2024 年度 SP+ Fund 報告書（General）

Project Report: SP+ Fund 2024 (General Program)

プロジェクトの基本情報／Key Project Information	
課題名（英語） Project name (in English)	Assessment of optimal sediment replenishment strategies in Zengwen Reservoir, Taiwan, and lesson learned from Naka River in Japan
期間／Period	From 2024/07/01 Until 2025/03/15
主な研究分野 Main research fields	Flood and sediment management in the river basin, Hydropower dams, Wadi flood
活動内容 （該当するものに全て✓してください。） Activities to be funded (check ✓ all applicable items)	☑ 研究ワークショップ、会議、ラウンドテーブル、シンポジウム等の実施／Research workshops, conferences, roundtables, symposiums, etc. ☑ 共同研究や研究打合せにかかる渡航・招へい Travel/invitations for collaborative research or research meetings ☑ その他 （具体的に）／Other (please specify) (Installation and purchase of devices (ex: cameras and water level guages…etc.))
区分／Type of collaboration	☑ Bilateral ※本学と SP 校との 2 機関で実施するプロジェクト (Project conducted by Kyoto University and one SP institution) ☐ Multilateral ※本学と SP 校に加え、さらに 1 機関以上 (Project conducted by Kyoto University, an SP institution, and one or more additional institutions)
実施場所／Location of implementation	☑ 京都大学／Kyoto University ☑ その他／Other location (National Taiwan University)

申請者（京都大学）／Applicant (Kyoto University)	
姓／Family name	KANTOUSH
名／Given name	Sameh Ahmed
職名／Position	Professor
所属部局 Faculty/dept. of affiliation	Faculty of Engineering/ Disaster Prevention Research Institute (DPRI)

SP 校のプロジェクト代表者／Representative from SP institution	
姓／Family name	You
名／Given name	Jiing-Yun
職名／Position	Professor
所属大学／Institution	☐ ボルドー大学／University of Bordeaux

SP 校のプロジェクト代表者／Representative from SP institution	
	☐ ウィーン大学／University of Vienna ☐ チューリヒ大学／University of Zurich ☐ ハンブルク大学／University of Hamburg ☑ 国立台湾大学／National Taiwan University
所属部局 Faculty/dept. of affiliation	National Taiwan University, College of Engineering, Civil Engineering Department

その他のプロジェクト代表者（Multi の場合）／Representative from other collaborating institution (in the case of multilateral projects) ※	
姓／Family name	
名／Given name	
職名／Position	
所属大学／ Institution	☐ ボルドー大学／University of Bordeaux ☐ ウィーン大学／University of Vienna ☐ チューリヒ大学／University of Zurich ☐ ハンブルク大学／University of Hamburg ☐ 国立台湾大学／National Taiwan University ☐ その他／Other （機関名／name of institution: ）
所属部局 Faculty/dept. of affiliation	

※4機関以上によるプロジェクトの場合は、必要に応じて欄を追加願います。
If the project involves four or more institutions, please insert additional fields as required.

プロジェクトの実施内容／Summary of the project

公開されている関連リンクや、フライヤー、プログラム、報告書、広報記事等の提出をもってして代えることも可能です。 This could be substituted by submitting publicly available relevant links, flyers, programs, reports, publicity articles, etc.

1. Benefits of the Funding and Alignment with Initial Objectives

In recent years, National Taiwan University (NTU) and Kyoto University have maintained a strong strategic partnership through annual research funding supported by the Office of International Affairs at NTU. However, due to unforeseen circumstances, this funding was temporarily suspended last year, posing a challenge to the continuation of this important collaboration. Despite this setback, Prof. You demonstrated exceptional dedication by securing alternative financial support from his research grants awarded by the National Science and Technology Council, Taiwan. His proactive efforts ensured that joint research activities between NTU and Kyoto University remained uninterrupted.

This additional funding laid the groundwork for this year's research endeavors, but the SP+ Fund played a pivotal role in fully achieving our project objectives. Thanks to this financial assistance, we successfully:

- Conducted field investigations and installed real-time monitoring equipment, establishing a real-time river monitoring system at Zengwen Reservoir.
- Analyzed the impacts of sediment replenishment on downstream river channels.
- Evaluated long-term morphological changes to assess the effectiveness of sediment replenishment.
- Strengthened academic exchanges between NTU and Kyoto University, facilitating research visits between Taiwan and Japan.
- Ensured the smooth execution of our research plan, including data collection, numerical modeling support, and an international symposium.

