

應用移動視窗法建置乾旱監測指標與預警機制 —以石門水庫為例

Development of Drought Monitoring Indexes and Early Warning Mechanism Using A Moving Window Approach

國立成功大學 水利及海洋工程學系 助理研究員 龔明人 Ming-Jen Kung	國立成功大學 水利及海洋工程學系 研究員兼任副教授 楊道昌 Tao-Chang Yang	國立成功大學 水利及海洋工程學系 助理研究員 林宥丞 Yu-Cheng Lin	國立成功大學 水利及海洋工程學系 名譽教授 游保杉 Pao-Shan Yu
--	--	---	---

摘 要

本研究採用石門水庫集水區之降雨量、水庫入流量以及水庫蓄水量等資料，應用移動視窗法(Moving Window)建立標準化降雨量指標(Standardized Precipitation Index, SPI)、標準化流量指標(Standardized Streamflow Index, SSI)以及標準化水庫蓄水量指標(Standardized Reservoir Storage Index, SRSI)，分別作為氣象、水文、社會經濟乾旱監測指標，並初步發展乾旱預警機制，用於輔助預判乾旱發生情勢，以提供超前部署抗旱因應作為其操作時機之參考。應用移動視窗法建置之乾旱監測指標(以下稱：移動視窗型乾旱監測指標)可每日更新，達到日日監看之需求，相較月時間尺度乾旱監測指標(更新頻率為每個月一次)而言，移動視窗型乾旱監測指標更能貼近實務應用，隨時掌握目前水情狀況。本研究建置之移動視窗型乾旱監測指標，主要以計算過去 30 天、60 天、90 天與 180 天的 SPI、SSI 與 SRSI，並以友善視覺化圖資呈現監測成果。經由前述的乾旱監測指標之變化趨勢可充分掌握水情現況，連續數個月 SPI 與 SSI 若呈現負值(氣象乾旱指標與水文乾旱指標偏向乾燥)，佐以 SRSI 為負值(蓄水量表現不佳)，可視為乾旱可能發生之警訊，必要時需提前採取相關節水措施。

關鍵詞：移動視窗法，監測指標，氣象乾旱，水文乾旱，社會經濟乾旱，預警機制

Abstract

This study uses data on rainfall, reservoir inflow, and reservoir storage in the Shimen Reservoir catchment to establish Standardized Precipitation Index (SPI), Standardized Streamflow Index (SSI), and Standardized Reservoir Storage Index (SRSI) through the Moving Window method. These indices serve as meteorological, hydrological, and socio-economic drought monitoring indices, respectively, to develop a drought early warning mechanism. This mechanism helps predict drought conditions and guide the timing of drought

mitigation measures. The Moving-Window Drought Monitoring Indices (MWDMIs) can be updated daily, making them more practical for real-time applications compared to monthly-scale indices (updated once a month). The study calculates the MWDMIs (SPI, SSI, and SRSI) for the past 30, 60, 90, and 180 days, presenting results through user-friendly visual maps and charts. By analyzing SPI, SSI, and SRSI trends, the current water situation can be fully understood. Negative values in SPI and SSI over consecutive months (indicating meteorological and hydrological drought indices tend toward dryness), along with negative SRSI values (indicating poor reservoir storage performance), can signal a potential drought, prompting the need for proactive water-saving measures.

Keywords: moving window, monitoring index, meteorological drought, hydrological drought, socioeconomic drought, early warning mechanism