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The sensitive area for targeting observation associated with two types of El Niño events

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The optimal forcing vector (OFV) approach is an effective method to rectify a numerical model by offsetting the tendency error of the model. Applying the OFV approach to Zebiak-Cane model, we successfully simulate 8 El Niño events after 1980 including 3 eastern Pacific (EP) ones and 5 central Pacific (CP) ones. Then we compute the conditional nonlinear optimal perturbation (CNOP) of each El Niño event which represents the fastest growing initial error of each event. It is found that the CNOP-type initial errors of different types of El Niño event have similar structures in both SSTA pattern and thermocline depth anomaly pattern. The CNOP-type errors can be classified into two types. One type has a SSTA pattern with negative anomalies in the equatorial central western Pacific, positive anomalies in the equatorial eastern Pacific, and a thermocline depth anomaly pattern with positive anomalies along the equator; while the other type presents patterns almost opposite to the former type. All these initial errors develop dramatically and make the predict results far away from the truths. This indicates that initial errors with particular patterns can cause serious uncertainty of El Nino predictions. We choose the region where SSTA errors are larger and when subtracting the initial errors in this area, the development of initial errors is significantly depressed and as a result, the predict skill of two types of El Nino events improves greatly. The region with initial errors being larger represents the sensitive area for targeting observation associated with predictions of two types of El Nino events. Increasing observations in the sensitive area is helpful for predicting which type of El Nino event will occur.