# Living With VOLCANOES

Renewal – August 22, 1999

## Mount St. Helens

Post-eruption – August 23, 1985

Pre-eruption – September 2, 1972

**EOSDIS**
**Data, Services, and Information**
***from the DAAC Alliance***

EARTH SCIENCE DATA

***Terra MISR images show eastern Sicily and the Mount Etna eruption plumes on July 22, 2001.***


Images courtesy of NASA/GSFC/JPL, MISR Science Team

Multi-angle Imaging SpectroRadiometer (MISR) images display eruption plumes expelling voluminous ash and a faint acid aerosol (smaller plume near the caldera; most visible in the fore-angle image). Fine ash falling on the Province of Catania closed the local airport, and lava flows from the volcano's southern flanks created a state of emergency for nearby towns. Mount Etna is the highest and most active volcano in Europe. This volcano has been partially destroyed by repeated caldera collapse and partially buried by younger volcanic structures over time.

Data set: MISR Level 1B2 Ellipsoid Data V001
Data granule ID for 70° fore image: SC:MI1B2E.001:865406
Data granule ID for nadir image: SC:MI1B2E.001:865914
Data granule ID for 70° aft image: SC:MI1B2E.001:865394

***This May 23, 2001, Landsat 7 ETM+ false-color image reveals lava flows from the ongoing Pu'u O'o eruption of Hawaii's Kilauea Volcano.***

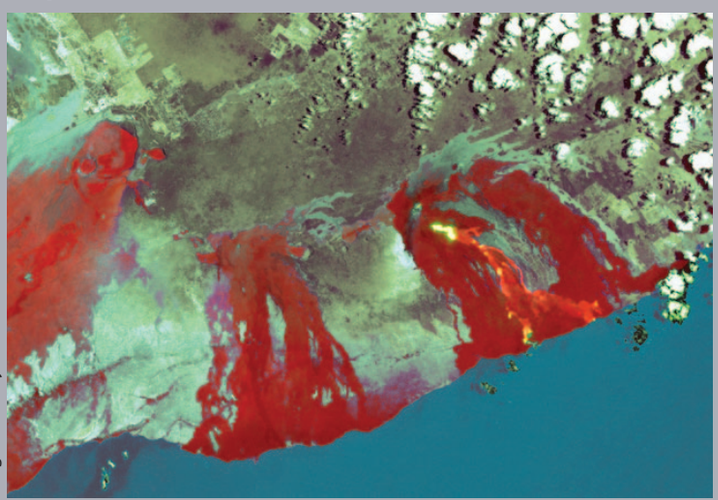


Image courtesy of NAA/GSFC Landsat 7 Science Team

In this Landsat 7 Enhanced Thematic Mapper Plus (ETM+) thermal infrared view, thin yellow threads mark active lava tubes. Red regions represent solid rock from previous lava flows on the volcano's lower flanks. Scattered clouds appear in white. On January 3, 1983, Kilauea on the Big Island of Hawaii opened a new vent, named Pu'u O'o, on its east rift zone. This vent began to emit torrents of molten rock and has continued intermittently ever since. Although its lava flows are seldom life threatening, large flows can cause considerable damage. Pu'u O'o's ongoing eruption has destroyed more than 200 structures and buried 102 $km^2$ of Kilauea's southern flank. Lava flows have also added more than 2 $km^2$ of new land to the island.

Data set: Landsat-7 Level-0R WRS-Scene V002
Data granule ID: SC:L70RWRS.002:2003066838

## On the Cover

# A Land's Renewal

Mount St. Helens, in southwestern Washington State, erupted on May 18, 1980. Before the eruption, Mount St. Helens' summit reached a height of about 2,950 meters. The eruption pulverized the upper 400 meters and sent an ash cloud higher than 19,200 meters. The lateral blast blew out the mountain's north face, triggering the largest recorded landslide and crumbling the entire northern slope. Massive explosions flattened vast areas of timberland and covered the immediate region with scalding hot ash that destroyed much of the surface vegetation. Ash completely darkened towns and cities to the east and traveled as far away as Oklahoma. Fifty-seven people were killed—many buried under tons of ash.

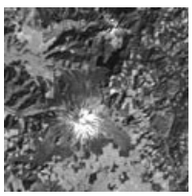
Two decades after the eruption, the Mount St. Helens area shows signs of recovery. Debris fields are being transformed as vegetation grows and lakes and rivers spread.

