

浙江水利水电学院“南浔学者”“南浔青年学者”  
中期考核表

考核时间：2024 年 1 月 至 2025 年 6 月

|                            |                           |                      |          |                |  |        |                       |          |    |                                 |  |
|----------------------------|---------------------------|----------------------|----------|----------------|--|--------|-----------------------|----------|----|---------------------------------|--|
| 姓名                         |                           | 宣伟栋                  |          | 所在单位           |  | 水利工程学院 |                       | 学者类别     |    | 南浔青年学者                          |  |
| 研<br>究<br>工<br>作<br>情<br>况 | 论<br>文<br>著<br>作          | 刊物名称/<br>出版单位        | 发表年<br>月 | 是否<br>期核<br>心刊 | 论 著 题 目  |        | 收录/<br>引用<br>情况       | 本人<br>排名 | 绩点 | 是否注<br>明该成<br>果由本<br>学者计<br>划资助 |  |
|                            |                           | 1. Water/MDPI        | 2024. 5  | 否              | A Numerical Model of<br>the Pollutant<br>Transport in Rivers<br>with Multi-Layer Rigid<br>Vegetation |        | SCI                   | 1        | 20 | 否                               |  |
|                            |                           | 2.                   |          |                |  |        |                       |          |    |                                 |  |
|                            |                           | 3.                   |          |                |  |        |                       |          |    |                                 |  |
|                            | 科<br>研<br>项<br>目          | 项目名称<br>及来源          |          | 经费<br>(万元)     |  | 项目级别   | 起止时间                  | 本人<br>排名 | 绩点 | 是否注<br>明该成<br>果由本<br>学者计<br>划资助 |  |
|                            |                           | 1. 庆元县建溪流域水资源调度数字化项目 |          | 138. 5         |  | V      | 2023. 12-2024<br>. 12 | 1        | 60 | 无 法 标<br>注                      |  |
|                            |                           | 2.                   |          |                |  |        |                       |          |    |                                 |  |
|                            |                           | 3.                   |          |                |  |        |                       |          |    |                                 |  |
|                            | 专<br>利<br><br>/<br>获<br>奖 | 专利名称/获奖名称            |          |                | 专利号/授予部<br>门   |        | 奖励等级/<br>本人排名         | 授予<br>时间 | 绩点 | 是否注<br>明该成<br>果由本<br>学者计<br>划资助 |  |
|                            |                           | 1.                   |          |                |  |        |                       |          |    |                                 |  |
|                            |                           | 2.                   |          |                |  |        |                       |          |    |                                 |  |
|                            |                           | 3.                   |          |                |  |        |                       |          |    |                                 |  |

|   |   |                            |        |
|---|---|----------------------------|--------|
| 参与技术咨询及社会服务工作情况   | 1. “南浔青年学者”培养期内需免费提供不少于 30 小时的技术咨询服务，为南浔企业转型升级解决创新瓶颈提供技术支持。<br>2. “南浔学者”培养期内需免费提供不少于 50 小时的技术咨询服务，为南浔企业转型升级解决创新瓶颈提供技术支持。<br>3. “南浔学者”、“南浔青年学者”培养期内平均每年在南浔（含浙江水利水电学院南浔校区）实际工作 120 学时及以上。 |                            |        |
|   | 时 间   | 承担工作及服务事项                  | 时 长    |
|   | 2024~2025 年   | 现场安全文明施工、各类专项方案指导、规范内业资料指导 | 240 小时 |
|   |   |                            |        |
| <p>个人小结（包括：下一步工作计划、完成协议所规定的工作任务等情况）</p> <p>2024~2025 年，本人以第一作者发表 SCI 论文一篇，主持 V 类项目一项，为南浔本地企业（湖州奥铭生态建设工程有限公司）提供总计 240 小时的免费技术咨询服务。接下来，本人将继续认真工作，做好科学研究和社会服务工作，尤其是为南浔区做好科技支撑服务。</p> |   |                            |        |
| <p>本人谨此声明以上资料均属真实。</p> <p>本人签名：<br/>年 月 日</p>   |   |                            |        |
| <p>已完成绩点为_____，<input type="checkbox"/>是 <input type="checkbox"/>否 已通过中期考核。</p> <p>部门负责人（签章）：<br/>年 月 日</p>   |   |                            |        |
| 学校意见  | <p>年 月 日</p>  |                            |        |

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- 4. 请同时提交考核期间论文版权页、基金中标批文、获奖证书、专利批文等证明件。



## Article

# A Numerical Model of the Pollutant Transport in Rivers with Multi-Layer Rigid Vegetation

Weidong Xuan <sup>1</sup>, Chenggang Yang <sup>2</sup>, Xiang Wu <sup>3</sup>, Yiting Shao <sup>1</sup> and Yu Bai <sup>1,\*</sup>

<sup>1</sup> Key Laboratory for Technology in Rural Water Management of Zhejiang Province, Zhejiang University of Water Resources and Electric Power, Hangzhou 311222, China; xuanwd@zjweu.edu.cn (W.X.); shaoyt@zjweu.edu.cn (Y.S.)

