Geophysical Research Abstracts
Vol. 17, EGU2015-9158, 2015
EGU General Assembly 2015

3D geometrical description of landslides using photogrammetric data acquired by Remotely Piloted Aerial System

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The need to have three-dimensional digital products of high accuracy and high resolution is now increasingly important for the study of the hydrogeological instability phenomena both from a geomorphological point of view and a geotechnical-geomechanical one. What until now was considered the prerogative of the laser scanner (both air-transported and terrestrial) for data acquisition, in many contexts is to be integrated and often replaced by photogrammetric techniques. The integration of the typical photogrammetry algorithms (Aerial Triangulation, bundle adjustment, collinearity equations, etc.) with Structure from Motion (SFM) algorithms derived from Computer Vision (CV) allows to get products "dense points cloud" of high quality and high resolution with almost complete automation of processes. The use of Remotely Piloted Aerial System (RPAS) equipped with high resolution photogrammetric and positioning sensors, allows to obtain, in a very short time and with low costs, all necessary data for the purpose. Through all stages of the photogrammetric processing, is obtained, as a base product, a dense cloud of points. Subsequently, after the phase of cleaning and classification of data, it will be possible to obtained all the necessary products for studing the geomorphological characterization and, in specific cases, also geotechnical-geomechanical characterization.
The high repeatability of surveys, due to the insertion of data always in the same reference system without introducing transformations between coordinate systems, and the high accuracy in the determination of Ground Control Point (GCP) measured and processed with geodetic techniques, mainly by GNSS instrumentation, allows to compare data and models over time. The possibility of the RPAS to carry on board the double frequency satellite positioning systems, so as to define the spatial coordinates of the perspective center with centimetric accuracy, it also allows to obtain repeatability of the data in difficult or absolutely no access areas (high-risk zones and so on). The high repeatability, therefore, makes it possible to perform evaluations of volumes variation and of the surfaces shape. When the data is very dense and, for example in case of rock slopes, you can also define the dip and dip-direction of discontinuity planes (like joints and faults), through specific procedures. With a high radiometric accuracy, when the situation allows it and when the texturing of the model is at a very high resolution, there is also the possibility of determining the “rake” parameter.