# An Iterative Greedy Algorithm for Observation Network Design with an Ensemble Kalman Filter

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Sequential assimilation systems use incoming observations to guide the trajectory of dynamic models. When only a limited number of sensors can be deployed, which often the case in practice, an important question is then where to locate the observation sensors so that a large amount of information can be retrieved.

In a sequential assimilation setting, it has been proposed to choose an observation network that will ensure a reasonable reduction of the forecast error variance [1]. To achieve this goal, one could perform, at every assimilation cycle, an optimization problem to maximize the gain between the forecast and the analysis statistics. This would generally result in a "sub-optimal" observation network using some greedy algorithms.

In this study, we propose an alternative algorithm that is expected to produce "more optimal" observation networks. We use for assimilation the well-known Singular Evolutive Interpolated Kalman (SEIK) filter. The method works by pushing the results of the greedy algorithm more towards optimality through backward iterations on the sub-optimal network until convergence. Convergence to some network usually happens in a finite number of steps. Numerical results from synthetic experiments using the wave equation and the Lorenz-96 model will be presented. We compare the performance of the filter when using fixed observations, adaptive observations with a greedy algorithm and adaptive observations with an iterative greedy algorithm.

**References**

**[1] T. M. Hamill and C. Snyder. "Using improved background-error covariances from an ensemble Kalman filter for adaptive observations,"** ***Monthly weather review*****, vol. 130, pp. 1552-1572, 2002.**