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中文题名	一二维耦合水力数值模型在分蓄洪区工程规划中的应用
英文题名	Application of 1D&2D coupling hydraulic mathematical model in planning of flood diversion project
中文关键词	分蓄洪区, 规划, 耦合模型, 二维, 零维
英文关键词	Flood storage basin, Planning, Coupling model, Two dimensional, Zero dimensional
中文文摘	<p>南海子郊野公园是《北京市城市总体规划（2020 年）》规划建设的四大郊野公园之一。公园不但应具备重要的生态隔离、湿地保护和景观休憩等多种功能，而且公园内的景观湖泊水系还应承担分蓄凉水河洪水，减轻凉水河下游河道洪水风险的任务。在深入规划过程中，明确了分蓄洪区应满足削减凉水河洪峰流量、压低分蓄洪区最高蓄滞水位、维持分蓄洪区较高的汛限水位、减少占地和快速退水这五条要求。由于分蓄洪区的用地主体由相互支离的若干坑塘组成且远离凉水河，则规划的主要任务为：确定分洪渠、退水渠、连通渠和湖区的开挖规模并提出洪水调度方案。本文建立了凉水河~分蓄洪区 Mike-Flood 一二维耦合水动力数学模型，通过多方案分析比选，优化了分蓄洪区的工程方案和调度方案，并进行了凉水河、分洪渠、湖区三个区域的糙率敏感性分析。同时搭建 HEC-RAS 一维~零维耦合水动力数学模型对规划成果作验证分析。基于对比分析，本文大致总结出在类似的“河~湖”连通工程中，以一维~零维耦合模型代替一二维耦合模型的若干特性或规律，以利于更高效精确地开展相关规划设计工作。本文主要结论如下：1、优化后的建设方案和调度方案均能较好的满足多种功能需求；2、基于肉眼观察和相关系数、标准误差和 Nash-Sutcliffe 效率系数的统计评估表明，规划成果具备较好的糙率敏感度适应性，能够在合理的糙率变动区间内可靠的兼顾削减凉水河洪峰流量和压低分蓄洪区最高水位的要求；3、本工程一二维耦合模型和一维~零维耦合模型成果在分洪阶段的一致度很好；而退水阶段由于退水流量与湖区内细微的水力坡降的相关性较大，则后者的模拟成果相对不合理；4、一维~零维耦合模型经过合理概化，在某些工况下模拟成果与一二维耦合模型差异很小，完全可以替代后者应用于工程项目的前期阶段，保证精确合理的同时，极大的提高工作效率。但是，以零维模型概化湖区，忽略了湖区水力坡降和“河~湖”间水流的动量传导，对于受这两种因素驱动较多的工况，应该基于更全面的、偏安全的分析，合理选用一维~零维耦合模型成果。</p>
外文文摘	<p>As one of the four big country parks in the planning of The overall plan of Beijing City (2020), Nan Hai Zi Country Park should have important functions of ecological isolation, wetland protection and leisure, but also lakes in which should shunt and store up the flood of Liangshui River to reduce downstream flood risk. In particular planning, Nan Hai Zi flood storage basins was required to reduce peak flow of Liangshui River to limit; drive down the highest flood stage of flood storage basins as much as possible; keep a high limited water level of flood storage basins in flood seasons; reduce area of construction and sluice to limited water level in 3 days. As the flood storage basins are far away from Liangshui River and be insulated from each other, the primary mission is to fix the size of flood diversion channel, sluice channel, communication channels and basins, in addition, make an flood dispatching rule. In this paper, a Mike-Flood 1D&2D coupling hydraulic mathematical model for Liangshui River and flood storage basins was established. Based on this model, engineering plan and operation scheme were optimized through schemes comparison, and the sensitivity of roughness are also analysed. Meanwhile, a HEC-RAS zero dimensional&one dimensional coupling hydraulic mathematical model was developed to verify results based on Mike-Flood model. Comparing the two kinds of models, some rules and characters about replacing 1D&2D coupling model with zero dimensional&one dimensional coupling model were discussed. The main conclusions of this paper are as follows. 1, after the optimization, the engineering plan and operation scheme can meet the demands better. 2, based on visual observation or statistical evaluation with correlation coefficient, root mean squared error and Nash-Sutcliffe coefficient, even roughness change in a possible interval, the planning results still have good roughness sensitivity adaptation to depress Liangshui River flood peak flow and keep the highest flood stage in storage basins</p>

	acceptable.3, when the flood flow into the flood storage basins, the results of zero dimensional&one dimensional coupling model correlate well with 1D&2D coupling model. However, when the flood flow out of the basins, the latter result become less rational because of the ignoring of tiny hydraulic slop in the basins which was highly correlated with drainage flow.4, In some conditions, the results of one dimensional&zero dimensional coupling model inosculated well with 1D&2D coupling model if the former was established rational. Therefore, the former can completely replace the latter in early stage of planning and design of flood control project with accuracy, rationality and efficiency at the same time. However, using zero dimensional model to generalize flows in basins caused neglection of hydraulic slop and momentum transfer between basins. For some hydraulic conditions droved by these two factors more, all-around and securer analysis should be done before the adoption of the results of one dimensional&zero dimensional coupling model.
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