

Publication

Relating groundwater heat-potential to city-scale heat-demand: A theoretical consideration for urban groundwater resource management

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To sustainably plan the use of subsurface resources, a discussion about thermal management is needed, as well as a more coordinated and efficient thermal use of subsurface resources. This contribution outlines a theoretical consideration for how to effectively manage urban subsurface resources. The consideration is made by means of assessing the heat-potential from urban groundwater resources against the background of heat-demand. We illustrate that, in principle, the heat-potential of subsurface resources could be directly 'mined' to exploit them and store thermal 'waste energy'. We show how quantitative flow- and heat-transport modeling approaches can offer a scientific basis for thermal management strategies. In combination with geographic information systems, evaluating heat-potential and heat-demand can become the basis for management concepts as well as for the overall economic and ecological thermal planning of subsurface resource usage. An index which relates groundwater heat-potential to heat-demand is introduced here. This index allows us to quantify the share that thermal 'waste energy' from groundwater resources could have to satisfy heat-demand. On the one hand, we demonstrate how the spatial distribution of this index can be derived for the urban area of Basel, Switzerland. On the other hand, we exemplify the temporal evolution of the heat-potential for selected urban areas and discuss the capacity for space heating with a typical annual heat-demand profile.

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