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Evaluating Hydraulic Responses of Soils to Cyclic Infiltration

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Recharge is a key component of sustainable water resource management that is especially difficult to quantify. Reducing this uncertainty is central to understanding the impacts of climate change on expanding urban areas within arid and semi-arid regions. This study uses numerical simulations of repeated precipitation and evaporation periods to examine the impact of changes in the nature of precipitation events on recharge. We show that for a constant total precipitation, the maximum depth of water content variation and the recharge depend on the duration and intensity of precipitation events and the soil hydraulic properties. Through numerical experiments, we find the following. Long, low intensity precipitation events increase recharge rates. The maximum depth of water content variation and recharge rate do not follow the order of soil texture. Water content variation depth increases as: silt; loam; clay; sand. It appears to be controlled by a combination of Ks and water holding capacity. Recharge increases as: silt; clay; loam; sand. It appears to be controlled the tendency of the soil to dry rapidly at the ground surface, leading to reduced evaporative loss. Generally, these results indicate that the temporal distribution of rainfall, even without a net change in total precipitation, can have profound effects on recharge rates.