OILMAP

Oil Spill Trajectory & Fates Modeling Software

Version 7.7 Release Notes

Leading with Science®

TETRA TECH

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1 GET IN TOUCH

Please use the following contact information to get in touch with RPS Group | a Tetra Tech Company (TT), regarding any questions concerning OILMAP.

Note: we have updated our email address; mapsupport@rpsgroup.com is now obsolete.

Email: MapSupport@tetratech.com

Phone: +1 401 789 6224

Address: 55 Village Square Drive, South Kingstown RI 02879

2 INTRODUCTION

The first version of OILMAP was delivered over 30 years ago and is now used globally by many international organizations, including major oil companies and marine pollution response agencies. 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 TT have incorporated lessons learned and new technologies into OILMAP version 7.7.0.

Version 7.7.0 of OILMAP includes many enhancements and added features to help improve oil spill response, drill exercises, impact risk assessments, and contingency planning. Enhancements were mainly made in the user interface. This document describes the various new features and bug fixes included in OILMAP v7.7.0.

2.1 Operating System Compatibility

Version 7 (and newer) of the TT MAP applications, OILMAP, SARMAP, and CHEMMAP, are supported on the following Microsoft Windows platforms: Windows 10 and 11, Windows Server 2016, 2019, 2022 and 2025 as well as cloud computing platforms including Microsoft Azure and Amazon Web Services.

2.2 OILMAP v7.7.0 Modules

Surface module	Simulates the behavior of surface oil spills released on the water surface.
Subsurface module	Simulates oil releases occurring below the water surface.
OILMAPDeep module	Simulates blowouts, including seabed dispersant application.
Backtrack module	Evaluates the source of a mystery spill.
Stochastic module	Calculates the probabilistic distribution of oiling in water and on shore.
Airmap module	Calculates the atmospheric dispersion of the lighter oil fractions from a spill.
OILMAPLand module	Evaluates the transport and fate of oil released on land reaching river networks.

3 OILMAP V7.7.0 USER INTERFACE UPDATES

3.1 General Interface Updates

The following updates and enhancements have been made in the OILMAP v7.7.0 interface:

1. In the table of contents to the left of the map window, the “GIS” tab was renamed to “Layers” for improved clarity.

Figure 1. TOC labels update.

2. Added Time as optional WMS parameter.
3. Added legend font size selection. Under “File” -> “Display Settings”.

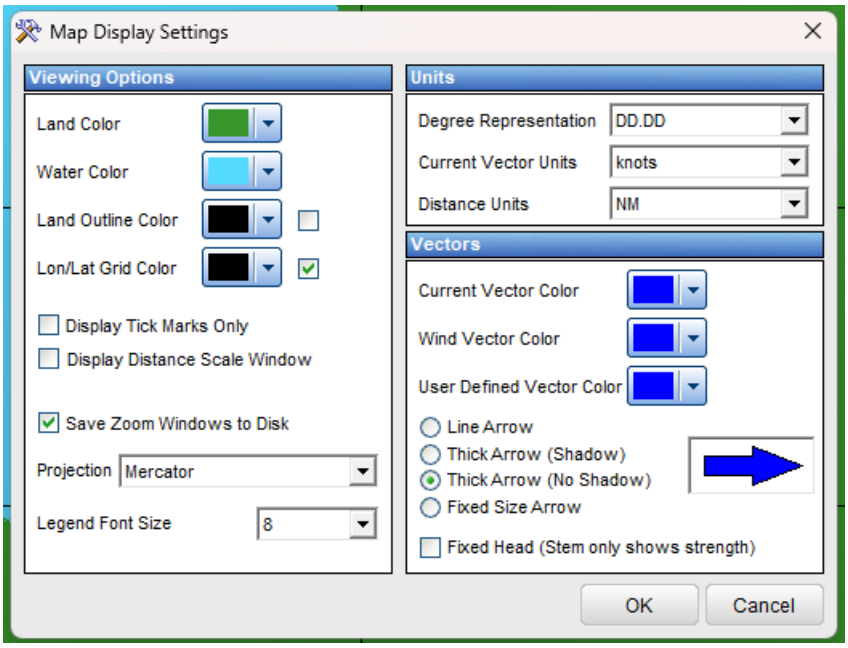


Figure 2. Legend Font Size selection in Map Display Settings.

4. Fixed issue of wet/dry (WD) file creation causing OILMAP to crash.

3.2 Resolved General Interface Bugs

The following bugs have been reported, logged, and **fixed**:

1. Fixed Creation of Loc Data Based on Open Street Map
    a. The user can now create a new Geographic Location (i.e., “Loc Data” - saved in C:\Users\Public\Documents\ASA Software\Loc_Data) from Open Street Map by using the World Database tool:

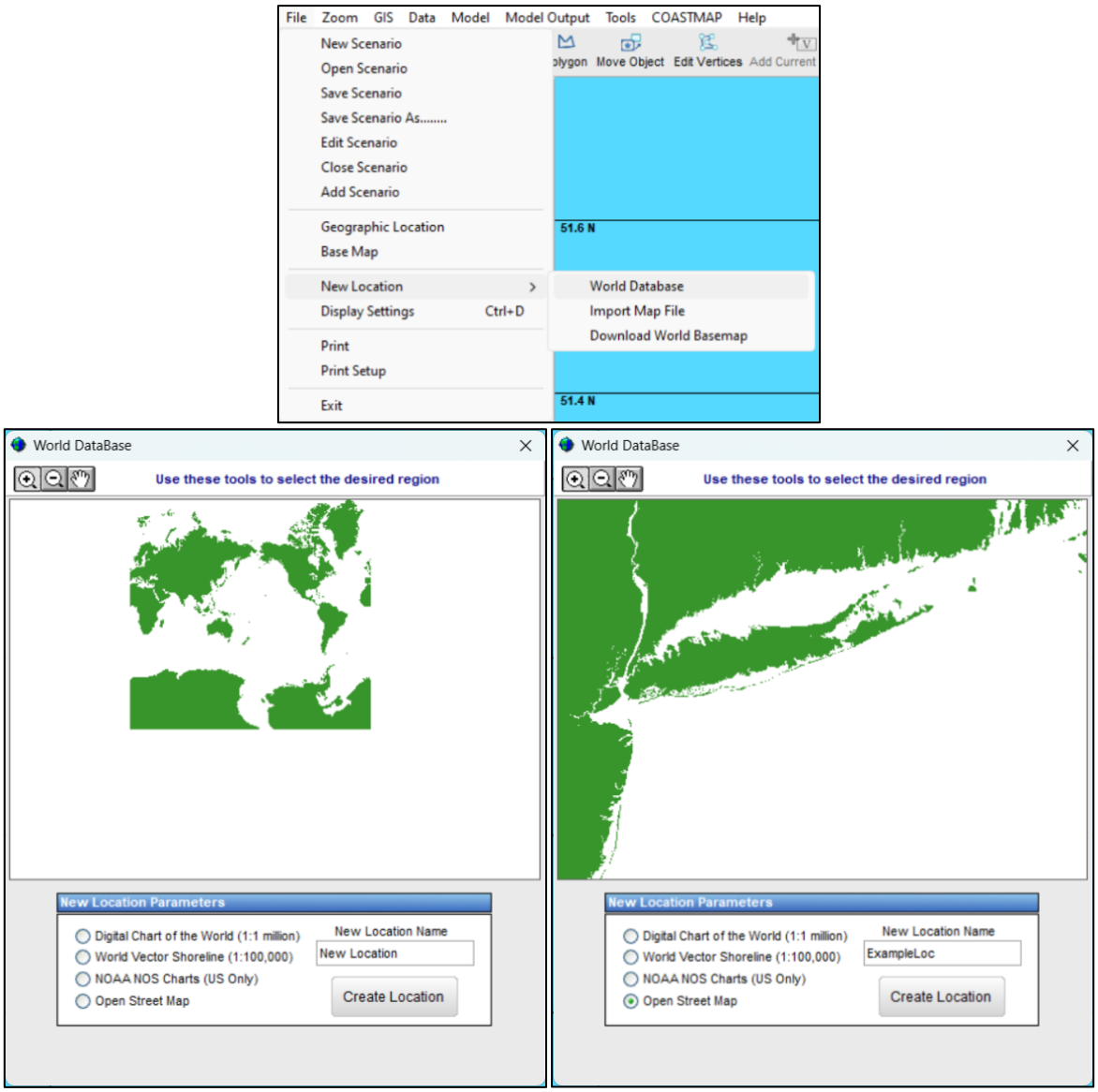


Figure 3. Loc Data creation from Open Street Map.

b. Once generated, the new Geographic Location will be saved with the “New Location Name”, in this example C:\Users\Public\Documents\ASA Software\Loc_Data\ExampleLoc. The “Coast” folder will integrate a .SHP file with the area selected and can be selected as default for any new scenario.

