OILMAP RELEASE NOTES

Version: 7.0 (July 2016)

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1 Introduction

The first version of OILMAP was delivered over 20 years ago and is now used globally by major oil companies and international governments. It has been used successfully to support spill response, planning, and permitting in over 100 countries. The Deep Water Horizon spill in 2010 shifted the demands on oil spill models in terms of their ability to manage deep water continuous releases and deal with complex environmental datasets. The scientists and researchers at RPS ASA have incorporated lessons learned and new technologies into the latest generation of OILMAP.

The new version 7 of OILMAP includes many enhancements and added features to help improve oil spill response, drill exercises, impact risk assessments, and contingency planning. Enhancements include tools such as the vertical Cross Section and the Time Series to better represent the behavior of oil in the water column over space and time. This document describes the various new features included in OILMAP v7.

1.1 Operating System Compatibility

One of the most notable features of Version 7 is that all of the RPS ASA MAP applications, OILMAP, SARMAP, and CHEMMAP are now Windows 10 compatible. OILMAP is currently supported on the following Microsoft Windows platforms: Windows 10, 8, 7, and Windows Server 2012.

1.2 OILMAP v7 Modules

Surface module   Simulate the behavior of surface oil spills released on the water surface

Subsurface module   Simulate oil releases occurring below the water surface

Deep module   Simulate blowouts, including the seabed dispersant application

Backtrack module   Evaluate the source of a mystery spill

Stochastic module   Calculate the probabilistic distribution of oiling in water and on shore

Airmap module   Calculate the atmospheric dispersion of the lighter oil fractions from a spill

Land module   Evaluate the transport and fate of oil released on land reaching river networks

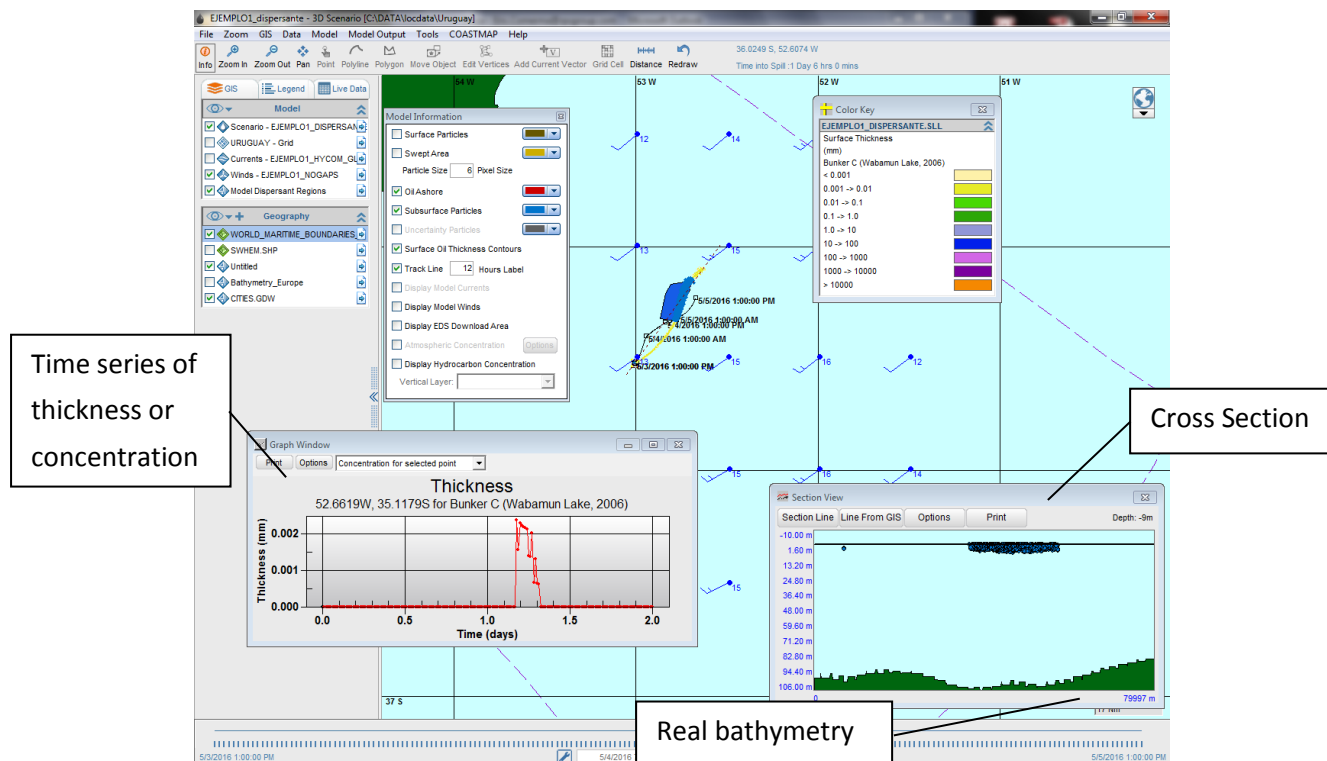|	OILMAP Modules					
	Deterministic				**Stochastic**	
	Surface	Subsurface & Deep	Backtrack	Airmap	Surface	Subsurface
Surface Release	✓	✓	✓	✓	✓	✓
Subsurface Release	✗	✓	✗	✓	✗	✓
Water Colum Concentrations (total hydrocarbons)	✗	✓	✗		✗	✓
Water-in-Oil Emulsion	✓	✓	✗		✓	✓
Spatially Varying Bathymetry	✗	✓	✓	✓	✓	✓
Vertical Cross Section	✓	✓	✓	✓	✓	✓
Surface Response Options: Booming, Surface Dispersant, Removal	✓	✓	✗	✓	✗	✗
Subsurface Dispersant Application	✗	✓	✗	✓	✗	✗

