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A Hydrus 2D model for predicting temperature distribution of heated fiber optics embedded in a porous media

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We present predictions of the temperature distribution within and surrounding cylindrical heated sources embedded in porous media using the widely-employed Hydrus 2D. The accuracy of the model is tested in two saturated scenarios: first, where heat it is only transferred by conduction and, second, with convection of heat driven by steady water flow. Results are compared to measurement from laboratory experiments.
A helical pattern of fiber optic was buried in a sandy-soil column of constant bulk density and exposed to heat pulses of variable intensity and duration for the two scenarios mentioned above. Measurements of resulting temperature increase were obtained by means of the Distributed Fiber Optic Temperature (DFOT) method (Silixa Ultima). The soil thermal properties were measured in situ as well (Decagon Kd2Pro).
Simulations with Hydrus-2D accurately reproduced the observed temporal patterns of temperature increase obtained by the DFOT method for both static and flowing water in saturated porous media. These results provide the basis for defining the range of fluxes which can be quantified using this means.