2. Fixed download of regional basemap based on Open Street Map.
   a. The user can now create a new .SHP file regional basemap from Open Street Map by using the Download World Basemap tool:

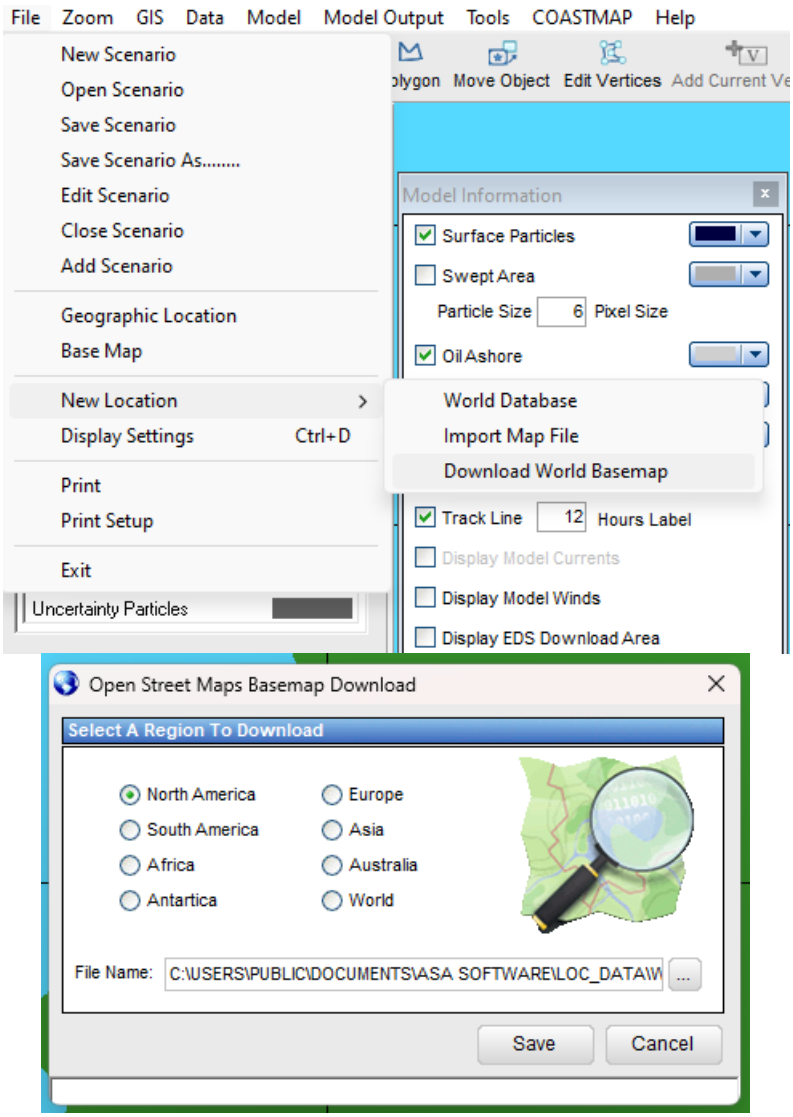


Figure 4. World or regional basemap creation from Open Street Map.

b. The user needs to select the File Name and location (it will default to the “Coast” folder of the active Loc_data). Once generated, the new “Coast” folder will integrate a .SHP file with the regional basemap selected and can be selected as default for any new scenario.

3. Fixed the oil density reported in the Master Database module. Previously, the Master Database in the interface reported the oil density at a fixed temperature of 15.6ºC, while specifying a different associated temperature. The database module now reports the correct density-temperature combination.
4. Fixed site coordinates rounding issue.
5. Fixed ALOHA file import.
6. Fixed oil removal plotting in mass balance graphs.

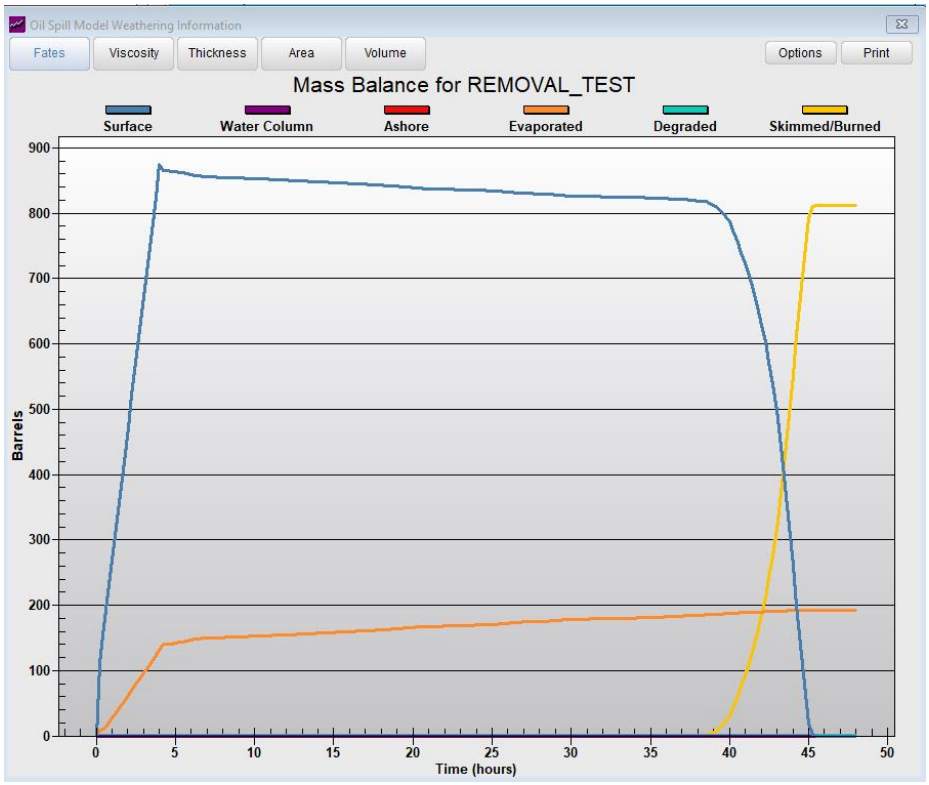


Figure 5. Mass balance plot for example scenario including removal.

7. Fixed simulation length changing when uploading scenarios to FTP.
8. Fixed integration of sevenCs into OILMAP. Users with a sevenCs license can now display 7CB files in the interface.

