Moosfluh: towards a rock slope failure?

Project Framework

The Great Aletsch Region (GAR, Swiss Alps) has undergone to several cycles of glacial advancement and retreat, which have deeply affected the evolution of the surrounding landscape. Currently, this region is one of the places where the effects of climate change can be strikingly observed, as the Aletsch glacier is experiencing a remarkable retreat with rates in the order of 50 meters every year. In particular, a deep-seated slope instability located in the area called “Moosfluh” has shown during the past 20 years evidences of a slow but progressive increase of surface displacement. The moving mass associated to the Moosfluh rockslide affects an area of about 2 km^2 and entails a volume estimated in the order of 150-200 Mm^3. In the late summer 2016, an unusual acceleration of the Moosfluh rockslide was observed. Compared to previous years, when ground deformations were in the order of few centimeters, in the period September-October 2016 maximum velocities have reached locally 1 m/day. Such a critical evolution resulted in an increased number of local rock failures and caused the generation of several deep tensile cracks, hindering the access to hiking paths visited by tourists. Current displacement rates are in the order of 2-5 cm/day, and we expect that during the summer 2017 a significant acceleration will be observed again.

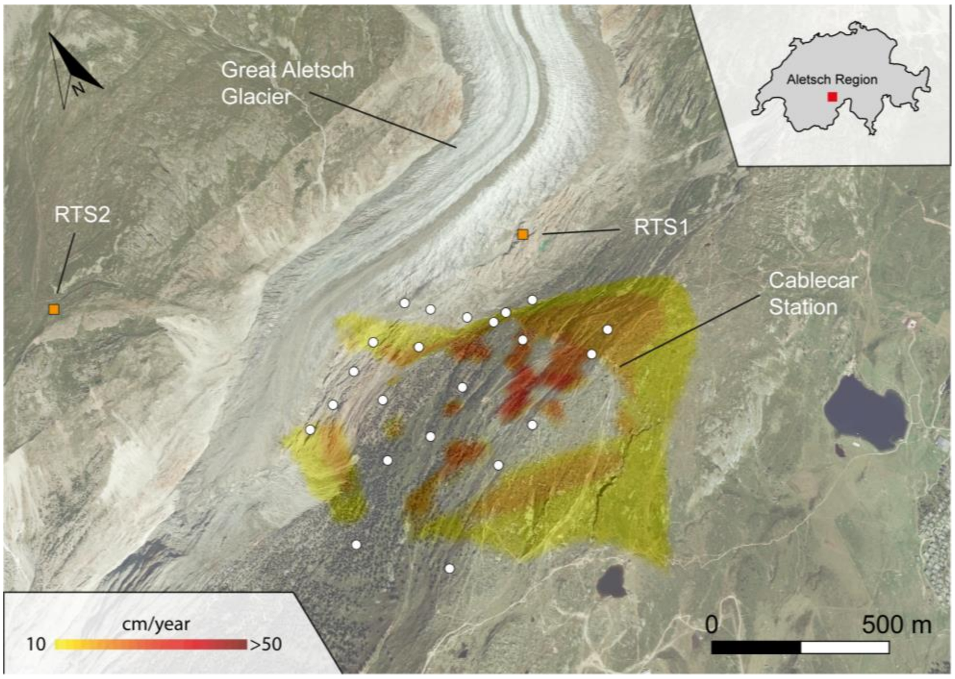

Figure 1: Surface deformation at Moosfluh retrieved with the analysis of space borne SAR data and the Total Station (RTS) monitoring network. Location for the installation of the Raspberry Shakes seismometers will be at the RTS locations + at the Moosfluh cable car station.

