International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM 2015 vol.2 N1, pages 649-656

Short-term forecast of landslide processes development using the method of engineering-geological analogy on the territory of Innopolis city (Russia)

Zharkova N., Latypov A., Nuriev I., Cherniychuk G.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© SGEM2015. Innopolis City (project population of 160,000 and an area of 22,7km2) is built on a high plateau, located at confluence of the Volga and Sviyaga rivers. The upper part of geological section has a bipartite structure. The lower part is represented by clays, rarely by sandstones, siltstones and carbonate rocks of the Permian system, and the top part is represented by clays and loams of anthropogenic system. Plateau is strongly embayed by river valleys and ravines; on the slopes of ravines are identified landslides of various sizes and ages. The paper presents the experience of engineering geological analogy method application for short-term forecast of landslide hazard on the territory of Innopolis city. The forecast was carried out in the framework of the two-level modeling: at first the forecast was made on local areas using software for the calculation of slope stability - Geo5 Fine, then the forecast was made on the whole territory by transferring and correction of data to the two-dimensional digital model of geological environment (using ESRI - ArcGIS). Algorithm of the forecast was as follows: Step 1. Identification of boundaries and determination of landslides' geometric parameters using geophysical methods and mining operations; laboratory studies of physical and mechanical properties of soils. Step 2. Building a digital model of geological environment in ArcGIS scale of 1:10 000 and subsequent zoning of the territory based on soil conditions and depth of groundwater (were identified 12 types of soil masses). Step 3. Selection of reference sites (selection criteria is a typical engineering-geological conditions and the presence of landslides); calculation of SF for slope using Geo5 Fine software for each site with the natural moisture of soil and maximum moisture (29 reference sites total) Step 4. Identification of the limiting values of surface slopes for all types of soil masses for each probabilistic category using the digital model of reference sites slope (SF ≤ 1.0 - «landslide displacements are inevitable», 1.0