At the outset, the project aimed to:

- **Monitoring river flow in real-time and analyzing the flow movement** by utilizing installed cameras and LSPIV technique
- **Assessing downstream river morphology** under a long-term period to evaluate sediment replenishment efficiency
- **Investigating the impacts of sediment replenishment** on the downstream river channel

With the support of this funding, these objectives have been effectively addressed. The financial aid not only sustained our collaboration but also enhanced the quality and depth of our research, paving the way for long-term scientific cooperation between NTU and Kyoto University.

2. Summary of the project

a. Background and Objectives

- Japan and Taiwan both face challenges related to water resource and sediment management due to hydro-environmental-induced disasters, particularly sedimentation in reservoirs and sediment replenishment downstream.

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- This project focused on assessing optimal sediment replenishment strategies for the Zengwen Reservoir in Taiwan, using lessons learned from the Naka River in Japan.

b. Major Research Activities and Achievements

1) Preliminary Site Survey and Technical Discussions

- Before installing monitoring equipment, online discussions were held to assess the feasibility and technical requirements of real-time river-flow and sediment monitoring.
- Researchers from the NTU team conducted an initial site survey at the Zengwen River, identifying suitable locations for installing the cameras and water level gauges to monitor and evaluate river flow conditions.
- The NTU research team reviews previous locations within Zengwen Basin with the devices already installed by the government to compile and share historical monitoring data.

2) Research Exchange and Mutual Visits

- **November 2024 – Kyoto University visit to Taiwan** *(Field and Monitoring Site Investigation included in this visit)*
  - Idea-exchange and technical discussions with NTU experts on sediment replenishment condition and field observations in Zengwen Reservoir
  - Site visits to the Zengwen Reservoir and downstream river channel
  - Check locations at Zengwen Bridge No.1, 2, 3 and 5 of installation of monitoring equipment, including cameras for LSPIV-based flow analysis and water level gauges for numerical model simulation and calibration.
  - Site visits to the Shimen Reservoir
    - Amuping Desilting Tunnel
    - Zhongzhuang Retention Basin
    - Houchun Weir
- **December 2024 – NTU visit to Japan** *(Including International Symposium and Knowledge Exchange)*
  - **International Symposium held at DPRI, Kyoto University, Japan (*Workshop on Establishing a Network focusing on Sediment Replenishment, Dec. 9th*):**
    - Share insights from Japanese sediment replenishment case studies and discussed findings from Taiwan's numerical modeling research, building an international network of experts, researchers, and professionals focused on sediment replenishment, bringing collaboration across institutions.
    - Enable participants to discuss successful projects, innovative techniques, and effective technical tools in different contexts.

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- Establish a collaborative network of research institutes, universities, and environmental organizations across countries to address challenges related to sediment replenishment.
- Create a platform for sharing the latest research, methodologies, and best practices in sediment replenishment.
- Enable participants to discuss successful projects, innovative techniques, and effective technical tools in different contexts.
- Encourage joint research initiatives on sediment replenishment, sediment transport modeling, and river morphology.
- Foster academic networking and potential future collaborations on sediment management and creating a foundation for long-term cooperative research and management strategies.

  - Field observation of sediment replenishment case in the Naka River, Tokushima, Japan.
    - Site visits to the Nagayasuguchi Dam(upstream) and the Kawaguchi Dam(downstream)
    - Visit the sediment replenishment site and the installed camera location at the upstream of the Naka River.
    - Conduct field surveys along the Naka River, including drone survey and grain size distribution sampling.
  - Knowledge exchange on sediment replenishment management
  - Comparative analysis preparation of river morphology changes in Japan and Taiwan

