

Experience with long-term monitoring of Lake Most

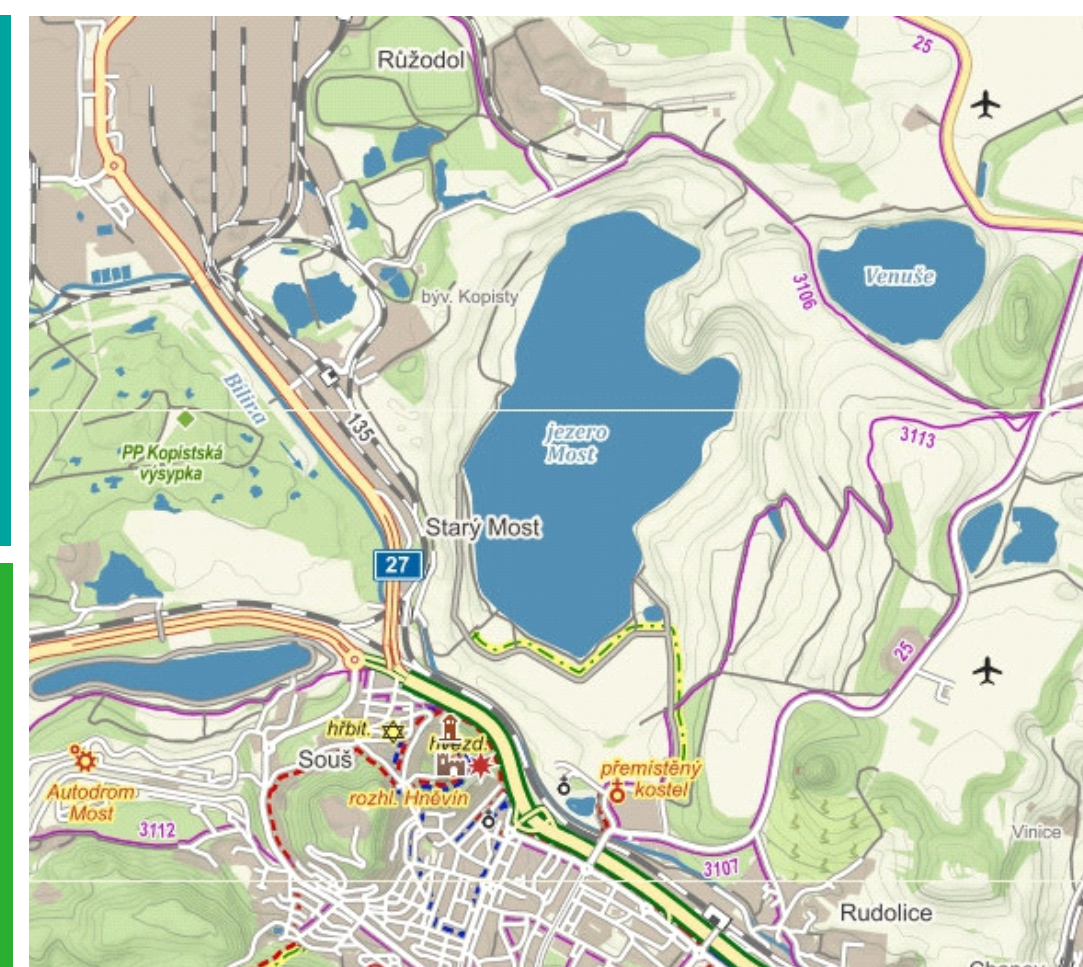
Vladimír Slivka, Jiří Mališ, Dagmar Dlouhá, Viktor Dubovský, Naďa Rapantová, Pavel Pospíšil, Tomáš Peňáz



The lake Most is located in the central part of the north-Bohemian brown coal basin, north of the town Most. The lake Most was formed by the reclamation of a former surface coal mine. Based on the lake level declines during the summer months, a study has been conducted whose main topic is the construction of a mathematical model for predicting the water balance of the Most Lake. The study also includes a geological model of the area, a digital model of the terrain, monitoring of water quality.

