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Application of the high resolution lidar data for detection of the mass movement's landforms at the Podhale area (southern Poland)

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Light Detection and Ranging (LiDAR) is a modern remote sensing technique, which provides accurate and precise topographical information. LiDAR method, also known as Airbone Laser Scanning (ALS) uses electromagnetical radiation in the optical range. This system consists of a transmiter and receiver of a laser beam, a scanning device and a real-time positioning system. The transmitter emits pulses of light that reflects from the ground surface (including natural surface, buildings and vegetation) and goes back to the receiver. The measurement of the time between sending and registration of the beam is used to calculate the distance to the points located on the Earth (Wehr & Lohr 1999). These points form a "point cloud", which is positioned in 3D spatial coordinate system. The density of these points could reach even 100 pts/m^2 (Jaboyedoff et al. 2012). Points corresponding to the forest canopy or buildings could be removed in post-processing. It allows to create Digital Elevation Model (DEM), which reflects morphology very accurately. Through this, application of the model facilitates searching and interpretation of morphological forms, including those hidden under the forest canopy (Van Den Eeckhaut et al. 2007).

The aim of this study is to test the application of the LiDAR technique as a support in mapping of the mass movement's landforms, for instance: landslides, debris slides, etc. This landforms were observed at the Podhale Flysch Area by Mastella (1975). The basic research method was to analyse the terrain model generated from the LiDAR data in comparison with the older cartographic sources and field verification. The laser scanning was carry out in the 2010 and the acquired data was used to derive the DEM. This model was compared with the topographic map at a scale 1:10 000, detailed geological map of Poland at a scale 1:50 000 and the ortophoto at a scale 1:5 000. DEM's horizontal resolution is 1 m and this model covers almost 100 km^2 of the area among the villages of Biały Dunajec, Jurgów, Trybsz and Poronin. Analysing of the area was based on different ways of displaying. This allowed selection of three test areas (3 km^2 each) as examples of the territory where morphological forms are associated with mass movements occur.

The obtained results allows precise delimitation, determination of surface and morphology of forms resulting from mass movements, which enabled more accurate mapping of these landforms, particularly in the area of dense vegetation cover. Moreover, a comparative analysis of LiDAR model with older cartographic sources can confirm or exclude the existence of areas considered as endangered of mass movements occurence. Airbone Laser Scanning method is therefore a perfect complement to the field studies in geology and geomorphology.

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