**The DAAC Alliance archives and distributes large quantities of EOSDIS time-series data for long-term regrowth analysis.**

*The Landsat images on the cover show the Mount St. Helens area before and after the May 18, 1980, eruption. Images and information were provided by the Land Processes (LP) DAAC.*

Data set: North American Landscape Characterization (NALC)*

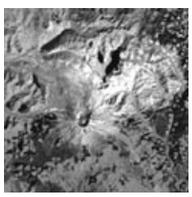
Data granule ID: LPNALC046028U
WRS1: Path 49, Row 28
Landsat 1 MSS bands: 5, 7, 4
Resolution: Resampled to 60 meters



The Landsat 1 Multispectral Scanner (MSS) subset image was acquired on September 2, 1972, almost 8 years before the May 18, 1980, eruption. Spirit Lake, located north of the peak, is dark blue. Conifer forests are dark green, while light green colors represent areas of mixed forest, open meadows, and grass. Forest clear-cutting is evident throughout the image and is exhibited in light purple and white. Barren rocks show as purple. White also indicates clouds, snow, and ice.

Data set: North American Landscape Characterization (NALC)*

Data granule ID: LPNALC046028U
WRS2: Path 46, Row 28
Landsat 5 MSS bands: 5, 6, 4
Resolution: Resampled to 60 meters



The Landsat 5 MSS subset image was acquired on August 23, 1985, about 5 years after the eruption. Spirit Lake was changed due to mudflows from volcanic explosions. Conifer forests are dark green, while light green colors represent areas of mixed forest, open meadows, and grass. Ash and barren rocks show as purple and white. Forest clear-cutting, in the northeast corner, is displayed in light purple and white. Conifer forest stands, especially around the volcano, were drastically reduced due to the blast.

Data set: Landsat-7 Level-1 WRS-Scene V002

Data granule ID: EISC:L70RWRS.002:2000162029
WRS2: Path 46, Row 28
Landsat 7 ETM+ bands: 3, 2, 1
Resolution: 30 meters

The Landsat 7 Enhanced Thematic Mapper Plus (ETM+) image was acquired on August 22, 1999, about 19 years after the eruption. Spirit Lake has changed significantly in size since the 1985 image. The rejuvenation of forest stands is evident in many parts of the mountain. Areas once covered by mudflows now display signs of regrowth. Conifer forests are dark green, while light green colors represent areas of mixed forest, open meadows, and grass. Barren rocks and ash appear gray and white. The streaking gray patterns extending from the crater are remnants of pyroclastic flows.

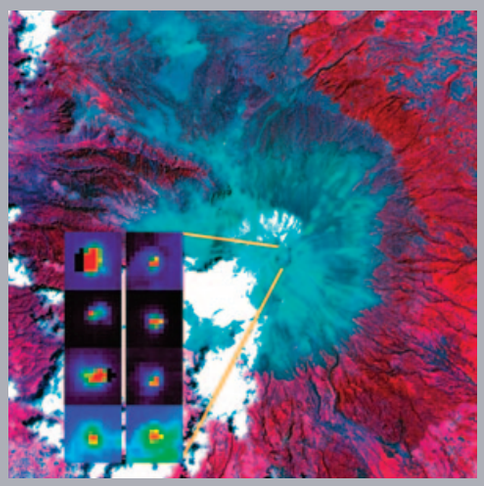
*Each NALC data granule contains multiple Landsat MSS images acquired during different time periods.

**For information about the DAAC Alliance**
***http://nasadaacs.eos.nasa.gov***

**To search and order EOSDIS data**
***http://eos.nasa.gov/imswelcome***

**For EOSDIS outreach resources**
***http://eos.nasa.gov/outreach***

***A clear view of the crater of Mexico's Popocatepetl Volcano was captured by Terra ASTER on September 6, 2000.***



Images courtesy of NASA/GSFC/MITI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team

The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) image of Popocatepetl depicts vegetation in red, bare rocks in blue, and clouds in bright white. During the past decade, Popocatepetl erupted three times, sending hot rocks and mudflows down the mountain. Ash clouds and gas vapors rose as high as 12 km and traveled as far as 72 km from the volcano, reaching Mexico City's million of residents.

Data set: ASTER L1B Registered Radiance at the Sensor V003
Data granule ID: SC:AST_L1B.003:2004009266

*The top-to-bottom sequence (September 6, October 10, and November 11, 2000, and January 2, 2001) of infrared hot spots at 2.16 μm (left column) and 11.33 μm (right column) exhibits a temperature range from hottest to coldest (red, orange, yellow, green, blue, purple, black). All images show the size and temperature of a hot lava dome present in the summit crater.*

***This ASTER false-color image gives a sharp synoptic view of Mount Vesuvius and the city of Naples, Italy, on September 26, 2000.***

