



On principal reason of landslides occurrence in seismically active environment

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The earthquake effect on slope stability is considered to be a trigger mechanism. The role of earthquakes triggering landslides seems to be obvious if landslide or rockfall occurs during the strong earthquake. Nevertheless, many things still remain unclear considering the interrelation between seismic and slope phenomena. For example, why rockslides are not uniformly spread over the seismic zones? Some zones with very high concentration of rockslides of different age are located along the borders of the Tien Shan while vast spaces between them are practically not affected by such phenomena [Strom and Abdrakhmatov, 2004]. How can we explain the occurrence of landslide motion before (20-50 hours) strong earthquakes [Torgoev et al., 2008]. There is also an opinion that not only strong earthquakes can cause slope phenomena. Since many earthquakes occur in the mountainous regions of the Tien Shan, they are common and regular natural phenomena. It is not an exaggeration to say that Tien Shan ground is never quiet in terms of seismicity. Very often earthquakes do not cause dangerous slope phenomena directly but just speed up such processes [Babaev et al., 2008].

The data on landslides mapped and decoded using space images in territory of the Northern Tien Shan, and data on continuous instrumental observation (2004-2006) in Tuyuk-Su landslide site were being considered. Landslide activity was compared to the spatial position of hypocenters of weak and moderate earthquakes (> 1.6) spatial distribution and the stress field derived from data on focal mechanisms.

The landslide Tuyuk-Su

The distances between landslide point and earthquake epicenters were examined by the empirical relation between the maximal distance up to the landslide site and earthquake magnitude [Keefer, 2002; Kalmetyeva and Gorbunova, 1988]. The landslide is located farther from dense accumulation of the earthquake epicenters as it follows from the empirical relations. Distinct motions of the landslide were occurred twice. The first motion coincided with moderate (≈ 4.6) earthquake in time. The direction of a motion in the earthquake source (according to focal mechanism data) coincided with landslide motion direction. In the second case abrupt landslide motion was not accompanied by occurrence of earthquakes coincident in time. Moreover for the period of observation there were some more moderate earthquakes which had no affect on the landslide activity.

Landslides of the Northern Tien Shan

Here the locality of landslides is not the same as of earthquake epicenters accumulation as well as in Tuyuk-Su landslide. Three periods of landslides activity were observed. In 2002 and 2006 landslides occurred to the west from a meridian 74.9 N, whereas in 2004 landslides occurred in the territory to the east from the meridian. Within the limits of these areas earthquake hypocenters have different depths. At the western site hypocenters depth range is 8-17 kms, whereas at the eastern site here is no any hypocenters in this range of depths; but two clusters of hypocenters are clearly identifiable above (5-8 kms) and below (17-25 kms) the depth range. Charts of time-scale fluctuations of compression axis spatial orientation differ here as well. The fact that landslides become active when a compression axis deviates abruptly from its horizontal position is common for the both sites.

Generalization of all above-stated [Kalmetieva et al., 2010] results in the assumption of landslides and seismic activity relationship. The landslides activity is independent deformation process of the certain scale level, which is defined by stress field of the Tien Shan Earth's crust as well as seismic activity is defined. The landslides locality should show culmination borders. Landslides activation depends on compression axis abrupt deviation from its horizontal position.

Strong influence of precipitation and anthropogenic factor as well on slope stability shades a true reason of landslides occurrence in seismically active areas.