Success Story
COMET

alpS - Centre for Climate Change Adaptation
Programme: COMET – Competence Centers for Excellent Technologies
Programme line: K1-Zentren
COMET subproject, duration and type of project:
L01 AdaptInfra, 04/2014 – 03/2017, multi-firm

AdaptInfra – remote sensing and monitoring of inaccessible slopes in mountain regions

In mountain regions, slope instabilities are a common phenomenon. These are often located in inaccessible terrain but have to be investigated and monitored in order to protect infrastructure and to preserve natural habitats. Within the research project AdaptInfra, methods to investigate inaccessible and potentially instable slopes with lasers-canning technology are developed. New methods and software algorithms are used to generate detailed 3D displacement maps and to get information about geological structures. This information forms the basis for further actions like the design of protection measures.

Investigating slopes with laserscanning technology

High mountain regions are very sensitive to climate change. Melting glaciers and permafrost retreat influence the stability of alpine soil and rock slopes. Slope instabilities near infrastructure in high mountains (e.g. traffic routes, ski resorts) must be investigated and monitored, in order to assess the hazard potential and to plan appropriate mitigation measures. The inaccessible and often hazardous terrain makes observations by geodetic measurements or in-situ field investigations difficult.

The usage of terrestrial laser-scanning (TLS, Fig. 1) provides a perfect alternative to investigate alpine slopes without the need of having direct access. Lasers-can technology permits a detailed, area-wide and three-dimensional survey of terrain surfaces. The data can be used to derive important information on geological structures and to detect and quantify slope deformations.

Challenging terrain

Terrestrial laser-scanning is an established technology for the investigation and monitoring of buildings or roads. However, the application of the method in mountain terrain is more challenging. This is due to the greater distances between the measuring instrument and the slope surface (resulting in an increasing positional uncertainty of the measurements), the irregular and rough surfaces of alpine slopes as well as the hindered access to the investigation sites.

Within AdaptInfra, methods are developed to use terrestrial laser-scanning also in alpine terrain. Accurate data acquisition and innovative processing algorithms are the keys for success. Here, we collaborate with the alpS project CCID II, which has been developing software for the processing of laser-scanning data for many years now. Besides approaches for an improved pre-processing of the data generated by topographical surveys, a team made up of GIS and remote sensing experts, software engineers and geologists develops specialised software tools.

bmwfw Federal Ministry of Science, Research and Economy
bmvit Austrian Ministry for Transport, Innovation and Technology

These tools enable the analyses and interpretation of geological structures as well as the detection of slope movements. By working on several case studies (Fig. 2), new methods were developed, validated and further improved.

Fig. 1: Terrestrial Lasers-canner (© alpS/Fey).

Impact and effects

The company partners use by now the surveying technique and the analysis methods developed to promptly obtain area-wide and detailed geological information on the investigated slopes. Repeated measurements allow monitoring of the slopes, to detect changes and to derive detailed maps showing the displacements.

These systematised workflows and software tools enable the project partners a considerably optimised and more efficient assessment of slopes concerning structure, stability and deformation behaviour.

Such information is required for further actions like the planning and construction of protection measures.

The developed methods and findings thus obtained have a high application potential, can easily be applied to other mountain regions worldwide, and provide a valuable contribution to the geohazard and risk management according to the best international practice.

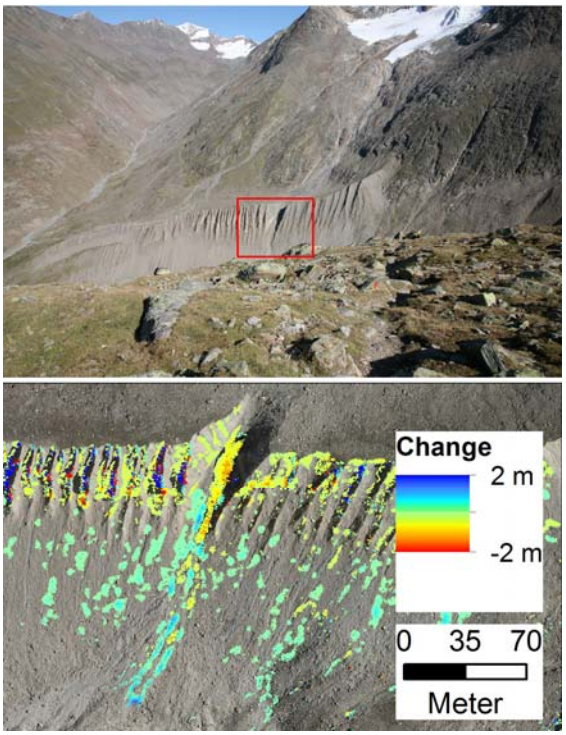

Fig. 2: Detected erosion of a glacier moraine (© alpS/Fey).

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