應用 CMIP6 統計降尺度日資料探討臺灣水文於氣候變遷情境下之變化

Application of CMIP6 Statistical Downscaling Daily Data to Investigate the Variation of Taiwan's Hydrology under Climate Change Scenarios

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摘　要

聯合國政府間氣候變遷專門委員會(Intergovernmental Panel on Climate Change，簡稱 IPCC)每 5~7 年發布一次全球氣候變遷有關之評估報告，提供國際氣候變遷相關科學成果與進展，作為決策與學術研究之參考。IPCC 已分別於 1990 年、1995 年、2001 年、2007 年、2014 年發布第一次至第五次評估報告，並於 2021 年發布第六次評估報告 (The 6th Assessment Report，簡稱 AR6)。隨著 IPCC AR6 報告的發布，報告中所使用最新的氣候變遷推估資料-耦合氣候模式對比計畫(Coupled Model Intercomparison Project ，CMIP)第六階段(CMIP6)資料，由「臺灣氣候變遷推估資訊與調適知識平台」計畫 (Taiwan Climate Change Projection Information and Adaptation Knowledge Platform，簡稱 TCCIP)將全球尺度資料降尺度至臺灣 5km 網格尺度的 CMIP6 統計降尺度日資料，並著手進行資料之測試。

本研究利用 TCCIP 之 CMIP6 統計降尺度日資料，透過集水區水文模式模擬集水區水文量的變化情形，分析臺灣水資源北中南東四分區 38 個集水區，不同氣候變遷情境下之降雨量、不降雨日數、逕流量、蒸發散量與入滲量等。研究結果以多個氣候模式資料與模擬結果之中位數進行分析，結果顯示北中南東四分區年降雨量均有上升的趨勢，但最大不降雨日數也同時上升，顯示降雨可能有極端化的趨勢。北中南東四分區春季的逕流量呈現一致性的減少，惟冬季的逕流量在北部及東部地區呈現減少的情況，顯示未來北部及東部可能面臨連續兩季水資源量減少的衝擊。本研究初步針對 TCCIP 之 CMIP6 統計降尺度日資料進行水資源相關分析與應用之測試，期待相關分析與數據可以作為相關應用之參考。

關鍵詞：氣候變遷，統計降尺度日資料，多模式成果，雨量變化，流量變化

Abstract

The Intergovernmental Panel on Climate Change (IPCC) publishes an assessment report on global climate change every 5 to 7 years, providing scientific achievements and progress related to international climate change as a reference for decision-making and academic research. The IPCC has released the first to fifth assessment reports in 1990, 1995, 2001, 2007, and 2014, and will release the 6th Assessment Report (AR6) in 2021. With the release of the IPCC AR6 report, the latest climate change projection data used in the report- the sixth phase of Coupled Model Intercomparison Project (CMIP6) were downscaled to 5km grid and started to test by the "Taiwan Climate Change Projection Information and Adaptation Knowledge Platform (TCCIP)".

This study used the CMIP6 statistical downscaling daily data of TCCIP, and used the hydrological model to simulate the hydrological amount of the catchments. A total of 38 catchments were used in the four sub-regions of the Northern, Central, Southern, and Eastern Taiwan. Hydrological changes under various climate change scenarios, such as rainfall, days without rainfall, runoff, evapotranspiration, and infiltration were analyzed. The median of multiple climate model data and simulation results of all indices were adopted for the result of future change trend. The results showed that the annual rainfall in the four sub-regions of the Northern, Central, Southern, and Eastern Taiwan has an increasing trend, but the maximum number of days without rainfall also increases, indicating that the rainfall may have a trend of extremes. The runoff in the northern, central, southern, and eastern Taiwan showed a consistent decrease in spring, but the winter runoff showed a decrease in the northern and eastern regions. This study preliminarily tested the water resources-related analysis and application of the CMIP6 statistical downscaling daily data of TCCIP, and hoped that the relevant analysis and data could be used as a reference for related applications.

Keywords：climate change, statistical downscaling daily data, multi-model results, rainfall variation, runoff variation