

以數學模型建立午後熱對流之特徵分布 Establishing Feature Distributions of Afternoon Thermal Convection Using Mathematical Models

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摘 要

本研究以 2022 年 8 月 6 日及 8 月 7 日中央氣象署 10 分鐘地面自動測站資料為基礎，探討午後熱對流發展前後之地面氣象參數特徵分布。研究區域聚焦於嘉義與臺南鄰近區域，並依午後時段 10 分鐘雨量是否達 0.5 mm，將測站區分為「午後有雨組」與「午後無雨組」。首先透過時間序列折線圖觀察氣溫、相對濕度、氣壓與風場之演變，再以盒鬚圖呈現不同測站群體在各時間點之中位數、四分位距與離散程度，以掌握有無發展午後熱對流之統計差異。進一步借用統計學中趨勢、動能、震盪與偏離度分析概念，將 MA、MACD、RSI、布林通道與 BIAS 等方法轉化為氣象時間序列特徵萃取工具，用以描述氣象參數之變化速度、加速度與波動幅度。結果顯示，午後有雨測站在對流發展前常呈現氣溫由高檔轉折並快速下降、相對濕度明顯回升、氣壓低點後反彈，以及風場變化加劇等特徵；相較之下，午後無雨測站多呈現較平緩或震盪型態。研究結果顯示，盒鬚圖與類技術指標可有效量化午後熱對流發展前之地面特徵分布，並可作為後續建立客觀化午後對流判識方法之基礎。

關鍵字：午後熱對流、盒鬚圖、技術指標分析

Abstract

This study analyzes surface meteorological parameters before and during afternoon thermal convection using 10-minute data from the Central Weather Administration on 6 and 7 August 2022 in the Chiayi-Tainan region. Stations were classified into those with and without afternoon rainfall (>0.5 mm). Time-series line plots examined temperature, humidity, pressure, and wind variations. Box plots showed median, interquartile range, and dispersion at different times to identify statistical differences. Meteorological concepts like MA, MACD, RSI, Bollinger Bands, and BIAS, adapted as feature extraction tools, described the rate, acceleration, and fluctuations of parameters. Results indicate stations with rainfall showed rapid temperature decline, increased humidity, pressure rebound, and wind variability before convection. Non-rainfall stations showed smoother or oscillatory patterns. These methods effectively quantify surface features related to convection and could inform objective detection methods.

Key words : Afternoon thermal convection; Box plot; Technical indicator analysis.