Shuttle Radar Topography Mission (SRTM)
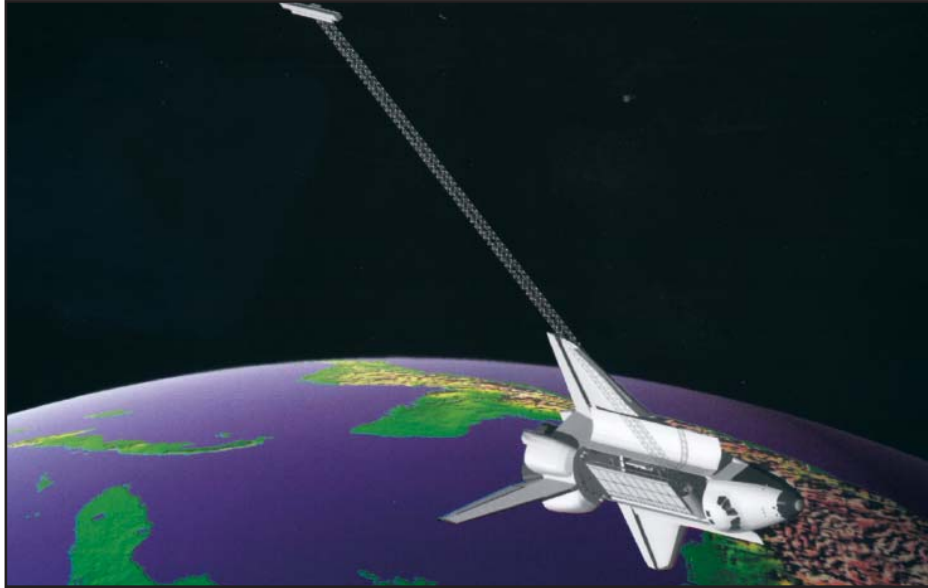

Figure 1: The Space Shuttle Endeavour and the 200-ft long SRTM antenna deployed for image acquisition.

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 now distributing elevation data from the Shuttle Radar Topography Mission (SRTM). The SRTM is a joint project between NASA and NGA to map the Earth's land surface in three dimensions at a level of detail unprecedented for such a large area. Flown aboard the NASA Space Shuttle Endeavour February 11-22, 2000, the SRTM successfully collected data over 80 percent of the Earth's land surface, for most of the area between 60° N. and 56° S. latitude. 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 specifically with a technique known as interferometry that allows image data from dual radar antennas to be processed for the extraction of ground heights.

Data

NASA's Jet Propulsion Laboratory (JPL) in Pasadena, Calif., processed more than 12 terabytes of raw SRTM data into preliminary, research-quality digital elevation models, on a continent-by-continent basis. NGA will complete editing, verification, and reformatting of the preliminary data by the end of September 2004. The USGS EROS Data Center in Sioux Falls, S. Dak., 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 (approximately 30-meter) resolution data over the United States and its territories, and 3-arc-second (approximately 90-meter) data over non-U.S. territory. The SRTM data complement other elevation data available from the USGS EROS Data Center.

Applications

Elevation data are used for various applications, most notably the production of topographic maps 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 provides a recent snapshot of the Earth's land surface, which is useful for comparing against historical elevation data like the USGS National Elevation Dataset (NED) to assess changes to the landscape, as illustrated in Figures 2 and 3: Satellite image data can be combined with SRTM elevation data for visualizations of the land surface.
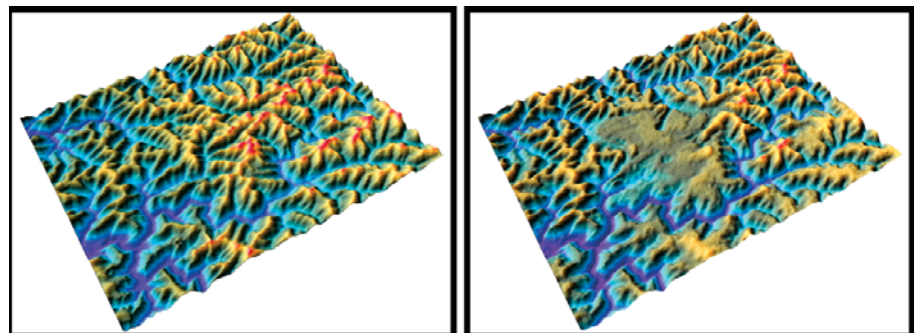

Figure 2: Changes on the land surface in eastern Kentucky (Breathitt, Knott, and Perry Counties) from surface mining, as depicted by comparing NED (left, pre-disturbance) and SRTM data (right, postdisturbance, with the Star Fire Mine in the middle of the image). The NED data are derived from topographic map data compiled in 1952. The SRTM data were collected in February 2000. This perspective view, looking to the northeast, covers an area of approximately 37 square miles.
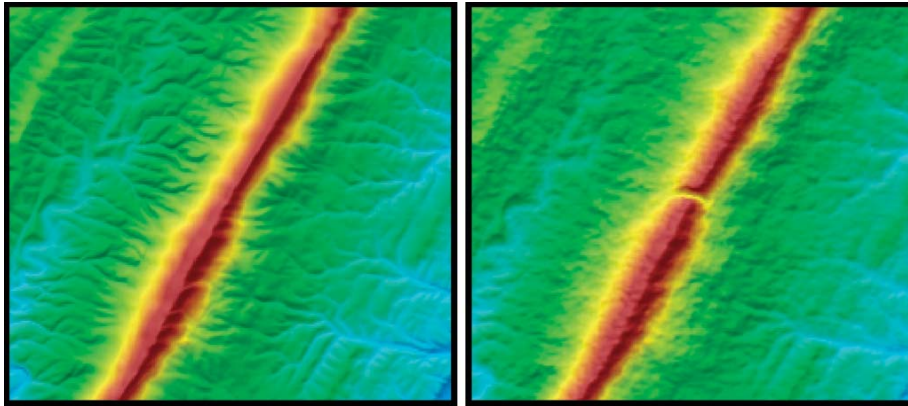
Figure 3: Interstate-68 road cut in western Maryland, as depicted by comparison of NED (left, preconstruction) and SRTM data (right, postconstruction, with the I-68 road cut in the middle of the image). The maximum depth of the road cut through the ridge is 322 feet. The NED data were derived from topographic map data compiled in 1947. The SRTM data were collected in February 2000. This view covers an area of approximately 15 square miles.

