

An APSIM model to describe the preferential transport of solutes in soils

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When rainfall or irrigation occur at high intensity water may flow preferentially through cracks and large pores in the soil profile. In this situation, part of the soil is not involved in the transport of water or solutes and this momentarily increases the likelihood for leaching of surface applied solutes. Evidence for preferential flow has been shown for various soils in different regions and it seems to be nearly ubiquitous. Despite being recognised as a common phenomenon, preferential flow is often not considered in modelling analyses; its natural variability and the complexity it would bring to the model seem to be the main reasons for this omission. The APSIM model framework is increasingly being used to study the fate of nutrients in soils from New Zealand and Australia, with a considerable amount of work done on describing the effects of urine patches on nitrogen leaching. However, the preferential transport of nitrogen has not yet been explicitly considered as this functionality is not present in APSIM. In this paper the implementation into APSIM of a relatively simple approach to account for preferential flow is presented and demonstrated. This model is largely based on the concepts introduced by Addiscott and Whitmore (1991), but keeps interesting features of APSIM's SoilWater model. With this addition, APSIM can be used to help with the study of preferential flow, establishing the relative potential effects of this phenomenon, and with comparisons against results from recent lysimeter studies in irrigated Canterbury soils.