Potential of Satellite SAR Interferometry for Assessment of Risk of Landslides
Case study of Angren, Uzbekistan

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Abstract

Angren region (Uzbekistan) is rich for mineral resources. Coal mining activities on the surface have caused largescale (over 100 m²) landslides - some of them seriously endanger an important highway connecting Tashkent with an agricultural area of Fergana - or encroach into a water reservoir. Slow creeping movements of the slope deformations are hard to detect by regular watch of the national landslide service. An application of satellite SAR interferometry in this region proved its potential to detect and monitor slope deformation processes - slight movements were detected well, field inspection has confirmed the detection.

A project involving this technique together with other remote sensing technologies (i.e. laser scanning) has been proposed and accepted within the framework of NATO: Science for Peace and Security programme (project SFP-984430) in the end of 2012. In the scope of the project, relevant Uzbek institutions should achieve an appropriate knowledge and skills for independent research using these modern remote sensing technologies for landslide risk mapping and assessment.

Landslide activity in Angren

Needs of an effective continuous monitoring of landslides to detect a safety threat in appropriate advance are high in Uzbekistan. There have been always a number of landslides in Angren surroundings - caused by natural processes over complicated geological structures and mix of claystones, sandstones, limestones - or caused by anthropogenic activities. Currently the largest landslide in the area, Atchi, affects a mass of 0.8 km³. The landslide has been remediated stirring at its front but afterwards reactivated by mining activities (the land mass has been lifted up in the process of ignite gasification). Vyerkhnyeturskyi landslide (at the left bank of Akhangaran Reservoir) is still active and directly endangers the reservoir. Landslide called Staraya podstacnya has been activated by open-pit mining but has been subsequently accelerated by 2011 Hindukush earthquake. The only highway connecting Tashkent with an agricultural region of Fergana has been seriously damaged and had to be (currently) rebuilt - shifted into a near but safer area.

Potential of satellite radar interferometry

There are even more potentially dangerous landslides active in the area. A differential SAR interferometry technique has been demonstrated as valuable in detection of deformations in terrain in a relatively large extent, using SAR satellites. Using archive satellite SAR data it is possible to document landslide activities since 1990s. Current and future SAR satellite systems have the potential to accurately identify terrain deformations and detect signs of landslide activities. In collaboration with national organisations and multidisciplinary experts, the satellite SAR interferometry may have a high practical impact in routine use for management of landslide risk monitoring and prevention.

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