# Shuttle Radar Topography Mission (SRTM)

## Background

Under an agreement with the National Aeronautics and Space Administration (NASA) and the Department of Defense's National Geospatial-Intelligence Agency (NGA), the U.S. Geological Survey (USGS) is distributing elevation data from the Shuttle Radar Topography Mission (SRTM). The SRTM is a joint project of NASA and NGA to map the Earth's land surface in three dimensions at an unprecedented level of detail. As part of space shuttle *Endeavour's* flight during February 11–22, 2000, the SRTM successfully collected data over 80 percent of the Earth's land surface for most of the area between latitudes 60 degrees north and 56 degrees south. The SRTM hardware included the Spaceborne Imaging Radar-C (SIR–C) and X-band Synthetic Aperture Radar (X–SAR) systems that had flown twice previously on other space shuttle missions. The SRTM data were collected with a technique known as interferometry that allows image data from dual radar antennas to be processed for the extraction of ground heights.



Artist's rendering of Space shuttle *Endeavour* and the 200-foot long SRTM antenna deployed for image acquisition.
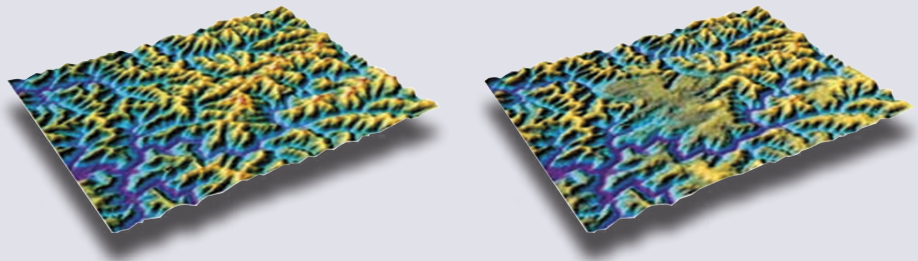
## Data

NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California, processed more than 12 terabytes of raw SRTM data into preliminary, research-quality digital elevation models on a continent-by-continent basis. NGA completed editing, verifying, and reformatting of the preliminary data by the end of September 2004. The USGS Earth Resources Observation and Science (EROS) Center in Sioux Falls, South Dakota, is the long-term archive for SRTM data and provides these data to the general public and the science community. Data available to the geospatial data user community include 1-arc-second (about 30-meter) resolution data over the United States and its territories, and 3-arc-second (about 90-meter) data over non-U.S. territory. The SRTM data complements other elevation data available from the USGS EROS Center.

## Applications

Elevation data are used for many applications and three-dimensional visualizations of the Earth's surface. The earth science community regularly uses products like SRTM data for hydrologic and geologic investigations. The SRTM dataset represents a recent snapshot of the Earth's land surface that can be compared to historical elevation data to assess changes to the landscape, as illustrated in figures 1 and 2. Satellite image data can be combined with SRTM elevation data for visualizations of the land surface.



**Figure 1.** Changes to the land from surface mining can be seen in eastern Kentucky (Breathitt, Knott, and Perry Counties), as depicted by comparing elevation from the National Elevation Dataset (NED; left, predisturbance) and SRTM data (right, postdisturbance, mining area in middle of image). The NED data are derived from topographic map data compiled in 1952. The SRTM data were collected in February 2000. This perspective view, looking to the northeast, covers an area of about 37 square miles.

