# DLR SRTM X-SAR Digital Elevation Models

The German Aerospace Center DLR is making the SRTM X-SAR digital elevation models (DEMs) available at no cost. The data can be accessed in three ways

- Traditional search and ordering via the DLR Earth Observation data portal EOWEB-NG,
- FTP bulk download via EOWEB-NG
- Viewing (WMS) and download (WCS/WFS) via the EOC Geoservice

This document contains background information on the mission and the DEM products, on data access and data use. More detailed information can be obtained by following the links provided.

## The Shuttle Radar Topography Mission - SRTM

The SRTM X-SAR DEMs were generated from X-band synthetic aperture radar (SAR) data acquired during the Shuttle Radar Topography Mission (SRTM) in 2000. The SRTM mission was conducted jointly between the German Aerospace Center DLR, the Italian Space Agency ASI, and NASA/JPL (USA). From February 11 to 22, 2000, two interferometric radar systems onboard the Space Shuttle Endeavor acquired data with the objective to generate a global high resolution digital elevation model. The American radar system, operating in C-band, was complemented by the German-Italian X-SAR, a higher resolution X-band synthetic aperture radar (SAR) system.

The SRTM DEMs were generated using 'radar interferometry' or 'InSAR'. Two SAR antennas, one inside the Space Shuttle cargo bay, the other at the end of a 60 m extension pole, simultaneously acquired radar data. During the processing, the phase differences of the two corresponding datasets are compared and converted into elevation values. An introduction to SAR interferometry can be found at this site.

The DLR SRTM website provides additional information on the SRTM X-SAR mission. Further details on the SRTM mission, on technology, accuracies, and applications are available on the NASA SRTM website and in this document.

While the DEMs generated from the American C-band data are available through the United States Geological Survey USGS and other sites, the X-SAR DEMs can be obtained via DLR.

## Coverage

Similar to the NASA/JPL SRTM C-band data, the DLR/ASI X-SAR DEMs cover the entire globe between 60° northern and southern latitude. However, the coverage of the X-band DEMs is not continuous. The gaps between the individual crisscrossing image strips are a result of the higher precision and therefore a narrow swath width of the X-band system. Information on the precise coverage of the SRTM X-SAR data can be obtained from the DLR SRTM website.

# Accessing SRTM X-SAR DEMs

Since December 2010 the DLR SRTM X-SAR DEMs are available at no cost. The data can be obtained via EOWEB-NG (http://eoweb.dlr.de), the Earth observation data portal of the Earth Observation Center at DLR. A user can perform a traditional search for SRTM data in EOWEB-NG and order up to 100 datasets. Additionally, the SRTM X-band DEMs can be downloaded in bulk from an FTP-Server, accessible via a separate link after logging on to EOWEB-NG. The EOC Geoservice provides a third way of accessing the SRTM X-SAR data via technical interfaces compliant with the standards of the Open Geospatial Consortium OGC. The OGC-compliant services include data discovery (CSW), viewing (WMS), and download (WCS/WFS) and are accessible via geoservice.dlr.de.

# SRTM X-SAR DEMs via FTP-Download

Via FTP-download the SRTM X-SAR DEMs are provided as compressed archives. One archive contains individual digital elevation models (DEMs) covering a geographic area of 10° by 10°. The filename of the archive specifies the bottom left coordinate of the 10° by 10° tile. In addition to the DEM files, the archive contains the corresponding height error maps (HEM), a browse image map providing an overview of the area covered by the files contained in the archive, a kml file for displaying the browse image of the coverage on Google Earth, and this 'Readme' file.

The corresponding SAR image data are not included in the package. They can, however, be ordered via EOWEB-NG (http://eoweb.dlr.de).

# Details on DEMs and Data Format

The DEMs inside the compressed archive are distributed as individual files, i.e. they are not mosaicked into one large DEM file. Each DEM covers an area of 15' by 15'. The filename of the individual DEM file specifies the bottom left coordinate of the corresponding 15' by 15' DEM tile.

The DEM and HEM data are in geographic (Lat/Long) projection, with datum WGS84. The elevation values are also WGS84, as specified in the product description available from the DLR SRTM website.

One pixel of the DEM files corresponds to approximately 25 m x 25 m on the ground. The elevation values are provided at a resolution of 1 m. The horizontal accuracy of the SRTM X-band DEMs is ±20 m (abs.) / ±15 m (rel.), both 90% circular error. The vertical accuracy is ±16 m (abs.) / ±6 m (rel.), both 90% linear error. Precise information on vertical and horizontal accuracies for individual tiles can be found in the accuracy description record (ACC) of the DTED file.

As a result of the processing methodology a few locations within the DEM will have no data values. These voids have not been removed in this particular product. Standard Remote Sensing image processing tools, however, are able to compute and insert the missing values. The DEMs have not been edited with respect to coastlines and water bodies. Therefore, coastlines may not be well defined and water bodies may not be perfectly flat.

The X-band SRTM DEM data are provided in DTED format. Detailed information on the DTED format can be found in the document 'Product Description of the SRTM DTED-Format' (SRTM/PD-03/11/03) available at the DLR SRTM website.

Since the DLR SRTM X-SAR DEMs are an experimental product they are provided as is on a best effort basis.

# Conditions of Use

The use of the SRTM data is governed by the following conditions of use. By clicking on the button 'Download SRTM data' or by accessing the data via the FTP-link provided, you are accepting these conditions of use.

The SRTM DEM data are intended primarily for scientific purposes. Redistribution of the original SRTM data is not permitted, neither for commercial nor for non-commercial purposes. No further restrictions, except for those contained herein, are being imposed on the use of the data or derived products.

The SRTM-X band DEMs have been processed to the highest possible standards of accuracy using state-of-the-art technology. However, the data are provided as is. No warranty of any kind, whether explicit or implied is given. Furthermore, as the SRTM data are provided free-of-charge, DLR shall not be liable for any damage arising out of the SRTM data's use. The user is responsible for observing that no damage is caused to anyone or anything by his use of the SRTM data. By clicking on the button 'Download SRTM data' or by accessing the data via the FTP-link provided, the user therefore agrees to hold the German Aerospace Center (DLR) harmless from and against any and all claims which might arise by himself or any third party out of the SRTM data's use.

For all products based on the SRTM X-band data, and for all publications including these data or derived products, it is mandatory to use the following copyright information: ©DLR/ASI <year of production>.