

Title:

Simulation of groundwater flow and heat transfer for the geothermal use of flooded abandoned old-mines

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T9.3 Low and high temperature geothermal energy

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Abstract (300 words maximum):

Groundwater in flooded abandoned mines could be used for geothermal purposes using heat-pumps and an open loop involving pumping and re-injection. Logically, warm water is usually expected to be pumped (or injected) in the deep parts of the open network, and cold water is expected to be re-injected (or pumped) in the shallower parts.

However, the feasibility and the durability of future 'Ground Source Heat Pump system' (GSHP) must be studied through a deep characterization of the subsoil but also using numerical models able to simulate groundwater flow and heat transfer in these complex geological environments. Depending on the type of abandoned mine, the true geometry of the interconnected network of open galleries and shafts can indeed be highly complex. A high-velocity water flow is expected in this type of network, while low-velocity groundwater flow occurs in less permeable fractured and porous rock massif.

The SUFT3D code that allows combining in a single model, and in a fully interacting way, linear or distributed reservoirs to model groundwater flows in mine galleries and classical groundwater flow in the variably saturated equivalent porous surrounding media is developed to model heat transfer using the similarities existing between solute and heat transfer equations. The code is then used to test on a simplified case study based on the characteristics of the Werister coal mine (Belgium), the impact of the hydrogeological conditions and of technical choices on the feasibility and the durability of these geothermal systems.

References

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Keywords (5 maximum):

Ground Source Heat Pump System, Flooded mines, Numerical model, SUFT3D.