Figure 4: Perspective view: Kamchatka Peninsula, Russia. The view shows a 20-mile-wide expanse of the Russian coastline, looking to the east, with the Sea of Okhotsk in the foreground (SRTM and Landsat 7 data acquired in August 1999).
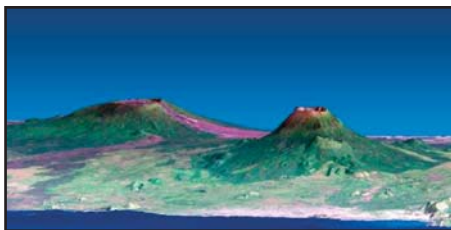

Figure 5: Preeruption perspective view of the Nyiragongo, Congo, volcano (peak on the right). This 13-mile-wide view, looking to the northeast, shows the city of Goma on the shore of Lake Kivu in the foreground (SRTM and Landsat 7 data acquired December 2001).
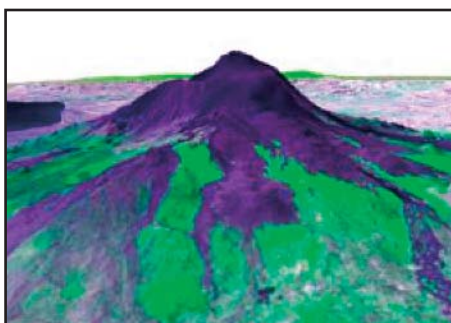

Figure 6: Perspective view: Mt. Etna, Italy (ASTER and SRTM), looking to the south. The ASTER data were acquired in July 2001.

Data Access

The SRTM data are currently available as preliminary and finished data. The preliminary data were processed by NASA/JPL to provide the research community with products prior to the final edited versions produced by NGA.

Preliminary, or research grade data, include SRTM 1-arc-second (30 meter) coverage of the conterminous United States, southern Alaska, Hawaii, and the island territories. These data can be obtained through the USGS Seamless Data Distribution System (SDDS) (seamless.usgs.gov). Preliminary global 3-arc-second (90 meter) data are also available through SDDS. These data are available for electronic download for areas up to 1.6 gigabytes in 100 megabyte files. Data can also be placed on media (CD-ROM or DVD) for a cost-to-produce fee of $32 per CD, plus $45 base charge and $5 handling per order. Or $60 per DVD, plus $60 base charge and $5 handling per order.

SRTM finished data are available in DTED® and SRTM Format. The SRTM Format is reprocessed DTED® data. The 1-arc-second (30 meter) data for the United States, southern Alaska, Hawaii, and island territories are available on DVD. Each DVD is $60, plus $5 handling fee. Ordering the 1-arc-second data is based upon a 7-grid area system. Each grid represents one DVD worth of data. The global 3-arc-second (90 meter) data are available on CD-ROM media. Each CD is $45, plus a $5 handling. Ordering the 3-arc-second data is based upon a 70-grid area system. Each grid area represents one CD worth of data. SRTM index maps are updated as new data are received from NGA. Information to search and order these data can be found at the USGS/EROS Data Center Elevation homepage: (edc.usgs.gov/products/elevation).

Further Information

For further information about SRTM and radar interferometry, visit the NASA Web site: www.jpl.nasa.gov/srtm/index.html.

For additional information on SRTM data and ordering procedures, visit srtm.usgs.gov or contact USGS EROS Data Center Customer Services:

USGS/EROS Data Center
Attn: Research
47914 252nd Street
Sioux Falls, SD 57198-0001
Tel: 800-252-4547
Tel: 605-594-6151
TTY/TDD: 605-594-6933
Fax: 605-594-6589
E-mail: custserv@usgs.gov

Information about the Land Remote Sensing Program is available at: remotesensing.usgs.gov.

Other complementary elevation datasets from the USGS EROS Data Center include the following:

National Elevation Dataset (NED)
ned.usgs.gov

Elevation Derivatives for National Applications (EDNA)
edna.usgs.gov

Global 30-Arc-Second Elevation Dataset (GTOPO30)
edcdaac.usgs.gov/gtopo30/gtopo30.html

HYDRO1k Elevation Derivative Database
edcdaac.usgs.gov/gtopo30/hydro/index.html

For information on other USGS products and services, call 1-888-ASK-USGS, or visit USGS Geography Products Web site at erg.usgs.gov/isb/pubs/pubslists/.

For additional information, visit the ask.usgs.gov Web site or the USGS home page at www.usgs.gov.