<sup>2</sup> Ningbo Water Resources and Information Management Center, Ningbo 315800, China

<sup>3</sup> Zhejiang Qiantang River Water Conservancy Construction Engineering Co., Ltd., Hangzhou 311222, China; wlong6677@163.com

\* Correspondence: baiyu254477574@126.com

**Abstract:** River water pollution is a key environmental issue to human society. How to effectively simulate the flow velocity and pollution transport in a vegetated river can provide a theoretical basis for solving such problems. Based on previous experimental data, this article uses the lattice Boltzmann method and random displacement method to simulate the velocity distribution and nutrient transport in multi-layer rigid vegetated rivers. The simulation results indicate that incorporating the drag force of the vegetation into the model according to different vegetation layers can effectively simulate the velocity in a multi-layer vegetated river. Incorporating the turbulent diffusion and mechanical diffusion effects of nutrients caused by vegetation into the model can effectively simulate the effects of multi-layer vegetation on nutrient transport. This model can provide effective predictions of the flow velocity and pollution transport in multi-layer vegetation.

**Keywords:** multi-layer rigid vegetation; pollution transport; velocity; lattice Boltzmann method; random displacement method



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## 1. Introduction

With the development of society, the river water environment is receiving more and more attention from people [1,2]. The main reason for the deterioration of rivers' water quality is that people discharge excessive production waste and domestic sewage into the river, causing eutrophication or heavy metal pollution, and so on. Rivers often contain a large amount of vegetation, including floating vegetation, submerged vegetation, and emergent vegetation. Vegetation is an important factor affecting the water environment of rivers [3,4]. It not only absorbs excess pollutants in the river, but also affects the hydrodynamics of the river [5,6]. At the same time, river vegetation also affects the hydrological conditions of rivers, including having an impact on the curvature of rivers, and so on. Studying the impact of vegetation on river hydrodynamics and pollutant transport can effectively provide theoretical assistance for the retention of river pollution.

The research and development of river flow dynamics have been improved a lot recently, and many scholars have made significant contributions to the study of the distribution of river flow dynamics. The research on river hydrodynamics can be divided into several methods: indoor laboratory flume velocity simulation, outdoor river hydrodynamic measurement, and numerical model simulation. For rivers without vegetation, the N-S equation can be directly used for the solution. Later, many studies also incorporated the influence of vegetation on river water dynamics into the solution. Vegetation has a certain drag effect on the water flow, and different vegetation types have different drag effects on the water flow [7,8]. Some scholars previously unified the resistance of vegetation to the water flow into a comprehensive roughness coefficient [9], but this was clearly a poor

V类项目：

| 政 府 采 购 合 同                    |   |
|--------------------------------|---|
| 合同编号：_____                     | 项目编号： 浙方咨招2023-0079号  |
| 项目名称： <u>庆元县建溪流域水资源调度数字化项目</u> | 项目名称： <u>庆元县建溪流域水资源调度数字化项目</u>  |
| 甲 方： _____                     | 甲方： <u>庆元县水利局</u>   |
| 乙 方： _____                     | 乙方： <u>浙江水利水电学院</u>   |
| 签署地点： <u>浙江省丽水市庆元县</u>         | 甲乙双方根据 <u>庆元县建溪流域水资源调度数字化项目</u> 公开招标的招标结果和招标文件的要求，并经双方协商一致，签署本合同。   |
| 签署日期： <u>2023年12月27日</u>       | 一、项目主要内容  |
|                                | 1.建设庆元县建溪流域水资源调度决策支持模块，包括调度工况管理、调度方案效果对比和调度成果展示分析。  |
|                                | 2.生态流量站点数据接收、上报功能完善开发部署数据接收、存储程序，实现监测数据的实时存储入库等。按照浙江省通讯规约，实现数据实时上报至浙江省平台。   |
|                                | 3.开发生态流量预测预报模块，松源溪（洋心桥处、阁门岭大桥上游、祝家阳处、屏都街道上游）安溪溪（安南乡上游处、安隆村处、淤上乡上游处、草古地村处）进行流量过程预报和水位过程预报。                                 |
|                                | 4.确定工程生态流量管控目标，复核工程生态流量管控目标、完善工程生态流量泄放设施、完善工程生态流量监测设施以及明确生态流量保障运行机制。  |
|                                | 二、合同金额  |
|                                | 2.1本合同金额为人民币（大写）： <u>壹佰叁捌萬伍仟元（¥ 1385000 元）</u>  |
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|                                | 2.2 本合同总价款还包含乙方应当提供的伴随服务/售后服务费用。  |
|                                | 2.3 供货时按实际用量供应，并以中标单价按实际用量结算。在供货期限内，不考虑市场价格波动的影响，中标单位最终结算以中标单价为结算价。   |
|                                | 三、技术资料  |
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兹有贵校宣伟栋老师于 2024~2025 年度为我公司提供技术咨询服务, 共计 240 个小时。具体服务内容包括现场安全文明施工、各类专项方案指导、规范内业资料指导等工作, 为我公司相关项目顺利开展提供了技术支持。

特此证明。

湖州奥铭生态建设工程有限公司

(签章)

2025 年 6 月 11 日

