應用創新趨勢分析法探討臺灣長期降雨趨勢

Application of ITA Method on Long-term Rainfall Trend in Taiwan

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摘　要

受到氣候變遷加劇之影響，極端氣象事件已更加頻繁地出現於台灣，如何有效率運用有限水資源成為一項嚴峻的挑戰。了解臺灣各地區在氣候變遷影響下之降雨量及降雨特性時空變化趨勢，將能助於擬定相關水資源管理策略，以降低災害所造成之衝擊。本研究以中央氣象署北、中、南及東部地區之 15 個地面有人氣象站 50 年長期歷史雨量觀測數據為基礎，應用新近提出之 Innovative Trend Analysis(ITA)創新趨勢分析法以及廣泛使用之傳統 Mann-Kendall Test (MK Test)趨勢檢定法進行不同尺度降雨量以及各種相關降雨指標之趨勢分析，並比較評估兩方法之表現。根據 ITA 之分析結果顯示，臺灣年降雨量趨勢在中南部地區呈現了較大的上升趨勢；季節及月降雨量中，夏季至冬季期間的 7 至 12 月主要呈現顯著上升趨勢，而春雨季至梅雨季期間的 2 至 5 月則多呈現顯著下降趨勢。各降雨指標部分，各地年降雨日數(RR)、年最大連續不降雨日數(CDD)及年大雨日數(R80mm)多呈現顯著下降趨勢，年降雨強度(SDII)及年豪雨日數(R200mm)則多呈現顯著上升趨勢，而年最大日降雨量(Rx1day)之趨勢變化方向則類似於年降雨量之趨勢。就以上結果綜合分析顯示臺灣地區明顯受到氣候變遷之影響，除了出現暴雨事件的機會增多，發生乾旱的機會也會越來越大。此外，相較於 MK Test 僅能檢測序列資料之單調趨勢，ITA 除了能提高趨勢偵測率外，也可藉由其視覺化之 ITA 趨勢分析圖檢測出隱藏在時間序列資料內之子趨勢差異性從而獲取更細節化之分析結果。本研究之結果將可提供相關單位針對氣候變遷之影響擬定更為全面的水資源運用及防災策略之參考依據。

關鍵詞：氣候變遷，降雨量，趨勢，創新趨勢分析法，Mann-Kendall Test

Abstract

Affected by the intensification of climate change, extreme meteorological events have occurred more frequently. How to efficiently use limited water resources has become a serious challenge. Understanding the spatiotemporal changes in rainfall and rainfall characteristics under the influence of climate change will help formulate relevant water resources management strategies to reduce the impact of disasters. The 50-year long-term historical

rainfall observation data obtained from 15 ground-based manned weather stations of the Central Weather Administration in the north, central, south and eastern regions were used for this study. The newly proposed innovative trend analysis (ITA) and the widely used traditional Mann-Kendall Test (MK Test) method were applied to conduct trend analysis of rainfall at different scales and various related rainfall indicators. Then the performance of the two methods was compared and evaluated. According to the ITA analysis results, the annual rainfall trend in the central and southern regions of Taiwan shows a significant upward trend; In terms of seasonal and monthly rainfall, the period from July to December (Spanning summer to winter) mainly shows a significant upward trend, while the period from February to May (Spanning spring to Mei-yu season) shows a significant downward trend. For various rainfall indicators, the annual number of wet days (RR), the maximum consecutive dry days (CDD), and the number of heavy rainfall days (R80mm) generally show a significant downward trend, while the annual rainfall intensity (SDII) and the number of extremely heavy rainfall days (R200mm) show a significant upward trend. The trend of the annual maximum daily rainfall (Rx1day) is similar to the trend of annual rainfall. The comprehensive analysis of the above results shows that the Taiwan is clearly affected by climate change, with not only an increase in the frequency of extreme rainfall events, but also an increase in the likelihood of droughts. In addition, compared with MK Test, which can only detect monotonic trends in sequence data, ITA can not only improve the trend detection rate, but also detect sub-trend differences hidden in time series data through its visual ITA trend analysis chart to obtain more detailed analysis results. The results of this study can provide a reference for relevant agencies to formulate more comprehensive water resource utilization and disaster prevention strategies in response to the impact of climate change.

Keywords: Climate Change、Rainfall、Trend、Innovative Trend Analysis、Mann-Kendall Test