Simulation of Mine Water Rebound in the Ostrava Basin – Part of the Upper Silesian Coal Basin

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Abstract

Because of the gradual decline of mining in the Czech part of the Upper Silesian Coal Basin, mine closure in the active part of basin and the termination of mine water pumping from abandoned mines is planned. Until now the mine water is maintained at specified level at already abandoned Ostrava Basin to prevent overflow from abandoned to active mines. Therefore, the need arises to predict groundwater rebound to the original conditions, unaffected by mining.

For this purpose, the construction of the mathematical model of mine flooding has begun. For the model construction the DHI FEFLOW software is utilized. Due to the complexity of the rock environment at the site and the need of incorporation as much mine workings as possible into the model, the size of the model is beyond what is typically done in FEFLOW. The model covers an area of 15.7 × 12.7 km with vertical extent of 1200 m. The total number of elements in the finite element mesh is more than 26 million. Vertical discretization of the model domain was done into 300 layers. The principal hydraulic properties of the rock environment (hydraulic conductivity and unsaturated-flow porosity), are determined with a set of more than 36 million data points. Furthermore, a complex net of 1D line discrete features representing the mining shafts and galleries has been imported into the model. The mine water quality evolution is not considered in this task, even so, the size and complexity of the model is currently on the limit of conventional desktop computer performance.

Hydraulic properties nad boundary conditions are being calibrated based on the observation of the first part of mine water rebound to the level -380 m b.s.l. This is a level on which the mine water is maintained by pumping from one central shaft in the abandoned partial basin. The mine water level is observed on one additional shaft proving water level difference in order of tens of meters (throttled interconnections between partial basins – mine pools).

The present state of simulation and experience from solving this demanding task – distributed modelling of mine water rebound will be presented.