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Tracing fast soil water fluxes using thermal energy as tracer

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Up to now hydrology has been concerned with the water balance, while meteorological land surface models focus on the energy balance. However, the water and thermal energy cycles in catchments are essentially linked and require a coupled treatment. This allows for integration of a wide range of temperature related observables into the model development and validation.

The objective of the proposed is to explore whether thermal energy as tracer may provide orthogonal and cheap information on fast subsurface flow processes as well as exchange between vadose zone and surface water bodies. The approach is to carry out coupled simulations of subsurface water and heat fluxes at the field scale using CATFLOW to reproduce distributed soil moisture and soil temperature observations collected at a very densely instrumented field site in the Bavarian forest. Based on a geostatistical analysis of the soil moisture data and available soil profile information we will estimate mean, variance and covariance structure of the porosity and hydraulic conductivity. We will then work out whether coupled observations of soil moisture and temperatures allow a less uncertain estimation of subsurface structures within a Monte Carlo approach.