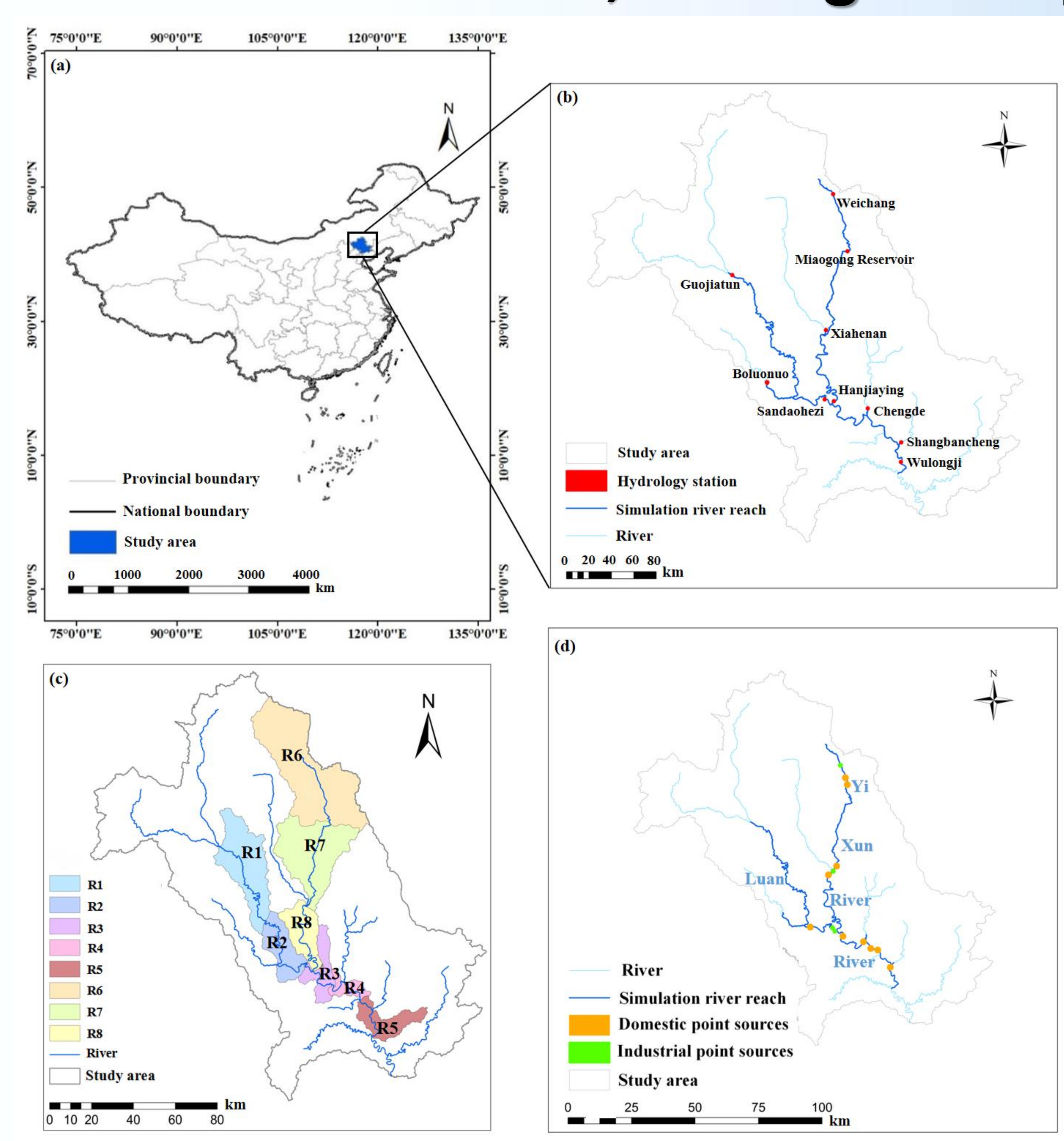
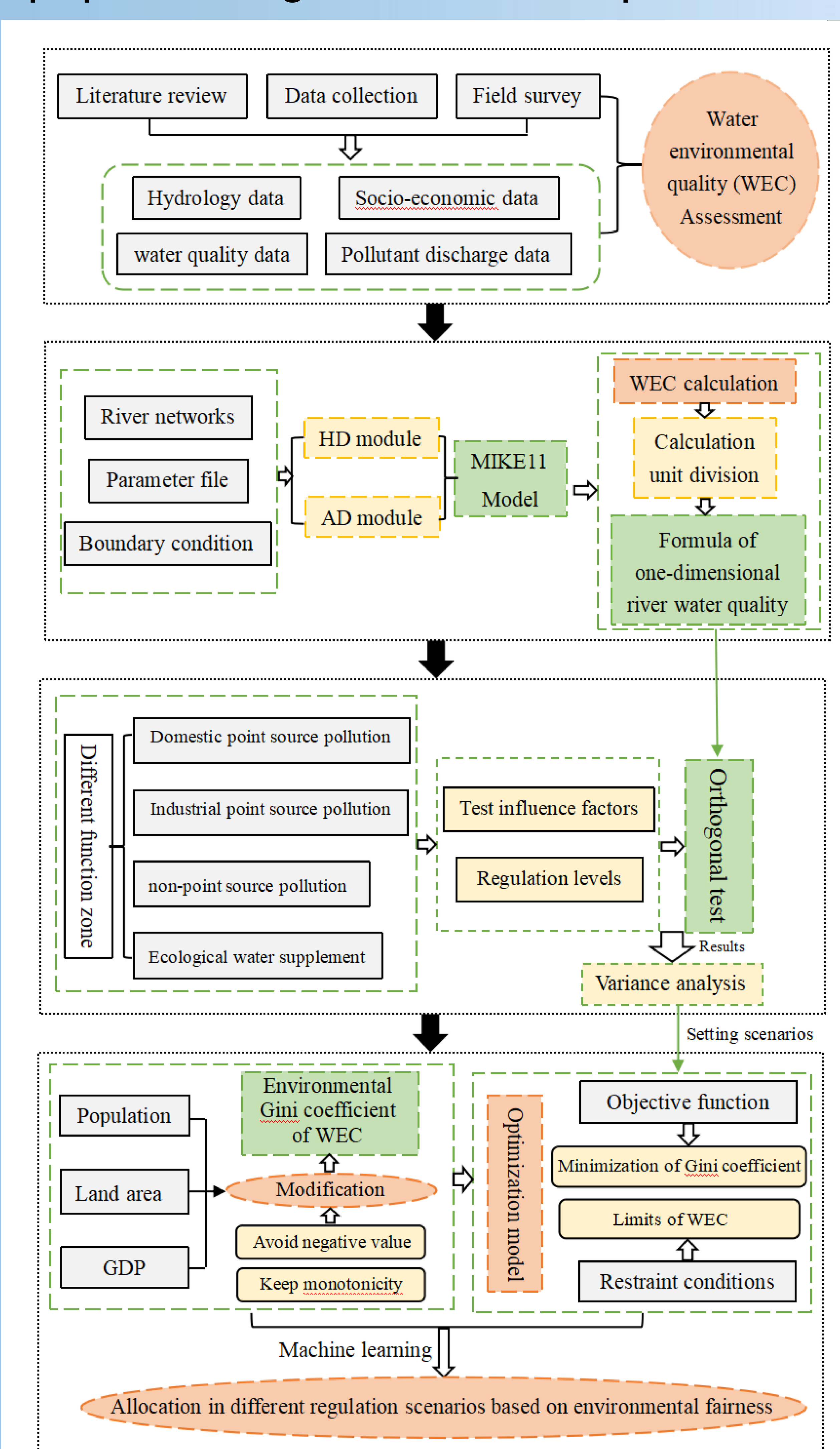
# 遥感科学国家重点实验室、北京市陆表遥感数据产品工程技术研究中心学生开放课题（2022）

