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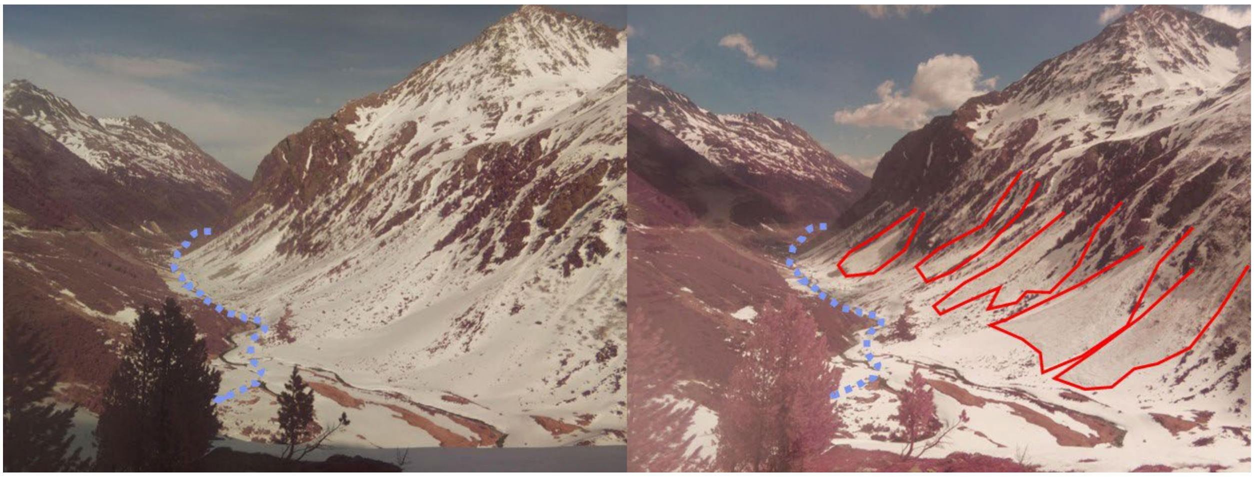
Science City Davos

Detecting avalanches with fiber optic cables

First tests on the Flüela Pass were successful



Photos from 13.04.2022 (left) without avalanches and from 16.04.2022 (right) with avalanches (red). Blue line: cable. Image: Alec van Herwijnen, SLF

Most avalanches occur unobserved in the mountains. However, for road safety in particular, it would be important to know exactly where and when an event occurred so that the authorities can efficiently clear and reopen the affected stretch of road. In addition, avalanche warning systems could also benefit from such data to refine their forecasts. Likewise, avalanche researchers are interested in accurate event times to improve their forecasting models. Now, existing fiber optic cables from telecommunications could be used as avalanche observers on site. These react to vibrations in the ground with minimal deformation. A device that sends laser pulses into the cables measures them, allowing the cables to be used as seismic sensors. “The technology is not new. But we have now applied it for the first time to detect avalanches,” says Alec van Herwijnen, an avalanche researcher at the WSL Institute for Snow and Avalanche Research SLF. Last winter, the researchers were able to use an existing fiber optic network between Susch and the Flüela Pass for tests. Pascal Edme from the Seismology and Wave Physics Group at ETH Zurich is performing the data analysis. His team identified several avalanches that occurred over or next to a cable along the pass.

Installed cameras to check signals

In order to check whether the signals of the vibrations really originate from avalanches, the researchers installed three cameras on the 9-kilometer-long route. They recorded a period with larger dry avalanches and one with many wet snow avalanches. “What we saw on the images coincided with the signals we received on the cable,” van Herwijnen confirms. Avalanches that go off several kilometers away, however, are virtually impossible to detect. “These would have to be very large avalanches. But what we could clearly see from our data was the eruption of the Hunga Tonga-Hunga Haʻapai volcano in the Pacific in mid-January," says van Herwijnen.

Long range, large data volumes

However, putting the system into practice is not entirely straightforward. It is true that the system has a long range and could, in principle, monitor entire mountain passes. But the problem is that every vibration of the ground generates a signal that is reflected in the data. "Evaluating the enormous amounts of data in area-wide monitoring requires new methods such as machine learning," says van Herwijnen. He is convinced that surveillance with fiber optic cables has potential and that research here will make great strides in the coming years.

The article appeared in slightly abridged form in WSL's DIAGONAL 2022/2 magazine, which is free and can be subscribed to or downloaded as a PDF at slf.ch.

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The SLF

The WSL Institute for Snow and Avalanche Research SLF is part of the Swiss Federal Institute for Forest, Snow and Landscape Research WSL and thus belongs to the ETH domain. Its tasks are research and scientific services related to snow, avalanches, other alpine natural hazards, permafrost and mountain ecosystems. Its best-known service is the avalanche bulletin. As part of the CERC (Climate Change, Extremes, and Natural Hazards in Alpine Regions Research Center), the SLF studies the effects of climate change on extreme events and natural hazards.
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