GEOPREVENT

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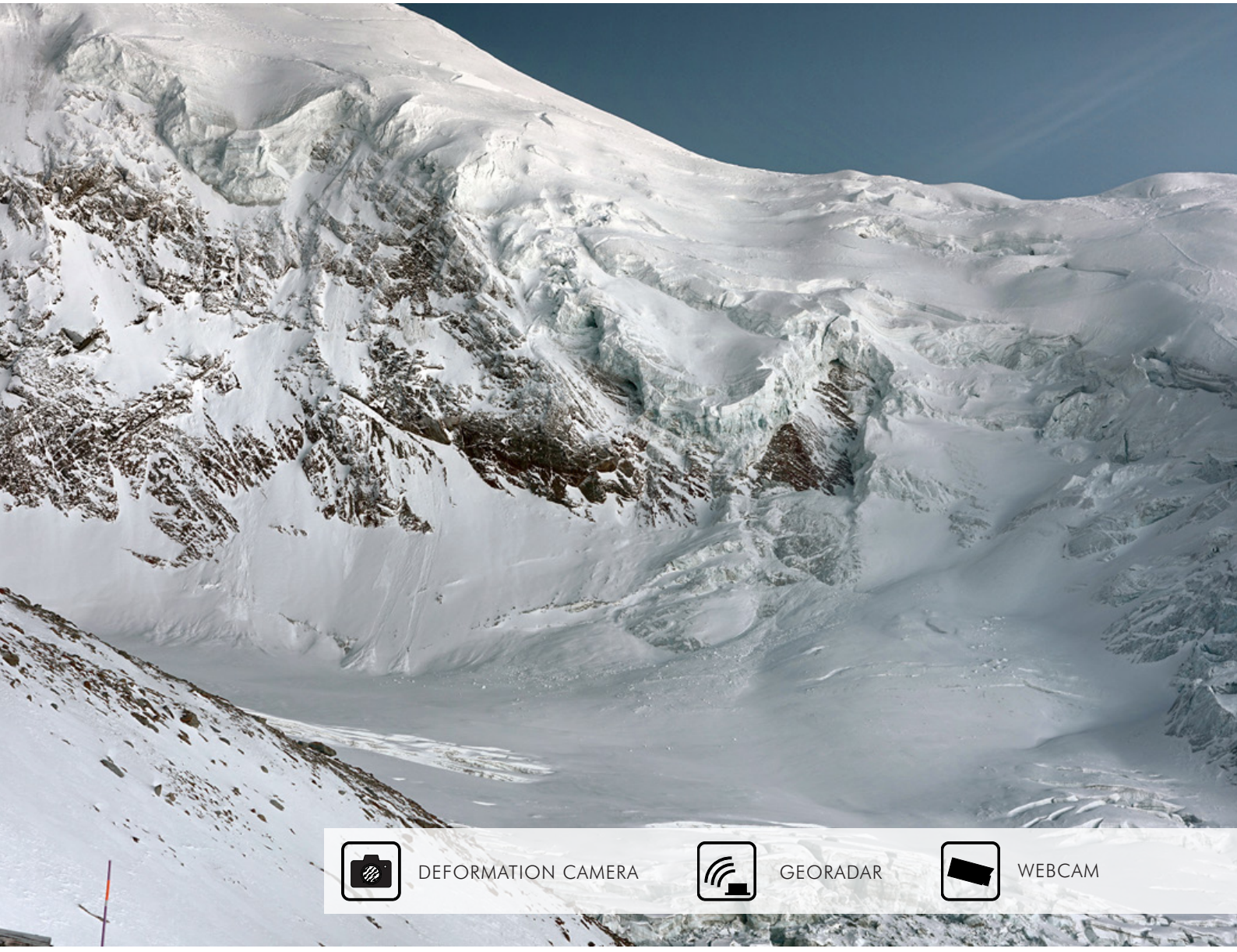
GLACIER MONITORING WEISSMIES

