

## GLACIER MONITORING WEISSMIES



DEFORMATION CAMERA



GEORADAR



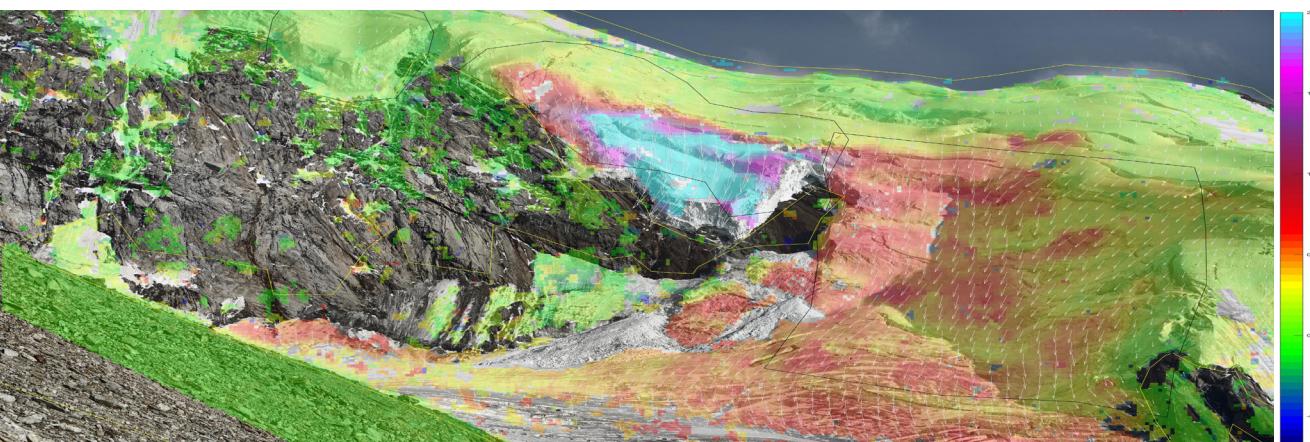
WEBCAM

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.



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Automatic deformation analysis with DEFOX® PRO camera revealed fast accelerations in an unstable zone of the glacier in August, 2017. One month after, the glacier collapsed.

### CHALLENGE

Weissmies (4,017 m/13,179 ft) is a mountain in the Swiss alps close to the well-known ski resort of Saas 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.

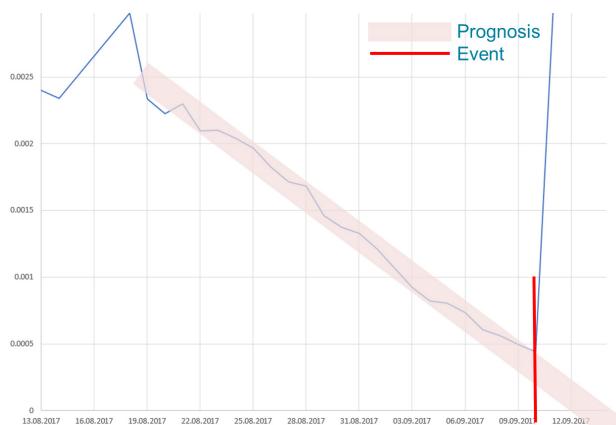
### SOLUTION

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.

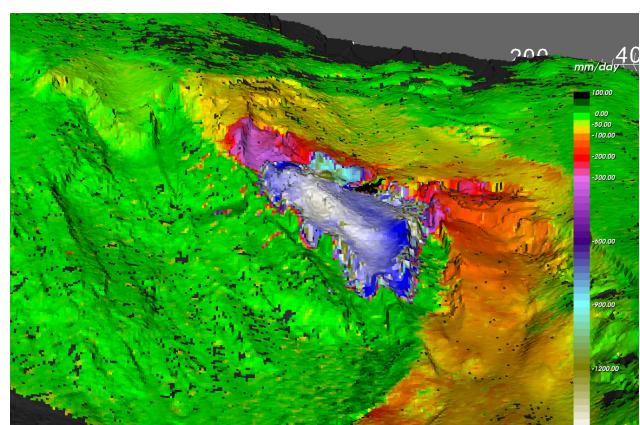
As destabilization was expected again a long-term

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.



Inverse velocity analysis with DEFOX® PRO camera data. The trend curve indicates later collapse but shows good agreement with the radar trend curve.



Live radar data shortly before the glacier collapse on September 10, 2017, 4 AM. All data was available online for authorized users.