**Figure 2.** Interstate 68 road cut in western Maryland, as depicted by comparison of NED data (left, preconstruction) and SRTM data (right, postconstruction, I–68 road cut in middle of image). The maximum depth of the road cut through the ridge is 322 feet. The NED data were derived from topographic map data compiled in 1947. The SRTM data were collected in February 2000. This view covers an area of about 15 square miles.
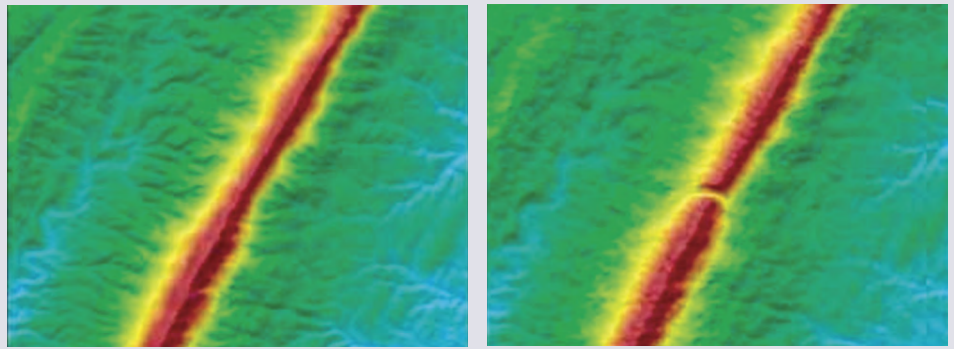


## Data Access

The SRTM finished products are available in Arc-Grid, GRIDFLOAT, BIL, and Tiff format. Data are available through the USGS Seamless Data Distribution System (SDDS; *http://seamless.usgs.gov*) and EarthExplorer (*http://earthexplorer.usgs.gov*). The SRTM 1-arc-second coverage includes the conterminous United States, southern Alaska, Hawaii, and island territories. The global SRTM 3-arc-second data are also available through the SDDS. These data are available at no cost via download. Information on how to search and download these data can be found at the USGS EROS elevation page: *http://eros.usgs.gov/products/elevation/*.



**Perspective view of Kamchatka Peninsula, Russia. The view, looking to the east, shows a 20-mile-wide expanse of the Russian coastline with the Sea of Okhotsk in the foreground (Landsat 7 and SRTM). The Landsat 7 data were acquired in August 1999.**

**Pre-eruption perspective view of the Nyiragongo, Congo, volcano (peak on the right). This 13-mile-wide view, looking to the northeast, shows the city of Goma on the shore of Lake Kivu in the foreground (Landsat 7 and SRTM). The Landsat 7 data were acquired in December 2001.**
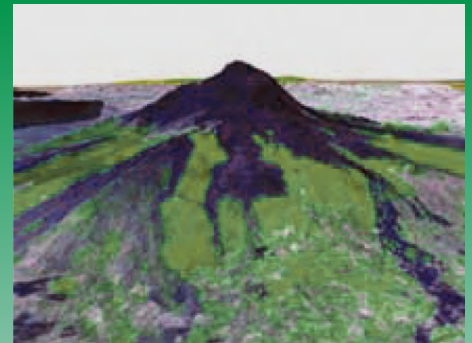
**Perspective view of Mount Etna, Italy [Advanced Spaceborne Thermal Emission and Reflection Radiometer(ASTER) and SRTM], looking to the south. The ASTER data were acquired in July 2001.**

## Further Information

● **Information about the Land Remote Sensing Program is available at *http://remotesensing.usgs.gov.***

● **For further information about the SRTM and radar interferometry, visit the NASA Web site at *http://www2.jpl.nasa.gov/srtm/***

For information on other USGS products and services, call 1-888-ASK-USGS, or visit the general interest publications Web site on mapping, geography, and related topics at *http://erg.usgs.gov/publications.html*.

For additional information, visit "Ask USGS" at *http://ask.usgs.gov* or the USGS home page at *http://www.usgs.gov*.

Related datasets from USGS EROS Center include the following:

- National Elevation Dataset (NED)
  *http://ned.usgs.gov/*

- Elevation Derivatives for National Applications (EDNA)
  *http://edna.usgs.gov*

- Global 30-Arc-Second Elevation Dataset (GTOPO30)
  *http://eros.usgs.gov/products/elevation/gtopo30.html*

- HYDRO1k Elevation Derivative Database
  *http://eros.usgs.gov/products/elevation/hydro1k.html*