冬春季東亞鋒面頻率及降水之分析與未來推估
Analysis and Projection of Frontal Activities in East Asia during Winter and Spring

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摘　要

本研究使用客觀方法偵測鋒面，統計氣候資料中鋒面發生的頻率、推估未來可能發生的改變及分析造成改變的可能機制。氣候資料包括ERA5、CMIP5 歷史及RCP8.5情境模擬。分析區域為東亞地區，針對鋒面發生頻繁之冬季及春季分析，季節採用自然季節之定義。CMIP5歷史模擬可以合理的掌握鋒面出現的氣候位置，但是鋒面頻率有高估的情況。未來推估則顯示，在副熱帶及中緯度地區，鋒面頻率的氣候極大值區，鋒面出現的次數將減少；夾在中間的極小值區，鋒面頻率將增加。比較CMIP5 歷史模擬及RCP8.5中的大尺度環流後發現，造成此變化的可能機制為，台灣到華南地區一帶出現一個反氣旋式的環流距平，將較多水氣傳送到中國華中至華北一帶，使該區域產生較大的溼度對比，因此鋒面發生頻率增加。CMIP5歷史模擬同時顯示，在副熱帶地區(約華南、台灣、琉球至日本南部海面的帶狀區域) 約有30% 的雨量與鋒面相關，鋒面降雨在21世紀末可能減少約10~30%。鋒面降雨減少可能會延長乾季的長度並對水資源帶來影響。

關鍵字：鋒面頻率、鋒面降水、未來推估

Abstract

An objective front detection method is applied to ERA5, CMIP5 historical, and RCP8.5 simulations to analyze front frequency and to understand future projections of seasonal front activities. The study area is East Asia for two natural seasons, winter and spring. The front location in CMIP5 historical simulations is captured reasonably with higher frequency. Projections suggest that winter fronts will decrease (increase) over climatological maximum (minimum). Front frequency increases in the central to north China is due to more moisture supply, which is carried by an anomalous anti-cyclonic moisture flow. Frontal precipitation accounts for more than 30% of total precipitation over subtropical regions. Frontal precipitation is projected to decrease for 10-30%. During spring, southern China and Taiwan will experience fewer fronts and less frontal precipitation that may prolong the dry season. Spring front activities are crucial for water resource and risk management in the southern China and Taiwan.

Key words: front frequency, frontal precipitation, future projection