2026旱災應變與預警技術研發
2026 Drought Emergency Response and Early Warning Technology Research and Development

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摘　要

臺灣降雨時空分布高度不均。2025年底至2026年上半年，西半部降雨明顯偏少，中部以北水庫水情嚴峻，凸顯旱災應變極需仰賴長期降雨預報與彈性水資源調度技術之重要性。

為提升水資源決策支援能力，國家災害防救科技中心(NCDR)導入次季節至季節(Subseasonal to Seasonal, S2S)跨尺度預報概念，整合人工智慧(AI)與數值天氣預報技術，進行空間降尺度與偏差修正，建置「季節曆」及「6週延伸降雨預報」產品，有效銜接短期天氣預報與季節氣候預估之間的預報缺口。在水文推估方面，利用中央氣象署提供之全球模式系集預報，結合AI降尺度技術推估集水區降雨量，並導入降雨-逕流物理模式，建立「集水區入庫流量預估技術」，將氣象預報資訊轉化為定量化之入庫流量預估，提供水庫營運與水資源調度決策參考。

此外，針對旱災應變期間之人工增雨作業，本研究整合三維雷達觀測與高解析度數值預報模式，即時分析集水區上空之過冷水含量、零度層高度等雲系物理特徵，並結合焰劑擴散模式及施作後雲水粒子監測技術，建置「人工增雨施作評估技術」，可自動判釋最適合施作時機並評估作業效益。

本研究整合跨尺度氣象預報、水文模擬與人工增雨評估等關鍵技術，建構涵蓋旱象預警、降雨預報、入庫流量推估及人工增雨應變之整合決策支援架構，可提供水資源管理單位更即時、精準且具科學依據之決策情資，提升旱災整備與水資源調度效能。

關鍵字：旱災應變、季節曆、人工增雨

Abstract

Taiwan is characterized by highly uneven spatial and temporal rainfall distribution. From late 2025 to the first half of 2026, below-normal precipitation over western Taiwan led to severe reservoir shortages, highlighting the need for reliable long-range precipitation forecasting and adaptive water resources management.

To support drought response, the National Science and Technology Center for Disaster Reduction (NCDR) developed an integrated decision support framework based on Subseasonal-to-Seasonal (S2S) forecasting. Artificial intelligence (AI) and numerical weather prediction (NWP) are combined through spatial downscaling and bias correction to produce a Seasonal Calendar and 6-week extended-range precipitation forecasts, bridging the gap between short-term weather forecasts and seasonal climate outlooks. Ensemble forecasts from the Central Weather Administration are further coupled with AI downscaling and a rainfall–runoff model to estimate watershed precipitation and reservoir inflow, providing quantitative information for reservoir operation and water allocation.

To improve cloud seeding operations during droughts, three-dimensional weather radar observations and high-resolution NWP are integrated to analyze cloud microphysical conditions, while flare dispersion modeling is applied to identify suitable seeding opportunities and assess operational effectiveness.

The proposed framework integrates meteorological forecasting, hydrological modeling, and cloud seeding assessment to provide timely and science-based decision support, enhancing drought preparedness and water resources management in Taiwan.

Key words : Drought Response, Seasonal Calendar, Cloud Seeding