Table 1: OILMAP Module Features

Figure 1: OILMAP v7 – An updated Graphic User Interface (GUI)

2 OILMAP v7 User Interface Updates

2.1 Surface (2D) Module Improvements At a Glance

- Constant bathymetry now available for surface releases
- Subsurface particles can now be visualized and interrogated
- Time series of floating oil thickness for a particular spot or peak value for the entire simulation
- The Cross Section View tool is now available for displaying subsurface particles even for surface releases. This tool can be found in Model Output → Section View. Mouse over a particle in the section view to display the particle's depth in the top right corner of the window.
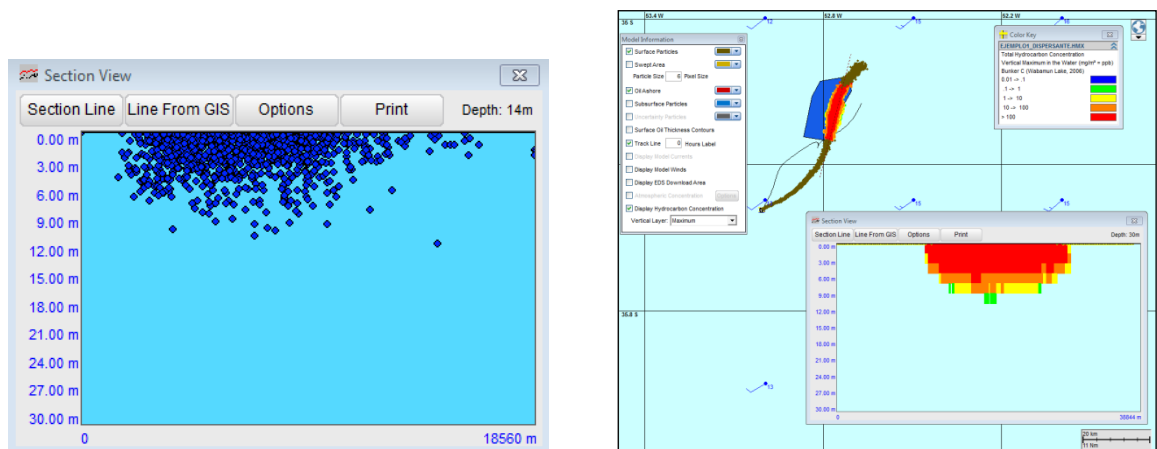

Figure 2: Presenting 3D results: Cross Section when running the Surface Module (left) and the Subsurface Module (right).

