Training Report

SRTM-2 Digital Elevation Model (DEM) Applications

19 – 22 September 2016
International Centre for Integrated Mountain Development (ICIMOD)
Kathmandu, Nepal

5 October 2016

Contents

Background

A regional training on Applications of SRTM-2 Digital Elevation Model (DEM) was held from 19 – 22 September 2016 in the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu, Nepal. The training was aimed at demonstrating the use of high resolution DEM data for applications in different thematic areas with specific intention to build capacity in the South and Southeast Asia, including the Hindu Kush Himalaya (HKH) and Lower Mekong regions.

NASA released 30-meter elevation datasets from the Shuttle Radar Topography Mission (SRTM) in 2014 referred to as SRTM-2, outdoing the previous 90-meter resolution elevation data. These data are now freely available and extremely valuable in addressing critical issues impacted by the Earth's topography such as the natural processes influenced by water flow including fresh water supply; extreme events such as heavy rainfall, river plain flooding, and coastal storm surges; agricultural stresses; and public health challenges.

The US Government, comprising of NASA, USAID, NOAA and USGS, is actively supporting the use and promotion of SRTM-2 data through regional workshops. This regional training was organized in collaboration and partnership with the Committee on Earth Observation Satellites (CEOS) Working Group for Capacity Building and Data Democracy (WGCapD) and the Secure World Foundation, alongside two upcoming workshops in Africa. These workshops build on the previous SRTM-2 training workshops in Nairobi, Kenya (2013), Pretoria, South Africa (2015), and Puebla, Mexico (2015).

With participants from relevant Government Ministries and agencies in Hindu Kush Himalaya (HKH) and Mekong regional countries, the training was facilitated by subject experts from the University of Washington, Seattle and the SERVIR hubs based in ICIMOD, Asian Disaster Preparedness Centre (ADPC) and the Regional Center for Mapping of Resources for Development (RCMRD).

Training objectives and participants

The training was designed to demonstrate the use of the high resolution digital elevation model (DEM) available (SRTM-2) and thereby build capacity in the region in the use of DEM data for applications in the thematic area of water and water-related disasters. Specifically, the training objectives were to provide participants with the:

- ability to describe the availability, applications, and limitations of satellite DEMs at varying spatial scales, from sub-meter to 90 m
- ability to use DEM data for delineation of river basins
- ability to use DEM data for flood modelling and inundation mapping
- understanding of the accuracies of flood maps produced using DEMs at various spatial scales
- ability to describe the applications and accuracies of using DEMs in flood models and inundation maps.

The participants of the training comprised of relevant mid and senior level professionals from the SERVIRHKH and SERVIR-Mekong Hubs, and Government Ministries from these two SERVIR hubs. A total of 22 participants, with 9 females, attended the training, comprising of representations from 18 different agencies.

Training proceedings

Day 1: Monday, 19 September 2016

Opening Session

Welcoming the training participants, Birendra Bajracharya, Regional Program Manager of Mountain Environment Regional Information System (MENRIS) gave an overview of ICIMOD's functions as a knowledge and information centre working in its eight regional member countries. He also introduced the global SERVIR framework within which ICIMOD operates as the regional hub for the HKH region. He highlighted the focus of SERVIR HKH activities in various thematic areas implemented to support the regional member countries in addressing climate-change impacts by integrating geospatial information and tools in the decision making process. Providing the rationale and objective of this regional training of SRTM-2 DEM Applications, he thanked NASA, CEOS, USGS, and all the collaborators for partnering with ICIMOD in conducting the training, and expressed his hope that the training will benefit the participants and the respective agencies represented in the training.

Karl Wurster from USAID-Nepal office reiterated Birendra in pointing out the importance of SERVIR-HKH activities in enhancing the capacity in using geospatial information and tools in decision-making, and that ICIMOD has the reputation in being the centre for excellence on geospatial solutions in the region. He reassured USAID's role and intervention in providing capacity building support and strengthening skills for day to day support in the SERVIR hubs' regional member countries. He acknowledged the importance of SRTM training and wished that the training is successful in meeting its objectives and expectations.