Information collecting, evaluation of available data

Data relating to the geomorphology, the rock environment, groundwater chemistry, anthropogenic interventions, climatic conditions, etc. Data from the following institutions have been used – State Administration of Land Surveying and Cadastre, Geofond Archive of Czech Geological Survey, Institute of Physics of the Atmosphere, Czech Hydrometeorological Institute, etc.

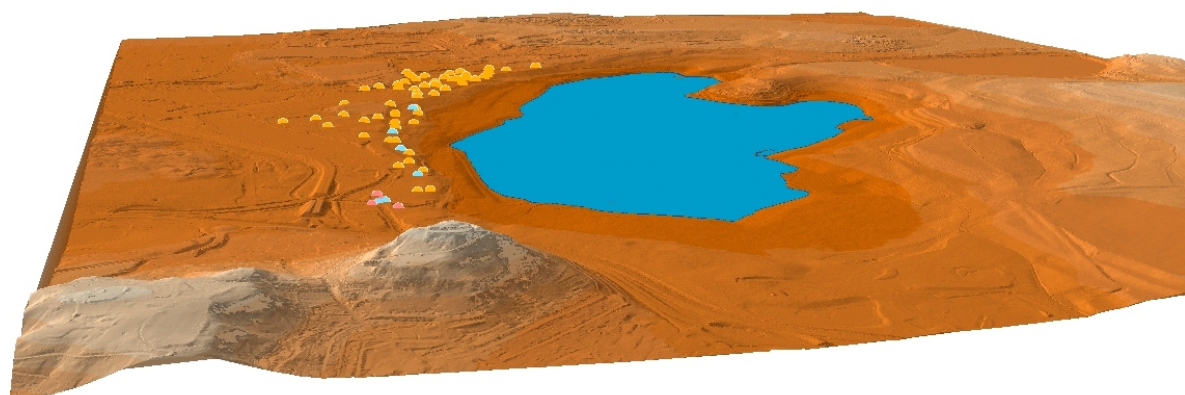


Geomorphological conditions and digital terrain model

A terrain model based on data from a 5th generation digital embossed model (DMR 5G). Identification of rock mass movements and monitoring of the dynamics of their movement was evaluated using radar data processing from the Sentinel 1 satellite.

