



## **Tropical Pacific decadal oscillation driven by the interaction between ENSO and mean state**

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Using CGCM output, we investigate the tropical Pacific decadal oscillation. The principal component (PC) time series associated with the first decadal mode of tropical Pacific SST identified by using EOF (empirical orthogonal function) analysis are highly correlated to the decadal changes of ENSO (El Nino-Southern Oscillation) variance and Skewness. Moreover, the first decadal mode of SST showing an ENSO-like pattern is similar to the residual pattern of SST resulting from uneven compensation between El Nino and La Nina during the decadal period of the high-variability ENSO. It indicates that the asymmetric oscillation of ENSO (i.e. a nonlinear ENSO cycle) can be rectified into the climate state. Meanwhile, the stability analysis of the intermediate ENSO model verified that the changes in the climate states could modify ENSO variability. Interestingly, the climate condition of SST corresponding to the high-variability ENSO decades, acts to intensify the growth rate of the ENSO mode, while that of thermocline does to suppress the ENSO activity.

In summary, we showed that the asymmetric oscillation of ENSO (i.e. a nonlinear ENSO cycle) is rectified into the climate state, and the change in climate state in turn influences the ENSO stability. Furthermore, this interactive feedback between ENSO and climate state possibly generates the tropical decadal oscillation through the combined effect of a positive feedback between ENSO activity and SST climate state and a negative feedback between ENSO activity and the thermocline climate state.