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Response of hydrological system to urbanization: a case study in Tianjin City, China

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ABSTRACT

Urbanization, which essentially creates more impervious surfaces, is an inevitable part of modern societal development throughout the world. Hence, it is important to understand the impact of urbanization on the water cycle as it helps people understand how urbanization will severely disturb the environment and assist policy makers in balancing development and environment sustainability. The objective of this study is to understand and quantify the sensitivity of the hydrological system to urbanization. A coupled rural-urban hydrological model, MODCYCLE, was set up to simulate the effect of changes in land use on daily streamflow and groundwater and applied to the Tianjin watershed in China. The model uses digital elevation maps, land use, soil, meteorological, and climatic data to represent important parameters in the catchment. The fraction of impervious surface was used as a surrogate to quantify the degree of land-use change. The results show that the expansion of urban areas had a great influence on generation of flow processes and on evapo-transpiration. The surface runoff was more sensitive to urbanization. Based on the results from this model, people can make more informed decisions regarding the extension of urbanization and attempting to balance sustainability and development.

Keywords: Urbanization; MODCYCLE; Land use; Hydrology

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