Identifying the sensitive area in targeted observation for improving the vertical thermal structure prediction in the summer Yellow Sea

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The sensitive area of targeted observation for the short-term prediction of the vertical thermal structure in the summer Yellow Sea is investigated by utilizing the Conditional Nonlinear Optimal Perturbation (CNOP) method and a adjoint-free algorithm with the Regional Ocean Modeling System. We use a vertical integration scheme of temperature to locate the sensitive area, in which reducing the initial errors are expected to yield great improvements in vertical thermal structure prediction of the verification area. We perform a series of sensitivity experiments to evaluate the effectiveness of the identified sensitive area. Our results show that, initially adding random perturbations in the sensitive area have the greatest negative effects on the prediction than in other areas (e.g., the verification area, regions east and northeast of the verification area). Moreover, Observing System Simulation Experiments (OSSEs) indicate that, eliminating the initial errors in the sensitive area can lead to a more refined prediction than in other selected areas (including the verification area itself). Our study suggests that implementing targeted observation is a feasible way to improve the short-term prediction of the vertical thermal structure in the summer Yellow Sea.