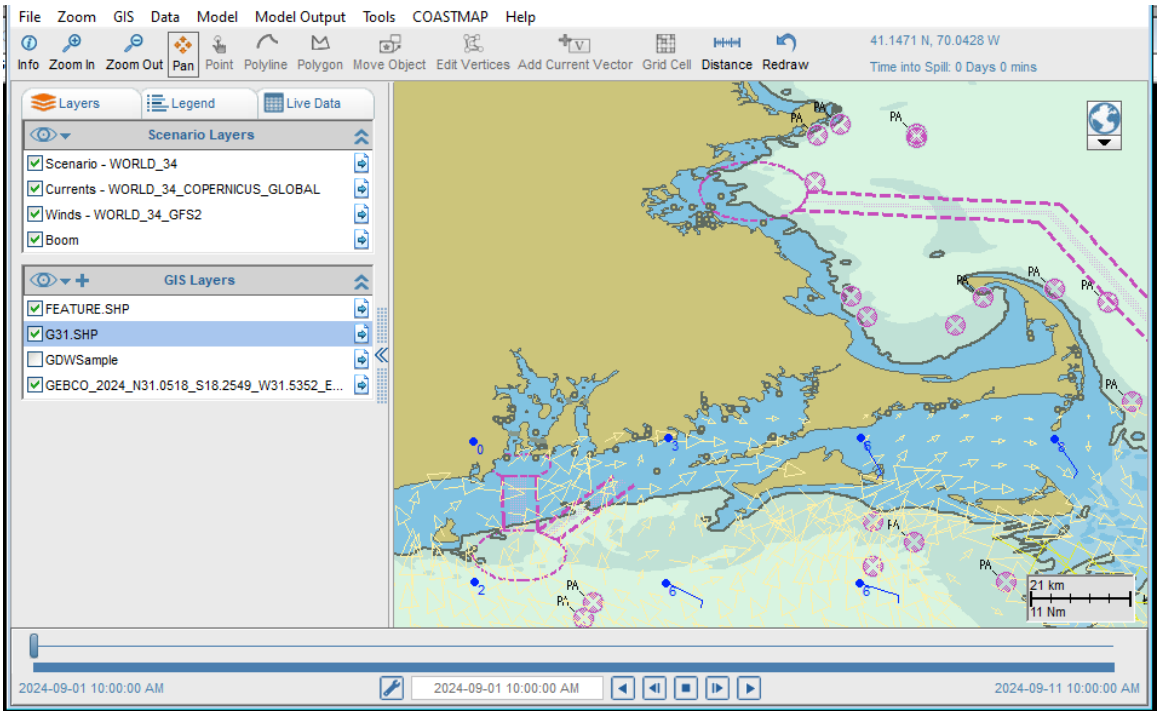


Figure 6. SevenCs files displayed in the interface.

9. Fixed import of NetCDF bathymetry from downloaded from the General Bathymetric Chart of the Oceans database (GEBCO).

a. A user can select a specific area under the GEBCO data download website and download a 2D netCDF Grid. Once downloaded the user need to create a “Land Water Grid” and import the GEBCO NetCDF bathymetry using the “Import Depth Data” tool.

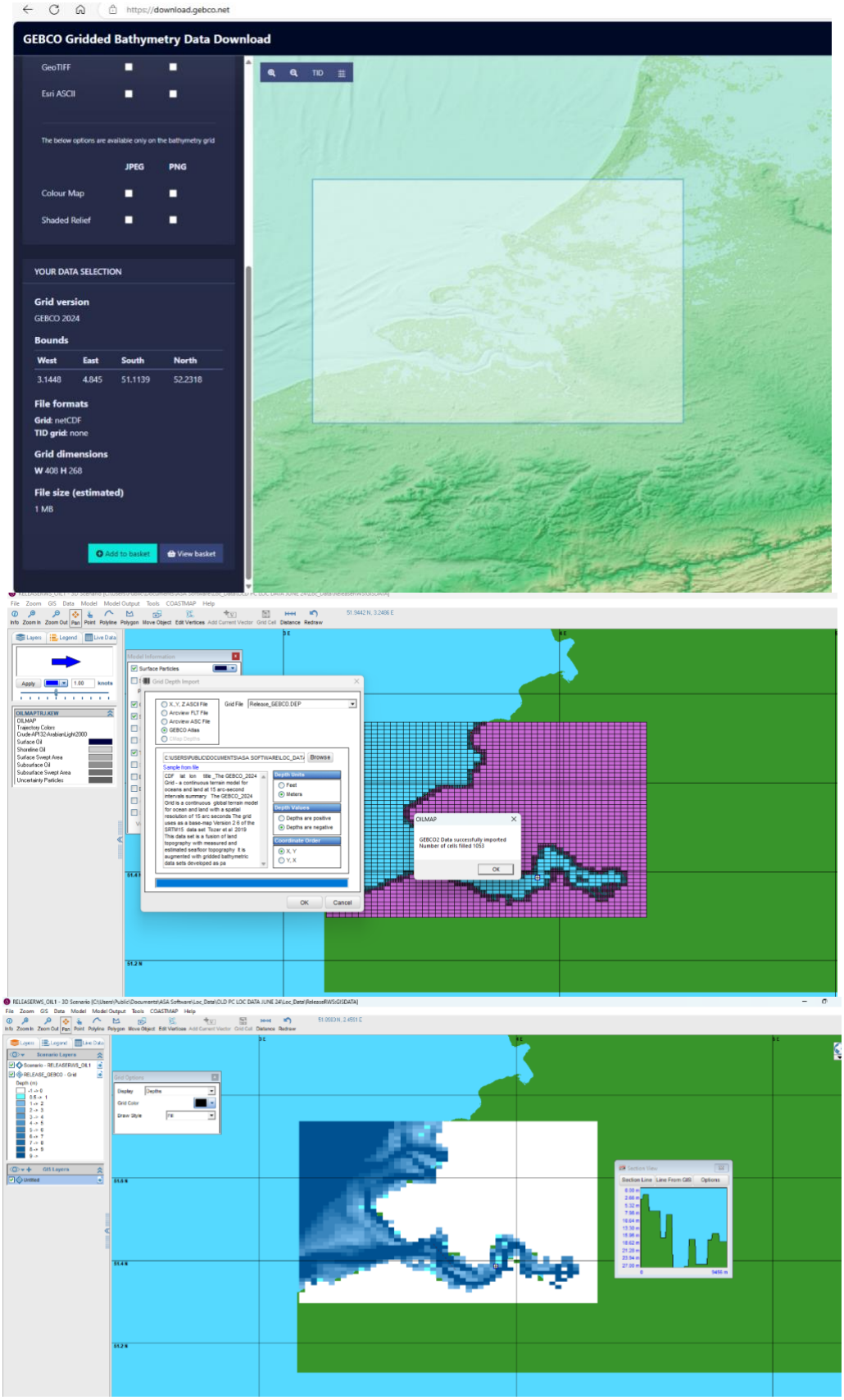


Figure 7. Example NetCDF bathymetry data from GEBCO.

3.3 Resolved Stochastic Tools Bugs

1. The interrogation feature for stochastic footprints was corrected to work with the stochastic model output files so the user may obtain information regarding stochastic footprints.

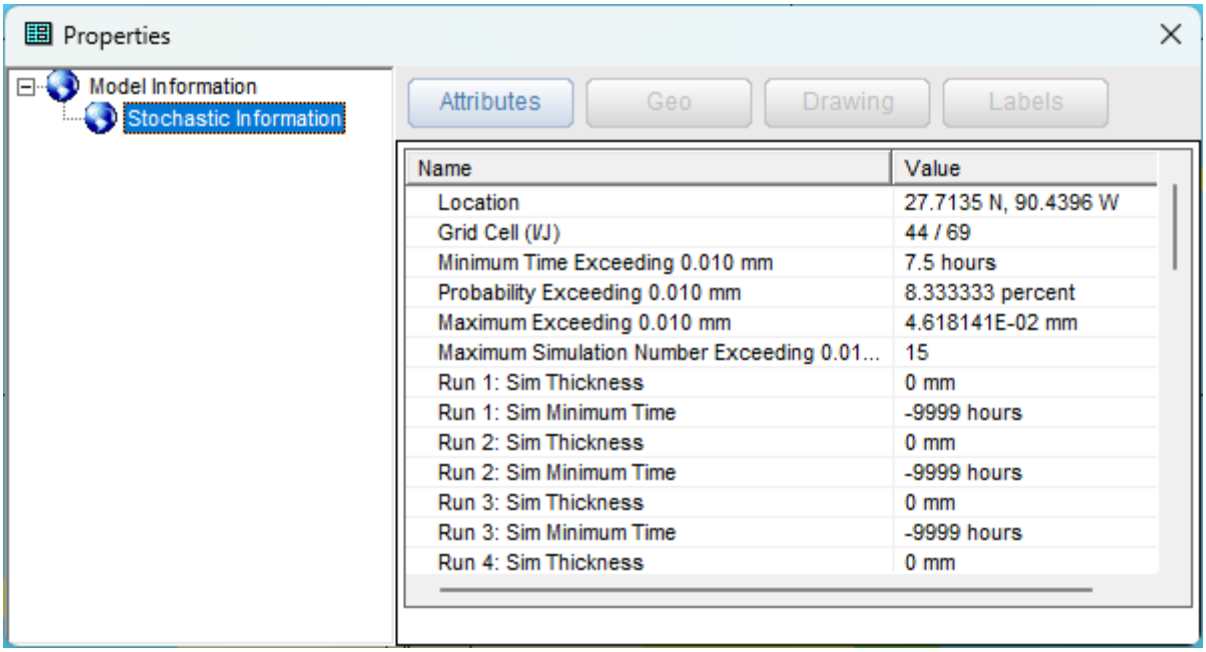


Figure 8. Stochastic interrogation information.

