



A NEW REDUCED RANK SQUARE ROOT KALMAN FILTER TECHNIQUE FOR DATA ASSIMILATION IN LARGE SCALE MODELLING SYSTEMS

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Data Assimilation techniques have gained increasing popularity in the atmospheric, oceanographic and geophysics communities over the last two decades. Suboptimal algorithms of the Kalman filter approach, which is optimal in the linear case but completely infeasible for large-scale problem, have been developed to solve the data assimilation problems in these fields of application.

The reduced rank square root (RRSQRT) filter is a special formulation of the Kalman filter for assimilation of data in large scale models. In this formulation, the covariance matrix of the model state is expressed in a small number of modes, stored in a lower rank square root matrix. The RRSQRT algorithm includes a reduction part that reduces the number of modes if it becomes too large in order to ensure that the filter problem is feasible. In the classical implementation some sort of normalisation of the square-root matrix is required in the reduction step when variables of different scales are considered in the model.

A new and more appropriate truncation procedure based on the Lanczos decomposition algorithm is presented. According to this approach one completely avoids normalisation problems, and, even more, the new truncation step needs much less computational time than the original procedure. In addition, it includes a precision coefficient

that can be tuned for specific applications depending on the trade-off between precision and computational load.