

## MONITORING LANDSLIDE MOOSFLUH



DEFORMATIONCAMERA

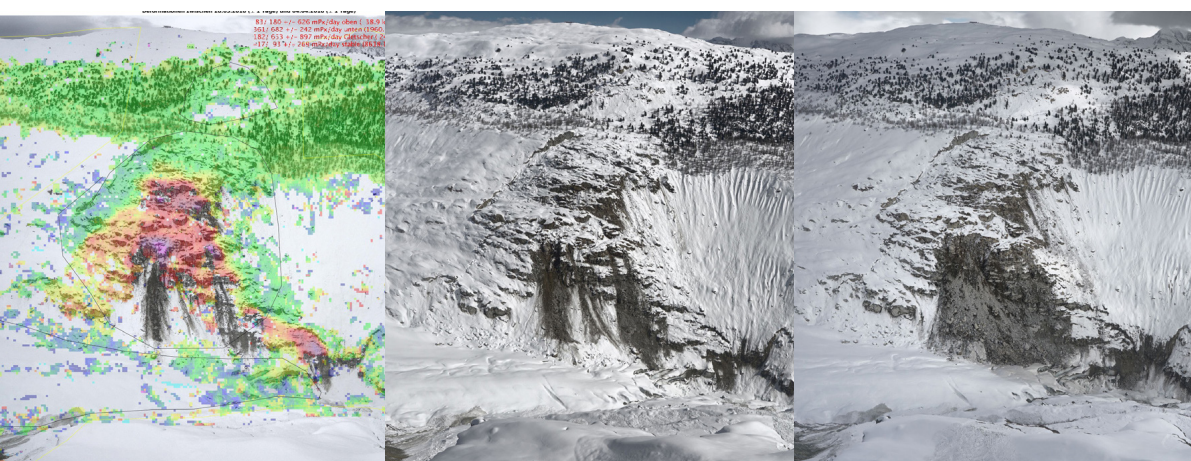


WEBCAM

The DEFOX<sup>®</sup> deformation camera permanently monitors the Moosfluh landslide area. Thanks to the daily deformation analysis, it is possible to detect as soon as the slide accelerates. This enables early intervention by authorities.







Title Page: Ideal camera view to the landslide area.

Figure 1: The rock fall in April 2018 (before the rock fall on April 5th: centre; after the rock fall on April 13th: right) had become apparent a few days earlier in the deformation analysis (left) by accelerated velocities.

## CHALLENGE

The Moosfluh is a large landslide area on the left edge of the famous Aletsch Glacier north of Riederalp in Valais, Switzerland. The landslide area extends over a surface of approximately 1 km<sup>2</sup> and a volume of at least 150 million m<sup>3</sup> (Figure 2). Due to the steady retreat of the glacier, the foot of the slope increasingly lacks the stabilizing effect of the glacier ice. This causes slope movement. Since the mid-90s, the unstable slope has been sliding continuously downhill, leading to deep cracks in the terrain and rockfall events. Repeatedly the Moosfluh slides very quickly, up to 80 cm/day. Spontaneous small landslides and break-offs are possible at any time. Consequently, all hiking trails in the area have been closed permanently in 2016. In extreme cases, a large landslide in the Moosfluh can trigger a glacial lake outburst flood (GLOF) from the Gibidum reservoir.

## SOLUTION

To monitor the Moosfluh landslide, Geoprevent installed a DEFOX<sup>®</sup> deformation camera on the counter slope in summer 2017. Since then the landslide area has been photographed several times a day and processed on site with HDR to improve the contrast. The high-resolution

images are then uploaded to the servers, where a complex algorithm selects the best photos and then calculates the deformation. For this purpose, the displacement of the smallest image fields over a desired period of time is calculated. Also, we apply a proprietary algorithm to select the optimum imagery considering the frequently changing visibility conditions and light/shadow conditions. All deformation analyses and the high-resolution images of the DEFOX<sup>®</sup> PRO webcam can be viewed at any time by authorized users via the Geoprevent online data portal on desktop, tablet or mobile (Figure 3). If required, an automatic alarm notification can also be integrated into the system. The service informs selected people immediately if a defined alarm value is exceeded. Every summer, the deformation camera shows an acceleration of the landslide, reaching its maximum in August. So far, no major event has occurred. Smaller discontinuities occur repeatedly and normally are shown in the deformation analysis days to weeks before (Figure 1). If a strongly increased activity of the landslide is detected, it is recommended to temporarily supplement the system with an interferometric georadar to obtain analyses in real time and under all weather and visibility conditions.



Figure 2: The Moosfluh landslide area: The foot of the slope is destabilized by the retreat of the Aletsch Glacier and the lack of glacier ice.



Figure 3: The high-resolution images of the DEFOX<sup>®</sup> PRO webcam are available at any time in the online data portal for authorized users.