2. The feature was corrected so that users can now display individual tracklines associated with stochastic scenarios.

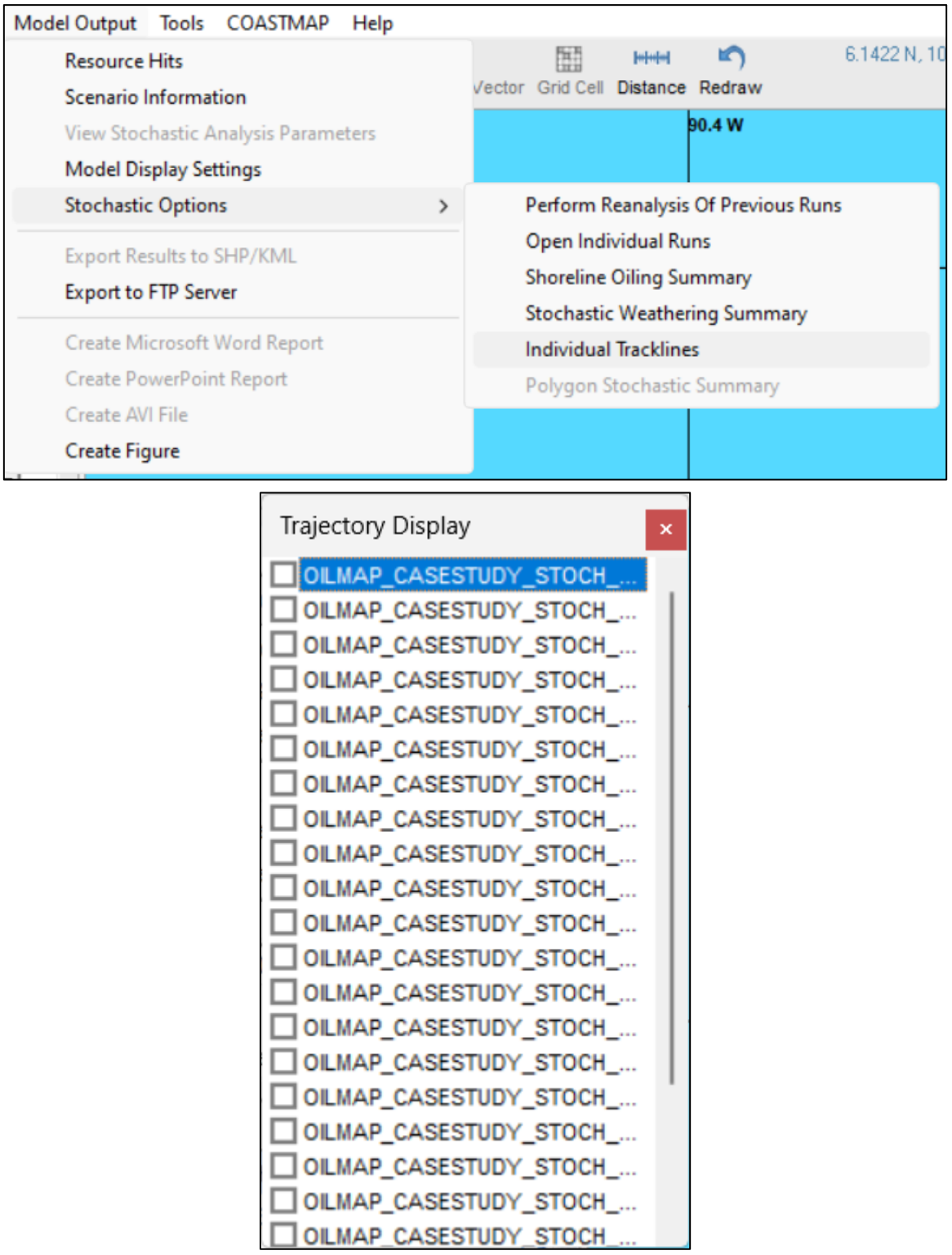


Figure 9. Individual stochastic simulation visualization.

3. The user can now smooth stochastic contour results.

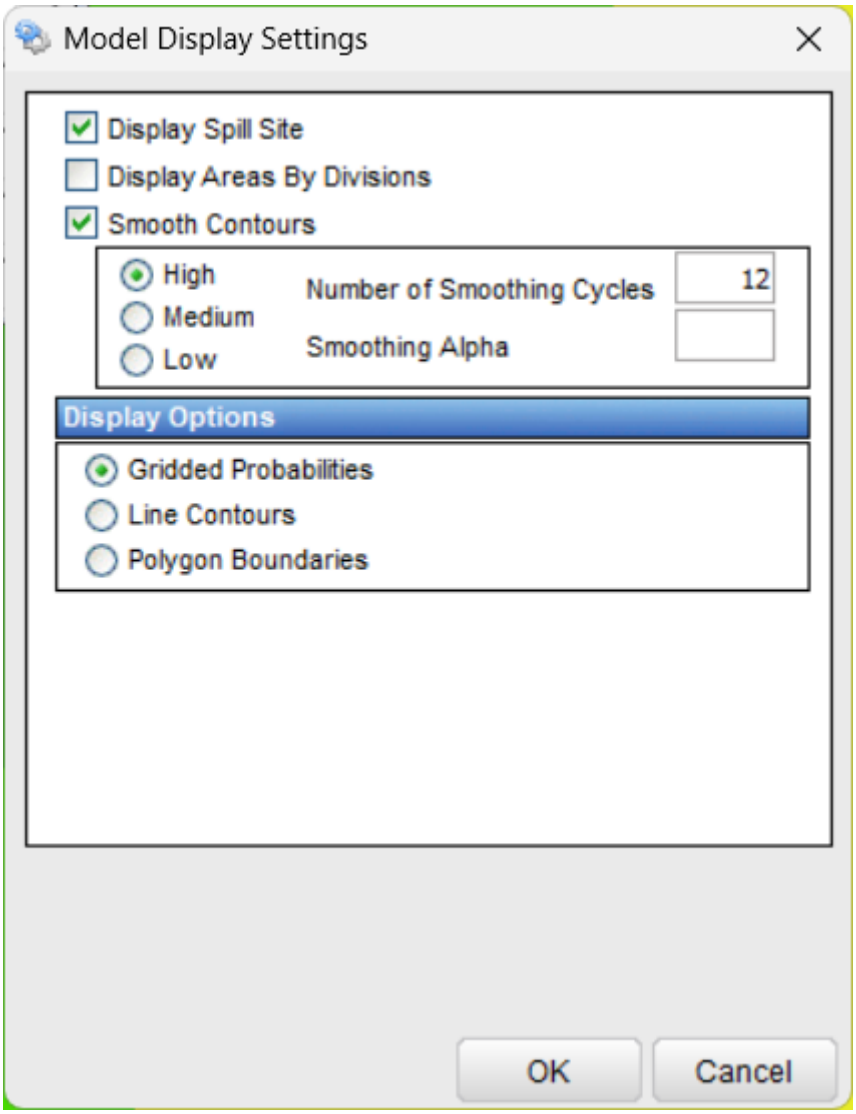
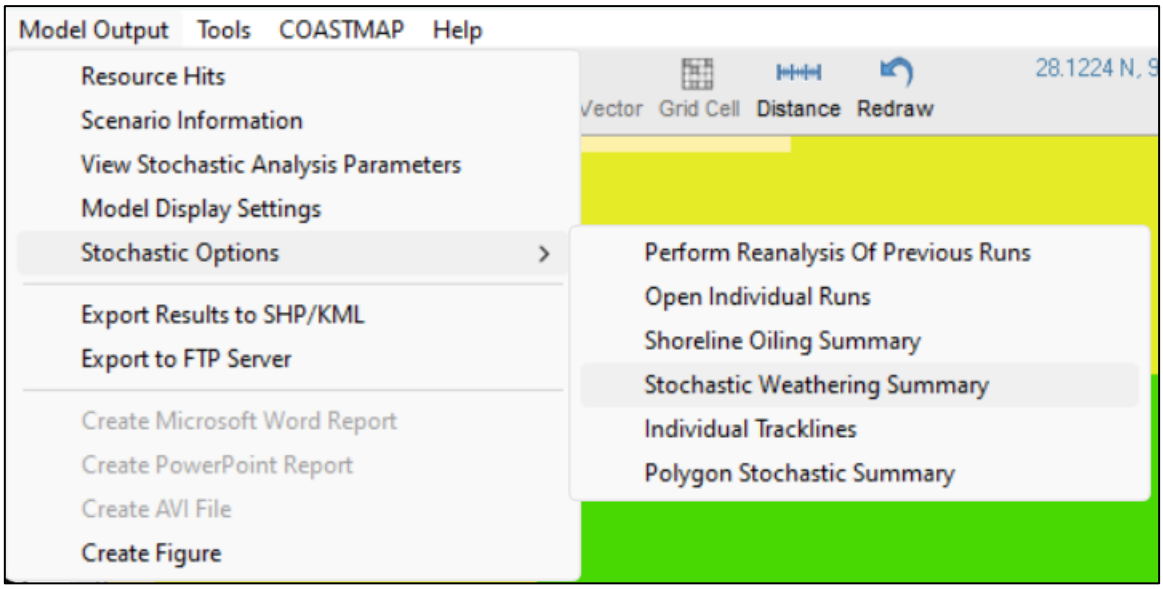


