

臺灣地區長期降雨多時間尺度不均勻性趨勢分析

Trend Analysis of Multiple Timescales Long-term Precipitation Unevenness in Taiwan

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摘 要

臺灣地區雖然雨量豐沛，但高度的時空不均勻也使得災害頻傳，降雨不均勻性是否隨時間更行加劇，是水資源規劃與管理的重要議題之一。因此，本文研究目的為透過長期雨量資料計算不同時間尺度之不均勻性指標，以分析臺灣地區雨量不均勻性的趨勢變化。本研究以臺灣地區八個具長期記錄的日雨量資料為分析基礎，所考慮不同時間尺度之降雨不均勻性指標包括日雨量的吉尼指數 (Gini index, GI) 與半年雨量最濕日數 (the wettest days to 50% of annual precipitation, 簡稱 WD50)、月雨量的降雨集中指數 (precipitation concentration index, PCI)、及半年雨量的豐枯季雨量比 (簡稱 WDR)，至於趨勢的存在與否本研究採用修正 Mann-Kendall 趨勢檢定進行分析。研究結果顯示，GI 在成功、大武、恆春、宜蘭與臺北等五個測站呈現顯著上升趨勢，代表這些地區降雨分布更加不均，雨量有集中於較少降雨日數之傾向。豐枯比方面，臺中與臺北測站呈現顯著上升，顯示原本有差距的乾濕季降雨差異更形擴大；PCI 則以成功測站呈現顯著上升，其餘測站多為不顯著變動。值得注意的是，雖然 WD50 在各測站皆未達顯著水準，但所有測站顯示達到全年半數雨量所需日數均有一致下降傾向，與 GI 上升所反映之降雨集中化現象相互呼應。臺灣地區部分測站所呈現降雨不均勻性增加與季節差異擴大之訊號，可作為未來大氣監測、極端降雨分析及水資源調適規劃之參考。

關鍵字：降雨不均勻性、趨勢檢定、吉尼指數、降雨集中指數、WD50

Abstract

Highly uneven precipitation in Taiwan often causes serious damage. Whether this inherent unevenness becomes stronger is an important issue in water resources planning and management. This study aims to detect trends in precipitation unevenness at multiple time scales using long-term rainfall records. Eight daily precipitation series with records of at least 80 years were analyzed. The indices include the Gini Index (GI), wettest days to 50% of annual precipitation (WD50), precipitation concentration index (PCI), and the wet- to dry-season precipitation ratio (WDR). The modified Mann-Kendall test was applied to identify trends in these indices. The results show significantly increasing GI trends at Chengkung, Dawu, Hengchun, Yilan, and Taipei, indicating more concentrated precipitation in fewer days at these stations. WDR also shows significant increases at Taichung and Taipei, suggesting greater differences between wet- and dry-season precipitation. A significant increase in PCI is found only at Dawu. No significant trends are detected in WD50 at any of the eight stations. However, negative but insignificant WD50 trends observed at all stations imply that fewer wet days are needed to account for half of annual precipitation. This tendency is consistent with the increasing GI results. Overall, the increasing precipitation unevenness found in this study provides useful information for atmospheric monitoring, extreme rainfall analysis, and water resources adaptation.

Keywords: precipitation unevenness, trend analysis, Gini index, precipitation concentration index, WD50.