

Study of Deformation and Movements on the Earth's Crust, of Technogenic Character, Based on Repeated Geodetic Measurements

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SUMMARY

Deformation measurements are an important part of engineering survey. The main tasks in deformation analysis are to describe crustal movements and the movements or the displacements of objects, such as landslides, buildings. This study treats the methods of monitoring deformations based on repeatedly observed geodetic networks with emphasis on modeling, processing and evaluation of geodetic observations. The Mirovo salt deposit is situated in NE Bulgaria. The mine has been exploited since 1956. Since 1980 several moderate earthquakes ($M > 4.0$) are occurred in this region. This work is in connection with the observed higher seismic activity and probable manifestations of technogenic seismicity in the region. Local geodetic network is build around the salt body and is deployed for monitoring the crustal movements in the region. Precise geodetic measurements to determine in the deformation, in the area Salt Deposit Mirovo are made. Mathematical model for combined, three-dimensional adjustment of classical and GPS measurements for the adjustment is performed, for several epochs of measurements, including: horizontal directions, distances, height differences and GPS observations. On the basis, of the estimated coordinates and covariation matrices, velocities for the control points are computed. In the article are presented computation methods for determining the deformation components of spatially oriented triangles. The calculations are based on data from numerous geodetic measurements carried out in a geodetic network. A graphic analysis has been conducted, as well as a comparison of the results. Presented are also diagrams of the main axes of deformation, as well as the surfaces of the angular and cutting deformations. Conclusions are drawn about the of the deformation processes, their possible stage at present. The results are compared with multi-year repeated results from geodetic measurements of the Mirovo geodynamic network. The necessity of regular monitoring of the geodynamic situation and surface subsidences are discussed. Results of the analyses of the geological and seismotectonic situation, assessment of the surface subsidence, analyses of the seismic regime variation are presented. The use of these analyses and their possible applications for the general stability assessment of the system are formulated. The results of study showed, that have activity on the Earth's crust in the area and confirmed, that the methods are appropriate for determining the technogenic movements of the earth crust.