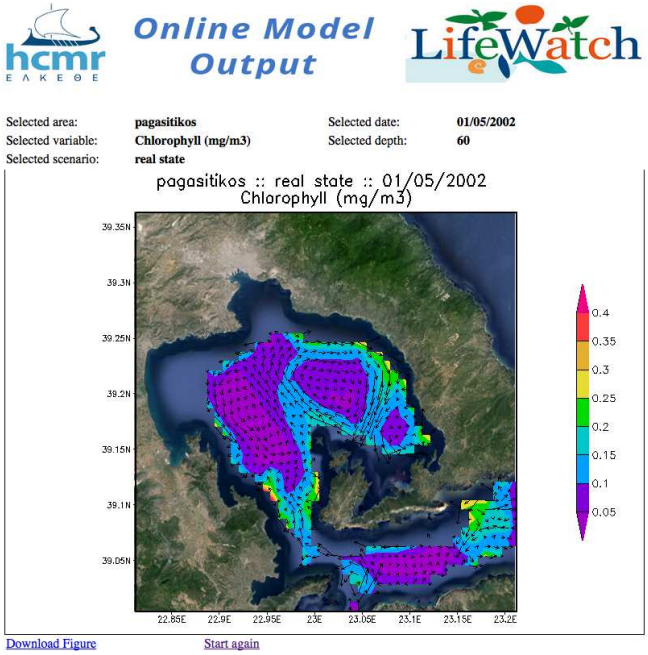

Figure 3: Surface shaded plot of the chlorophyll concentration of Pagasitikos Gulf at 60m depth under a real state scenario on 01 May 2002.

Cross sections

The cross section plots produce depth-longitude (longitudinal cross sections) or depth-latitude (latitudinal cross sections) maps. The bottom in these plots is grayed out. The configuration window of the cross-section plots is shown in the left panel of Figure 4. User should leave the depth field and lon (or lat) field blank in order to get a longitudinal (or latitudinal) cross section plot like that shown in the right panel of Figure 4. Assigning a value to the depth field will produce a time series instead of a two dimensional plot.

As a more complex example of use consider the following question: “How does the ecological state in

the modeled area of Cyprus change away from the shore, if it does so, under a specific scenario?" The longitudinal cross section plots of the ecological indices produced using the same configuration (Figure 5), confirm a gradual change in the ecological state in relation to the distance from the shore. The range of the values of each index are used to characterize the conditions as oligotrophic, mesotrophic or eutrophic. The legend with the respective ranges is shown in the lower part of the plot area of both panels of Figure 5.

