Introduction and evaluation of a Weibull hydraulic conductivity - pressure head relationship for unsaturated soils

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Analytical and numerical solutions for flow through partially saturated soils typically require functional relationships between water content, pressure, and hydraulic conductivity. Here we propose a Weibull-type function to describe the hydraulic conductivity-pressure head function. We show that this is a more flexible function that has the ability to address air entry pressure, while retaining the ease of integration and differentiation that facilitates many important computations which have to this point favoured the Gardner exponential function (which is a special case of the proposed function). The ability to fit measured values is shown to be better than commonly employed functions of similar simplicity. Strong relationships were found between the parameters of the proposed function and the corresponding soil water retention curve, thus providing predictive capability. A simple relationship was also found between the parameters of the function and the wetting front pressure. Applying the proposed function to estimate the wetting front pressure improves the accuracy of predictions for infiltration using the Green and Ampt model.