A coupled dynamic leakage loss and flood routing model for ephemeral rivers with complex sections

Congmin Liu¹, Chengzhong Pan¹, Chunlei Liu¹, Yuanzheng Zhai¹, and Wanlai Xue²

¹Beijing Normal University

²Beijing Water Science and Technology Institute

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Abstract

Ephemeral rivers commonly occur in regions with a shortage of water resources, and their channel configuration tends to change substantially owing to cultivation, tree planting and sand extraction. There is an urgent need to restore degraded river ecosystems. During short-term water conveyance, water storage in sand pits and leakage in dry riverbeds retards the flow of water, which is detrimental for ecological restoration of the riparian zone. A coupled dynamic leakage loss and flood routing model was established to predict the flow processes in the complex river channel of the Yongding River in China. The model mainly included three sub-models of flow dynamics, dynamic leakage loss, and water balance along multiple cross sections of the river channel. The complex section is reflected in the different infiltration properties for each section, and the existence of sand pits. The water head was dominated by flow velocity and the overflow from sand pits. Owing to the difference in landforms and the deposited sediment size of the riverbed bottom, the river channel was divided into 11 cross sections and a sand pit to ascertain the respective infiltration or leakage loss processes. The input parameters of the model came from field surveys of sand pits, river geometry and hydrogeology. The model was also calibrated and validated using monitoring data from ecological water releases into the Yongding River in 2019 and 2020. This coupled model can predict the water leakage loss and flow process of the water head and also provide important guidance for river reconstruction and ecological restoration.

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