# Large scale assessment of the effects of sustainable heat recycling in the shallow subsurface on above ground temperatures.

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Urban overheating and a sustainable energy supply are two of the most important challenges of our time. More than 50% of the global population lives in cities and is therefore exposed to a climate shaped by the built environment. In most regions of this planet so-called urban heat islands dominate temperatures, which can threaten the health, general well-being, and productivity of local populations. At the same time, European households use more than 80% of their total energy consumption for space and water heating. Conventional methods are primarily based on fossil fuels. While both topics are so far only considered separately, they are linked through the urban underground. Here, like above ground, temperatures are elevated representing the accumulated waste heat of the city. This waste heat can be recycled with shallow geothermal systems. This project answers the question whether a sustainable thermal use of the urban underground - i.e., exhaustion of all technical options for heat extraction, albeit limited by the actual heating demand - can help to mitigate urban heat locally. This question is considered globally on a sub-city scale. By linking geospatial data science with remote sensing, energy science and urban climatology, the urban heat imbalance is addressed under three aspects: a) modelling the effects cooling the subsurface will have on air temperatures; b) a large-scale mapping of the technically feasible potential for heat recycling (and thus cooling of the subsurface); and c) quantifying heating demands using high-resolution satellite images and machine learning.

**Projektbeteiligte**

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