Geophysical Research Abstracts
Vol. 17, EGU2015-14328, 2015
EGU General Assembly 2015

Long-term monitoring of a large landslide by using an Unmanned Aerial Vehicle (UAV)

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Currently UAVs become more and more important in various scientific areas, including forestry, precision farming, archaeology and hydrology. Using these drones in natural hazards research enables a completely new level of data acquisition being flexible of site, invariant in time, cost-efficient and enabling arbitrary spatial resolution.
In this study, a rotary-wing Mini-UAV carrying a DSLR camera was used to acquire time series of overlapping aerial images. These photographs were taken as input to extract Digital Surface Models (DSM) as well as orthophotos in the area of interest.
The "Pechgraben" area in Upper Austria has a catchment area of approximately 2 km^2. Geology is mainly dominated by limestone and sandstone. Caused by heavy rainfalls in the late spring of 2013, an area of about 70 ha began to move towards the village in the valley. In addition to the urgent measures, the slow-moving landslide was monitored approximately every month over a time period of more than 18 months. A detailed documentation of the change process was the result. Moving velocities and height differences were quantified and validated using a dense network of Ground Control Points (GCP). For further analysis, 14 image flights with a total amount of 10.000 photographs were performed to create multi-temporal geodata in in sub-decimeter-resolution for two depicted areas of the landslide.
Using a UAV for this application proved to be an excellent choice, as it allows short repetition times, low flying heights and high spatial resolution. Furthermore, the UAV acts almost weather independently as well as highly autonomously. High-quality results can be expected within a few hours after the photo flight. The UAV system performs very well in an alpine environment. Time series of the assessed geodata detect changes in topography and provide a long-term documentation of the measures taken in order to stop the landslide and to prevent infrastructure from damage.