Geophysical Research Abstracts
Vol. 17, EGU2015-8699-3, 2015
EGU General Assembly 2015

Structural assessment and multi-parameter monitoring - an application to the Salcher landslide (Austria)

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Landslides pose a serious threat to many communities in Austria. The region of Lower Austria is underlayed, amongst others, by the lithological units of the Flysch Zone and the Gresten Klippenbelt. Both are particularly affected by landslides and the majority of episodic occurrences are bound to these two units. The active Salcher landslide is situated at the western border of the municipality of Gresten and is embedded in the geologic transition zone of the respective lithological units. The landslide is a reactivated and deep seated complex landslide that endangers buildings, parts of a road and lifelines such as power and optical fiber lines, fresh and sewage water supplies. Its varying movement rates are in the order of a few centimeters per year and consequently are classified as slow to extremely slow.

Despite biannual geodetic surveys, little is known about the dynamic behavior including the triggering and controlling factors and its internal structure. Surface and subsurface investigations were therefore carried out on that landslide. With the intention to detect morphological surface changes, comparative geomorphologic mapping and terrestrial laser scanning was performed. Additionally, surface kinematical information was acquired by historical documents and GNSS measurements. The detailed present soil-physical conditions and their relation to current dynamics were investigated by six drill cores and three inclinometer installations. Soil specimens were obtained by percussion drilling. Particle size distribution, and water and carbonate content were subsequently analyzed in the laboratory. In addition, dynamic probing was performed at 13 sites across the landslide body and resistance values were compared to textural findings. The soil specimens show a heterogeneous texture and large variations in carbonate and water content. Soil wedges, originating from local displacements, were determined in two drill cores. Very high water content and resulting plastic behavior indicate the presence of weakness zones with the geometry of a translational landslide. The depths of the drill cores ranged from 5 m to 9 m. The sampling density of each respective core was less than one meter. The final depth of the three inclinometers ranged from 6.5 m to 13 m. The inclinometers were placed at prominent morphological landslide features like the head, bulged levee and the transitions zone and were maintained over the past eight months. Subsurface displacement measurements were then compared with the soils' texture. GNSS based geomorphological mapping revealed areas that underwent morphological changes. Surface displacements were analyzed by terrestrial laserscanning. These sites investigations are the basis for a detailed understanding of the landslide dynamics. In the future, the measurements will be applied in modelling concepts which will be embedded in a comprehensive landslide early warning system.