臺灣WBGT網格資料之誤差特性與可用性評估

Error Characteristics and Applicability Assessment of Gridded WBGT Data in Taiwan

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摘　要

近年臺灣高溫事件頻仍，評估脆弱族群面臨的熱壓力風險便成為一重大議題。Wet Bulb Globe Temperature (WBGT)為一結合日照、通風、溼度等多項因素而成之熱壓力指數。作為一久經驗證之指標，WBGT已在各國環境單位，乃至於本署應用於熱壓力風險評估。然而，因缺乏長期歷史資料作為基準，決策者難以定義界定正常與異常情況。在此背景下，具備可靠的WBGT網格基期資料作為判定異常高溫之基準，其重要性不言可喻。

本研究分析2016至2024年全臺26個署屬有人測站的逐時WBGT及其計算所需之氣象要素資料，並與相應的網格資料進行比較，以評估網格資料之品質與可用性，其中網格資料選用Taiwan Station-based Analysis (TaiSA)作為乾球溫度、相對溼度以及地面氣壓的來源，短波輻射來自於Himawari-8 (H8)反演資料，風速則來自於Mesoscale Dynamic Analysis System (MDAS)。WBGT數值皆以Liljegren et al. (2008)提出之方法計算。分析結果顯示MDAS之風速資料整體呈現低估傾向，由於現有演算法在強短波輻射與弱風條件並存時，對風速變化之敏感度可能顯著提高，因此低風速區間的風速偏差可能對日間估計產生明顯影響。整體而言，WBGT網格資料之不確定性，並非僅源於單一氣象要素，而是與風速、短波輻射等輸入資料誤差及演算法在特定氣象條件下的敏感性共同相關，因此，後續研究將聚焦於上述誤差，持續針對WBGT網格資料進行優化調整。

關鍵字：熱壓力、WBGT、天氣資料

Abstract

The increasing frequency of extreme heat events in Taiwan makes assessing heat stress risks for vulnerable populations a critical priority. The Wet Bulb Globe Temperature (WBGT), which incorporates multiple factors, including sunlight, wind, and humidity, is a well-established metric for assessing heat stress and is widely utilized by various operational agencies. However, the lack of a historical baseline makes it challenging for policymakers to distinguish extreme events from normal conditions. Therefore, establishing a reliable, gridded WBGT dataset to serve as a baseline is essential.

This study analyzes hourly WBGT and meteorological variables required for its calculation from 26 CWA-operated manned stations across Taiwan for 2016–2024, comparing them with corresponding gridded data to evaluate the quality and applicability of the gridded dataset. Gridded datasets for temperature, relative humidity, and surface pressure were sourced from the Taiwan Station-based Analysis (TaiSA) dataset. Solar radiation and wind speed were obtained from the Himawari-8 (H8) satellite-derived dataset and the Mesoscale Dynamic Analysis System (MDAS), respectively. Gridded WBGT values were estimated using the Liljegren et al. (2008) method. Results show that MDAS wind speed is overall underestimated. Since the algorithm's sensitivity to wind speed increases under strong shortwave radiation and weak wind, low-wind biases may significantly impact daytime

estimates. Overall, gridded WBGT uncertainty stems from combined input errors and algorithmic sensitivity under specific meteorological conditions. Therefore, future research will focus on these errors to optimize the gridded dataset.

Key words : Heat stress, WBGT, Weather data