

Estimate the size of the 2010 Deepwater Horizon Oil Spill Using Google Earth

In addition to allowing you to view the world through its own satellite imagery, Google earth lets you import data layers (other satellite images, historic maps, demographic information, etc.) into Google earth. (After you open Google earth, have a look at the Layers section on the left to see the data layers already included.)

Google earth takes a flat satellite image (or a flat map) and georectifies it -- i.e., when importing the image, it takes into consideration the curve of the earth and key coordinates in Google earth and the image and bends the image to fit.

You will be using Google Earth to estimate the size of the oil spill that could be seen on the top of the ocean. This is what SkyTruth did to get its estimates of the number of barrels of oil being released from the Deepwater Horizon rig after the explosion.

There are three steps to estimating the area of the spill:

1. Open the KMZ file that includes satellite imagery from April 25, April 27, April 29 and May 1. Save and rename the file, if you wish.
2. Draw a polygon around the oil spill in each satellite image.
3. Once you have finished drawing the polygon, get the measurement in square kilometers.

① Open the KMZ file and save it

To open and the view satellite images of the oil spill in Google earth:

1. Click on the link to the Deepwater Horizon Oil Spill KMZ file in the left column.
2. Save the file to your desktop or another area that has been specified by your teacher. (Your teacher or school's tech support person may have already done this step.)
3. Double-click on the KMZ file to open it in Google earth.

Why are the files you open in Google earth called KMZ and KML files?

KMZ stands for Keyhole Markup language Zipped. A single layer is called a KML, which stands for Keyhole Markup Language. The company that originally built the technology that Google Earth uses was called Keyhole, and they named the computer language they use after the company. By the way, the founders of Keyhole named their company after KH, a series of spy satellites built by the CIA. Using the satellites to gather intelligence was supposed to be as easy as spying through a keyhole.

4. The KMZ file will automatically open to satellite imagery from April 25. If it is not already checked, click the checkbox next to the Deepwater Horizon Oil Spill KMZ. The approximate placement of the Deepwater Horizon underground oil leak is marked.
5. Before you begin working with the satellite image, move the KMZ file from Temporary Places to My Places. If you don't do this, any changes you make to the KMZ file will be lost if Google earth unexpectedly closes for some reason. To do this:
 - a. Right-click on the KMZ file in Places >> Temporary Places on the left side of Google earth. Select Save to My Places. This moves the KMZ file from Temporary Places to My Places.
 - b. Click the arrow to the left of the KMZ file. This will open up the layers that include satellite imagery for each date.
 - c. If multiple people will be using the computer you're working on, you may want to save your KMZ file by a different name. To do that, right-click on the KMZ file and select Rename.

② Draw a polygon around the oil spill

The next step is to draw a polygon around the oil spill. It's easiest to do this if you are looking straight down on the map with North at the top. To adjust the map, click on the satellite image, then type R. (You can do this any time the map orientation needs adjusting, as long as no dialog boxes are open.)

Before you start to draw your polygon, make sure that you have the oil spill sized large enough to be able to draw a polygon around it. Also make sure that the entire spill is visible on the screen. While you are drawing a polygon, you can't move or resize the map.

To draw a polygon around an oil spill:

1. If not already selected, click the radio button next to the satellite image you will be working with.
2. Click the polygon icon in the top menu:  (If you hover your mouse over the icons, you'll see a tooltip that describes what each tool does.)
3. A "New Polygon" dialog box opens. Note that this box must be open while you are drawing your polygon. (It may open on top of your map; if this is the case, you can drag it out of the way so you can see the oil spill.)
4. Give your polygon a name, then click the Style, Color tab to select colors for the fill and outline of your polygon. Try setting your Polygon Area opacity to 0% so you can see the oil slick while you draw it. You

Google earth Tips and Tricks:

Click + R - Re-ori-ents your view to looking straight down with North at the top.

The Exit ground-level view button (top right) will get you back to viewing the world from above.

Drawing polygons - the dialog box must stay open in order to draw. Don't click OK until you are finished and ready to save your work.

The New Polygon dialog box will almost always cover up your work area but you can drag it out of the way.

can change the outline and fill settings after you've drawn your polygon.

5. Use your mouse to draw a line around the spill. You can also use your mouse to click points and these will stitch themselves together into a polygon. If you want to adjust your points, you can tap and move them. You can also delete a point by selecting it (click on it) and then right-clicking.
6. When you are finished, click the OK button at the bottom of the New Polygon dialog box. (This saves your work.)

③ Get the measurement of the oil spill

1. Right click the polygon layer that you just created and select Properties.
2. Click the Measurement tab. Write down the Area in square kilometers.
3. You can print out the worksheet in this Guide to write down measurements and do your calculations of volume and flow rate.

You can see a lot of strange and wonderful things using satellites. Plug these coordinates into the Search box (top left of Google earth) to see a few. Some are pretty small, you may have to zoom in to see them.

19°56'56.96"S 69°38'1.83"W
 38°29'0.16"N 109°40'52.80"W
 -25.344375, 131.034401
 51.848637, -0.55462
 35.027185, -111.022388
 44.525049, -110.83819
 -33.350534, -71.653268
 -33.867886, -63.987
 26.357896, 127.783809

Oil Spill Flow Rate Calculations Worksheet

Here's how SkyTruth calculated the minimum flow rate of the oil spill on a given day.

- ① Use your square kilometers measurement find cubic meters of oil. Multiply area (square kilometers) by depth (1 micron, or μ), using meters as your common measurement.

$$\begin{aligned}
 1 \text{ km}^2 &= 1,000,000 \text{ m}^2 \text{ OR } 1 \times 10^6 \text{ m}^2 \\
 1 \mu &= 1/1,000,000 \text{ m}^2 \text{ OR } 1 \times 10^{-6} \text{ m}^2 \\
 1 \text{ km}^2 \times 1 \mu &= 1,000,000 \text{ m}^2 \times 1/1,000,000 \text{ m} = 1 \text{ m}^3
 \end{aligned}$$

If your polygon area measured 5,783 km^2 , which is the number SkyTruth go on April 27, 2010, then you would have 5,783 m^3 of oil.

date	km^2	m^3
April 25, 2010		
April 27, 2010		
April 29, 2010		
May 1, 2010		

- ② Next convert cubic meters to slick volume, in liters.

$$\begin{aligned}
 1 \text{ m}^3 &= 10 \times 10 \times 10 \text{ L} = 1,000 \text{ L} \\
 \text{Slick Volume} &= V \text{ L (volume in liters)} \\
 \text{Slick Area} &= A \text{ km}^2 \\
 V_L &= A \times 1,000 \\
 1 \text{ L} &= 0.00628981077 \text{ bbl} \\
 V_{\text{bbl}} &= A \times 1,000 \times 0.00628981077
 \end{aligned}$$

V_{bbl}	=	A	X	1,000	X	0.00628981077	=	L
								L

- ③ Now calculate the flow rate/per day.

Flow rate = total V_{bbl} of oil leaked/ number of days leaking

V_{bbl}	/	days	=	barrels/day