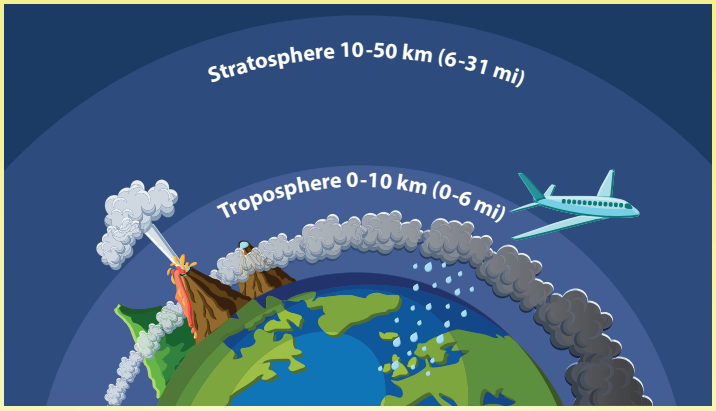
Sky High: Keeping Track of Volcano Plumes

eo Kids

When a volcano erupts, it spews more than just lava. Rocks fly, steam rises, and plumes of gas and ash are blown far and high into the sky. Satellites give us an excellent point of view to accurately track these **volcanic plumes**. It is important to monitor the ash and gas because if they rise all the way up to the **stratosphere** they can affect airplanes, weather, and climate.



Ash and Airplanes: Safety in the Stratosphere

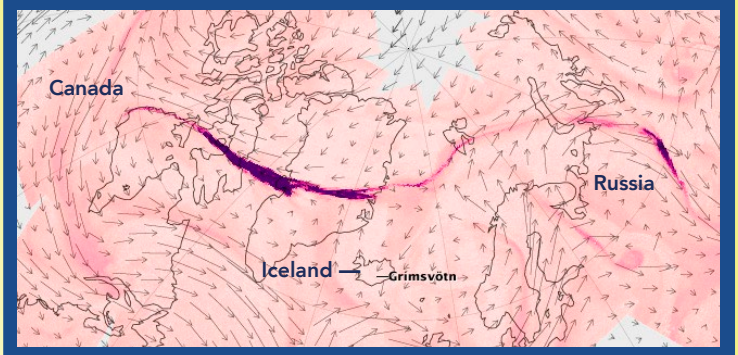
Volcanic ash is made up of tiny pieces of jagged, rough volcanic glass, which is sharper than volcanic rock. If the ash rises high enough, it can destroy jet engines. This is why airplanes are often grounded after a volcanic eruption.

Klyuchevskoi is one of the most active volcanoes on the Kamchatka Peninsula in Russia. In 2013, astronauts took this photo of the erupting volcano from the International Space Station.

Sky High Volcanic Gas: Sulfur Dioxide

Sulfur dioxide is one of the most plentiful gases emitted by volcanoes. It is invisible to the naked eye, but we can see it with instruments on satellites.

In May 2011, Iceland's Grímsvötn volcano erupted and sent volcanic ash and gas into the stratosphere. Within 5 days, strong winds in the upper atmosphere spread sulfur dioxide north and then to the east and west, stretching into Canada and Russia.



Sulfur dioxide is not really dangerous to planes or people, but it can have a big impact on the weather and climate. Sulfur dioxide reacts with water vapor to create tiny, light-colored particles (aerosols) that reflect sunlight back into space. This can cool the Earth for a while. Some very large eruptions have been known to cool the planet by several degrees for several years.

Vocabulary:

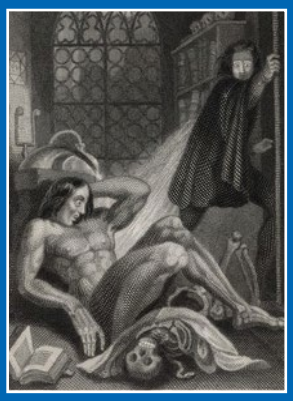
volcanic plume – A column of spreading volcanic ash and gas.

stratosphere – A layer of the Earth's atmosphere between approximately 10 and 50 kilometers (6 to 30 miles) above the ground.

sulfur dioxide – An invisible, colorless, and smelly gas (smells like rotten eggs).

The Year Without a Summer

The Mount Tambora eruption in 1815 blocked sunlight and caused the world to cool by as much as 3 degrees Celsius (5 degrees Fahrenheit) for several years. Around the world, crops failed and livestock died; people starved. It was also during this dark, cold, and gloomy time that Mary Shelly wrote *Frankenstein*.



