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PARAMETER OPTIMISATION IN GROUNDWATER USING PROPER ORTHOGONAL DECOMPOSITION AS A REDUCED MODELLING TECHNIQUE.

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Abstract. *This paper deals with different approaches of applying Proper Orthogonal Decomposition in the field of groundwater flow, specifically the Richards equation, which is a convection-diffusion partial differential equation governing the behaviour of unsaturated fluid flow through a porous medium. The motivation for this research is the need to reduce computational complexity in inverse modelling studies, where a significant number of simulations are needed to determine suitable model parameters. Three different methods of implementing Proper Orthogonal Decomposition are explored. The first method is the Petrov-Galerkin method, a method well suited to speeding up linear problems. The second method is a "Hybrid" method, and proposes a linearization of all non-linear functions, building upon the Petrov-Galerkin approach. As such, it is suitable for use in the non-saturated groundwater zone. The third method combines the use of kriging and Proper Orthogonal to create a non-intrusive model for comparison purposes. With these three methods, the suitability of Proper Orthogonal as a reduced modelling method for unsaturated groundwater flow is shown.*

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