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Nonlinear Dynamic Reconstruction of CZ model and its Applications

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Using the output of the month mean fields of a typical 1000-year numerical solution of Cane-Zebiak (CZ) model, we reconstruct a low-order nonlinear dynamic model. The low-order nonlinear dynamic model has a small embedding dimension and is based on only a time series of the month-mean anomalies of sea surface temperature (SST) field at an arbitrarily chosen grid point of the model. The model data is used to build nonlinear mappings that relate variables of the low-order system from the base point to the entire SST and thermocline depth fields of the model. With independent model data, we demonstrated that the reconstructed dynamic system faithfully reproduces the entire time-space evolution of all the fields of the ZC model to a great accuracy. This reconstructed low-order system is further used to reconstruct observed month-mean anomalies of sea surface temperature field by combining the model based nonlinear mappings and observed time series of SST at the vicinity of the chosen base point. Using the observed SST data only at the single point, the reconstructed SST field is surprisingly realistic comparing with the observed field. We conclude that our approach may have useful applications in ENSO predications and data reconstructions.