Joint optimization of water allocation and water quality management in Haihe River basin

A hydroeconomic optimization modelling framework for joint water allocation and water quality management is presented in this study. Water resources planning is often limited to water quantity, even though water quantity and quality are interdependent. Including water quality in a hydroeconomic optimization model increases complexity and uncertainty. In this study, the problem is addressed with a multi-reservoir, multi-temporal, multi-objective linear optimization model with fixed but spatially variable water quality. Model complexity is kept at a manageable level, leading to limited demand for computational resources, despite a high spatial resolution and representation of both surface water and groundwater resources. The model is applied to Haihe River basin, a water-scarce and highly polluted river basin in China. Economic trade-offs between limiting groundwater overdraft and sub-basin specific costs as well as maps of water availability shadow prices are presented. Adding water quality to the model framework impacts water availability shadow prices, which can influence model-based decision support. If groundwater abstractions are limited to sustainable levels, Haihe River basin will benefit from increasing inter-basins transfers and groundwater recharge to the shallow plain area aquifer. A scenario analysis showed that managed aquifer recharge in the plain area is also a feasible adaptation strategy.

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