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Modelling strategies for the thermal management of shallow rural and urban groundwater bodies

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Thermal management of aquifers requires knowledge on interactions and heat transport processes not only on a local but also on a more regional scale. Therefore, prediction of temperature developments due to thermal use and other anthropogenic impacts necessitate the use of large scale numerical models based on field temperature measurements. This contribution presents different modelling strategies for the thermal management of shallow rural and urban groundwater bodies. Depending on the settings and the relevant management topics different boundary conditions have to be considered. Whereas, thermal regimes within rural groundwater bodies primarily are governed by natural boundaries and the interaction with the atmosphere, in urban areas also the influences of urbanization and heated subsurface constructions have to be considered. Therefore, the setup of modelling tools as basis for the thermal management of groundwater bodies in different settings requires different interaction processes to be focused on.

The study is illustrated by selected examples of a rural groundwater body located in the “Leibnitzer Feld” (Austria) and an urban groundwater body located in the city of Basel (Switzerland). The two case studies differ in their respective hydro-geological setting, above all in the vertical extents of the saturated and unsaturated zone. Therefore, specific modelling approaches are used to focus on a reliable description of the main governing impacts. The regional models evaluate current and future thermal use of the groundwater bodies and highlight the advantages arising from a regional view of heat transport processes.