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# Determination of water retention curves of rocks by a differential evolution algorithm

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Several different parametric models have been developed to describe fluid flow and mass transport in unsaturated media. The experimental data can be fitted to the models obtaining a water retention curve (WRC) which best describes the hydraulic properties of the soil or rock under investigation.

However, all these models need a complete data set and require an accurate measurement of the dependence of the matric potential ($\psi$) on water content ($\theta$) from saturation to oven dryness using methods that are time consuming and error-prone, especially when investigating rock media.

In this work, a new approach for the determination of the model parameters that best fit the WRC of rocks is presented. The approach uses a differential evolution algorithm (DE), an evolutionary computation algorithm particularly useful for multidimensional real-valued problems, to calculate the parameters that best fit the models to the available experimental data. We show here that with DE it is possible to strongly decrease the number of experimental data needed to obtain model parameters that accurately describe the hydraulic properties of the rocks.

In this work, we have applied DE to calculate the WRCs of rock samples, using several widely used models. The measurements have been performed on samples of sedimentary carbonatic rocks of marine origin, belonging to "Calcarenite di Gravina" formation (Middle Pliocene – Early Pleistocene) and coming from two different quarry districts in Southern Italy.