Three Dimensional Landslide Mapping with High resolution Satellite images Using the RPC Forward Intersection Approach

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ABSTRACT:

Landslide occurrence is one of the natural disasters which annually cause great damages worldwide and, therefore, landslide prediction and monitoring is of great concern. Landslide susceptibility determination largely relies on the information provided by the landslide inventory maps. Therefore, precise land displacement determination can be regarded as one of the preliminary steps towards a more reliable landslide prediction. Recent improvements in high resolution satellite images (HRSI) equipped with precise positioning technology on board the satellites and the large ground coverage, offer high potential for land slide monitoring and mapping. In this paper we present a strategy for three dimensional land displacement detection using HRSI stereo pairs. It starts with sub-pixel image matching over the salient points on the susceptible areas using least squares image matching which indeed is capable to generate sub-pixel disparity values. The matched points are then transferred into three dimensional terrain coordinates using the HRSI supplied RPC's. Without a need for any ground control point for RPC bias compensation, landslide detection can be carried out by a Helmerts transformation between the terrain coordinates generated from the first imaging epoch and the three dimensional coordinates generated for the same points from the other epochs. The calculated discrepancies can then be interpreted as the detected relative land displacements. Moreover, if only a single ground control point is measured on the field, then the RPC bias can be compensated yielding the absolute values with respect to the global reference frame for the landslide mapping. The preliminary stage of this approach is tested over a mountainous terrain using IRS P5 high resolution stereo images using a manual image pointing method. The residual discrepancies indicate sub-pixel values. However, no significant land movement is detected on the tested dataset. Further investigation is being carried out on the areas more susceptible to landslide occurrence.