STEREO EVALUATION OF ALOS PRISM AND IKONOS DATA IN YEMEN

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1. INTRODUCTION

DLR's Remote Sensing Technology Institute has a long lasting experience in developing spaceborne stereo scanners (MEOSS, MOMS) and the corresponding photogrammetric software systems for stereo evaluation and orthorectification [1][2][3][4]. It takes part in the ESA/JAXA-AO Program to evaluate the performance and potential of the three-line stereo scanner PRISM and the multispectral imaging sensor AVNIR-2 on-board the Japanese satellite ALOS as a principal investigator. The high geometric resolution of PRISM (2.5 m ground sampling distance at nadir) combined with the medium swath width of 35 km has the potential to achieve high quality Digital Elevation Models up to 1:25.000 scale topographic maps for various applications. For one application the test site located near Sana'a, Yemen, is proposed, where additionally to the PRISM stereo data also an IKONOS stereo image pair exists, which is used for DEM comparison and performance analysis. The results of this test site are evaluated in cooperation with the Federal Institute for Geosciences and Natural Resources (BGR), Hannover.

2. METHODOLOGY

The paper gives a report on the generation of digital surface models (DSM) and orthoimages from ALOS/PRISM 3-line stereo data using DLR's automated stereo processing chain [5]. Ground control points (GCP) of sufficient accuracy are introduced to increase the geometric accuracy of the derived DSM and orthoimages, but as well the evaluations without using GCP shall demonstrate the pointing performance of the ALOS/PRISM system. After the images are prepared for the processing, a matching is performed between the three images in forward, nadir and backward direction using a hierarchical intensity based matching. Sub-pixel accuracy is achieved by a local least squares matching. Blunder reduction is done by thresholds and bi-directional matching. A densification of the tie points is achieved by a region growing algorithm based on local least squares matching. From the obtained tie points, object space coordinates are derived from two different methods to interpolate a regular grid to create a DSM. For the first method Rational Polynomial Coefficients (RPC) are generated for the PRISM images. For the second method a rigorous approach is applied using the exterior and interior orientation parameters as input for the forward intersection. Both methods are compared and the applicability of RPC for PRISM is discussed. Finally the resulting DSM is compared to the DSM generated from the IKONOS stereo pair and evaluated regarding horizontal and vertical accuracy by 3D shift determination between the individual DSM, as well as profile analysis for different terrain steepness.

2. APPLICATIONS

The possible potential of the derived results is demonstrated for an integrated water resource management in Amran (Yemen), where satellite data of sufficient resolution can provide important information of the changing agrarian areas and resultant water supply. Assessment of potential location for water dams can be derived from high quality DEM. Also terrace cultivation in Yemini mountain valley environment is endangered by mass movements, particularly rock and land slides triggered by flash flood after heavy rainfalls. Susceptibility mapping and monitoring using DEM and land use information from ALOS PRISM and AVNIR-2 data can contribute to these topics.

4. REFERENCES

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