THREE-DIMENSIONAL MONITORING OF SURFACE DEFORMATION USING DIGITAL CAMERAS WITH RTK

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Japan is a very mountainous country, with three-fourths of the national land being mountains. To mitigate against sediment disasters which can be detrimental to property, livestock and human lives, surface monitoring is routinely performed. Currently, the methods employed for surface deformation monitoring rely heavily on visual inspection of cracks and flakes. This approach is time-consuming and subjective as the results vary depending on the inspector. Moreover, it requires experienced workers and with recent financial difficulties, this has become a challenge. Hence, it is necessary to establish a more efficient and versatile monitoring method. This paper utilizes Structure-from-Motion (SfM) Photogrammetry to detect surface deformation using a Digital Single-lens Reflex (DSLR) camera connected to a Real Time Kinetic (RTK) Global Navigation Satellite System (GNSS). This system is affordable, can be used in confined spaces, and provide better image quality due to the high resolution and reduced noise. With advances in SfM software, 3D models can be constructed from digital images. In the proposed surface monitoring method, two sets of 3D models are used. Each model is aligned using the Iterative Closest Point (ICP) algorithm, and differential data is generated from the two models to visualize surface deformation. ICP is an algorithm that seeks to minimize the difference between two point clouds by transformation. In this research, this technique is tested to study its potential for adaptability to real slopes. In this paper we show that this system can produce high quality visualizations of surface deformation with high accuracy comparable to the traditional method.

Keywords: SfM photogrammetry; RTK, GCP; surface monitoring; ICP