Figure 10. Stochastic control smoothing controls.

4. The user can now visualize the footprint for each individual run of a stochastic case, in addition to the footprint associated with all runs.
5. The user can now visualize a weathering summary of the individual trajectories of a stochastic case. When clicking “Stochastic Weathering Summary”, a text file pops up with the output.



Oil Spill Stochastic Analysis (UKCS format)
Scenario: OILMAP_CASESTUDY_STOCH

Run Number	Simulation Date (dd:mm:yyyy hh:mm)	Beaching time (dd:mm:yyyy hh:mm)	Latitude (°)	Longitude (°)	Flash (° C)	S Vol (m³)	E Vol (m³)	D Vol (m³)	R Vol (m³)	B Vol (m³)	Visc (mPascals)	WC (%)	% at Sea (%)
0007	01:04:2005 00:00	06:04:2005 03:30	28.92693	- 089.40465	00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0019	01:10:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0001	01:01:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0013	01:07:2005 00:00	06:07:2005 14:30	28.92043	- 089.41148	00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0020	15:10:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0002	01:03:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0008	15:02:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0003	01:05:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0021	01:11:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0009	15:03:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0014	15:07:2005 00:00	23:07:2005 05:00	29.09203	- 090.18650	00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0004	15:01:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0022	15:11:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0005	15:04:2005 00:00	20:04:2005 13:45	29.06657	- 090.29713	00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0010	15:05:2005 00:00	20:05:2005 21:00	28.92331	- 089.41410	00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0015	01:08:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0023	01:12:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0006	01:02:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0024	15:12:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0011	01:06:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0016	15:08:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0012	15:06:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0017	01:09:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78
0018	15:09:2005 00:00	(no shore hit)			00.000	1421.7	6124.0	10535.1	000.0	714.4	21074.5600	040.6	349.78

Figure 11. Stochastic weathering summary information.

6. OILMAP now provides more guidance to the user in the information box of stochastic reanalysis.

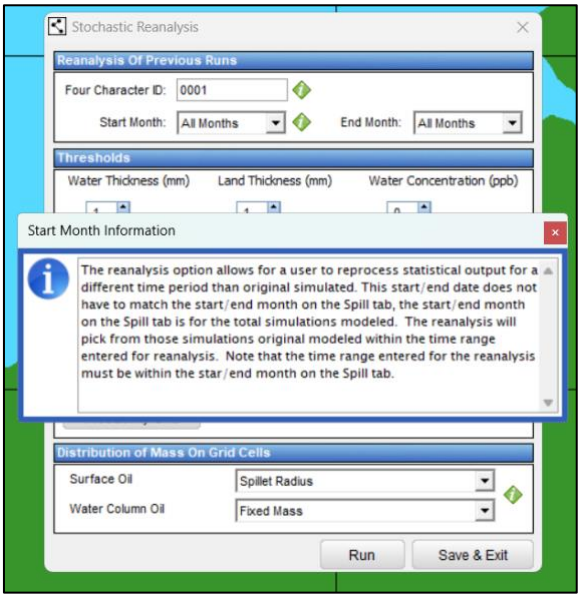


Figure 12. Stochastic reanalysis information box.

4 OILMAP V7.7.0 NEW FEATURE ADDITIONS

4.1 Oil Database Changes and Improvements

1. Curated a list of 56 commonly bulk-shipped oils (27 new oils and 29 enhanced versions of oils that were in the 2016 oil database). These oils are divided into the following categories:

Table 1. Oil Database Categories

Oil Type	Number of Oils
Crude Oil (“Crude”)	31
Condensate (“Cond”)	3
Heavy Fuel Oil (“HFO”)	8
Light Fuel Oil (“LFO”)	7
Low Sulfur Fuel Oil (“LSFO”)	2
Alternative Fuel/Petroleum Product (“ALT”)	5

   a. Oil names use the following nomenclature: Oil Type - Oil's API - Unique Oil Name/Description (e.g., Cond-API49-Oso; Crude-API35-GreenCanyonBlock200)
      i. Please see appendix for underlying physical/chemical data on all oils (e.g., density, viscosity, etc).
   b. 29 of the oils listed in the 2016 version of the oil database were reconfigured in this newest version. These oils have been slightly adjusted using newer data, and their analogous proxy oil can be found using the table below.
      i. If you have questions regarding the adjustments made to any of these oils, please reach out to our team via mapsupport@tetratech.com.
      ii. If you are interested in modeling a 2016-version oil that is not included in Table 2, please contact our team for assistance via mapsupport@tetratech.com.

