# Examples

Try out these examples to learn the basics of modeling oil spills in Casco 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, otherwise specified in a particular example.
Uncertainty: Not included, unless specified.
Wind: Constant at 0 knot, unless specified.
Pollutant type: Non-weathering, unless specified.
Spill size: 1000 barrels (bbls), unless specified.
Spill: (Examples 1-3) A point source on Jordan Reef at 43° 37’ N, 70° 11.22’ W
(Example 4) A point source in Portland Harbor at 43° 39’ N, 70° 15.2’ W.

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

**1.** Tides are an important part of the circulation in Casco Bay. In this example, you will examine the effects of tides by starting spills at two different times in the tidal cycle. You will run these spill in GNOME twice, once at the beginning of a flood tide and once at the beginning of an ebb tide.

**(a)** First, set up GNOME for a spill that occurs on February 9, 2001 at 0545 (the beginning of a flood tide). Place a spill on Jordan Reef at 43° 37’ N, 70° 11.22’ W (southeast of the main channel entrance to Portland Harbor).

**Observe the effects of tides on the spill trajectory and beach impacts.**

> **Hint:** 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!)
>
> **Answer:** When the spill starts with the **flood tide**, beach impacts occur as far north as Portland and Great Diamond Island, with extensive beaching in the South Portland area and on the southern islands of the bay.

**Note:** You will need to use the spill settings from this example in Example 2 below. Before moving on, save your settings as a Location File Save (LFS) by choosing **Save** from the GNOME **File** menu.

**(b)** Next, change the spill start times to February 9, 2001 at 1200 (the beginning of an ebb tide).

**Compare the effects of the ebb tide with the previous example.**

> **Hint:** 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 1200**.** GNOME will then prompt you to change the model start time to match the spill start time**.** Click "Change"**.** Because GNOME is set up to adjust the *model* start time to the *spill* start time, you should always change the spill start time first.
>
> **Answer:** When the spill starts on the **ebb tide**, the spill moves back and forth with the tides while slowly moving seaward. This spill affects waters further south and has fewer shoreline impacts overall.

**Note:** Don't forget to save your settings as a Location File Save (LFS) by choosing **Save** from the GNOME **File** menu.

**2.** 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 previous ebb tide scenario (1200 on February 9, 2001), adding a 15-knot wind from the northeast.

**How do the oil's trajectory and shoreline impacts change from the scenario without any wind?**

> **Hint:** To change the wind conditions in GNOME, double-click **Wind** in the Summary List, then enter the wind speed and direction in the Constant Wind window.
>
> **Answer:** Wind dramatically changes the oil's trajectory and causes the floating oil to beach. In the scenario with no wind, the oil moved south along the coast; however, in the "wind" scenario, most of the oil beaches along the northeastern shoreline of Cape Elizabeth.

**3.** Forecasts of environmental parameters are inherently uncertain. For example, wind and weather forecasts can be "off" in the speed, direction, or timing of the 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 flood tide spill from Example 1 (0545 on February 9, 2001), but first make these changes: (1) change the wind to 8 knots from the south; and (2) include the “Minimum Regret” solution.

**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:** Although our “Best Guess” solution shows very little, if any, oil impact on Long Island or in Portland Harbor at the mouth of the Fore River, the “Minimum Regret” solution shows that there could be oil contact in these areas. Responders use the "minimum regret" trajectory 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.

**4.** Different types of pollutants weather differently. In the previous examples, the pollutant that spilled did not change with time (it was "non-weathering"). Now you are going to run a “What if?” scenario that compares the effects of different types of pollutants.

A tanker loading product at 2:30 p.m. (1430), July 24, 2001 in Portland Harbor spills oil into the harbor (43° 39’ N, 70° 15.2’ W). At the time of the spill, winds were from the southwest at 4 knots.

Run the above scenario for a tanker spilling **fuel oil #6** and for a tanker spilling **jet fuel**. At the end of your 24-hour prediction, write down the mass balance for each scenario in the table below.

**How does the "weathering" of these pollutants affect the spill impacts?**

> **Hint:** 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 Guess” trajectory.

| | **Fuel Oil #6 (barrels)** | **Jet Fuel (barrels)** |
|---|---|---|
| Released | 1,000 | 1,000 |
| Floating | | |
| Beached | | |
| Evaporated and Dispersed | | |
| Off map | | |

**Answer:** Heavier oils remain in the environment longer than lighter, refined products. You can see that the beach impacts from the fuel oil are more extensive than for the jet fuel. Much more jet fuel than fuel oil has evaporated and dispersed. (Your numbers may differ slightly.)

| | **Fuel Oil #6 (barrels)** | **Jet Fuel (barrels)** |
|---|---|---|
| Released | 1,000 | 1,000 |
| Floating | 383 | 123 |
| Beached | 486 | 152 |
| Evaporated and Dispersed | 181 | 725 |
| Off map | 0 | 0 |