Geophysical Research Abstracts
Vol. 21, EGU2019-16942, 2019
EGU General Assembly 2019

Process based rockfall modelling in 3D using data sets from RPAS.

Alexander Preh and Emmanouil Fleris

Vienna University of Technology, Institute of Geotechnics, Research Unit Engineering Geology, Wien, Austria
(alexander.preh@tuwien.ac.at)

A number of methodologies for the quantitative rockfall hazard assessment and the definition of hazard or danger zones have been proposed in the scientific literature (e.g. Mölk & Rieder, 2017). In general, the classification and ranking of the factors contributing to hazard is an intrinsically uncertain task and different researchers propose different techniques to tackle the problem. Despite some major differences, what is common in these approaches, is the use of 3D physically based rockfall modelling for the generation of the necessary spatially distributed data, in the form of 3D rockfall trajectories. Since this data serves as the basis for any subsequent hazard assessment, it is evident that data quality and its resolution will dictate the results of the task.

The use of RPAS (Remotely Piloted Aircraft Systems), employing different data acquisition techniques (e.g. Photogrammetry - SfM (Structure from Motion), LiDAR) is constantly increasing in the field of geosciences. In relation to rockfall modelling, RPAS provide with advanced methods for obtaining remotely sensed data. Digital Elevation Models of fine resolution can be generated, Rockmass characteristics can be remotely investigated, overcoming difficulties imposed by physically inaccessible and/or dangerous terrains. A rockfall dedicated field-mapping campaign can be enriched with valuable information. A question that emerges is to what extent our existing numerical tools can utilize this information. What could be useful and what is not.

For the past few years we have been working on developing numerical algorithms for rockfall modeling and further exploring the idea of a simple but yet effective hybrid lumped mass model, using a deterministic method to mathematically treat rockfall impacts (Goldsmith, 1960), modified by the introduction of stochastic surface roughness and the calculation of hyperbolic restitutions factors (Bourrier & Hungr, 2011). WURF (Fleris & Preh, 2016) is a PYTHON numerical code based on the aforementioned principles, creating through its functions a virtual environment for the study of rockfall in 3D.

As resolution and the preciseness of remotely sensed data increase, finer geomorphological detail is being captured in generated DEM's. This can be problematic to high resolution 3D rockfall numerical modelling since it is to affect the range of artificial roughness that should be stochastically introduced to rockfall simulations. There currently exists limited information on the direct use of high resolution data sets (i.e. LiDAR) in rockfall numerical models.

We are to present results from numerical modelling in 3D using WURF and utilizing data arriving from RPAS, both at regional and smaller topographic scales. Data sets have been acquired in the context of the NoeTALUS project (Melzner & Preh, 2019).We are also to address how the remotely acquired data may assist in solving problems while preparing for and conducting rockfall numerical modelling in 3D such as i) the correct representation of topography ii) the uncertainty of identifying rockfall release positions and measuring rockfall release volumes, iii) the spatial distribution of several key model input parameters (e.g. definition of homogenous regions of surface roughness and restitution) iv) model calibration and v) model efficiency.