Objectives

During the acceleration phase, rock fall events will also take place at different locations of the landside body, and involving different volumes. The main goal of the project is to compare/correlate surface deformation and processes observed with remote sensing techniques with the occurrence, the location and the size of rockfalls in order to better characterize the kinematic evolution of a failing rock slope over space and time. Rockfalls will be identified and investigated by analyzing the data acquired from a local seismic network composed of 3 Raspberry Shake seismometers. Surface processes will be analyzed by processing optical imagery acquired from a webcam installed at the Driest location, on the opposite side of the Moosfluh rock slide.

Figure 2: Surface deformation obtained by analyzing digital photos acquired from the Driest location

Methods and Approach

The idea is to combine low-cost instruments to gather an insight on the kinematic evolution of the Moosfluh roclk slope during the acceleration phase. Three Raspberry Shake (low-cost seismometers) have to be installed in the area of investigation, likely in April-May 2017. Several field visits are envisaged during the Spring-Summer 2017. Seismic data will be collected and analyzed by using different approaches and algorithms to identify rockfall phenomena. The webcam is already installed and acquires optical imagery every 10 minutes. This dataset has to be first organized, (visually) compared to the results obtained from the local seismic network, and analyzed by applying the Digital Image Correlation approaches to measure surface deformation. **Note: The student will actively cooperate in the design, installation, implementation and management of the monitoring network. Starting from May 2017, this work requires a daily commitment to check that the monitoring infrastructure is working properly and the data for the project continuously and properly acquired.**

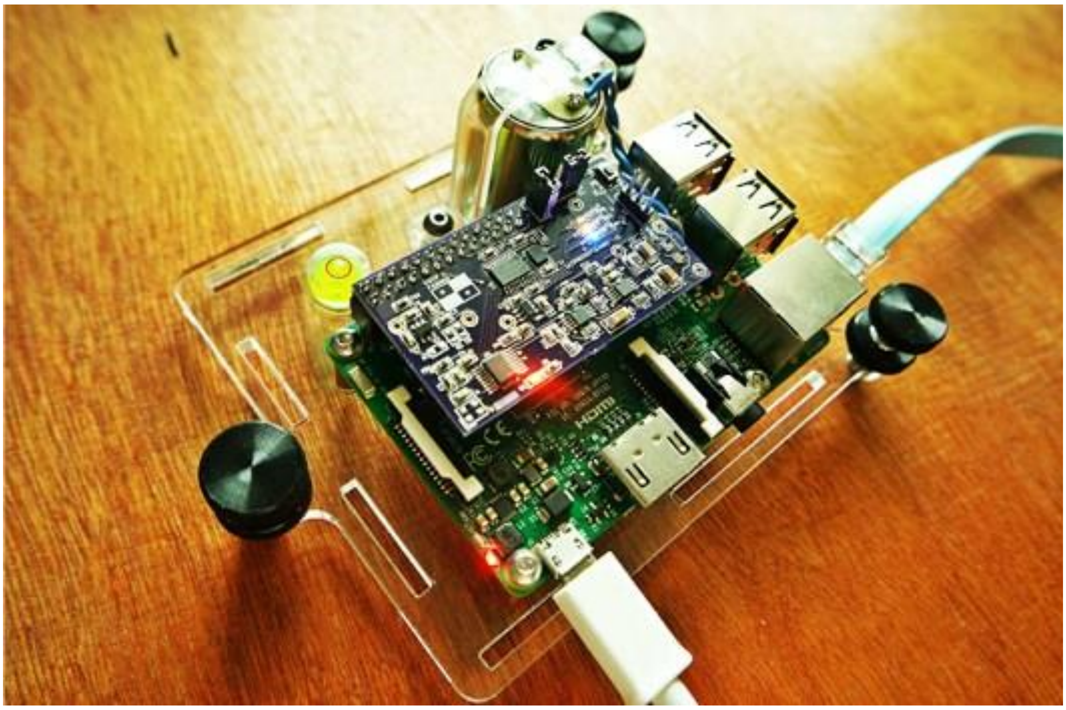

Figure 3: Raspberry shake seismometer (www.raspberryshake.org)

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