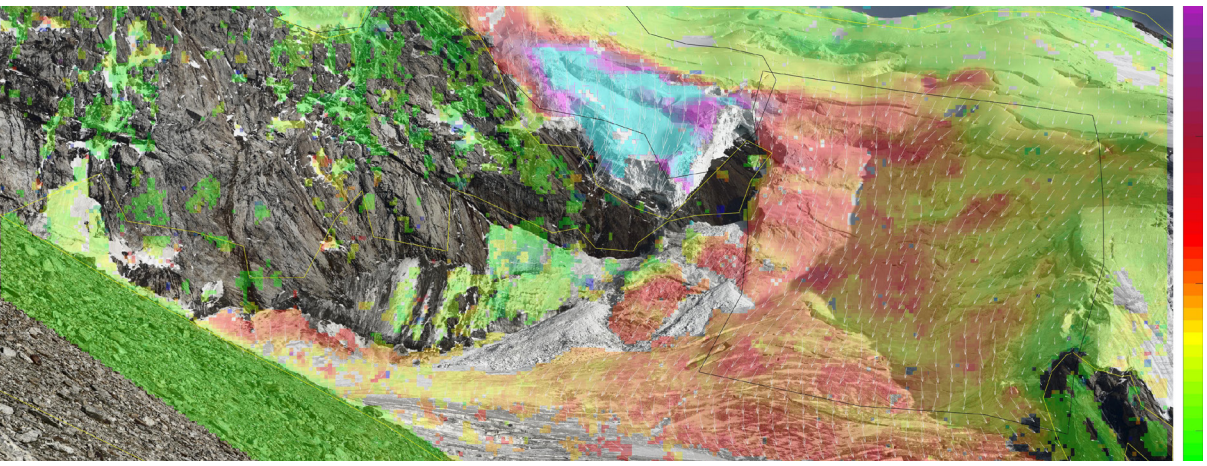


PART OF HEXAGON

Long-term monitoring of the Trift glacier flow velocities with DEFOX® PRO deformation camera and interferometric radar. In September 2017, a large glacier collapse was correctly predicted within a few hours of accuracy.

GEOPREVENT AG
Räffelstrasse 28
8045 Zurich
Switzerland

Tel. +41 44 419 91 10
info@geoprevent.com



Title Page: Weissmies Glacier.

Figure 1: Webcam view: If the avalanche does not reach the road, the closure can be revoked immediately.

CHALLENGE

Weissmies (4,017 m/13,179 ft) is a mountain in the Swiss alps close to the well-known ski resort of Sass Fee. The mountain ridge separates the Saas valley from the Simplon valley close to the Italian border. In its northwest face lies the Trift glacier, a hanging glacier originating from the Weissmies peak. The glacier has been retreating for many years and increased ice avalanche activity had been reported since 2014. The hanging glacier had destabilized due to glacial ablation, predominately in steeper areas. Consequently, a large part of the glacier was at risk of collapsing and potentially threatened the touristic area and village of Saas Grund.

SOLUTION

In 2014, Geoprevent installed an interferometric radar to continuously monitor the unstable glacier area. The radar is able to measure spatially resolved deformation rates with high accuracy in any weather and at any time of day. Initially, the radar detected velocities of 20 cm/day, subsequently unstable glacier area decelerated steadily to less than 5 cm/day in late 2016.

As destabilization was expected again a long-term monitoring was required. Addressing this need a DEFOX® PRO camera for automatic deformation analysis was installed alongside the radar in winter 2016/2017. The DEFOX® PRO camera analysis provided excellent results and proved to be a cost-effective alternative to radar measurements - in case weather is not an issue. Following the test period, the DEFOX® PRO took over glacier monitoring.

In August 2017, deformation analysis showed rapidly increasing the flow rates of the unstable glacier area. As a bad weather period was forecasted and more precise measurements were required, the interferometric georadar was reinstalled again on short notice. The initial flow rate of 80 cm/day tripled in only two days. Based on glacier expert judgement of the measure data, the collapse was estimated to September 10, 2017, early morning. The unstable glacier continued to accelerate and finally reached 3.5 m/day before breaking off in several events between 5:30 AM and 6:30 AM. The portion of the village potentially at risk from the ice avalanche was evacuated the night before the collapse. Fortunately, the ice masses stopped on the glacier area below without reaching the village.

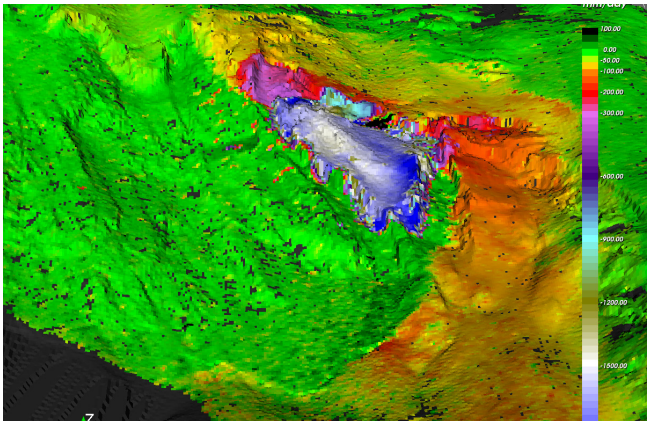


Figure 2: The radars monitor a total area of roughly two square km. The color in this graph indicates the distance to the radar in meters.

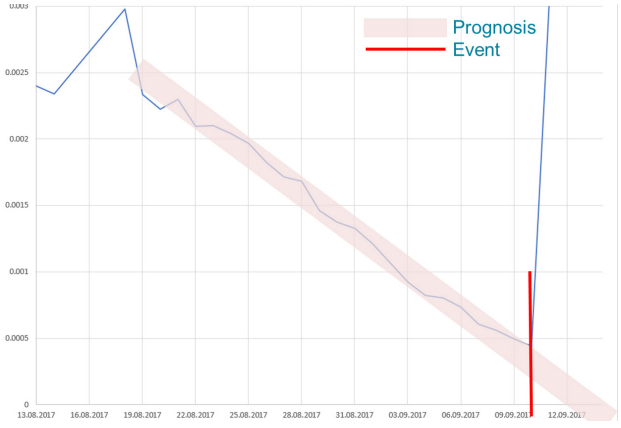


Figure 3: Overview of the alarm system in Zermatt. The radars are mounted on the opposite side of the valley.