## 2.2 Time Series for Oil Thickness and Water Column Concentrations

Users of the Surface Module can now view a time series of oil thickness of surface floating slicks at a particular location or peak values for all oil particles.

- Turn on the "Surface Oil Thickness Contours" option in the ToC.
- Click on the Info button.
- Click on the map within the oil slick to interrogate.
- In the Properties window click on Concentrations in the menu on the left panel.
- Click to view the Thickness graph.
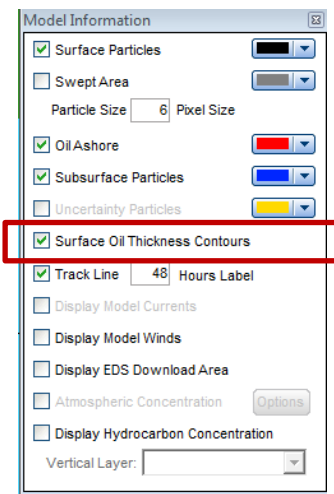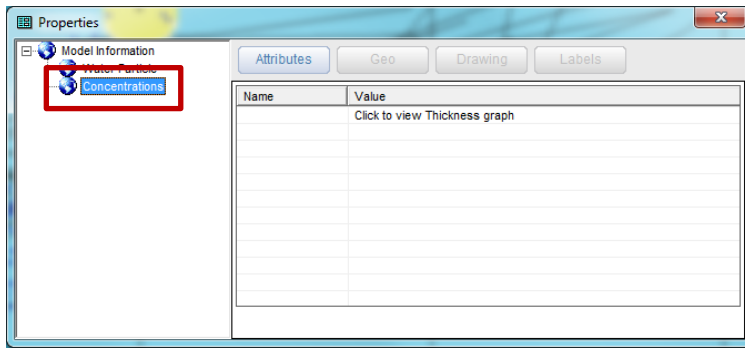
- Use the dropdown menu to switch from "Concentration for selected point" to "Peak concentrations."
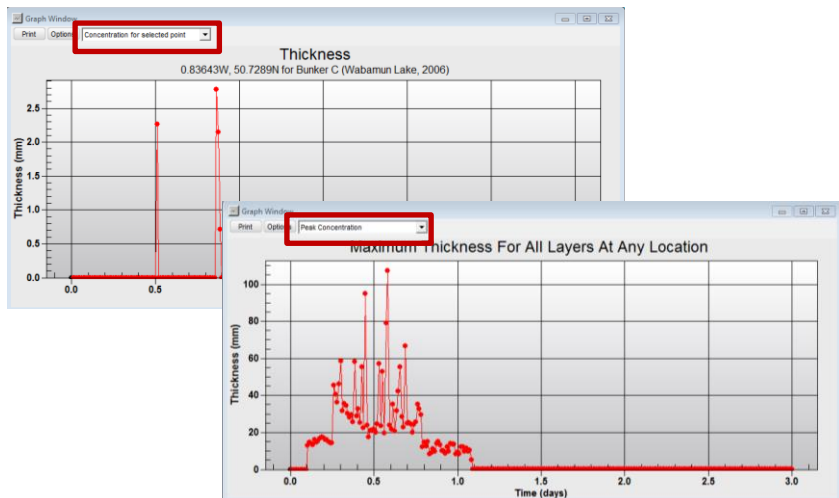

For users of the Subsurface (3D) Module, it is now possible to view a time series of total hydrocarbon concentrations in the water column.

