Popular science summary

Motivation

Mining activity is usually associated with deformation of the surface above the mining operation. These deformations can have continuous (e.g. subsidence basins) or discontinues character (e.g. sinkholes, troughs). Occurrence of secondary deformations, i.e. deformations that develop even many years after the end of mining, is a growing problem worldwide. This is due to closure of an increasing number of underground mines, and reaching for deposits below older underground workings in difficult geological and mining conditions. Unexpected, secondary deformations can have a devastating effect on the surrounding environment, such as pollution, damage to infrastructure and risk to human safety.

Aim of the project

The purpose of this project is to investigate, analyse, map and model deformations of the surface in the area of done brown coal mining operation in the Muzakow Arch area. The geomorphological landscape of this area is characterised by numerous and differentiated forms of anthropogenic origin associated with underground and opencast mining of brown coal that ended in the 70-ties of the last Century. The complex and complicated geometry of these deposits is the result of glaciotectonic processes associated with subsequent stages, of accumulation and weathering. The entire area is subjected to geodynamic processes associated with weathering of exposed areas, deterioration of shallow underground workings and changing hydrogeological conditions of the rock mass. The process secondary deformations and its effects on the surface are presently unknown.

Scope of the project

The primary aim of this project is to establish whether it is possible to determine and to model (forecast) accurately surface deformations (movements) caused by mining activity in space (3D) and time (4D) domains with numerical, parametric methods. We will try to identify, analyse, map and model geological, mining and environmental conditions responsible for the process of developing mining deformations in complicated and complex rock mass conditions then we will develop models of deformations with spatial statistic (spatial regression) and deterministic (finite element) methods.
We will test whether these, integrated, models perform correctly based on the results of spatial mapping of deformations with satellite radar interferometry and satellite GNSS levelling and whether the developed numerical models can be applied universally to other areas of done underground mining.

Expected results

In the project we plan to the following questions, what conditions are significant for the occurrence and development of deformations, what is the measure of this significance and whether deformations can be predicted accurately with deterministic and spatial modelling approach.
In the result we will describe and model the process of deformations associated with mining shallow brown coal deposits in a complex glaciotectonic environment.