A COMPARISON OF A DEM's DERIVED FROM DS1 AND SRTM

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Abstract

Digital Elevation Model (DEM) can be obtained from topographic maps, ground surveying airborne data or Remote Sensing technologies. In remote sensing technology, stereo pair (images) and Rational Polynomial Coefficient (RPC) are used to extract DEM. The extraction can be done either in single orbit or two different orbits based on the satellite capability and agility. In this paper, two types of DEMs have been used to generate Three Dimensional (3D) image of Fujairah area in United Arab Emirates for comparison and assessment purpose. The first DEM has been generated from Shuttle Radar Topography (SRTM) in a single orbit with 90m resolution, while the second DEM has been extracted from Dubai Satellite1 (DS1) in two different orbits.

Keywords: DEM, SRTM, DS1, 3D image.

1 INTRODUCTION

Remote Sensing satellite systems become essential part of the development that the world witnesses nowadays. SRTM is one type of Terra SAR satellite that was launched in year 2000 with the aim of obtaining elevation data for most the world with a resolution of 90m and 250 m at the equator [1]. SRTM is an international project organized by the National Geospatial Intelligence Agency (NGA) and the National Aeronautics and Space Administration (NASA) [2]. Another type of satellite is DS1 which consider as the first optical satellite owned by a UAE totally. DS1 is an initiative of Emirates Institution of Science and Technology (EIAST) [3], and it was launched in 2009. The resolution of DS1 is 2.5m for panchromatic images and 5m resolution for multispectral images with an operational life of 5 years. Moreover, in order to obtain stereo images from satellite, two methods are used, which are the along track from the same orbit and the cross track from two adjacent orbit.

Digital Elevation Model (DEM) is the process of representing the elevation data of the terrain in a three dimensional space of a surface. It could be acquired through different techniques, such as photogrammetry, Light Detection And Ranging (LIDAR), land surveying, satellite images, and other techniques. Furthermore, DEM is used for different purposes, for example, it is used to determine accurate positions of land areas and to establish the location of risky terrain areas. DEM is also used as the most basic for digitally produced relief maps, and it is often used in geographic information system. The purpose of this study is to compare between DS1 and SRTM DEMs of Fujairah area with the help of Environment for Visualizing Images (ENVI) software [4]. Figure 1.1 shows the block diagram of the procedure that was followed to generate 3D image.

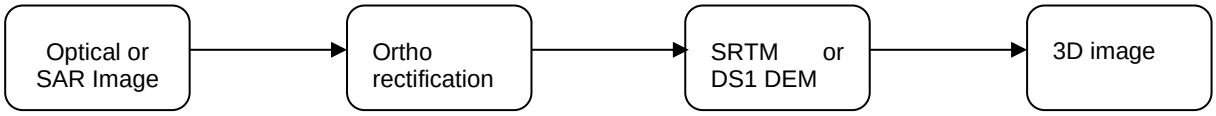


Figure 1.1 The diagram shows the steps of generating 3D image

2 DEM GENERATION

DEM generation using satellite data provides many advantages in respect to time and accuracy. ENVI software was used to generate DEM in this study. It supports imagery collected from satellites and airborne sensors. These sensors include Landsat, ASTER Worldview and more. It has the ability to edit DEM, ortho-rectification and mosaic. Figure 2.1 shows the block diagram of the steps that was followed to extract DS1 DEM.

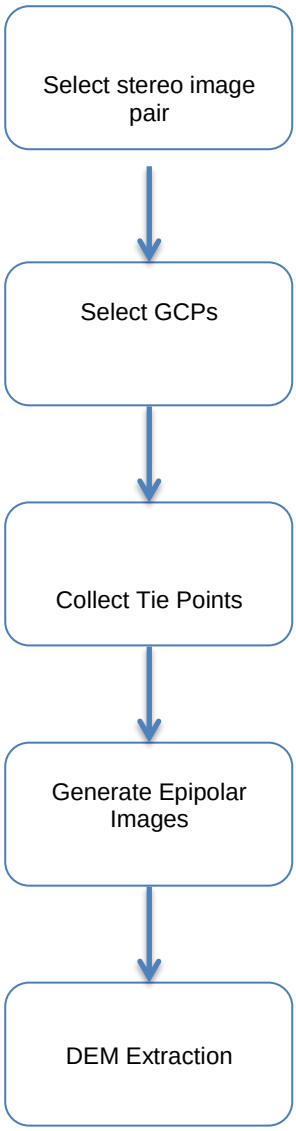


Figure 2.1 The diagram shows the steps to extract DS1 DEM

The DS1 DEM was generated by chosen GCPs for Fujairah area. The stereo images were selected and generated tie points for both sides as shown in figures 2.2 and 2.3

