Examples

Try out these examples to learn the basics of modeling oil spills in Mobile Bay. 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 Guess" 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: As specified in each example.
Model and Spill Start Time: As specified in each example.
Model duration: 1 day, unless specified in a particular example.
Uncertainty: Not included, unless specified in a particular example.
Wind: No wind (constant at 0 knots), unless specified in a particular example.
Pollutant type: Non-weathering, unless specified in a particular example.
River flow: Low (30 kcfs), unless specified in a particular example.
Spill size: 1000 barrels (bbls), unless specified in a particular example.
Spill: (Example 1) A point source midway between the entrance to Mobile Bay and the Theodore Ship Channel at 30° 22' N, 88° 1' W.
(Example 2-4) A point source on the Mobile Ship Channel near Mobile at 30° 37' N, 88° 1' W.
(Example 5) A point source at the entrance to Mobile Bay, near Mobile Point, at 30° 13.49' N, 88° 2.01' W.

Use GNOME's Standard Mode and the Mobile Bay Location File to answer the following questions:

1. Tides are an important part of the circulation in Mobile Bay. To test this, you will start the same spill at two points in the tidal cycle: the beginning of a flood tide (2340 on July 1, 2000) and the beginning of an ebb tide (1215 on July 2, 2000). Place a spill at 30° 22' N, 88° 1' W (about halfway between the Gulf entrance to Mobile Bay and the Theodore Ship Channel) and observe the effects of tides on the spill trajectory and beach impacts.

What are the differences in beach impacts between the two spills?

> **Hints:** When you change the start time of the 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 Date to July 2, 2000 and the Release Start Time to 1215. GNOME will then prompt you to change the model start time to match the spill start time. Click "Change".

Answer: When the spill starts just before the flood tide, most of the beached oil is on the fill island east of Deer River Point and some of the beached oil is on the western end of Theodore Ship Channel. When the spill starts just before the ebb tide, most of the spill is transported out of Mobile Bay towards the Gulf, with some oil beaching on Dauphin and Pelican Islands.

2. The circulation in Mobile Bay is significantly affected by the flow rate of the Mobile River. In this example, you will look at a spill closer to Mobile in the springtime and examine the effects of low and high river runoff on the transport of the spill. Set the spill at 30° 37' N, 88° 1' W and set the run time to 0530 on March 14, 2000 (a flood tide is just starting at this time). Run the spill two times in GNOME, the first time with a low (30 kcfs) river flow and the second time with a high (200 kcfs) river flow. Change the model run duration to 3 days for this example problem.

What are the differences in beach impacts between these two scenarios?

Hints: First, change the spill start time and location. (Double-click the spill description in the Summary List, as you did in Example 1.) Next, change the spill duration. (Double-click "Duration: 24 hours" in the Summary List.)

To change the river flow rate, double-click the name of your Location File, "Mobile Bay," under **Location File** in the Summary List. In the windows that follow, you can change any of the conditions that you set earlier. In this case, you only want to change the river flow rate. In the Setting River Flow window, change the flow rate to "High 200 kcfs." Click "Next" to bypass windows that don't need to be changed. You can then rerun the model with the same spill, under the same conditions, but with a new river flow rate.

Answer: Changing the river flow rate changes the oil spill trajectory, leading to different beach impact areas. When the river flow rate is low, the spill moves further up into the bay on the flood tides, impacting the marsh areas surrounding Mobile, before slowly starting to move toward the bay's entrances. When the river rate is high, the spill moves toward the entrances of Mobile Bay at a *much* faster rate, allowing less time for beach impacts enroute.

3. Wind both moves the oil along the water's surface and drives currents. Rerun the previous spill with the high river flow rate and add a 15-knot wind from the northwest. Run this spill scenario for 2 days.

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

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

Answer: The wind dramatically changes the oil's trajectory! Instead of quickly moving seaward, much of the oil beaches along the eastern shoreline of Mobile Bay, from Seacliff to Palmetto Beach.

4. 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 Guess" solution that you have been running. The "Minimum Regret" solution takes into account our uncertainty in wind, horizontal mixing, and currents. Now you will add the "Minimum Regret" solution to see where else the spill might go.

Rerun the previous spill with a high river flow rate, but first make these changes: (1) change the wind to 15 knots from the east; (2) change the spill start time to 0100 on March 15, 2000; (3) reset the model duration to 1 day; and (4) include the “Minimum Regret” solution.

"Zoom in" to your spill area and briefly discuss the difference between the "Best Guess" (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 Minimum Regret” box under **Model Settings** in the Summary List.

Answer: The "Minimum Regret" solution shows where else the spill could go if the currents, winds or other model inputs were a little bit different. Although our "Best Guess" solution does not show any oil impacts on the fill island, the "Minimum Regret" solution shows that there could be oil contact. Responders use this information to make decisions about how they will allocate response resources. Sometimes a highly valued environmental resource (e.g. an endangered species) may be important enough to protect, even if it has a low probability of being oiled.

5. Different types of pollutants weather differently. In the previous examples, you were using an imaginary type of pollutant that did not change with time ("non-weathering"). Now you are going to run a "What if?" scenario that compares the effects of different types of pollutants.

A barge carrying 10,000 barrels of product grounds at 0530, March 14, 2000 at the entrance to Mobile Bay, near Mobile Point (30° 13.49' N, 88° 2.01' W). The Mobile River is currently running low; winds are from the northwest at 8 knots.

Run the above scenario for a barge containing medium crude and a barge containing gasoline. At the end of your 24-hour prediction, write down the mass balance for each scenario in the table below.

	Medium Crude (bbls)	**Gasoline (bbls)**
Released	10,000	10,000
Floating		
Beached		
Evaporated and Dispersed		
Off map		

Hint: To view the mass balance for each scenario, click the right-pointing triangle next to the spill description ("Medium Crude: 10000 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 Guess" trajectory.

Answer: Heavier oils remain in the environment longer than lighter, refined products. You can see that the beach impacts from the medium crude spill are more extensive than for the gasoline spill. (Your numbers may differ slightly.)

	Medium Crude (bbls)	**Gasoline (bbls)**
Released	10,000	10,000
Floating	1,250	70
Beached	6,520	160
Evaporated and Dispersed	2,230	9,770
Off map	0	0