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# Modelling Soil Water Characteristic Curves for the Investigation of Hydrophobicity

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Soil hydrophobicity presents a major challenge for the future, as it reduces both plant-available water and irrigation efficiency, and can increase flooding hazards and erosion. A collaborative research project has been set up in the UK to study hydrophobicity over a wide range of length scales.
At core scale, we are investigating the wetting behaviour of water repellent soils in order to model percolation through hydrophobic pore spaces. To that end, water retention measurements were carried out on both wettable and forcibly-wetted water-repellent soils collected from three locations in England and Wales. The data were then fitted with both the commonly used Van Genuchten model and an alternative model from PoreXpert, a software program that analyses and models porous materials. The Van Genuchten model fits a curve to the data using parameters related to air entry suction, irreducible water content and pore size distribution. By contrast, PoreXpert uses a Boltzmann-annealed simplex to find a best-fit curve based on parameters directly related to the void structure of the soil: the size of the voids, the shape of the void size distribution, and how the voids are connected to each other.
Both Van Genuchten and PoreXpert fit the experimental data well, but where Van Genuchten forces an S-shaped curve that can mask small variations, PoreXpert gives a closer fit of no pre-defined shape that captures subtle differences between data points. This allows us to calculate differences in the effective pore and throat size distributions, and provides a mechanistic framework from which to model additional hydrologic behaviour in water repellent soil. Simulations of capillary induced wetting based on these mechanistic postulates are then compared to wicking experiments at the core scale, which can then be upscaled and applied to other soils.