Application of conditional nonlinear optimal perturbations method to transitions of Kuroshio path south of Japan

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Many studies have indicated that the Kuroshio path south of Japan displays bimodal behavior (the straight path and the large meander path). Here the conditional nonlinear optimal perturbation (CNOP) method is used to investigate the transitions between the straight path and the large meander path of Kuroshio path south of Japan. Based on the kinetic energy norm, we calculate the parameter errors, the initial errors and the combinational errors of parameter and initial condition using the CNOP method to study the path transitions between the bimodal patterns. Through numerical experiments, we find that our results are consistent with other researchers' conclusions. That demonstrates the CNOP method is an useful tool for considering problems about variability of Kuroshio path south of Japan.