西風イベントの環境場依存性がもたらすENSOの多様性
ENSO diversity generated by the state dependence of westerly wind events

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A coupled dynamics between westerly wind events (WWEs) and El Niño-Southern Oscillation (ENSO) is examined using an atmosphere-ocean coupled model with an intermediate complexity. WWEs are short-lived surface westerly wind anomalies over the western-central equatorial Pacific and observed frequently at the eastern edge of the warm pool when the sea surface temperature (SST) anomaly at the Niño4 region (160 °E-150 °W, 5 °S-5 °N) is positively large. These features of WWEs are parameterized as a state-dependent stochastic noise to wind stresses in the model. Without the noise (experiment NO), the model produces a periodic ENSO-like oscillation with a period of 6 years and its variance increases with respect to a parameter that controls efficiency of the positive thermocline feedback, γ. When additive (purely stochastic) noise is given to the model over the western Pacific (experiment AD), oscillations become irregular with the dominant period of about 5 years and the increase of its variance relative to NO depends on γ. When the state-dependent noise is adopted (experiment SD), the oscillatory solution is also irregular besides its variance and asymmetry increase irrespective the value of γ.
Both the additive and state-dependent noises help to produce two types of oscillation, corresponding to the eastern-Pacific (EP) and central-Pacific (CP) El Niños, although there is no such diversity in NO. EP El Niño is magnified in SD due to the eastward shift of the noise location caused by the warm pool expansion. CP El Niño is even favored by the state-dependent stochastic noise, which enhances the zonal advection to warm the central Pacific, and in turn the warmer Niño4 SST increases the probability of occurrence of the noise. This positive feedback ensures the existence of CP El Niño regardless of γin SD, while the number of CP El Niño declines with larger γ in AD. The above results thereby suggest that the state dependence of WWEs may play a crucial role on the asymmetry and diversity of ENSO in nature.

キーワード：西風イベント、エルニーニョ・南方振動、環境場依存性
Keywords: Westerly wind event, ENSO, State dependence