- Turn "Display Hydrocarbon Concentration" in the ToC and select which layer to display (Maximum or Layer Number).
- Click on the Info button along the top of OILMAP.
- Click on the map to select the location to be interrogated
- In the Properties form, click on Concentrations in the left panel.
- Click to view Hydrocarbon Concentrations graph.
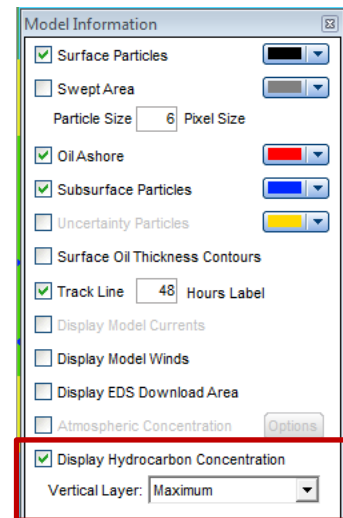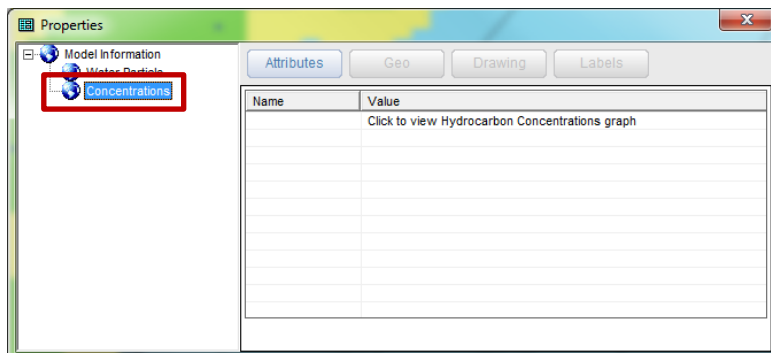
- Use the dropdown menu to switch from "Concentration for selected point" to "Peak concentrations."
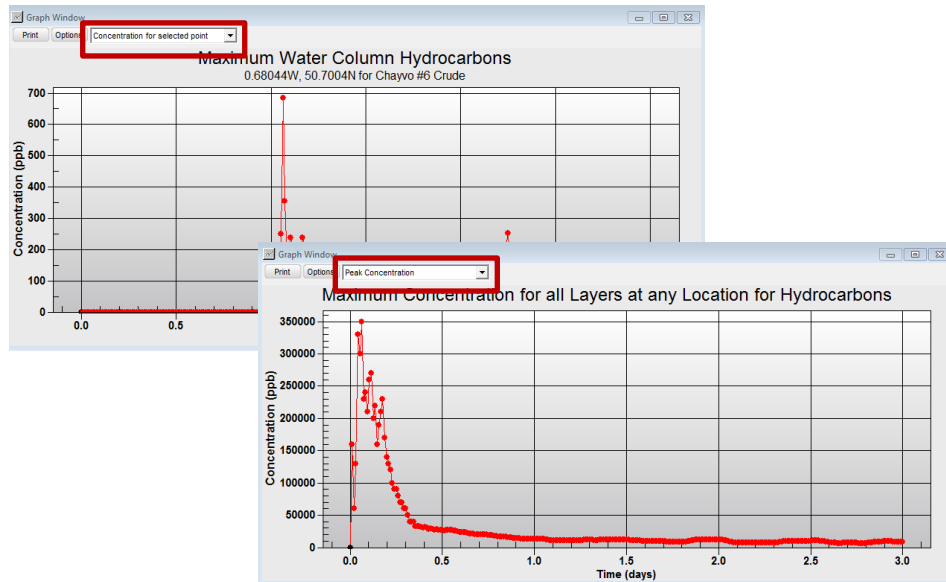
2.3 OILMAP Spill Response Options

The OILMAP **Response Options** such as Booming, Removal, and surface dispersant application now have enhanced input parameters.