Acid Rain

Sulfur dioxide can build up in the lower levels of the Earth's atmosphere. Luckily, rain washes it out. However, this rain is acidic ("acid rain").

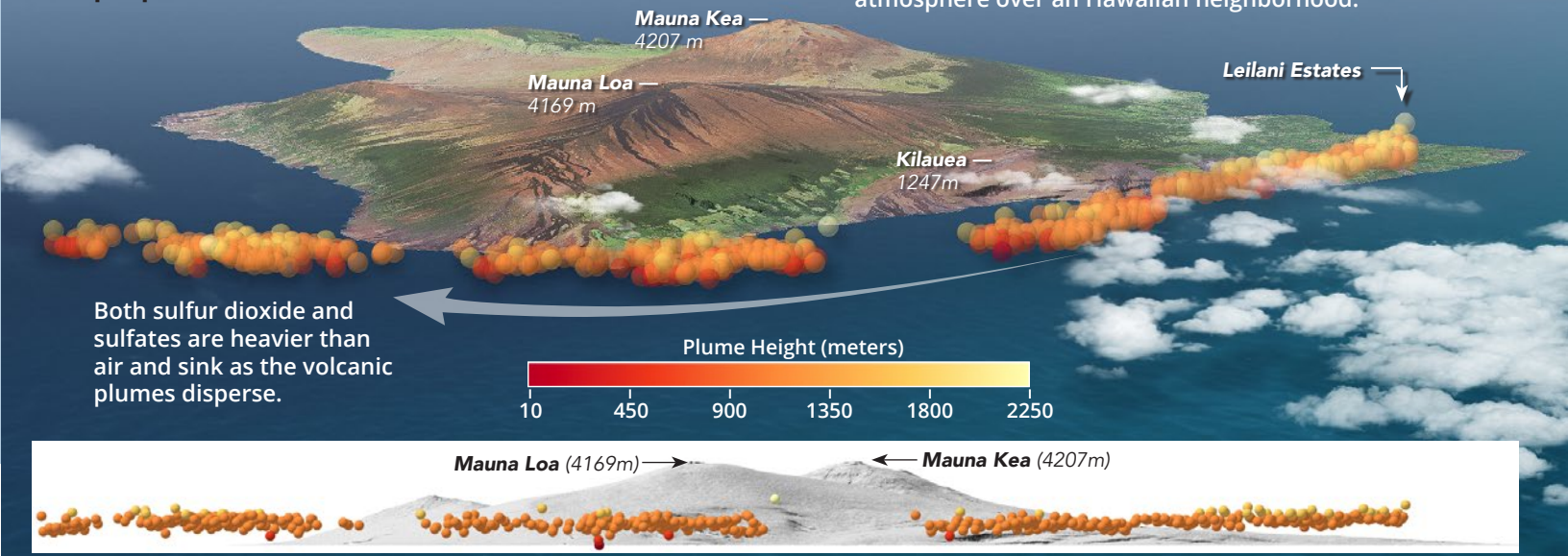
Kilauea Erupts!

Kilauea volcano in Hawaii has been continuously erupting since 1983. It is known for its steady flows of lava and lack of explosive eruptions. However, on May 3, 2018, new cracks (fissures) opened and released lava and sulfur dioxide into nearby neighborhoods. The sulfur dioxide did not travel as far as the gas in some more explosive eruptions because it didn't reach the stratosphere. But for the residents of Hawaii, the air quality could have become dangerous if the gas lingered near the ground. Fortunately, winds carried the plume of sulfur dioxide over the ocean and away from the people.

Tracking Plumes from Space

When volcanic plumes rise into the stratosphere, where winds are often stronger than the lower atmosphere, volcanic material can spread over great distances. In 2011, stratospheric winds spread sulfur dioxide from the Puyehue-Cordón Caulle eruption in South America almost completely around the world.

Along with lava, plumes of water vapor, carbon dioxide, and sulfur dioxide gas were released into the atmosphere over an Hawaiian neighborhood.



Both sulfur dioxide and sulfates are heavier than air and sink as the volcanic plumes disperse.

For image credits and resource links, visit earthobservatory.nasa.gov/eokids

Data Detective

9 Eyes in the Sky: 3-D Volcanoes

We know that volcanic plumes can rise really high into the atmosphere, but how do satellites know how high the plumes travel?

Humans have two eyes that see the world from two slightly different angles. This allows us to see the world in three dimensions. It is called binocular vision. One satellite carries an instrument that has nine "eyes" that look at Earth from different angles.

