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Low-dimensional nonlinearity of ENSO and its impact on predictability

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Using a hybrid coupled model, we performed the breeding vector (BV) analysis and retrospective ENSO (El Niño and the Southern Oscillation) forecast for the period from 1881-2000. The BV local dimensionality (refereed to as BV-dimension hereafter) inherent to nonlinear dynamics was analyzed. Emphasis was placed on exploring the relationship between BV-dimension and model prediction skills, which shed on lights on the impact of low-dimensional nonlinear dynamics on ENSO predictability. The result shows that the BV-dimension of ENSO system is positively related to its predictability, namely that, the high predictability is attained when the low-dimensional nonlinearity is enhanced, and vice versa. Further the low-dimensional nonlinearity of ENSO is investigated and confirmed using observations. The possible mechanism for the link between the strength of low-dimensional nonlinearity and ENSO predictability was also discussed.