



Dynamic management of a water resources-socioeconomic-environmental system based on feedbacks using system dynamics

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System dynamics (SD) have been used in water resources management for many years. However, water resources management using SD is usually in one direction, up to down or down to up, and doesn't consider internal and external system feedbacks, which may mislead managers and reduce the adaptability of water resources systems. Therefore, dynamic management of a water resources-socioeconomic-environmental (WSE) system based on feedbacks was established in this paper using SD, and a feedback function considering different intensities of feedbacks was proposed. The Beijing-Tianjin-Hebei region (BTHR), China, was chosen as the study area. Three subsystems were included in the WSE system: socioeconomic subsystem, water resource subsystem, and environmental subsystem. We established and compared different dynamic management scenarios with various intensities of feedbacks. The results show that shortage of water resources and pollution in the BTHR will continue to deteriorate from 2015 to 2030 if no management measures are taken, and the government should direct more attention to reducing the water demand of primary industry and population growth. In addition, we found that the three subsystems in the WSE system influence each other and evolve mutually. In particular, the influence of the water resources subsystem on the environmental subsystem is remarkable and cannot be ignored. This paper may act as a guide for adaptive and multi-objective management of WSE systems.