2.3.1 Booming

In addition to entering a Current threshold and wave threshold, users now specify a Maximum Wind speed as well. Start and End time for the boom are now entered as hours into spill.
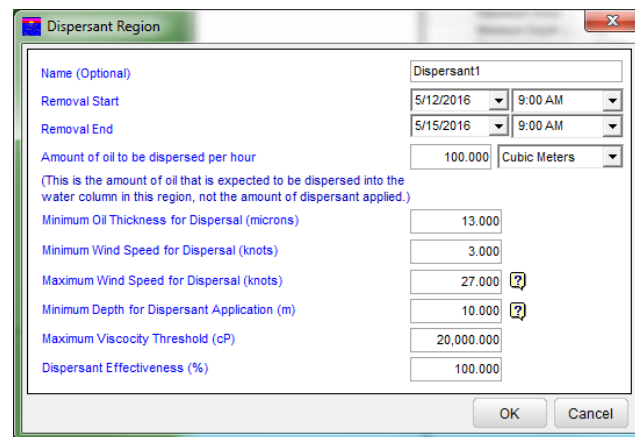
2.3.2 Dispersant Region

The dispersant application response option has been improved to be more realistic. In addition to entering the amount of oil dispersed per hour and the start/end times for the dispersant application, users now enter the Minimum Oil Thickness, Minimum Wind Speed, Maximum Wind Speed, Minimum Depth for Dispersant Application, Maximum Viscosity Threshold, and Dispersant Effectiveness.
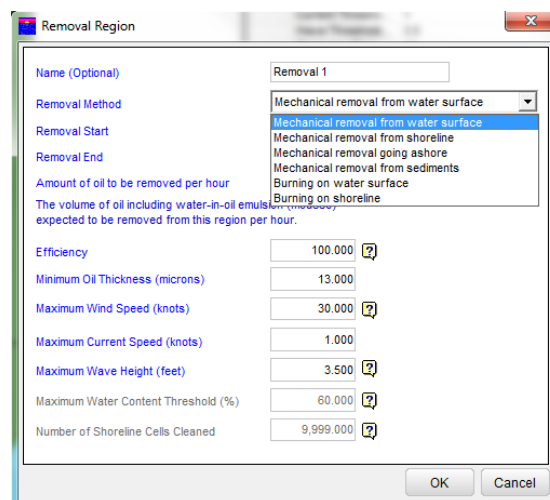

2.3.3 Removal Region

Select Removal Method from the dropdown menu. The various input fields below become enabled or disabled based on the removal method selected. New inputs include: Efficiency, Minimum Oil Thickness, Maximum Wind Speed, Maximum Current Speed, Maximum Wave Height, Maximum Water Content Threshold, and Number of Shoreline Cells Cleaned.
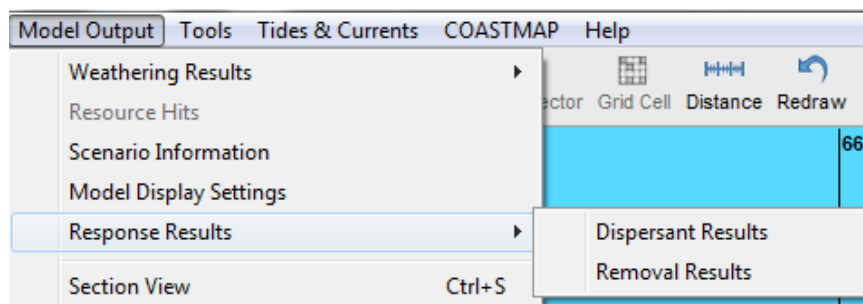
2.3.4 View Response Output Information

After running a model with Dispersant or Removal activities, view specific information about the response application in the Model Output Menu. Go to Model Output → Response Results.

This text file contains information by region (application polygon) and time step, including the amount of oil, rate of removal, available oil, and unavailable oil for response (e.g. oil too viscous to disperse).

