

Lunokhod-1 Panoramic Images and Stereo Topography

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Abstract

The study has been carried out on the basis of the results of mission Luna 17 (Lunokhod-1) and new data obtained by LRO spacecraft. A detailed DTM, generated from Lunokhod-1 stereo pairs, and orthotransformed panoramic images will be presented at the conference.

1. Introduction

The unmanned interplanetary probe Luna 17 was launched on 10 November 1970 and entered lunar orbit on 15 November 1970. The spacecraft successfully landed in the Sea of Rains on 17 November 1970 and Lunokhod-1 was deployed to the surface. During the operation Lunokhod-1 sent to the Earth 211 lunar panoramas and approximately 25,000 images. Lunokhod-1 was detected on LRO images in March 2010.

In this study we have identified and selected a number of stereo pairs from the Lunokhod-1 mission. The selected stereo pairs will be photogrammetrically processed and referenced to area topography, obtained from the orbital LRO data [1]. Images 150756018 and 150749234 (left and right cameras) from LRO are used for the study.

2. Research method

In preparation, we created a detailed DTM (Fig. 1) based on LRO images using automatic correlation of stereo pairs and block adjustment techniques, performed by means of the “Photomod 5.2” software package [3]. From ground sample distance (GSD) of 0.55 m, a DTM at grid size of 1.1 meters was derived.

A detailed DTM was constructed with the use of images which obtained by the Lunokhod-1 camera from the lunar surface. Tie-points on stereo pairs were identified manually and adjusted as free stereo pairs without referencing. All measurements and

processing have been carried out by means of “Photomod 5.2”.

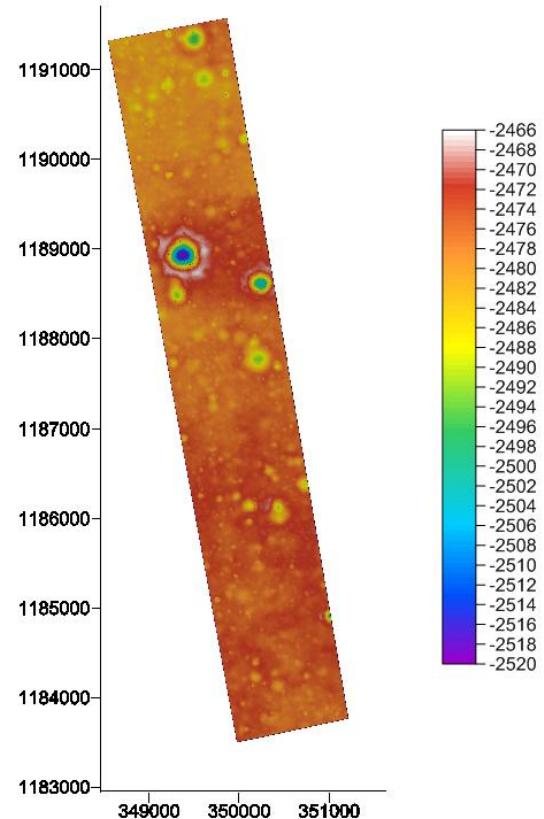


Figure 1: DTM created using LRO stereo pairs, the area is approximately 142.2 km² (Mercator projection, central meridian is 325°).

3. Results

For creation of Lunokhod-1 panoramas more than 20 tie-points have been measured for each stereo pair. Using these measurements block adjustment was carried out adopting the reported base length between the positions of the rover, when images were taken.

Examples of stereo pairs processed are presented at Fig. 2.

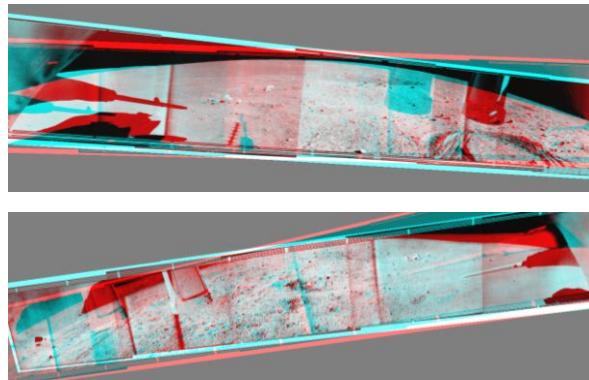


Figure 2: Examples of Lunokhod-1 processed stereo pair.

Adjustments were made without absolute referencing. The precise identification of Lunokhod-1 panoramas on LRO images is in progress.

4. Future Work

At the next stage we will reference the Lunokhod-1 stereo pairs to LRO data, using landmark points on the surface, such as craters and Lunokhod's tracks. Using these control points three-dimensional location of stereo pairs will be determined and manual stereo vectoring will be made. Results of the study will be presented at the conference. We will compare our results with results from a previous study [4].

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References

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