氣候變遷下水資源系統串接對跨區水源調度與灌溉韌性之影響-以濁幹線與北幹線串接為例

Impact of Water Resource Systems Interconnection on Inter-Regional Water Allocation and Irrigation Resilience under Climate Change: A Case Study on the Cho and Northern Canal

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摘　要

面對氣候變遷下降雨極端化，呈現「豐越豐、枯越枯」的趨勢，導致枯水期面臨嚴重缺水風險，對農業及產業用水造成挑戰。本研究主要貢獻為建立水資源系統串接下跨區水源調度之分析理論與工具，並以「濁幹線與北幹線串接工程」為案例，模擬其提升區域水源調度彈性與供水穩定性之效益，進一步分析現有工程對於未來極端氣候下灌溉的因應調適能力。

本研究建立水資源系統管理之最佳化模型，模擬濁幹線與北幹線在未串接及串接狀態下的最佳配水策略，並進一步量化水資源系統串接對供水能力與可調度彈性，以分析系統串接對水資源管理之影響。模擬涵蓋豐水年與枯水年，評估不同調配機制下灌溉缺口的變化情形。

研究結果可提供未來不同系統架構下水資源管理調度策略之分析，亦有助於研擬面對極端氣候風險的中長期調適方案，建構更具彈性與韌性的區域供水體系。

關鍵詞：水資源調度，氣候變遷

Abstract

Facing the trend of increasing rainfall extremes due to climate change, characterized by "wetter wet periods and drier dry periods," severe water scarcity risks during dry seasons present significant challenges to agricultural and industrial water use. This study primarily contributes by establishing analytical theories and tools for regional water resource system integration to support inter-basin water transfer scheduling. Using the "Cho and Northern Canal Interconnection Project" as a case study, it simulates the enhancement of regional water transfer flexibility and supply stability, while analyzing the adaptation capacity of existing

infrastructure for irrigation under future extreme climate scenarios.

An optimization model for water resource system management was developed to simulate the optimal water allocation strategies for the Cho and Northern canal under connected and unconnected conditions. Furthermore, the water resource system integration's impact on supply capacity and scheduling flexibility was quantitatively analyzed to assess its influence on water resource management. Simulations cover both wet and dry years to evaluate changes in irrigation water deficit under different allocation mechanisms.

The study results provide analytical support for future water resource management and scheduling strategies under varying system configurations and contribute to the design of medium- to long-term adaptation measures addressing extreme climate risks, aiming to build a more resilient and flexible regional water supply system.

Keywords: Water resources scheduling, climate change