Diagnosing Representations and Associated Impact Factors of the ENSO Persistence Barrier based on CMIP5 Simulations

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The persistence barrier (PB) of the El Niño-Southern Oscillation (ENSO) phenomenon is investigated using the historical simulations of the Coupled Model Intercomparison Project Phase 5 (CMIP5) models, which can be quantitatively measured in terms of its occurrence timing and intensity by the negative maximum gradient of autocorrelation decline of Niño indices of sea surface temperature (SST) anomaly. It is found that most of the CMIP5 models can reasonably reproduce the observed timing of the ENSO PB that typically occurs during boreal late spring-early summer though the PB intensity is slightly underestimated in the model simulations. The PB properties of the eastern Pacific (EP) ENSO are much better represented by the models than the central Pacific (CP) ENSO in terms of individual indices, and around a half of the models can more accurately reflect the intensity and timing of PB for indices of EP ENSO than those of CP ENSO, with the modeled PB timing showing a larger uncertainty. Further diagnosis is conducted on the relationship between the ENSO PB intensity and associated impact factors in SST. Results show that the intensity of PB has an evidently better relationship with the seasonality of modeled SST amplitude in central Pacific rather than the mean SST intensity. Furthermore, the phase-locking intensity of Niño3 SST anomalies with respect to the annual cycle shows a high correlation with the PB intensity. These suggest that the seasonality of tropical SST variations may essentially contribute to the ENSO PB.

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