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A study on the roles of initial errors in spring predictability barrier for ENSO events

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The approach of conditional nonlinear optimal perturbation (CNOP) and the Zebiak-Cane model are applied to investigate the seasonal dependence of initial error growth for ENSO prediction. The characteristics of the initial errors generated by CNOP method are analyzed. CNOP-type errors stand for the initial errors which cause the largest uncertainties at prediction time under proper constraint conditions. A series of numerical experiments have been made. It is found that the evolution of CNOP-type errors has considerable seasonal dependence related to spring predictability barrier (SPB).

Whether the initial random errors yield SPB or not is also studied. Analysis indicates that there is no obvious seasonal dependence of the evolution of random initial errors, consequently which does not yields SPB. The results suggest that SPB is resulted from some kind of initial error patterns, e.g. the CNOP-type error, rather than the random initial errors.

The spacial patterns of CNOP-type errors are further investigated. The localness of such patterns suggest that there is possibility to reduced SPB in ENSO prediction by targeted observations in the area represented by CNOP patterns.