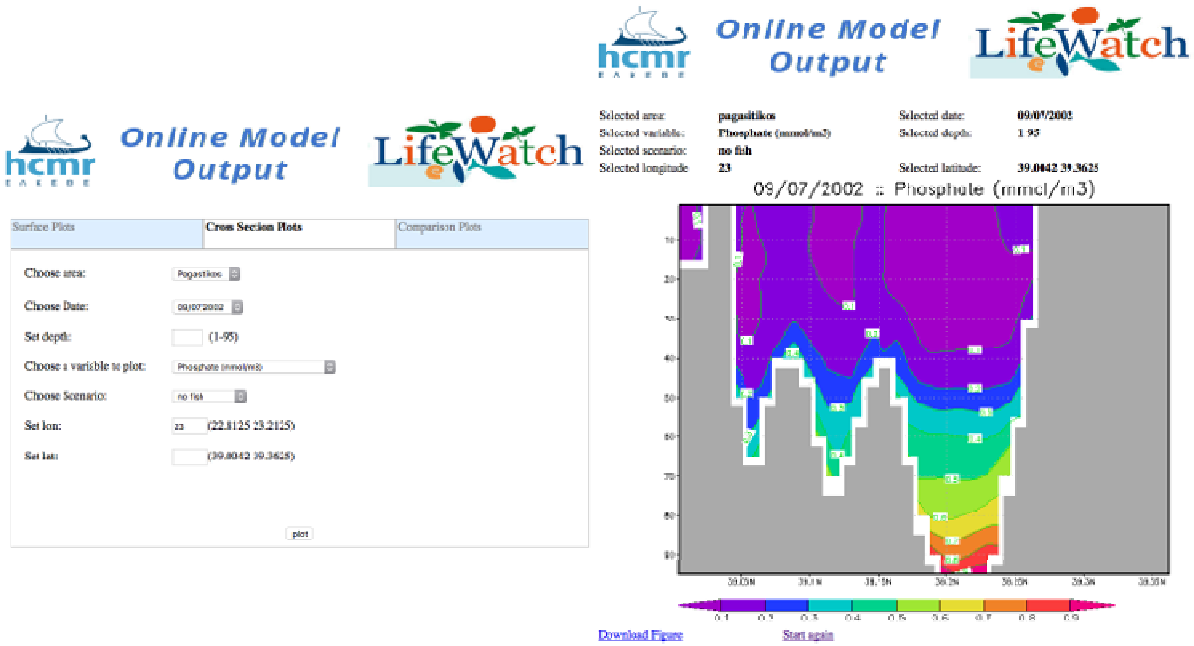

Figure 4: Configuration tab (left panel) and the resulting meridional cross section plot (right panel) of the phosphate concentration of Pagasitikos Gulf under no fish scenario on 09 July 2002.

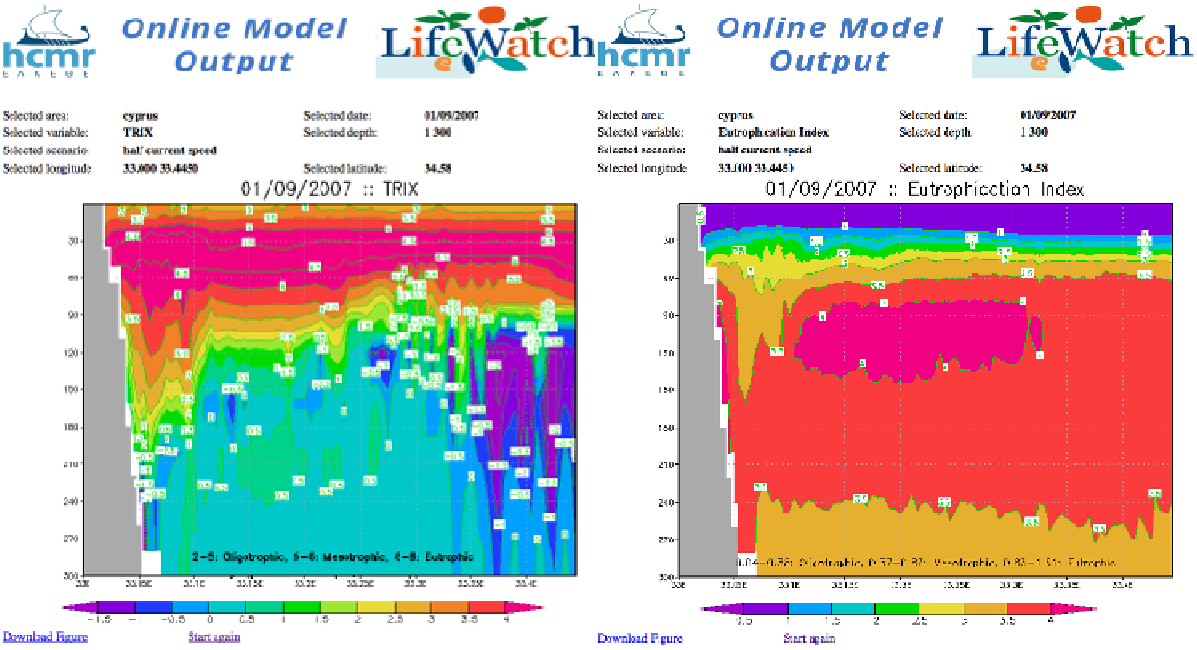

Figure 5: Two cross section plots showing the TRIX index (left panel) and the Eutrophication Index (right panel) inside the modeled are of Cyprus. The plots have been produced with the same configuration.

Comparison plots

The configuration window of the comparison plots is shown in Figure 6. The purpose of the comparison

plots is to provide a quantitative view of the ecological changes of the area that are triggered by the different scenarios. This is achieved by subtracting the values of the same variable that are produced under different scenarios at each grid point of the model domain. As an example, Figure 7-left panel- shows that in the absence of an aquaculture unit the state changes towards oligotrophy. Simulations used halved current velocities and not the observed ones. The right panel of Figure 7 shows that in the vicinity of the aquaculture unit and in the direction of the currents (one could verify that by creating a surface plot with currents overlay, as in Figure 2 and Figure 3) the oxygen concentration of the real state scenario is lower than the concentration of the half current - no fish load scenario.

