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Estimating Error Statistics in Geomagnetic Data Assimilation

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Data assimilation is the name given to a collection of statistical methods for combining all of the available information of a geophysical system so as to obtain the best possible estimate of the state of a system. This information includes output from a numerical model and observational data, along with estimates of the error statistics from each. Error statistics are in some sense both the most important and most difficult to obtain information on a system. The relative weighting of model and observation data depends on the estimated error variances of each, and the spatial spreading of observational information to unobserved regions depends on knowledge of how errors correlate in the model. We present some of the standard techniques for determining error statistics currently used in atmospheric data assimilation. These include ensemble techniques [Sun et. al. 2007], lagged forecasts, and covariance tuning methods. We show how these methods can be applied to geodynamo model solutions and used in our geomagnetic data assimilation system, MoSST-DAS [Kuang et al, 2008]. We also discuss how a data assimilation system can be evaluated using observing system simulation experiments [Liu et al, 2007].

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