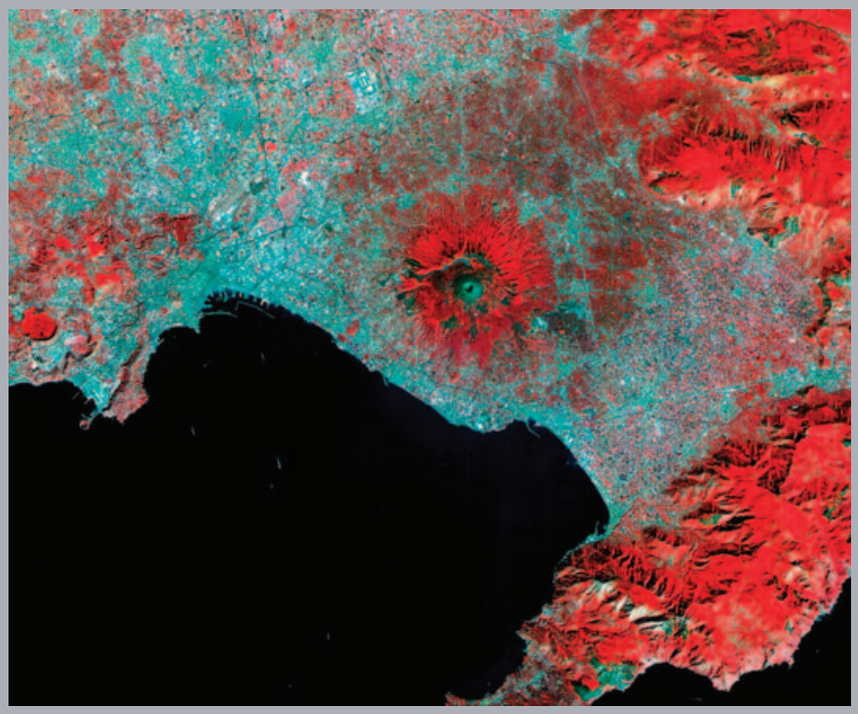


Image courtesy of NASA/GSFC/MITI/ERSDAC/JAROS, and U.S./Japan ASTER Science Team

This 36- by 45-km image shows in great detail the volcano and the surrounding dense urban area, which is home to about 2 million people. In 79 A.D., Mount Vesuvius buried the Roman towns of Pompeii and Herculaneum with up to 30 meters of ashfall and mudflow deposits, killing more than 2,000 people. The volcano last erupted in 1944, but the Phlegraean Fields caldera (in the far left of the image), believed by early Romans to be the entrance to Hell, threatens with seismic and ground-deformation pulses of activity.

Data set: ASTER L1A Reconstructed Unprocessed Instrument Data V002
Data granule ID: SC:AST_L1A.002:2002474047

# EOS Satellites Map and Monitor Volcanoes

*NASA's Earth Observing System (EOS) satellites' visible, near-infrared, and thermal sensors are able to detect hot spots, gas emissions, ash clouds, and other volcanic activity. EOS Data and Information System (EOSDIS) satellite data can be used in conjunction with ground-based data to monitor pre-eruption events. In remote or underdeveloped areas where ground-monitoring systems are poor, satellite data prove invaluable.*

EOSDIS remote-sensing data can be used to detect lithological differences, vegetation changes, and altimetric variations before and after volcanic events, as well as to observe the urbanization of endangered areas. Monitoring of thermal anomalies (hot spots), crustal deformation, and other volcanic landforms can be used to provide warning of future volcanic activity.

Active volcanoes are recognized not only for their hazards to life and property, but also for their benefits. An estimated half-billion people worldwide live close to active volcanoes, largely because of the rich soils, valuable minerals, and favorable climatic conditions in volcanic regions. The extent to which a volcano is considered hazardous depends on its events and proximity to people.

*EOSDIS data can be used to monitor and assess the three main types of volcanic hazards to people and property.*

***Lava flow*** can burn, crush, or bury everything in its path and at times overfill deep valleys. When lava flows onto ice or snow, the meltwater can cause substantial flooding. When it enters forestlands, it can start forest fires. Data acquired from multiple satellite passes allow time-series measurements of the areal extent and volume of new lava flows. EOSDIS data (e.g., Landsat ETM+, MODIS, and ASTER) can be used to produce maps to better evaluate potential risks from lava and meltwater flows, and allow for improved land-use policy.

***Volcanic ash (tephra)*** ejected into the atmosphere causes property damage to buildings and croplands; disruption of transportation, communication, and utility systems; and loss of human life. EOSDIS data (e.g., MISR, MODIS, and TOMS) can be used for monitoring the positions of eruption plumes and mapping the surface effects of ash eruptions in manners similar to those for lava flows. EOSDIS data (e.g., TOMS and MOPITT) combined with global circulation models can be used to monitor and predict the impact on regional and global climate patterns.