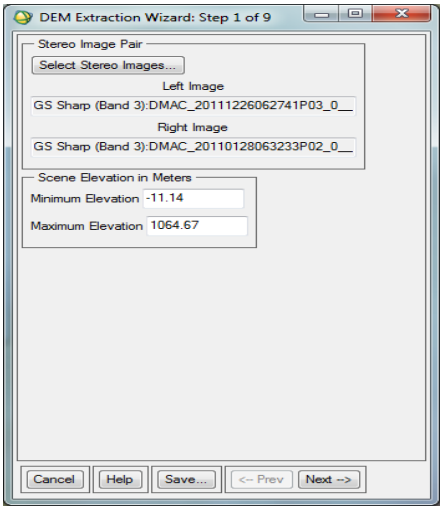
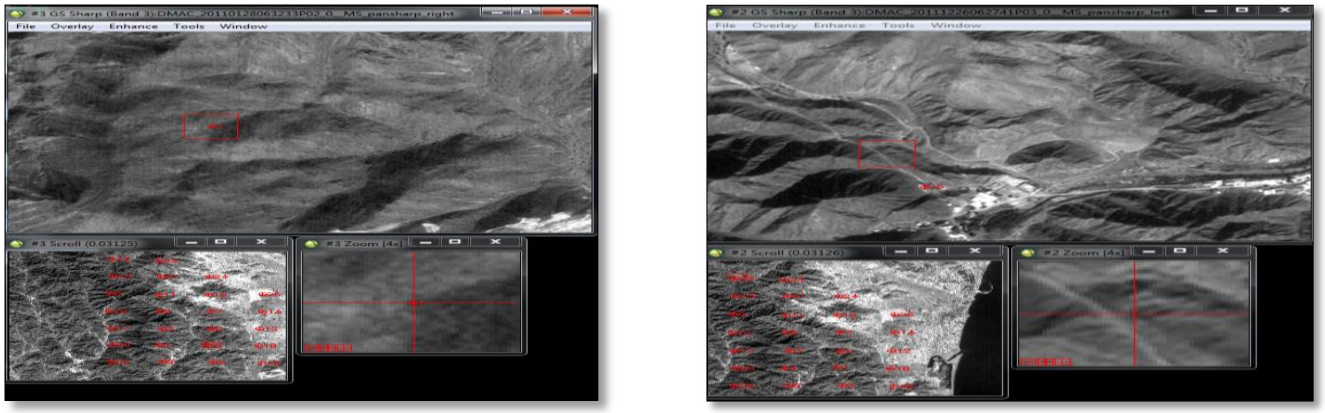


Figure 2.2 Select stereo images (left& right sides)



A B

Figure 2.3 Select tie points for both sides A&B automatically. A: left & B: right

The y parallax value should be as small as possible as shown in figure 2.4.The SRTM DEM for UAE's area and DS1 DEM of Fujairah area is shown in Figure 2.4 and 2.5. It can be easily observed that SRTM DEM give clearer result than DS1 DEM.

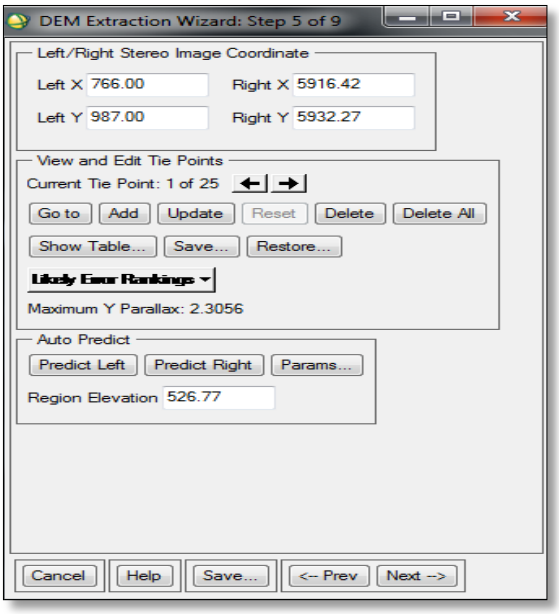


Figure 2.4 Y parallax's value

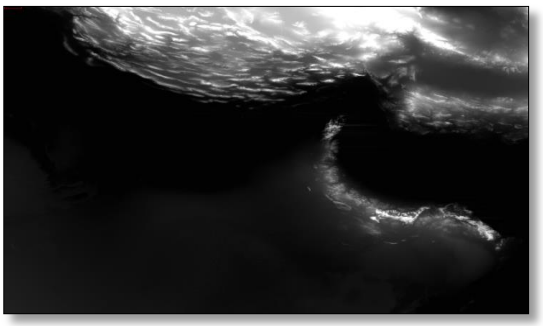


Figure 2.5 SRTM DEM for UAE's area.

