

Measuring flow rates and volumes of active volcanoes

*We'll begin by looking at some images of a volcano, taken over a span of 3 days.
Download and unzip the Ex. 9 folder to the Desktop.*

1. Start Scion Image (Start Menu, Programs, Scion Image). “Import” (File menu) the file called ‘c1.78L’, located in the Ex. 9 folder. This is a perspective view of the flank of Kilauea where the color is the radar correlation value.
2. Locate the Pu’o O’o cinder cone and some of the small craters in the chain of craters. Near the bottom of the image, find several bands of decorrelation that are lava flows. Other decorrelation areas are vegetation.
3. Compare the flows shown in this image with others shown in ‘c1.89L’ and ‘c1.910’. (You’ll probably want to “Import” all of these images so that they are all open at once.) What differences can you find? How do you explain them?
4. Close all of these images and examine the ‘Correlation Coefficients.tif’. (Since it’s a .tif file you can just ‘Open’ it, though ‘Importing’ works fine too.)
5. Which flows increased over the 3 days? Which decreased? Identify flow regions 1, 2, and 3 for your future reference. You may want to leave this image open to aid you in the rest of the lab.

Now we will begin to quantify these results.

6. Import the file ‘c1.78L.crop.TIF’. Identify the three lava flow regions.
7. Under ‘Options’, select ‘Threshold’. Note that the image turns fully black and white.
8. Place the cursor on the color lookup table (LUT) on the left and adjust the threshold values such that the lava flows are white and the background black.
9. Under the ‘Process’ menu, select ‘Binary’, then ‘Make Binary’.
10. Select the magic wand tool located near the bottom of the tool bar, in the left column (not the zoom tool). Place the wand on a flow and click the mouse. The flow should now be selected by a flashing outline.

Calibration

11. Under the 'Analyze' menu, select "Set Scale" and choose 'meters'. Enter a measured distance of 1 pixel, and a known distance of 15 meters. The scale should read 0.067 meters/pixel. Click OK.
12. Under the 'Analyze' menu, pick 'Measure'. In the info box note the pixel count and the area in square meters.
13. Record the area on the attached table. Make sure that your results seem reasonable.
14. Repeat the measurement for each flow region in each image. If you select multiple small flows for a given region, record each measurement. For those regions with multiple measurements, calculate the total area covered.
15. Assume an average flow thickness of a half-meter. What is the volume of each flow? (You can find a calculator at 'Start Menu, Programs, Accessories, Calculator.') You can round off any excess digits (485627 → 490000, or even 500000, etc).
16. What is the area of each flow for each day? What can you say about flow distribution?
17. What is the total effusion rate (volume of lava production) in cubic meters per day, for each day? Is this rate constant?
18. Briefly summarize what you have discovered about lava production on Kilauea for these days.
19. When you are finished, close Scion Image, log out of your PC, and enjoy the fact that you're done the last computer lab.

| | Days 7-8 | Days 8-9 | Days 9-10 |
|---------------|----------|----------|-----------|
| Flow Region 1 | | | |
| Flow Region 2 | | | |
| Flow Region 3 | | | |