Geophysical Research Abstracts
Vol. 17, EGU2015-11231, 2015
EGU General Assembly 2015

Application on-line imagery for photogrammetry comparison of natural hazards events

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The airborne (ALS) and terrestrial laser scanner (TLS) technologies are well known and actually one of the most common technics to obtain 3D terrain models. However those technologies are expensive and logistically demanding. Another way to obtain DEM without those inconveniences is photogrammetry, in particular the structure from motion (SfM) technic that allows high quality 3D model extraction from common digital camera images without need of a expensive material.

If the usual way to get images for SfM 3D modelling is to take pictures on-site, on-line imagery offer the possibility to get images from many roads and other places. The most common on-line street view resource is Google Street View. Since April 2014, this service proposes a back-in-time function on a certain number of locations. Google Street View images are composed from many pictures taken with a set of panoramic cameras mounted on a platform like a car roof. Those images are affected by strong deformations, which are not recommended for photogrammetry. At first sight, using street view images to make photogrammetry may bring some processing problems.

The aim of this project is to study the possibility to made SfM 3D model from Google Street View images with open source processing software (Visual SFM) and low-cost software (Agisoft). The main interest of this method is to evaluate at low cost changes without terrain visit. Study areas are landslides (such those of Séchilienne in France) and cliffs near or far away from roads. Human-made terrain changes like stone wall collapse by high rain precipitations near of Monaco are also studied. For each case, 50 to 200 pictures have been used.

The mains conditions to obtain 3D model results are: to have a street view image of the area of interest. Some countries like USA or France are well documented. Other countries like Switzerland are only partially or not at all like Germany. The second constraint is to have two or more sets of images at different time. Third condition is to have enough quality images. Over- or underexposed images, bad meteorological conditions (fog, rain, etc.) or bad images resolution compromise the SfM process. In our case studies, distances from the road to the object of interest range from 1 to 500 m.

First results show that SfM processing with on-line images is not obvious. Poor-resolution and deformed images with unknown camera features make the process often difficult and not predictive. The use of Agisoft software give bad results because of the abovementioned features while Visual SFM give interesting results for about two thirds of cases. It is also demonstrated that 3D photogrammetry is possible with on-line images under certain restrictive conditions. Under these conditions of images quality, this technique can then be used to estimate volumes changes.