Examples

Try out these examples to learn the basics of modeling oil spills in New York Harbor. Explore how the changing tides affect the trajectories of oil slicks, how wind can move an oil slick in a different direction from the currents, and how model and observation limitations can be overcome by considering both the "Best Estimate" and the "Minimum Regret" (Uncertainty) solutions. This knowledge will help you in designing your own GNOME model runs.

The following conditions hold for each of the examples:

Date: March 26, 2008.
Model and Spill Start Time: As specified in each example.
Model duration: 1 day.
Uncertainty: Not included, unless specified in a particular example.
Wind: No wind (constant at 0 knots), unless specified.
Pollutant type: Non-weathering, unless specified.
Spill size: 1000 barrels (bbls).
Spill: (Examples 1-3) Point source east of Staten Island at 40° 38' N, 74° 3.5' W. (Example 4) Linear source extending from Sandy Hook, 40° 28.5' N, 74° 0' W, to Coney Island, 40° 34.2' N, 74° 0' W.

Use GNOME's Standard Mode and the New York Harbor Location File to answer the following questions:

1. Tides are an important part of the circulation in New York Harbor. In this example, you will place a spill at 40° 38' N, 74° 3.5' W (east of Staten Island) and examine the effects of tides by starting the spill at two different times in the tidal cycle. Run the spill in GNOME twice, once at the beginning of an ebb tide (Start Time: 0115) and once at the beginning of a flood tide (Start Time: 0800).

What are the differences in beach impacts? How do the two spills differ in the amount and location of pollutant?

> **Hints:** To easily set a spill at a particular location, simply click anywhere on the water area of the map. In the Spill Information window that opens, you can then enter the exact latitude and longitude of the spill. (This method is much easier than moving your mouse around the map and watching its location in the lower left corner of the window!)
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> When you change the start time of a spill, you will want to change both the spill start time and the model start time. To do this, double-click the description of the spill ("Non-Weathering: 1000 barrels") under **Spills** in the Summary List (the left section of the Map Window). In the Spill Information window, change the Release Start Time to 0800. GNOME will then prompt you to change the model start time to match the spill start time. Click "Change".

Answer: When the spill starts with the ebb tide, after 24 hours, the spill ends up staying primarily in the Lower Bay, impacting Hoffman Island and Swinburne Island. The rivers feeding the harbor give it a net flow out to sea. The spill would continue to move back and forth with the tides, while slowly moving seaward. Little shoreline is impacted by the spill. When the spill starts with the flood tide, the spill moves much further up the harbor. Oil moves nearly as far north as Governor's Island. When released on the flood tide, the spill has the potential to impact the shoreline on Staten Island and the area that the ebb tide spill could affect.

2. Not much oil comes ashore in Example 1 because the spill is moving and spreading only under the influence of the water. As a result, the oil tends to flow parallel to the shoreline, without very much of it beaching. Wind can have a significant effect on a spill because it both moves the oil along the water's surface and drives currents. Rerun the flood tide spill (Start Time: 0800) with the addition of a 10-knot (kn) wind from the WSW.

How does the oil's trajectory and shoreline impacts change from the previous example?

> **Hint:** To add wind to your model, double-click **Wind** in the Summary List, and then enter the wind speed and direction in the Constant or Variable Wind window.

> **Answer:** With the WSW wind, almost all the oil impacts shorelines to the east of the spill, including Governor's Island, both sides of the East River and Brooklyn.

3. Forecasts of environmental parameters are inherently uncertain. For example, wind and weather forecasts can be "off" in the speed, direction, or timing of winds. GNOME supports a "Minimum Regret" solution in addition to the "Best Estimate" solution that you have been running. The "Minimum Regret" solution takes into account uncertainty in wind, horizontal mixing, and currents.

Rerun the flood tide spill with a 10-kn WSW wind. This time, run the spill with the "Minimum Regret" solution.

"Zoom in" to your spill area and briefly discuss the difference between the "Best Estimate" (black) and "Minimum Regret" (red) trajectories. Why do you think this type of information would be useful?

> **Hint:** To include the Minimum Regret (Uncertainty) solution, click the "Include the Minimum Regret solution" box under **Model Settings** in the Summary List.

> **Answer:** The "Minimum Regret" solution covers a larger area than the "Best Estimate" solution. This indicates to responders and planners that they must consider oil impacts to be a possibility over a larger area than just the "Best Estimate" solution. Responders may choose to protect a highly valuable resource (such as endangered species) even though the probability of oil impacts is low.

4. Different types of pollutants weather differently. In the previous examples, you were using an imaginary type of oil ("non-weathering") that did not change with time. Now you will run a spill with two different types of products to see how evaporation and dispersion change the oil impacts. Create a linear spill that extends from Sandy Hook to Coney Island, (try from 40° 28.5' N, 74° 0' W to 40° 34.2' N, 74° 0' W). Start the spill on March 26, 2008 at 0800 with no (0-kn) wind. Run one spill with 1,000 bbls of fuel oil #6 (a North Shore crude) and then another spill with the same amount of gasoline. You can record your results from the mass balance in the table below.

	Fuel Oil #6 (barrels)	Gasoline (barrels)
Released	1,000	1,000
Floating		
Beached		
Evaporated and Dispersed		
Off map		

Hints: To remove the old point source spill, select its description ("Non-Weathering: 1000 barrels") under **Spills** in the Summary List. Under the GNOME **Item** menu, select Delete. To quickly set a linear spill at a particular location, click and drag the Spill Tool from any starting point to any end point on the water. In the Spill Information window that opens, you can then enter the exact location of the starting point and end point of the spill.

To view the mass balance for each scenario, click the right-pointing triangle next to the spill description ("Fuel Oil #6: 1000 barrels") under **Spills** in the Summary List. Then click the right-pointing triangle next to "Splot Mass Balance" to view the mass balance for the "Best Estimate" trajectory.

Answer: Heavier oils remain in the environment longer than lighter, refined products. (Your numbers may differ slightly.)

	Fuel Oil #6 (barrels)	Gasoline (barrels)
Released	1,000	1,000
Floating	789	22
Beached	31	1
Evaporated and Dispersed	180	977
Off map	0	0