

Gravitational processes in permafrost areas - Detection, quantification and monitoring based on airborne laser scanning and optical satellite (Pléiades) data

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The occurrence of gravitational processes in high mountain areas are often supposed to be associated with permafrost degradation. The decrease in permafrost distribution in many mountainous areas could therefore be followed by an increase in gravitational processes. To gain a better understanding of the relationship of permafrost degradation and gravitational processes, monitoring of permafrost as well as monitoring of the processes are helpful.

In our study, bi-temporal airborne laser scanning (ALS) data is used to map, quantify and monitor rock falls, landslides and debris flows over a large study area using differential digital elevation models. The study area is located in the Eastern Alps and encompasses the Montafon (Vorarlberg, Austria) the Ötztal Alps (Tyrol, Austria) and the Vinschgau (South-Tyrol, Italy). In addition to the ALS data, high resolution optical satellite data (Pléiades tri-stereo) are used to extend the data series and to gain additional information on the mapped processes. The high resolution and short repeat cycle of the Pléiades satellites will also open up new possibilities for future applications.

The permafrost distribution for the study area is modelled based on rock-glacier inventories, topographic and climatic parameters and validated in some areas with field investigations. In a next step, the gravitational processes are analysed with the aim of gaining a better understanding of the relationship between the occurrence of permafrost and gravitational processes.

A majority of the mapped processes occurred in permafrost and recently deglaciated areas, which also highlights the importance of the investigation, especially considering the ongoing climate change, which subsequently causes changes in permafrost distribution.