Expanding the Toolbox: From High-End to Low-Cost in Permanent Laser Scanning Applications

Daniel Czerwonka-Schröder, Ute Holtkamp, Solveig Sander and Yihui Yang (Germany)

Key words: Deformation measurement; Engineering survey; Laser scanning; Low cost technology; Risk management; Permanent laser scanning; Low-cost LiDAR; geomonitoring; Sensor comparison

SUMMARY

Permanent Laser Scanning (PLS) has become a valuable tool in Earth observation and environmental monitoring, enabling continuous 3D measurements of dynamic surface processes. High-end instruments such as RIEGL scanners deliver benchmark accuracy at the millimeter level, yet their high costs restrict widespread use beyond research projects. Low-cost LiDAR sensors, like the Livox Avia, offer a more affordable alternative and raise the question of how far they can complement established systems.

Within the BMBF-funded research project AImon5.0, both sensor types were deployed under identical conditions at the monitored rockfall site “Augenscheiner” in Trier (Germany). A comparative experiment was conducted to analyze measurement range, point density, noise characteristics, and environmental sensitivity. The paper presents the results of this experiment, including cases where both sensors generated nearly identical point cloud outcomes as well as cases where differing conditions led to observable deviations.

The contribution provides a detailed description of the experimental setup, the applied processing workflow, and the comparative findings. This forms the basis for further discussion on the potential roles of different sensor classes in PLS-based Earth observation and environmental monitoring.