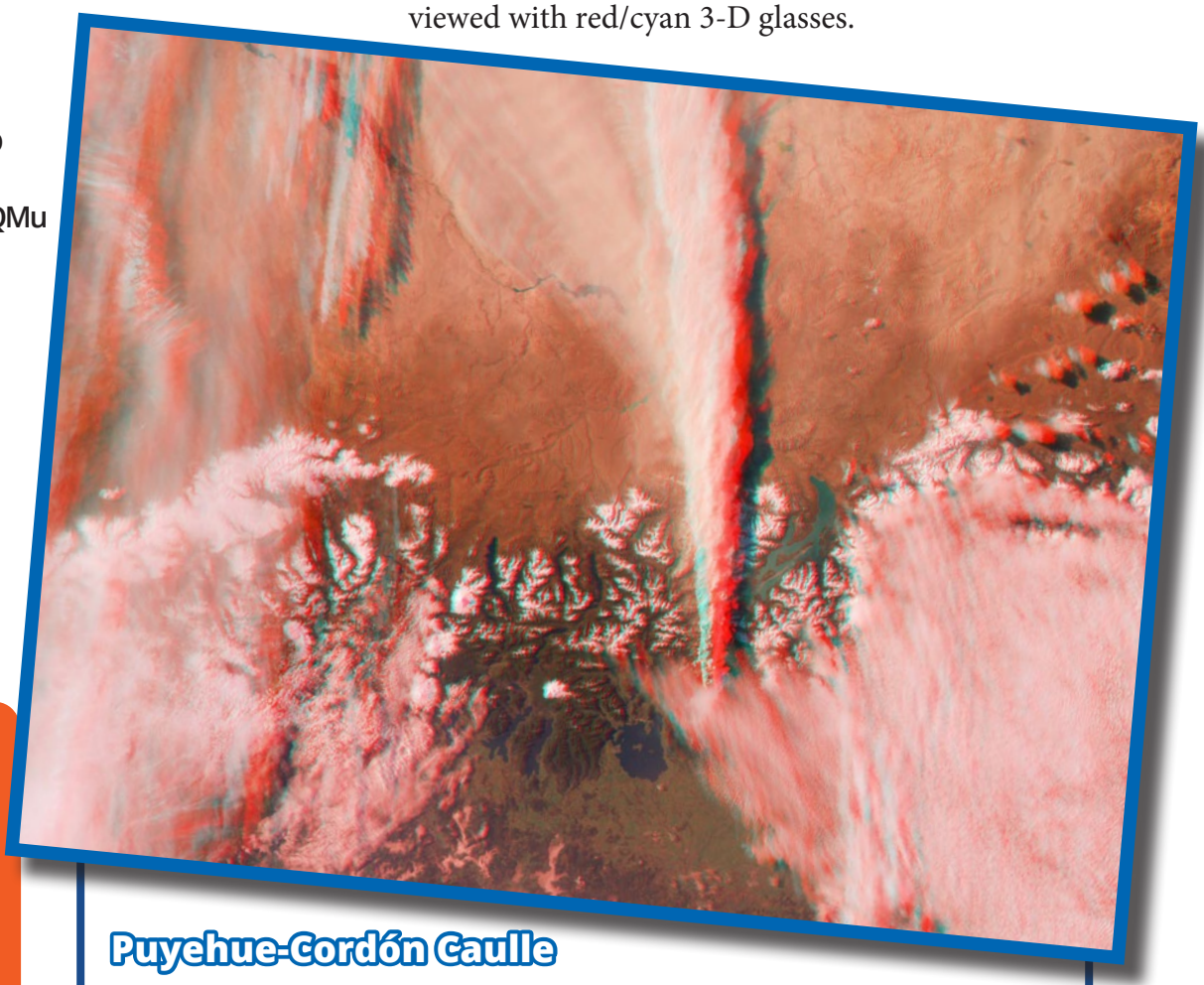
The satellite is Terra, and the instrument is the Multi-angle Imaging SpectroRadiometer (MISR). These different views of volcanic eruptions make it possible for scientists to measure how high the plumes go. When we use two of the nine angles we can produce some pretty cool images that can be viewed with red/cyan 3-D glasses.

Materials:

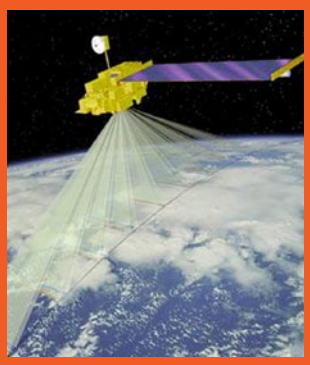
- a pair of red/cyan 3D glasses (make one https://go.usa.gov/xQQMu or order online)
- this image of the Puyehue-Cordón Caulle eruption

Check it out!

