Paper Number: 3427

Air- and space-born inventory and monitoring of emergency slope deformations in Slovakia

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Due to extreme climate events, but also due to human interference into the sensitive slopes, in the period of 2010 - 2016 more than 650 new slope deformations were generated throughout Slovakia. The most serious of them have been included into a running programme of Monitoring of Natural Hazards in Slovakia. Till 2010, the inventory and monitoring techniques were supported mainly by ground-based methods. With emerging new technologies of remote sensing, the gradual shift from the ground-based to the airborne and remote sensing methods has started since 2010.

In 2010, after heavy and long-lasting precipitation in May, several hundreds of landslides were levelled using a GPS device – this methodology was used for the first time [1] in the landslide inventory practice in Slovakia, resulting in inventory of 551 slope failures covering 2.88 km^2. In the spring of 2013 a large Kraľovany rockslide was triggered in an active limestone and dolomite quarry. The investigation of the slide has comprised engineering geological mapping, exploration drilling with subsequent installation of inclinometers and piezometers and geodetic monitoring based on terrestrial and GNSS methods, land-based and airborne photogrammetry and laser scanning [2].

In March 2013, an emergency situation was declared in the city of Prievidza, due to extensive damage at the housing estates in the suburbs of Hradec and Veľká Lehôtka. Despite cracks on many buildings, roads and fences, no clear signs of landsliding could be confirmed – such as head scarps, landslide tension cracks, accumulation zones, etc. The engineering geological survey and monitoring supported by inclinometric boreholes has confirmed movement along shear planes at various depths. In 2015 the SGIDŠ launched an InSAR high-resolution imaging of the urban area, which has shown, that the whole area is under movement, due to gravitational disintegration of the Vtáčnik mountain range NW flanks, with huge blocks of andesite creeping into the Prievidza Basin. In the forefront of the volcanic blocks, overlying soft Neogene rocks, an extensive stripe of block fields and landslides has evolved. Since 2015, the InSAR technology, based on the available Sentinel data, has been incorporated into the monitoring programme.

In July 2014, after an extremely intense rain-storm, an enormous debris flow evolved, fed by tens of small landslides in the uppermost parts of a cirque-shaped valley in Vrátna. In addition to the field research, airborne laser scanning and photogrammetry were used in order to generate a very precise DMR of the territory with an area of about 4 km^2 affected by this event. The DMR has enabled to elaborate very precise landslide and debris flow map of the area on the updated geological map.

References:

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