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Assessing soil water storage distribution under sprinkler irrigation by coupling 3D simulations and field observations

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This work analyzed the variability of sprinkler irrigation application over a bare soil, both in terms of water application efficiency and uniformity, by integrating and comparing the information on the irrigation depth data (ID), as measured by catch cans, soil water storage in the upper root zone, as measured by TDR probes, and a 3D simulations of water flow in soils. Three irrigation tests were performed at three different pressures (2, 3 and 4 bar). A lateral water redistribution was observed and simulated after each irrigation event by comparing spatial distributions of site-specific water application efficiency (AEs), as well as ratios of site-specific actual water storage increase (SWEs) and irrigation depth (IDs) to the water content before irrigation. Because of soil water redistribution processes, distribution uniformity based on soil storages was systematically higher than the catch can uniformity. The obvious consequence of lateral water redistribution processes was that the soil smoothing action on non-uniformity observed at the surface increased both with depth and over time. At a given depth the uniformity of soil water storages always attained the same value, whatever the pressure considered and the catch can-based uniformity coefficient. It was concluded that, for the case of random distribution of ID, the uniformity of water storages is driven by the soil behavior rather than by the irrigation system.