

年代際預報模式對ENSO及其遙相關預報能力之比較

Comparison of Decadal Prediction Skill for ENSO and Its Teleconnections among Decadal Prediction Systems

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摘 要

年際至年代際氣候預報可提供未來數年至十年尺度之氣候資訊，對氣候風險管理及調適決策具有重要價值。其中，聖嬰－南方振盪（El Niño－Southern Oscillation, ENSO）為全球最主要的氣候變異之一，可透過大尺度環流影響東亞及臺灣氣候，因此ENSO的可預報度一直是年代際預報研究的重要議題。本研究比較三組年代際預報模式，分別為Community Earth System Model version 1－Decadal Prediction Large Ensemble（CESM1-DPLE）、Norwegian Climate Prediction Model version 1（NorCPM1）及Taiwan Earth System Model version 1（TaiESM1），分析其 lead year 1－10 於北半球冬季（DJF）的預報結果，比較不同模式對 ENSO、熱帶海溫異常及其相關大尺度環流型態之預報能力。

結果顯示，三組年代際預報模式皆能於前兩年維持較高的 ENSO 預報技術，之後技術隨 lead year 增加而快速下降，但不同模式在預報技術及其衰減速度仍存在差異。本研究成果可作為本署發展年際至年代際氣候預報及氣候服務之參考，亦可提供不同年代際預報模式預報能力比較的基礎，作為未來建構多模式整合預報系統之依據。

關鍵字：年際至年代際預報、聖嬰－南方振盪

Abstract

Interannual-to-decadal climate prediction provides climate information on timescales from several years to a decade, offering valuable support for climate risk management and adaptation planning. Among the major sources of climate variability, the El Niño–Southern Oscillation (ENSO) exerts profound influences on the climate of East Asia and Taiwan through large-scale atmospheric circulation, making its predictability a key topic in decadal climate prediction.

This study compares the prediction skill of three decadal prediction systems: the Community Earth System Model version 1 Decadal Prediction Large Ensemble (CESM1-DPLE), the Norwegian Climate Prediction Model version 1 (NorCPM1), and the Taiwan Earth System Model version 1 (TaiESM1). Boreal winter (December–February, DJF) forecasts for lead years 1–10 are analyzed to evaluate the ability of these models to predict ENSO evolution, tropical sea surface temperature anomalies, and the associated large-scale atmospheric circulation patterns.

The results show that all three prediction systems maintain relatively high prediction skill for ENSO during the first two lead years, after which the skill decreases rapidly with increasing lead time. However, the rate of skill degradation differs among the models. The findings provide a useful reference for the development of interannual-to-decadal climate prediction and climate services at the Central Weather Administration, and offer a basis for evaluating multiple decadal prediction systems and supporting the future development of an operational multi-model prediction framework.

Key words : Interannual-to-decadal climate prediction, ENSO