

Monitoring by

GEOPREVENT

GEOBRUGG®

BRUGG

Safety is our nature



MONITORING SOLUTIONS FOR NATURAL HAZARDS

WHAT DO WE DO?

Our partner Geoprevent has been the leader for many years in the development, installation and operation of alarm and monitoring solutions for natural hazards. Together we offer monitoring of hazard zones: **Warning systems** recognize precursors to events. These enable measures to be taken in good time (e.g. closures, evacuations). **Alarm systems** recognize the event itself. Alerts take place in real time so immediate protection can be guaranteed.



ROCK/ROCKFALL

- Identification of unstable zones
- Monitoring of rock movements
- Detection of rockfall in real time with alerts



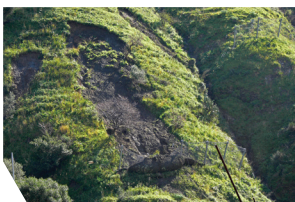
PROTECTION NETS

- Detection of impacts
- Monitoring of status parameters



DEBRIS FLOWS

- Detection of debris flows in real time with alerts
- Automatic images of the event
- Rain measurement with notification in case of torrential rainfall



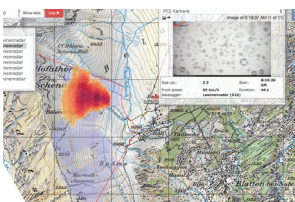
LANDSLIDES

- Monitoring of the movement of landslide areas
- Early detection of an acceleration of the landslide



AVALANCHES

- Detection of avalanches in real time with alerts
- Images/videos of the event
- Tracking/mapping of avalanches



DIGITALIZATION

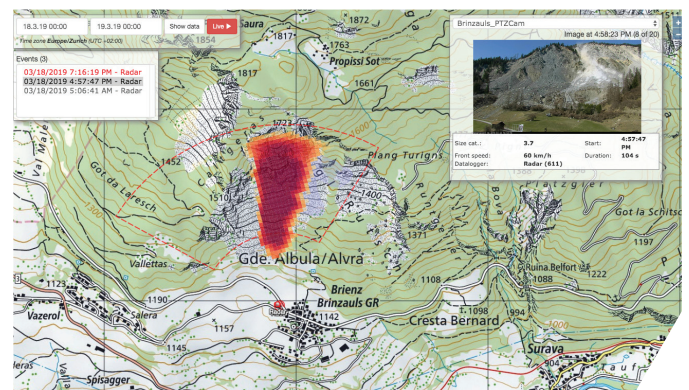
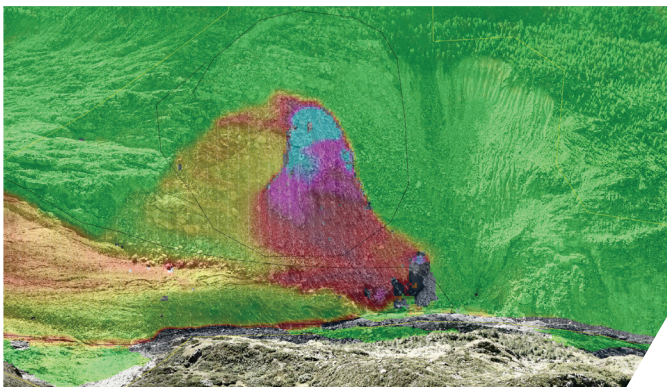
- Password-protected online data platform
- Cloud-processing of the measurement data
- System integration