Basanta Shrestha, Director of Strategic Cooperation, ICIMOD, welcomed the participants for the training and said that this is a unique example of "SERVIR in action" since the training has provided a common space for participants from three SERVIR hubs, namely, SERVIR HKH, SERVIR Mekong and SERVIR East Africa, to come together and share their experiences. He reminded that SERVIR is a global initiative that promotes networking of people around the world in the use of geospatial data and information. ICIMOD, with its mission in conserving environment and strengthen sustainable development, accentuates on having people at the centre of development activities. It pursues its goals and missions in various thematic areas supported by several regional programs to address country-specific as well as trans-boundary issues such as conservation, climate-change impacts, air pollution, water resources, glaciers retreat, and so on. In this respect, the SRTM-2 DEM is very important data set, especially in today's context of "datademocratization". In current time of technological progress and convergence taking place all over the world and across all agencies, there is a huge amount of data collected through Remote Sensing and Earth Observation tools. Therefore, it is extremely important to put these information into use in the most effective way for the right purpose. Such information are critical in catastrophes to help coordinate disaster response, recovery and reconstruction. In this context, he expressed his appreciation to the SERVIR hubs for coordinating this training, and also thanked USAID and partners for making this training possible.

Technical Session

The technical session of the first day of the training started with introduction to DEMs by Mir Matin from ICIMOD. To set the context of the training, he presented an overview of Digital Elevation Model (DEM), Digital Terrain Model (DTM), their creation and structure, and their use.

As part of introduction to SRTM-2, Matin also highlighted DEM availability, different SRTM versions and sources, overview of NASA DEM, ASTER GDEM-2, GTOPO30, GMTED2010, TanDEM-X, TerraSAR WorldDEM, SPOT Elevation30, ALOS World 3D, Vricon Data Suite offerings and structure, etc. He touched

on the importance of Broad Scale, High Resolution DSM Technology, DSM Production Process, and JAXA – DEM.

This was followed by presentation on examples of DEM by Kiran Shakya of ICIMOD. Recapping the meaning of DEM from the first presentation, he gave examples of different DEM applications in Sagarmatha National Park, East Rapti, etc. He displayed DEMs in different resolutions such as GTOPO of 1 kilometer, Aster of 30 meter, SRTM of both 30 and 90 meters and 5 meter ALOS. He also explained the uses of different DEMs in various applications.

He highlighted the common use of DEM in:

- Extracting terrain parameters
- Modeling water flow for hydrology
- Creation of relief maps
- Rendering of 3D visualizations
- Base mapping
- Surface analysis

In the presentation on generation of DEM from Stereo Image, Sudan Bikash Maharjan of ICIMOD presented and discussed the process of producing and creating DEM from the stereo image.

Sudip Pradhan of ICIMOD presented on how DEM is used in estimation of solar radiation. The presentation included a recap of the different types of renewable energy, different types of solar energy resource data used in the world and introduction to ArcGIS Solar Radiation Toolsets for creating solar radiation datasets. The presentation also provided detailed steps followed in creating Solar Radiation and Sunshine Hour data for entire HKH region.

Following the presentation, the participants were a guided on a hands on exercise to generate solar radiation using SRTM 30m DEM.

Day 2: Tuesday, 20 September 2016

The second day of the training was focused on demonstrating different applications such as using DEM at varying spatial scales, including the following:

- Watershed delineation
- Landslide hazard zonation
- Height Above Nearest Drainage (HAND): Flood Inundation
- Identification of Priority Areas for Soil Erosion Management in the Koshi Basin

Kiran Shakya presented on application of Height Above Nearest Drainage (HAND) model for flood inundation and discussed its work flow process, structure and direction, flow accumulation, drainage networking, etc. He also showed a demo on preparation of HAND for east Rapti river using 5m ALOS DEM.

Kabir Uddin from ICIMOD talked about the application of DEM in soil erosion management and identification of priority areas, and demonstrated the application used for the Koshi Basin. He discussed about different dynamics on estimation of soil erosion by using GIS and RS to assess priority areas for soil conservation. The presentation included scope of study area, study methodology combining Universal Soil Loss Equation and GIS, development of factor specific data layers, different soil classes with

erodibility factors, equations for calculating slope and slope length factors, field sample collection, and validation of results.

