Geophysical Research Abstracts
Vol. 15, EGU2013-9257, 2013
EGU General Assembly 2013

Ensemble Optimal Interpolation Data Assimilation of Surface Currents by Utilizing Monte Carlo Simulation

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This paper describes the application of Ensemble Optimal Interpolation (EnOI) with Monte Carlo (MC) simulation for surface currents forecasting. Environment Fluid Dynamics Codes (EFDC) is run for 7 days with initial conditions and boundary conditions. For the assimilation process, Direct Insertion (DI), Optimal Interpolation (OI) and Ensemble Optimal Interpolation (EnOI) approaches are applied from t=5.0d, and wind forcing is switched off during updating process. For Optimal Interpolation, background error covariance is estimated from the first run combining empirical correlation function, while for Ensemble Optimal Interpolation, background error covariance is calculated from the ensemble of first run, optimal number of ensemble is acquired by comparing different assimilation. Different strategies have been proposed to obtain the measurement error covariance, optimal measurement error covariance gives the least forecast error. Different kinds of pseudo measurements are produced from Monte Carlo simulation by adding different type of perturbations, which obey certain distribution. A series of experiments with distinct perturbations are carried out to show the improvement of simulating the stochastic process. Three types of reference points: inside of the assimilation area, outside of the assimilation area, and the boundary points are analyzed to show the improvement of the assimilation process and the influence after assimilation. This study also investigates the impacts of the updating interval for the assimilation process, the felicitous updating interval is chosen by comparison. To compare the improvement of operating Ensemble Optimal Interpolation with Direct Insertion and Optimal Interpolation, RMS error and data assimilation skill are calculated.