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Preferential flow influence on the stability assessment of a partially saturated riverine dike via dual permeability model

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The stability of soil composed dikes is often affected by high water and rainfall events. These loading conditions are often included in the stability assessment performed by designers and managers. These assessments are performed often by limit equilibrium methods such as Bishop or Spencer's as they have proven to be simpler to calculate and faster to compute with respect to finite element methods. However, the time dependent preferential flow effects cannot be included in the limit equilibrium methods as they do not allow the inclusion of the porous media flow effects. In addition, the initial conditions such as permeability anisotropy, initial water content and infiltration capacity are recognized as important features which may also influence the dike stability. The present study aimed to understand the effects of preferential flow in the stability assessment of a riverine dike. This was done by simulating a riverine dike as dual permeability conceptualization of the soil, based on a 2D Darcy-Richards numerical solution. With this model it was possible to identify which of the initial conditions affects the dike stability the most and how much it differs when compared to the results obtained with a limit equilibrium assessment. The results showed that the stability assessment may differ by as much as 10% when dual permeability effects are included and that changes in the permeability anisotropy influence the results the most.