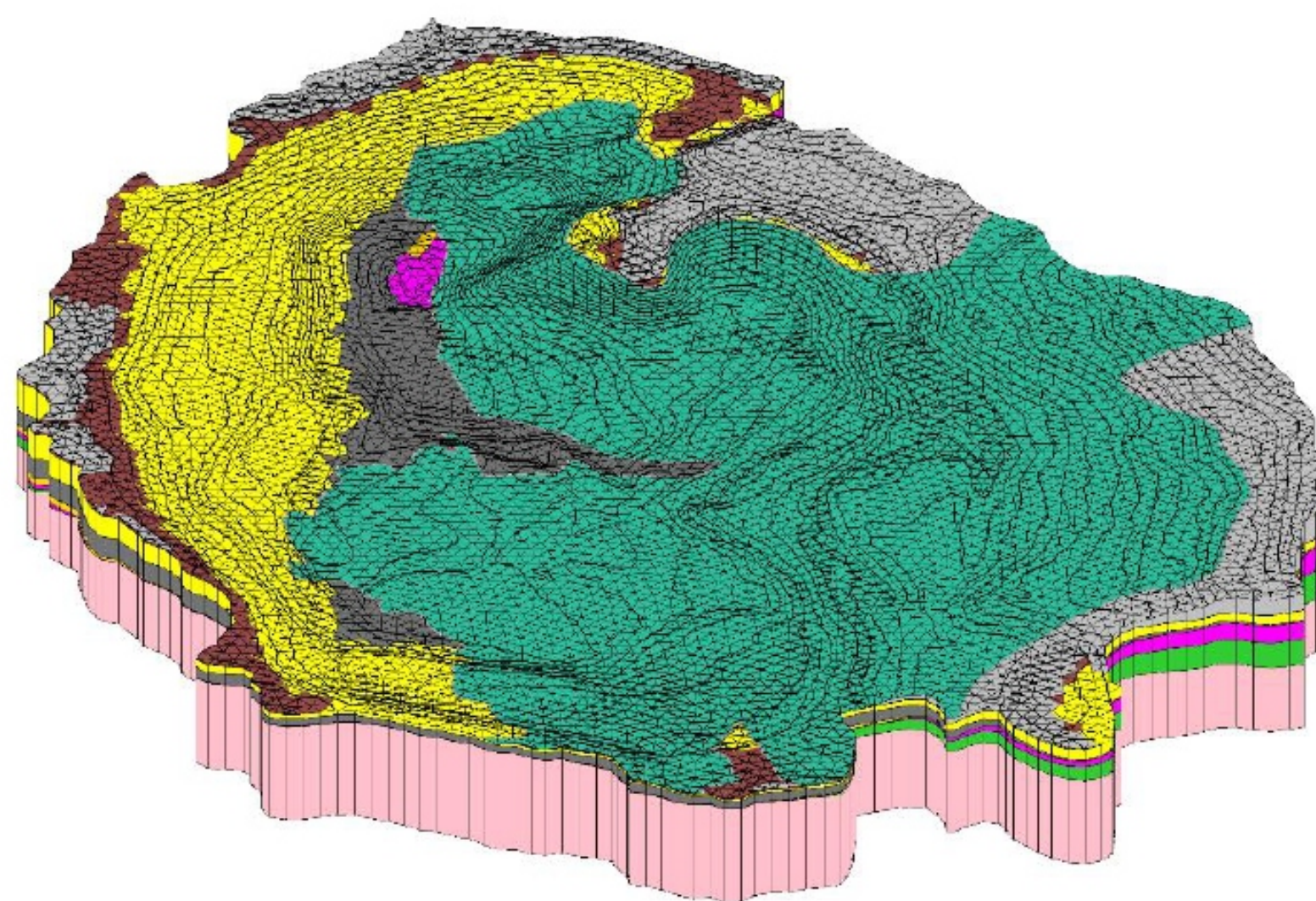


The aim was to verify the assumption of the ongoing declines. The stable points shown in green are the points in yellow for which a minimal decrease was recorded. Red points are characterized by a more pronounced decrease.



