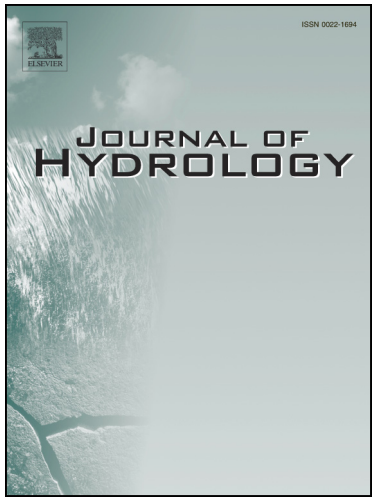

Research papers

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Han Dongmei, Zhou Tiantian

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Soil water movement in the unsaturated zone of an inland arid region: Mulched drip irrigation experiment

Han Dongmei[a,b,*], Zhou Tiantian[a,b]

a Key Laboratory of Water Cycle & Related Land Surface Processes, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, 11A Datun Road, Chaoyang District, Beijing, 100101, PR China

b University of Chinese Academy of Sciences, 19A Yuquan Road, Beijing, 100049, PR China

Corresponding E-mail: handm@igsnrr.ac.cn

Abstract

Agricultural irrigation with trans-basin water diversion can effectively relieve the water paucity in arid and semi-arid regions, however, this may be accompanied by eco-environmental problems (e.g., saline soils, rising groundwater levels, water quality problems). The mechanism of soil water movement under irrigation in the unsaturated zone of arid regions is a key scientific problem that should be solved in order to evaluate agricultural water management and further improve current irrigation practices. This study investigated the impact of drip irrigation on soil water movement in the unsaturated zone of a cotton field in an inland arid region (the Karamay Agricultural Development Area), northwest China. Combining in-situ observational physical data with temporal variation in stable isotopic compositions of soil water, we described the soil water flow system and mechanism in severe (Plot 1) and mild (Plot 2) saline-alkali cotton fields. The infiltration depths are 0-150 cm for both plots. Drip irrigation scheduling makes no significant contribution to local groundwater recharge, however, groundwater can move into the unsaturated zone through capillary rise during cotton flowering and boll periods. Plot 2 is less prone to having secondary soil salinization than Plot 1 due to the existence of a middle layer (approximately 100 cm thick), which elongated the distance between the root zone and aquifer. Rise in the water table (approximately 60 cm for Plot 1 and 50 cm for Plot 2) could be caused by lateral groundwater flow instead of vertical infiltration. We