SYSTEM TYPES

WARNING SYSTEM

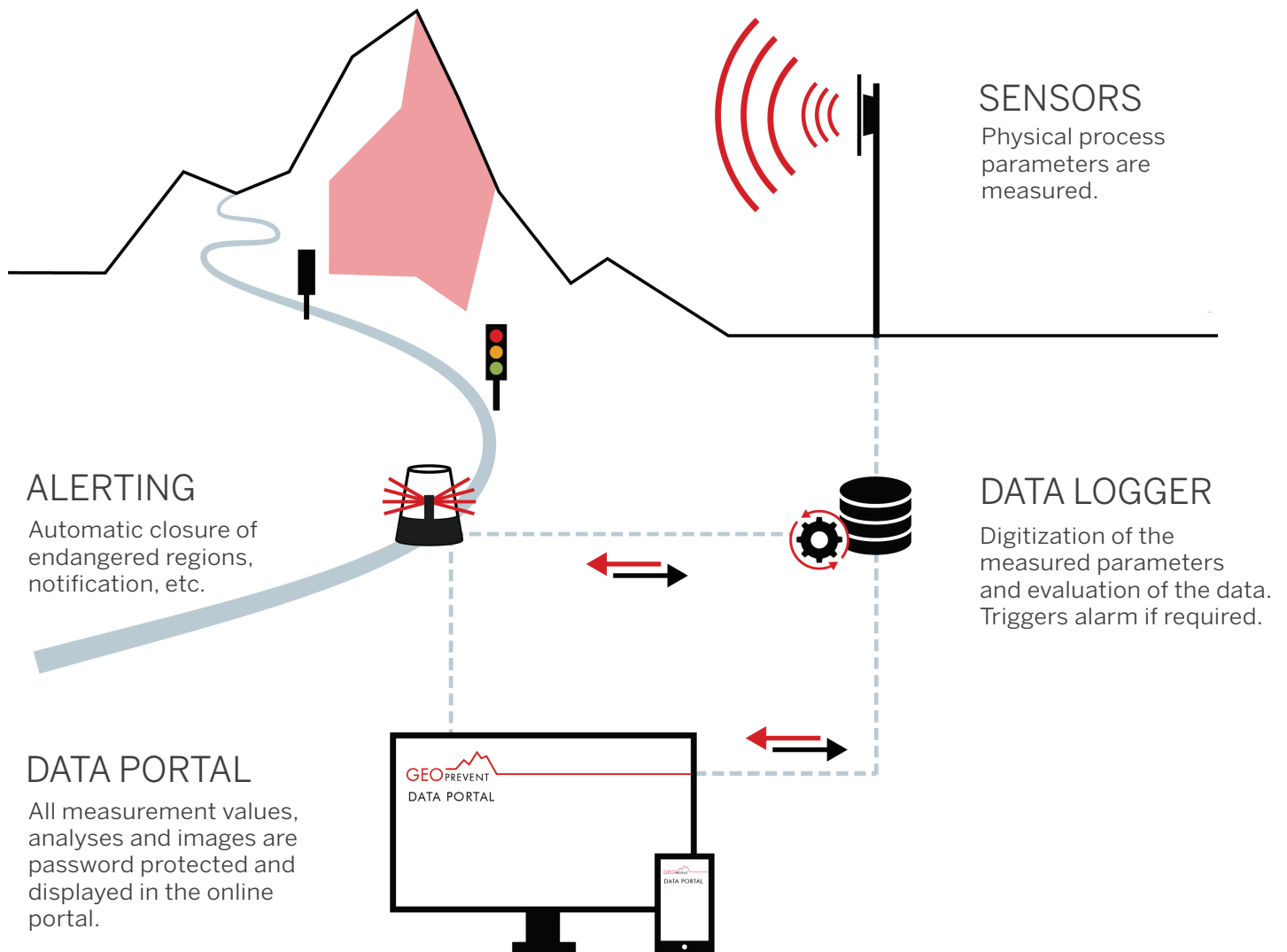
ALARMING SYSTEM

FUNCTION	Signs of an upcoming event are measured	Automatic detection of the event itself
ACTIONS	Interpretation of the measured data by experts, possible actions are triggered "manually" (e.g. evacuation)	Instant, automated actions such as closures of roads, railways and evacuation (e.g. building sites)
WARNING TIME	Hours - weeks	Seconds - minutes
APPLICATIONS	Processes that develop slowly and continuously (such as rock movements or landslides)	Spontaneously triggered processes or those that build up rapidly (such as avalanches or mudslides)
MEASUREMENT PARAMETERS	Deformation, precipitation, snow depth, flow height, temperature, activity (e.g. rockfall, avalanches), vibration	Deformation, velocity, pressure, flow depth, flow height, vibration
TECHNOLOGIES	<ul style="list-style-type: none"> • Interferometric geo-radar • Deformation camera • Crack meters • GPS • Motion sensors 	<ul style="list-style-type: none"> • Avalanche radar • Rockfall radar • Personnel radar • Water level measurements • Release cords
EXAMPLES	<ul style="list-style-type: none"> • Permanent rock monitoring at Pizzo Cengalo, Bondo • Landslide monitoring Moosfluh, Aletsch region 	<ul style="list-style-type: none"> • Avalanche radar with automatic road closure, Zermatt • Debris flow alarm system, Spreitgraben



MAKING THE INVISIBLE VISIBLE

A monitoring unit is a system solution and consists of various components. In order that the individual components can stand up to the harsh environmental conditions, we build in several redundant stages and carry out rigorous system tests.



OUR TECHNOLOGIES



RADAR

During day, night, wind, fog, etc.: Radar works reliably in all visibility conditions and is used for various applications.

- **Interferometric radar:** Captures rock movements in large rock faces or landslides in the sub-mm range (up to a distance of 4 km)
- **Avalanches, rockfall, debris flow radar:** Detection of an event up to 5 km away with real-time alerting
- **Level radar:** Detects debris flows, tsunamis or flooding in real time by the level status and triggers an alarm



CAMERAS

During daytime requiring good visibility: High-resolution webcams and optical deformation analysis of the surface to monitor landslides or rock movements.

- **Deformation camera:** Image analysis for detection of terrain deformations based on high-resolution images
- **Webcam:** For live inspection and for automatic event images/videos webcams are remote-controllable, and the high resolution enables a detailed assessment



LASER

Evaluation according to different criteria. Functions both day and night when the weather is good.

