Geophysical Research Abstracts
Vol. 17, EGU2015-616-1, 2015
EGU General Assembly 2015

Application of a long-range terrestrial laser scanner in research on lowland geodynamic processes

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Progress in the LIDAR technology allows collection of data over a longer range and with a higher precision than most of geodetic measurement methods. It is particularly useful in areas that are inaccessible, dangerous, or with a highly variable morphology. These include mountains, steep slopes of river valleys, and edges of water bodies. Because of a high variation in altitude, they are particularly prone to geodynamic processes. In recent years, such areas have been surveyed more and more often with the use of Airborne Laser Scanning, but the high costs and low frequency of surveys make it difficult to trace the dynamics of phenomena and recorded processes. A few years ago, a new method for imaging of land surfaces started to be used: Terrestrial Laser Scanning. The latest scanners make long-distance scanning possible, up to several kilometres), which until recently had been reserved exclusively for Airborne Laser Scanning. The ease and mobility of scanning allows recording of geodynamic processes immediately after their initiation and their constant monitoring, with a high frequency of data collection. The usefulness of long-distance Terrestrial Laser Scanning is presented here on the basis of mass movements on slopes of a large river valley (the lower Vistula valley) and edges of artificial water bodies. These areas were selected because of a high dynamics of geodynamic processes. The scanning was performed at a distance of 2-4 km from the objects, with a resolution of 0.002º. Such parameters of the equipment and the broad scope and long range enable researchers simultaneous scanning of wide belts of the marginal zone. They also allow precise imaging of slopes, including the microforms that cannot be recorded with any other method. Thanks to the characteristics of laser beam reflection, it is also possible to perform analyses that allow identification of landslide initiation, as well as initial stages of erosion of river banks and edges of water bodies. In this study, we used an innovative method, Multi Station Adjustment, enabling easy linking of scans and their georeferencing without the need to establish benchmarks in the field. In practice, this allows further processing of the scans with GIS software.
This study is a contribution to the Virtual Institute of Integrated Climate and Landscape Evolution (ICLEA) of the Helmholtz Association