

Measure A Changing Volcano

Activity from UNAVCO:

www.unavco.org/education/outreach/demonstrations/measure-changing-volcano/measure-changing-volcano.html

Demonstration Length

30 minutes to construct

5 – 20 minutes to demonstrate

About the demonstration

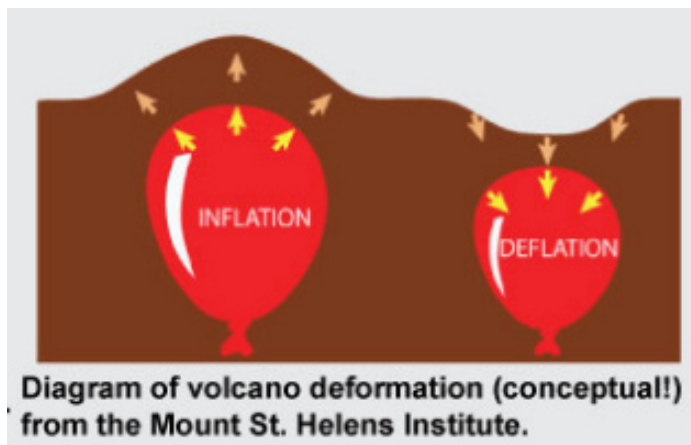
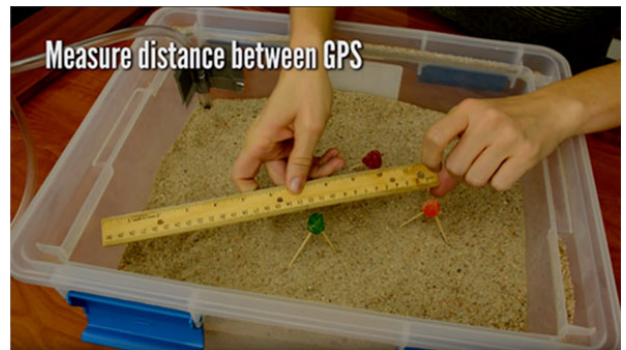
This hands-on demonstration illustrates how GPS can be used to measure the inflation and deflation of a volcano. It also shows how the rocks at the summit of a volcano weaken and crack to form a crater or caldera as the volcano inflates and deflates. The difference between a volcanic caldera and a volcanic crater is that calderas are really wide, often more than a mile in diameter. The Yellowstone caldera is approximately 50 miles (80 km) long and 40 miles (65 km) wide!

Major concepts

- Volcanic craters and calderas can form by the collapse of the rock near the summit without an eruption.
- Volcanoes inflate (pressurize) and deflate (depressurize) without necessarily erupting (diagram below).
- We can understand what's going on inside a volcano by measuring changes at the surface, even a few millimeters of movement, using GPS.
- Most craters form slowly over time as the volcano inflates and deflates, deforming and weakening the rocks near the summit.
- The volcano's magma chamber is made up of sponge-like rock.

Supplies

- A box, approximately 8" x 8" x 6" (shoe boxes work well or small storage boxes)
- 5 - 10 lbs flour (2 bags of flour works well)
- Red balloon - small
- Balloon pump (optional, and worth it)
- 2 feet of flexible tubing (1/4-inch diameter)
- Duct or packaging tape
- Gumdrops and toothpicks (to make GPS models)



Screen grabs from UNAVCO video showing steps for this activity. Watch video here.: <https://youtu.be/9x8kNI5grHU>

Instructions for assembly (images at right)

1. Tape the balloon onto tubing and tape tubing firmly to the bottom of container - off center.
2. Attach the other end of the tubing to the balloon pump (cut small hole in tubing at the pump to let out air).
3. Cover the balloon with 3-5 inches of flour.
4. For an added touch, make GPS monuments out of toothpicks and gumdrops, and place on either side of the balloon to measure the inflation and deflation of the volcano.

Leading the demonstration

1. Invite visitors to place GPS instruments on the flour to measure the inflation and deflation of the volcano.
2. Pump air slowly to inflate the balloon to form radial and ring fractures. Invite visitors to comment on their observations.
3. After a few pumps, let some air out to form a small caldera. Repeat.
4. While visitors observe, allow the balloon to deflate quickly.

Optional: Have visitors measure the distance between the GPS instruments at various stages while inflating the volcano.

Sample questions to consider

- What is the first sign the volcano is changing?
- What patterns do you see in the cracks?
- Did the GPS instruments change their position?
- How did the GPS instruments move (farther apart, closer together, up, down?)

Points to remember

- The demonstration illustrates that fractures develop over time and calderas can form without an eruption.
- Flour fractures and collapses in a similar pattern to rock.
- Most volcanoes have one source of magma, similar to this model.
- Flour is not rock. Rock is much stronger.
- Magma chambers aren't really like empty balloons. As magma moves through a magma chamber, it melts the rock, pushes rock out of way, and squeezes into rock cracks. Some of the magma escapes as lava.
- Magma is very hot, hot enough to melt rock. This demonstration is at room temperature.

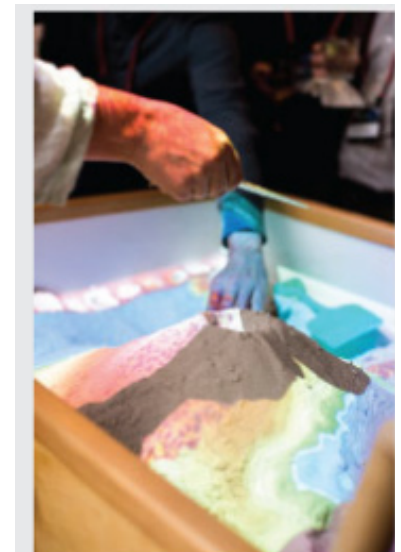
More ideas!

- Use flour or spackling compound to illustrate other faults and fractures. The model below illustrates regions undergoing extension, creating basins and ranges, such as in Nevada and western Utah.
- To emphasize overall deformation (instead of fracturing and caldera formation), use sand. This also works in an augmented-reality sandbox! Watch augmented-reality video:

<https://youtu.be/3G3SG9vAipg>



Top: Parts. Center: balloon taped to bottom of plastic tub. Lower: Flour buries the balloon.



Augmented-reality flour volcano.