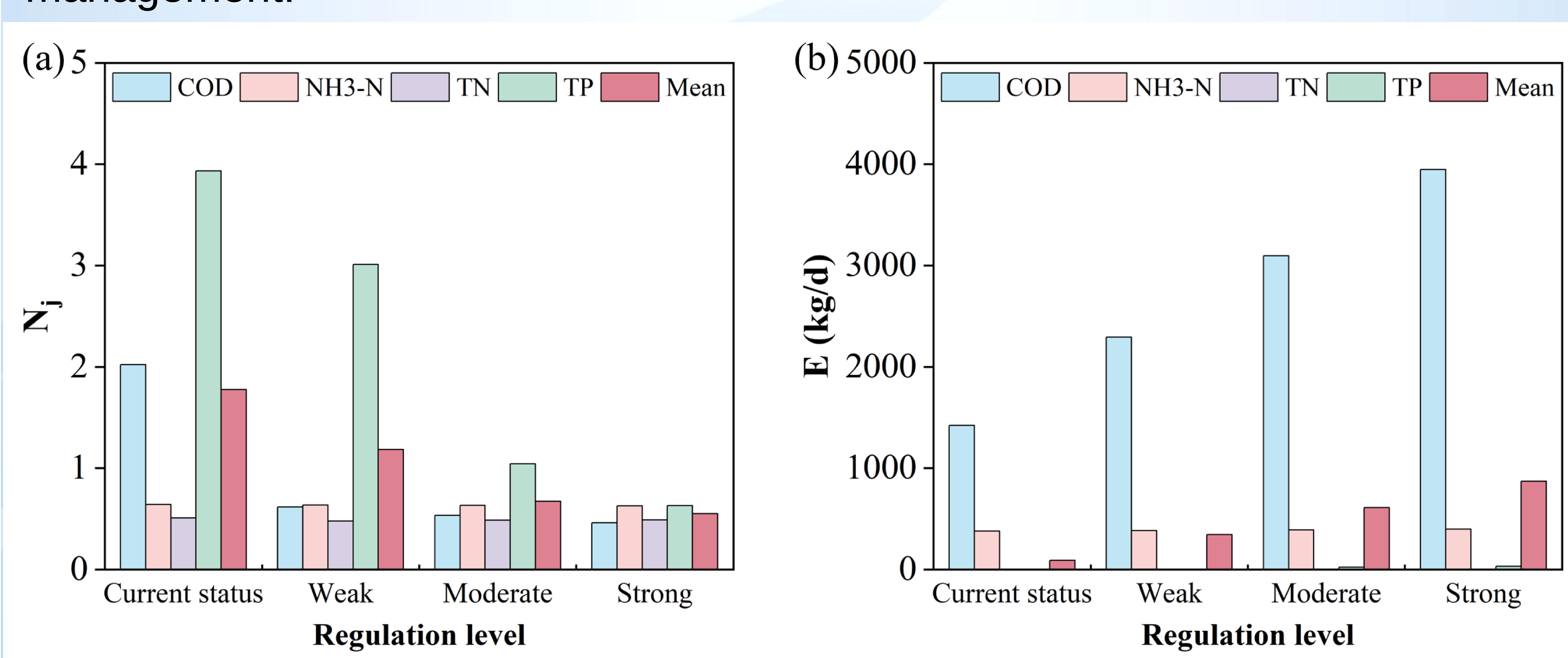
# Research on the dynamic water environment capacity response and optimization allocation in the Luanhe River Basin, Chengde City

