Geophysical Research Abstracts
Vol. 21, EGU2019-7799-2, 2019
EGU General Assembly 2019

Using soil water status sensors to determine the optimal irrigation regime

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Determining the irrigation regime using sensors that measure the water status can optimize irrigation efficiency. agriculture systems are highly heterogeneous and there is a difficulty to locate a single sensor in a way that will represent the entire area. The question is how many sensors are needed, where it is best to place them and what is the algorithm that will be used to trigger the irrigation. To answer those questions numerical modeling experiments were carried out. The model that was used in the research is HYDRUS-1D. This model solves Richards' equation for saturated-unsaturated water flow in one dimension. Transpiration by plants was included in the simulations as well. The domains that were simulated were composed from homogeneous parallel sandy soil columns, each soil column with different soil hydraulic parameters. This quasi 3D modelling represents the soil heterogeneity of an entire field. The soil columns were simulated simultaneously by integrating HYDRUS-1D with MATLAB software. Numerous simulations were conducted in various sandy soil heterogeneity distributions and with many triggering irrigation algorithms in order to find the optimal algorithm. The simulations provided clear evidence that the positioning of the sensors and the triggering algorithm considerably affect irrigation efficiency. We show that if the soil heterogeneity distribution of a field is defined in any practical way, our modeling approach can be a useful tool to determine where is the best location to place soil moisture sensors and what is the optimal triggering algorithm.