### **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). 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 NGA. Version 1 is the original dataset produced by the NASA Jet Propulsion Laboratory (JPL), while Version 2.0 is a "finished" version produced by NGA. 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 using elevation data from commercial and non-commercial sources, and this product was released at 3 arcseconds. 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") 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 shows the progression of these versions.

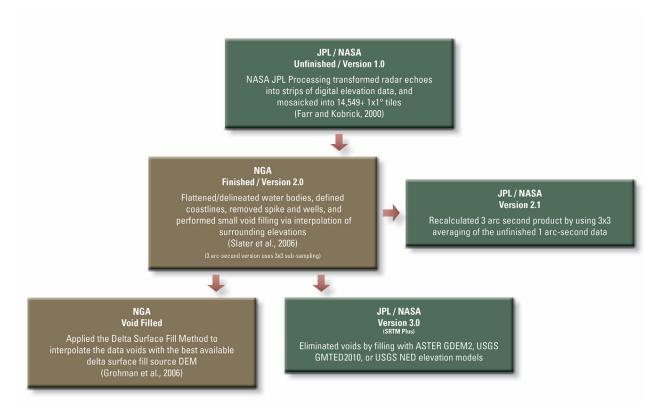


Figure 1. SRTM Genealogy

#### **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.

Table 1. SRTM Data Products

Product name	Version	Resolution	Coverage	Available from
SRTM 1 Arc-Second	3	1 arc-second	Global	USGS <sup>1</sup>
Global				
SRTM Non-Void Filled	1	1 arc-second	U.S.	USGS <sup>1</sup>
SRTM Non-Void Filled	1	3 arc-second	Global	USGS <sup>1</sup>
SRTM Void Filled	2	1 arc-second	U.S.	USGS <sup>1</sup>
SRTM Void Filled	2	3 arc-second	Global	USGS <sup>1</sup>
STRM Water Body Data	N/A	N/A	Global	USGS <sup>1</sup>
NASA SRTM3	3	1 arc-second	Global	USGS <sup>1</sup>
SRTMGL1				
NASA SRTM3 SRTMGL3	3	3 arc-second	Global	USGS <sup>1</sup>
NASA SRTM3	2	30 arc-second	Global	USGS <sup>1</sup>
SRTMGL30		30 arc-second	Global	0000
NASA SRTM3	3	3 arc-second	Global	USGS <sup>1</sup>
SRTMGL3S				
NASA SRTM3	3	3 arc-second	Global	USGS <sup>1</sup>
SRTMSWBD				
SRTMGL1	3	1 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMGL1N	3	1 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMGL1_NC	3	1 arc-second	Global	LPDAAC <sup>3, 4</sup>
SRTMGL1_NUMNC	3	1 arc-second	Global	LPDAAC <sup>3, 4</sup>
SRTMGL3	3	3 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMGL30	2.1	30 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMGL3N	3	3 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMGL3S	3	3 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMGL3 NC	3	3 arc-second	Global	LPDAAC <sup>3, 4</sup>
SRTMGL3_NUMNC	3	3 arc-second	Global	LPDAAC <sup>3, 4</sup>
SRTMIMGM	3	1 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMIMGR	3	1 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>
SRTMSWBD	3	1 arc-second	Global	LPDAAC <sup>2, 3, 4</sup>

<sup>\*</sup>Global coverage is being released region-by-region.

<sup>\*\*</sup> 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.)

<sup>&</sup>lt;sup>1</sup>https://earthexplorer.usgs.gov

<sup>&</sup>lt;sup>2</sup> https://e4ftl01.cr.usgs.gov/

<sup>&</sup>lt;sup>3</sup> https://search.earthdata.nasa.gov/search?q=SRTM

<sup>&</sup>lt;sup>4</sup> https://lpdaac.usgs.gov/product\_search/?query=SRTM&view=cards&sort=title

#### References

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.

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.

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:

https://lpdaac.usgs.gov/data/get-started-data/collection-overview/measures/

https://lpdaac.usgs.gov/documents/179/SRTM User Guide V3.pdf

Data access is available through NASA's Earthdata Search, USGS EarthExplorer (EE), and LP DAAC Data Pool:

https://search.earthdata.nasa.gov/search

https://earthexplorer.usgs.gov/

https://e4ftl01.cr.usgs.gov/MEASURES/

### **More Information**

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