GEOPREVENT

EIGER GLACIER MONITORING

AVALANCHE RADAR

GEORADAR

WEBCAM

PART OF HEXAGON

Radar based early warning and alarm system as protection against ice avalanches at the Eiger Glacier.

GEOPREVENT
Räffelstrasse 28
8045 Zurich
Switzerland

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

Title Page: Eiger glacier.

Figure 1: Avalanches detected by the avalanche radar are immediately mapped on our data portal.

CHALLENGE

Every year, roughly one million tourists take the cogwheel railway up to Jungfraujoch to admire the famed summits of Eiger, Mönch and Jungfrau. In fall 2015, ETH's Laboratory for Hydraulics, Hydrology and Glaciology detected crevasses appearing near the terminus of a hanging glacier above the Eigergletscher station of the Jungfrau railway, indicating that up to 80'000 m^3 of ice might be approaching detachment. Model runs at the Swiss Snow and Avalanche Research Institute suggested that the Eigergletscher station could be damaged if the entire volume of ice collapsed at once. Traditionally employed means of observation like cameras, total stations or GPS were not suitable for this monitoring task because the rely on good visibility, only offer point measurements, and, in some cases, require equipment to be installed within the danger zone.

SOLUTION

Geopraevent has designed a warning and alarm system specifically optimized for the situation at the Eiger glacier. As early warning system, a ground-based interferometric radar continuously measures glacier flow velocities over the entire glacier front. This data is available in our online data-portal, permitting glaciologists to predict ice avalanches and enabling responsible personnel to take appropriate measures like closing a ski run a few days to hours before the event.

For a safe operation of the cogwheel railway and the safety of a nearby construction site in case of an ice avalanche, the system also includes an alarm component. In addition to the radar interferometer, an avalanche radar monitors the glacier around the clock and in all weather. The system sounds an alarm on the construction site and stops the train if an avalanche of a certain size is detected. Given a warning time of 35 – 45 seconds, both the construction workers and the train can move to the safety of the tunnel if they are in the danger zone when the avalanche is detected.

Combining the interferometric and avalanche radars, in addition to several webcams, offers maximum safety for the operation of the Jungfrau railway, letting a million tourists enjoy the beauty of glaciated mountains every year.

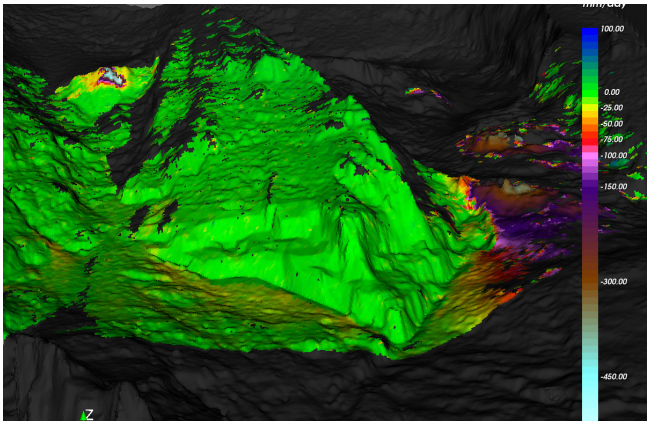

Figure 2: Projection onto digital elevation model: The data of the interferometric radar show increased velocity on the right margin of the glacier.

Figure 3: The interferometric radar is well protected by a wooden case. Next to it, a camera and the avalanche radar also look at the glacier.