Table 2. 2016 Oil Database vs 2020 Oil Database

Version 2016 Oil	Analogous Version 2024 Oil
Alaminos Canyon Block 25	Crude-API31-AlaminosCanyonBlock25
Alaska North Slope Crude (2002)	Alaska North Slope Crude (2002)
Alaskan Crude - Cook Inlet 2003	Crude-API34-CookInlet2003
Alaskan Crude - Prudhoe Bay Crude - High Volatile	Crude-API27-PrudhoeBay_USEPARefStd_2004
Alaskan Crude - Prudhoe Bay Crude - Low Volatile	Crude-API27-PrudhoeBay-EVOS-1989
Alaskan Crude - Sockeye Crude (2000)	Crude-API20-Sockeye2000
Alberta Sweet Mix Blend Crude (Reference 5)	Crude-API37-AlbertSweetMixedBlend_5
Anadarko HIA376 Crude	Crude-API35-AnadarkoHIA376_ECCC

Arabian Light Crude (2000)	Crude-API32-ArabianLight2000
California Crude - Platform Elly	Crude-API16-PlatformElly
Chayvo #6 Crude	Crude-API38-Chayvo6
Diesel 2002	LFO-API39-Diesel2002
Fuel Oil No. 2 - North Cape, High Aromatic	LFO-API32-No2FuelOil_HiPAH
Fuel Oil No. 2 - North Cape, Low Aromatic	LFO-API32-No2FuelOil4percPAH
Fuel Oil No. 5 (Bunker B Fuel Oil)	HFO-API12-No5_2000
Gasoline (unleaded)	LFO-API63-Gasoline_Automotive
Heavy Fuel Oil – FPL	HFO-API08-No6FuelOil_FPL
Heavy Fuel Oil 6303 (2002)	HFO-API12-6303_2002
Intermediate Fuel Oil 180	HFO-API15-IFO180
Intermediate Fuel Oil 380 - Prestige	HFO-API11-380_Prestige
Jet A _Jet A-1	LFO-API42-JetA_JetA1
Louisiana Crude - Mississippi Canyon Block 807 (2002)	Crude-API18-MC807
Louisiana Crude - Morpeth Block EW921	Crude-API37-MorpethBlockEW921
Louisiana Crude - Green Canyon Block 200	Crude-API35-GreenCanyonBlock200
Mars TLP Crude 2004	Crude-API27-MarsTLP_2004
Maya Crude 2004	Crude-API20-Maya_2004
Petronius Block VK 786A	Crude-API31-PetroniusBlockVK786A
South Louisiana Crude (USEPA Standard, 2004)	Crude-API37-S_LA_USEPA_std_2004
South Louisiana Crude 2001	Crude-API34-SLA2001

c. The 27 new oils are listed with a brief description in the table below:

Table 3. New Products in the 2020 Oil Database

New 2024 Oils	Description	
ALT-API14-MIDEL-7131-Synthetic_Ester-Dielectric_Fluid-Lube_Oil	Alternative fuel (to mineral oil)	Biodegradable synthetic ester transformer fluid; Dielectric fluid; Lubricating oil
ALT-API15-Biodiesel-Pure_Castor_oil	Alternative fuel (to diesel); Biodiesel; API (15 – 35); Biodegradable; Renewable	100% castor oil
ALT-API22-Biodiesel-Pure_Soybean_oil		100% soybean oil
ALT-API35-Biodiesel-B20-Soybean_oil		20% soybean oil (80% petroleum diesel)
ALT-API48-Neodene-Shell	Alternative petroleum product	Manufactured from ethylene; Linear alpha olefins mixture
Cond-API49-Oso	Condensates	

Cond-API59-GoM_Condensate	(API 49 - 61)	
Cond-API61-SableIsland_ExxonMobil		
Crude-API19-Mandalay	Crude Oil (API 19 - 41)	
Crude-API22-WCS2017		
Crude-API23-CLB		
Crude-API27-BowRiverBlend		
Crude-API27-PrudhoeBay_USEPARefStd_2004		
Crude-API27-PrudhoeBay-EVOS-1989		
Crude-API28-ArabHvy2000		
Crude-API33-AlaskanNorthSlope2017		
Crude-API33-Hout		
Crude-API34-HOOPS		
Crude-API34-Odoptu		
Crude-API35-MC252_2020		
Crude-API37-WestTexasIntermediate		
Crude-API41-Bakken		
HFO-API05-No6FuelOil_FPC	Heavy Fuel Oil (API 5 - 12)	
HFO-API10-No6FuelOil_MJBerman		
HFO-API12-HFO_NovaScotia2002		
LFO-API35- Marine_Gas_Oil-SINTEF2016	Marine Gas Oil	
LFO-API39- Marine_Diesel-2018ECCC	Marine Diesel	
LSFO-API13-VLSFO-Shell2019	Low Sulfur Fuel Oil (API 13 - 24)	Very-low sulfur fuel oil (<0.50% sulfur)
LSFO-API24-ULSFO-Shell2019		Ultra-low sulfur fuel oil (<0.10% sulfur)

4.2 Open Sea Map

OILMAP users may display the Open Sea Map as their base map in the map window. Users can go to the “GIS” menu to "attach new layer" and then select "map services", then select “Tile Service" and then "Open Sea Map" and click OK. Users then select “Open **Street** Map” from the base map selection in the top right of the map window or the base map of their choice.

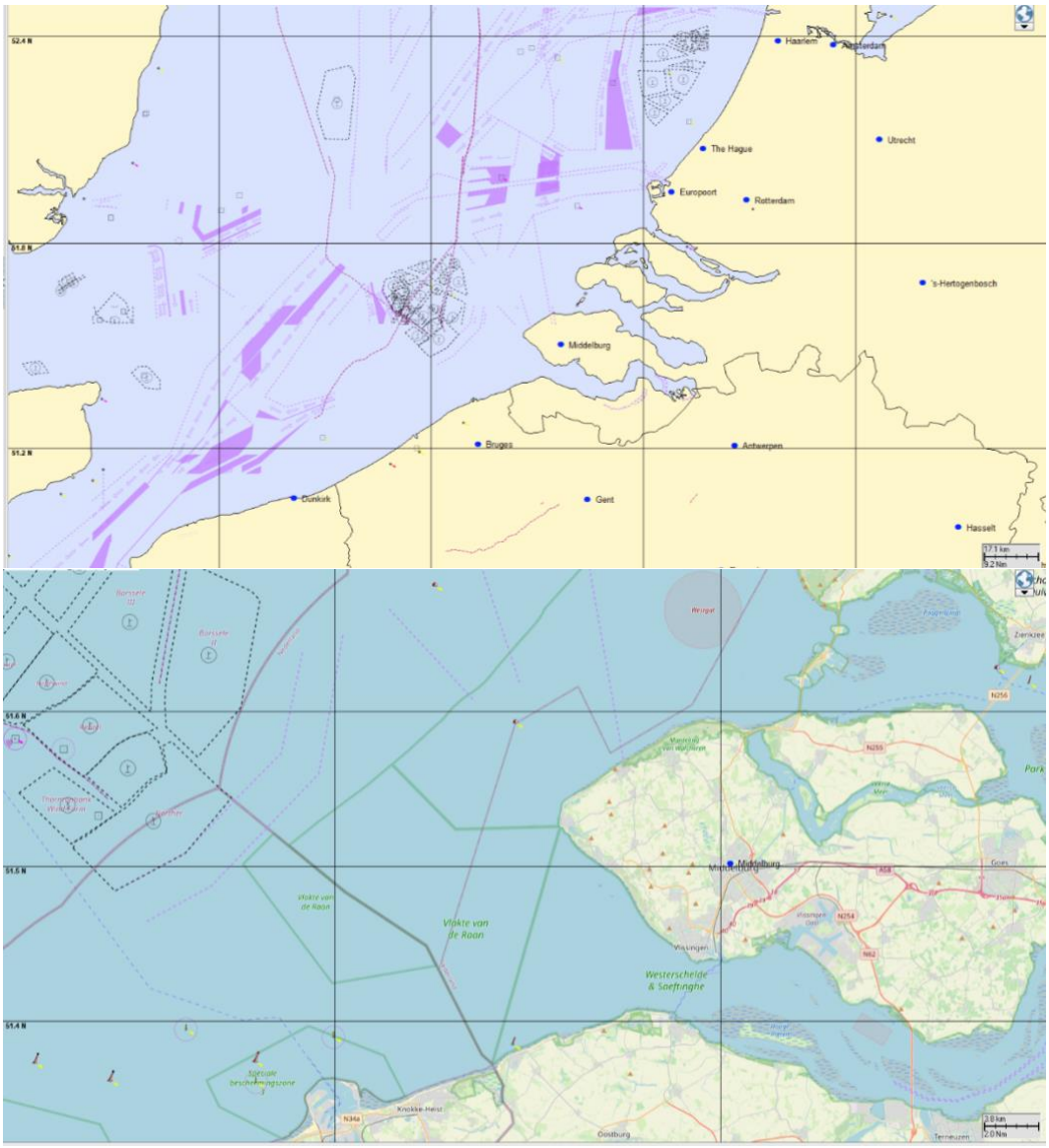


Figure 13. Example Open Sea Map visualization with two base maps: user-set base map (top) and Open Street Map base map (bottom).