2.4 ESRI SHP File Export

The OILMAP SHP File Export has been updated, including the option to export concentrations and thickness contours. To export model results as a SHP file, go to Model Output → Export Results to SHP or KML File.

By default for each scenario, OILMAP generates four SHP files:

- Oil particles as a point layer (ScenarioName.SHP)
- Shoreline oil as polyline layer (ScenarioName_Shoreline.SHP)
- Trackline as point layer (ScenarioName_track.SHP)
- Trackline as polyline layer (ScenarioName_line.SHP)

There are two additional options when exporting results to a SHP file. These must be checked on in the Export Model Results form:

- Export Surface Thickness Contours as a polygon layer (ScenarioName_Thick.SHP)
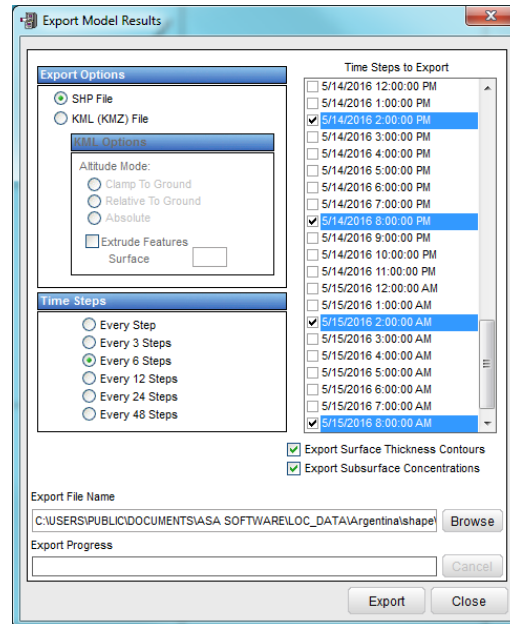- Export Subsurface Concentrations as a polygon layer (ScenarioName_Subsurface.SHP)

Figure 2: Model Results Export Window

The default location for the SHP file export is the SHAPE folder in the Loc_data. This destination folder may be changed in the Export File Name field by clicking on the Browse button. Depending on the length of the simulation and the number of steps being exported, the SHP files may be very large in size.

The variables names and corresponding units in the SHP file export are as follows:

- DATETIME = Date and time of particle
- HRS_IN_SPL= Hours into Spill
- LONGITUDE= Longitude
- LATITUDE= Latitude
- MASS_MT= Mass of particle, Metric Tonnes
- THICK_MM= Thickness of particle, Millimeters
- VISC_CP= Viscosity, Centipoise
- WTRCNT_PCT= Water Content, Percent
- STATUS= Identifies particle as Surface, Shoreline, or Subsurface particle. 0= Surface, 1= Shoreline, 2 = Subsurface.
- DEPTH_M= Depth of particle, Meters

Figure 4: Export results to SHP file. Attach SHP file to OILMAP and interrogate the layer to view SHP file information shown above. Exported SHP files may be viewed in other GIS tools.

For subsurface concentrations the SHP file includes the total hydrocarbon concentrations by vertical layer as well as the vertical maximum concentration.
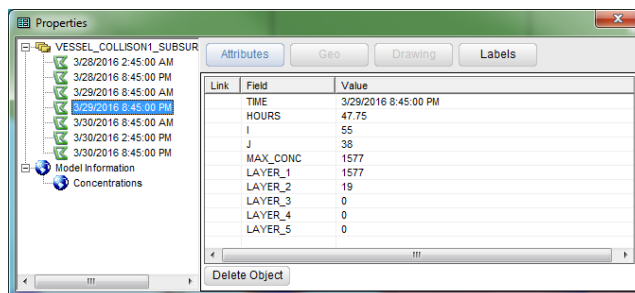
Figure3: Properties window when interrogating an Export SHP file attached as layer in OILMAP.

