

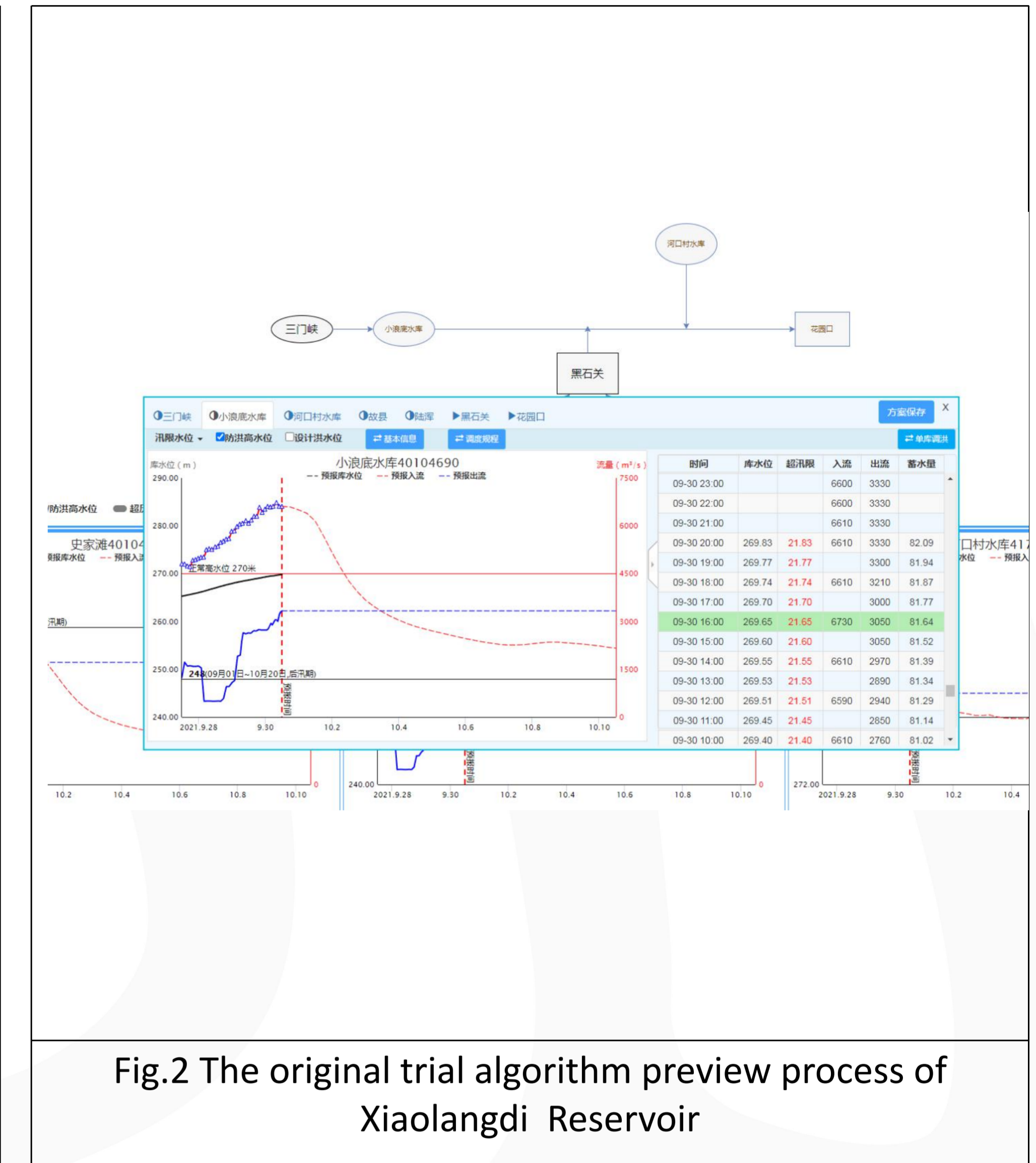
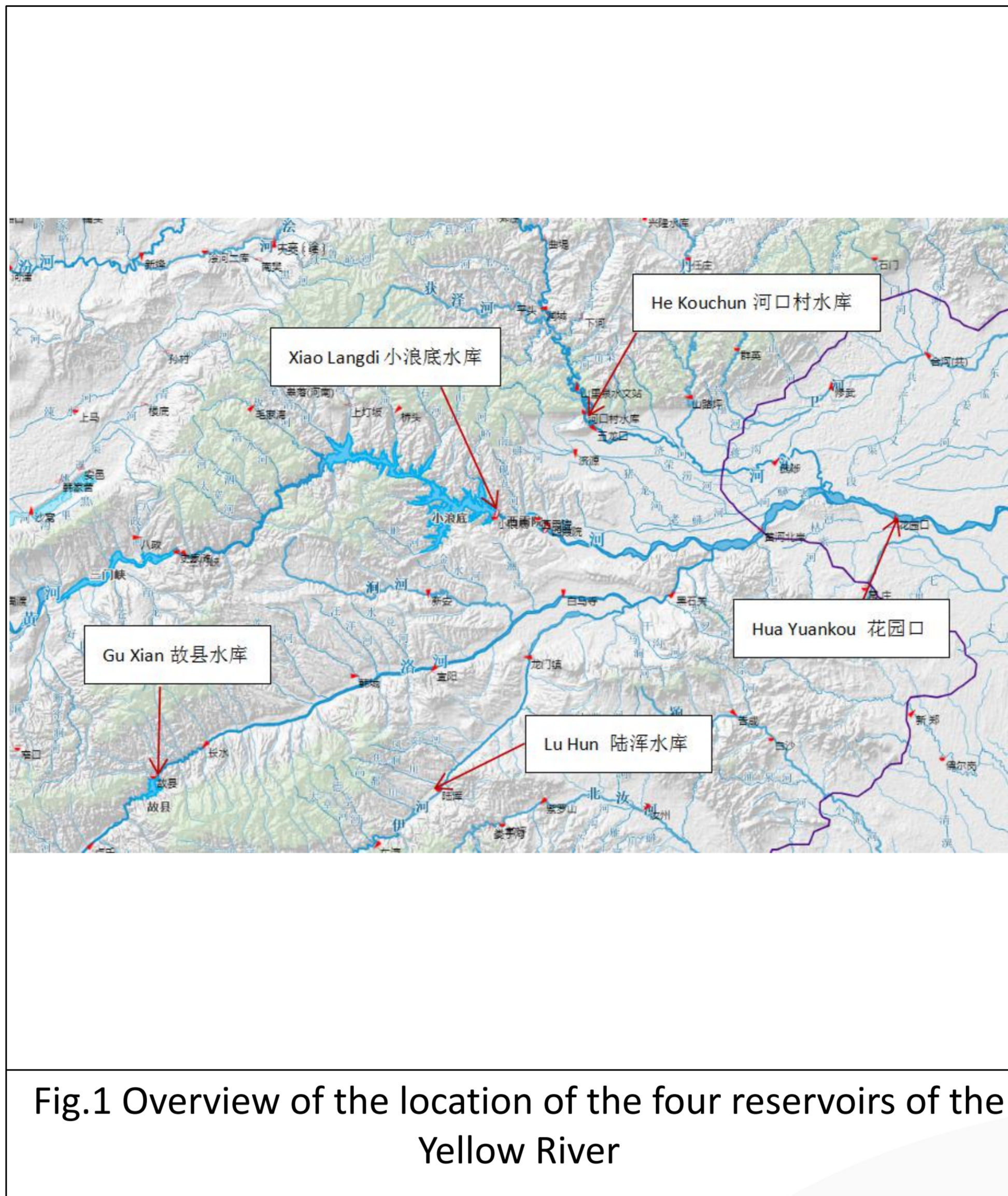
# Application of Reverse preview technical in flood prevention in the autumn floods of the Yellow River in 2021

