Geophysical Research Abstracts
Vol. 18, EGU2016-17813, 2016
EGU General Assembly 2016

Globally referenced real time monitoring of mass movements using monoscopic time-lapse photography.

Robert Kenner (1), Marcia Phillips (1), and Manfred Buchroithner (2)

(1) WSL Institute for Snow and Avalanche Research SLF, (2) Institute for Cartography, Dresden University of Technology

The creep movement of a rock glacier was monitored in daily resolution using images of an automatic in-situ time-lapse camera (AC). Displacements were calculated between the images in 2D image coordinates using the imaging velocimetry algorithm of Roesgen and Totaro, 1995. To georeference and scale these displacements, a creep velocity field captured once by a terrestrial laser scan (TLS) repeat measurement was used. The laser scan point cloud and the creep velocity vector field were projected in image coordinates of the AC to obtain a georeferencing mask, a scale mask and an azimuth mask for the 2D displacements calculated between two images. The scale mask was obtained by comparing the TLS derived displacement vectors with those of the AC, referring to a common measurement period.

The automatic procedure includes the following work steps:
1. Offsets between two images are identified and corrected based on image parts representing unchanged terrain.
2. 2D displacements are calculated between all chronological image sequences.
3. Faulty displacement vectors are eliminated based on a predefined threshold for spatial direction differences.
4. The remaining displacements are georeferenced, scaled and attributed with individual displacement directions (azimuths) in global coordinates.
5. In addition to the displacement values, displacement velocities and accelerations are calculated using the date of the images.
6. For chronologically successive displacement vector fields, the spatial mean of the relative velocity is defined and expressed as a percentage of the first displacement velocity in the series. The time series of the relative velocities is expressed in chart form.
7. The spatial resolution of all georeferenced output data sets is homogenized, as they were influenced by the central projection of the photos.

The described procedure proved to be a reliable, low cost method to monitor mass wasting processes. Even under difficult conditions, like thin snow coverage or different lighting conditions, a high relative accuracy and a high spatial and temporal resolution could be obtained.

Reference:
Roesgen, T., Totaro, R., 1995. Two-dimensional on-line particle imaging velocimetry. Experiments in Fluids,19, 188-193.