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Seasonal Patterns of Temporal Persistence of Water Content Profile of the Dark Shestnut Soil Profile

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In case of mechanically intact soil profile its depth-temporal patterns of soil water storage is a result of the temporal dynamics of both water flow & solute transport coupled with exchange process and the evolution of bio-physical & bio-chemical properties of soil profile horizons. In soil profile with steady state of biological and chemical processes these patterns can be considered like depending just from soil water fluxes at upper and lower boundaries, internal water uptake by root of plants and physico-chemical parameter governing unsaturated soil hydraulic properties. At these conditions soil profile should exhibit a temporal persistence of soil moisture profile.
The objective of this note is to demonstrate temporal persistence of soil moisture profile patterns as well as some exclusion. These profiles were measured at experimental site located in agricultural area within left bank of middle part Volga River with extensive use of sprinkler irrigation. Soil of study area was classified as dark-chestnut with about 3 % of organic matter content and clayey texture.
Experimental site was customized with aim to prove agricultural efficiency of novel strategies of water reuse for irrigational purposes as well in the frame of FP6 Water Reuse 516731 project and eco-innovation technologies to reduce negative impact of irrigation into land degradation in the frame of FP6 DESIRE 037046 project. For this purpose an experimental setup was established at non-irrigated part of the irrigated field used for perennial alfalfa crop from its 1st (2006) till 4th (2009) year of sowing seasons. This setup was consisted by multiple experimental plots with size 2x4 m and quite similar micro landscape. These plots were equipped by vertically installed plastic access tubes for monitoring of vertical soil moisture content profile during four consecutive years of spring-summer-autumn field monitoring campaigns. One type of these tubes reaching depths of 0,9-1,1 m were used for monitoring at 6 experimental plots with TDR vertical probe Trime FM (IMCO Company).
Before and during the measurement campaign a calibration of TDR probe was tested at artificial soil monolith developed from the same soil material with different soil water content profile. Overall positive results of testing have permitted the following use of measurement device without recalibration of calibration done by plant.
After monitoring protocol a measurements of soil moisture content at each experimental plot were done with depth increment of 5 cm, 1 time per day during evaporation/rain time period and from 5 till 10 measurements per day during irrigation water applications. Irrigation water application at each experimental plot was performed according to established scheduling of irrigations. The total nu mbers of measurements done at access tube are in the range between 3724 and 2726 for 17 and 15 depths of measurements.
Two data sets of weather parameters were used for interpretation of recorded soil moisture time series. First with standard 6 hour protocol was taken from meteorological station located at about 25 km. Second with 1 hour temporal increment was recorded by automatic weather station installed near experimental plots. Results of this interpretation showed that there is quite strong temporal persistence of soil moisture profile patterns during time periods of evapotranspiration/redistribution between adjacent period of rainfall or/and irrigation water application during summer time. Recorded soil moisture profiles after snow melting time and during rainfalls in autumn have no similar pattern. At the same time it is noted that observed soil moisture profile patterns are quite specific to each location of monitoring with rare similarity between them.