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Combination of seismic impact and rainfalls as a large slopes instability triggering factor

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Now in mountain and foothill areas of Uzbekistan slope instabilities, landslides, mud and debris flows occurs annually, especially in high water years and characterized by mass and sudden manifestation in loess and clay rocks. It is fixed nearly 2 thousand landslide sites where for the last 50 years occurred nearly 10 thousand various primary and repeated, small and large landslide events. More than 50 % have taken place for the last 15 years, 4 times more than in 80th and 2 times more, than in 60th. The share of the landslides formed under influence of technogenic influences in comparison with 1970-80 increased in 3-4 times.

At spatial supervision special attention has been paid to the mapping of ancient landslide circuses, caused by historical strong earthquakes. It is due to the relation that places of formation of many modern landslide sites are inherited. As a result of strong earthquakes were formed various gravitational, seismotectonic residual deformations. The nature of interrelation of places of formation of modern landslides with ancient ones, first of all is connected with character of new watering of slopes. Ancient landslide circuses change the form of slopes, expand the feeding area and concentrate a superficial drain at rainfalls. As a result slope erosion amplifies ravines, directions of a filtration of underground water changes. In ancient landslide circuses uniform sustained water bearing horizon it is not kept, and there are local sites with temporal water bearing horizon.

Except strong historical earthquakes, the beginning of formation of modern large landslides are triggered not so much by local earthquakes with intensity 4 -5 units, but by strong far deep earthquakes with M=5,5-7,4 with long low-frequency ground fluctuations. As a result of earthquake in May, 16, 1995 in Hindu Kush (Afghanistan), M = 5,9 in Angren area took place liquefaction of sandy-argillaceous water-saturated

rocks. In result was formed landslide Naugarzan with volume 25,0 mln m^3. The greatest amount of strong earthquakes was observed in 2002 when for 40 days, from March, 3 till April, 14 there were 6 earthquakes with magnitude 6,3-7,4 in Hindu Kush. In result on the slopes of motorway Tashkent - Osh the series of rectilinear cracks with extent of 40-60 m were formed. Landslide – rock fall in Iertashsai with volume of 600 thousand m^3, and vertical deformation in karst suffosion cavities occurred. After strong rainfalls in the next 3-10 days it was formed debris flow and mud flow with extent of 1,2 km.

In May, 1 2006 as a result of 2 earthquakes in Chimkent (South Kazakhstan), M = 5,7-5,4 within interval 20 minutes, liquefaction of water-saturated sandy-argillaceous rocks at depth of 25-30 m was initiated landslide Altynbel with volume 8,0 mln m^3.

Except earthquakes for the last decade, has become frequent technogenic dynamic influence to slopes from quarry blasts. These landslides - flows, are characterized by high speed of displacement and large extent up to 1,2 - 1,5 km. The structure and components of the displaced rocks, homogeneous loess soils with natural humidity of 20-25 %, due to fast displacement and numerous impacts from an opposite board of canyon are strongly shattered, but not liquid. The surface of sliding is characterized by a high angle (25-40 $^{\circ}$) an inclination, clean smooth surface and, the most important, absence of outputs of springs.

Investigations of the seismic factor in landslide triggering mechanism allow to reveal the zones of formation of ancient and repeated modern landslides. The role of a trigger mechanism may play far deep earthquakes causing long low-frequency fluctuations in humidified loess and water-saturated sandy-argillaceous rocks. It is recommended at estimation of landslide hazard to consider a combination of the seismic impacts and rainfalls during spring period