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Category: Ocean and Atmospheres

- Paper ID: 57-00A-A1133
 - **Title:** Conditional Nonlinear Optimal Perturbations: A New Approach to the Estimation of Uncertainty of Numerical Modeling

Abstract:

Considering the limitation of linear singular vector (LSV) in the estim uncertainty of numerical modeling in geophysical sciences, conditiona nonlinear optimal perturbation (CNOP) is proposed recently , which is nonlinear generalization of LSV. The essential characteristic of CNOP i both nonlinearity of models and physical constraint conditions on initi and model parameters are taken into account . Comparisons betweer and LSV demonstrate that CNOP is more applicable in the estimation uncertainty of numerical modeling of nonlinear motions of oceans and atmospheres. Examples of applications of CNOP are also presented, includes the stability and sensitivity of ocean's thermohaline circulatic (THC) to finite amplitude perturbations, the prediction error of El Ninc Nina events, the precursors of El Nino and Southern Oscillation (ENSC the spring predictability barriers problem of ENSO event .

Presentation Mode:

Keywords: optimal perturbation, nonlinear, uncertainty, ENSO, THC, predictability

Status: Reviewed.

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