Coupling a Boussinesq-type model to an unsaturated zone model: theory and application to field data.

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In hydraulic groundwater theory the parameter drainable porosity is introduced for the purpose of mass conservation, i.e. matching the modelled outflow to the observed water table dynamics, thereby accounting in some way for the effects of the unsaturated zone. For pure drainage experiments techniques have been developed to estimate the value of drainable porosity. However, for more realistic rainfall patterns this estimation is more complicated, since it requires information on the storage in the unsaturated zone. Here we present the coupling of a saturated zone model (i.e. the hillslope-storage Boussinesq model) to a fairly simple (wave equation-type) unsaturated zone model. Both models are described in the form of partial differential equations and are solved numerically. The relationship between the drainable porosity, and the interaction of the saturated with the unsaturated zone will be discussed. The coupled model's behaviour and performance will be evaluated by comparison to measurements from a field site in Troy, Northern Idaho, US.