

# UAV LiDAR flight planning for high-precision rockfall monitoring in alpine environments: first strategies and preliminary results on Mt. Hochvogel

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## SUMMARY

This paper outlines a practical workflow for surveying alpine regions that are susceptible to rockfalls using UAV LiDAR (unmanned aerial vehicle-based light detection and ranging). The primary goal is to capture the area of interest as comprehensively as possible while ensuring high geometric resolution and accuracy. The generated point clouds are utilized to detect deformations with high precision, capable of measuring changes within a few centimeters. The resulting findings contribute to alpine monitoring and thus also to future hazard prevention measures to protect people and nature. In this study, we apply our workflow to the rockfall on Mt. Hochvogel, located at the border between Germany and Austria.

Firstly, this study introduces a new flight planning approach that considers the specifications of SLAM-based laser scanners. This method allows for a particularly close flight to the object of interest, which makes it possible to capture a usable point cloud for our application. Secondly, we evaluate the quality of the point cloud obtained through UAV LiDAR by comparing it with tachymetric measurements like targets as well as with a point cloud collected via Terrestrial Laser Scanning (TLS) from an earlier period. The analysis of those specific data sets demonstrates that UAV LiDAR in this configuration achieves an accuracy of less than two centimeters relative to the reference measurements, confirming its suitability for rockfall monitoring. Our strategy regarding UAV Lidar demonstrates the enormous potential of this combined system, which we intend to expand and deepen in our future research.

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