Geophysical Research Abstracts
Vol. 16, EGU2014-6709-1, 2014
EGU General Assembly 2014

Root distribution analyses as a means of improving sensor-based deficit irrigation systems

Sebastian Kloss, Martin Werisch, and Niels Schütze

Technische Universität Dresden, Institut für Hydrologie und Meteorologie, Dresden, Germany
(sebastian.kloss@tu-dresden.de)

The limited and seasonally variable availability of water and its efficient distribution when growing crops is still an unsolved problem in agriculture. Sensor-based deficit irrigation (DI), where a sensor is used to detect the soil water status and irrigation is provided according to certain threshold values, is one strategy to address that issue. Threshold values are needed that ensure high water productivity and high reliability.
A stochastic approach of simulation and optimization in combination with irrigation experiments of drip irrigated maize for model parameterization was used to derive reliable soil water tension threshold values for irrigation control. A weakness of the applied model was the unknown parameterization of the plant root, which had to be included into the optimization besides parameters for the soil only, thus increasing the complexity of the problem. In a follow-up irrigation experiment with the same DI system parameters, focus was put on the investigation of the plant's root distribution in order to improve the validity of the model when determining optimal soil water tension threshold values in sensor-based deficit irrigation systems. Soil samples for a fully and a deficiently irrigated treatment during different stages of plant development were taken and the root density at different depths was determined. The difference in root growth for both treatments are shown and reliable soil water tension threshold values for varying values of irrigation parameters recalculated in a Monte Carlo simulation, after incorporating the new root parameterization into the model. This further improves the significance of derived threshold values and helps to assess possibilities and limitations of this approach when used for investigating the potentials of sensor-based DI systems.