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## Objectives

To guarantee the safety of the upstream reservoirs and to ensure non-bankfull flood in the downstream of the Yellow River is the biggest difficulty of flood prevention in the autumn floods of the Yellow River in 2021. The weakness of the joint operation of the four reservoirs of Yellow River is that it can only perform single-target forward preview for single reservoir or tandem reservoir group, and can only adjust manually during reverse preview, which seriously affects the timeliness and accuracy of scheduling. How to fill the gap of single and parallel reservoir group inverse preview is a complex problem.

在保证上游水库安全的前提下,保障黄河下游洪水不漫滩是2021年黄河秋汛洪水防御中水库防洪调度的最大难点.当前黄河四库联合调度功能较弱,仅可对单库或串联库群进行单目标正向预演,在反向预演时只能手动试算调整,严重影响了调度的时效性与准确性.如何填补该空白是一个复杂的问题.



## Methods

In this paper, we propose to adopt the compensatory scheduling model of reservoir group based on excess water allocation, comprehensively consider four factors, namely, spatial location of reservoirs, free storage capacity, incoming flooding process and subsequent rainfall, and use the dynamic adjustment coefficient reflecting the dynamic adjustment capacity of reservoirs to solve the iterative optimization of each reservoir in turn.

本项目拟采用基于超额水量分配的水库群补偿调度模型,综合考虑水库的空间位置、空闲库容、入库洪水过程以及后续降雨四个因素,采用反映水库动态调节能力的动态调节系数对各个水库依次进行迭代优化求解。

## Results

For the 2021 fall flood, Huayankou's the maximum flow which calculated by the inverse precession model is of 4800 m<sup>3</sup>/s, the dispatching results successfully cuts down the flood peak and meets the safe flow requirement at the flood control point. The outflow of the optimized scheduling of each reservoir is smooth, the gates do not need to be operated frequently, the generated scheduling scheme is highly operable.

对于2021年秋汛洪水,花园口断面通过反向预演模型计算得到的最大流量为4800m<sup>3</sup>/s,成功削减了洪峰,满足了防洪点的安全流量要求。四个水库优化调度的出流平稳,闸门无需频繁动作,生成的调度方案具有较强的可操作性,且花园口防洪点的流量过程平稳。

## Conclusions

The joint scheduling inverse calculation model based on excess water allocation and rotating reservoir compensation iteration has rigorous mathematical theory and tight mathematical derivation, which is more generalized and applicable to other reservoir cluster systems with parallel structure.

基于超额水量分配与轮库补偿迭代的联合调度逆向计算模型具有严谨的数学理论和严密的数学推导,通用性较强,适用于并行结构的其他水库群系统。