- **February 2025 – Kyoto University visit to Taiwan**
  - **International Symposium held at National Cheng Kung University (*2025 Symposium on Water, Feedbacks and Complexity (WFC), Feb. 7th - Feb. 8th*)**
    - Establish diverse and interdisciplinary collaborations between six universities, including National Cheng Kung University, National Taiwan Universit, Kyoto University, Kyushu University, Korea University, and Hong Kong University.
    - Visit to Tainan Hydraulics Laboratory and HOE Hydraulic Engineering Lab at National Cheng Kung University to gain a better understanding of hydraulic experiments (Fig. 1).
    - Through the group project of discussions and practical check dam design, we gained a deeper understanding of impact on the downstream river morphology changes (Fig. 2).
    - Via presentation between diverse aspects of different water issues, facilitating partnerships of collaborative field studies, shared data, and joint publications.
  - Meeting in Feng Chia University, Taichung, Taiwan for discussion on sediment replenishment modeling, collaborative data analysis and planning for future joint studies of Zengwen River

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- Conduct field surveys of the Zengwen River, starting from the upstream reservoir and extending to the coastal areas downstream.
  - Check the installed cameras and water level gauges (Fig. 3).
  - Decide ground control points for future LSPIV analysis
  - Observe the impact of sediment replenishment and river conditions along the Zengwen River.

Location	**Main Observation Focus**	**Key Observations**
Zengwen Bridge No.1, No.2, No.5 (曾文 1, 2, 5 號橋) (Fig. 4)	Main sediment replenishment sites & Core upstream monitoring points with installed cameras and water level gauges	• The changes in river surface velocity and water level • The form of the riverbed cross-section • The distribution and erosion changes at the sediment replenishment sites
Yufeng Bridge (玉豐大橋) (Fig. 5)	Key monitoring point in the midstream	• Changes in erosion & deposition • Riverbed elevation variation • Sediment distribution
Zoumalai Bridge (走馬瀨橋) (Fig. 6)	Erosion & deposition transition zone	• Changes in sandbar size Trends in riverbed erosion • Nearby vegetation changes
Erxi Bridge (二溪大橋) (Fig. 7)	Monitoring deep channel variations	• Riverbed changes • Post-desilting riverbed conditions • Erosion & deposition characteristics
The Zengwen River Flume (曾文溪渡槽橋) (Fig. 8)	The site where the average riverbed elevation changes of the Zengwen River begins to become stable	• Changes in the riverbed • Types of grain size distribution
Mashan Bridge (麻善大橋) (Fig. 9)	Tidal reach & water quality monitoring station	• Suspended solids variation • Monitoring aquatic & riparian species

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		• Vegetation impact
Xinfulung Sandbar (新浮崙汕沙洲)	Changes in river mouth sediment	• Shifts in sediment deposits • Sandbar expansion/contraction • River flow patterns
Zengwen River Estuary (曾文溪出海口) (Fig. 10)	Coastal transition observation	• Impact of desilting on the coast • Changes in wetlands & ecology • Coastal retreat trends

Fig. 1 The experimental site of Tainan Hydraulics Laboratory.

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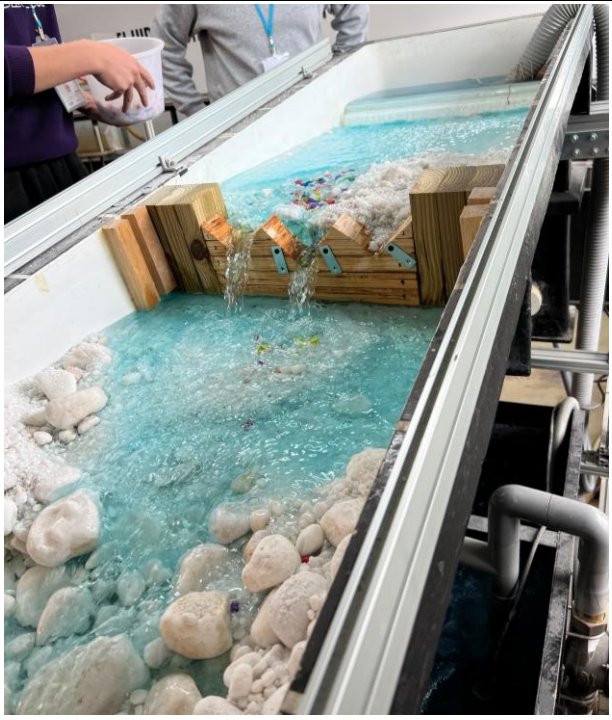

Fig. 2 The designed check dam for the group project of WFC.

