Geophysical Research Abstracts
Vol. 14, EGU2012-11486, 2012
EGU General Assembly 2012
© Author(s) 2012

Understanding vadose zone hydrology to improve irrigation practices in cotton production of Uzbekistan

Y. Dernedde (1), I. Forkutsa (1), L. Breuer (2), G. Stulina (3), H.-G. Frede (1,2)

(1) Center for International Development and Environmental Research (ZEU), Justus-Liebig-University, Giessen, Germany(Irina.Forkutsa@zeu.uni-giessen.de), (2) Institute of Landscape Ecology and Resources Management, Justus-Liebig-University, Giessen, Germany(Lutz.Breuer@umwelt.uni-giessen.de), (3) Scientific Information Center of Interstate Coordination Water Commission (SIC-ICWC),Tashkent, Uzbekistan(galina_stulina@mail.ru), (1,2) Institute of Landscape Ecology and Resources Management, Justus-Liebig-University, Giessen, Germany(Hans-Georg.Frede@umwelt.uni-giessen.de)

In many arid and semi-arid ecosystems irrigation activities are consuming a major part of freshwater resources through water withdrawal from rivers, lakes and groundwater. In Central Asia about 90 % of the total water consumption is located in the agricultural sector. In this study we focus on the Ferghana Valley Region in Uzbekistan where water intensive cotton production is carried out under poor on-farm water management practice. Here, water fluxes are mainly forced by irrigation treatment as the contribution of precipitation is small during the vegetative period. The current irrigation practice provokes soil water surplus during the irrigation periods which leads to ineffective losses of irrigation water due to increased evaporation and drainage. A major task towards a more sustainable water management is to determine the actual state of soil water availability by modeling soil water fluxes. It seems the only feasible way to obtain means for a comprehensive and exact irrigation controlling system.

In regions like Central Asia information about the actual water consumption in high temporal and spatial resolution are needed because there is lack of exact data. This study monitored the following variables determining soil water fluxes within the unsaturated zone at experimental sites under irrigation treatment: (1) Volumetric water content in the topsoil layer (0.05 m) measured at 4 sites during 2 years to determine the spatial (records of 98 sampling points per site in a 5 day interval) and temporal (hourly records) variability; (2) Records of volumetric water content along the soil profile for 2011 only (2 profiles, 5 soil depths, hourly recordings) to monitor plant water uptake from the root zone, fluctuations of soil water storage and relocation from irrigation water applied from the surface; (3) Groundwater levels (5 day interval) to determine the temporal fluctuation induced by irrigation; (4) Vegetation development to derive plant water requirement.

From analysis of monitored data sets in 2010 we found standard deviations of 1- 4 % vol. water content describing a low spatial variability while variability in time is forced by irrigation application rather than by precipitation for soil water content and ground water level. The observed water fluxes are modeled by a 1D modeling approach in order to quantify water losses from the soil water storage through evaporation and drainage. We will present findings from monitoring and its incorporation to modeling and obtained results from modeling which contribute to an improvement in irrigation management.