

Iterative ensemble variational methods and its application for the prediction of geomagnetic secular variation

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The 4-dimensional ensemble variational method (4DEnVar) is a data assimilation method which is easy to implement as a post-process. The iterative version of the 4DEnVar, which is sometimes referred to as the iterative ensemble smoother, is also regarded as a useful tool for nonlinear data assimilation problems. Since these methods are derived based on a linear approximation of a dynamical system model, the behavior of the algorithm under the situations with large uncertainties is not trivial. In this study, the accuracy of the algorithm was evaluated after considering second and higher order terms of the Taylor expansion of a system model. The sufficient conditions for finding a local maximum of the objective function are then explored, and the behavior of the algorithm under the situation with nonlinearity is discussed. The applications for the prediction of geomagnetic secular variation based on the above approach will also be introduced.

Keywords: Data assimilation, Ensemble variational method, Geomagnetic field, Geomagnetic secular variation