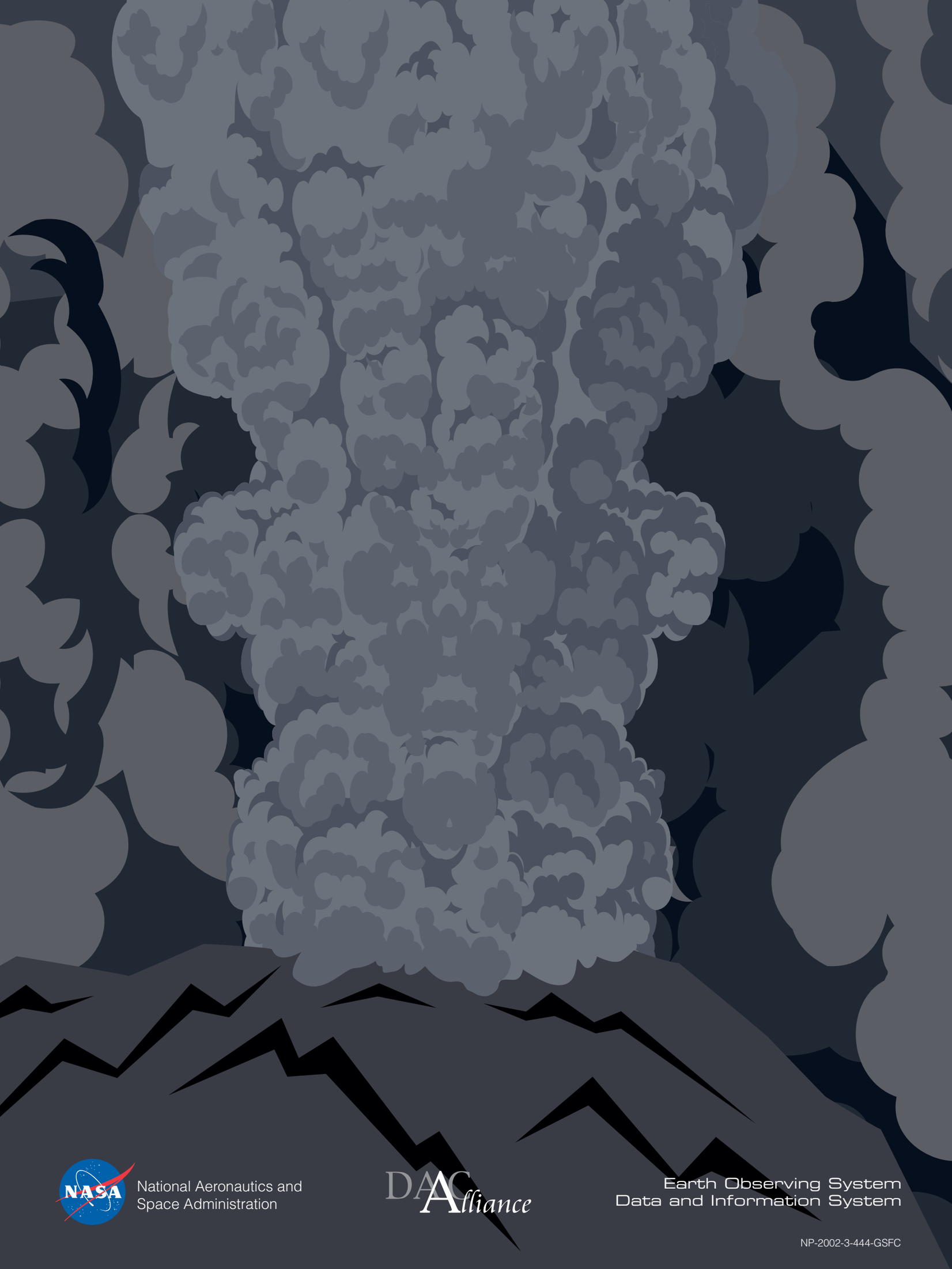
***Volcanic gases***, even when very dilute, can be extremely dangerous to human, animal, and plant life. EOSDIS data (e.g., TOMS, MOPITT, MODIS, and ASTER) allow the detection and mapping of pre- and post-eruption gas clouds.

EOSDIS distributes data from EOS and other NASA Earth-measurement systems. EOSDIS data products and related services are available from the Distributed Active Archive Center (DAAC) Alliance.

For information about the data centers of the DAAC Alliance, see http://nasadaacs.eos.nasa.gov.

To search and order data through the EOS Data Gateway (EDG), see http://eos.nasa.gov/imswelcome.

## *Featured Volcanoes and Tectonic Plate Boundaries*



National Aeronautics and
Space Administration

DAAC Alliance

Earth Observing System
Data and Information System

NP-2002-3-444-GSFC