Calibration of a seawater intrusion model with surrogate simulations

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ABSTRACT

In both local and global optimization literature, surrogate models are increasingly used to optimize parameters for models that require significant computational resources. In this study, calibration is undertaken for a computationally demanding seawater intrusion model using simpler, more computationally efficient surrogate models. The "complex" model comprises a heterogeneous SEAWAT-model that employs a computationally demanding solver for advective transport. Less computationally demanding surrogate models that are subsequently used are comprised of a SEAWAT-model with a more efficient advective transport solver and a model applying MODFLOW's SWI-package. Both types of surrogate models provide only an abstract image of the "true" complex model due to numerical diffusion and a sharp interface assumption. However, it is assumed that such surrogate models mimic the physical behaviour of the complex model, which suggests their use to infer parameter sensitivities that can be used to calibrate and perform uncertainty analyses for the complex model with less computational effort. Results of this study compare parameter estimates that are obtained with a standard calibration approach of the complex model versus a calibration approach with simpler surrogate models. Furthermore, uncertainty measures and structural model error is analysed together with the computational gains when surrogate models are employed for model calibration.

Keywords: Surrogate Model, Inversion, SWI-package, SEAWAT

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