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非充分灌溉条件下农田水分转化SWAP模拟

Simulation study of field water transformation under deficit irrigation with SWAP model

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作者	单位
冯绍元	1. 扬州大学 水利科学与工程学院，扬州 225009； 3. 中国农业大学 中国农业水问题研究中心，北京 100083
马 英	2. 中国科学院地理科学与资源研究所 陆地水循环及地表过程重点实验室，北京 100101;3. 中国农业大学 中国农业水问题研究中心，北京 100083
霍再林	3. 中国农业大学 中国农业水问题研究中心，北京 100083
宋献方	2. 中国科学院地理科学与资源研究所 陆地水循环及地表过程重点实验室，北京 100101

中文摘要:

非充分灌溉改变了农田水分转化过程，以往的研究较少讨论作物根系层以下的土壤水分转化动态及其对作物耗水的影响。该文在北京市典型农田开展了冬小麦-夏玉米非充分灌溉试验，在对SWAP模型率定与验证基础上，模拟分析了非充分灌溉农田耗水规律与水分转化过程，并应用模型得到了研究区不同降水年型的最优非充分灌溉模式。结果表明：非充分灌溉的实施促使作物消耗大量土壤贮水，当降雨或灌溉量较小时，土壤水可占作物耗水量的46.1%；根区和储水区之间土壤水分交换明显，转化通量变化范围为-2.67～0.45 mm/d，而储水区底部水分通量较小且无明显变化，根区土壤水分渗漏出现在灌溉或较大的降雨之后，储水区水分向上补给主要发生在作物需水关键期；与常规灌溉相比，最优非充分灌溉模式在丰水年、平水年和枯水年分别节水375、225和225 mm，储水区底部深层水分渗漏量分别减少了89%、17%和2%。

英文摘要:

Deficit irrigation changes the process of field water transformation. Few previous studies discussed the soil water dynamics below the crop root zone and its impact on crop water consumption. In this study, field experiments of winter wheat-summer corn rotation under deficit irrigation were conducted at the typical farmland in Beijing. The process of crop water requirements and water conversion under deficit irrigation were simulated by the SWAP model after calibration and validation. Furthermore, the optimal deficit irrigation modes under the condition of different hydrological years were obtained based on this model. The results indicated that deficit irrigation made crop consumed large amount of soil water. When precipitation and irrigation were small, the soil water consumption could be accounted for 46.1% of crop water consumption. There was obvious soil water exchange between root zone and storage zone with the range of soil water flux from -2.67 to 0.45mm/d. However, the water flux at the lower boundary of storage zone was small and changed a little. The percolation of the root zone always occurred after irrigation or larger precipitation, and soil water was supplemented from the storage zone upward into the root zone at the critical period of crop water requirement. Compared with conventional irrigation, the optimal irrigation modes could save irrigation water of 375mm, 225mm and 225mm, and the amount of drainage reduced up to 89%, 17% and 2% in the hydrologic years of 75%, 50% and 25%, respectively.

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