Examples

Try out these examples to learn the basics of modeling oil spills in the Strait of Juan de Fuca. Explore how winds, current reversals, and changing tides can affect the trajectories of oil slicks. In addition, you'll see 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: 2 days.
Uncertainty: Not included, unless specified in a particular example.
Conditions at the entrance to the strait: Normal, unless specified.
Wind: No wind (constant at 0 knots), unless specified.
Pollutant type: Non-weathering, unless specified.
Spill size: 1000 barrels.
Spill: As specified in each example.

Use GNOME's Standard Mode and the Strait of Juan de Fuca Location File to answer the following questions:

1. On July 13, 2001, a vessel traveling the inbound lane of the Strait of Juan de Fuca begins to leak medium crude while transiting from 48° 20'N, 124° 20'W to 48° 14'N, 124° W. The release occurs at 0930 and the oil continues to leak over a two-hour period.

Try the following conditions to see how the current reversal and wind can affect the trajectory:

(a) Conditions at the entrance to the strait: normal; no wind.

(b) Current reversal (mild to strong); no wind.

(c) A 10-knot east wind with any of the previous cases.

How do the beach impacts differ in each case? How does the trajectory change?

> **Hints:** To easily set a line spill, click and drag the spill tool from the *any* starting point on the water area of the map to the *any* endpoint. In the Spill Information window that opens, you can then enter the exact latitude and longitude of the starting point and endpoint. (This method is much easier than moving your mouse around the map and watching its location in the lower left corner of the window!) To simulate a leak that occurs over time, check the "Different end release time" box, then enter the End Time (1130).

To change the current reversal conditions, but keep all other Location File settings the same, double-click the name of your Location File, "Strait of Juan de Fuca," under **Location File** in the left section of the Map Window (the Summary List). The Location File Welcome window will appear, followed by windows with all the settings you had previously chosen. You only have to enter information that you would like to change. You can then rerun the model with the same spill, under the same conditions, but with a new current reversal condition.

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:

(a) Conditions at the entrance to the strait: normal; no wind.

The spill travels west along the strait; very little of the oil beaches.

(b) Current reversal (mild to strong); no wind.

As the current reversal increases, the spill is carried further east. Beach impacts are minimal.

(c) A 10-knot east wind with any of the previous cases.

The wind causes the oil in each scenario to beach more quickly and more extensively on the north coast of Washington.

2(a) Set a spill at the mouth of Admiralty Inlet (48° 11.35'N, 122° 48.87'W) at 0200 on July 22, 2001, with a light (10-knot) wind from the east. Choose normal conditions at the entrance to the strait. Run trajectories with the "minimum regret" solution for a 2-day spill simulation first with a light product (gasoline), then with a heavy product (fuel oil #6).

Compare the differences in risk to Dungeness Spit (approximately 48° 10'N, 123° 8'W) from the two different products.

> **Hints:** To remove the spill from Example 1, select the spill's description ("Medium Crude: 1000 barrels") under **Spills** in the Summary List. Under the GNOME **Item** menu, select Delete.
>
> To quickly set a spill at a new location, simply double-click the Spill Tool on the GNOME toolbar. You can then enter the *exact* latitude and longitude of the spill in the Spill Information window.
>
> To include the Minimum Regret (Uncertainty) solution, click the box labeled "Include the Minimum Regret solution" under **Model Settings** in the Summary List.

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

Answer: Heavier oils remain in the environment longer than lighter, refined products. Beach impacts from the fuel oil spill are much more extensive around Dungeness Spit than for the gasoline spill, most of which evaporated and dispersed. (To view the mass balance for a 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.)

2(b) Can you change the wind to make the beach impacts more extensive?

Answer: Any wind with a southerly component will certainly increase beach impacts. You just need one strong enough to beach the gasoline spill *quickly*.

2(c) Try starting the fuel oil spill (your saved file) at a different part of the tide cycle. Move the start time to 1130. Change the wind conditions back to a 10-knot wind from the east.

How do beach impacts change? Where is the uncertainty?

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 ("Fuel Oil #6: 1000 barrels") under **Spills** in the Summary List. 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: More oil beaches in the spill that occurs at 1130 than in the 0200 spill (about 31% compared with about 14%, respectively). GNOME's "Minimum Regret" solution takes into account uncertainty in wind, horizontal mixing, and currents. Areas that are uncertain after this spill include regions of Dungeness Spit, the western shoreline of Sequim Bay, Protection Island, and Port Townsend.