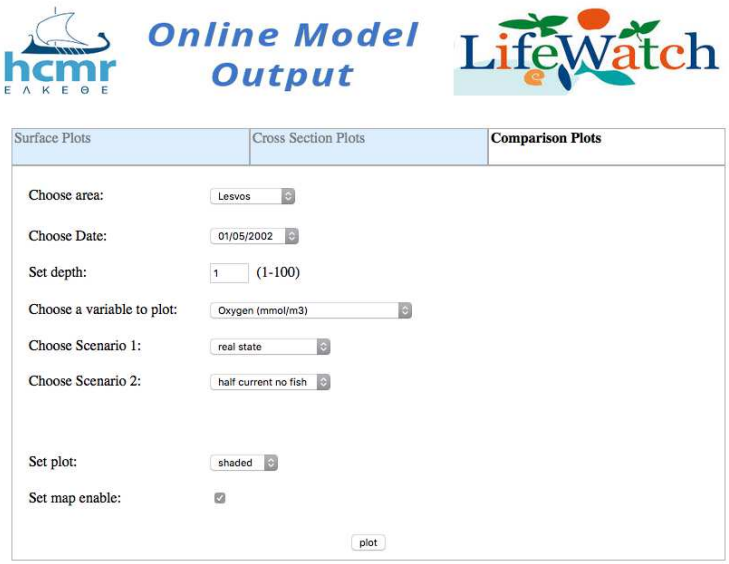

Figure 6: The configuration window of the comparison plots is shown.

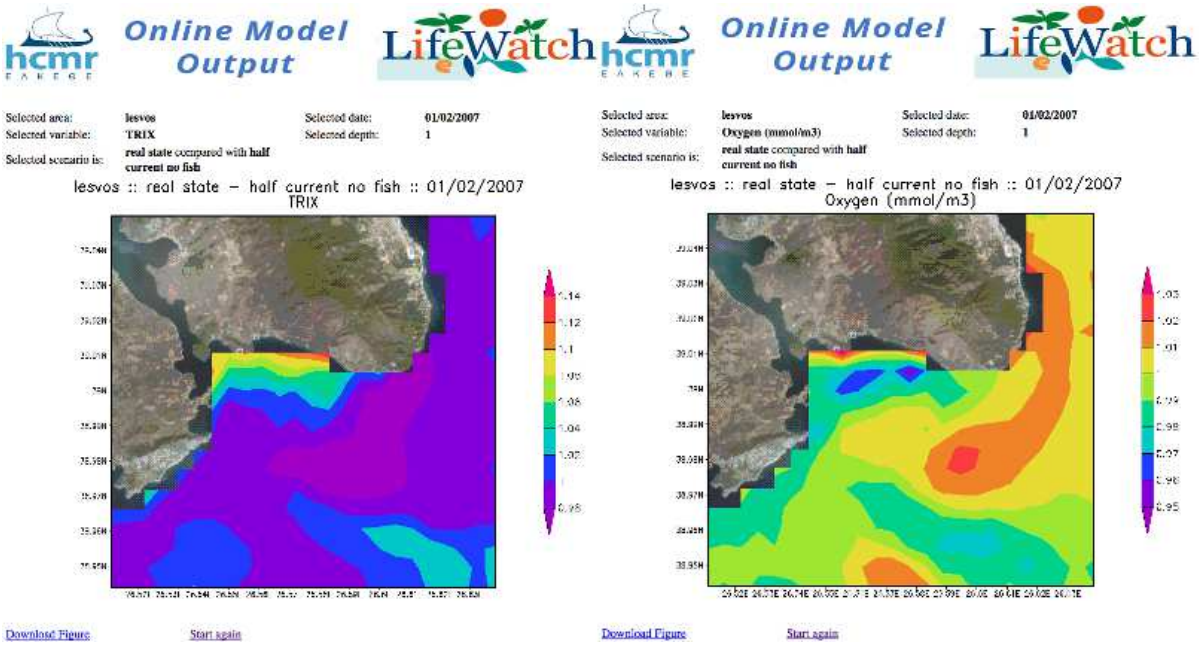

Figure 7: Comparison plots at the sea surface on 01 Feb 2007 at Lesvos. An aquaculture unit is located to the east of the mouth of Gera Gulf (located at the north east part of the maps). The difference of the TRIX index (left panel) and oxygen concentration (right panel) under the scenarios of Figure 6 are shown.