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Thermohydraulic Modeling on the Continuous Operation of Standing Column Wells under Regional Groundwater Flow

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Coupled hydrogeological-thermal simulation of the standing column well (SCW) system is essential to provide an optimized configuration and operation schedule for boreholes on the site. This paper presents numerical investigations and thermohydraulic evaluation of standing column well system operating under continuous flow regime.
A three-dimensional numerical model for groundwater flow and heat transport is used to analyze the heat exchange in the ground. The model includes the effects of convection and conduction heat transfer, heat loss to the adjacent confining strata, and hydraulic anisotropy. The operation scenario consists of continuous injection and recovery and four periods per year to simulate the seasonal temperature conditions. For different parameters of the system, performances have been evaluated in terms of variations in the recovery temperature. The calculated temperatures at the producing pipe were relatively constant within a certain range through the year and fluctuating quarterly a year. Pipe-to-pipe distance, injection/production rate, ground thickness, and permeability considered in the model are shown to impact the predicted temperature profiles at each stage and the recovery water temperature. The influence of pressure gradient, which determines the direction and velocity of regional groundwater flow, is also substantial.