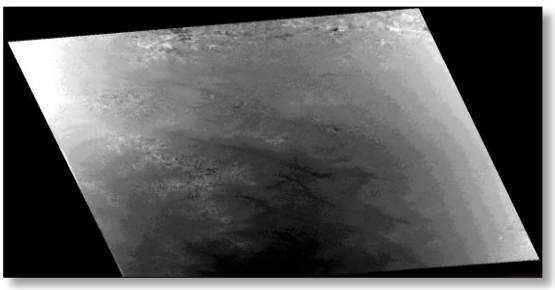


Figure 2.6 DS-1 DEM for Fujairah area.

3 THE OUTCOME

3.1 3D images of Fujairah and Dubai using SRTM DEM

After the images are ortho-recified, they can be generated to 3D by utilizing SRTM DEM and DS1 layers in ENVI software. The final 3D images of Fujairah is shown in Figures 3.1 and 3.2

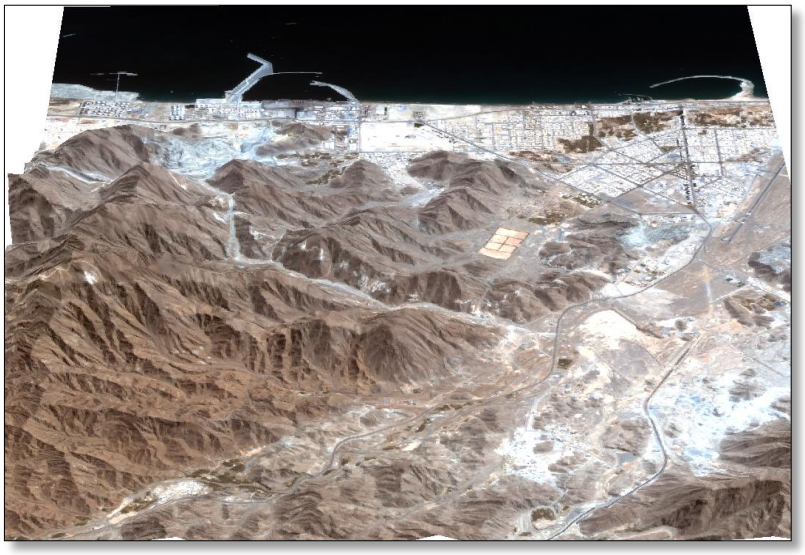


Figure 3.1 3D images of Fujairah using SRTM DEM

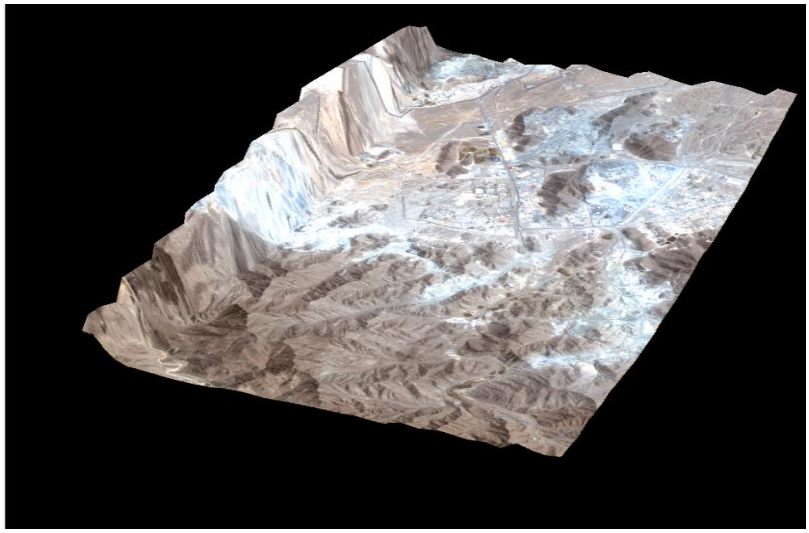


Figure 3.2 3D images of Fujairah using DS1 DEM

4 CONCLUSIONS AND FUTURE WORKS

Based on the final results, DEM that was extracted from SRTM shows better result than DEM that was extracted from DS-1. However, there are still some errors in both results, thus more methods are required to be investigated. DEM with high resolution is needed, in order to get better results. As for the future work, a comparison between Komsat-3 satellite and Light Detection And Ranging (LIDAR) with 5m resolution for DEM and 0.7m, 2.5 m for stereo images respectively.

AUTHOR's Background

Eman Altunaiji, Associate Image Processing Engineer in Emirates Institution for Advanced Science and Technology (EIAST).

Eman has a bachelor degree in Electrical Engineering (Electronic major) from Ajman University. She is currently pursuing a master degree in Engineering System Management at American University of Sharjah. She has joined EIAST in September 2012. Eman.altunaiji@eiast.ae

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