4.3 COASTMAP EDS Form Updates

The EDS servers are now labeled as “Primary” and “Secondary”, to clearly indicate which server users should be connecting to.

4.3.1 EDS Metadata Catalog Download Option

The following data sources had a detailed catalogue added:

- GFS
- ECMWF Winds

This process will be ongoing and we will continue to update the catalog for additional data sources that have not been updated with this release.

4.3.2 Full EDS Metadata Catalog

The following datasources contain a detailed catalog:

- AEMET HARMONIE CAN
- AEMET HARMONIE PEN
- ECMWF Open Winds
- GFS
- HFRadar EBRO DELTA
- HFRadar Galicia
- HFRadar Gibraltar
- HFRadar Huelva - Algarve
- HFRadar Ibiza
- NOAA CIOFS
- SAMPA Algeciras
- SAMPA Estrecho de Gibraltar
- SAMPA Gibraltar
- SASEMAR WRF Winds
- WMOP ROMS
- Global HYCOM (NCEP)
- Global HYCOM (Navy) Currents
- Copernicus, GLOBAL
- Bluelink v3
- NAVGEM (Navy)
- NW_ATL
- Copernicus, MED SEA
- ACCESS G3
- CNMI ROMS
- Guam ROMS
- ECMWF Winds
- Copernicus, NW ATL SHELF
- Copernicus, IBI
- Baltic Sea Currents
- Arctic Ocean Currents
- Samoa ROMS
- MOHID Artabro
- MOHID Vigo

5 OILMAP V7.7.0 MODEL UPDATES (1.6.10.38)

5.1 Resolved Trajectory and Fates Model Bugs

1. Fixed path to ice files.
2. Fixed initialization error with 2D sigma NC files.
3. Fixed uninitialized variables when wind=fill value.
4. Fixed an edge condition in the i,j index computation from the k-d tree index.
5. Fixed bug with thresholds for SFA output not being initialized.
6. Fixed division by 0 with subsurface polygon release.
7. Fixed initialization error in water column concentrations when graphics are turned off.

5.2 Model Changes and Improvements

1. Previously, the interface was converting the volume of oil removal rate to mass using oil density at a fixed temperature. This was corrected so that the model does the conversion using the volume in m^3 from the REM file and the oil density at the modeled temperature.

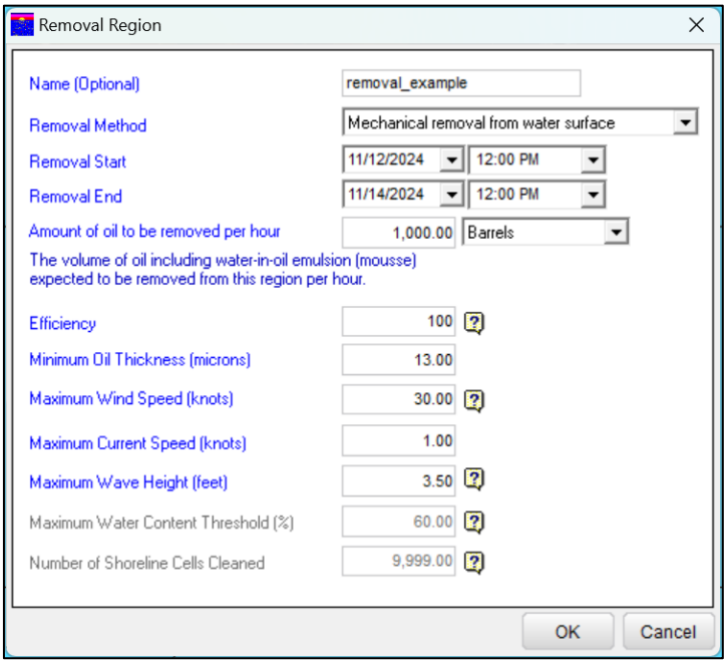


Figure 14. Example removal inputs.

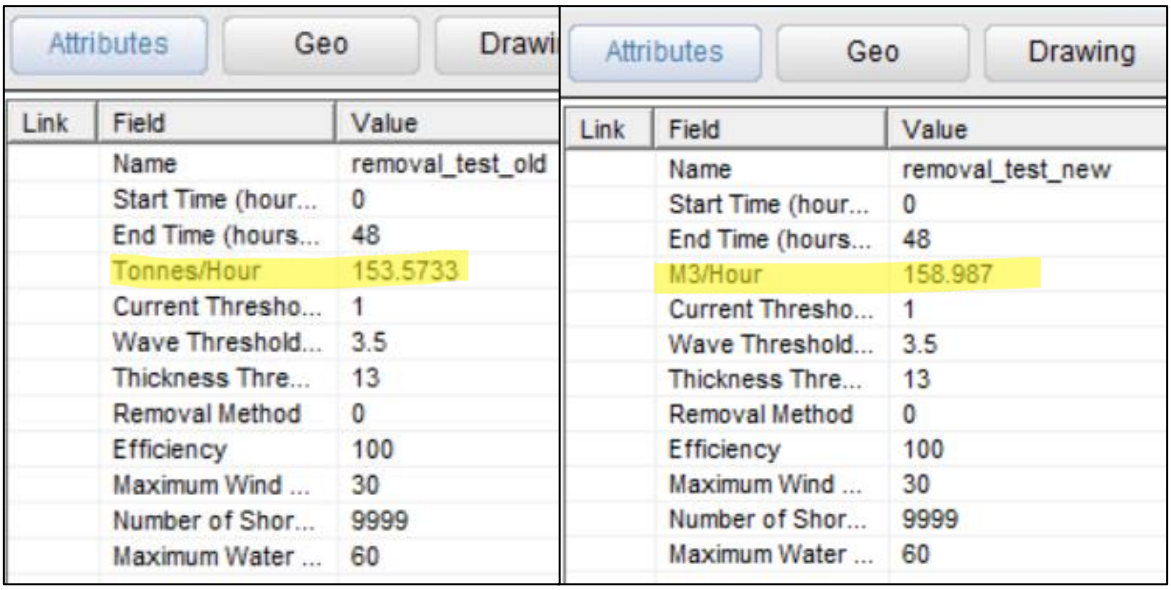
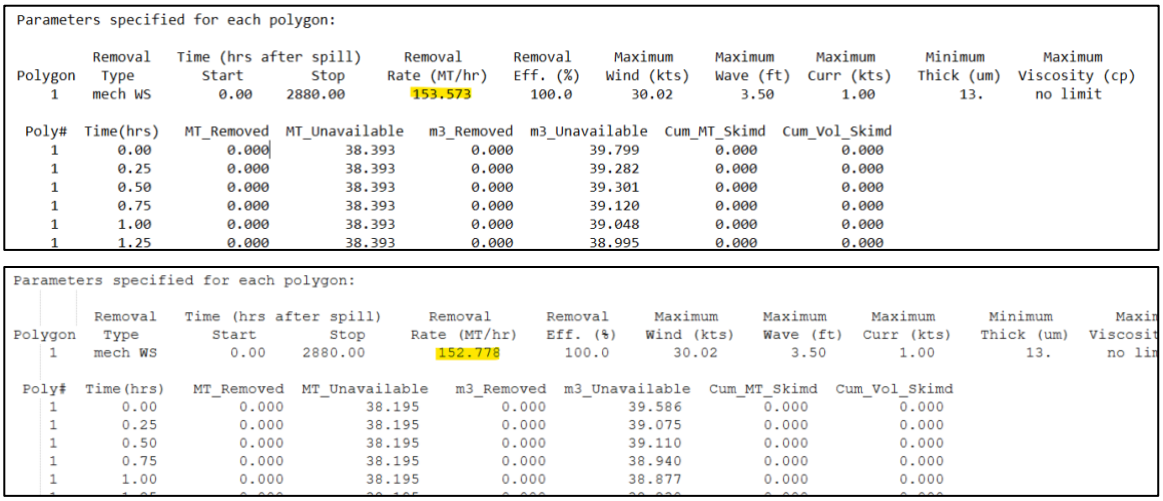


Figure 15. Removal information for example cases; old with incorrect recovery rate conversion to MT/hr (left) and new with correct unconverted recovery rate in m^3/hr (right).



