Target observation of mesoscale eddies in the ocean

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Previous studies show that the kinetic energy of mesoscale eddies (MEs) accounts for more than 80% of the global ocean energy. The theoretical study and numerical simulation of MEs will enable us to better understand the dynamics of ocean circulation. Weiss and Grooms (2017) found that assimilating uniform observations taken over MEs is much better than assimilating a subset of observations on a regular grid for improving prediction skill of SSH associated with ocean state. In the present study, we use a conditional nonlinear optimal perturbation (CNOP) approach to investigate the sensitivity of the ocean state sea surface height (SSH) predictions on MEs with a two-layer quasi-geostrophic model and show the optimal assimilating scheme. In the study, the CNOPs of SSH predictions are first computed. It is found that, if one regards the regions covered by the grid points with large values of CNOPs as sensitive area of SSH predictions, the sensitive areas are mainly located on MEs. Furthermore, the stronger the MEs, the more the MEs grid points covered by the sensitive area. Especially, these grid points associated with sensitive areas are not uniformly distributed over the MEs. It is obvious that the predictions of SSH are quite sensitive to the initialization of MEs (especially that of the particular region of large values of CNOPs for strong MEs, rather than of the uniformly distributed grid points over MEs). Therefore, an appropriate initialization of MEs is much helpful for improving the prediction accuracy of SSH. And the CNOPs of SSH prediction here may provide useful information on how to improve initialization of MEs.