Prediction of water content at different potentials from soil property data in Jazan region

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In dry regions effective irrigation management is crucial to maintain crop production and sustain limited water resources. Effective irrigation requires good knowledge of soil water content in the root zone. However, measurement of soil water in the root zone over time is extremely expensive and time consuming. On the other hand, weather and basic soil property data are more available, either from existing databases or by direct measurement in the field. Simulation models can be used to efficiently and accurately estimate soil water content and subsequent irrigation requirements based on the available weather and soil data. In this study we investigated three hierarchical approaches to predict water content at variable potentials (0, 10, 33, 60, 100, 300, 500, 800, 1000, and 1500 kPa) using the Rosetta model: soil texture class (STC); percent of sand, silt, and clay (SSC); bulk density, percent of sand, silt, and clay, and water content measurements at 33 and 1500 kPa (SSC+WC). Estimation of soil water content at 43 locations in Jazan region using the three hierarchical approaches was compared with gravimetric water content. Results showed that the three approaches failed to describe water content accurately at saturation conditions (<10kPa). At water potentials lower than 10 kPa, good agreement was obtained, in general, between measured and simulated soil water content indicating that soil property data can be used to provide adequate estimates of the average soil water content in the root zone. The third approach gave the best results as indicated by an average NSCE value of 0.75 as compared to 0.16 and 0.18 for the first and second approaches, respectively. The ability to predict the amount of available water in the soil profile will facilitate the accurate estimate of irrigation requirements and achieve effective irrigation scheduling especially in locations where only limited weather and soil date are available.