Fig. 3 (a) The water level gauge on Zengwen Bridge No.1, (b) the water level gauge and camera on Zengwen Bridge No.2, and (c) the camera on Zengwen Bridge No.5.

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Fig. 4 The second temporary storage area of sediment replenishment.

Fig. 5 Downstream of the Yufeng Bridge

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Fig. 6 Downstream of the Zoumalai Bridge

Fig. 7 Downstream of the Erxi Bridge

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Fig. 8 Downstream of the Zengwen River Flume

Fig. 9 Downstream of the Mashan Bridge

Fig. 10 Zengwen River Estuary

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3. Key Outcomes and Impact

- **Facilitated knowledge exchange between Kyoto University and NTU on sediment replenishment**, deepening mutual understanding of its environmental implications. Discussions during the research period enhanced awareness of sediment replenishment's role in river morphology, ecosystem sustainability, and long-term sediment management strategies.
- **Established an initial research collaboration framework**, laying the foundation for future joint studies, academic exchanges, and potential funding applications. This project strengthened professional connections between researchers at Kyoto University and National Taiwan University, fostering opportunities for future interdisciplinary cooperation.
- **Successfully installed real-time monitoring equipment in the Zengwen Reservoir**, enabling continuous water level measurement and visual observation of sediment accumulation. This system provides a valuable dataset for future research on sediment dynamics and reservoir management.
- **Raised awareness among researchers, students, and policymakers about sediment replenishment practices**, contributing to broader discussions on sustainable sediment management strategies in Japan and Taiwan.

今後の展望／Prospects for future research collaboration

(1) Strengthening and Expanding Collaborative Research

- **Building on the foundation of this project, Kyoto University and NTU aim to deepen and expand our collaboration on sediment replenishment and river management.** The success of this initial research has demonstrated the value of interdisciplinary and international cooperation, providing a solid platform for more extensive joint studies.
- **Future collaborations will focus on integrating expertise from both institutions**, combining Kyoto University's experience in hydro-environmental disaster research with NTU’s strengths in numerical modeling and field monitoring. By leveraging each institution’s specialized knowledge, the partnership can develop more effective strategies for sediment replenishment and sustainable river management.
- **Increasing opportunities for researcher and student exchanges** will further enhance mutual understanding and cooperation. Expanding exchange programs will allow young researchers and students to gain hands-on experience in field surveys, data analysis, and modeling, fostering the next generation of experts in sediment and water resource management.

(2) Long-Term Monitoring and Research Development

- **The real-time monitoring system installed in the Zengwen Reservoir serves as a crucial tool for future research**, enabling continuous observation of water levels, sediment accumulation, and flow dynamics. These data will provide essential insights for refining sediment replenishment strategies and improving reservoir management.
- **Longitudinal studies using the installed monitoring system will help assess the long-term effectiveness of sediment replenishment.** By continuously collecting and analyzing data, researchers can monitor changes in river morphology, sediment transport, and ecosystem responses, contributing to evidence-based decision-making.
- **Combining real-time monitoring with numerical simulations** will enhance predictive modeling capabilities. Future research will focus on improving simulation accuracy and developing adaptive strategies to optimize sediment replenishment efforts under varying hydrological conditions.
- **Expanding the monitoring network to additional locations** in both Japan and Taiwan will allow for comparative studies on sediment replenishment under different environmental and hydrological conditions. By broadening the geographic scope, researchers can identify the best practices applicable to diverse river systems.

(3) Advancing Practical Applications and Policy Recommendations

- **Findings from this research will contribute to the development of practical guidelines for reservoir and river sediment management**, benefiting government agencies, water resource managers, and policymakers in Japan and Taiwan.
- **Strengthening industry-academic-government collaboration** will enhance the applicability of research outcomes. By engaging with decision-makers and industry stakeholders, researchers can translate scientific findings into actionable policies and engineering solutions.
- **Hosting regular academic conferences and workshops** will facilitate the continuous exchange of research findings, ensuring new insights and technological advancements are shared among the scientific community and practitioners.