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Finite formulation for the computation of sorptivity

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Soil sorptivity is one of the key hydraulic parameters for modelling water infiltration into soil. It quantifies the capacity of a soil to infiltrate water by capillarity. Several formulations, based on various models, have been proposed to compute it from the water retention and the unsaturated hydraulic conductivity functions. All these formulations use the integration of the product of either the hydraulic conductivity or diffusivity function with the flux concentration function. The integration can be performed either over an interval of water pressure head or water content, yielding two equal values. However, the expression of the integral as a function of water pressure head may involve a huge or even infinite interval, which can be numerically difficult to handle. In opposite, the expression of the integral as a function of water content involves the integration of a diverging function (diffusivity) over a large interval, which is also troublesome from a numerical point of view. In this paper, we provide a new expression for sorptivity by cutting the integral in two parts, in order to involve only the integration of a finite function over a finite interval. The dependency of the integral on the flux concentration function is also investigated.