Parameters specified for each polygon:

Polygon	Removal Type	Time (hrs after spill) Start	Stop	Removal Rate (MT/hr)	Removal Eff. (%)	Maximum Wind (kts)	Maximum Wave (ft)	Maximum Curr (kts)	Minimum Thick (um)	Maximum Viscosity (cp)
1	mech WS	0.00	2880.00	153.573	100.0	30.02	3.50	1.00	13.	no limit

Poly#	Time(hrs)	MT_Removed	MT_Unavailable	m3_Removed	m3_Unavailable	Cum_MT_Skimd	Cum_Vol_Skimd
1	0.00	0.000	38.393	0.000	39.799	0.000	0.000
1	0.25	0.000	38.393	0.000	39.282	0.000	0.000
1	0.50	0.000	38.393	0.000	39.301	0.000	0.000
1	0.75	0.000	38.393	0.000	39.120	0.000	0.000
1	1.00	0.000	38.393	0.000	39.048	0.000	0.000
1	1.25	0.000	38.393	0.000	38.995	0.000	0.000

Parameters specified for each polygon:

Polygon	Removal Type	Time (hrs after spill) Start	Stop	Removal Rate (MT/hr)	Removal Eff. (%)	Maximum Wind (kts)	Maximum Wave (ft)	Maximum Curr (kts)	Minimum Thick (um)	Maxim Viscosit
1	mech WS	0.00	2880.00	152.778	100.0	30.02	3.50	1.00	13.	no lim

Poly#	Time(hrs)	MT_Removed	MT_Unavailable	m3_Removed	m3_Unavailable	Cum_MT_Skimd	Cum_Vol_Skimd
1	0.00	0.000	38.195	0.000	39.586	0.000	0.000
1	0.25	0.000	38.195	0.000	39.075	0.000	0.000
1	0.50	0.000	38.195	0.000	39.110	0.000	0.000
1	0.75	0.000	38.195	0.000	38.940	0.000	0.000
1	1.00	0.000	38.195	0.000	38.877	0.000	0.000

Figure 16. RLG removal output file for example cases; old with incorrect recovery rate conversion to MT/hr (top) and new with correct recovery rate conversion to MT/hr (bottom).

2. Added a keyname to make the CLST folder location configurable.
3. Updated to check for NaN before doing floating point comparison.
4. Updated k-d tree computation to avoid losing resolution when computing the average of a large number of cells.
5. Added the ability to handle ice data from a regular grid and updated 2D lat/lon ice file processing to improve efficiency.
6. Updated handling of 2D latitude/longitude files to improve interpolation for rivers.
7. Updated VFL to remove hard-coded array size.
8. Added new format for removal file.
9. Added uncertainty particles to the H5 output file
10. Update to culib to allocate arrays to the heap instead of the stack
11. Write the thickness and concentration data to a netCDF file
12. Added the ability to run automated tests

OILMAP
Oil Spill Trajectory & Fates Modeling Software

Oil classification based on API

GROUP 1 OILS: API > 45

API > 45
Pour point: -118 to -3 (°C)
Viscosity @ 25°C : <2.5 cP
% boiling below 180°C: <99%
% boiling above 370°C: 0 to 100%

	API	Pour Point (°C)	Viscosity @25 °C (cP)	% Boiling < 180°C	% Boiling > 370°C
Gasoline (Leaded)	63	-55	0.5	98	0
Gulf of Mexico Condensate	59	-55	0.6	43	5
Oso Condensate	49	-3	1.5	38	18
Sable Island Condensate	61	-118	0.6	70	0
Shell Neodene	48	-10	2	0	100

GROUP 2 OILS: API 35 - 45

API 35-45
Pour point: -65 to -4 (°C)
Viscosity @ 25°C: between 1.5 and semi-solid
% boiling below 180°C: <71%
% boiling above 370°C: <62%

	API	Pour Point (°C)	Viscosity @25 °C (cP)	% Boiling < 180°C	% Boiling > 370°C
Albert Sweet Mixed Blend #5	37	-18	3	26	35
Bakken	41	-28	3	27	27
Chayvo #6	38	-4	1.5	24	30
Diesel (2002)	39	-50	2	22	0.1
Green Canyon Block 200	35	-10	7	23	42
Jet A / Jet A-1	42	-55	1.6	70	0
Marine Diesel (2018)	39	-6	4	0	0
Marine Gas Oil	35	-36	4	1	0
MC252	35	-28	5	23	38
Morpeth Block EW921	37	-65	16	11	62
South Louisiana USEPA Reference Standard (2004)	37	-41	5	19	46
West Texas Intermediate	37	-23	4	25	35

API 17.5-35
Pour point: -72 to 24 (°C)
Viscosity @ 25°C: between 0.5 and semi-solid
% boiling below 180°C: <32%
% boiling above 370°C: 0 - 100%

GROUP 3 OILS: API 17.5 - 35

	API	Pour Point (°C)	Viscosity @25 °C (cP)	% Boiling < 180°C	% Boiling > 370°C
High pour point <6°C					
Alaminos Canyon Block 25	31	-72	21	17	54
Alaska North Slope (2002)	32	-32	7	23	46
Alaskan North Slope (2017)	33	-24	7	11	54
Anadarko HIA-376	35	-35	8	15	47
Arabian Heavy (2000)	28	-32	22	19	49
Arabian Light (2000)	32	-21	7	16	52
Biodiesel-B100 Soybean Oil	22	-10	47	0	100
Biodiesel-B20 Soybean Oil	35	-41	7	4	35
Bow River Blended	27	-39	22	13	53
Cold Lake Blend	23	-25	79	19	60
Cook Inlet (2003)	34	-54	6	23	43
Fuel Oil No. 2 - 4% PAHs	32	-21	3	0	0
Fuel Oil No. 2 - High PAHs	32	-21	3	0	0
HOOPS15X	34	-54	7	23	43
Hout	33	-25	9	21	49
Mandalay	19	-40	249	18	57
Mars TLP	27	-28	30	11	69
Maya (2004)	20	-20	279	19	53
Mississippi Canyon Block 807	18	-57	0.8	18	57
Odoptu	34	-48	4	32	19
Petronius Block VK786A	31	-19	2	14	51
Prudhoe Bay EVOS (1989)	27	-23	20	14	51
Prudhoe Bay USEPA Reference Standard (2004)	27	-23	20	20	43
Sockeye (2000)	20	-25	315	12	66
South Louisiana (2001)	34	-41	7	18	46
Western Canadian Select (2017)	22	-42	178	5	78
High pour point >5°C					
Shell ULSFO	24	24	9995	0.1	77

GROUP 4 OILS: API < 17.5

API < 17.5
Pour point: -56 to 6 (°C)
Viscosity @ 25°C: between 45 and semi-solid
% boiling below 180°C: <14%
% boiling above 370°C: >63%

	API	Pour Point (°C)	Viscosity @25 °C (cP)	% Boiling < 180°C	% Boiling > 370°C
High pour point <6°C					
Biodiesel-B100 Castor Oil	15	-10	608	0	100
Fuel Oil No. 5 (2000)	12	-19	292	1.5	69
Fuel Oil No. 6 - Florida Power & Light	8	-9	1210	0	66
Fuel Oil No. 6 - Florida Power Corp.	5	-6	893	0	74
Fuel Oil No. 6 - MJBerman	10	-6	4641	0	84
HFO 6303 (2002)	12	-1	5401	1.1	73
Intermediate Fuel Oil 180	15	-10	840	4	68
MIDEL 7131	14	-56	48	0	98
Nova Scotia (2002)	12	-1	5401	2	73
Platform Elly	16	-20	1408	14	63
Shell VLSFO	13	3	3473	0.4	78
High pour point >5°C					
HFO 380	11	6	8957	0	84