1. Use the glasses to look at the image with the red lens over your left eye.
2. What do you see?



MISR on the Terra satellite with its nine sensors views the Earth from multiple angles.



Puyehue-Cordón Caulle

This image of the 2011 eruption of Puyehue-Cordón Caulle was created by using two of MISRs nine views (straight down and forward). When this image is viewed with the red/cyan glasses, your left eye sees the straight-down image and your right eye sees the forward image. Your brain processes this information, so that you see one three-dimensional image.

Answers for page 4 activity: 1. sulfur dioxide; 2. sulfur dioxide; 3. sulfur dioxide

Data Viz Flipping for Volcanoes

On April 22, 2015, the Calbuco volcano in Chile erupted ash and gas more than 15 kilometers (9 miles) into the sky. The strong winds of the stratosphere carried the plume on a journey for miles around the globe.

Scientists use data from the Suomi NPP satellite to create maps of volcanic clouds. This information can be used to forecast where dangerous clouds of ash are spreading, helping pilots avoid areas where such debris could damage their airplanes.

Make a Volcano Animation

Make your own flipbook animation to track aerosols and sulfur dioxide from the 2015 eruption of Calbuco.

Materials:

- Flipbook images (pages 5-8)
- Color printer
- White card stock
- Scissors
- Binder clip

Calbuco Volcano erupting over Puerto Montt, Chile

1. Print flipbook pages double-sided on card-stock and cut along dotted lines.

2. Stack the frames in numerical order from 1 to 35.

3. Clip together the left side of the stack with a binder clip.

4. Flip through the stack quickly and watch the animation.

Think Like a Scientist

1. Which traveled farther: ash or sulfur dioxide?
2. Which traveled faster: ash or sulfur dioxide?
3. Which lingered for the longest time?

Answers on page 3

Try This!

Make your own volcano visualization. Draw or rubber stamp an eruption on each frame and flip the pages to see your volcano in action.

Calbuco Erupts! Make your own data visualization of volcanic ash and sulfur dioxide.

Binder Clip Here

EO Kids: Flipbook

Calbuco Volcano April 2015 Eruption

Sulfur Dioxide

Less More

Volcanic Ash

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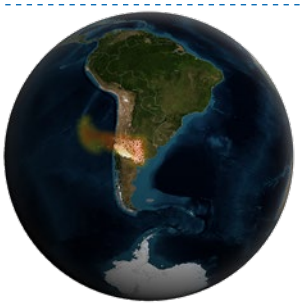
9 

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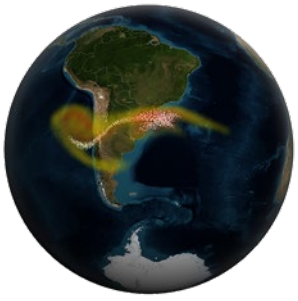
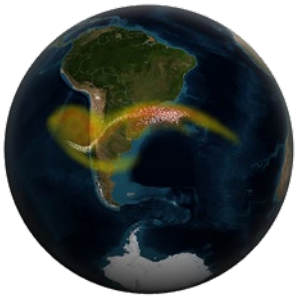
16 

17 

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Make your own volcano animation on the flip-side.

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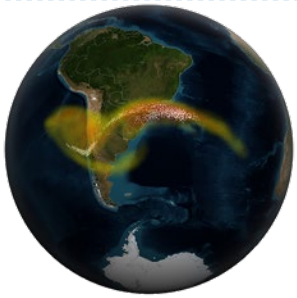
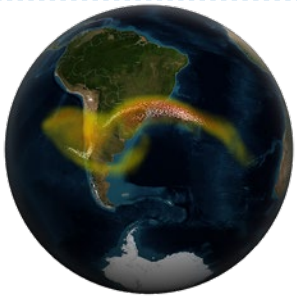
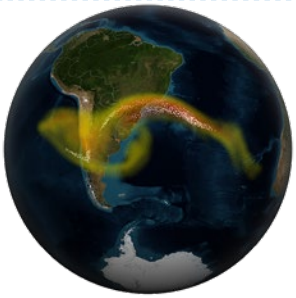
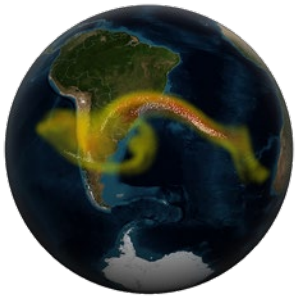
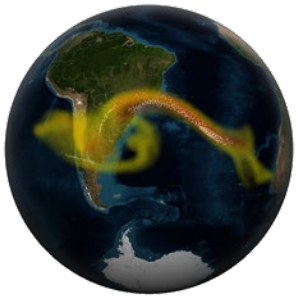
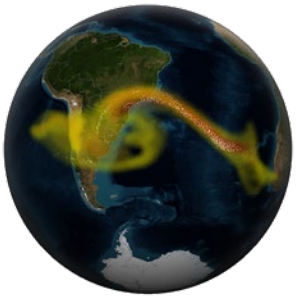
18 

