

# 東亞鋒面活動及降水未來推估

## The Future Projection of Front Activities and Precipitation in East Asia

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### 摘要

春季(二~四月)及梅雨季(五、六月)降雨是農業、工業及民生重要的水資源。推估鋒面活動及其降水在暖化後的變化可提供參考資訊給水資源管理及風險評估使用。過去CMIP5對鋒面及相關降水的模擬仍有較高不確定性。此研究使用較新的CMIP6資料並改善自動偵測鋒面的方法，加入氣旋式環流為偵測條件，提高對梅雨鋒面的偵測能力。比較歷史模擬(1995-2014)與ERA5再分析資料，顯示CMIP6及新版自動偵測方法已能良好的模擬及偵測冬、春季及梅雨季的鋒面活動。

我們以SSP5-8.5於21世紀末(2081-2100)之模擬相較於歷史模擬的變化來代表未來推估。冬季(12月~一月)及春季在原本鋒面盛行的區域，鋒面頻率將明顯減少，伴隨的鋒面降雨亦下降。全部降水減少的量有超過一半來自鋒面降雨的減少。梅雨季鋒面頻率於大部份東亞地區下降，但是中國南部沿海、台灣及琉球群島鋒面頻率將增加。梅雨季整個東亞地區的總降水增加，但長江流域及部分東北亞區域的鋒面降水減少，表示這些地區未來降水型態可能改變。台灣附近的總降雨量及鋒面降雨都將增加，但是鋒面降雨佔的比例減少，表示降水強度可能增強。

關鍵字：鋒面活動，鋒面降水改變，CMIP6，未來推估

### Abstract

The precipitation in the spring (Feb-Apr) and Mei-yu (May to June) seasons is a crucial water resource for agriculture, industry, and people's livelihood. The future projection in front activity and frontal precipitation after global warming can provide insights into water resource management and risk assessment. However, the simulation of fronts and the associated rainfall shows considerable uncertainty in CMIP5 data. This study uses CMIP6 data, and we have modified the front objective detection method by including the cyclonic flow in detecting the Mei-yu fronts. The detection method has been shown to detect Mei-Yu fronts successfully.

The preliminary results indicate that the front frequency in the prevalent areas will decrease in winter (Dec-Jan) and spring after warming. The spatial pattern of total precipitation change resembles that of frontal precipitation change, and the frontal precipitation changes account for more than half of the total precipitation change. In the Mei-yu season, the front frequency will decrease over most East Asia, except the coast of Southern China, Taiwan, and the Ryukyu Islands. The frontal precipitation change illustrates local differences. The Yangtze River basin and part of North East Asia are projected to have less frontal precipitation while the total precipitation increases, implying changes in precipitation types. In the vicinity of Taiwan, frontal precipitation and total precipitation increase, but the proportion of frontal precipitation decreases, leading to more extreme rainfall intensity.

Keywords: front activity, frontal precipitation change, CMIP6, future projection