Geological model of the area

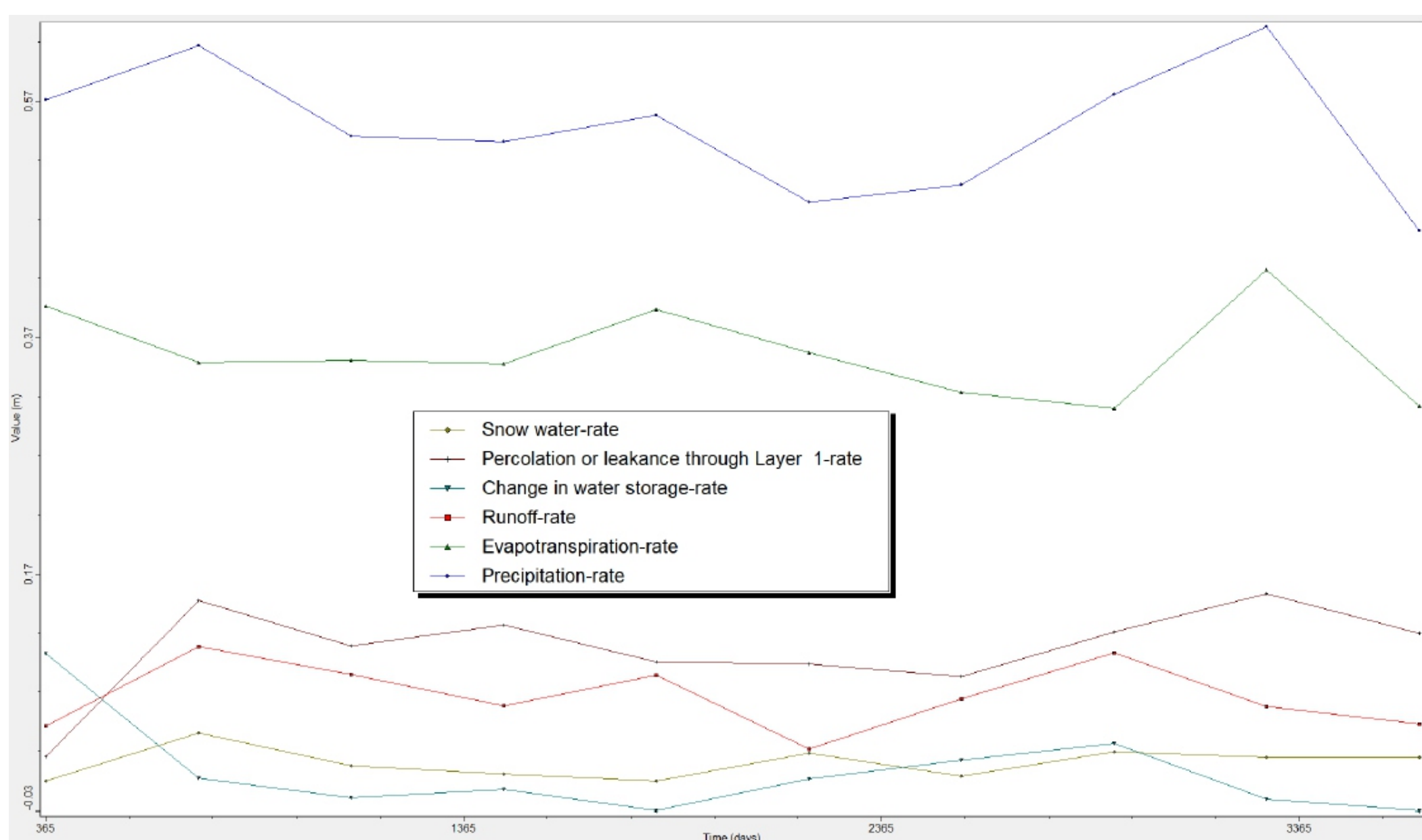
From existing geological documentation, focusing on the appreciation of all rock discontinuities, both natural and anthropogenic, emerges the creation of a geological model of the Bridge Lake area. To create it, a database was compiled with data from 1650 wells drilled in the past.



Calculation of effective infiltration and surface runoff - balance method

Calculation of effective infiltration to groundwater from precipitation in an area characterized by geological, climatic and vegetation conditions. Effective infiltration calculated as the residual of other balance components: R - effective infiltration P - precipitation D - surface runoff ET - current evapotranspiration ΔW - stock change

$$R = P - D - ET - \Delta W$$



Compilation of the water balance of Lake Most

Result of a hydrological model (HELP), a hydraulic groundwater flow model (MODFLOW), lake vapour calculations, based on different methods. The methods of calculating fumes are largely empirical, often due to the particular climatic conditions under which they were derived and the variance of their results is enormous. Also, precipitation modelling in a complex anthropogenically disturbed environment is based on incomplete knowledge of spatial distribution of a number of variable parameters. Combining the use of different methodological approaches and optimising monitoring is the only option to reduce high uncertainties.

Possible proposals for action

In terms of geological structure and the method of sealing the bottom of the lake, there is a real possibility of water transfer from the lake to the subsoil. Only part of the bottom was sealed and despite the low permeability of the rocks at the site in the entire area of the lake, part of the water must pass into the deeper horizons (there is no totally impermeable rock and usually no sealing). An analysis of old mining maps was performed in order to identify places in the shores of the lake where potential contact with old mining parts of the preferential flow zone would be possible. Balance sheet results show an increase in this component great uncertainty of calculations.

Monitoring the water quality of Lake Most

Analysis of lake water taken from different depths - zonal sampling and analysis of water taken from a network of shallow wells following the shoreline. In addition to collecting and analysing groundwater, we also perform comparative analyses from the tributaries and waters of the lake.

