# Vergleichsplattform für Erdwärmesondenmodelle

## *Benchmark toolbox for borehole heat exchanger models*

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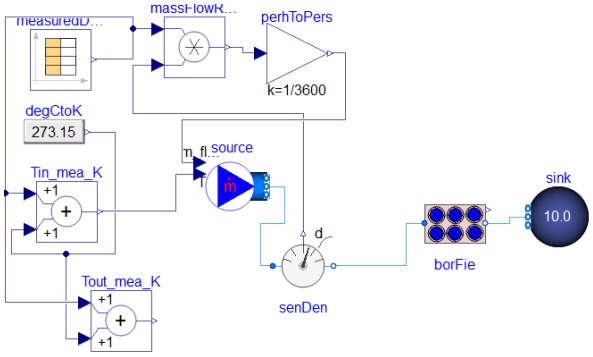
**Master-/Bachelorthesis**
**aus dem Bereich energieeffizientes Bauen und energetische Vernetzung**

**Topic:**

Heat pumps have been identified as key technologies for decarbonizing the energy system (International Energy Agency, 2024). Heat pumps use ambient energy to provide heating and cooling to buildings. Of those, ground-source heat pumps are especially efficient, as the undisturbed temperature in the ground remains stable over the year.
To exchange heat with the ground, different systems exist, of which the most common are borehole heat exchangers (BHEs). BHEs consist of U-shaped pipes installed in vertical boreholes filled with grout. A circulating fluid within the pipes enables heat exchange with the surrounding ground.
Accurately modeling the heat transfer process between the fluid circulating in the BHEs and the ground is essential for determining the number of required BHEs and optimizing GSHP operation. However, due to the slender geometry of the BHEs and the complexity of heat transfer processes, numerical models are often impractical. Instead, simplified modeling approaches—such as RC networks, hybrid models, and g-functions—are widely used (e.g. Heim et al., 2024). These models are typically validated against specific experimental datasets. Due to the availability of various models, selecting the most suitable one or comparing different models for specific applications can be challenging. Most models have not been consistently validated using the same datasets, making it difficult to evaluate their relative strengths and weaknesses.

To address these issues, we propose developing a BHE Model Benchmark Toolbox. This toolbox will enable the simulation of BHE operation using available datasets (e.g., from thermal response tests, and operational data) with multiple BHE models, and compare the simulated temperatures to the measured data. The inputs and outputs of the models will be designed to be as generic as possible, with clear documentation to facilitate the addition of new models. The toolbox will be shared via GitHub to ensure accessibility.




**Possible tasks:**

- Gathering data sets
- Developping a universible applicable simulation framework
- Comparing different models
- …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