2.5 Multi-point sub-surface release

For users with a Subsurface (3D) Module, it is now possible to initialize a multi-point release below the water surface, at any depth. Go to Model → Add Spill Site and click on the map to create additional spill locations. Add as many spill sites as needed for the multi-point release. When entering input parameters in the Trajectory Model form, use the Subsurface Parameters form in the Spill tab to enter a depth for the release. Only one depth may be used for all spill sites.

2.6 Reporting Shoreline Oil as Segments

Oil that comes onshore is now reported as a line segment rather than a single point. Use the Info button along the top of OILMAP to interrogate shoreline oil. Be sure to click the center of the line segment to obtain the oiling information. The oil properties information window now shows the length of the oiled shoreline (distance in Meters) as well as the mass (in Metric Tons), as well as the start and end points of the oiled shore segment (location as latitude/longitude).

2.7 "This is a Drill" Label

It is now possible to apply a "This is a Drill" Label to the map on top of the model results. Right click on the map and select Model Display Settings. Turn on the option to Display "This is a Drill" Label. The label is automatically centered on the map when zooming in and out.
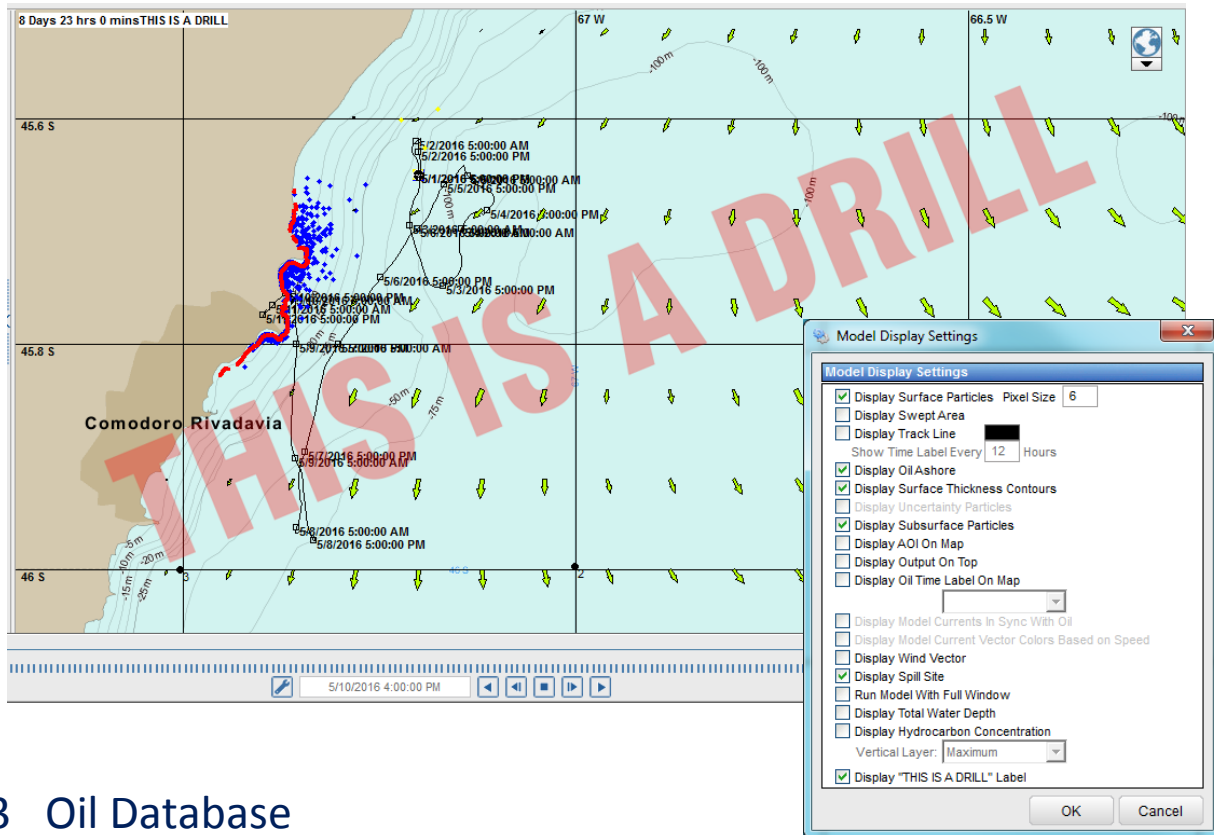
3 Oil Database