The allocation of pollutant discharge is still a challenging work due to the conflicts between environmental fairness and efficiency. Water environment capacity (WEC) is a pivotal metrics for effective control of total pollutant discharge and water environment management. Therefore, this paper proposed a fairness-based decision-making framework for the optimal allocation of WEC. To achieve this aim, the environmental Gini coefficient (EGC) was modified through the probability distribution function based on a multi-criteria system. The Luan River Basin of Chengde City in China was chosen as a study case to illustrate the application of this novel framework. Five water environment function zones and eight calculation units were divided considering the basin characteristics and administrative divisions. Hydrodynamic and advection-dispersion modules in the MIKE 11 model were employed to simulate the migration and transformation process of water pollutant discharges; and the river one–dimensional model was integrated to assess the WEC. Then, a total of 14 significant influence factors for WEC were identified by orthogonal experiment, and then different water environment regulation scenarios were designed. Subsequently, the modified EGC was analyzed by establishing the relationship between WEC and evaluation indices (i.e., population, gross domestic product and land area).




The results allowed for the decision-making of an optimal allocation scheme for WEC with the objective function by minimizing the average value of the modified EGC. The status quo served as a reference for comparison. With the improvement of regulation level, the WEC exhibited an upward trend. The largest WEC appeared at the strong regulation level, with a value of 525.97 and 261.27 kg/d larger than those observed at weak and moderate levels, respectively. Additionally, the minimal value of EGC occurred at the strong regulation level (<0.7), thereby obtaining the optimal allocation scheme for WEC. This study presents a new insight into the optimal strategies of WEC allocation for environmental fairness. The proposed framework can be applied to other regulated rivers for pollutant discharge control and water environment management.




| | $A_1$–DPS | $A_1$–NPS | $A_2$–DPS | $A_2$–IPS | $A_2$–NPS | $A_3$–DPS | $A_3$–NPS | $A_4$–DPS | $A_4$–IPS | $A_4$–NPS | $A_5$–DPS | $A_5$–IPS | $A_5$–NPS | WS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $R_1$ | | ** | | * | | * | | | | | | | | |
| $R_2$ | ** | ** | | | | * | | | | | | | | |
| $R_3$ | ** | ** | ** | ** | ** | | * | | * | * | * | | ** | ** |
| $R_4$ | ** | ** | ** | ** | ** | | | | | * | | | | |
| $R_5$ | | ** | ** | ** | ** | ** | ** | | * | | | | | |
| $R_6$ | | | | | | | | ** | ** | ** | | | ** | * |
| $R_7$ | | * | | | | | | ** | * | ** | ** | ** | ** | ** |
| $R_8$ | | | | * | | | | * | | ** | ** | ** | ** | ** |


Author: 杨志敏 (Zhimin Yang)