- **LiDAR:** Measures surfaces of rock faces or landslide regions with mm precision
- **Profile scanner:** Measures profiles of streams for example, and can be used to detect debris



OTHER MEASURING TECHNOLOGIES

- **Cleft measurement devices:** Monitors rock discontinuities in the sub-mm range
- **GNSS (GPS):** Monitoring of landslide areas
- **Vibration measurement devices:** Avalanches, debris flows or rockfall can be detected by vibrations that can trigger an alarm
- **Motion sensors:** Detect impacts in protection nets
- **Release cords, meteorological sensors and more**



ENERGY

If there is no mains power, there are several alternatives available for supplying power.

- Solar cells
- Fuel cells with methanol
- Batteries for bridging
- Wind/water turbines
- Energy management and as per situation requirement combined energy sources
- Charging levels, filling levels etc. can be read off by remote surveillance



COMMUNICATION

Reliable communication systems for data and alarm transmission.

- Applicable communication channels: GSM (mobile radio), WiFi, glass fiber, radio, LoRAWAN (depending on sensor), etc.
- For alerts, we recommend using two communication channels for redundancy reasons
- In-house (directional) radio systems possible

SAFETY MEETS ADDED VALUE

Besides offering the quickest possible alerts, a monitoring system also offers economic benefits with particular regard to the availability of infrastructure. Monitoring measures can make a decisive contribution to safeguarding housing, traffic routes, tourist destinations or industrial sites.

PERMANENT INFORMATION

- Online data portal, automatic notifications
- Monitoring of instabilities possible in the millimeter range
- Event detection in all visibility conditions with tracking and mapping

MINIMIZING CLOSURES

- Traffic routes are closed automatically only in the case of an event
- Automatic re-opening: If the event does not reach the traffic route, the closure is reversed

UNDERSTANDING PROCESSES

- Monitoring supplies valuable process information such as:
- Location of unstable zones, estimate of volume
 - Movement speeds/direction
 - Event frequency, mapping, event images/videos etc.

WIDE RANGE MONITORING

- Ideal supplement to installed measures for monitoring large, infrequent events
- Low landscape impact through remote monitoring

INVEST IN SAFETY

- Cost-effective solution to increase safety
- Low maintenance costs
- Cost-efficiency through shortened closure times of transport routes, infrastructure etc.

WORLDWIDE APPLICATION – SOME REFERENCES

ROCK/DEBRIS FLOW MONITORING BONDO, SWITZERLAND

- **Interferometric radar with webcam:** Measures rock movements in millimeter range on the Pizzo Cengalo (mm per day to months); correct prediction of several small events
- **Level radars with webcams:** Detects a debris flow in Val Bondasca and immediately closes the main road in the valley.
- **Automatic notification:** The authorities are informed by text messaging.



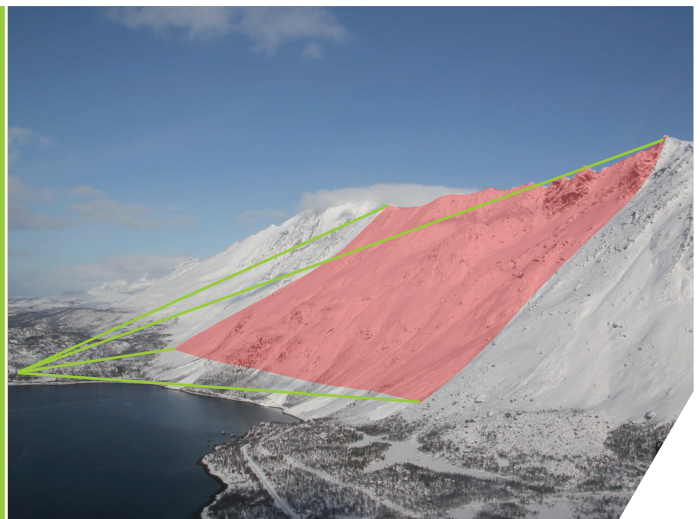
DEBRIS FLOW MONITORING, MT. KAZBEK, CAUCASUS

- **Level radars with webcam:** Detects a debris flow event and automatically closes the waiting area for traffic at the Georgian-Russian border
- **Webcam** for glacier monitoring
- **Release cords:** Redundancy to level radars; in the case of an event, they are pulled out and also close the road



AVALANCHE ALARM SYSTEM, HOLMBUKTURA, NORWAY

- **Avalanche radar:** Observes several avalanche tracks with a range of up to 4 km
- **PTZ-camera** (pan-tilt-zoom): It records avalanches automatically or if required provides a situation overview at any time
- **Thermal imaging camera**
- Road sections are **automatically closed**



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Safety is our nature



- ▲ Headquarter & production facilities
- ▲ Subsidiaries
- ▲ Sales offices
- ▲ Partners

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