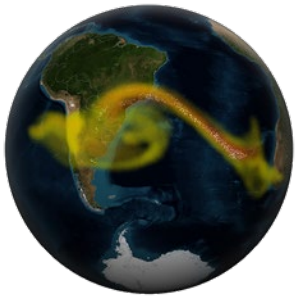
19 

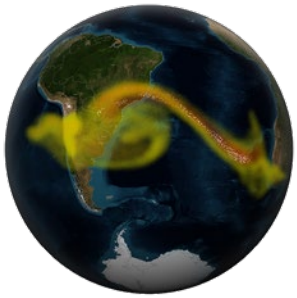
20 

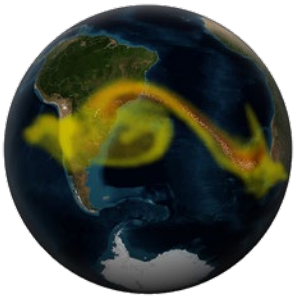
21 

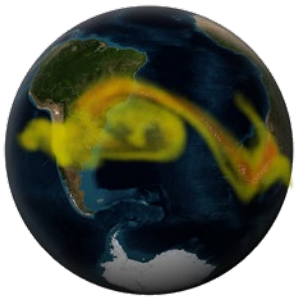
22 

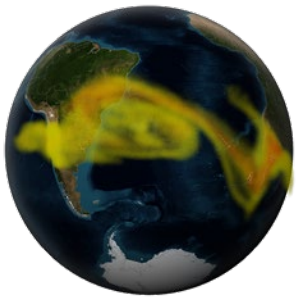
23 

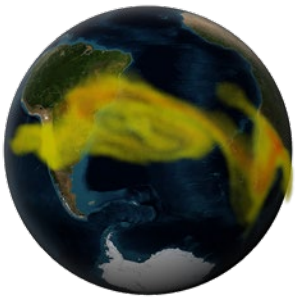
24 

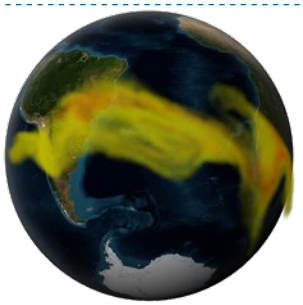
25 

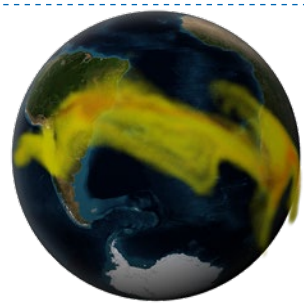
26 

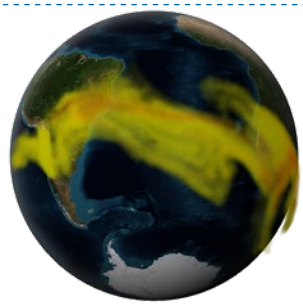
27 

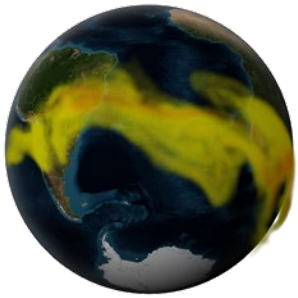
28 

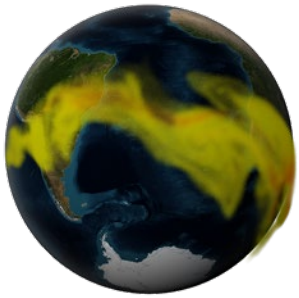
29 

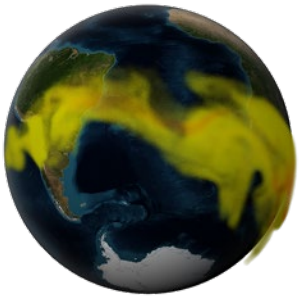
30 

31 

32 

33 

34 

35 

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