Examples

Try out these examples to learn the basics of modeling oil spills in Kaneohe Bay, Hawaii. 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:

Wind: Constant at 0 knot, unless otherwise specified in a particular example.
Pollutant type: Non-weathering, unless specified.
Model duration: 1 day.
Uncertainty: Not included, unless specified.

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

1. Tides are an important part of the circulation within Kaneohe Bay. To compare the effects of tides in this region, you will simulate a 100-barrel spill off Kualoa Point at 21° 30.7'N, 157° 49.26'W. Start the spill at two different times in the tidal cycle, once at the beginning of a flood tide (8:15 p.m. on Jan. 9, 2001) and once at the beginning of an ebb tide (3:15 a.m. on Jan 10, 2001). Set a constant wind from the east at 5 knots and observe the effects of the spills after 24 hours.

"Zoom in" to the spill area and discuss the differences in the trajectories and beach impacts between these two spills.

    Hints: (1) To easily set a spill at a particular location, simply click *anywhere* in 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!) (2) 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 Time to 0315 on January 10, 2001. 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: The spill that occurred at flood tide has greater impacts within the bay. The spill that occurred at ebb tide, on the other hand, has greater impacts up the coast, with heavy beaching from Kualoa Point to Kaaawa

Point. Knowing the time when a spill occurs is very important for making good spill trajectory predictions in areas with significant tidal currents.

2. Wind both moves the oil along the water's surface and drives currents. To see how changing winds affect an oil slick's trajectory, run a new spill scenario with a release that occurred north of Moku Manu at 21° 28.83'N, 157° 43.3'W. This 70,000-gallon "spill" occurred at 3:15 a.m. on Jan. 10, 2001 (the same time as the previous example). Run this scenario once with no wind, then rerun it with a 10-knot east wind.

How does the oil's trajectory change with the addition of wind?

   Hint: (1) To change the spill conditions, double-click the description of the spill as you did in Example 1. In the Spill Information window, change the amount and location of the release. (2) To change the wind conditions, double-click **Wind** in the Summary List, then change the wind speed and direction in the Constant Wind window.

   Answer: The wind dramatically changes the oil's trajectory! With no wind, the oil remains out in the water; however, with the 10-knot wind, shoreline oiling is *very* heavy in the northern sections of the bay and up the coast.

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 Guess" solution that you have been running. The "Minimum Regret" solution takes into account our uncertainty in wind, horizontal mixing, and currents. Now you run a spill that includes the "Minimum Regret" solution to see where the spill is expected to go, and where else the spill *might* go.

Rerun the previous scenario (with the 10-knot east wind). This time, run GNOME with 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. In this case, the "Minimum Regret" solution shows that the spill impacts could be much more severe, with the possibility of pollutant reaching as far north as Kaoio Point and as far south as Moku o Loe (Coconut) Island, a marine life conservation district. The area around Pyramid Rock on Mokapu Peninsula could also be impacted.

Responders use both the "Best Guess" and "Minimum Regret" trajectories to make decisions about how they will allocate response resources. Sometimes a highly valued environmental resource (e.g. an endangered species, or a sensitive habitat such as a coral reef) 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 will compare the effects of different types of pollutants.

Run two scenarios for a "spill" that occurs within Kaneohe Bay at 21° 26.38'N, 157° 47.85'W. The spill occurs at 2:00 p.m. on July 2, 2000. Winds at the time were 0 knot. First simulate a spill of 70,000 gallons of **fuel oil #6** (a common fuel on merchant vessels), then simulate a spill of the same amount of **jet fuel**. You can record the mass balance for each scenario in the table below.

	Fuel Oil #6 (gallons)	Jet Fuel (gallons)
Released	70,000	70,000
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 ("Fuel Oil #6: 70000 gallons") 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. The longer a product is in the water, the larger the area that could be impacted. In this example, you should note that much of the jet fuel (about 70%) evaporated and dispersed within 24 hours. In contrast, only about 15-20% of the fuel oil #6 evaporated and dispersed. (Your numbers may differ slightly.)

	Fuel Oil #6 (gallons)	Jet Fuel (gallons)
Released	70,000	70,000
Floating	46,200	15,330
Beached	11,130	3,920
Evaporated and Dispersed	12,670	50,750
Off map	0	0