Shuttle Radar Topography Mission (SRTM)

Overview

The Shuttle Radar Topography Mission (SRTM) was flown aboard the space shuttle Endeavour February 11-22, 2000. The National Aeronautics and Space Administration (NASA) and the National Geospatial-Intelligence Agency (NGA) participated in an international project to acquire radar data, which were used to create the first near-global set of land elevations.

The STS-99 mission of the space shuttle Endeavour acquired topographic (elevation) data using single-pass interferometry to capture two radar datasets simultaneously via two antennas with slightly different angles. The main antenna was located in the shuttle's cargo bay while the other was located at the end of a 60-meter (200-foot) mast extended from the cargo bay once the shuttle was in space. SRTM surface elevation above, at, or below sea level (in meters) was then calculated from the difference between the two signals.

The SRTM collected radar data over 80% of the Earth's land surface between 60° north and 56° south latitude. These data were used to construct a global digital elevation model having elevation postings every 1 arc-second (approximately 30 meters)[1]. Until a recent policy change, SRTM elevation data outside of the United States were distributed at 3 arc-second postings (approximately 90 meters). The recent policy change permits the unrestricted distribution of 1 arc-second elevation data outside of the US, which are being released on a region-by-region basis.

SRTM Versions

SRTM elevation data have been improved both by NASA and the National Geospatial Intelligence Agency (NGA). Version 1 is the original data set produced by JPL, while version 2.0 is a "finished" version produced by NGA[2]. The finishing consisted of flattening the water bodies and interpolating very small voids. At this point, the NGA and NASA versions diverge.

Version 2.1 was produced by NASA as an alternative 3 arc-second product, having slightly poorer spatial resolution but less vertical noise than the NGA 3 arc-second product. All products up through NGA Version 2.0 and JPL Version 2.1 have voids (no data) where SRTM was not successful in generating elevation measurements.

NGA developed a "Void-Filled" product from version 2.0[3] using data from commercial and non-commercial sources of elevation data, and this product was released at 3 arc-seconds. However, with the release of 1 arc-second SRTM data, any license-restricted data from commercial sources were removed, resulting in the return of voids.

NASA JPL Version 3.0 ("SRTM Plus") instead filled the voids with non-commercial ASTER GDEM2, GMTED2010, and NED, to produce both the 1 arc-second and 3 arc-second products. For the 3 arc-second products, the "SRTMGL3" is averaged and the "SRTMGL3S" is subsampled. The diagram in Figure 1 below shows the progression of

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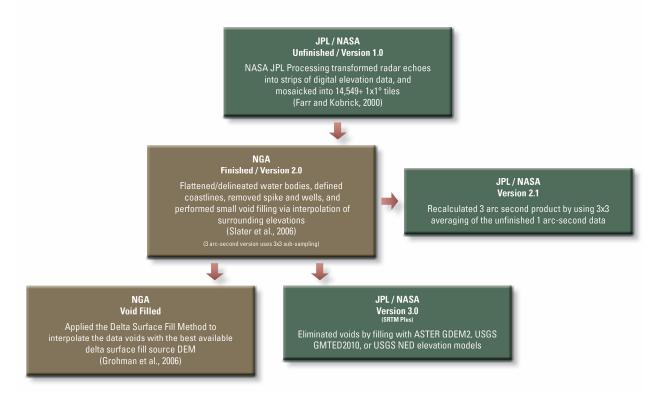
these versions:

Figure 1. SRTM Genealogy

SRTM Data Products

SRTM data are organized into individual rasterized tiles each covering one-degree of latitude by one-degree of longitude. Sample spacing for individual data points is either 1 arc-second or 3 arc-seconds depending on the product selected as identified in Table 1 below.

Product name	Version	Resolution	Coverage	Available from
Version 1	1	1 arc-second	U.S.	USGS[1]
Version 1	1	3 arc-second	Global	USGS[2]
SRTM Non_Void Filled	2	1 arc-second	U.S.	USGS
SRTM Non_Void Filled	2	3 arc-second	Global	USGS
SRTM Water Body and Shapefiles Dataset	N/A	1 arc-second	Global	USGS[5] and LP DAAC[5, 6, 7]
Version 2.1	2.1	1 arc-second	U.S.	USGS[3]
Version 2.1	2.1	3 arc-second	Global	USGS[4]

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Product name	Version	Resolution	Coverage	Available from
SRTMGL30	2.1	30 arc-second	Global	LP DAAC[5, 6, 7]
NGA SRTM Void Filled**	Void Filled**	1 arc-second	Global*	USGS[5]
NGA SRTM Void Filled	Void Filled	3 arc-second	Global	USGS[5]
NASA JPL SRTMGL1	3	1 arc-second	Global*	LP DAAC[5, 6, 7, 8]
NASA JPL SRTMGL3	3	3 arc-second	Global	LP DAAC[5, 6, 7, 8]
NASA JPL SRTMUS1	3	1 arc-second	U.S.	LP DAAC[5, 6, 7, 8]
NASA JPL SRTMGL3S	3	3 arc-second	Global	LP DAAC[5, 6, 7]

Table 1. SRTM Data Products; *Global coverage is being released region-by-region.
** Voids were returned to the 1 arc-second product where they had been filled by license-restricted commercial data and previously released at 3 arc-seconds. (The license allows public release at 3 arc-seconds but not 1 arc-second.)

[1] http://dds.cr.usgs.gov/srtm/version1/United_States_1arcsec/1arcsec/

[2] http://dds.cr.usgs.gov/srtm/version1

[3] http://dds.cr.usgs.gov/srtm/version2_1/SRTM1

[4] http://dds.cr.usgs.gov/srtm/version2_1/SRTM3

[5] http://earthexplorer.usgs.gov

[6] https://lpdaac.usgs.gov/data_access/data_pool

[7] http://reverb.echo.nasa.gov

[8] http://gdex.cr.usgs.gov

References

1 – Farr, T.G., E. Caro, R. Crippen, R. Duren, S. Hensley, M. Kobrick, M. Paller, E. Rodriguez, P. Rosen, L. Roth, D. Seal, S. Shaffer, J. Shimada, J. Umland, M. Werner, 2007, The Shuttle Radar Topography Mission. Reviews of Geophysics, volume 45, RG2004, doi:10.1029/2005RG000183.

2 – Slater, J. A., G. Garvey, C. Johnston, J. Haase, B. Heady, G. Kroenung, and J. Little, 2006, The SRTM data 'finishing' process and products, Photogramm. Eng. Remote Sens., 72, 237–247.

3 – Grohman, G., G. Kroenung, and J. Strebeck, 2006, Filling SRTM voids: The Delta Surface Fill method. Photogrammetric Engineering and Remote Sensing, v. 72, no. 3, p. 213-216.

Links

More detailed descriptions of SRTM products and versions can be found here:

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https://lpdaac.usgs.gov/products/measures_products_table

https://lpdaac.usgs.gov/sites/default/files/public/measures/docs/NASA_SRTM_V3.pdf

Data access is available via Reverb, USGS EarthExplorer (EE), Global Data Explorer, and LP DAAC Data Pool: https://lpdaac.usgs.gov/data_access

More Information

For more information on SRTM, please contact LP DAAC User Services via phone at 1-866-573-3222 or e-mail at lpdaac@usgs.gov.