Day 3: Wednesday, 21 September 2016

The third day of the training was dedicated to learning through experience sharing on application of DEM applications in different thematic service areas. Faith Mathew from RCMRD presented and shared their experience on application of GIS flood tools and DEM flood mapping. She talked about the different processes, structure and experiences in the use of applications and discussed about its purpose, effectiveness and impacts. It was followed by hands-on exercises on real world cases.

Day 4: Thursday, 22 September 2016

Safat Sikder from the University of Washington discussed on reservoir management applications of SRTM elevation data. His presentation included an introduction to the Application of 1 arc-second SRTM DEM for Reservoir Applications for Area-Elevation Curve and Outflow, and discussed different aspects of the reservoir management such as mass balance for outflow, change of storage using Area-Elevation relationship.

The major focus of the day was the guided hands-on-exercise on data download, data processing, area elevation curve, and calculation of reservoir outflow, using different tools, and process steps.

Conclusion

The training brought together three SERVIR hubs together to participate in design and delivery of the training. The participants from different regions got an opportunity to learn and share their experiences on common problems and applications of DEM. This kind of events can be very effective when all the regional hubs are working on similar topics for capacity building.

Annex 1: Training Program

Day One: Monday, 19 September 2016		
Time	**Activity**	**Presentation by:**
09:00 – 10:00	Arrival of Participants and Registration	Everest Hall
10:00 – 10:30	Welcome remarks	Birendra Bajracharya, Regional Program Manager, MENRIS, ICIMOD
	Remarks	Karl Wurster, Environment and Energy Team Leader, USAID/Nepal
	Keynote introductory remarks	Basanta Shrestha, Director of Strategic Cooperation, ICIMOD
10:30 - 11:15	Introduction of participants, with their experience/needs in DEMs and application	Participants
11:15 - 11:45	Tea/Coffee Break Group Photo	
11:45 – 12:30	Introduction to DEMs	Dr. Mir Matin, Sr. Geospatial Application Specialist, ICIMOD
12:30 – 13:30	Lunch Break	
13:30 – 14:30	Introduction to SRTM – 2	Mir Matin
14:30 - 15:00	Example of DEM	Kiran Shakya
15:00 - 15:30	Tea/Coffee Break	
15:30 - 16:00	DEM generation from Stereo Image	Sudan Bikash Maharjan
16:00 -17:00	Solar radiation estimation	Sudip Pradhan
Day Two: Tuesday, 20 September 2016		
Time	**Activity**	**Presented By**
09:30 – 10:30	Applications using DEMs at varying spatial scales: - Watershed delineation	Sudan Bikash Maharjan
10:30 - 11:00	Tea/Coffee Break	
11:00 – 12:00	- Landslide hazard zonation	Sudan Bikash Maharjan
12:00 – 12:30	Height Above Nearest Drainage (HAND): Flood Inundation	Kiran Shakya
12:30 – 13:30	Lunch Break	
13:30 – 15:30	- Identification of Priority Areas for Soil Erosi Management in the Koshi Basin	Kabir Uddin

15:00 -	- Tea/Coffee Break	

Day Three: Wednesday, 21 September 2016		
Time	**Activity**	**Presented By**
09:00 - 11:00	Application of GIS flood tools and DEM for flood mapping: Sharing the RCMRD experience	Faith Mitheu, RCMRD
11:00 - 11:30	Tea/Coffee Break	
11:30 - 12:30	Sharing the RCMRD experience (cont.)	Faith Mitheu, RCMRD
12:30 - 13:30	Lunch Break	
13:30 - 15:00	Sharing the RCMRD experience (cont.)	Faith Mitheu, RCMRD
15:00 - 15:30	Tea/Coffee Break	
15:30 - 17:00	Sharing the RCMRD experience (cont.)	Faith Mitheu, RCMRD

Day Four: Thursday, 22 September 2016		
Time	**Activity**	**Presented By**
09:00 - 11:00	Reservoir management applications of SRTM elevation data	Safat Sikder, University of Washington
11:00 - 11:30	Tea/Coffee Break	
11:30 - 12:30	Guided exercise on reservoir management applications	Safat Sikder, University of Washington
12:30 - 13:30	Lunch Break	
13:30 - 15:00	Guided exercise on reservoir management applications	Safat Sikder, University of Washington
15:00 - 15:30	Tea/Coffee Break	
15:30 - 16:00	Feedback from Participants	Participants
16:00 – 16:30	Workshop closure	