OILMAP includes the most up-to-date oil database from RPS ASA. This Master Database includes all of the necessary oil property information to run the new oil spill model. Although users are blocked from editing the Master oil database, it is possible to copy an oil to the Personal oil database for editing and adjusting. Users are also able to create new oils in the Personal oil database through the user interface.

The Adios database has been removed from the model input form. Oils from this database may no longer be used in the model as many of them do not contain sufficient oil properties information to run the model.

The Adios oil database is still available for viewing and reference in the Data menu. To run the model with an oil similar to an Adios oil, copy a similar oil from the Master oil database to the Personal oil database. Adjust the oil properties of this new oil with the available values from the Adios oil database. This new oil can now serve as a proxy oil in the model.

4 OILMAP v7 Model Updates

The OILMAP v7 model has undergone major updates to include new algorithms, integrating years of applied research and consolidating experience from real events such as the Deep Water Horizon (DWH) oil spill in the Gulf of Mexico. OILMAP now includes a comprehensive 3-dimensional oil spill model that tracks the various hydrocarbon components in the marine or fresh-water environment and in the atmosphere. The oil spill model includes new degradation rates that have been updated based on the last six years of research undertaken as a result of DWH.

4.1 Model Computational Improvements

- With improved computational handling of subsurface particles, OILMAP runs much faster.
- The blue model status window that appeared during a model run has been removed to improve model computation time. OILMAP now shows a progress bar of the model running.
- The new oil spill model features embedded multi-core functionality. No additional components are necessary. Both deterministic and stochastic simulations now leverage all available cores on the computer.
- If user cancels a simulation while the model is running, results up to that point are available and can be displayed in the GUI.

4.2 New and Improved Model Algorithms

- The Scenario Information file now has more comprehensive information about the model input parameters. This file can be found in Model Output → Scenario Information.
- The new oil spill model expects users to provide water depth information, whether this is for surface spills or subsurface releases. The bathymetry can be entered in different ways: Surface Module users can enter a simple uniform depth ('flat bottom'). Subsurface Module users can input spatially varying depth data from a file (currents or GEBCO bathymetry).
- Users may now enter a constant salinity value for use in the spill model.
- Surface oil viscosity is now calculated taking into account any potential entrained water into the oil (water-in-oil emulsion).
- Subsurface oil does not increase in viscosity due to water-in-oil emulsion formation until the oil surfaces. Subsurface oil which has surfaced and re-entrained (due to wind/wave action) is able to increase in viscosity.
- Vertical entrainment of floating oil is blocked when the surface oil viscosity reaches a maximum of 10,000 cP.

- The oil spill model includes new degradation rates that have been updated based on the last six years of research for the Deep Water Horizon incident. Degradation rates are set in the oil database for the residual components and hard coded in the model for the volatile components.
- Minimum oil slick thickness is now a function of the oil's viscosity and is now calculated by the model "on the fly". Previously, this was a set value in the oil database.
- Surface oil thickness is now calculated based on the oil particle's radius, rather than a Gaussian spreading.

5 Modeling Input Guidelines

- Users are encouraged to only use the Master Oil Database. ADIOS oil database is included as a reference as many of the oils do not include sufficient data to run an accurate simulation.
- OILMAP Surface Module Users must enter a Constant Depth value in the Parameters form.
- Due to the improvements of OILMAP's model, it is recommended that users enter many more particles (in the Parameters Tab). Number of particles should be on the order of 1,000 and more (compared to previous versions of OILMAP). Less than 1,000 particles should not be used.

Figure 4: Parameters Tab